

Question and Answer
RFA No: PAOP- RFA-2022-008
RFA Name: Mini-grid Development in Rwamwanja Refugee Settlement, Uganda
Date: Wednesday, January 19th, 2022

The following attachments are included with this question and answer document:

- Attachment A: Rwamwanja Refugee Settlement Market Assessment
- Attachment B: Productive Uses of Energy Assessment
- Attachment C: Simple Map (PDF file)
- Attachment D: Detailed Map (GPKG file)

Alternatively, send an email to paopgrants@powerafrica-offgrid.org requesting for above listed attachments.

1. **Question:** We would like to understand the approximate envisaged size of the mini-grid installation or alternatively if any preliminary load data is available at this stage.
PAOP Response: The developer has been given a budget of 500,000USD with the mandate to propose up to three appropriately sized minigrids. Applicants should justify the sizing, based on capital and operational costs during the implementation process.
2. **Question:** The RFA asks for 3 mini grids to be developed in Ntenungi village, will all these three supply power to one village Ntenungi or even the surrounding villages? If so how many villages?
PAOP Response: The main village is Ntenungi and coordinates and maps of surrounding area have been provided. The applicant is expected to perform a physical survey of the village to ascertain the latest developments and make propositions according to what is existent on ground.
3. **Question:** How many households, businesses or social services are currently established in this area. The RFA shows that there was preliminary research that was done, refer to section 1, part b of the RFA. Can this information be shared with us?
PAOP Response: A preliminary study on households and businesses was conducted, refer to "Attachment A: Rwamwanja Refugee Settlement Market Assessment". Note that this study is only a guide, latest developments will have to be established and verified by the applicant.
4. **Question:** What is the land area for Ntenungi village and how much of this area is allocated to the three mini grid developments?
PAOP Response: A file has been provided indicating the expected area of operation. The developer will have to establish the required size of the land to be utilized. The applicant is to liaise with the office of the prime minister to be allocated land within the settlement.
5. **Question:** When you state the award period, does it apply to design, installation and commissioning or it includes the 5 years operation period?
PAOP Response: The award period only applies to the design installation and commissioning. The 5-year operation period is outside this.
6. **Question:** Please could you provide site locations and coordinates
PAOP Response: This data is available, refer to:

- Attachment A: Rwamwanja Refugee Settlement Market Assessment
- Attachment B: Productive Uses of Energy Assessment
- Attachment C: Simple Map (PDF file)
- Attachment D: Detailed Map (GPKG file)

Alternatively, send an email to paopgrants@powerafrica-offgrid.org requesting for the documents.

- Question:** Please could you provide site photographs?

PAOP Response: Photographs are not available. The applicant is expected to make a physical survey to ascertain the specifics of the area.
- Question:** What form of JV is required at application stage (joint venture agreement, MOU, expression of interest)?

PAOP Response: Any type of association shall be documented and proven through a partnership agreement, but the lead applicant should have a presence in Uganda (refer to RFA “iv. Applicant Eligibility”)
- Question:** Who will be responsible for the billing and load management of the customers' connections?

PAOP Response: The developer is expected to identify a suitable billing and load management system. The application guideline has a section for this.
- Question:** How many connections per grid are expected?

PAOP Response: This has been left to the developer. The developer should propose the design, the implementation and operation of the minigrid including a reasonable number of connections. The resulting requested subsidy per connection would be among the evaluation criteria.
- Question:** Please could you indicate the level of service required for households and business/institutions?

PAOP Response: The service offering should be within the stipulated regulations set out by ERA and REP during the licensing.
- Question:** What is the site security in the settlement like?

PAOP Response: The settlement has been in existence for a long time and therefore deemed safe. However, it is upon the developer to ensure their staff operate in a safe and secure environment.
- Question:** Could you please provide the preliminary data for the market studies and socio-economic assessments?

PAOP Response: These have been provided, refer to “Attachment A: Rwamwanja Refugee Settlement Market Assessment”.
- Question:** What is the anticipated project kickoff date?

PAOP Response: The expected award date is 15th April 2022.
- Question:** Please provide the electricity connections policy.

PAOP Response: This is available from the Rural Electrification Program (REP) of the Ministry of Energy and Mineral Development, Uganda.

16. **Question:** What is the expected capacities for these MGs, as well as the expected number of connections? I read in the documentation that there would be a maximum of 3 MGs and that the grant would also cover the cost of productive use equipment. But I did not find any indication of expected capacities (both solar and storage) nor connections.
PAOP Response: We have some indicative numbers from a study undertaken by the Power Africa Uganda Electricity Supply Accelerator (PAUESA), but we decided that it was the responsibility of applicants to conduct their own assessments and analysis, which also has the advantage of being less prescriptive in system design.
17. **Question:** Are the productive use of energy (PUE) equipment DC or AC compatible equipment?
PAOP Response: There is no limitation on either AC or DC compatible equipment.
18. **Question:** Are the refugees to pay for the electricity supplied to them or that arrangement is strictly for the surrounding host communities?
PAOP Response: The developer is to propose and implement a business model that works for the settlement and surrounding communities.
19. **Question:** Is the mini grid ownership to be community based, private sector, utility based or hybrid ownership?
PAOP Response: The minigrid is owned and operated by the developer for the duration of the project and handed over to the government of Uganda at the end of the 5-year operating period.
20. **Question:** Is it allowed to use any biomass or diesel as backup in project design or must batteries be the only energy storage option?
PAOP Response: No diesel backup is allowed. Batteries are to be used.
21. **Question:** Can we have a variable tariff with a lower tariff for productive use, an off-peak tariff for the nighttime, and a peak tariff for households and a different tariff for shops? Or must we set a uniform tariff?
PAOP Response: This is to be determined /authorized by the regulator upon for a license, where organizations will inform desired tariff structure.
22. **Question:** Is it possible to get any further pre-feasibility & ESIA information on the project including: number of connections planned, the locations of each connection, demand, and load profiles etc? Or whether the applicants could be given authority to travel to the sites to complete the surveys
PAOP Response: The Applicants are expected to design, implement, and operate the minigrid including obtaining pre-feasibility and ESIA reports. Applicants that wish to travel to the site location to ascertain details may do so at own cost.
23. **Question:** We are a utility Cooperative Society managing both the main grid in the central service territory and some off-grid systems in Kyegegwa and Kyenjojo districts, however with the RFA, we would like to partner with another agency experienced in EPC as we take on the operations and we would like to know whether this call accepts an application made in partnership between

organizations of different legal backing (say a Cooperative Society with a Government entity and /or a private company) in pursuit for efficiency and effectiveness of the project.

PAOP Response: Joint ventures of mixed entity types are allowed; however, government entities are not an allowable applicant.

24. **Question:** We have some requirements that will help us in our proposal and determine the suitable solution which can be supplied to you as following:
- Location of places that will be energized by off-Grid systems on Google map.
 - Available areas to be used for installation of Systems (ground mounted – rooftop mounted)
 - Needed power for each system, if this not available kindly determine the number of customers and their minimum requirements from electrical usage and hours of usage (limited to no. Of hours or 24 hours usage).
 - No. Of schools, medical centres, Places of worship, markets, etc) that can be energized by off-Grid systems, their electricity usage and working hours per day.
 - Soil investigation reports for location of Systems.

PAOP Response: Applicants are expected to design, implement, and operate the minigrid system based on industry best practice; refer to

- Attachment A: Rwamwanja Refugee Settlement Market Assessment
- Attachment B: Productive Uses of Energy Assessment
- Attachment C: Simple Map (PDF file)
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25. **Question:** Are you intending to provide market studies/geospatial data and coordinates of the site in?

PAOP Response: This data is available, refer to:

- Attachment A: Rwamwanja Refugee Settlement Market Assessment
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26. **Question:** Can you confirm who the customers will be, and if they are to be the refugees, is there any guarantee/further information on their ability/willingness to pay?

PAOP Response: Applicants are expected to develop business models that are suited to the settlement and take into consideration different categories of consumers.

27. **Question:** Are there any word limits on the Annexes?

PAOP Response: No, there are no word limits on the annexes.

28. **Question:** Can you confirm that Annex E does not need to be filled in at this stage?

PAOP Response: Documents listed below are requested, but not required at application stage, but are required prior to any award:

- Annex E: Required Certifications (signed and dated).
 - Past performance business referral letters for previously performed similar work.
 - Organizational diagram.
29. **Question:** Is the level of energy service we can provide (i.e., larger loads) considered when evaluating our proposal? For example, is there greater weighting given to commercial or industrial connections as opposed to residential?
PAOP Response: Applications will be evaluated using the evaluation criteria stated in the RFA, refer RFA “SECTION III. APPLICATION MERIT REVIEW CRITERIA”.
30. **Question:** Is the application to obtain a DUNS number expected to start at this stage of the application, or can such an application be made once notified of the application’s success?
PAOP Response: A DUNS number does not need to be included in initial application but will need to be submitted later in the process if an application advances to negotiation or award.
31. **Question:** Can we upload our own financial model, using our own template, or do we have to strictly adhere to the spreadsheet provided?
PAOP Response: No, applicant must use RFA template.
32. **Question:** Are there any specific financial requirements relating to turnover/revenue, balance sheet, etc.?
PAOP Response: Applicant must have realized income equal to funding sought within 2019 or 2020.; refer to RFA “iv. Applicant Eligibility”.
33. **Question:** Are applications that ask for the lowest funding (grant) amount preferred?
PAOP Response: Applicants are assessed on 8 criteria; cost efficiency is only one of them. Refer to RFA “SECTION III. APPLICATION MERIT REVIEW CRITERIA”.
34. **Question:** Is there a bid bond/any form of bid security?
PAOP Response: There is no bid bond/any form of bid security.
35. **Question:** Do we have to model O&M costings based on a 5-year concession period?
PAOP Response: No, applicants are expected to propose the best operating model.
36. **Question:** Do we have to provide committed match funding immediately or is a fundraising plan sufficient at this stage?
PAOP Response: Applicants may match funding at later stage but must show proof that it is work in progress.
37. **Question:** We intend to apply through one of our subsidiaries based in Uganda. However, if our subsidiary does not meet “realised financing (income, grant, debt, equity) of at least the amount of grant funding sought within calendar year 2019 or 2020”, can we use the parent accounts?
PAOP Response: Parent accounts can be used as long as they are the lead applicant.
38. **Question:** Does the ‘Certainty Percentage’ in Annex A (Section E, page 18) relate to the ‘certainty’ of receiving the financing in?
PAOP Response: This refers to the level of certainty that other sources of funding will contribute to this project.

39. **Question:** Due to our experience in Uganda, we are aware that regulators would want a tariff of ~\$0.30 per kWh or below, and a concession period of up to 10 years. To that end, are there any specific tariff expectations? For example, if a \$0.50 per kWh tariff is permissible, we would require less grant funding – but we are unsure if this would be accepted by the regulators. It would therefore be useful to know the regulators’ stance on appropriate tariffs/concession periods.
PAOP Response: There are no tariff expectations. The applicant is expected to apply to ERA who will then apply appropriate tariff.
40. **Question:** Has there been contact with the Ugandan Rural Electrification Agency (REA) when implementing this programme? In the past, REA have helped finance and build the distribution infrastructure. Do we know if REA has the financial capabilities to assist? If not, are we expected to fully finance the distribution grid?
PAOP Response: The REP is a key stakeholder to the project. The applicant is expected to build LV line as part of the grant. REP will support with customer connections through the ECP.
41. **Question:** Has the standard licensing period (~4 months) + time required to attain necessary approvals such as construction permits and environmental licenses (e.g., NEMA needs around 6 months to approve ESIA studies) been taken into consideration to determine the period of availability of the funds (for an indicative duration of 6 months appears to be such a short period of time)?
PAOP Response: The applicant is expected to work within indicative/allotted time. Reasonable delays will only be accepted with proof. PAOP may extend the period of performance of the grant should circumstances and funding permit.
42. **Question:** After the award of the contract and the license exemption certificate there is a period needed to achieve financial close as stipulated in the standard license conditions; this will also have to be taken into consideration to determine the availability of the subsidy funds. Can you confirm?
PAOP Response: This is a fully grant funded project, any additional financial contribution should not interfere with project implementation timeline.
43. **Question:** Is the project going to be tax exempt? This is for both the import duty and related taxes to be paid during implementation as well as VAT paid on electricity for the beneficiaries?
PAOP Response: The project must be operated within the laws of the Republic of Uganda. It is the applicant’s responsibility to ensure they consider all costs including taxes.
44. **Question:** Are there any specific technological requirements, e.g., needs to be fully renewable/viability of diesel back-up, type of battery, etc.?
PAOP Response: There is no specific technological requirements; however, emphasis is on solar PV/Battery. Applicants may should propose the best possible solution.
45. **Question:** Will the Tier of operations be taken into consideration, such as 24/7 operations vs. operating 12 hours a day? We are asking since the Tier 5 level of 24/7 operations will require higher CAPEX costs but deliver increased impact.
PAOP Response: The applicant is at liberty to propose the best possible solution within regulations / QoS as guided by ERA.

46. **Question:** While it is clear that operations need to be covered by applicant for the first 5 years, do you have visibility on the operational model that you envision? E.g., has refugees' willingness and ability to pay been investigated? Are subsidies available? What is the plan past the 5 initial years?
PAOP Response: Specific studies on willingness to pay in the target village have not been undertaken by PAOP or its partners; however, there are some reports available that include indicative willingness to pay. The business and financial model for long-term operation is the responsibility of applicants to propose, including securing any proposed subsidies.
47. **Question:** Must applicants be based in Uganda?
PAOP Response: Applicants, or at least one applicant within a joint venture must have the right to operate in Uganda, including compliance with Uganda's tax and electrotechnical regulations.
48. **Question:** Can we be in partnership with different companies in more than one application so long as we are not the lead applicant in more than one application? For example, can we be the lead applicant in one application, and the local EPC partner in another application?
PAOP Response: Yes, your organization can apply in different forms as long as the applicants or at least one joint venture member meets the RFA eligibility criteria.
49. **Question:** Do we have an indication of the size and number of connections of the mini-grid? If not, does the applicant need to do a study prior to submitting the application?
PAOP Response: Applications can be for up to a maximum of 3 mini-grids. The design and number of mini-grids is to be proposed by applicants. Applicants are expected to undertake any research or studies they feel necessary to inform their application.
50. **Question:** To apply for and obtain the license exemptions and permits necessary for the generation system, distribution system, and even the building(s) can be a drawn-out process. Are the relevant authorities (and district authorities, for building permits) willing to provide expedited clearances for this project, given the envisaged 6-month total timescale?
PAOP Response: Yes, exemptions are drawn out for various reasons, usually companies must prove business case. With the grant support, this will be straight forward. Relevant authorities will provide clearances in accordance with the law. It is prudent that the developer conform to all requirements to avoid delays.
51. **Question:** From the Eligibility Criteria, would NGOs be allowed to be the lead applicant in a JV, or should the developer be the lead?
PAOP Response: The lead applicant can be a non-profit or for-profit enterprise. There are no additional requirements or restrictions on lead applicants. Lead applicants will however be the party whom the award is formally made to, and all financial transfers will be to the lead applicant only.
52. **Question:** Do applicants need to hold all required renewable energy and electrical licenses or permits at time of application or at time of award?
PAOP Response: Proof of application for permits or licenses are required at time of application.

53. **Question:** Is the limit of 3 minigrids the limit for the whole settlement, or just per application? If the latter, do you have an ideal number for the total number of minigrids implemented across the whole refugee settlement?
PAOP Response: The 3 minigrid limit is for this project. The developer is free to develop other minigrids in accordance with Ugandan regulations.
54. **Question:** Role of REA and ERA - would REA provide construction of distribution network and subsidy for the last mile? Is ERA license needed to operate MGs in refugee settlements? and if yes, would the standard requirement and process apply also here?
PAOP Response: Yes, your organization will need to apply for ERA license exemption for minigrids. The standard procedure applies.
55. **Question:** : Is that if I apply for \$300,000 my company account should reflect it?
PAOP Response: No, however the applicant should have audited accounts indicating transactions of that amount within 2019/2020 period.
56. **Question:** I think I saw in the RFP that joint applications can have up to 3 partner organizations. Is this a hard limit - i.e., would consortia of 4 partners be rejected, or would they just need to provide additional justification?
PAOP Response: This is not a hard limit; justification should be provided. The role of each partner must be clearly stipulated.
57. **Question:** With reference to U22 CFR 216 Agency Environmental Procedures, which we have to comply to: Are applicants required to complete all the environmental assessments (IEE, EA) or are we granted a Categorical Exclusion based on the fact that the mini grid project would not produce any negative effects on the natural or physical environment (if anything only positive)? Are we required to submit a Scoping Statement which outlines the project impacts?"
PAOP Response: Applicants are to follow ERA (www.era.go.ug) guidelines which clearly stipulate requirements for MG exemption license.
58. **Question:** Role of REA and ERA > would REA provide construction of distribution network and subsidy for the last mile? Is ERA license needed to operate MGs in refugee settlements? and if yes, would the standard requirement and process apply also here?
PAOP Response: ERA MG exemption license is required for operation. The standard process is applicable. REA/REP is party to the RFA - however regular procedures should be followed.
59. **Question:** Does this include meters, service lines, and home wiring?
PAOP Response: This includes meters and service lines. Home wiring is the duty of homeowner.
60. **Question:** There was mention of site-specific studies conducted as well as GIS data. If yes-Is this available to the applicants?
PAOP Response: Yes this data is available, refer to:
- Attachment A: Rwamwanja Refugee Settlement Market Assessment
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 - Attachment C: Simple Map (PDF file)
 - Attachment D: Detailed Map (GPKG file)

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61. **Question:** Are all three minigrids going to supply one village Ntenungi or even neighboring villages?
PAOP Response: The minigrid supply is for the village and surrounding villages.
62. **Question:** What is the role of the hosting community? Is the intervention also impacting them? Is the intervention looking to electrify institutions such as NGOs or UN compounds?
PAOP Response: The developer can electrify all social institutions that are used for peaceful and developmental purposes. Connections may extend to the host community and not only within the refugee settlement, although the settlement is the focus of the project.
63. **Question:** Is the tariff to be negotiated with ERA?
PAOP Response: Yes, successful applicants will have to apply for license exemption from ERA (including a tariff). ERA will apply its algorithm to generate appropriate tariff.
64. **Question:** Do you confirm that payment is made by milestones, please?
PAOP Response: The disbursement plan and grant mechanism will be determined by the pre-award assessment results of the selected company.
65. **Question:** Are overheads allowed? if yes, in which percentage, please? NICRA
PAOP Response: Overheads related to grant implementation are allowable; however, the overheads being charged must be clearly reflected in the budget and budget justification.
66. **Question:** Are there a minimum of connections expected per MG?
PAOP Response: There is no stipulated or expected number of connections. Based on grant amount and own business plan, the applicant will propose a reasonable number of connections. This should be clearly justified.
67. **Question:** With reference to U22 CFR 216 Agency Environmental Procedures, which we have to comply to: Are applicants required to complete all the environmental assessments (IEE, EA) or are we granted a Categorical Exclusion based on the fact that the mini grid project would not produce any negative effects on the natural or physical environment (if anything only positive)? Are we required to submit a Scoping Statement which outlines the project impacts?
PAOP Response: ERA MG exemption license is required for operation. The standard process is applicable. REA/REP is party to the RFA - however regular procedures should be followed.
68. **Question:** Does the applicant, in addition to this, need to undergo the environmental assessments (IEE, EA) as required by U22 CFR 216 Agency Environmental Procedures?
PAOP Response: No, applicants are not required to submit a full environmental impact assessment to the national environmental authority. However, applicants are expected to outline environmental and social impacts in a project brief and submit it to NEMA for approval. The certificate of exemption from NEMA will then be presented to ERA. In the unlikely event that NEMA does not approve, the applicant must follow NEMA guidelines to obtain the exemption.

69. **Question:** What are the criteria upon which PAOP decides to award a FAA or a cost reimbursable award in case of a cost reimbursable award, would we still be required to complete the Milestone schedule or only the planning budget
PAOP Response: We use the due diligence or pre-award assessment result of the organization. Yes, all applicants are required to complete the milestone schedule.
70. **Question:** Kindly throw more light on the PUEs; are they AC or DC?
PAOP Response: We do not have any technological bias. The specific productive use of energy equipment to be used in terms of application or voltage is entirely up to the applicant; what we will be judging it against is things like impact expected from those devices, rather than the specific types of devices used.
71. **Question:** What is the level of co-financing requested/advised?
PAOP Response: We are not seeking a specific target or threshold, in terms of other types of co-financing or funds leveraged; however, funds leveraged are one of the mirrors your categories and they will be factored into the scoring. That can be both committed funds and proposed funds, and it can also be monetary and in-kind contributions, so please do include details on any contributions, and we will be including that in the mirror review categories, however, there is no minimum or threshold expected.
72. **Question:** How far wide into the surrounding host community are we to plan for?
PAOP Response: Some documents have been provided to indicate the expected areas size of operation, but the developer, will have to do the work and establish the required sites to be utilized in the RFA. The applicant will have to coordinate with the Office of the Prime Minister to be located land within the settlement.
73. **Question:** How can we access the information regarding the population and social services that are in these other villages? Are we able to know the names of these villages or can you share the preliminary research information?
PAOP Response: Yes this data is available, refer to:
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74. **Question:** Is there time scheduled time for site visit
PAOP Response: There are no scheduled site visits; it is up to individual applicants to arrange their own site visits, if necessary to inform their application, and that includes any coordination with the office of the Prime Minister for access to the refugee resettlement.
75. **Question:** You mentioned Solar PV and battery, is there allowance for a generator as a back-up? You mentioned that REP is in charge of customer connections? To what extent are they involved and to what extent are we involved? Is there a standard for the distribution network that we

must follow, that is yes? can we charge a tariff approved by the regulator for the 5 years? if so, are there studies on ability and willingness to pay within refugee settlements?"

PAOP Response: Back-up diesel generator isn't allowed in the proposal. The proposal is for solar PV and battery backup. Please refer to ERA's regulations on tariff approval and revision. REP has approved standards for distribution grid: ABC cable, load limiters, treated wooden poles of 9m, 3phase at the beginning of the line (near the power plant) and 2 phase. ERA has a list of eligible connection materials and associated standard prices, these are used for compensation under the connection policy framework. The applicant will make connections in accordance with ERA and REP regulation then will be reimbursed by REP.

76. **Question:** Are there any instruments or measures to mitigate the high risks related to capacity to pay off the off takers (refugees); i.e. minimum consumption/revenues guaranteed by stakeholders such UNHCR or local governments in charge of managing the settlements

PAOP Response: We do not have any anchor tenant, therefore the RFA requires applicants provide a PUE strategy, so the focus is not just on households, but how applicant or the successful developer will stimulate demand to ensure that the power that is generated is used. There is no guarantee that UNHCR, or local governments or other, will buy the power. The applicant is advised to work with existing entities to ease entry into the settlement.

77. **Question:** Are there any feasibility/assessments done on communities that can be shared?

PAOP Response: Applicants take the whole responsibility of their design and economic/financial analysis. Some market studies do exist but are 2 or years old. These will be shared by all webinar participants.

78. **Question:** Where can I find information about the actual demand for the Mini Grid?

PAOP Response: Please refer to:

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79. **Question:** Is a deadline extension possible and what is the expected project timeline?

PAOP Response: The RFA dates remain unchanged. Companies should monitor the RTI Website (<https://www.rti.org/rfp>) for any amendments to the request for application that may be posted Responses to questions will be published on the [RTI website](#) on January 24, 2022. The RFA closing date/submission deadline is February 8, 2022 at 17h00 SAST (GMT +2). Anticipated award date is April 15, 2022. Applicants are encouraged to not submit at the last minute. Any applicant not meeting the deadline will be automatically disqualified.

80. **Question:** Will the grant fund Solar home systems or a mix of Minigrid and solar home systems solutions?

PAOP Response: This funding opportunity is designed specifically with mini grid in mind that can be supplemented with solar home systems, but any application for solar home systems only would not be considered eligible.

81. **Question:** Elaborating on the previous GIS Question, have powerplant locations been identified, and is there any site control (government ownership, lease, wayleave, etc.) on these locations?
PAOP Response: Some preliminary studies, including a GIS survey identifying some of the potential locations for the power plants was undertaken a number of years ago; however, we are not sticking with that particular design, it is up to applicants to propose their own designs, which may include different locations for the power plants, particularly as the refugee resettlement has evolved over time and the needs of the man centers may have moved. In terms of site control, there is nothing currently in place, however, there could be potential for assistance from the rural electrification project in securing that land or the RPM and that can be discussed during the negotiations for award.
82. **Question:** We would like to know the project coverage area? Why ... we see two villages Ntenungi I & II and Rwamwanja Refugee Settlement Village all in Nkoma ParishThe expected area is not clear for proposal submission.
PAOP Response: The Project is to cover Ntenungi village and surrounding areas. To see actual area of operation, refer to:
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 - Attachment B: Productive Uses of Energy Assessment
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- Alternatively, send an email to paopgrants@powerafrica-offgrid.org requesting for the documents.
83. **Question:** What is the maximum number of organizations in a joint venture, is it 3 or 4?
PAOP Response: This is not a hard limit; justification should be provided. The role of each partner must be clearly stipulated.
84. **Question:** What is the expected size of the PV grids?
PAOP Response: The applicant shall propose the size and number of connections with clear justification. Evaluations will consider the applicant that makes the most optimal solution among other criteria.
85. **Question:** Who will determine the tariffs to be charged onto the consumers/customers/users?
PAOP Response: The final tariffs will be negotiated during your organizations license exemption process in discussion with ERA, the regulator and Uganda. Note, the tariffs will not be determined by PAOP.
86. **Question:** Is it that the maintenance costs after commissioning of the project are to be realized from revenue from power sold to the connected users in the community? Also, if above is true, this means that some would be beneficiaries may be limited access due to lack of financial capacity?
PAOP Response: The applicant is to provide a comprehensive business plan on how they intend to utilize the grant. Preference is given to applicants that will supplement the grant with other sources of funds.

87. **Question:** I am a Master student of renewable energies from Germany and plan to live in Uganda for three months starting in April. Is there a possibility to help with the planning or the construction of the plant and to write my master thesis about this? I would definitely offer my help.
PAOP Response: Students that wish to learn and help with the project can liaise with the winning applicant who will be [publicly announced](#).
88. **Question:** What is the boundary of required connections to refugee households? Is it acceptable to only connect part of the households located in the settlement? Is there an existing marketplace in the location? If so, approximately how many shop keepers?"
PAOP Response: To see actual area of operation, refer to:
 - Attachment A: Rwamwanja Refugee Settlement Market Assessment
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 - Attachment C: Simple Map (PDF file)
 - Attachment D: Detailed Map (GPKG file)

Applicants are expected to propose the most optimal solution and number of connections with justification.

89. **Question:** What is the REP rate of reimbursement per household connections?
PAOP Response: This is stipulated in ECP policy.

90. **Question:** What is the expected project timeline?
PAOP Response: Expected duration of funding is indicative 6 months; however, final duration to be determined at signing stage.

91. **Question:** Is the reimbursement on customer connection at cost of hardware (metering devices and the drop wires) or there is it a capped amount/connection
PAOP Response: The applicant is to come up with a clear business plan stating cost with clear justification.

92. **Question:** How long is the repayment for connections by REP likely to take (for cashflow consideration)
PAOP Response: REP process is 3-6 months as long as applicant follows all procedures.

93. **Question:** Who will be responsible for the maintenance activities after the duration of six months
PAOP Response: The applicant is to maintain and operate the minigrid for 5 years in accordance with rules set out by ERA.

94. **Question:** Given the need to negotiate for land, get agreement from community and Prime Minister's office, get permits/exemptions, and then build the infrastructure, 6 months as a project timescale seems extremely ambitious!
PAOP Response: The Applicant is expected to work within proposed timeline. However, final duration is to be determined at signing stage and implementation delays will be considered on a case-by-case base.

95. **Question:** It is not clear how one gets a renewable energy license. If my company has experience in power line construction, would this not be enough to qualify me for an eligible bidder?
PAOP Response: Assuming the company meets the eligibility criteria outlined in the RFA; then your organization can submit an application.
96. **Question:** If we do a site visit, is there a space that has been left for solar installation?
PAOP Response: Applicants are expected to liaise with the Office of the Prime Minister to allocate them space for the installation.
97. **Question:** More elaboration on this please: What is the role of REA and ERA > would REA provide construction of distribution network and subsidy for the last mile? Is ERA license needed to operate MGs in refugee settlements? and if yes, would the standard requirement and process apply also here?"
PAOP Response: ERA license exemption is required to operation a minigrad in Uganda. Yes, standard ERA requirement and process (terms and conditions) apply.
98. **Question:** Can you explain further on the land acquisition process for the solar?
PAOP Response: The Office of the Prime Minister oversees allocating of land within refugee settlements.
99. **Question:** : We were told that there is a market assessment report on the target site that could be shared with the Applicants (including households, what they currently spend on energy, what kind of energy solutions are used, geospatial data, etc.). Could this please be shared with us?
PAOP Response: Please refer to:
- Attachment A: Rwamwanja Refugee Settlement Market Assessment
 - Attachment B: Productive Uses of Energy Assessment
 - Attachment C: Simple Map (PDF file)
 - Attachment D: Detailed Map (GPKG file)

Alternatively, send an email to paopgrants@powerafrica-offgrid.org requesting for the documents.

100. **Question:** : In addition, I have in my webinar notes conflicting info on surveys carried out on willingness to pay – in my understanding PAOP + partners did not carry out any willingness to pay report, but that there are other reports (done by third parties?) that include indicative willingness to pay. Can you please confirm/share if applicable?
PAOP Response: Market assessment reports have been done, refer to:
- Attachment A: Rwamwanja Refugee Settlement Market Assessment
 - Attachment B: Productive Uses of Energy Assessment
 - Attachment C: Simple Map (PDF file)
 - Attachment D: Detailed Map (GPKG file)

Alternatively, send an email to paopgrants@powerafrica-offgrid.org requesting for the documents.

Attachment A: Rwamwanja Refugee Settlement Market Assessment



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RWAMWANJA REFUGEE SETTLEMENT MARKET ASSESSMENT

USAID Power Africa Uganda Electricity Supply
Accelerator

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This publication was prepared and conducted solely by the Power Africa Uganda Accelerator. The views and analysis contained in the publication therefore do not necessarily represent the views of other agencies. Any errors in this publication are solely our own.

This document was produced for review by the United States Agency for International Development Uganda Mission (USAID/Uganda).

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ACRONYMS

ACRONYM	DEFINITION
ACORD	Agency for Cooperation and Research in Development
AHA	Africa Humanitarian Action
AIRD	African Initiatives for Relief and Development
CFL	Compact Fluorescent Light
DRC	Democratic Republic of Congo
FAO	Food and Agricultural Organization (United Nations)
FIDA	Ugandan Association of Women Lawyers
GIS	Geographic Information system
GoU	Government of Uganda
GPS	Global Positioning System
ICRC	International Committee of the Red Cross
IDA	International Development Association (World Bank)
IOM	International Organization for Migration
kVA	Kilo-volt-ampere
kW	kilowatt
kWp	kilowatt peak
LED	Light Emitting Diode
LPG	Liquified Petroleum Gas
LWF	Lutheran World Foundation
NGO	Non-Governmental Organization
ODK	Open Data Kit
OPM	Ugandan Office of the Prime Minister
PSN	People with Special Needs
PV	Photovoltaic
SACCO	Savings and Credit Cooperative Organization
UGX	Ugandan Shillings
UNFPA	United Nations Populations Fund
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
URA	Uganda Revenue Authority
URCR	Uganda Red Cross Society
USAID	US Agency for International Development
WFP	World Food Program
WHO	World Health Organization
Wp	Watt peak
WTU	Windle Trust Uganda

EXECUTIVE SUMMARY

Located in Uganda's Kamwenge District, the Rwamwanja refugee settlement was established in 1964 by the United Nations High Commissioner for Refugees (UNHCR) to host refugees from Rwanda; it closed in 1995 when many repatriated. The settlement was reopened by the Ugandan Office of the Prime Minister (OPM) in April 2012 to host refugees fleeing the Democratic Republic of Congo (DRC) due to violence in North and South Kivu. The Rwamwanja refugee settlement falls within eight villages in the Nkoma subcounty; covering approximately 127 km² with 45 villages in 14 zones. As of March 2018, the population in the Rwamwanja area was 80,361, of which the refugee population represents 52,207. The settlement is at full capacity and no longer receives new arrivals.

This report provides an evidence-based market assessment for the Rwamwanja refugee settlement, which will serve as a base for designing solutions to facilitate access to new energy infrastructure and service delivery. Improved energy services should result in increased economic productivity such as improved employment opportunities and skills development for businesses and community members in Rwamwanja.

This assessment comes at an important time given that the settlement has become a permanent living solution for many refugees. Any energy market solutions for the Rwamwanja settlement will need to be built on a model that integrates refugees and the host community to support both short-term humanitarian and long-term development interventions. A key to developing these energy market solutions is understanding demographic characteristics and current economic activities to provide insights for evaluating energy solutions.

The objective of these socioeconomic analyses was to both develop financial viability analyses as well as to identify complementary opportunities for economic growth where development assistance can lead to income growth for Rwamwanja refugees and the host community. Potential solutions for Rwamwanja are intended to include integrated energy service delivery with an emphasis on access to electricity, digital financial services infrastructure, internet connectivity, training and capacity development, agriculture and livestock development, and support to private sector entrepreneurship. The data and analysis presented in this report will provide USAID, Power Africa, and implementing partners with objective evidence to evaluate rational energy solutions for the community.

The survey was designed and undertaken by NRECA International, a contributing partner on the Power Africa Uganda Accelerator team. NRECA International used a geospatial platform (into which a digital dataset of all Rwamwanja houses and shops was entered) to develop a randomized survey sample. The survey team implemented the survey across the entire Rwamwanja settlement covering over 127 km². The survey was designed with a 95% confidence level and 5% error rate resulting in a sample size that included 457 households and 89 businesses. In parallel, the team conducted a census of all small industries in Rwamwanja. Specially designed survey instruments were administered for each type of survey. The survey instruments were customized for each category of surveyed consumers—residential, commercial, and small industrial. Each instrument included modules to collect demographic, energy consumption, income, expenditures, credits, phone use, internet connectivity, and transaction data.

Seventy-six thousand refugees live in Rwamwanja; 99.9% of which are Congolese with few Rwandese. Differences in living conditions amongst refugees appear to be based primarily on income sources and to a lesser extent upon length of residency in Rwamwanja. The households interviewed

report residency in Rwamwanja for up to eight years, where 70% report residency from four to seven years.

Housing in Rwamwanja is of poor quality, with little variance throughout the settlement and between Ugandan nationals and refugees. Ninety percent of the structures are temporary with mud wall construction and tarpaulin roofs. Permanent and semi-permanent structures comprise approximately 10% of the surveyed households in equal portions; refugee status does not allow construction of permanent houses. The Government of Uganda (GoU) and donor sponsors provide newly arrived refugees with construction materials adequate for temporary housing.

The survey data do not show a clear correlation between the length of residency and the likelihood of developing or acquiring more stable social and financial networks, whether through remittances or the ability to engage in debt-related transactions. Only twelve instances of remittances were recorded amongst the 408 refugee households, receiving from US\$14 to US\$111 per year except for a businessman who received US\$700 in 2017.

Western Union has an office at Centenary Bank in Kamwenge Trading Center, but the most common method of transferring funds in Rwamwanja is via mobile money services offered by MTN and Airtel networks. While there is a significant need to send and receive money in Rwamwanja, there is no money transfer company based in the settlement. Approximately 32% of surveyed households received cash donations ranging from US\$6 to US\$122 per month with an average donation equal to US\$48 per month. Cash donations are distributed through the World Food Program (WFP) to refugees who chose cash over food rations. According to WFP, refugees receive US\$12 per month per family member, thus a family of four would receive US\$48 per month. The WFP is the only implementing partner that provides refugees cash payments. Four percent of the surveyed households depend exclusively on cash donations while 10% consider cash donations a secondary source of income.

The living cost in this analysis was measured in monetary terms based on monthly household income. The living cost per day per household within the settlement is on average US\$1.80. Ugandan family households report daily expenditures of US\$1.92 while the Congolese families report daily expenditures of US\$1.78. Both figures are below the Ugandan national poverty line reported as US\$1.90¹ per capita by the World Bank. The average household size of surveyed households is 5.7 people.

Food is the largest expense in Rwamwanja. Energy expenditures remain one of the smallest expenditures among surveyed households with a monthly average of US\$2.37, but 92% of households pay for energy services or phone charging.

The GoU allocates 50 x 50 m² plots to new arrivals. Because the land is fertile, most community members farm their plots. In fact, farming is the most prevalent income source for households; 56%

¹ The World Bank. Uganda Poverty Assessment 2016: Fact Sheet. (2016); <http://www.worldbank.org/en/country/uganda/brief/uganda-poverty-assessment-2016-fact-sheet>

of the surveyed families claim farming as the primary income source and 19% claim farming as the secondary income source.

In addition to surveying households, the team surveyed 88 businesses that were engaged in 92 business activities. The most common business (37%) was operating a general shop selling dry goods, hardware, food, tools, construction materials, light bulbs, electronics, and other goods. Approximately 12% of the stores sell only grocery items. Other types of businesses include tailors, bars, carpentry shops, boutiques, barbershops, and food processing centers, among others. Forty-four percent of the business owners are female. About 72% of the employees are related to the employer; the female to male employee ratio is 1 to 1.

Households participating in the survey reported using disposable torches, solar home systems or solar kits (2 Wp to 150 Wp), dry cells, and to a much lesser extent, solar lanterns and rented solar kits for electricity. Fewer than 1% of the households use large rechargeable batteries, electricity from neighbors, kerosene, and candles. Energy is primarily used for lighting, phone charging, and listening to the radio at the household level.

A majority of the businesses surveyed have purchased solar home systems. These systems provide electricity to businesses for radio, music equipment, phone charging, lighting, TV, tailoring, fans, and selected salon equipment. Solar photovoltaic (PV) systems installed to provide electricity for these appliances range in size from 10 to 400 Wp. Most of the solar home systems were purchased with savings; in some cases, business owners borrowed funds through a Savings and Credit Cooperative Organization (SACCO) or credit was provided by the solar service provider. The average reported cost per installed watt was US\$1.06 when purchased with savings, US\$2.48 when money was borrowed from a SACCO, and US\$5.96 when using credit from a solar company.

The team also surveyed 18 small industries which include mills, fuel stations, welding shops, bakeries, and milk collection centers. The main agricultural products that require postharvest processing by small industries in Rwamwanja are maize, cassava, sorghum, millet, and rice. Most small industries have their own generator; a total of 20 generators were identified during the survey, 18 of which are operational, and they vary in size from 0.8 to 30 kW.

INTRODUCTION

Uganda has a generous asylum policy (2006 Refugee Act and 2010 Refugee Regulations) welcoming refugees from neighboring countries. The Government receives, registers, and issues civil documents to refugees and decides on asylum applications and appeals with the support of the UNHCR.

The GoU allocates land for refugee settlements to use for housing and farming, allowing refugees to grow their own food and sell their surplus produce. Compared to camps, settlements provide greater livelihood opportunities for refugee families to achieve socioeconomic security, which reduces their dependency on donated food and other items. The Government's refugee policy permits freedom of movement as long as refugees living outside settlements can support themselves. Opportunities for refugees to transition to legal residency status in Uganda are restricted. However, there have been recent indications of Government efforts to explore an alternative residency status as a potential solution to long-term displacement.

The OPM coordinates with UNHCR, Non-Governmental Organizations (NGOs), and civil society in providing protection and support. Among the implementing partners of OPM and UNHCR are the Lutheran World Foundation (LWF), Africa Humanitarian Action (AHA), Windle Trust Uganda (WTU), and the African Initiatives for Relief and Development (AIRD). These organizations provide a wide variety of community services to the refugees such as settlement management, water and sanitation, health and education services, and shelter. Implementing and operational partners closely collaborate to ensure that activities are complementary. If refugees seek assistance from an organization that is unable to provide the specific services requested, such as livelihood support or psychosocial counseling, partners refer them to other organizations better equipped to address their needs.

Despite the significant infrastructure deployed in Rwamwanja and the continuous high investments for access roads, security, protection, water, sanitation, health, nutrition and education, many challenges remain. The most critical challenges include food assistance as well as lack of adequate shelter, medicine, hospital equipment, and educational resources.

There is a need to support self-sustaining businesses and to move away from an unsustainable assistance-based economy. To this end, partners are exploring ways to build a development-oriented economy that benefits both the refugee and host community in the Rwamwanja settlement. This report provides evidence-based information that can be used to evaluate strategies that would bring an effective transition from humanitarian and relief work to development of more sustainable livelihood initiatives. It includes in-depth analysis of empirical data collected on income, expenses, consumption patterns, connectivity



Photo 1: A pupil attends class in one of the many schools in Rwamwanja.

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and financial transactions in the refugee settlement and the host community. The analysis shows the need for improved infrastructure or new infrastructure creation to deliver services.

This project was financed by USAID through the Power Africa Uganda Electricity Supply Accelerator (Power Africa Uganda Accelerator) project to collect and evaluate energy expenditure and demographic data for households, businesses, and small industries located in Rwamwanja. The report presents a description of the methodology employed for the survey, survey results for each of the three market segments, and an interpretation of the results.

TABLE 1: UNHCR IMPLEMENTING PARTNERS FOR 2018

Settlement Management, Coordination, and Security	Office of the Prime Minister (OPM)
Protection Community Services Reception Center Water and Sanitation Livelihoods and Environment	Lutheran World Foundation (LWF)
Education Health/Nutrition Shelter Logistics/Development	Windle Trust Uganda (WTU) Africa Humanitarian Action (AHA) African Initiatives for Relief and Development (AIRD)



Photo 2: Refugees wait for medical attention at the Mahani Health Centre II.

HERBERT OPIO

TABLE 2: UNHCR OPERATING PARTNERS FOR 2018

Food	World Food Program (WFP) through Samaritans Purse, Feed the Hungry (meals in schools)
Child Protection	International Committee of the Red Cross (ICRC)/Uganda Red Cross Society (URCS), United Nations Children's Fund (UNICEF)/Save the Children
Health/Nutrition	World Health Organization (WHO), United Nations Populations Fund (UNFPA)/Agency for Cooperation and Research in Development (ACORD) (Reproductive Health), UNICEF (nutrition), WFP (nutrition)
Gender-based Violence	UNFPA/ACORD, AHA
Water/Sanitation	International Organization for Migration (IOM), UNICEF/Water Missions LWF
Livelihoods & Environment	Food and Agriculture Organization (FAO)/Adventist Development and Relief Agency (ADRA)
People with Special Needs (PSN) Support	The Uganda Association of Women Lawyers (FIDA)
Infrastructure	LWF
Early Childhood Development Centers	UNICEF/Save the Children

RWAMWANJA MARKET ASSESSMENT

The project team used surveys to gather energy consumption and socioeconomic data in the Rwamwanja refugee settlement. The data and results from those surveys can then be used to design energy systems that can support sustainable improvements and income generation in the community. This assessment also provides the information necessary to evaluate impacts of proposed interventions addressing the needs of switching from short-term humanitarian assistance for refugees to more sustainable solutions.

SURVEY DESIGN AND METHODOLOGY

SURVEY DESIGN

Energy consumption surveys have been used for several decades to collect critically important information needed to evaluate energy consumption patterns, to forecast demand, and to evaluate the ability to pay for future energy services from grid and off-grid energy solutions. The survey process includes developing a survey instrument (questionnaire), defining a sample size, randomizing the sample, and defining the sample frame. The questionnaires for this survey were designed to collect information from households, businesses, and small industries. The survey questions for households and business were designed to collect a variety of data which was used to characterize the demographic profile of the community, to evaluate income and expenses, and to evaluate access to energy services, internet connectivity, and financial transactions. A census of small industries operating in Rwamwanja with power generation of 5 kVA and greater is also included in the survey. These small industries were identified during the first week of the household and business survey process. The information included in the small industry survey includes business demographics, productive activity, power generation or purchase of electricity, and special equipment used by the business.

SAMPLING DESIGN

To set up a random sample for the survey, the team digitized 7,703 structures using satellite imagery of the Rwamwanja refugee settlement based on geo-reference data obtained by the Rural Electrification Agency Master Plan. The digitized structures were numbered, and a random sample of the structures was generated to select a sample for surveys.

A confidence level of 95% with a 5% error rate was used to calculate the sample size. Over-sampling was required to successfully obtain the representative amount of data. The sample size of the 457 households and 89 businesses for the survey was selected to collect a statistically representative sample of demographic characteristics of the Rwamwanja settlement.

The randomly sampled structures were arranged by their geographic position and divided into groups to facilitate the survey process by a team of ten census takers. Each census taker was assigned to survey 80 sampled structures. GPS-enabled tablet computers were loaded with satellite imagery and the specific survey assignment for each census taker; as the census takers conducted surveys, the tablet computers recorded the locations of each surveyed household and business to allow the survey supervisor to ensure that the survey instructions were followed.

The survey instrument was loaded onto the tablet computers using Open Data Kit (ODK) Collect², an open-source software framework designed to conduct surveys of this nature. Each surveyed household/business data would be stored temporarily on a tablet computer. Use of this data collection method guides census takers to the correct household/business as well as through the interview process to reference the relevant questions depending on the respondent’s answers to preliminary questions.

The ODK Collect software supports a variety of question types, including multiple choice responses; this also allows questions to be skipped based on relevance. The software can repeat blocks of questions if needed, for example those questions pertaining to lighting and appliance use within the energy use module. The digital survey instruments also support restrictive values for certain questions, ensuring that the required answers are available for analysis. Examples of these restrictive values include nationality, years living in Rwamwanja, number of adults bringing income to the household, etc.

TABLE 3: RWAMWANJA GIS INFORMATION NKOMA SUBCOUNTY, KAMWENGE DISTRICT

VILLAGE	AREA (km ²)	STRUCTURES
Nkoma	17.006	1165
Katalyeba	10.914	694
Mahani	22.591	574
Ntenungi	19.288	1602
Kyempango	31.946	3072
Rwencwera	6.651	305
Buguta	12.549	51
Mukole	14.988	240
Total	135.932	7,703

SURVEY IMPLEMENTATION

The survey was conducted from March 12 – 21, 2018. The survey team included ten census takers, four specialists (GIS, financial, and communications), and two renewable energy experts. Ten local translators supported the activity as there are seven languages spoken within the community. Two vehicles allowed the survey team to conduct surveys in different areas of the survey project area. Each census taker was equipped with a Nexus 7 Android tablet for data collection and routing, an

²ODK is an open-source set of applications that enable users to design, implement, and collect data on a mobile device for a variety of purposes. It essentially replaces the need for paper forms and databases through a suite of applications.

identification badge, notebook, pencil, survey shirt, and umbrella. In addition, ten power banks were available to the census takers to charge their tablet when their battery reached a critically low level.

The main applications used (on each tablet) during the survey included:

- Open Data Kit Collect
- OsmAnd (global positioning system software for Android devices)
- Barcode Scanner
- Google Docs
- Integrated calculator and camera applications.

Mapping the Survey Location

OsmAnd was chosen as the main tablet-based GIS application used to route each census taker to the sampled digitized structures to be surveyed. OsmAnd can display off-line open source maps, as well as display GPX³ files, create waypoints, navigate to points, and track movement. For each sampling frame, each census takers' OsmAnd was loaded with a GPX file showing the sampled points they were to survey. The census taker could then either use the built-in navigation function to guide them to that point or they could make their way by map. When a census taker completed a survey at a specific location, they recorded the position/structure as completed using an OsmAnd function. This allowed the census taker to display all locations to be surveyed and those completed in different colors on a tablet display map.

The survey managers could use the OsmAnd software manage the census takers by tracking their movements and timing. Tracking the movement of each census taker allowed the survey specialist to ensure that the census taker had visited the points assigned and view a timeline of their movements. OsmAnd was also used to store navigation GPX files created by the census taker when they used the navigation feature to move from one survey location to another. This data was reviewed on each tablet at the end of the day and loaded onto Google Earth Pro by the survey specialist.

Review and Verification

At the close of each day, the survey supervisor and survey specialist met with each census taker to review their activities. This included movement tracking through OsmAnd, as well as reviewing the forms completed within ODK Collect. During the first days of the survey, the survey supervisor carefully reviewed each the census taker's forms in detail at the end of each day. If no errors were found, the census taker was released for the day. If errors were found, they were discussed and dealt with before declaring the survey form complete; in the case of errors not resolved during the discussion, the survey form was labeled incomplete until all errors were corrected (if they were not corrected, the survey was not used). As the survey progressed and the census takers become more proficient, a random sample of five forms per census taker was reviewed by either the supervisor or

³ GPX, or GPS Exchange Format, is an XML schema designed as a common GPS data format for software applications.

specialist with the census taker. On average, the census taker completed eight to nine surveys each day.

Open Data Kit Aggregate: Creating the Database

ODK Aggregate was used to create the database by combining the submitted, completed forms from each tablet at the close of each day. The team used a program called ODK Briefcase to synchronize the full survey database from ODK Aggregate. The master database was first saved as a CSV file and then as an Excel file.

RESULTS

HOUSEHOLDS

The household survey instrument was used to capture data on household demographics, income source, energy use, expenditure patterns, use of credit, bank account ownership and other questions related to cash or digital transactions, and to communications and connectivity. A total of 457 households were included in the survey, of which 408 were refugee families from DRC and 49 Ugandan families.

Demographics

Seven languages are spoken within the settlement (as shown in Figure 1). Sixty five percent of the population speaks Kinyarwanda and 23% speaks Swahili; both are distinct languages in Eastern DRC and Southern Uganda. English and four other Ugandan languages are used to a lesser extent.

In the context of this analysis, a household is defined as a group of people, related or unrelated by blood, residing in the same housing structure, led by one a specific household head and eating from the same pot. Approximately 90% of the surveyed household structures are temporary; permanent and semi-permanent structures make up the remaining 10% of housing structures at the settlement—each at about 5% as shown in Table 4. The main construction materials for temporary structures are mud and wood for the walls and tarpaulin for roofs. Refugee status does not allow the construction of permanent houses.

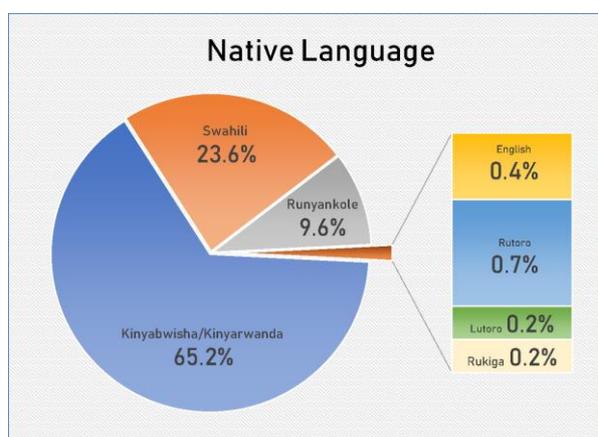


Figure 1: The assessment identified seven spoken languages at Rwamwanja. Each census taker was accompanied by a translator fluent in at least three of the languages.



Photo 3: A typical temporary house in Rwamwanja.

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TABLE 4: DISTRIBUTION OF TYPE OF HOUSING STRUCTURES WITHIN RWAMWANJA SETTLEMENT

HOUSING STRUCTURES	UGANDAN	DRC	TOTAL
Permanent	38.8%	1.5%	5.5%
Semi-Permanent	10.2%	4.2%	4.8%
Temporary	51.0%	94.4%	89.7%
Total	49	408	457

Data disaggregated by gender shows that males and females are well balanced, accounting for almost 50% of the total population each as is shown in Table 5. A closer look at the data highlights that adults 18 years and over represent 56% of the population, and children below 18 are 43% of the population. The average household size is 5.7 people and the average number of rooms per house is 2.6. Around 23% of the households are headed by women and 55% of adults are female.

Seventy percent of the children attend school. More Ugandan adults within the households earn income than refugee adults (3 to 2). It was also found that on average, Ugandans earn 1.56 times what refugees earn.

The household head's level of education is strongly correlated to annual income as shown in Table 6; as the level of education of the head of the household increases, the annual income also increases. For example, a household head with no education earns on average US\$311 annually, while a household head with a completed high school education earns on average US\$711 annually. Sixty percent of the household heads have no formal education, 28% completed primary school, and 11% completed high school.



Photo 4: Solar PV technologies for lighting purposes are widely accepted within the settlement.

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TABLE 5: DEMOGRAPHICS OF THE SURVEY SAMPLE

	HEAD OF HOUSEHOLD GENDER	FAMILY MEMBERS	ADULTS	FEMALE ADULTS	ADULTS/INCOME	CHILDREN	GIRLS	CHILDREN/ SCHOOL	ROOMS
DRC									
FEMALE	103	4.5	1.6	1.2	1.3	2.3	1.5	1.5	2.1
MALE	305	6.0	2.3	1.1	1.9	2.6	1.7	1.8	2.7
DRC TOTAL	408	5.6	2.1	1.2	1.8	2.6	1.7	1.7	2.5
UGANDA									
FEMALE	6	6.2	2.5	1.7	2.3	2.3	1.3	2.8	2.8
MALE	43	6.4	3.4	1.8	2.9	2.3	1.7	2.3	3.5
UGANDA TOTAL	49	6.4	3.3	1.8	2.8	2.3	1.6	2.4	3.4
GRAND TOTAL	457	5.7	2.2	1.2	1.9	2.5	1.7	1.8	2.6

TABLE 6: LEVEL OF EDUCATION OF THE HOUSEHOLD HEADS AND ANNUAL INCOME GENERATION

EDUCATION LEVEL	COUNT	EDUCATED PEOPLE	CONTRIBUTION TO TOTAL INCOME	ANNUAL INCOME
NO FORMAL EDUCATION	272	59.52%	45.83%	\$311.17
COMPLETED PRIMARY SCHOOL	128	28.01%	31.89%	\$460.13
COMPLETED HIGH SCHOOL	52	11.38%	20.04%	\$711.58
COMPLETED VOCATIONAL TRAINING AFTER HIGH SCHOOL	3	.66%	1.83%	\$1125.90
COMPLETED UNIVERSITY BACHELOR'S PROGRAM	2	.44%	.4%	\$1261.43
TOTAL	457			

Income Sources

The Office of the Prime Minister allocates 50 x 50 m² land plots to new arrivals to support food production and income generation. Refugees use the land to grow food and to sell surplus produce. Maize and beans are staples most commonly distributed by World Food Program (WFP) to refugee families. Maize and beans are also the primary crops grown by the refugees with direct support from the Lutheran World Foundation (LWF). LWF provides refugee farmers seeds for maize and beans; they also provide seeds for rice, cabbage, tomatoes, onions and eggplant. Beans, maize, cooking oil, rice, flour, soy are some of the most common products distributed by the donor agencies and NGOs.

Farming is the most frequent income source for households; 56% of the families fully depend on growing and selling surplus produce while 19% use produce sales as a secondary income source. The second most important income source for households is also related to farming; 17% of the surveyed population noted that farm laborer wages are a primary income source and 18% of the respondents highlighted farm laborer wages as their secondary income source. Other income sources included casual labor, business ownership, boda-boda driver, rental property

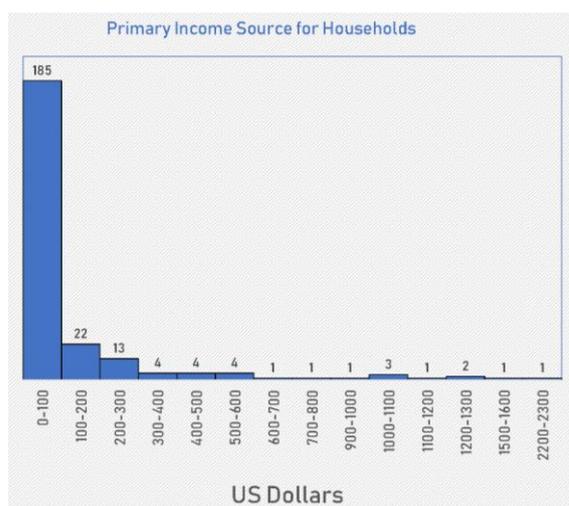


Figure 2: Monthly income distribution from farming.

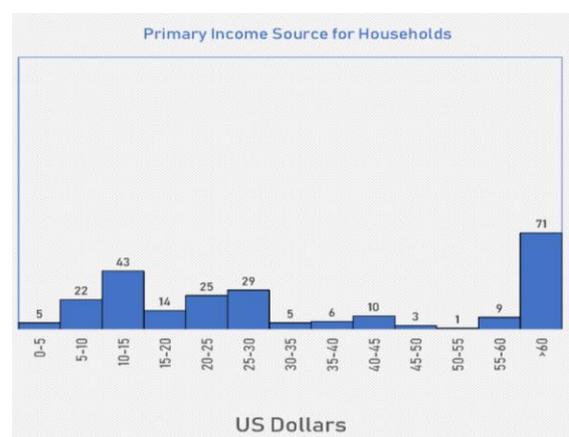


Figure 3: A closer look at the monthly income distribution from farming.

management, livestock, professional services, skilled labor, tailoring, and remittances, among others.

Almost 32% of the households receive cash donations; the amounts range from US\$6 to US\$122 per month per household. The average donation is US\$48. Cash donations are distributed by the WFP to those refugees who choose cash over food rations. According to the WFP, refugees receive US\$12 per month per family member. If a family has four members, that family receives US\$48.

Approximately 4% of the sample depends on financial aid and 10% consider it a secondary income source. Refugees that opt to receive cash have other payment needs beyond food such as the need to pay school fees or purchase household items like cooking oil. To receive cash, refugees must have been at the settlement for at least two years. The groups that will not be transitioned to cash are child-headed families and people with special needs (PSNs) because of their vulnerable status.

Refugees also receive other types of in-kind donations such as construction materials, health services, education for children, and fresh water. Many surveyed respondents expressed appreciation for health services.

Only 3.5% of the surveyed households received remittances. Thirty-one percent of those receiving remittances receive between US\$14 to US\$30 per year; a notable outlier reported a remittance of US\$700 in 2017.

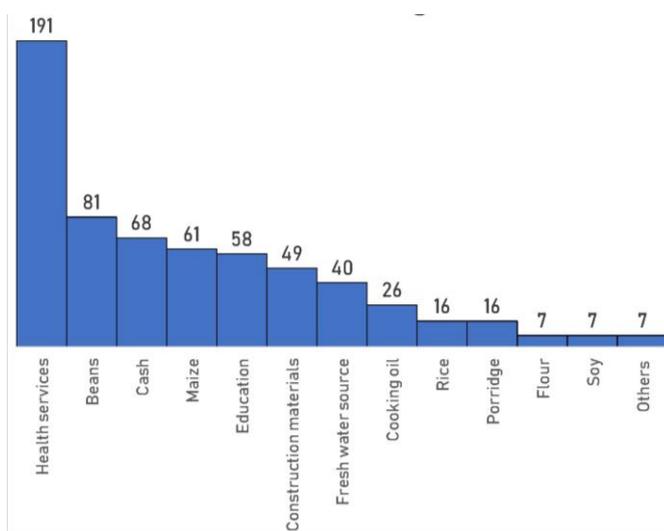


Figure 4: Donations given to refugees.



Photo 5: Selling surplus agricultural produce is the most important source of income for households.

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TABLE 7: PRIMARY AND SECONDARY INCOME SOURCES OF RWAMWANJA HOUSEHOLDS

INCOME SOURCES	PRIMARY INCOME SOURCE	SECONDARY INCOME SOURCE
Farming (growing and selling crops)	254	85
Wages paid for agricultural laborer	80	82
No steady job, laborer as demanded	22	16
Wages paid for non-agricultural labor	22	20
Ownership of a business	20	20
None	19	154
Financial Aid	16	46
Wages for professional services	6	6
Income from rental of property	5	12
Skilled labor	4	3
Remittances	0	3
Boda-boda driver	2	1
Trading	2	0
Interest from group savings	0	2
Lending	1	0
Livestock	1	3
NGO Worker	1	0
Pension	1	0
Tailoring	1	0
Bee keeping	0	1
Charcoal production	0	1
Traditional doctor	0	1
Village Health Team	0	1
Total	457	457

Expenses

Between the host and refugee communities, there is a notable difference in the average expenses per day per household. On average, a Ugandan household spends US\$4.45 daily while a Congolese household spends US\$2.48 daily.

Expenditures were divided into weekly, monthly, quarterly and annual expenditures. It is common that people do not track or record this type of information. The survey was designed not only to make people comfortable in responding to these questions but also to make it as easy as possible to provide accurate responses. Some questions asked for weekly expenditures such as for food, charcoal or firewood for cooking, mobile phone charging, and transportation; other questions asked for monthly payments such as rents for housing and/or land for farming. Additional questions were asked about infrequent expenses such as health care expenses, school fees, clothing and remittances to family members and relatives. Questions regarding more significant expenses such as the purchase of furnishings, appliances or vehicles were asked and presented on the basis of when these expenses occurred for each surveyed household.

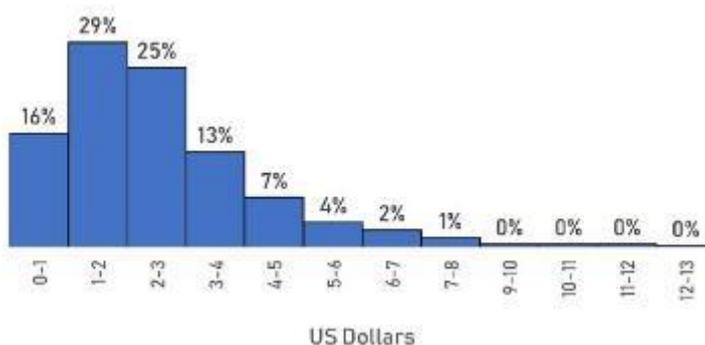


Figure 5: Distribution of household daily expenses.

Figure 5 illustrates that 45% of the Rwamwanja households spend less than US\$2 per day, 70% spend less than US\$3 per day, 83% spend less than US\$4 per day, and 90% spend less than US\$5 per day.

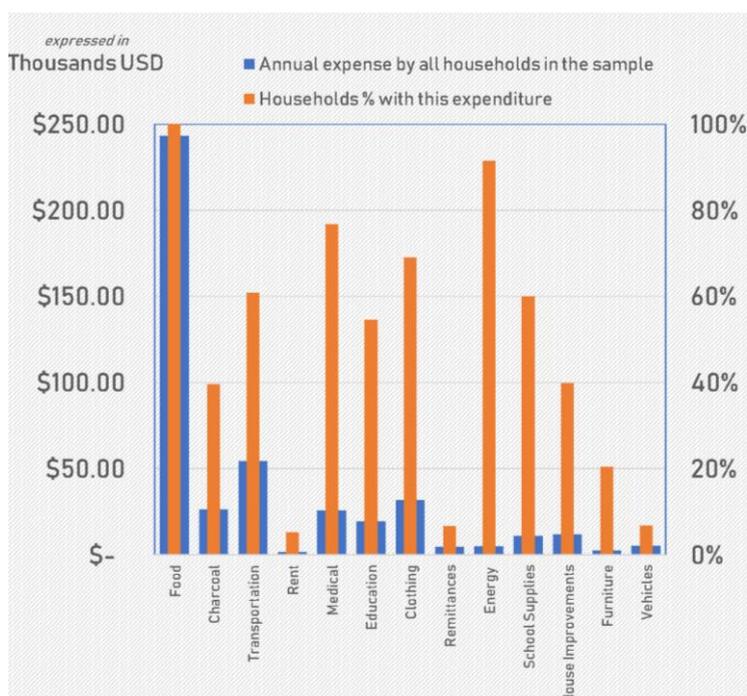


Figure 6: Total annual expenses of the surveyed households.

Food is the most common expense in the Rwamwanja community followed by energy; ninety-two percent of surveyed households buy some form of fuel or energy service. However, energy expenses as a portion of total expenses is small relative to food and other expenses. The average energy expense corresponds to 1.1% of total household expenses.

The analysis shows that food is the most significant expense followed in order of importance by energy, medical care, clothing, transportation, school supplies such as uniforms and school fees,

charcoal for cooking, and house improvements. Less common expenses include furniture, remittances, and rents.

Electricity Consumption

When asked if households have used any energy sources last month, seven reported no energy expenditures for lighting or other non-cooking uses. The majority of households use disposable torches for lighting (60.4%), followed by solar home systems or solar kits (35.7%) and dry cells (14.2%). A much smaller fraction of the households use solar lanterns (3.9%), rented solar kits (2.2%), and/or rechargeable appliances (2.2%). Less than 1% of the households use large rechargeable batteries, electricity from neighbors, kerosene, and candles. Twenty-eight percent of the households pay to charge cell phones, 37% charge them at home, while the remainder (35%) do not own phones.

Households spend from US\$0.11 to US\$8.50 per month on disposable torches. Most purchases (81%) of torches are made weekly. Monthly and bi-weekly purchases are around 7% each. Disposable torches cost Ugandan Shillings (UGX)1,000 (US\$0.28).

According to the survey, 163 households own solar home systems or solar kits. These vary in size from 2 Wp to 150 Wp and the purchase price ranges from UGX15,000 to UGX1,650,000 (US\$4 to US\$471).

Dry cell batteries are the third most significant source of electricity among the people in Rwamwanja. Use is limited to lighting and radio.

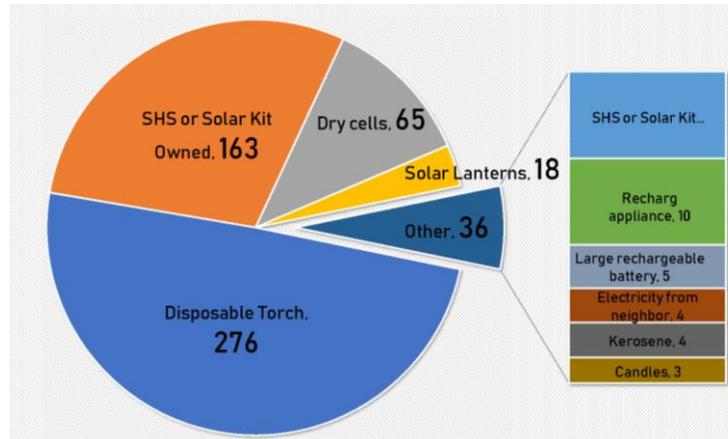


Figure 7: Forms of energy sources for households in Rwamwanja.

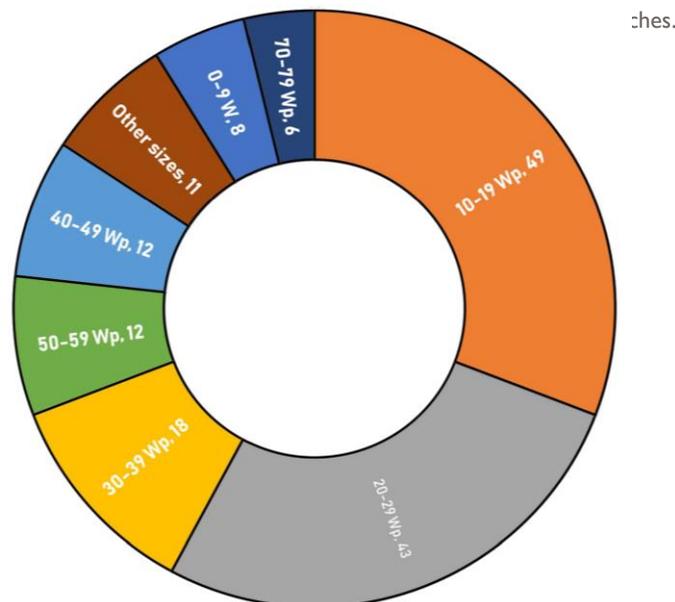
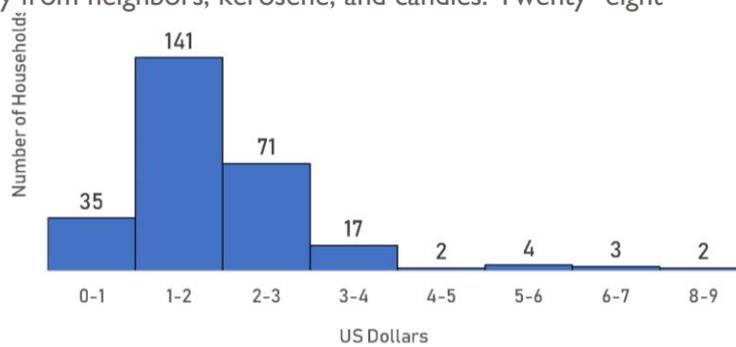


Figure 9: Size of owned solar home systems or solar kits.

Lighting and Other Appliances

Thirty-nine percent of surveyed households use electricity for lighting and 29% own appliances. For lighting, the most common bulbs are Light Emitting Diode (LED) bulbs which are provided by agency donors and are sold at local trading centers. The majority of homes in Rwamwanja have two LED lights that are used for four to eight hours per night.

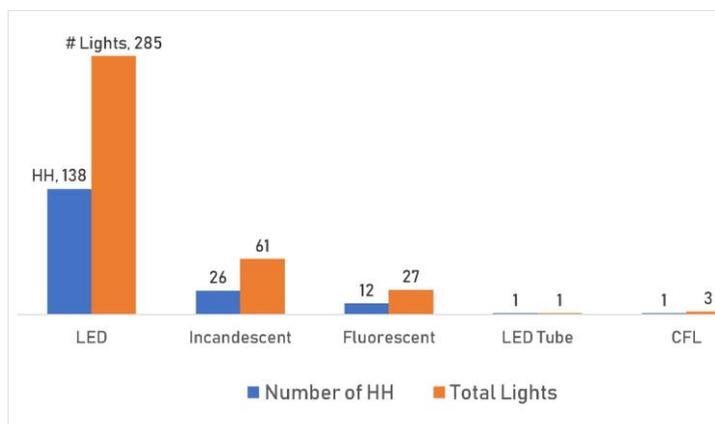


Figure 10: Type and number of lights use in Rwamwanja households: 76% LEDs, 16% Incandescent, 8% Fluorescent

All households expressed the desire for lighting with 66% stating a desire for appliances such as fans, radios, and televisions. Eighteen percent report using electricity for phone charging.

Many surveyed households had a desire for electricity in order to start a business; a large number of those had an interest in starting a salon. Other responses in terms of electrical appliance demand were for electrical tools, irons, and sewing machines.

TABLE 8: MOST FREQUENTLY FOUND SCENARIOS OF LIGHTING IN HOUSEHOLDS

PERCENTAGE OF HOUSEHOLDS	NUMBER OF LED PER HOUSEHOLD	TOTAL LIGHTS	AVERAGE HOURS OF USE	MAXIMUM HOURS	MINIMUM HOURS
26%	2	98	8	24	4
17%	1	63	8	12	3
10%	3	36	10	24	4
8%	6	30	8	12	5

TABLE 9: APPLIANCE OWNERSHIP

APPLIANCES	HOUSEHOLD OWNING APPLIANCES	TOTAL APPLIANCES
Radio		
1 Radio	37	37
2 Radios	1	2
Other Music Playing System	2	2
Electric Iron	1	1
Mobile Phone Charger		
1 Charger	66	66
2 Chargers	10	20
3 Chargers	5	15
Television	5	5
Grand Total	127	148

Ability to Pay for Electricity Services

The survey data shows that households are currently spending very little for energy resources even though all respondents have acknowledged that energy is the second most important expense after food. As Figure 11 indicates, 70% percent of the households could spend US\$1 per month; 41% could spend US\$2; 25% could spend US\$3; and 14% can pay as much as US\$4 per month. Electricity provision solutions are usually planned for clusters of households where there may be a

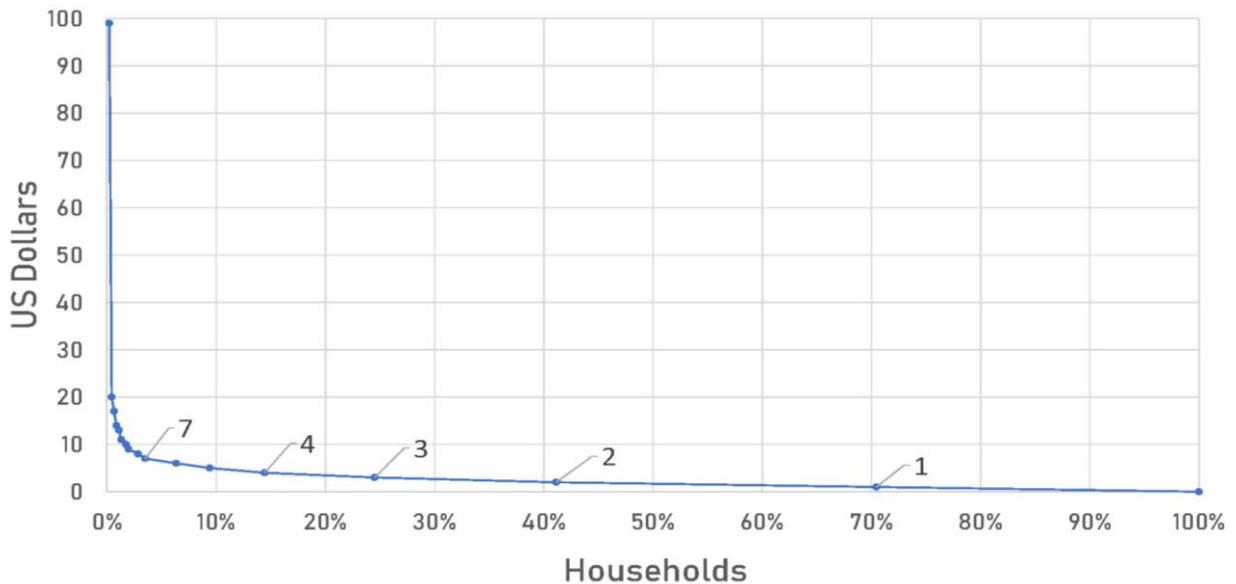


Figure 11: Ability to pay for electricity by Rwamwanja households.

concentration of businesses and public services. Economic activity is higher in such areas so the household’s ability to pay is higher. This approach can add sustainability to electrification projects.

Connectivity

Sixty percent of the 457 surveyed households reported using cell phones. Whether the phone is owned or borrowed from a neighbor, the Rwamwanja community greatly values cell phone communications. Simple flip phones are most commonly used; only 6% of the households (18) used smart phones.

Forty-three percent of the phone users pay for charging services. The charging costs range from UGX100 to UGX1000 per charge; the majority (84%) of charging costs UGX 500 (US\$0.14). Most users pay for charging every two to four days, although a few users pay for phone charging once a week.

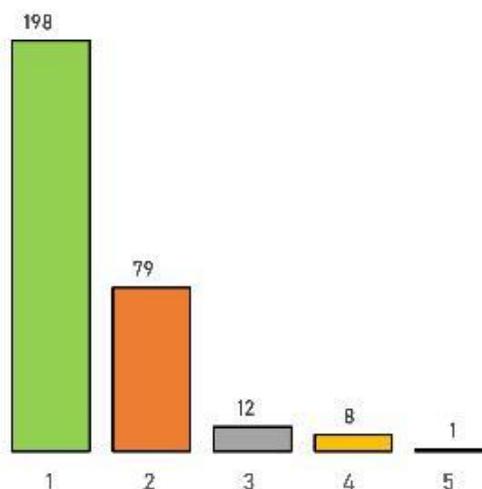


Figure 12: Number of cell phones per household.

Forty-two percent of the cell phone users use mobile money services to receive money (29.1%), send money (25.3%), save money (27.2%), and buy airtime (15.6%). Less common uses for mobile money services are payments for family expenses, suppliers, solar kits, or to receive money on behalf of others. Refugees use their alien identity card or refugee identification to register for mobile money services. There are few instances of refugees borrowing phones or IDs to register.

Twenty-two percent of the households interviewed have relatives abroad. Out of the 97 families, 41% have relatives in the DRC, 21% in Rwanda, and 9% in the United States. Twenty-one percent of families have relatives in Canada, England, Dubai, Kenya, Tanzania, Australia, Burundi, China, Denmark, France, Mozambique, Norway, and Sudan.

A majority of the communications with relatives abroad happen through phone calls, however people are starting to use Facebook or WhatsApp to communicate with their relatives. The survey found that 82% of people communicated through phone calls; 3% use Facebook; 3% use WhatsApp; 1% use email; 1% travel; and 10% do not communicate.

Use of Credit

Forty-six percent of the 457 households have requested credit at some point, but only 35% have been granted loans. The main reasons for loan application rejections is either a failure to demonstrate steady income or lack of credit history. Other reasons include the fact that the applicant is a single woman, has no national identity card, has no affiliation to a SACCO, and/or has no collateral.

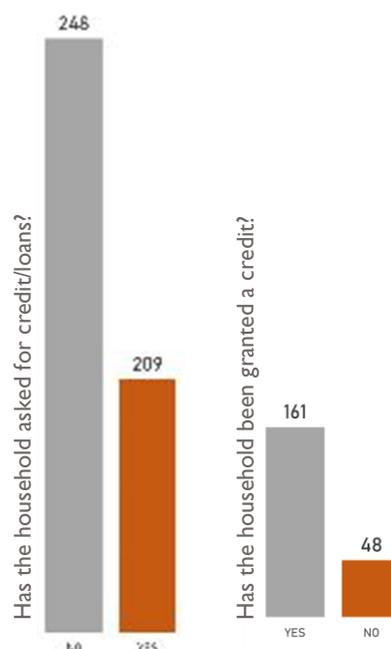


Figure 13: Responses to questions related to credit.

Informal loans are the most common type of credit and account for 48% of all loans, with an average credited amount of US\$30. The instances of borrowing from a local money lender and from the SACCO are 29% and 22% respectively. Moneylenders lend on average US\$24. The 35 loans from the SACCO average US\$136. Only two loans were obtained from a local bank. These loans were larger amounts; the largest was a loan for US\$1,429 at a 24-month loan term.

The most common uses of loans in order of importance are to buy food (24%), pay school fees (19%), pay medical expenses (17%), buy clothing (7%), buy construction materials (4%) buy and seeds for farming (4%). Smaller uses of loans include paying for animal treatments, burials, starting a business, buying a car, buying land, paying debt, paying employees, and/or buying solar products.

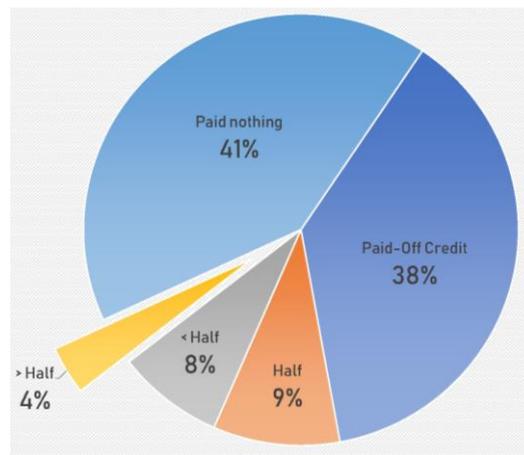


Figure 14: Status of credit payments.

TABLE 10: SOURCES OF LOANS FOR HOUSEHOLDS

	NO. LOANS	AVERAGE LOAN TERM (MONTHS)	MAX LOAN TERM (MONTHS)	AVERAGE CREDITED AMOUNT	MAX CREDITED AMOUNT
Commercial bank	2	13.5	24	\$786	\$1,429
Relatives or friend living in host country	75	1.4	10	\$30	\$200
Village or local money lender	45	1.3	6	\$24	\$286
SACCO	35	2.4	12	\$136	\$2,857
157 Total		1.7 Months Av.	24 Months Max.	\$61 Average	\$2,857 Max.

Transactions

A total of 49 bank accounts were identified for the 457 surveyed households; broken out as 10 individual accounts and 39 joint bank accounts. The main use of bank accounts is for savings, qualifying for loans, sending and receiving money, and paying salaries.

Most transactions within the settlement are cash-based. Household expenses and phone charging are the most common cash

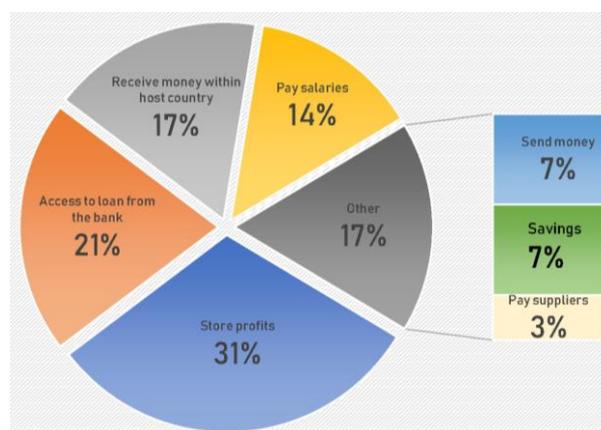


Figure 15: How residents use bank accounts.

transactions. Other cash transactions include air time credit, phone purchases, and school fee payments.

There is no money transfer company based in Rwamwanja. The money transfer agent (Western Union) is located in Kamwenge trading center. The most common means of funds transfer is mobile money service offered through MTN Uganda and Airtel agents.

Forty-two percent of the cell phone users use mobile money to receive/send money, save money, buy airtime, pay for family expenses, pay for suppliers, and pay for solar kits.

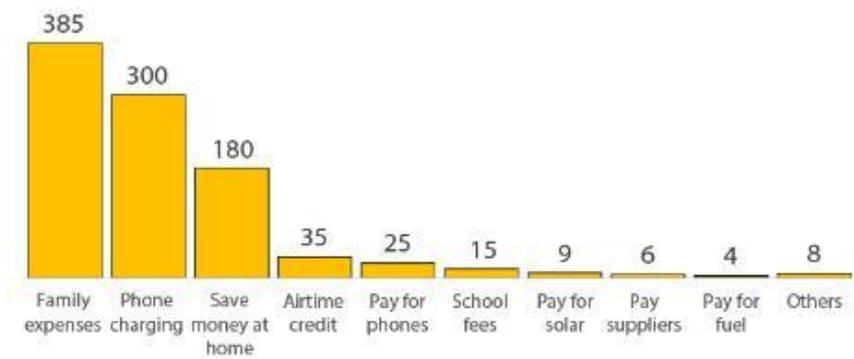


Figure 16: Purposes of cash transactions.

BUSINESSES

The business survey instrument included modules similar to those for the residential survey such as a demographics module, an income module, modules for expenses, energy use, use of credit, credit to customers, bank account ownership, questions related to cash or digital transactions, and questions related to communications and connectivity.

Demographics

A total of 88 business owners were surveyed in seven languages. Forty-three percent of the interviews were conducted in Swahili, 38% in Kinyabwisha, and 11% in Runyankole. Other interviews were conducted in Luganda, English, French, and Rutooro. Most of the businesses (80%) were owned by Congolese, followed by Ugandans (18%), with one business owned by an Ethiopian and one by a South Sudanese. As shown in Figure 17, 38% of the business owners have no formal education, 35% completed primary school, and 23% attended high school. Sixty percent of the business owners interviewed received their education in their home country and 6% of the refugee business owners received their education in Uganda.

Sixty-five percent of the business structures are temporary, 22% are permanent, and 14% are semi-permanent structures. The main construction materials



Photo 6: Newly constructed buildings changing the economic landscape of Katalyeba Town Council.

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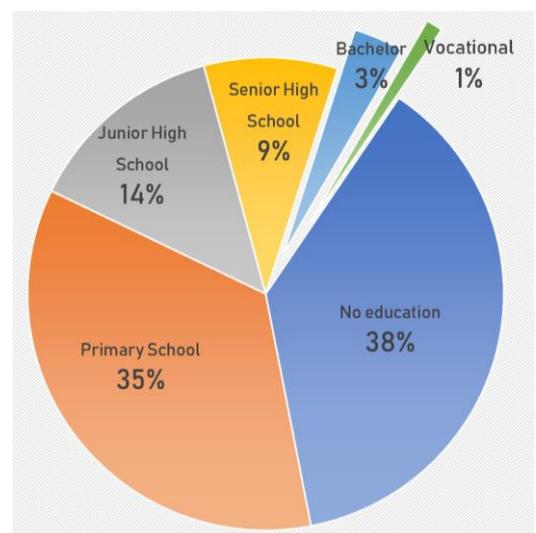


Figure 17: Education level of business owners.

for the temporary structures are mud and wood for the walls and tarpaulin for roofs as is shown in Table 11.

Few businesses have more than one line of activities as is shown in Table 13. Within the 88 businesses surveyed, 92 activities were identified. General shops are the most frequent activity (37%); these shops sell food, tools, construction materials, light bulbs, electronics, etc. The second highest type of business activity found is grocery stores (12%). Tailoring is also an important activity in Rwamwanja (almost 10%). Twenty other business types were assessed such as bars, carpentry shops, boutiques, barbers, and some food processing. Most businesses operate seven days a week (66%) and 17% operate six days a week.



Photo 7: A fully stocked retail shop in Katalyeba Town Council.

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The surveyed businesses are fairly new establishments. They have been operating for 2.2 years on average. Forty-four percent of the business owners are female and about 72% of the employees are related to the employer. There is an even number of female to male employees. Sixty-seven percent of the businesses do not pay any fees to be able to operate formally. Thirty-three percent pay fees either to the town council or the District in an annual basis. The fees range from US\$3 to US\$58.

Building sustainable services and expanding economic opportunities through job creation and skills development is crucial for both refugees and the host community. Three of the businesses assessed received donor support to start operations. In addition, 17 businesses reported receiving general training, 12 reported receiving financial training, and 4 reported receiving technical training. Training for literacy, elementary education, and sanitation were also mentioned.

TABLE 11: BUSINESSES IN RWAMWANJA BY TYPE OF CONSTRUCTION, SERVICE CATEGORY AND OWNER NATIONALITY

BUSINESS STRUCTURES	DRC OWNER	UGANDAN OWNER	ETHIOPIAN OWNER	SOUTH SUDANESE OWNER	TOTAL
Permanent	14	5			22%
Semi-Permanent	6	5	1		14%
Temporary	50	6		1	65%
Commercial	22	4			30%
Agroindustry					0%
Mixed used (Residential and commercial)	48	12	1	1	70%
Shed/kiosk	8	1	1		11%
Stall	18	4			25%
Store	44	11		1	64%

TABLE 12: DEMOGRAPHICS OF BUSINESSES IN THE RWAMWANJA AREA

NATIONALITY	COUNT	YEARS OPERATING	AVERAGE EMPLOYEES	TOTAL EMPLOYEES	AVERAGE FAMILY MEMBERS	TOTAL FAMILY MEMBERS	AVERAGE FEMALE EMPLOYEES	TOTAL FEMALE EMPLOYEES	AVERAGE ROOMS
DRC									
FEMALE	27	1.9	2.0	53	1.6	42	1.3	34	1.4
MALE	43	2.2	2.6	111	1.7	73	1.0	44	1.3
DRC TOTAL	70	2.1	2.3	164	1.6	115	1.1	78	1.4
ETHIOPIA									
FEMALE	1	3.0	2.0	2	2.0	2	1.0	1	5.0
ETHIOPIA TOTAL	1	3.0	2.0	2	2.0	2	1.0	1	5.0
SOUTH SUDAN									
MALE	1	0.2	1.0	1	1.0	1	0.0	0	1.0
SOUTH SUDAN TOTAL	1	0.2	1.0	1	1.0	1	0.0	0	1.0
UGANDA									
FEMALE	11	3.2	1.4	15	1.1	12	1.4	15	1.3
MALE	5	2.3	1.8	9	1.4	7	0.4	2	1.4
UGANDA TOTAL	16	2.9	1.5	24	1.2	19	1.1	17	1.3
TOTAL	88	2.2	2.2	191	1.6	137	1.1	96	1.4

TABLE 13: BUSINESS ACTIVITIES

	NUMBER OF BUSINESSES
General shop	34
Grocery Store/Super Market	11
Tailor	9
Bars	6
Woodwork	4
Charcoal trade	3
Barber	2
Boutique	2
Food processing	2
Grain mill	2
Hair saloon	2
Maize trade	2
Pharmacy	2
Restaurant	2
Butcher	1
Clinic	1
Cold storage	1
General agricultural processing site	1
Local drinks	1
Money lending	1
Phone repairs	1
Retail	1
Vegetable sellers	1

TABLE 14: MONTHLY EXPENSES OF BUSINESSES BY ACTIVITY TYPE

BUSINESS ACTIVITIES	SUM OF INVESTMENT USD	SUM OF MONTHLY REVENUE USD	SUM OF MONTHLY EXPENSE USD	NO. BUSINESSES	AVERAGE PROFITS PER BUSINESS
Bar	\$489	\$1,423	\$910	6	\$85.48
Barber	\$171	\$129	\$60	2	\$34.29
Boutique	\$743	\$186	\$30	2	\$77.86
Butcher	\$100	\$43	\$14	1	\$28.57
Charcoal Trade	\$171	\$40	\$94	3	\$(18.10)
Clinic	\$343	\$17	\$34	1	\$(17.14)
Cold Storage	\$29	\$-	\$-	1	\$-
Food Processing	\$94	\$50	\$173	2	\$(61.43)
General	\$8,733	\$7,233	\$4,546	34	\$79.03
Grain Mill	\$1,686	\$251	\$214	2	\$18.57
General Agriculture	\$57	\$29	\$26	1	\$2.86
Grocery Store	\$1,191	\$1,020	\$397	11	\$56.62
Hair Salon	\$355	\$171	\$111	2	\$30.00
Local Drinks	\$17	\$17	\$6	1	\$11.43
Maize Trade	\$857	\$1,429	\$857	1	\$571.43
Pharmacy	\$286	\$300	\$340	2	\$(20.00)
Restaurant	\$2,581	\$369	\$201	2	\$83.86
Retail	\$143	\$229	\$34	1	\$194.29
Tailor	\$1,226	\$326	\$535	9	\$(23.27)
Woodwork	\$300	\$843	\$423	4	\$105.00

Revenues and Expenses

General stores have the highest revenues on a monthly basis; thirty-four general stores were surveyed, and they reported an average monthly profit of US\$79. Grocery stores report an average monthly profit of US\$56. These findings are aligned with the findings from the household survey; the greatest expense for households is food. Some individual businesses such as retail and maize trading also report significant profits.

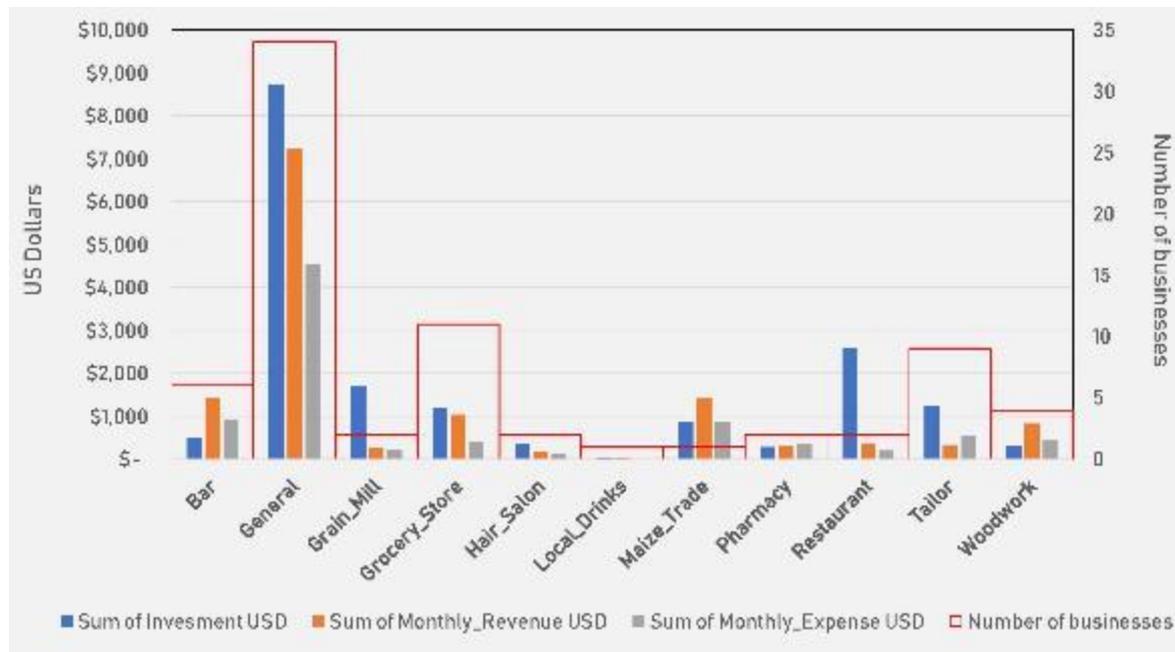


Figure 18: Total investments and monthly revenues and expenses by type of businesses.

Energy Consumption

The 88 surveyed businesses report 106 energy sources used to support business functions; some businesses use multiple energy sources such as generators, solar PV systems for lighting, and liquified petroleum gas (LPG) for cooking. The most common combination reported by businesses is use of solar PV systems with disposable torches. In other cases, businesses may use solar PV systems in combination with dry-cell batteries.

As is shown in Figure 19, solar PV systems are used by over 70% of surveyed business owners and are the most commonly reported source of electricity. Solar PV systems can be rented or leased; 11% of the businesses that use solar PV systems report renting or leasing them. Energy use for businesses that report using solar PV systems include radio/music equipment (32.4%), phone charging (31.8%), lighting (20%), television (10.4%), tailoring (3%), fans (1.2%), and salon equipment (1%). The sizes of the solar systems range from 10 to 400 Wp. The average size for an owned system is 64 Wp and the average size for a rented or leased system is 114 Wp.

Most solar PV systems owned by businesses were purchased with savings while in a few notable cases, money was borrowed from a SACCO, or credit was provided by a solar PV vendor. The cost per watt was US\$1.06 when purchased with savings, US\$2.48 when borrowed from a SACCO and US\$5.96 when a solar company credit was used. The monthly rent/lease cost per watt is US\$0.15.

Disposable torches are not only popular within the households but also with businesses. Twenty percent of the businesses use disposable torches which are most commonly purchased weekly. The unit cost of torches is UGX1,000 (US\$0.28); businesses spend from US\$0.28 to US\$3.50 per month on disposable torches.

Six businesses (7%) use dry-cell batteries primarily for lighting purposes. Dry-cell battery expenditures range from US\$1.50 to US\$26 per month. Generator use is limited to one restaurant and a grain mill. Monthly expenses for generator use exceed US\$100; this cost includes fuel, maintenance, and depreciation. Other minor energy expenditures include car batteries, candles, LPG for cooking, kerosene, rechargeable torches, and solar lanterns.

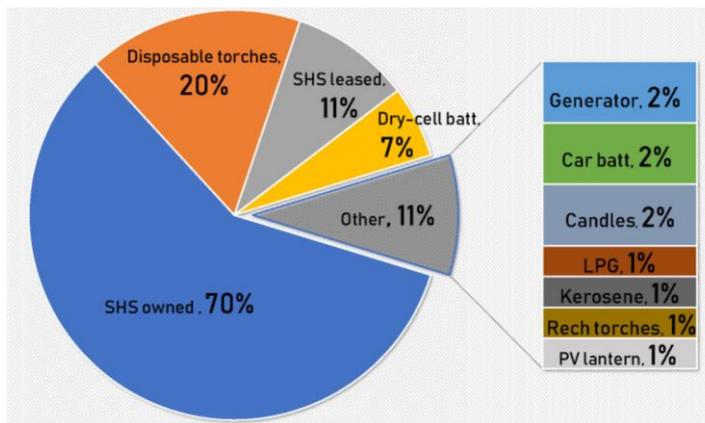


Figure 19: Energy sources used by businesses.

Lighting and Appliances

Businesses reported using appliances such as phone chargers (40%), radios (27%), CD players (14%), televisions (12%), shavers (5%), and one electric sewing machine and a satellite dish.

The average number of lights is 2.52 per business. The majority of the lights (157 out of 182) use LED technology. Fluorescent tubes and incandescent lights were reported by 3.8% and 9.9% of the surveyed businesses respectively. While one restaurant claims to use lights 24 hours per day, the average reported daily lighting duration is 6.6 hours.

The survey included a question that asked business respondents, “If you had electricity, what would you use it for?”. All business respondents stated a desire for grid-electric service and if provided, 88 respondents provided 306 potential uses. General lighting was the most common response (26%), followed by security lighting and by a desire for computers, fans, radios, and televisions. The next most commonly stated desire was refrigeration to preserve food. Some businesses reported the desire for task lighting, electrical tools, electrical sewing machines, woodworking tools, milling and grinding equipment, and internet-connected computers.

Business Energy Expenditures

Data collected shows that business expenditures on energy services ranges from less than US\$1 to as much as US\$113 per month. Sixty-one percent of the businesses spend at least US\$1; 42% spend US\$2; 34% spend US\$3; 25% spend US\$4 and 10% spend US\$20. Four businesses are paying US\$60 and above. Table 13 and Figure 26 characterize energy expenditures by surveyed businesses in Rwamwanja. The highest economic activity in Rwamwanja is adjacent to the UNHCR base camp and most businesses are concentrated in this area. As the table 15 highlights, grain mills and restaurants spend much more than other businesses for energy services.

TABLE 15: MONTHLY EXPENSES ON ELECTRICITY BY TYPE OF BUSINESS

MONTHLY EXPENSES ON ELECTRICITY BY TYPE OF BUSINESS	COUNT	MAX ELECTRICITY EXPENSE	MIN ELECTRICITY EXPENSE	AVERAGE ELECTRICITY EXPENSE
Bar	7	\$9.14	\$0.31	\$2.33
Barber	2	\$1.05	\$-	\$0.53
Boutique	2	\$2.25	\$-	\$1.13
Butcher	1	\$6.57	\$6.57	\$6.57
Charcoal Trade	3	\$3.53	\$0.20	\$2.39
Clinic	1	\$0.61	\$0.61	\$0.61
Food Processing	2	\$5.51	\$1.62	\$3.57
General	34	\$62.22	\$0.14	\$6.41
Grain Mill	2	\$113.25	\$18.29	\$65.77
General Agriculture	1	\$4.98	\$4.98	\$4.98
Grocery Store	11	\$3.43	\$0.20	\$1.73
Hair Salon	2	\$42.86	\$-	\$21.43
Local drinks	1	\$-	\$-	\$-
Maize Trade	1	\$0.10	\$0.10	\$0.10
Pharmacy	2	\$2.22	\$-	\$1.11
Restaurant	2	\$105.10	\$0.31	\$52.70
Retail	1	\$26.85	\$26.85	\$26.85
Tailor	9	\$59.43	\$-	\$8.67
Woodwork	4	\$5.71	\$-	\$2.35
	88	\$113.25	\$-	\$7.72

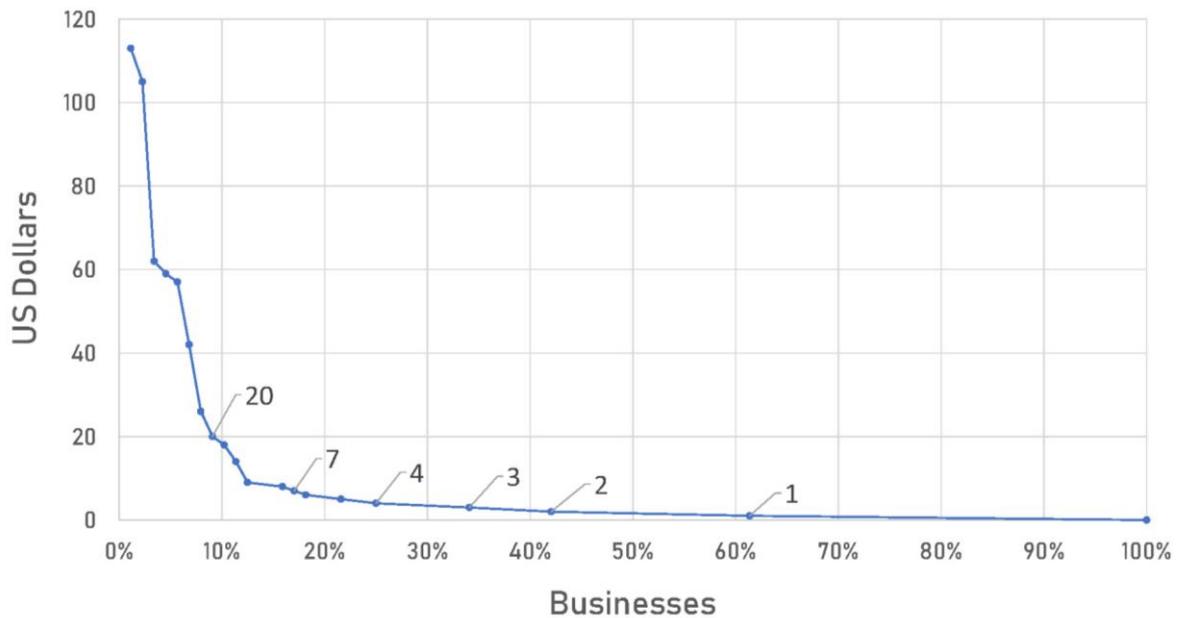


Figure 20: Ability to pay for electricity services by businesses in Rwamwanja.

Use of Credit

Thirty percent of the 88 businesses have applied for credit at some point but only 24% have been approved for loans. The most common need for capital shared in the survey is to start a business, to expand a business, or to buy inventory. Three of the respondents used the credit to pay for solar PV systems. Respondents also noted using credit for farm supply investments, food, school fees and equipment repair.

The reasons cited for failing the loan approval process were from a lack of steady income and lack of credit history. Two respondents mentioned that they couldn't get credit because they have a history of late payments and/or have not paid a previous loan.

As shown in Table 16, local money lenders are the most common source of business loans with 57% of reported loans, followed by 33% of all loans provided by SACCOs. The loan term offered by local moneylenders is reported to be from one to three months, while SACCOs offer loans with repayment periods of up to 12 months.

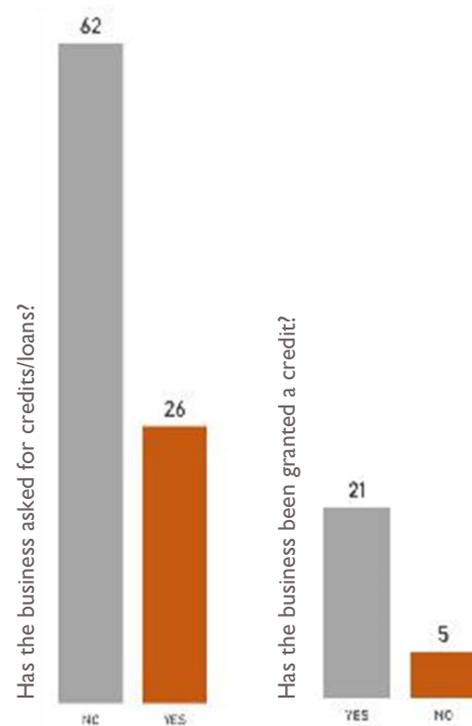


Figure 21: Responses from businesses to questions related to credits.

TABLE 16: SOURCE OF LOANS FOR BUSINESSES

SOURCE OF LOANS	NUMBER OF LOANS	AVERAGE LOAN TERM (MONTHS)	MAX LOAN TERM (MONTHS)	AVERAGE CREDITED AMOUNT
Local Lender	12	1.42	4.00	\$36.07
SACCO	7	7.00	12.00	\$566.67
Solar Seller	2	24.00	24.00	\$714.29
	21	5.38	24	\$273.18

Short Term Credits from Suppliers

Eighty businesses report buying goods from up to 15 different suppliers. Sixty-nine percent report buying goods from three or fewer suppliers, 89% report buying from fewer than six suppliers. Businesses like the grain mills, grocery stores, and general shops report buying from 6 to 15 suppliers. Eighty percent of the suppliers are local and 92% of the transactions are in cash. The remainder of the transactions are made via mobile money options. Loan terms from suppliers to businesses vary from a few days to three months but most of them require payment in a few days to two weeks.

Credit to Customers

Most businesses (92%) provide credit to their customers. The credit can be repaid using several methods including cash, goods, or services. Sixty-nine percent of the credit is extended for goods, 19% corresponds to cash loans, and 12% consists of providing services like haircuts or tailoring to be paid at a later date. The credit terms can extend for more than one month and the terms depend on the type of credit and the debtor. If money was lent, there is an interest rate and fee attached. Almost all transactions with customers are in cash.

Connectivity

Eighty-five percent of the 88 surveyed businesses use cell phones. Flat and flip phones are the most common type of phones used; 75 flat/flip phones were reported by the surveyed population and four businesses own both flat and smart phones. A total of 13 smart phones were reported in the survey. Twenty-five percent of the phone users pay someone else to charge the phone. The cost for phone charging ranges from UGX300 up to UGX1000. A majority pay UGX500 (US\$0.14) for charging services. Most charging takes place every one to three days.

Seventy percent of the businesses use mobile money services to save money (27%), receive money (22.5%), send money (21.3%), buy airtime (18%), and pay suppliers (5.6%). Other uses of mobile money services are for family expenses, bank transfers, and solar home system payments. Refugees have been using their alien identity card (23%) or their refugee status card (52%) for mobile money registration. Two refugees borrowed a national ID.

Forty seven percent of the business owners interviewed have relatives abroad. The majority of relatives mentioned are from the business owner's home country—DRC (57%) or Rwanda (11%).

The remainder (32%) have relatives in USA, England, South Africa, South Sudan, Netherlands, Dubai, Australia, Kenya, France, and Canada.

The majority of communications are made through phone calls (69%). Other means of communicating with relatives abroad is through Facebook (12%), WhatsApp (12%), Viber (2%) and emails (1%). Four percent do not communicate with their relatives.

Other Transactions

Most transactions are cash-based. Only 8 business owners report business/personal bank accounts. The purpose of the accounts is to bank profits. Cash transactions for businesses, in order of importance as prioritized by respondents, are to pay suppliers (89%), pay family expenses (65%), purchase airtime (26%), purchase solar lanterns (13%), and purchase phones (11%). Other cash transactions include fuel expenses, internet data payments, transportation expenses, machine repairs, business expenses, salary payments, phone charging, and livestock purchases.

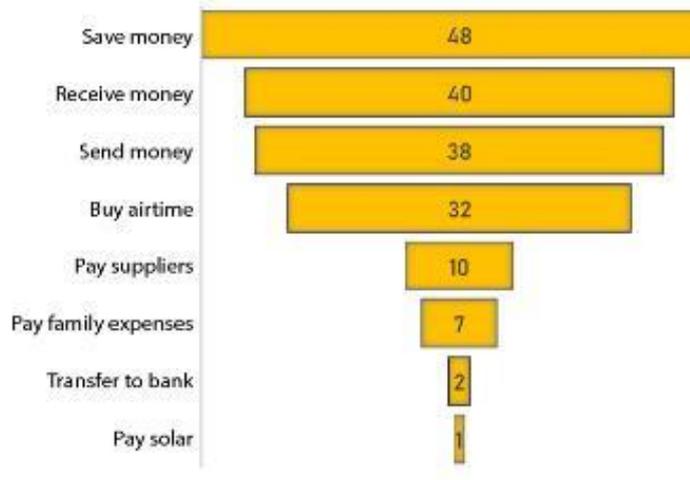


Figure 22: Uses of money among businesses.



Photo 8: Refugee Sarah Kiden (right) pays for vegetables with an e-voucher card at Bidibidi refugee settlement in Uganda.

UNHCR / CATHERINE ROBINSON / <https://reliefweb.int/report/uganda/phone-technology-gives-refugees-uganda-cash-lifeline>

CASE STUDY: CREATION OF THE SACCO

NDABAZI ANTEL GENERAL MERCHANDISE SHOP

Ndabazi Antel is a Ugandan businessman operating a general merchandise retail shop since 2012. Antel's well-stocked shop is quite busy with customers entering every 5 – 10 minutes. He sells toiletries, stationery, and beverages to organizations such as LWF that work in Rwamwanja. The shop also offers mobile money services.

Antel stocks the shop weekly. Most of his suppliers are located in Kyenjojo and Fort Portal but at times he travels to Kampala to buy supplies including Nescafe and Euro silk tissue paper that are not in the western region. Ndabazi Antel is one of the most successful businessmen in Rwamwanja due to the variety of products he sells and the customers he has attracted to his store.

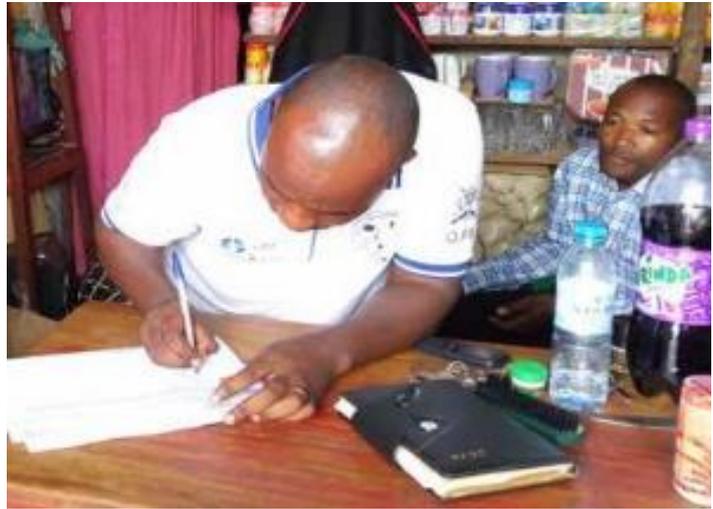


Photo 9: Antel Ndabazi, one of the founders of the Katalyeba SACCO.

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EXPERIENCE WITH FINANCIAL INSTITUTIONS

For five years, Antel had to travel to Ibanda and Fort Portal to interface with Stanbic Bank where he has a business account. Antel also has a personal account at PostBank in Kamwenge. Due to difficulties in transport and the need to keep long shop hours, Antel was often forced to keep cash deposits in his home or shop, a practice that raised anxiety. Because there was no financial institution in Rwamwanja, most people save individually or in village savings groups.

Together with neighbors and colleagues, Antel proposed forming a savings cooperative, an initiative that received support from UNHCR and OPM in late 2017. The Katalyeba Farmers SACCO was formed by Antel and his colleagues and now serves all community members who register as SACCO member-owners. Antel was elected to the SACCO Board of Directors and reports the following benefits from this home-grown financial solution:

- The SACCO is based in the community which allows deposits to be made on a daily basis.
- Withdrawals can be made quickly and easily to finance goods for sale and other business activities on an as-needed basis.
- There is ready access to loan capital.
- The SACCO reduces transportation costs and travel time.

CASE STUDY: DISABLED PERSONS IN RWAMWANJA

UMOJA WA WALEMAVU, WAZEE NA WANAOPENDA MAENDELEO GROUP (ELDERLY, YOUTH AND DISABLED DEVELOPMENT GROUP)

A group comprised of 5 disabled people, 5 youth, and 5 elderly (all refugees from DRC) decided in August 2017 to launch a business to support income generation of group participants. Activities have initially focused on making plastic baskets sold on market days. The basket sizes vary, and prices range from US\$1.50 to US\$5.

The group gathers twice weekly to make at least 30 baskets per day. The baskets are sold at multiple markets and events and sales average 15 – 30 baskets per event. The group targets distribution for days when the refugees receive monthly financial distributions which result in increased sales. A percentage of money earned from sales is kept by the Katalyeba Farmers' SACCO, some is used to buy raw materials, and the remainder is shared among members.

On days when the members are not making baskets, they usually farm, work part time jobs, and operate individual businesses. The group has benefited from SACCO services that allows local banking in a supportive atmosphere. Funds can be banked safely and easily; the group was also able to apply for and receive a small loan of US\$20 that was used to buy raw materials.

The business does not yet have a connection to electric services, so business operations are limited to daylight hours. The business hopes to invest in sewing machines and salon equipment to further empower the members once they are able to gain access to electricity. The members have the necessary skills acquired from the DRC and hope to use these skills to generate income in their home-grown enterprise in Rwamwanja.



Photos 10, 11, 12: Crafts made by Maendeleo group members on display (left), the Chairman of the Maendeleo PSN group (middle), a craftswoman showing her tailoring equipment (right).

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SMALL INDUSTRY

In addition to the household and small business questionnaires, a survey instrument was designed to gather energy expenditure and a variety of other data from all small industries in Rwamwanja. These data include demographics, productive activities, product sales, power generation, and energy use/expenditures. The following sections describe each of these thematic areas included in the survey.

Demographics

A total of 19 small industries were surveyed in four different languages: 42% of the interviews were conducted in Swahili, 37% in English, 15% in Luganda, and 5% in Runyankole. Fifty-three percent of the businesses are owned by private individuals or groups, 21% are cooperatives, 21% are family businesses, and 5% are run by NGOs. Privately-owned and family business data in this analysis are included in the private business category. The survey respondents include owners of private enterprises (41%), technicians (29%), managers (24%), and administrators (6%). Nationalities represented include 50% Congolese, 43% Ugandan, and 7% Rwandese. This group includes only one female small industry owner.

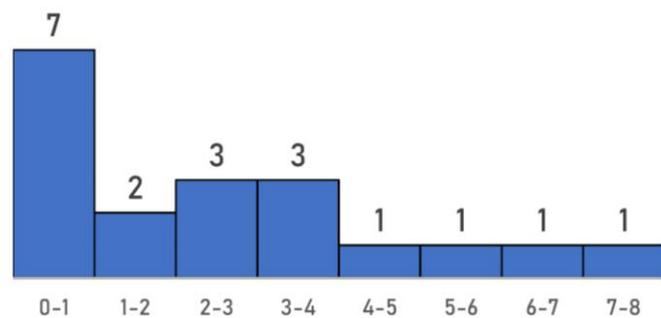


Figure 23: Years of operation of small industries in Rwamwanja.

Thirty-six percent of the small industry owners completed primary school, thirty percent attended high school, and 14% completed a university program. Educational levels of the remaining 2% were not disclosed. Respondents received their education in their home country.

Thirty-seven percent of the industry buildings are permanent, and the remainder are temporary structures. Construction materials are the same for these business structures as others reported earlier: walls constructed of mud and wood and tarpaulin for roofs. These structures are used for business purposes only. On average, these enterprises have been operating for 2.7 years while 7 have operated less than a year. The minimum and maximum years of operation at the surveyed location are one month and eight years. Sixteen business are open seven days a week and 3 are open five days a week. The power plant, gas station, hotel, and the bakery operate two shifts per day.

Eleven businesses pay annual fees to the town council to be able to operate formally. The communication booster business pays an annual fee to the Uganda Revenue Authority (URA). The data collected on fees range from US\$8 to US\$86.

In support of creating new economic opportunities, two cooperatives and an enterprise run by an NGO received support to start operations. Both cooperatives also benefitted from training on technical, managerial, and financial topics.

TABLE 17: OWNERSHIP OF SMALL INDUSTRIES IN RWAMWANJA

SMALL INDUSTRY	OWNERSHIP	EMPLOYEES	FAMILY MEMBERS	FEMALE EMPLOYEES
Cooperative	4	25	6	4
Family businesses	4	29	3	4
NGO	1	2	0	
Private	10	48	12	10
Grand Total	19	104	21	18

Productive Activities

Agricultural activities are dominant in the Rwamwanja economy; analysis of the data collected indicates that agricultural activities are more significant than all other economic activities taken together. Small farmers produce most of the food they consume and sell the rest to generate income. Families in Rwamwanja produce more food than they need due to the excellent access to water, fertile soils, and adequate rainfall.

The WFP provides supplemental food supplies in the form of two important staples: maize and beans. Maize is distributed as grain that must be ground into meal or processed in order to be prepared as food. Cassava, sorghum, and millet are also grown but in smaller quantities. The main agricultural products that require post-harvest processing in Rwamwanja are maize, cassava, sorghum, millet, and rice. Fourteen of the mills are used for grain processing. The millers provide milling services for grain grown in Rwamwanja as well as providing milling services for WFP-provided grain.

Monthly Revenues of Small Industries

The Rwamwanja Cooperative Dairy Society represents 85% of all monthly sales from all ten mills that were surveyed. Additional industries include welding enterprises, a briquette factory, and a bakery.

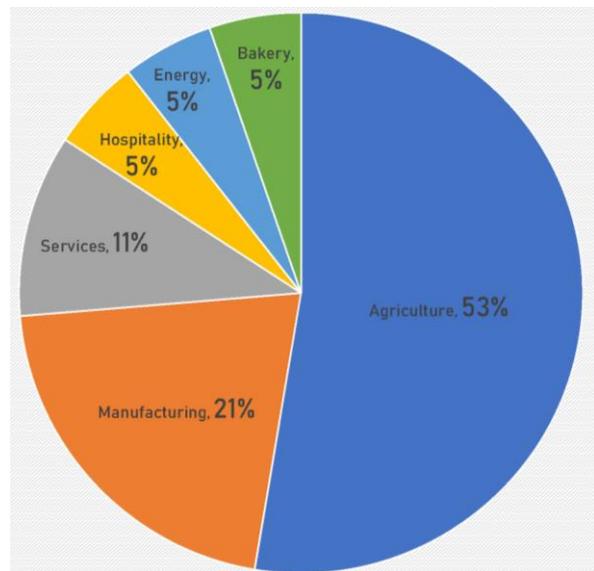


Figure 24: Categories of small industry established in Rwamwanja.

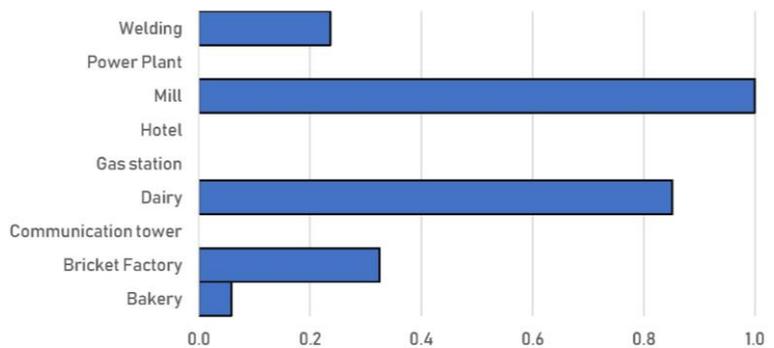


Figure 25: Normalized sales of the small industries in Rwamwanja.

Private enterprises are responsible for 64% of mill production, family mills are responsible for 15%, and cooperatives account for 20%. The family mills produce over three times the average production of the private mills. The average production of all mills is 130 kg/day with a maximum of 400 kg/day. Mills process a large amount of maize (from 80% to 100%) compared to other agricultural products. Cassava is the second largest processed agricultural product; sorghum, millet, and rice are processed in much smaller quantities (less than 6%); see Table 18.



Photo 13: A worker at the Katalyeba Bakery prepares the next day's bread orders.

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Photo 14: Briquettes from the Kingfire Energy factory drying.

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TABLE 18: PRODUCTION AND SALES OF MILLS IN RWAMWANJA

MILLS PRODUCTION	PRODUCTION IN kg/DAY			SALES IN US\$/DAY		
	DAILY	MAX	MIN	DAILY	MAX	MIN
Cooperative						
Cassava	50	50	50	\$-	\$-	\$-
Maize	400	400	400	\$-	\$-	\$-
Millet	30	30	30	\$-	\$-	\$-
Rice	8	8	8	\$-	\$-	\$-
Total	488	400	8	\$-	\$-	\$-
Family						
Maize	370	370	370	\$21.14	\$21.14	\$21.14
Total	370	370	370	\$21.14	\$21.14	\$21.14
Private						
Cassava	295	100	35	\$14.14	\$7.14	\$1.00
Maize	1200	300	100	\$68.57	\$17.14	\$5.71
Sorghum	50	30	20	\$1.71	\$0.86	\$0.86
Total	1545	300	20	\$84.43	\$17.14	\$0.86
	2403	400	8	\$105.57	\$21.14	0

Energy Generation

Most small industries own and operate individual generators (see Table 19). Twenty generators were registered in the small industry survey (of which 18 are operational). Generators vary greatly in size from 0.8 to 30 kW. Most generators use diesel fuel which costs US\$1 per liter and is purchased daily. Fuel consumption varies considerably with an overall average of 25 l liters/month, a minimum of 8 liters/month, and a maximum reported consumption of 1,200 liters/month. The most frequent reported diesel consumption is 90 liters/month.

The gas station has a 9-kW diesel system as well as a 1.2 kWp solar home system with a 1,600 A-h battery array. The solar system is the primary source of electricity for operations.

One of the welding shops has a 5-kW diesel generator, a 1.6 kW petrol generator, and a 10-Wp solar system; the other welding shop operates a 7.5-kW diesel generator. These businesses are open from ten to twelve hours every day.

The generators owned by the mills range in size from 9 to 30 kW. They are all diesel generators. Four of the mills work for twelve hours every day, while the others operate over lower service intervals ranging from three to eleven hours per day.

The only small industry which receives free electricity from the basecamp's diesel power plant is the briquette factory.

A 120-kW diesel power plant provides free electricity to agency donors, government, NGOs, and some other relevant facilities within base camp. The system is operated by AIRD and has been functioning for six years. It runs for 22 hours a day, seven days a week. The equipment and operations are funded by UNHCR.

Facilities receiving free electricity are:

- UNHCR
- Office of the Prime Minister
- Lutheran World Federation
- Windle Trust Uganda
- Africa Humanitarian Action
- African Initiative for Relief and Development
- World Food Program
- ICRC/Uganda Red Cross Society
- UNICEF
- UNFPA/ACORD, AHA
- WHO, UNFPA
- IOM
- FAO/Adventist Development and Relief Agency (ADRA)
- IDA (PCU-FI)
- SACCO
- Kingfire Energy briquette factory
- Rwamwanja Secondary School



Photo 15: A maize mill run by Rwamwanja Integrated Community Empowerment Group.

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TABLE 19: ENERGY GENERATION BY SMALL INDUSTRIES IN RWAMWANJA

SMALL INDUSTRY	NO. GEN	NO. GEN OPERATIONAL	GEN MAINTENANCE (USD/MONTH)	DIESEL LT/MONTH)	DIESEL (USD/MONTH)	LPG (KG/MONTH)	LPG (USD/MONTH)
Communication Tower	1	1	\$-	1200	\$1,200.00		
Dairy	1	1	\$114.29	400	\$388.57		
Gas station	1	1	\$-				
Hotel-1	2	1	\$4.29	150	\$137.14	60	\$71.14
Mill-1	1	1	\$17.14	90	\$128.57		
Mill-2	1	1	\$10.86	90	\$87.43		
Mill-3	1	1	\$7.71	80	\$77.71		
Mill-4	1	1	\$10.86	80	\$77.71		
Mill-5	1	1	\$20.00	40	\$42.86		
Mill-6	1	1	\$-	150	\$137.14		
Mill-7	1	1	\$12.86	8	\$7.77		
Mill-8	1	1	\$2.86	120	\$116.57		
Mill-9	2	2	\$102.86	600	\$548.57		
Mill-10	1	1	\$8.57	10	\$10.00		
Welding-1	3	2	\$-	300	\$274.29	90	\$108
Welding-2	1	1	\$85.71	450	\$450.00		
Grand Total	20	18	\$398	3768	\$3,684	150	\$179

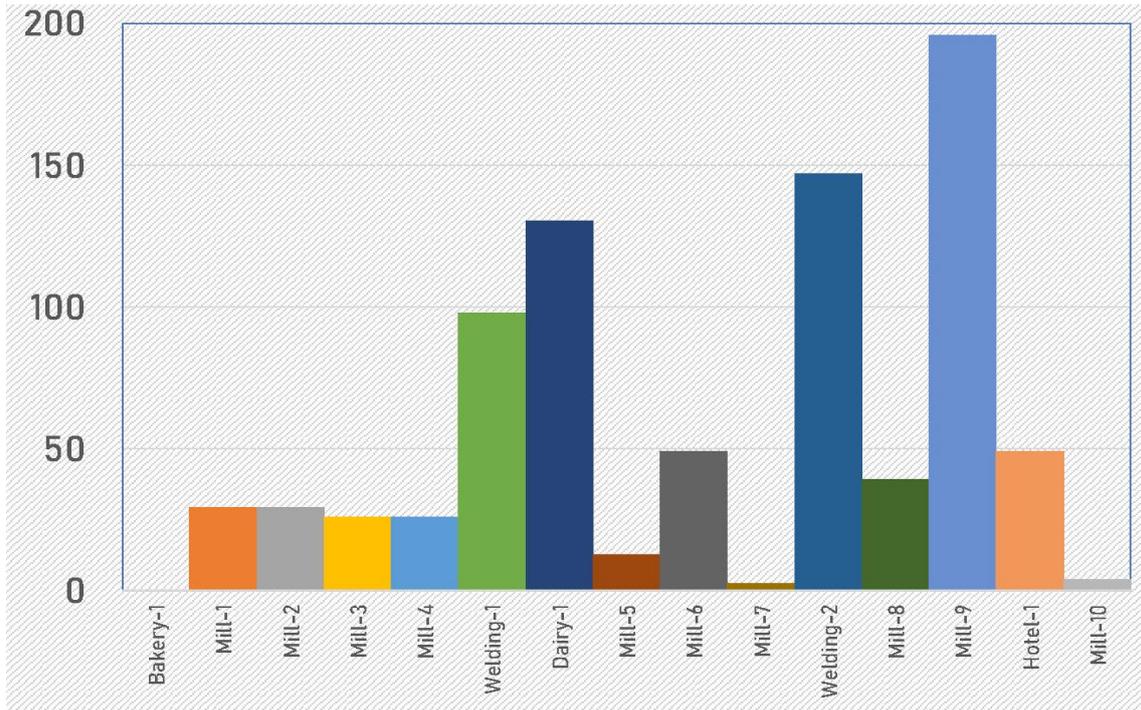


Figure 26: Daily energy demand in kWh. Note: A power factor of 0.8 was used for the calculations of the energy demand of small industries. Load factors for the mills had a power factor of 0.75 and welding a power factor of 0.5.

Energy Use

Thirty-four kinds energy-using equipment were identified in the survey; 41% are in the milling industry, 29% in the welding industry, and 12% in gas stations. The briquette factory has a conveyor belt, a crusher, and a charcoal mold.

Appliances and Lighting

Most of the small industries do not use appliances with the exception of the hotel which uses a public-address system and a projector on weekends from 6pm – 12pm. Ten of the 19 small industries included in the survey use a total of 68 lights, of which 56% are LEDs, 22% are compact florescent lights (CFLs), and 12% are fluorescent tubes. Of those, 10% serve as security lighting. The average number of lights per enterprise is 6.8; the business with the largest number of lights is the gas station with 18 lights and the welding shop only had a single light. The mills do not use any lights, except for the cooperative-based mill.

TABLE 20: SPECIAL EQUIPMENT USED IN RWAMWANJA SMALL INDUSTRIES

SPECIAL EQUIPMENT	NO. EQUIPMENT	POWER RATING (KW)	BUSINESS HOURS
Briquette Factory			
Charcoal briquette mold	1	15	10
Conveyor belt	1	3	10
Crusher	1	7	10
Dairy Cooler/ condenser	1	5	7
Gas station Fuel Pumps	4		7
Hotel			
High pressure water pump petrol	1		24
Submersible Water pump	1		24
Mill			
Crusher	7		46
Grain mill	1		8
Maize mill	1	8	6
Maize mill	1	10	4
Maize mill	1	19	8
Rice mill	1	11	6
Thresher	2		6
Welding			
Drill	1	1	7
Grinder	2	4	15
Welding generator	1	3	7
Welding machine	1		8
Welding rods	5	3	7
Grand Total	34	88	221

CASE STUDY: BISMILLAH RWAMWANJA METAL WORKS LTD

The Bismillah Rwamwanja Metal Works welders provide a great service to the community with the business manufacturing at least two products each day. Typical products include windows, gates, and doors. The metal works makes about two maize mills a month and two corn shellers from January to July; this can change as the orders for milling equipment is seasonal.

Bismillah also provides training for youths (about 17 years and older) with tuition at US\$140 for 6 – 8-month trainings. The youths are mainly Ugandans from the host community in Katalyeba Town Council. Some of the trainees become fulltime employees after their training; at this time the business has two apprentices.



Photo 16: Apprentices at the Bismillah Rwamwanja metal workshop manufacturing a window.

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Ability to Pay for Electricity Services

When questioned about payments for electricity services, survey results highlight that 67% of enterprises spend at least US\$78 per month, 44% spend US\$117 monthly, and 11% spend nearly US\$549 per month. As seen in Figure 27, few enterprises are able to pay more than US\$600 monthly for electricity services. Data collected from the gas station was excluded for this analysis due to the reluctance of the respondent to provide the data requested. In similar fashion, given that the briquette factory does not pay for energy services, it was excluded from this analysis.

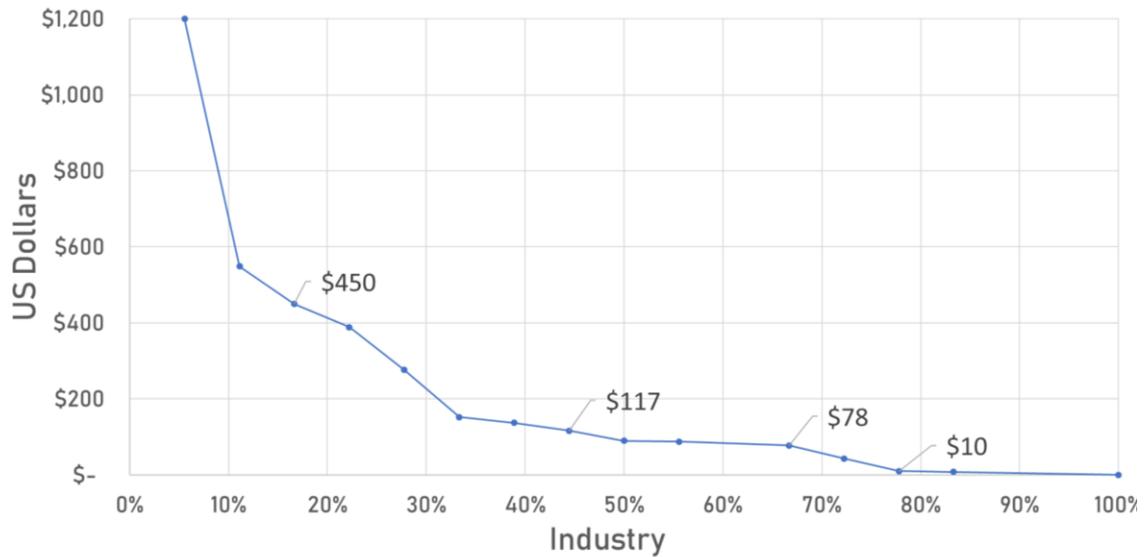


Figure 27: Ability to pay for electricity services by small industries in Rwamwanja.



Photo 17: A maize mill run by the Rwamwanja Integrated Community Empowerment Group with support from LWF.

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INTERPRETATION OF RESULTS

Having a better understanding of household income sources and expenditures is critical to analyze the extent to which households can engage in and depend on markets. This information not only provides insights into household level market participation but can also be expanded to inform meso-level analyses.

The reported average daily expenditure in Rwamwanja per household based on data collected in this assessment is US\$1.80. The data reveals that the average Ugandan family spends US\$1.92 while the Congolese families spend US\$1.78. Both figures are significantly below the Ugandan national poverty line reported as US\$1.90 per capita by the World Bank. People in Rwamwanja lack financial resources to meet basic needs that include food, clothing, and shelter. Poverty in Rwamwanja is due to more than a lack of money. Efforts are underway by the donor community to supplement a wide variety of services including distribution of food and money; as well as other services such as education, health, water, and housing.

Expense and income histograms are illustrated in Figures 28 and 29. Note the mismatch above US\$4.00 in the two graphs. In many cases people do not reliably track and report expenses but in this situation, people live with such meager resources that it is not difficult to remember how much they have spent on food, clothing, or school supplies.

Development is often measured in terms of energy consumption. The results of this assessment indicate that energy consumption in households is very low; although it was found to be the second most important expenditure after food. Ninety-two percent of the households buy some provision for energy or phone charging. Most households use disposable torches for lighting followed by the use of solar home systems or solar kits and dry cells. A much smaller fraction of households uses solar lanterns, rented solar kits, rechargeable appliances, large rechargeable batteries, electricity from neighbors, kerosene, and candles.

Business in Rwamwanja include everything from retail shops, welding workshops, bakeries, maize mills, mobile money agents, restaurants, hair dressing salons, and tailors. The most frequent source of electricity for businesses are the owned solar home systems. Data collected shows that businesses are currently spending from less than US\$1 and up to US\$113 per month on electricity. Sixty one percent of the businesses pay US\$1; 42% pay US\$2; 34% pay US\$3; 25% pay US\$4 and 10% are paying US\$20. Four businesses are paying US\$60 and above.

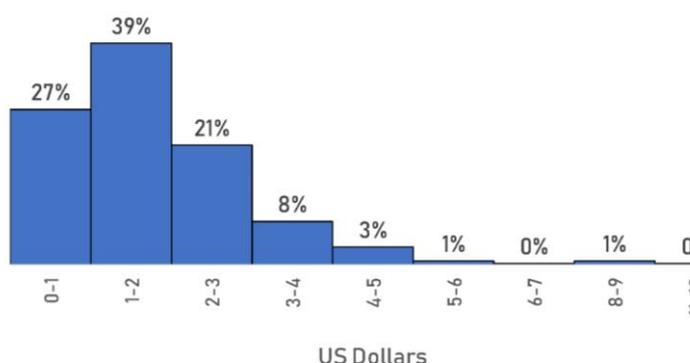


Figure 28: Histogram of household daily incomes.

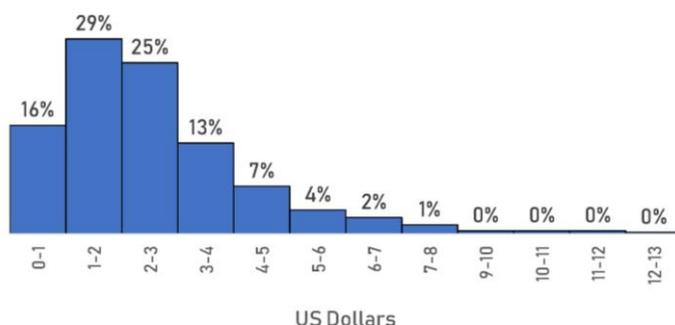


Figure 29: Histogram of household daily expenses.

A total of 18 small industries were surveyed. Agricultural activities are dominant in Rwamwanja economy; analysis of the data collected indicates that agricultural activities are more significant than all other economic activities taken together. The main agricultural products that require postharvest processing in Rwamwanja are maize, cassava, sorghum, millet and rice. These crops represent a direct source of income to households, traders/merchants, and millers. Most enterprises buy diesel in a daily basis to run their own generators. From fuel consumption data collected, it has been estimated that 67% of enterprises pay US\$78 for electricity services; 44% pay US\$117; and 11% are paying almost US\$549.

Attachment B: Productive Uses of Energy Assessment



PRODUCTIVE USE OF ELECTRICITY FOR MINI-GRID DEVELOPMENT

SURVEY OF PRODUCTIVE USE OPPORTUNITIES IN RWAMWANJA REFUGEE SETTLEMENT

June 2019

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ACRONYMS AND ABBREVIATIONS

BDS	Business Development Services
Freq	Frequency
GenSet	Generator Set
IEC	Information, Education and Communication
LED	Light Emitting Diode
LWF	Lutheran World Federation
MFI	Micro Finance Institution
MS	Microsoft
NGO	Non – Governmental Organisation
ODK	Open Data Kit
PUE	Productive Use of Electricity
PV	Photo Voltaic
RE	Renewable Energy
REA	Rural Electrification Agency
SACCO	Savings And Cooperative Credit Organization
SCC	Smart Communities Coalition
SHS	Solar Home Systems
SME	Small and Medium Enterprises
STATA	Statistics and data (Software by StataCorp US)
TV	Television
UGX / UGS	Uganda Shillings
UNHCR	United Nations High Commission for Refugees
US	United States
USAID	United States Agency for International Development
Wp	Watt Peak

EXECUTIVE SUMMARY

This report presents the findings of a productive use of electricity (PUE) survey undertaken in Rwamwanja Refugee settlement and a way forward for the implementation of a comprehensive PUE campaign. It highlights the various PUE opportunities that mini-grid developers can exploit.

The Rwamwanja refugee settlement covers a land area of 127 square kilometers in Kamwenge district in central-western Uganda and provides housing to approximately 70,000 people living in 9,000 households. The settlement is 6.5 kilometers from an existing medium voltage feeder. The Rural Electrification Agency (REA) is extending the national grid to the settlement as part of Government of Uganda efforts to electrify refugee settlements and this extension will serve four villages including Mukole, Nkoma, Katalyeba, and Rwencwera in the northwestern parts of the settlement. The report is aimed at providing additional information for supporting the development of mini-grids in Ntenungi, a village that is outside the main grid expansion programme for the Rwamwanja refugee settlement.

At 95% confidence level and 5% error rate, 262 businesses and 22 institutions were selected as the survey sample population that was sufficient to provide statistically representative data on PUE use and opportunities. The respondents were randomly selected.

The survey found that all businesses reached had a mean operating time of 12 hours, with a standard deviation of 2.95. Basically, businesses opened around 9am and operated until 9pm, with the evening energy supply through a number of solutions, including solar systems, solar lanterns, kerosene lanterns and candles. Apart from bars/restaurants which tended to operate late, most businesses are closed at around 9pm.

It was also found that 77% of the businesses in the settlement use solar home systems, largely for the provision of lighting services, phone charging and powering radio/stereos. Only 4% of the respondents employed the use of a generator and this was being used for milling, threshing, hurling and dehusking. Of the businesses, reached, 10% did not have a single electricity source.

The bulk of electrical equipment is used by general merchandize shops and hair saloons as usage of heavy load-utilizing equipment e.g. metal fabrication plants, cold storage services etc. is absent. Interestingly, the survey also found that many of the businesses maintained a duality of electrical and non-electrical equipment. For example, carpentry shops were using a lot of manual saws (circular and reciprocating) and none had nail guns or a compressor for spraying the furniture. In hair salons, only clippers were powered by solar systems, while other equipment, including that for sanitation was manually operated.

From the foregoing, the survey determined that 83% of the businesses would procure more equipment if they had access to safe, quality and reliable electricity. This equipment includes televisions, refrigerators, electric saws, electric flat irons, phones, sound systems, electric sewing machines, salon equipment, power drills, lighting bulbs, table saws, etc.

There were a number of non-governmental, non-profit making organizations identified in the settlement that provided both humanitarian and business development services. Humanitarian services include provision of food, water and sanitation facilitation, education and health services while BDS include skills capacity building through vocational schools, ICT training and business management training. Other BDS include providing agricultural inputs, financing through group lending, value chain and market development. While these are not commercially driven entities, yet they are also users of electricity and are likely to be anchor clients for the mini grids.

The study identified a number of challenges to PUE development in the settlement.

- No MFIs were found in the settlement. This means that there is lack of access to finances for business startup and growth
- Most of the business owners had not received any business hand holding services and lacked business management skills. This has led to a high turnover in business failures.
- There is also a lack of skilled manpower for current and potential businesses. There is therefore need for increased outreach training in vocational skills.

- The current low cost electricity sources used in the settlement are limited in power output capacity and yet those of large capacity bear high operation and maintenance costs making them unsustainable in the long run.
- Lack of access to high quality equipment has led to repeat costs against purchases of low cost equipment that breaks down often and produces poor quality services or products. This leads to high business losses and low customer satisfaction.
- Space management is also a challenge as some respondents claimed they did not have enough space to set up their businesses.

It is proposed that the PUE demand acceleration campaign by mini grid developers and operators should tap into the already established and trusted networks of civil society organizations in the settlement as an initial point of entry for identifying and promoting PUE. The campaign should;

- Incorporate business skills training for targeted mini grid users so as to attract and increase commercial micro finance institution confidence in working in the settlement.
- Include a partnership with good quality equipment suppliers innovated around proved business models incorporating credit facilitation.
- Include working with industrial bodies or apex entities to run pilot or demo projects based on identified business opportunities.
- Encourage PUE business development through group initiatives rather than individuals. This is more likely to allow for good business practices, build creditor confidence and ensure business longevity.
- Explore value chain development inclusive of packaging and branding so as to lay ground for market development especially outside the settlement.
- Encourage electricity day time usage using tariff disparity. This is to help the mini grid investors emphasize electricity generation rather than storage and thus keep investment costs low which in turn will allow for a more affordable tariff.

I. INTRODUCTION

This report presents the findings of a productive use of electricity (PUE) survey undertaken in Rwamwanja Refugee settlement and highlights the various PUE opportunities that mini-grid developers can exploit. It also presents a way forward for the implementation of a comprehensive PUE campaign. The report is aimed at providing additional information for supporting the development of mini-grids in Ntenungi, a village that is outside the grid expansion programme for the Rwamwanja refugee settlement being implemented by the Uganda Rural Electrification Agency (REA).

I.1 Rwamwanja Refugee Settlement¹

The Rwamwanja refugee settlement covers a land area of 127 square kilometers in Kamwenge district in central-western Uganda and provides housing to approximately 70,000 people living in 9,000 households. The settlement is 6.5 kilometers from an existing medium voltage feeder. The Rural Electrification Agency (REA) is extending the national grid to the settlement as part of Government of Uganda efforts to electrify refugee settlements and this extension will serve four villages including Mukole, Nkoma, Katalyeba, and Rwencwera in the northwestern parts of the settlement. The project includes 9 distribution transformers that will serve up to 2,000 households.

I.2 The case for mini-grids

Unfortunately, due to the expansive nature of the settlement, REA is unable to ensure that the whole settlement is covered with grid electricity. As a result, there will remain black spots, especially for villages far from the main road from Kamwenge to Bwizi trading center where the grid expansion works are concentrated. As part of its contributions to the Smart Communities Coalition², the U.S. government led Power Africa partnership, led by USAID, initiated an activity to explore the development of mini-grids in Rwamwanja Refugee settlement to provide safe and reliable electricity to refugees and host communities in areas not being reached by the national grid.

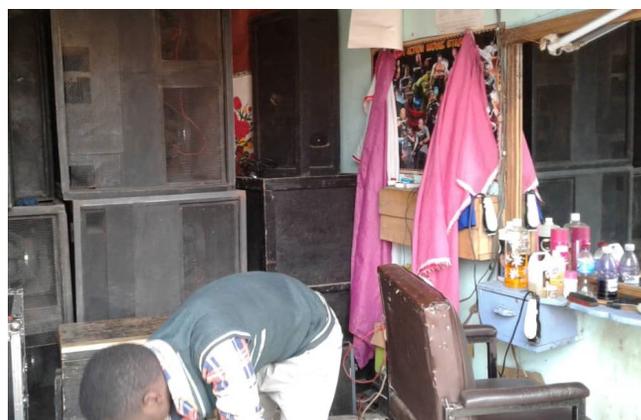


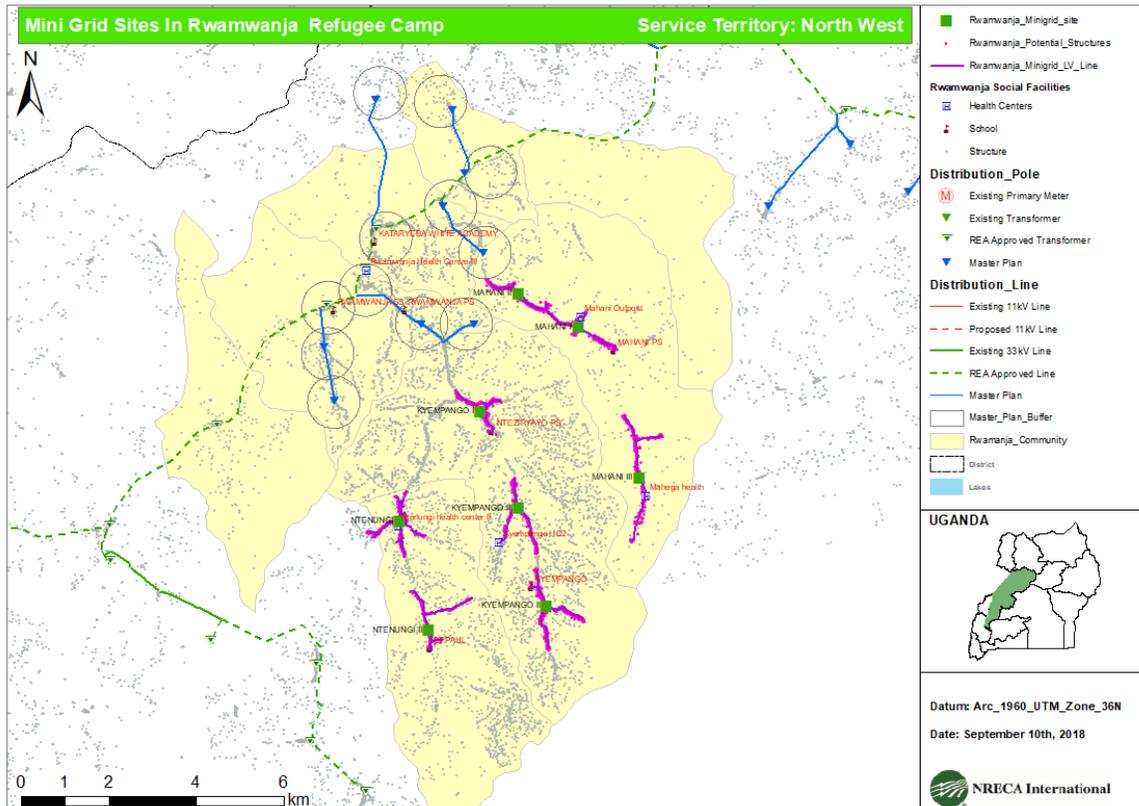
Photo 1: A barber shop that also deals in sound equipment in Rwamwanja Refugee Settlement.

¹ The majority of refugees engage in livelihood activities associated with low incomes and no job security, and conduct business within the Rwamwanja settlement. The average household size in the settlement is 4.7 people, and 18 percent of households are female-headed (compared to 4.8 people and 31 percent in surrounding host communities). Approximately 41 percent of refugee children in the settlement are stunted and 15 percent are underweight. The surrounding non-refugee population in the district was estimated to be 451,500 in 2016 and also faces significant development challenges. While benefitting from social services provided to the refugees, the non-refugee population remains chronically vulnerable to food insecurity and malnutrition; up to two-thirds of the population in the Mid-Western sub-region experience some level of chronic food insecurity. Eighty-five percent of households in the district practice subsistence farming as their primary economic activity.

² Co-chaired by Mastercard and Power Africa, through USAID, the Smart Communities Coalition (SCC) seeks to improve the delivery of essential services to refugees and host community members through enhanced coordination between public and private entities and strategic implementation of technology. Efforts focus on three foundational pillars - connectivity, digital tools, and energy access - with the intent to launch pilots in Uganda and Kenya in 2018.

Deeper independent analysis identified nine potential mini-grids that could be designed and built to the south of the defined service area under contract by REA. The analysis determined that the Rwamwanja grid extension project will only serve four villages of Mukole, Nkoma, Katalyeba, and Rwencwera in the northwestern parts of the settlement, but will not cover the villages of Kyempango, Mahani and Ntenungi. The analysis has further determined that there are nine viable mini-grid sites in three villages that will not be grid connected.

Figure 1: Mini-grid sites and line alignments



1.3 Study methodology

1.3.1 Objectives

The purpose of the survey was to gather information on productive use possibilities in the settlement to support the design and subsequent successful mini-grid operations in the settlement as the identified PUE activities would act as anchor loads for the mini-grids. The survey therefore focused on the following cardinal issues:

- Identifying PUE opportunities in the area;
- Identifying PUE equipment potential in the area;
- Identifying access to finance for



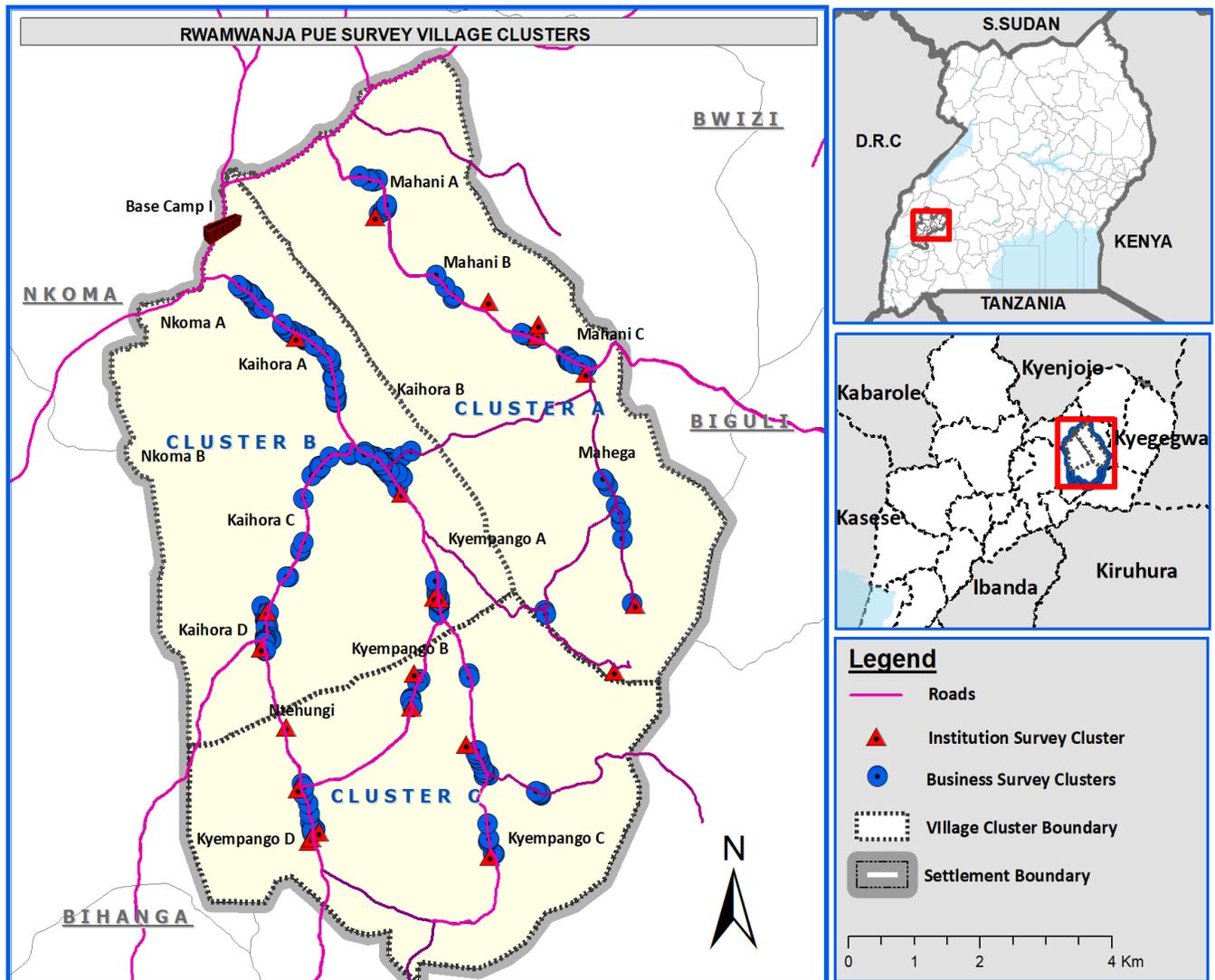
Photo 2: A welding business in Katalyeba Town Council, Rwamwanja.

PUE investment;

- Assessing the capacities of PUE SMEs in the settlement; and
- Identifying business development service (BDS) providers.

The survey aimed at gathering data on PUE in the Rwamwanja refugee settlement so that this can support the design of mini-grids for the settlement. The primary mini-grid clusters are highlighted below:

Figure 2: PUE clusters for mini-grid development in Rwamwanja



Source: REA GIS datafiles

1.3.2 Survey design

Energy surveys are at the core of generating planning information, especially with regard to consumption, PUE capacities, demand forecasts, ability and willingness to pay, among others. In this regard, the survey process included developing a survey instrument (questionnaire), defining a sample size, randomizing the sample, and defining the sample frame. Survey questionnaires were developed for PUE businesses and institutions as these are what mini-grid operators are distinctly interested in. The questionnaires sought to unearth information on existing businesses/investments, equipment used, potential for new equipment and new investments, etc. The survey did not highlight socio-economic and other demographic information of the respondents.

1.3.3 Sample population and data collection

At 95% confidence level and 5% error rate, 262 businesses and 22 institutions were selected as the survey sample population that was sufficient to provide statistically representative data on PUE use and opportunities. The respondents were randomly selected.

The questionnaires were loaded on tablets to tap into Open Data Kit (ODK), an open-source set of applications that enable users to design, implement, and collect data on a mobile device for a variety of purposes. It essentially replaces the need for paper forms and databases through a suite of applications. Data from each surveyed business or institution would be stored temporarily on a tablet computer and reviewed every evening by the research supervisor. If no errors were found, the survey officer would be cleared for more data collection the next day. On the other hand, if errors were found, the survey officer would be stopped from resuming data collections until the errors were all resolved. As the survey progressed and the survey officers became more proficient, the research supervisor reviewed a random sample of five forms per survey officer.

1.3.4 Data Analysis

Data cleaning, coding, entry and analysis, and other management components of the survey were conducted using MS Excel and the STATA statistical software. In these, descriptive statistics of frequencies, means, and percentages were tabulated for majority of the quantitative and qualitative indicators, and different types of analyses were constructed for illustration and comparison purposes as will be seen subsequently.



Photo 3: Yoghurt chills in a solar powered fridge in Katalyeba Town Council,

1.3.5 Ethical considerations

During the issuance of the questionnaires, the background information was shared and the consent of respondents was secured. Also, where needed and appropriate, the anonymity of respondents guaranteed where needed and confidence of personal responses guaranteed.

1.2 Some Socio-Economic history and considerations

Agriculture is the mainstay of the settlement. Just like other settlements, the socio-economic situation in

Rwamwanja Refugee Settlement is broadly characterized by widespread chronic food insecurity, driven by inadequate food accessibility and utilization, and a weak policy and systems environment. Under the Government of Uganda policy, all refugees in Uganda are integrated into local economies, production systems, and market networks.

Unfortunately, market systems approaches have not been emphasized greatly and thus the aid dependency exhibited. Research conducted in Rwamwanja in 2014 by the Oxford University found that up 99.7% of the refugees reported receiving food assistance and were dependent on aid.

Table 1: Selected Development and Food Security Indicators for Refugees, Rwamwanja Settlement

Indicator	Rwamwanja Settlement
Household size (people/HH)	4.7
% female headed households	18%
Average land size per HH (acres):	
Flatland (garden)	0.18
Upland (cultivation)	0.32
% land “owned” (allocated and used):	
Flatland (garden)	56%
Upland (cultivation)	44%
Swamp	0%
% HH owning any goats	5%
% HH owning any poultry	18%
% HH with ≥ 1 income earner (%)	96%
% HH owing debt	45%
Average HH debt (UG Shillings)	41,600

Source: GOU, UNICEF, WFP and UNHCR (2015).

In terms of education and skills levels, most of the residents of the settlement are literate. A study by the Oxford University shows that 65% of the settlement have completed primary school, with some completing secondary, university and other business, technical and vocational courses. This points to the presence of human capital that can invest and work in PUE businesses, but can also be influenced through ardent communication messages.

In terms of land ownership, the average land size per household in Rwamwanja is a half-acre, split between flatland for a house and kitchen garden, and an upland plot for cultivation. The size of land allocated to households is reducing annually across Uganda’s refugee settlements because of high population density, long duration of displacement, and competing claims to land by local communities. This will continue to lead to innovation in production. The study did not find any existing literature about agro-production and –productivity by the residents of the settlement and the host community.

2. STUDY FINDINGS

2.1 Findings for Businesses

2.1.1 Businesses reached

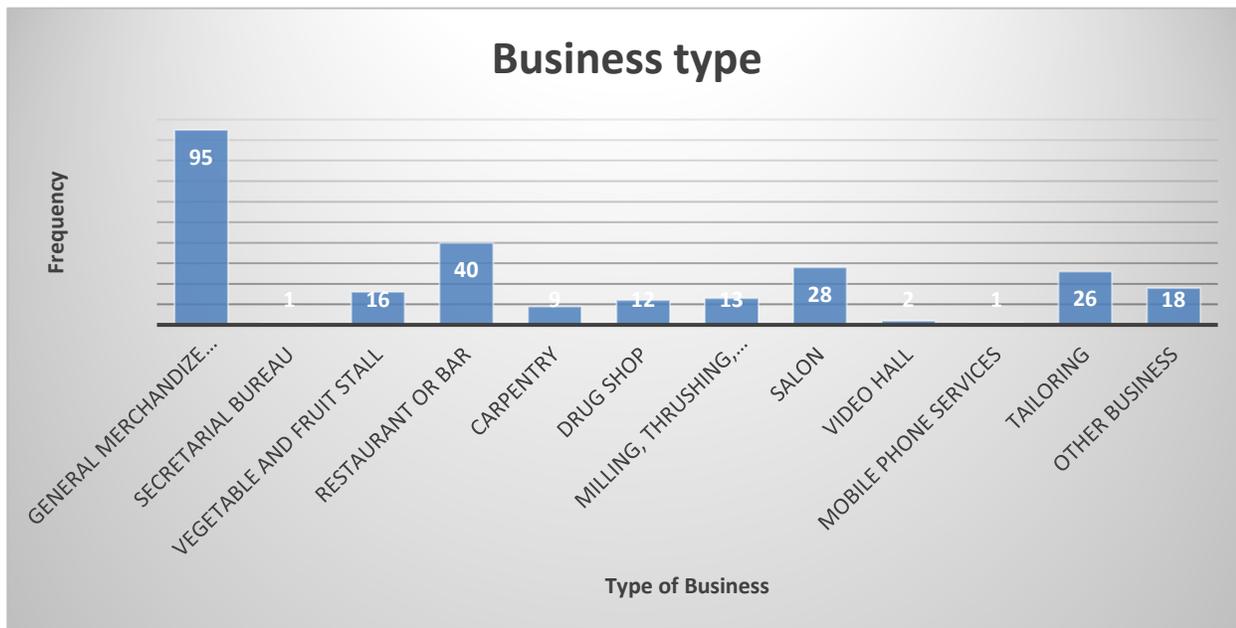
The study reached 261 businesses in the areas of Basecamp, Kaihora, Katafali, Kikurura, Kyempango, Mahani, Mahega, Nkoma and Ntenungi as seen below:

Table 12: Villages covered

Village Cluster	Village	No of Businesses Surveyed
Cluster A	Kyempango A	2
Cluster A	Mahani A	12
Cluster A	Mahani B	13
Cluster A	Mahani C	6
Cluster A	Mahega A1	2
Cluster A	Mahega A2	2
Cluster A	Mahega B2	4
Cluster B	Base Camp 4	27
Cluster B	Kaihora A	79
Cluster B	Kaihora B	16
Cluster B	Kaihora C	10
Cluster B	Kaihora D	35
Cluster B	Kyempango A	8
Cluster B	Kyempango B	4
Cluster C	Kaihora D	21
Cluster C	Katafali	5
Cluster C	Kikurura C	6
Cluster C	Kyempango B	8
Cluster C	Ntenungi B	1

91% of the respondents were the owners of the businesses reached and only 9% were business employees, which increased the veracity of the information garnered by the survey. In Ntenungi where 3 mini-grids are planned to provide electricity to three villages, 35 businesses were reached, showing a presence of sufficient start-up anchor loads.

Chart 1: Businesses reached by type



The survey discovered a myriad of businesses in the settlement that can tap into PUE opportunities, with 36% comprised of general merchandise shops, the highest response rate, followed by restaurants/bars (15%) and hair saloons (11%). All these categories of businesses had a combination of electrical and non-electrical equipment that is used in day-to-day operations. Other businesses like tailoring (10%) do not have access to electricity and were found to operate only during the day.

2.1.2 Time of Operations

The survey found that all businesses reached had a mean operating time of 12 hours, with a standard deviation of 2.95. Basically, businesses opened around 9am and operated until 9pm, with the evening energy supply through a number of solutions, including solar systems, solar lanterns, kerosene lanterns and candles. Apart from bars/restaurants, which tended to operate late, most businesses are closed at around 9pm.

The respondents confirm that they would operate for an additional 4 hours in the day if they had access to electricity, which aligns with the traditional peak period for energy use (6pm – 11pm). Unfortunately, this is not happening at the moment.

2.1.3 Sources of energy employed

TABLE 23: ENERGY SOURCES

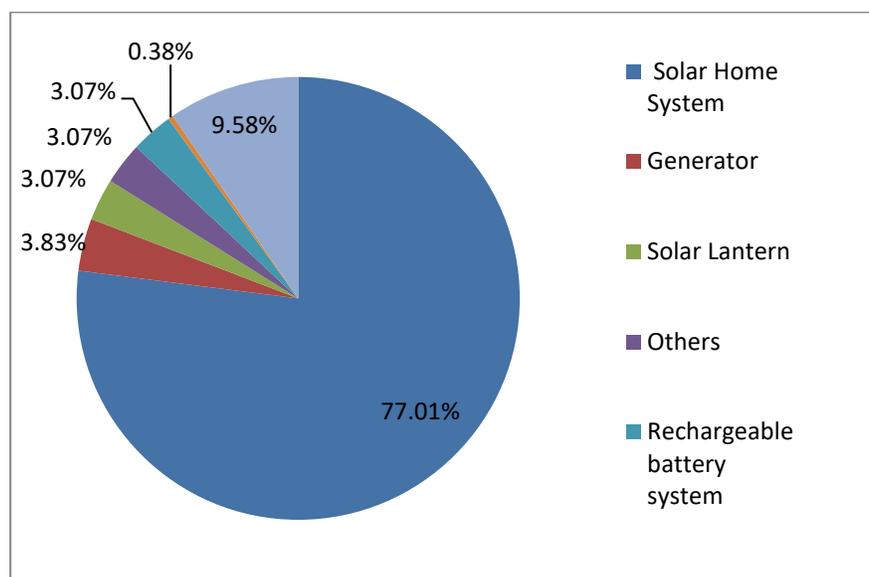
Energy Source	Frequency	Percent (%)
Solar Home System ³	201	77.01
Generator	10	3.83
Solar Lantern	8	3.07
Others	8	3.07
Rechargeable battery system	8	3.07
Dry cell battery	1	0.38
No electric Power	25	9.58
Total	261	100.00



Photo 4: A solar powered fridge in a supermarket in Rwamwanja.

³ The Average solar system varies in size from 2 Wp to 150 Wp and the purchase price ranges from UGX15,000 to UGX1,700,000 (US\$4 to US\$460).

Chart 2: Energy Sources



The survey found that 77% of the businesses in the settlement use solar home systems, largely for the provision of lighting services, phone charging and powering radio/stereos. Only 4% of the respondents employed the use of a generator and this was being used for milling, threshing, hurling and de-husking. Of the businesses, reached, 10% did not have a single electricity source as seen in the table

TABLE 4: SOURCES OF ENERGY BY NUMBER

	SHS	PV Lantern	GenSet	Rechargeable lamp	Dry cells	No power	Other
General merchandize shop	83	3	0	2	0	5	2
Secretarial Bureau	1	0	0	0	0	0	0
Vegetable and fruit shop	4	2	0	1	1	7	1
Restaurant or bar	23	0	0	0	0	2	0
Carpentry	2	1	0	0	0	5	1
Drug shop	11	0	0	0	0	0	1
Milling, threshing, hurling and de-husking	1	1	10	1	0	0	0
Salon	26	0	0	2	0	0	0
Video hall	2	0	0	0	0	0	0
Mobile Phone services	0	0	0	0	0	1	0
Tailoring	21	0	0	1	0	3	2
Other business	12	1	0	1	0	2	2
Total	201	8	10	8	1	25	8

2.1.4 Electrical equipment

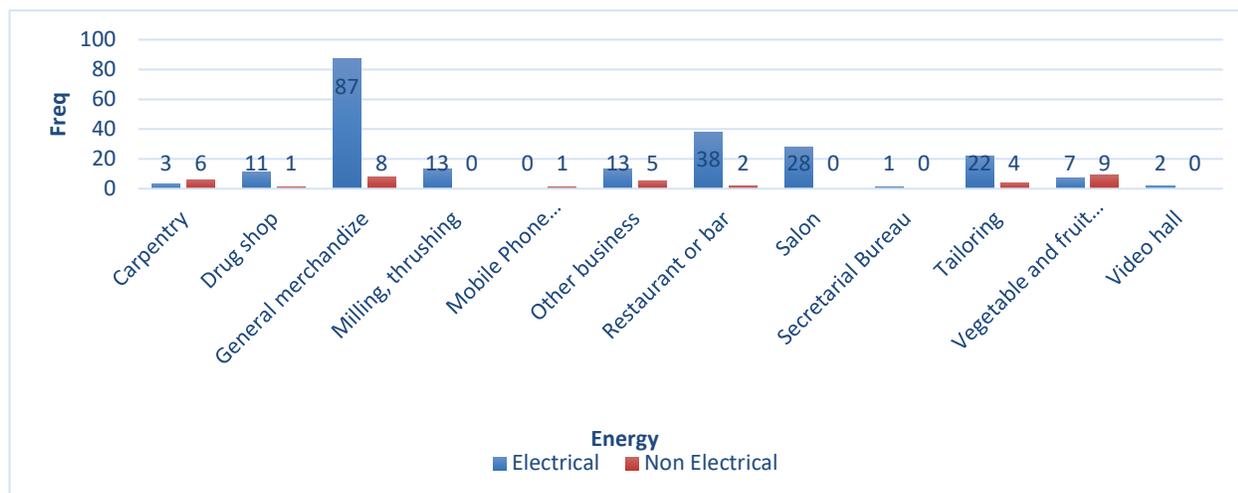
2.1.4.1 Equipment employed

Successful mini-grid models are anchored on the presence of electrical equipment that can be used by domestic, commercial and industrial end-users, as these are the anchor loads that help improve the load profiles of the mini-grid. The survey found that out of all the businesses reached, 86% are actually employing some sort of

electrical equipment with only 14% not employing electrical equipment. This paints a great scenario as businesses in the settlements are already employing electrical equipment, an exciting entry point for mini-grid operators.

The bulk of electrical equipment is used by general merchandize shops and hair saloons while usage of heavy load-utilizing equipment e.g. metal fabrication plants, cold storage services, etc., is interestingly absent.

Chart 3: Employing electrical Equipment



Interestingly, the survey also found that many of the businesses maintained a duality of electrical and non-electrical equipment. For example, carpentry shops were using a lot of manual saws (circular and reciprocating) and none had nail guns or a compressor for spraying the furniture. In hair salons, only clippers were powered by solar systems, while other equipment, including that for sanitation was manually operated – see chart 3 above and table 4 below.

TABLE 4: BUSINESSES AND TYPE OF EQUIPMENT USED

Business Type	Electrical	Non-electrical	Total
Carpentry	3	6	9
Drug shop	11	1	12
General merchandize	87	8	95
Milling, thrushing	13	0	13
Mobile Phone services	0	1	1
Other business	13	5	18
Restaurant or bar	38	2	40
Salon	28	0	28
Secretarial Bureau	1	0	1
Tailoring	22	4	26
Vegetable and fruit stall	7	9	16
Video hall	2	0	2
Total	225	36	261

This speaks to the latent opportunity that exists as most of the non-electrical equipment can be replaced or converted with the presence of reliable and safe electricity. Therefore, the design and implementation of a prudent mechanism for availing affordable electrical equipment within the settlement will fill the gaps in electrical equipment employment and provide the opportunity for increasing the load that a mini-grid can service.

2.1.4.2 Electrical equipment used by frequency

The survey found that most of the businesses used the available electrical energy for lighting, phone charging, radio and television, in descending order. Majority of the respondents use electricity for LED lights at 46% (208), 13% for phone charging, 10% for listening to the radio, 8% watching television, 7% for lighting fluorescent tubes and the remaining 16% for other uses. The survey found only 9 millers and one crop sheller, which depict true PUE capacities. While this points to minimal use of electrical use for productive and value addition use, it also points the latent PUE potential that's exists in a settlement that has always depended on aid-based approaches.

Chart 4: Frequency of electrical equipment

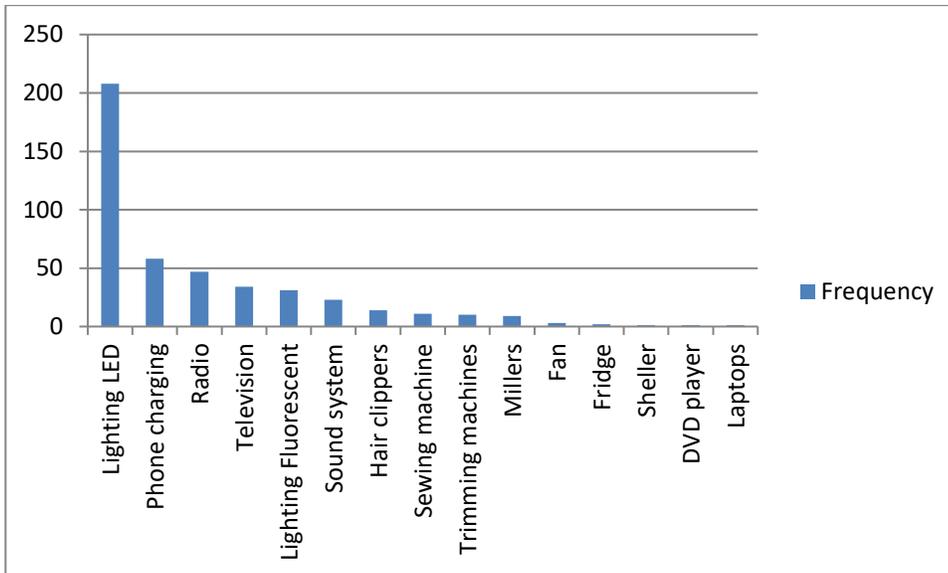
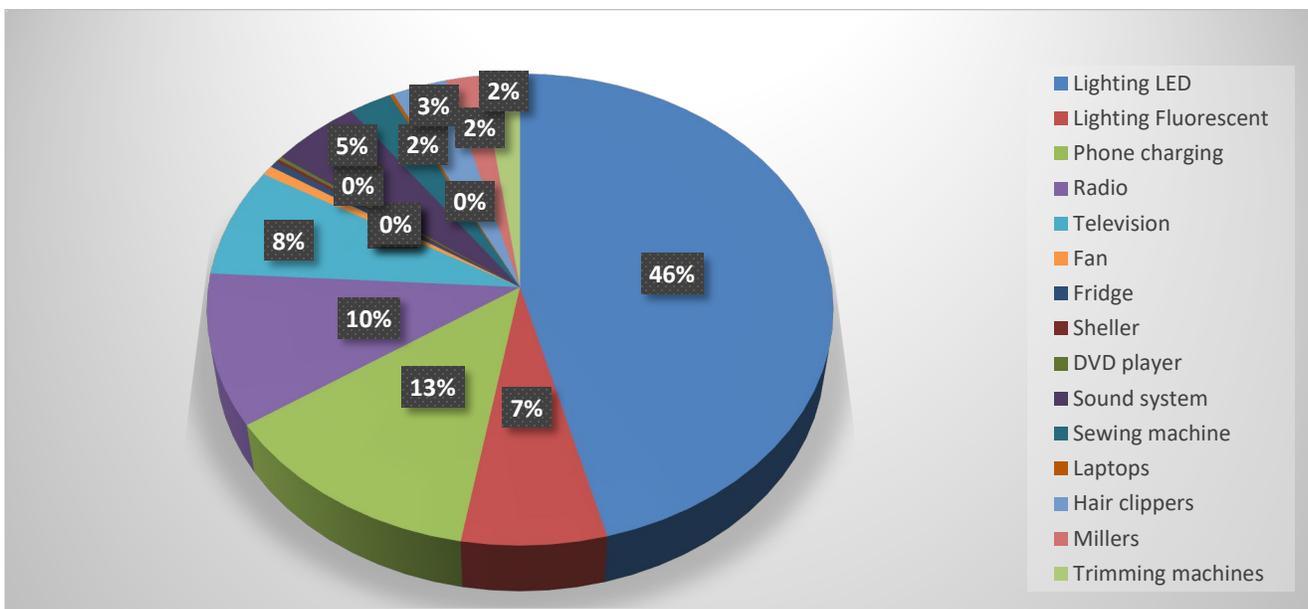


Chart 5: Electrical equipment used



2.1.5 Other non – electrical equipment deployed

The survey found that all businesses deployed some sort of non-electrical equipment and these include kerosene lanterns, candles, dry cell non-rechargeable torches, hand mills, handsaw, and hand chisels, as seen below.

TABLE 6: NON-ELECTRICALS USED

Business type	Candles	Wick mp / kerosene lamp	Dry cell torch	Hand mill	Handsaw	Hand chisel
General merchandise shop	1	7	0	0	0	0
Restaurant or bar	1	1	0	0	0	0
Carpentry	0	5		1	1	1
Drug shop	0	1	0	0	0	0
Mobile phone services	0	1	0	0	0	0
Tailoring	0	4	0	0	0	0
Vegetable and fruit stall	0	8	1	0	0	0
Other businesses	0	5	0	0	0	0

The major reasons for the use of the non-electrical equipment were:

- Lack of an electricity source (for those without electricity);
- Lack of sufficient electrical energy to cater for other equipment (especially for businesses that relied on solar systems);
- Minimizing energy costs - reduced use of electrical equipment minimized fuel consumption. This was common for users of diesel-powered generators.

2.1.6 Electricity usage/ Watts and pattern of use

The measure of importance of electrical equipment to the mini grid operators is determined by the measure of energy consumption of the same. The survey found that on average, businesses own equipment with a power rating of 232.6 watts with the maximum being 4108 watts.

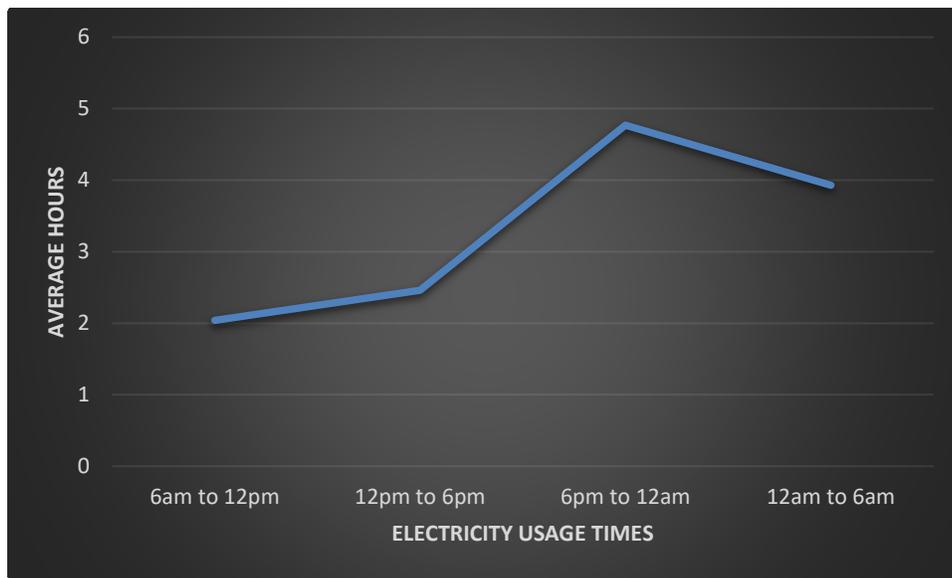
The survey found that the daily energy usage pattern of the settlement is consistent with that of other off-grid communities, with most of the equipment being utilize for an average of 10 hours as shown in Table 6 below:

TABLE 7: HOURS ELECTRICAL APPLICATION IS CONTINUOUS

Variable	Observations	Mean	Std. Dev.
Hours	189	10.82011	5.479111

The resulting average load profile for the businesses reached is highlighted in the frequency curve below and is consists of day and evening loads, but also highlights that the evening load (6pm – 10pm) is the highest. The night load is a result of lighting. What is also worth noting is the fact that the day demand profile is not anchored or significantly based on PUE loads due to the limited number of PUE businesses in the study area.

Chart 6: Average daily load profile for businesses



On the basis of the power rating of the existing equipment, existing businesses, operating for an average of 10 hours a day are able to consume up to 1,322 Kwh per month. This load would increase exponentially with PUE promotion and community engagement.

2.1.7 Willingness to utilize electrical equipment

Any model to operationalize mini-grids in the settlement must be anchored on the presence of electrical equipment that not only end-users can utilize for their increased operational efficiency and productive effectiveness, but also for ensuring that the mini-grid developer has good off-take capacity available. The survey therefore attempted to determine the ability and willingness of residents to procure electrical equipment.

From the foregoing, the survey determined that 83% of the businesses would procure more equipment if they had access to safe, quality and reliable electricity. This equipment includes televisions, Refrigerators, electric saws, flats irons, phones, sound systems, electric sowing machines, salon equipment, power drills, lighting bulbs, table saws, etc.

18% of the businesses are currently not interested in buying more equipment and this was also because of the following:

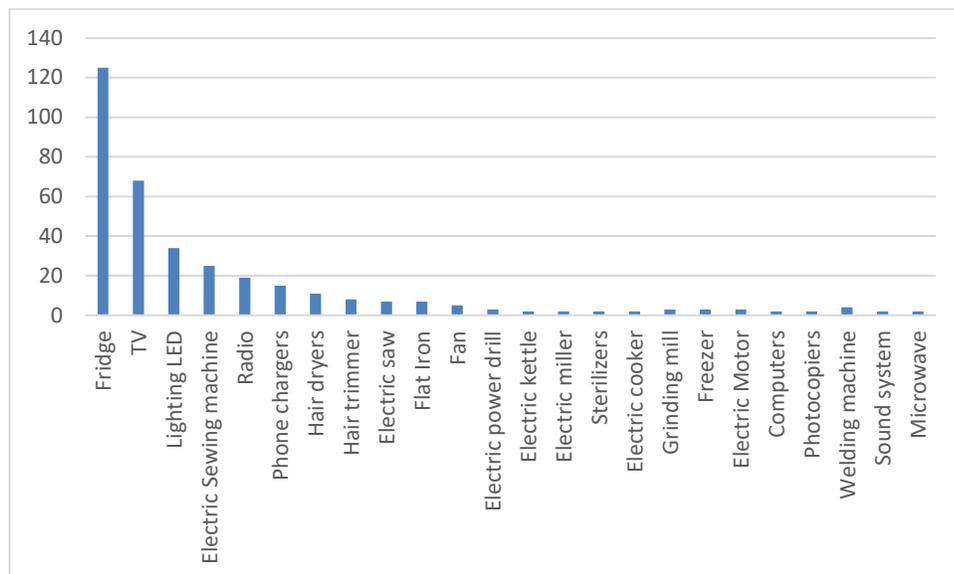
- Most do not think they need the equipment;
- Some are interested in financing for agro-input purchase, especially those in milling as a starting point for business expansion.
- Some quoted the lack of access to good quality equipment in the area;



Photo 5: A tailoring business with an electric sewing machine in Rwamwanja

- Lack of money to procure new equipment.

Chart 7: Equipment with demand



The top ten equipment highlighted were refrigerators (34%), TVs (18%), LED lights (9%), sewing machines, radios/stereo, phone chargers, hair dryers, hair trimmers, electric saws and flat iron. Interestingly, other equipment identified include electric power drills, threshers, electric power grinders, electric kettles, etc. Three respondents are interested in electric motors as these would enable them migrate from the less efficient diesel-powered engines to the lower cost electric energy and in turn increased productive efficiency and effectiveness. These are core to the principle of mini-grid operationalization as they point to the presence of latent productive capacities and willingness to engage on the same.

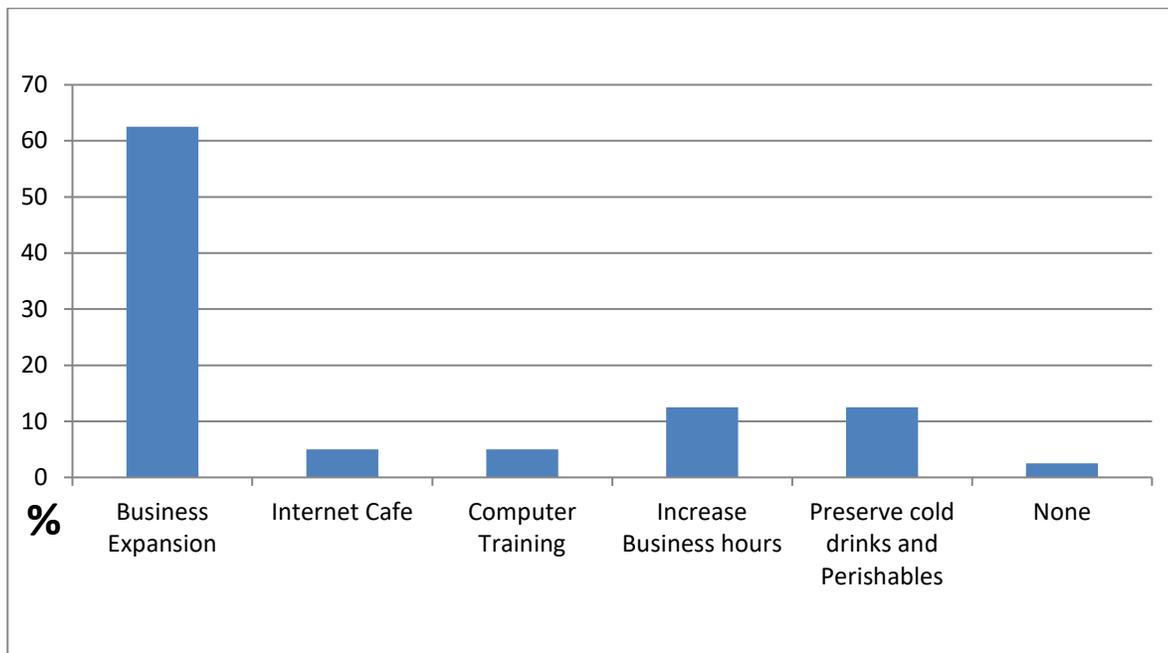
2.1.8 Business management and expansion

The survey attempted to identify the key business management skills gaps for businesses that were reached in the settlement. This was done alongside identifying how such businesses would expand when connected to a mini-grid. This exercise was aimed at stimulating future demand profiles, where possible.

2.1.8.1 Business expansion

All the businesses that were reached by the survey expressed a desire to get electricity connections from a mini-grid that could be developed. However, only 62% of the businesses reached said they would expand their businesses if connected to electricity; only 1.75% did not expect any business change with access to electricity. Most respondents highlighted the lack of capital for business expansion or start-up and the lack of micro-credit facilities to support such entrepreneurial ventures. Other reasons given were lack of skills, lack of space and manpower.

Chart 8: Business changes with access to electricity



Other businesses highlighted by SMEs as potential entry points were salons and entertainment centers.

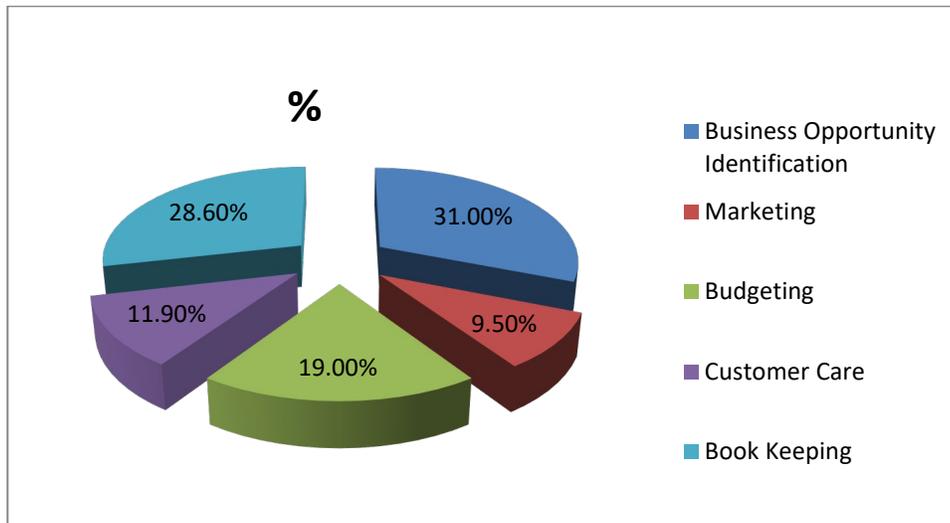
Businesses would be willing to embark on metal fabrication (18.6%), milling (14%), preserve cold drinks (11.6%) and internet cafes (4.7%) in that order. This is if they were enabled to access the mini grid network. The trend is similar to most businesses and highlights the importance the region attaches to milling and metal fabrication. However, businesses whose owners are involved in agriculture were seldom interested in value addition due to challenges in access to technology and skills. Most pointed to low on-farm production and the need for collection and consolidation of produce more value addition can be undertaken.

2.1.8.2 Business management skills gaps

Of critical concern to the identification study was determining the management skills capacity of SMEs as this is at the core of PUE promotion. This section was significant as it helped identify what kind of support existing PUE businesses need to improve performance and productivity.

The study found that most SMEs have gaps in business opportunity identification and selection (31%), book keeping (28.6%), budgeting (19%) and marketing garnering the lowest mark (9.5%).

Chart 9: Business Skills Gaps



30% of the business owners confirmed that they have started businesses before and they have collapsed in not more than 12 months. The major reasons given for the business collapse were:

- Limited due diligence on the opportunity (businesses rushed into);
- Lack of on-going technical assistance or handholding, which a PUE promotion activity can provide;
- Limited skills in business management, especially record keeping. One lady explained that she started a poultry business but did not distinguish poultry business capital from income attained from other ventures.

Other challenges to the success of businesses identified are: lack of access to credit, low education levels of the promoters, lack of access to energy and low-income levels to facilitate business startup.

2.1.9 Business Development Support services

Promotion of PUE worldwide has been effective when supported by the presence of competent BDS so that entrepreneurs have access to information on products and markets, handholding and skills building support. Studies also show that in areas like refugee settlements, it makes sense if BDS is provided by existing institutions in the target area. In this regard, the survey mapped existing institutions that can provide BDS and these are presented below:

TABLE 8: BUSINESS DEVELOPMENT SERVICE PROVIDERS

Organization	Sectors	Business support services
Lutheran World Federation (LWF): deals in the livelihood of the refugees in the settlement. LWF currently supports 10 farmer groups in the settlement.	Crop production Horticulture Rice Goat rearing Poultry Water sanitation and	<ul style="list-style-type: none"> • Value chain development and agribusiness support services • Irrigation and support services • Group dynamics and formation; • Access to finance through group lending; Renewable energy
Windle Trust International; primarily supports education (early childhood to vocational) and supports St. Paul's Ntenungi.	Education	<ul style="list-style-type: none"> • Entrepreneurship training • Information and Communication Technology (internet of things) • Education/vocational development • Renewable energy artisan training
Save The Children / UNHCR: crosscutting and covers all the major sectors.	Humanitarian	<ul style="list-style-type: none"> • Livelihoods empowerment; • Education; • Water and Sanitation; • Business and Entrepreneurship Development
African Humanitarian Africa: focuses on health care service delivery	Health	<ul style="list-style-type: none"> • Health care provision; • Technical training; • Powering medical facilities
Finn Church Aid: supports youth between 15 and 25 years of age	Humanitarian	<ul style="list-style-type: none"> • Youth and entrepreneurial training; • Business development support; • Access to finance; • Access to markets; • Skilling and capacity building

The survey did not find any commercial BDS providers that serve the settlements and its host communities and this is linked to the perceived inability to pay for BDS services. Additionally, the survey found that most of the business owners have not received any BDS services and do not know where to source it.

2.2 Findings for institutions

2.2.1 Types of institutions

The Rwamwanja Refugee Settlement plays to host to a number of institutions that provide social services in education, health, religion, and technology, and other entities of civil societal nature. These institutions are consumers of energy for themselves and also in pursuit of the delivery of their social development mandates. In this regard, the survey aimed at identifying existing institutions that can utilize electricity but also use electricity to improve the quality of lives of communities in and around the settlement.

The survey reached 22 institutions and 27% were educational in nature (schools), 23% were Churches, 18% were health centers and another 18% were civil society organizations.

TABLE 9: INSTITUTIONS IDENTIFIED

Institution type	Frequency	Percent (%)
School	6	27.27
Church	5	22.73
Health Centre	4	18.18
NGO	4	18.18
Mosque	1	4.55
Other institution	2	9.09
Total	22	100.00

The immediate implication is that there is a significant presence of institutions that participate in social development and these can be electricity off-takers, especially health centers that need electrical equipment for medical diagnoses, analyses and treatment. However, the same also presents a question in terms of the ability of these institutions to pay for the electricity consumed on a sustainable basis. Previous analysis points to health centers and schools not being able to cover their monthly energy bills due to the lack of operating budgets for the same.

In terms of demand analysis, the surveyed institutions only operate for an average of 10 hours per day, which also follows the pattern by businesses reached in the survey. The pattern is influenced by the energy source deployed which results in the closure of the facilities in the evenings. For example, only 3 schools had solar systems installed on the administration block, which implies that these schools can't have night classes.

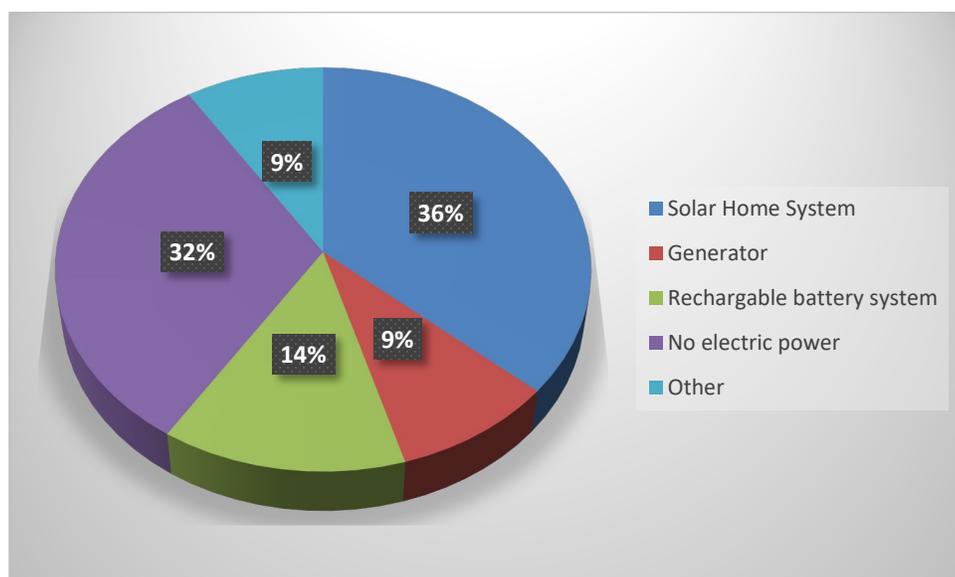
TABLE 10: DURATION OF OPERATION

Variable	Observations	Mean	Standard deviation	Min	Max
Business day duration	22	10	2.390457	4	15.5

2.2.2 Sources of Energy

The survey found that most institutions (36%) were using solar systems but 32% did not have access to any sort of electrical energy. Other sources of energy include rechargeable batteries (14%) and generators (9%). This scenario points to an opportunity for powering these institutions through mini-grids.

Chart 10: Sources of energy for institutions



Interestingly, only NGOs have diesel generators. This is simply because generators can power all the equipment in place and because NGOs have budgets that are provided to meet operational expenses like fuel. This is a serious constraint for other institutions. Even the NGOs are faced with ever-increasing energy costs which further distort their development budget. From the foregoing, all NGOs met are desirous of connecting to a mini-grid.

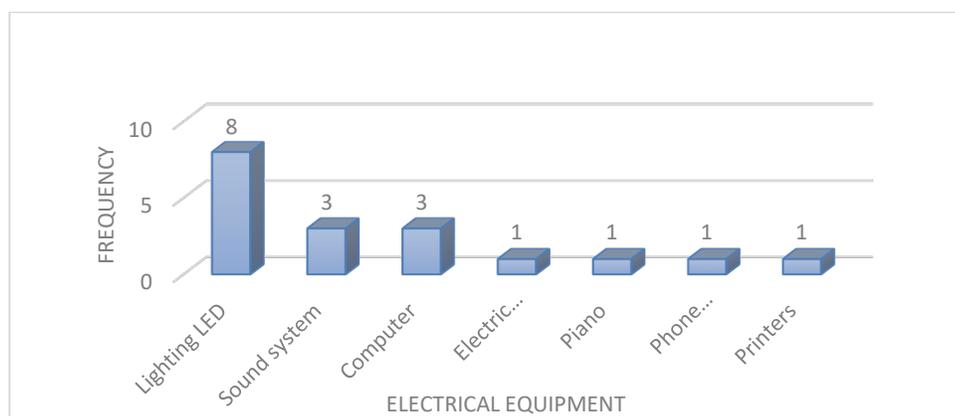
TABLE II: SOURCES OF ENERGY BY INSTITUTION

Institution type	Solar Home system	Generator	Rechargeable battery system	No electric power	Other	Total
School	3	0	1	1	1	6
Health Centre	2	0	0	2	0	4
Mosque	1	0	0	0	0	1
Church	1	0	2	2	0	5
NGO	0	2	0	2	0	4
Others	1	0	0	0	1	2
Total	8	2	3	7	2	22

2.2.3 Equipment used

The institutions reached by the survey have a different set of equipment, compared to businesses, that include LED lighting, sound systems that are used in Churches and the Mosque while the NGOs are the only ones that have printing equipment.

Chart 11: Electrical equipment used



What is distinctly clear is that none of the institutions use equipment for production or value addition, and neither of the NGOs was involved in agro-production but rather the deliverable aid and other refugees support services.

TABLE 12: EQUIPMENT USED BY INSTITUTIONS

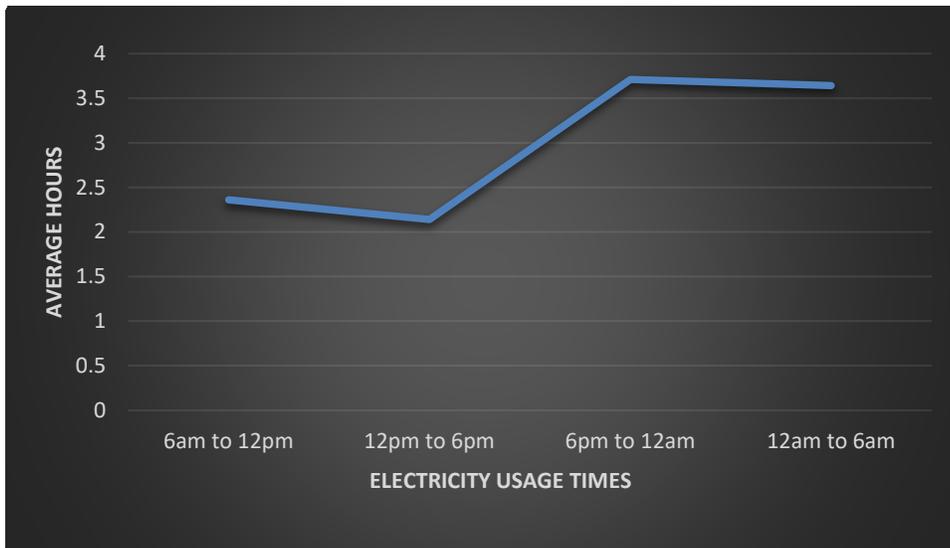
Institution	EQUIPMENT								Total
	Lighting LED	Sound system	Computer	Electric Guitars	Piano	Phone charging	Printers	Other	
School	3	0	0	0	0	0	0	2	6
Health Centre	2	0	0	0	0	0	0	0	4
Mosque	1	1	0	0	0	0	0	0	1
Church	1	2	0	1	1	0	0	0	5
NGO	0	0	2	0	0	0	0	0	4
Other Institution	1	0	1	0	0	1	1	0	2
Total	8	3	3	1	1	1	1	2	22

2.2.4 Electricity usage patterns

The institutions reached in the survey have an average consumption capacity of 355 watts per day with the maximum highlighted being 1,060 watts. This translates into around 954KWh per month. The average institutional demand is slightly higher than that of businesses simply because electrical equipment available is in use when institutions are operational e.g. computers for NGOs.

In terms of duration of use, the survey determined that institutions still employ minimal use of the sources of energy they possess. During 9am – 12 noon, usage is for an average of 2.36 hours, while during 12 noon to 6pm, usage is for an average of 2.14 hours, accounting for the lull in business activity in the early afternoon. From 6pm – 12am, usage increases to an average of 3.71 hours but this is also due to lighting within and outside the facilities. After midnight, 12am – 6am, consumption reduces slightly to an average of 3.64 hours, still a function of lighting. The resulting average daily load profile, presented in the curve below is a result of energy usage by businesses in the settlement and increased lighting in the evening and at night.

Chart 12: Electricity profile for institutions

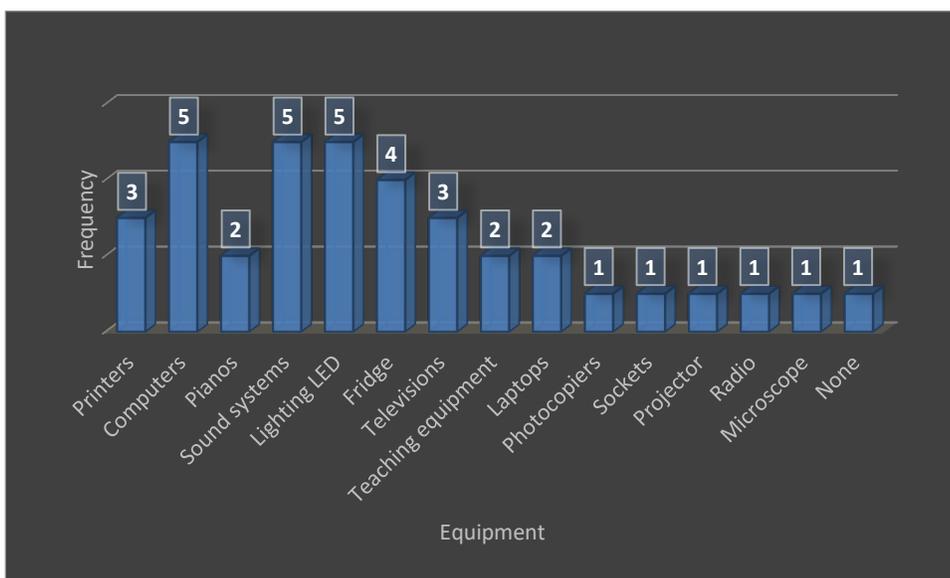


2.2.5 Increasing demand – equipment potential

One of the issues the survey aimed at determining was the willingness of the institutions to acquire more equipment if a more reliable and quality electricity source was availed through mini-grids. The survey found that 86% of the institutions would buy more equipment if there was electricity.

Because of the nature of the business of the institutions reached, most of the equipment that would be procured are to support office work for NGOs (printers and computers), lighting, refrigeration and televisions. As highlighted below, there was limited desire for equipment that would enhance value addition or was more outward looking – the bulk of the equipment that has demand is for improving organizational processes and access to information.

Chart 13: Equipment needed by institutions



2.3 Access to finance

The promotion of PUE businesses only succeeds with the presence of lines of credit that PUE entrepreneurs can access. The survey found that 89% of the businesses expressed a willingness to borrow to finance their energy needs, new PUE businesses and related expansion needs. Unfortunately, there is a clear absence of financing institutions in the settlement as there is only one Savings and Credit Cooperative Organization (SACCO). As a result, access to finance is limited, with most loans provided by the SACCO averaging UGS 400,000 which is too small to support PUE businesses.

3. NEXT STEPS

3.1 Background notes

Analysis of mini-grid operations around the world shows that anchor clients and productive uses of energy are key to economics of increasing access through more reliable demand; however, most off-grid projects overwhelmingly focus on household access. Unfortunately, literature review and survey findings all point to the fact that productive use of electricity projects are difficult to implement in Uganda due to a lack of funding, reliable and appropriate machinery, awareness and good PUE data to inform promotion and training. Additionally, financiers and partners (donors) focus largely on access to energy – not building energy demand, which is a key tenet of mini-grid operations. Therefore, successful mini-grid models must allowed demand-building initiatives. In rural Uganda where agriculture is the mainstay, rural communities, especially farmers, require targeted training that helps them identify opportunities and increase uptake of productive use technology. This section highlights next steps for entrenching productive use potential.

3.2 The traditional PUE promotional campaigns

Mini-grid operators in Rwamwanja refugee settlement will undertake traditional PUE promotion campaign with support from development partners (where available and appropriate). Such campaigns will include the following:

3.2.1 Undertake an identification survey

This should be undertaken within the mini-grid footprint with the use of relevant survey tools and should:

- Identify general and special business and income-generating opportunities in the area (adapted to the local potential);
- Identify the key appliances and equipment that would be used by the end-users once connected to the main grid;
- Make an inventory of available BDS providers in the surrounding area who can be recommended to end-users for the provision of regular BDS;
- Identify focal persons for MFIs, commercial banks and other credit institutions in the surrounding areas, determining key conditions and existing opportunities that can be tapped into;
- Undertake a brief capacity assessment of SMEs and other end-users in good business management practices;
- Map the area on the basis of identified PUE entrepreneurs for purposes of holding communal promotional campaigns and PUE business trainings.



Photo 6: A milk chilling station in Katalyeba Town Council, Rwamwanja.

3.2.2 Develop PUE training materials

These would include information, education and communication (IEC) materials, and a comprehensive PUE business-training manual that would teach PUE entrepreneurs on how to start new businesses, improve productivity and efficiency.

3.2.3 Undertake PUE trainings and behavior change campaigns

Many studies have identified the need for PUE activities in rural electrification initiatives, with such studies largely undertaken by the World Bank. All such studies point to the need for PUE campaigns if rural populations are to be able to tap into the business, household and community benefits of electricity. Trainings are a key component of this and will be aimed at improving the capacities of PUE entrepreneurs and would focus on areas like business basis, business planning, marketing, access to finance, enterprise management, energy efficiency, cash flow management, safety and handling, etc.

3.3 Communication strategy for PUE

3.3.1 Why a communication strategy

The reason for a communication strategy is to create effective awareness. Without well targeted information campaigns highlighting the various problems and limitations associated with traditional energy use, and describing improved solutions and business opportunities, the promotion of mini grid electricity for productive use is likely to fail. The form of communication channels should be matched to the target audience to provide for effectiveness. These can be village broadcasting channels, hall conferences or one on one and they can utilize leaflets, billboards, street theatre, radio and TV spots etc.

3.3.2 What will be the message?

The communication which should ride on the back of availability of services should highlight the advantages that come along with being associated with mini grid electricity productive use. These advantages must be embedded in the mini grid project business plan and implementation and should not be only about monetary profit but also about other benefits like lower costs, reliability, cleanness of energy (healthy), capacity to handle loads etc.

The communication should;

- Promote maximizing productive use during day time hours using tariff disparity
- Promote financing through group lending to encourage organized group business development. This is also meant to provide marketing for partnering MFIs. Group business development enables business sustenance and ensures future energy demand.
- Provide information on accessible and available markets to stimulate business development or growth for identified business opportunities.
- Provide information on available high efficiency equipment. This will help promote more efficient use of the mini grid electricity while promoting sales of partnering equipment suppliers.

It is important that the communication drive consider and work around possible barriers to reach target audiences e.g. bad internet connections, access to mass media, harvest seasons, opening hours of shops and restaurants, hierarchies in ministries and associations, etc.

3.3.3 Community Engagement Strategy

The survey found that most respondents were apprehensive of a mini-grid developer-operator with poor or no community engagement skills. In this regard, the mini-grid developer-operator should be supported to develop a Community Engagement Strategy that would be part of the Communication Strategy. This would ensure meaningful, timely, or productive communication on tariffs, equipment purchase and other demand side management options

3.4 Institutional strategies for promoting PUE

For mini-grid operators to succeed in refugee settlements, iterations in the overall business model must allow for some or all of the following strategies:

- Ensure that demand side management is part of the mini-grid operator's business strategy. This would ensure the mini-grid meets increasing demand without investing in additional generation facilities, until this is not feasible. This would include peak load clipping, valley filling and load shifting. Peak clipping could example involve replacing existing, inefficient appliances with ones that are more energy-efficient. Demand shifting focuses on shifting demand to coincide with sufficiency in generation. Therefore, operators need to increase demand at times when there is surplus energy generated, and reduce demand at times when there is not enough, and this can be supported by time of use tariffs;
- Work with civil society organizations operating in the settlement in the areas of PUE identification and promotion. This will enable the mini-grid operators to tap into great networks that are already trusted and operational;
- Innovate around business models so that mini-grid operators are able to sell PUE equipment to PUE businesses and other end-users. The partnership with equipment dealers should target refrigerators, cookers, pressure cookers, vocational/artisan tools (for carpentry and metal fabrication), millers, TV sets, fans, etc., so that end-users have access to good quality and efficient tools. This however means that the mini-grid operator should innovate around suitable and applicable payment plan for end-users so that payments are staggered over a period of time. This could also target digital financial services like pay-as-you-go platforms. The scheme would need to have some repair and warranty support and end-user education on use, purchase terms and benefits;
- Mini-grid operators should start ancillary businesses that can operate as supportive profit centers. Such businesses would consume power from the mini-grid and in the target areas could include agro-processing facilities for maize and rice and water pumping. The mini-grid operator should study good brought to the settlement, technologies available to be tapped into and major inputs available for value addition.
- Boost demand through consumer awareness, particularly through increased roll out of more established and tested technologies like solar irrigation and pumps. Raising awareness would lead to a rise in demand, and in turn encourage existing and new companies to utilize productive use technologies.
- Further market research on existing PUE opportunities is needed to help identify investment gaps and explore value creation. More information in this nascent sector will help mini-grid operators and PUE investors fully understand and take advantage of potentially large market. Once this is in place, it would be easier for the mini-grid operator to stimulate innovation of financing mechanisms for PUE businesses. The mini-grid operator should educate customers about the benefits of electricity and electrical appliances that have PUE capacity, integrated PUE into the mini-grid's customer service agenda and provide business support to people who are setting up businesses – especially those who could become

larger consumers. The mini-grid operator should consider a more light-touch but continuous approach once the grid is more established but hands-on coaching support can be reserved for potential and existing high-consumption business customers to develop, and fully utilise the mini-grid

- Mini-grid operators can work with industry bodies and apex entities to run PUE pilot but also explore incentive programs to support PUE innovation and entrepreneurship. This could include competitions and other financing calls.
- Incorporate BDS methods as part of the mini-grid operator's model so as to assist small and home-based enterprises in gathering information, finding credit and addressing technology constraints through marketing and assistance campaigns. The BDS approach has been applied in other rural PUE programs, especially in Bangladesh, targeting income generating activities in other sectors by working, often in collaboration with other institutions, to assist enterprises improve and start small businesses by addressing technical skills, markets, finance, technology and other constraints. Such programs should particularly target women entrepreneurs as they play a significant role in areas of production such as baked goods, milk production, ceramics and textiles, and are represented in all types of activities.

3.5 Conclusion

In conclusion, Rwamwanja Refugee Settlement presents an opportunity for successful mini grid development and operation based on the current PUE activities and future demand projections once the mini grid is in place. Such a development will greatly improve livelihoods in the settlement by attracting improved services, providing healthier energy options and stimulating business development and growth. The study has shown that while there is existing demand, there is strategic and focused promotion of PUE, while the mini-grid operator(s) must adopt innovative business models that attract and support PUE.

Annexures

Annexure I: Contacts of key people interviewed

	DISTRICT	VILLAGE	RESPONDENT NAME	CONTACT NO
1	Kamwenge	Katafali	Namulindwa Sauda	785107258
2	Kamwenge	Katafali	Kamagoba Jalya	777110628
3	Kamwenge	Katafali	Susan Kalungi	773641371
4	Kamwenge	Katafali	Muchunguzi Edward	788261959
5	Kamwenge	Kikurura C	Kisito Muzafalu	777810828
6	Kamwenge	Kikurura C	Byamugisha	779248116
7	Kamwenge	Katafali	Mutwasaje	787806070
8	Kamwenge	Ntenungi C	Nzayikorera Joseph	787210653
9	Kamwenge	Kikurura C	Nzabonibah	782528704
10	Kamwenge	Kyempango	Ndajiminana Yvonne	778667548
11	Kamwenge	Mahani A	Atuhairé Honest	774820238
12	Kamwenge	Kaihora A	Kakuze Leocadian	784706889
13	Kamwenge	Kaihora C	Maombi Branda	787901879
14	Kamwenge	Kaihora A	Niyibizi Disiya	9999
15	Kamwenge	Kaihora A	Alice Nkundimana	78651591
16	Kamwenge	Ntenungi B	Safari Solomon	
17	Kamwenge	Ntenungi B	Baraka Deo	777319715
18	Kamwenge	Ntenungi B	Tusimbere John	782185840
19	Kamwenge	Ntenungi B	Muhawe Bonane	784244616
20	Kamwenge	Ntenungi B	Nyirabashitsi Barata	781983468
21	Kamwenge	Ntenungi B	Josephine Niyongere	786543137
22	Kamwenge	Ntenungi B	Nambwayo Miriam	774401294
23	Kamwenge	Ntenungi B	Nzalamwita Godance	786135925
24	Kamwenge	Ntenungi B	Namanya Sedrack	778169853

25	Kamwenge	Ntenungi B	Elijah Bahati	783632795
26	Kamwenge	Kikurura C	Lambert Nzanbonipa	787898796
27	Kamwenge	Kikurura C	Abraham Sekusigazi	782367711
28	Kamwenge	Ntenungi C	Mugisha Vumilia	0
29	Kamwenge	Ntenungi A	Hakizimana Jean Pierre	779708960
30	Kamwenge	Ntenungi B	Bihiga Emmanuel	773605142
31	Kamwenge	Ntenungi B	Sekeraludoma	774627094
32	Kamwenge	Ntenungi C	Sebanza Libakare	784188203
33	Kamwenge	Ntenungi C	Nsabimana George	786040603
34	Kamwenge	Ntenungi C	Anociata Nyiranohele	0
35	Kamwenge	Ntenungi C	Ingabire Florence	0
36	Kamwenge	Ntenungi C	Azarius Hakizimana	77806473
37	Kamwenge	Ntenungi C	Gatwa Damian	0
38	Kamwenge	Mahani B	Bahizi Ndeko	785638497
39	Kamwenge	Mahani B	Dolf Impyau	785263597
40	Kamwenge	Mahani B	Wimana Nadia	787897150
41	Kamwenge	Mahani B	Mbanza Didier	782166025
42	Kamwenge	Mahani B	Apolinel Wabiyonva	774819341
43	Kamwenge	Mahani B	Balisubileho Jafet	788275287
44	Kamwenge	Mahani B	Tumhirwe Alayira	783875386
45	Kamwenge	Mahani B	Tugume	781979006
46	Kamwenge	Mahani B	Abenaitwe Goreti	775400999
47	Kamwenge	Mahani 2	Tusiche Emmanuel	789678539
48	Kamwenge	Mahani 2	Twinomugisha Rachael	773465356
49	Kamwenge	Mahani 2	Tubbu Veronica	774825435
50	Kamwenge	Mahani B	Ndyamuhaki Denis	783324207
51	Kamwenge	Nkoma C	Frara Habimana	783653854

52	Kamwenge	Nkoma C	Bahati Aline	78708798
53	Kamwenge	Kyempango A3	Hitimana Innocent	785828277
54	Kamwenge	Kyempango A3	Ushindi Emmanuel	78582844
55	Kamwenge	Kyempango A3	Idi Senga	78252739
56	Kamwenge	Kyempango A3	Saidi Moses	773523394
57	Kamwenge	Kyempango B	Moses Innocent	778666589
58	Kamwenge	Kyempango B	Uwamahoro Betty	787016473
59	Kamwenge	Kyempango B	Zawadi Sifa	0
60	Kamwenge	Kyempango B	Nshuti Patrick	78940467
61	Kamwenge	Kyempango A2	Manirafasha Peter	773193978
62	Kamwenge	Kyempango A3	Hakiza Jamari	78519743
63	Kamwenge	Kyempango A3	Fabrice Nsekerabandi	779937518
64	Kamwenge	Kyempango B	Tumaini Mbonye	0
65	Kamwenge	Mahani B	Munyanziza Muhazi	781484895
66	Kamwenge	Mahani A	Sukuyuwa Venansia	
67	Kamwenge	Mahani A	Mutuyimana Fideri	788758386
68	Kamwenge	Mahani A	Kaitesi Florence	756516587
69	Kamwenge	Mahani A	Rulinda Emmanuel	772261866
70	Kamwenge	Mahani A	Fideri Samson	775359378
71	Kamwenge	Mahani A	Sadiki John Baptist	786556105
72	Kamwenge	Mahani A	Sadiki John	786556105
73	Kamwenge	Mahani A	Hategikimana Emmanuel	772588947
74	Kamwenge	Mahani A	Nyandwi Daria	772570155
75	Kamwenge	Mahani A	Tuwombe Jane	786747624
76	Kamwenge	Mahani A	Muhindu Shadrack	781964916
77	Kamwenge	Mahani A	Saidi Bagereza	773849810
78	Kamwenge	Mahega B I	Akisman alois	783870268

79	Kamwenge	Kyempango C2	Maniragaba Faustin	784669521
80	Kamwenge	Kyempango C1	Maombi Agnes	9999
81	Kamwenge	Mahega A4	Joseph Baraka Benedi	774491651
82	Kamwenge	Kyempango B3	Tuombe Tereza	777334104
83	Kamwenge	Mahani 1	Deus Bikorwomuhangi	705269761
84	Kamwenge	Kyempango B3	Mugisha John	777104985
85	Kamwenge	Mahega A1	Joy Birra	774398125
86	Kamwenge	Kyempango B3	Brucemelod Israel	785794939
87	Kamwenge	Mahani 2	Biramahire Moses	789933523
88	Kamwenge	Mahega A1	Kabagahe Evans	781986724
89	Kamwenge	Mahega A2	Ushindi Joseph	786778171
90	Kamwenge	Kyempango	Martine Ayine	701066532
91	Kamwenge	Mahega A2	Claudi Bahati	787149100
92	Kamwenge	Kyempango B3	Kabagambe John	777742010
93	Kamwenge	Kyempango B3	Munguiko Prince	784057312
94	Kamwenge	Kyempango B3	Claudine Masengesho	773844186
95	Kamwenge	Mahani 2	Tumusime Godfrey	788433373
96	Kamwenge	Kyempango B3	Frank Munyambabazi	9999
97	Kamwenge	Mahani 2	Kampala Ronald	784255540
98	Kamwenge	Mahani 2	Mukisa Micheal	778123944
99	Kamwenge	Kyempango A4	Rose Muhindo	789877446
100	Kamwenge	Mahega	Lucy Busenge	787113969
101	Kamwenge	Ntenungi C	Owimana Mbazira	783033917
102	Kamwenge	Ntenungi B	Kajibwami Eric	787897567
103	Kamwenge	Ntenungi B	Iyamuremye	785291157
104	Kamwenge	Kikurura C	Oliver Gerusha	789400149
105	Kamwenge	Ntenungi B	Eric Zenith	787897567

106	Kamwenge	Kaihora A	Neema Sarah	789308541
107	Kamwenge	Kaihora A	Habyalimana Laurent	788541412
108	Kamwenge	Kaihora C	Sifa Antoinette	788932716
109	Kamwenge	Kaihora A	Dusenge Odette	773354073
110	Kamwenge	Kaihora A	Niyonzima Emmueal	784457045
111	Kamwenge	Kaihora A	Faustin Ngabo	784334235
112	Kamwenge	Kaihora A	Maniriho Liziki	789291564
113	Kamwenge	Ntenungi C	Wimana Flancin	782857235
114	Kamwenge	Ntenungi C	Bahati Karere	772724345
115	Kamwenge	Ntenungi C	Ishimwe John Bosco	784871679
116	Kamwenge	Ntenungi C	Ishimwe John Bosco	784871679
117	Kamwenge	Ntenungi C	Irakujije Rachel	
118	Kamwenge	Ntenungi C	Tushimimana Emmanuel	787399638
119	Kamwenge	Ntenungi C	Dusengimana Rachel	
120	Kamwenge	Ntenungi C	Wimana Flaha	78271954
121	Kamwenge	Ntenungi C	Cyikyeko Francis	775783139
122	Kamwenge	Ntenungi C	Hakizimana Jean Pierre	779708960
123	Kamwenge	Kaihora A	Bagumanawo Samuel	778459051
124	Kamwenge	Kaihora A	Eric Filbert	771924421
125	Kamwenge	Kaihora A	atukwase Assumpta	773405368
126	Kamwenge	Kaihora A	Muhebwaruhanga Madina	779801757
127	Kamwenge	Kaihora A	Akimana Paskalsia	
128	Kamwenge	Kaihora A	Lukanda Eric	785618269
129	Kamwenge	Kaihora A	Zawadi Mawombi	
130	Kamwenge	Kaihora A	Ndyanawo Onesmas Biretwa	780148834
131	Kamwenge	Kaihora A	Mukandikubwayo Salima	783454673
132	Kamwenge	Kaihora A	Munguhiko Eria	776772851

133	Kamwenge	Kaihora A	Mwesigye Willy	777770006
134	Kamwenge	Kaihora A	Emily Akampulira	786487561
135	Kamwenge	Kaihora A	Amani Leoncie	786191163
136	Kamwenge	Kaihora A	Tumwiine Brian	786664063
137	Kamwenge	Kaihora A	Kaihura Stephen	787820298
138	Kamwenge	Kaihora A	Biira Evas	785059153
139	Kamwenge	Kaihora A	Obed Mutoreka	782164096
140	Kamwenge	Kaihora A	Sabimana Egide	774949743
141	Kamwenge	Kaihora A	Beria Mukandutia	788376842
142	Kamwenge	Kaihora A	Nastori Kanyankole	775560063
143	Kamwenge	Kaihora A	Komugisha Adrine	782594181
144	Kamwenge	Kaihora A	Hirwamuremye Vianny	789337610
145	Kamwenge	Kaihora A	Kasongo Partist	785833828
146	Kamwenge	Kaihora A	Wimana Valeria	781296717
147	Kamwenge	Kaihora A	Kabasere Emme	784903484
148	Kamwenge	Kaihora A	Bahati Alex	774488080
149	Kamwenge	Kaihora A	Mukeshema Aderephine	775596330
150	Kamwenge	Kaihora A	Ishimwe Ndagije	786035137
151	Kamwenge	Kaihora A	Tuhumwire Jackline	784491395
152	Kamwenge	Kaihora B	Biharibike Klisos	773565339
153	Kamwenge	Kaihora B	Ababa Alosious	778108152
154	Kamwenge	Kaihora A	Habimana Silas	785773030
155	Kamwenge	Kaihora A	Ssekibole George	755869952
156	Kamwenge	Kaihora B	Abdul Akismana	7
157	Kamwenge	Kaihora A	Mbonankira Celestine	
158	Kamwenge	Kaihora B	Makurarata Nyirabatutsi	784397103
159	Kamwenge	Kaihora B	Bahati Focus	785856302

160	Kamwenge	Kaihora A	Shamamba Ramathane	785402935
161	Kamwenge	Kaihora B	Deogratiuous Tugumizemu	782627156
162	Kamwenge	Kaihora A	Kyokunzire Dorothy	788987642
163	Kamwenge	Kaihora B	Tungwire Restdia	784948405
164	Kamwenge	Kaihora A	Basemesa Aline	
165	Kamwenge	Kaihora B	Bahati Tuyenabo	775724952
166	Kamwenge	Kaihora C	Bizimana Jean d'Amour	785857871
167	Kamwenge	Kaihora A	Kanawume Ruvamwabo	773154126
168	Kamwenge	Kaihora D	Isaacs Rusangiza	785100943
169	Kamwenge	Kaihora D	Rehema Tuheshime	784481856
170	Kamwenge	Kaihora A	Shadia Uwimana	787771805
171	Kamwenge	Kaihora A	Shabana Barutwanayo	777385440
172	Kamwenge	Kaihora A	Bigirimana Jack	0
173	Kamwenge	Kaihora D	Bahati Joseph	784725066
174	Kamwenge	Kaihora A	Alex Semanza	
175	Kamwenge	Kaihora A	Uwasenga Mariam	781650787
176	Kamwenge	Kaihora A	Maria Sifa	780200810
177	Kamwenge	Kaihora A	Eritie Nkurunziza	
178	Kamwenge	Kaihora A	Murengezi Gerald	784635845
179	Kamwenge	Kaihora A	Zawadi Rehema	0
180	Kamwenge	Kaihora A	Sebunyagwa Zawadi	0
181	Kamwenge	Kaihora D	Ruth Faraja	782744528
182	Kamwenge	Kaihora A	Sebutozi John	786905572
183	Kamwenge	Kaihora D	Uwamahoro Christine	784275281
184	Kamwenge	Kaihora A	Nkinamubanzi Gustav	780387792
185	Kamwenge	Kaihora D	Eliya Daniel	784548754
186	Kamwenge	Kaihora D	Leah Uwimana	782881108

187	Kamwenge	Kaihora A	Nirere Denise	0
188	Kamwenge	Kaihora A	Sebukino Safari	781385471
189	Kamwenge	Kyempango C	Niyonzima Ezekel	779970841
190	Kamwenge	Kaihora A	Antoinette Ngirabakunzi	787099803
191	Kamwenge	Kaihora A	Muchina Peace	774757067
192	Kamwenge	Kaihora A	Tureberaho Generoza	0
193	Kamwenge	Kyempango B1	Muhomba Mungu Muhawe	784529412
194	Kamwenge	Kyempango C1	Cifa Zawadi	772676669
195	Kamwenge	Kaihora B	Mugisha Emmanuel	786736622
196	Kamwenge	Kyempango C1	Anne Maombi	774063685
197	Kamwenge	Kaihora A	Komuhendo Annet	0
198	Kamwenge	Kyempango C1	David Lutikanga	786036941
199	Kamwenge	Kyempango C1	Jannette Ampire	9999
200	Kamwenge	Kyempango C1	Sibomana Augustin	777497882
201	Kamwenge	Kyempango C2	Furaha Espoir	782390672
202	Kamwenge	Kyempango C2	Iradukunda Maranath	771495481
203	Kamwenge	Kyempango C2	Mfitumukiza Karihungu	782267382
204	Kamwenge	Kyempango C2	Rukundo Jean Claude	778151931
205	Kamwenge	Kaihora A	Nyirabazairwa Prof	781565407
206	Kamwenge	Kaihora A	Hategeka Bigirimana	0
207	Kamwenge	Base Camp 4	Munyandetwa Emmanuel	786234706
208	Kamwenge	Base Camp 4	Munyandetwa Emmanuel	786234706
209	Kamwenge	Base Camp 4	Munyandetwa Emmanuel	78623470
210	Kamwenge	Base Camp 4	Emerance Noellah	0
211	Kamwenge	Base Camp 4	Muhawimana Elizabeth	786033955
212	Kamwenge	Base Camp 4	Nyirarukundo Flavia	775098417
213	Kamwenge	Nkoma C	Neema Borah	788454796

214	Kamwenge	Base Camp 4	Tegeye Karambizi	771480478
215	Kamwenge	Nkoma C	Katusiime Kusemererwe	773798420
216	Kamwenge	Kyempango BI	Ruharaza Ndagari	785334906
217	Kamwenge	Kyempango BI	Niyonzima Zirimabagabo	
218	Kamwenge	Base Camp 4	Akampunguzi Peace	779664237
219	Kamwenge	Base Camp 4	Uwimana Mukesha	0
220	Kamwenge	Nkoma C	Isabelle Uwingeneye	786962577
221	Kamwenge	Base Camp 4	Uwimana Gakunde	779032429
222	Kamwenge	Kyempango BI	Bahati janat	777384799
223	Kamwenge	Base Camp 4	Uwamahoro Shakira	777924187
224	Kamwenge	Kyempango BI	Nsekanabo Jean Baptiste	
225	Kamwenge	Base Camp 4	Uwamahoro Shakira	777924187
226	Kamwenge	Kyempango BI	Onorine Ngirabatware	
227	Kamwenge	Base Camp 4	Musabyimana Chombe	784246725
228	Kamwenge	Base Camp 4	Hakiza Ezekiel	789651427
229	Kamwenge	Base Camp 4	Nduhigi Seleman	788534981
230	Kamwenge	Base Camp 4	Mugisha Ruganda	0
231	Kamwenge	Kyempango BI	Jeanne Nyirabukara	
232	Kamwenge	Base Camp 4	Tumusifu Angelique	784949487
233	Kamwenge	Base Camp 4	Hussein Sadik	781437625
234	Kamwenge	Base Camp 4	Jack Claude	782357705
235	Kamwenge	Base Camp 4	Ujumbe Muhindo	780307684
236	Kamwenge	Base Camp 4	Lukengwa Eugene	781956910
237	Kamwenge	Base Camp 4	Ndatimana Claude	775762111
238	Kamwenge	Base Camp 4	Uwase Sarafina	0
239	Kamwenge	Base Camp 4	Aggress Agaba	775556115
240	Kamwenge	Base Camp 4	Barungi Hope	787876824

241	Kamwenge	Base Camp 4	Neema Francine	9999
242	Kamwenge	Base Camp 2	Niyonzima Makombe	786034057
243	Kamwenge	Base Camp 4	Zawadi Lodrige	773516084
244	Kamwenge	Base Camp 4	Justine Matunguru	786636657
245	Kamwenge	Base Camp 4	Anita Kyomukama	9999
246	Kamwenge	Kaihora c	Tempeya Dorothy	
247	Kamwenge	Base Camp 4	Victor Usene	771875610
248	Kamwenge	Kaihora C	Tezirijose Vianny	786019773
249	Kamwenge	Base Camp 4	Albert Ryanabo	772805403
250	Kamwenge	Kaihora C	Havugimana Damiyane	774858076
251	Kamwenge	Kaihora c	Munga Asaja	778857660
252	Kamwenge	Kaihora c	Uwimana Bimenyimana	781649895
253	Kamwenge	Kaihora A	Nyenyenzi Yvette	780919233
254	Kamwenge	Kaihora A	Nyiransaba Daforoza	
255	Kamwenge	Kaihora B	Mudahoga Theogen	788576169
256	Kamwenge	Base Camp 4	Bahati Katebuke	781994326
257	Kamwenge	Base Camp 4	Uwimana Chantal	783185363
258	Kamwenge	Base Camp 4	Ngarukiye Jean Pierre	781660647
259	Kamwenge	Base Camp 4	Tumayine Francoise	
260	Kamwenge	Base Camp 4	Kasongo Fausttine	778709928
261	Kamwenge	Base Camp 4	Bahati Byamungu	789299938

Annex 2: Equipment Vendors

Attachment D: Detailed Map (GPKG file)

Click on the link to access the [Detailed Rwamwanja Refugee Settlement Map](#)

Opening a GeoPackage - for using a desktop application, there are a number of options. We recommend choosing the GeoPackage implementation that is best suited for your operational environment.

- For using a direct SQL interface, consider [DB Browser for SQLite](#) or [Manifold](#)
- For using a web application, consider using [NGA's application](#)