



# SIGMA Fieldwork Report: Key findings and Case Study database

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# Outline

- Sampling process
- Fieldwork
  - Mini grids visited
  - Characteristics of studied mini grids
- General findings/observations
  - Governance
  - Economic issues: Cost of Electricity, Consumption, Business models
  - Inclusivity: Community engagement/participation
- Challenges/limitations

# Key informant interviews

- Government
  - Ministry of Energy
  - Energy and Petroleum Regulatory Authority
- Developers
  - Renewvia
  - PowerHive
  - Nal Offgrid
  - Kudura Power East Africa
  - Skynotch Energy Africa
- DFIs
  - CAMCO Energy
  - Nordic Development Fund
  - NEFCO
- Associations
  - AMDA

# Counties and Sites visited

## Turkana County (4 mini-grids)

- Long'ech
- Nadwat
- Lolupe
- Kalobeyei Settlement

## Busia County (2)

- Sidonge
- Dirakho

## Siaya County (2)

- Ndeda Island

## Homa Bay County (2)

- Mfangano Island
- Ringiti Island

## Kisii County (3)

- Powerhive 249
- Baranne
- Gionseri B

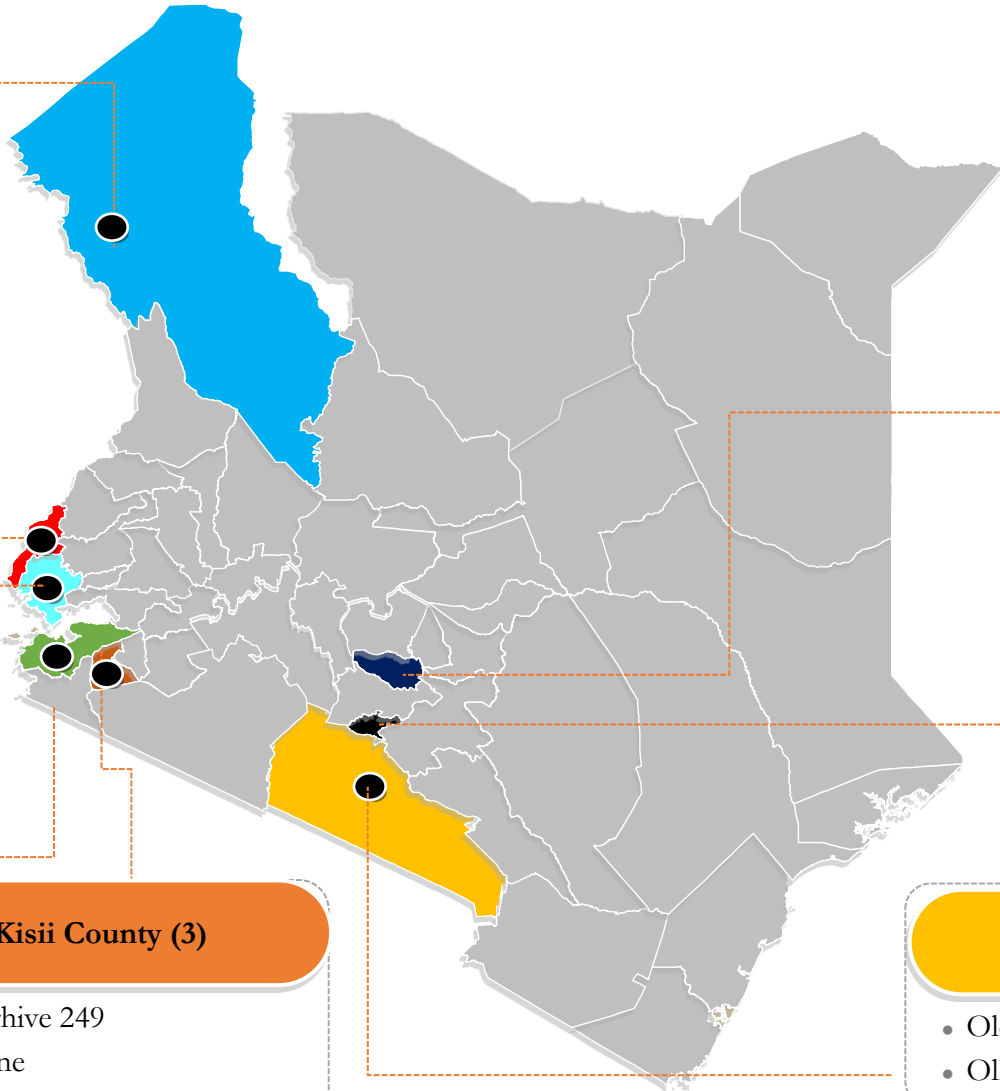
## Murang'a County (1)

- Magiro HydroPower

Nairobi

## Kajiado County (2)

- Oloika
- Olkiramatian



# Sites visited

Location	Date (2022)	Name of mini-grid/Location	Minigrid developer
<b>Kajiado County</b>	1 <sup>st</sup> & 2 <sup>nd</sup> February	Oloika	University of Southampton
	3 <sup>rd</sup> February	Olkiramatian	Renewvia
	7 <sup>th</sup> February	Kajiado County Energy Department	
<b>Siaya</b>	15 <sup>th</sup> February	Siaya County Energy Department	
	15 <sup>th</sup> & 16 <sup>th</sup> February	Ndeda Island	Renewvia
<b>Homabay</b>	18 <sup>th</sup> February	Mfangano	Kengen/KPLC
	20 <sup>th</sup> February	Ringiti	Renewvia
<b>Kisii</b>	22 <sup>nd</sup> February	Powerhive team and Powerhive chicken slaughterhouse	
	23 <sup>rd</sup> February	Powerhive 249	Powerhive
	23 <sup>rd</sup> February	Kisii County Energy Department	
	24 <sup>th</sup> February	Baranne	Powerhive
	24 <sup>th</sup> February	Gionseri B	Powerhive
<b>Busia</b>	16 <sup>th</sup> March	KUDURA Power East Africa Team	
	16 <sup>th</sup> March	Sidonge	KUDURA Power East Africa
	17 <sup>th</sup> March	Dirakho	KUDURA Power East Africa
	18 <sup>th</sup> March	Busia County Energy Department	
<b>Turkana</b>	21 <sup>st</sup> March	Long'ech	Nal-off grid
	22 <sup>nd</sup> March	Lolupe	Nal-off grid
	22 <sup>nd</sup> March	Nadwat	Nal-off grid
	23 <sup>rd</sup> March	Kalobeyei Settlement	
	24 <sup>th</sup> March	Turkana County Energy Department	
<b>Murang'a</b>	10th May	Magiro Hydropower	
	11th May	Muranga County	

# Characteristics

Mini grid name	Technology	Capacity (KW)	Status	Ownership	Connections
Oloika	Solar	13.5	Semi operational	Community	46
Olkiramatian	Solar	6.2	Fully operational	Private	70
Ndeda	Solar & Wind	Solar-9 Wind-6	Fully operational	Private	400
Ringiti	Solar	20.45	Fully operational	Private	290
Mfangano	Diesel & Solar	Diesel-520 Solar-10	Fully operational	Public	5,000+
Powerhive 249	Solar	60	Fully operational	Private	169
Gionseri B	Solar	60	Fully operational	Private	374
Baranne	Solar	50	Decommissioned	Private	80
Sidonge	Solar	7.3	Fully operational	Private	220
Dirakho	Solar	30	Fully operational	Private	524
Longech	Solar	45	Semi operational	Private	218
Lolupe	Solar	22	Fully operational	Private	136
Nadwat	Solar	44	Semi operational	Private	180
Kalobeyei Settlement	Solar	60, expanding to 504	Semi operational	Private	504 expected to rise to 2,000+
Magiro (Kahinduini)	Hydro	70	Fully Operational	Private	1,500

Interviews  
conducted  
= 245

	HH- Connected	HH unconnected	PUE	Institutions	FGD	Community leaders	Operator	County Energy Dept.
Oloika	10	5	5	2		1	1	1
Olkiramatian	10	5	5	2			1	
Ndeda	10	5	5	2		1	1	1
Ringiti	10	5	5	2			1	1
Mfangano			2	1	1		1	
Powerhive 249	10	5	3	0			1	1
Gionseri	10	5	3	0			1	
Baranne					1		1	
Sidonge	10	0	5	0		1		1
Dirakho	10	0	5	1		1	1	
Longech	10	5	5	2			1	1
Lolupe					1		1	
Nadwat	10	5	5	0				
Kalobeyei Settlement	10	5	5	3				
Magiro					TBD			1

# Mode of data collection for interviews

Respondents	Approximate No of Interviews	Average length of each Interview	Mode of data collection
Key Informant Interviews	12	1 hour 30 minutes	-Interviews conducted online (Via zoom) -Face to Face Interviews (1 Interview)
Connected Households	110	30-45 minutes	-Audio Recording -Electronic data collected (use of tablets) -Note taking
Unconnected Households	45	25-35 minutes	-Face to face interviews -Audio Recording -Electronic data collected (use of tablets) -Note taking
Productive users & Businesses	51	35-45 minutes	-Audio Recording -Electronic data collected (use of tablets) -Note taking
Focus Group Discussions (FGD)	3	1 hour 30 minutes	-Audio Recording -Electronic data collected (use of tablets) -Note taking
Developers/Operators	10	30 minutes-1 hour 30 minutes	-Audio Recording -Note taking
County Energy Officers	7	1 hour 30 minutes	Audio Recording -Note taking
Community Leaders	4	45 minutes-1 hour	Audio Recording -Note taking -Electronic data collected (use of tablets)



# Data on the Kobotoolbox

The data captured using ODK app and Kobotoolbox.

Out of 206 expected interview forms, 175 have been submitted with the rest still being cleaned before submission

Interview type	Expected number of forms to be submitted	Current number of submitted forms
Connected Households	110	102
Unconnected	45	35
Productive Users	51	38

The screenshot shows the KoBoToolbox web interface. At the top, there is a search bar labeled 'Search Projects' and a user profile icon with the letter 'M'. On the left sidebar, there are navigation icons and a 'NEW' button. Below the sidebar, there are three status filters: 'Deployed' (3), 'Draft' (0), and 'Archived' (0). The main content area is titled 'Deployed' and contains a table with the following columns: Name, Shared by, Created, Last Modified, and Submissions. The table lists three projects:

Name	Shared by	Created	Last Modified	Submissions
SIGMA-Households-Connected		January 6, 2022	Last Thursday at 8:37 AM	102
The Centre for Frugal Innovation in Africa (CFIA), Kenya Hub—which...				
SIGMA-Organizations and Productive Users		January 18, 2022	March 17, 2022	35
The Centre for Frugal Innovation in Africa (CFIA), Kenya Hub—which...				
SIGMA-Households-Unconnected		January 31, 2022	March 14, 2022	38

# Data on the Kobotoolbox

- Both quantitative and qualitative data captured

27. What was the average monthly household income currently?

- No income
- Less than Ksh. 1000
- Ksh. 1000-10000
- Ksh. 10001-20000
- Ksh. 20001-30000
- Ksh. 30001-40000
- Ksh. 40001-50000
- Ksh. 50001-60000
- Ksh. 60001-70000
- Ksh. 70001-80000
- Ksh. 80001-90000
- Ksh. 90001-100000
- Above 100000
- Prefer not to say
- I don't know

64. What is your opinion of the participatory process? What was done well? What could be done differently?

65. Beyond using energy from the mini grid, do you or any member of your household participate in the running of the mini grid?

- Yes
- No

68. What were your personal contributions/inputs to the process?

69. What is your opinion on the way that the mini grid is managed?

70. Is there currently a channel in place for addressing complaints around any issues regarding the mini grid?

# Sample of the submitted forms on Kobotoolbox

**KoBo toolbox** SIGMA-Households-Connected 99 submissions M

SUMMARY FORM **DATA** SETTINGS

hide fields

1 - 30 99 results	Validation	start	end	Interview...	group_ot54...	group_ud7...
<input type="checkbox"/>	Show All	Search	Search	Show All	Show All	Show All
<input type="checkbox"/>	—	Feb 23, 2022 ...	Feb 23, 2022 ...			
<input type="checkbox"/>	—	Feb 23, 2022 ...	Feb 23, 2022 ...			
<input type="checkbox"/>	—	Feb 2, 2022 1...	Feb 2, 2022 9...	Abigael Okoko	Kajiado	
<input type="checkbox"/>	—	Feb 2, 2022 1...	Feb 2, 2022 9...	Abigael Okoko	Kajiado	
<input type="checkbox"/>	—	Feb 2, 2022 1...	Feb 2, 2022 1...	Abigael Okoko	Kajiado	
<input type="checkbox"/>	—	Feb 3, 2022 1...	Feb 3, 2022 1...	Abigael Okoko	Kajiado	
<input type="checkbox"/>	—	Feb 3, 2022 1...	Feb 3, 2022 1...	Abigael Okoko	Kajiado	
<input type="checkbox"/>	—	Feb 3, 2022 1...	Feb 3, 2022 1...	Abigael Okoko	Kajiado	
<input type="checkbox"/>	—	Feb 16, 2022	Mar 18, 2022	Abigael Okoko	Siaya	

← PREV Page 1 of 4 30 rows ▾ NEXT →

# Field Notes

Interview Dates	
Name of mini-grid developer	
Name and contacts of Mini-grid operator.	
Location of the Mini-grid	
Mini-grid location coordinates	
Year of Mini-grid Establishment	
Minigrid Capacity	
Ownership of Mini-grid	

# Structure of Field Notes

- General information
- Minigrid technology
- Economics of the minigrid
  - Types of users: households, productive users, institutions
  - Affordability, payment models, energy stacking
- Technical issues, O&M of the minigrid
  - Maintenance, power outages, voltage fluctuation and electricity consumption.
- Governance and participation issues
  - Relationship with developers, community engagement
- Impact
- Plans to expand/upgrade the minigrid.
- Emerging issues

# Focus Group Discussions

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- Composition:
  - 12-15 community members participated in each FGD constituted as follows:
  - 1 community leader (2 in one case)
  - 3 men
  - 3 women
  - 2 elderly persons
  - 3 youth
  - 1 unconnected person



# Preliminary findings



# Governance

- Issues around the draft minigrid regulations
  - Contentious issues:
    - Grid arrival,
    - 15km radius from KPLC transformer,
    - subsidies,
    - Grid readiness, technical specifications
    - role of county govt not clear
  - Participation issues
  - Lack of transparency in the process:
    - issuing permits, tariff setting, electrification planning



# Governance

- At the county level:
  - Energy department not fully decentralised (devolved?)
  - Budget constraints, energy not prioritized
  - Lack of energy policies in counties
  - Some counties have no energy department (Murang'a)
  - Partnerships for electrification
    - Busia County/REREC-Matching Fund/Facility
    - Turkana county/partners e.g., GIZ
- Regulatory challenges/inconsistencies
  - Land issues, lack of coordination (approval processes),
- Political challenges: local politics create financial and project risks

# Financing minigrids

- DFI financing is being used to test commercial minigrids: sustainable?
  - Focus on energy access gaps, SDGs, renewables, catalyse private investment
- Hybrid financing models
  - Financing model affects the tariffs. Epra pushing for more debt
  - At the early stage, grants are crucial. Long run: loans with long maturities
  - Equity, debt, grants. At least 60% is needed for viability
- De-risking projects is core to financing
  - Demand risk, regulatory risk, slow RoI, capacity issues in govts
- Preference for PPPs, GESi issues

# Economic issues: Affordability

- **Cost of connection**
  - Varies with developer/operator/technology/use (household or productive): Flat rate vs Tier system
- **Tariff**
  - Varies with developer/operator/technology/use (household or productive user)
- **Payment systems/methods**
  - For connection
    - Full payment vs staggered system
  - For consumption
    - Metered systems: mobilemoney, PayGo/prepaid, cash
- Underutilisation of minigrids keeps costs high

# Economic issues: Energy consumption/impact

- **Household use**
  - Lighting; powering electrical devices: tv, radios, charging mobile phones
  - Increased security, convenience, negative impact on social cohesion, health outcomes improved, reduced cattle rustling, mixed findings on appliance usage, energy stacking
- **Productive use**
  - Businesses such as barber shops, salons, welding & mechanic workshops, posho mills/grinders
  - New business ventures, expanded operating hours, new product/services.
  - Back up systems where power is unreliable/rationed, business closure.
- **Institutions**
  - Schools (powering learning equipment), hospitals (powering refrigerators, lighting, night births)
  - Back up systems where power is unreliable/rationed
- **Peak consumption time**
  - HH: Morning 5-8 a.m. and evening 6-9 pm
  - PU: 8 am –7 pm

# Economic issues: Business models

- Anchor projects
- Appliance financing
- Leasing of infrastructure
- Reduced cost with increased consumption
- Bundle system
  
- Productive use is an ideology, a panacea: no economic activity, no productive use
- Need to develop the entire value chain



# Inclusivity: Community participation

- Who is the community? Who is a community leader? (representation issues)
- Regulation on participation is underdeveloped
- Communities' capacity to participate varies across the country
- Cultural factors determine who is included; who has a voice
- Implementing an inclusive process is very costly for government and developers. Not clear on what the value addition is

# Inclusivity: Community participation

- **During mini establishment**
  - Community entry points
    - CBOs (KUDURA, Magiro)
    - Influential persons (Mfangano off-grid)
    - Community leaders (Chiefs, BMUs)
- **Modes of participation**
  - CBO meetings, general community meetings/barazas
  - Invitation is through public announcement/calls (common in the islands)
- **In mini grid operations**
  - Many cases household members are not engaged except for one person employed as a site agent

# Complaints

## Types of complaints

- Outages
- Delays in recharging once client has purchased tokens
- Power Rationing (Long'ech and Nadwat)

## Channelling of complaints

- Through the site agent by:
  - physical meetings/calls/Sms
- WhatsApp groups
- Toll free lines (powerhive)

## How the complaints are handled:

- Site agent checks the problem, if he can't handle notifies operator/developer
- Technician sent on site: However, may delay especially if it is one complaint & technician has to be sent from outside the area
- Some sites have had complaints going unaddressed causing dissatisfaction



# Unconnected households

## Reasons for not connecting

- Paid but not yet connected (waiting phase)
  - Lack of equipment
  - Operator waiting to build the numbers to send technician to the ground
- Unreliability of the current supply discourages others, so they opt for alternatives (stand-alone home solar systems e.g. sun king, solar panels etc)
- Interested but cannot afford

# O&M challenges

## ✓ O & M

- Batteries: Unreliable electricity supply when batteries begin to run down therefore opting for alternatives (Oloika, kalobeyei settlement, Nadwat, Longech)
- Weather challenges for solar mini grids (rain, cloud cover)
- Frequent cleaning of panels due to dust and bird poop
- Replacement of poles (termites, soil acidity, rotting)
- Mini grid operating beyond capacity (connection of too many households)



# Challenges/Limitations

## ✓ Field work planning

- Challenges in organising for fieldwork: Coordinating dates especially where the trip was bundled up
- Getting contact details for mini grids to be visited (especially Central Kenya)

## ✓ Actual field work

- Delays in getting an interview especially with county officials
- Distance between one interview site and the next (county & mini grid site): in most cases unable to divide ourselves due to the distance
- Not getting the right person to interview due to non-establishment of the energy department at the county government level
- Data acquisition challenges: (Technical, OPEX, CAPEX)
- Technological: data collection using tablet is limiting depending on how the coding of a question is done (one may want to take a point but no provision for it).
- Insecurity in areas we planned to visit ( Northern Kenya)

# Next steps

- Visit another
  - public diesel-operated minigrid
  - Small hydro minigrid
- Finalise interviews with key informants
- Finalise blog articles
- Paper abstracts
  - **Are mini grids a solution to energy poverty? A case of mini-grids in Kenya** submitted to the DSA 2022 Conference
  - **Household innovation and agency in minigrid energy use**, submitted to a workshop on Household Innovation and Agency in Sustainability Transitions by Monash University



*Magiro Hydro, Muranga*

**THANK YOU**



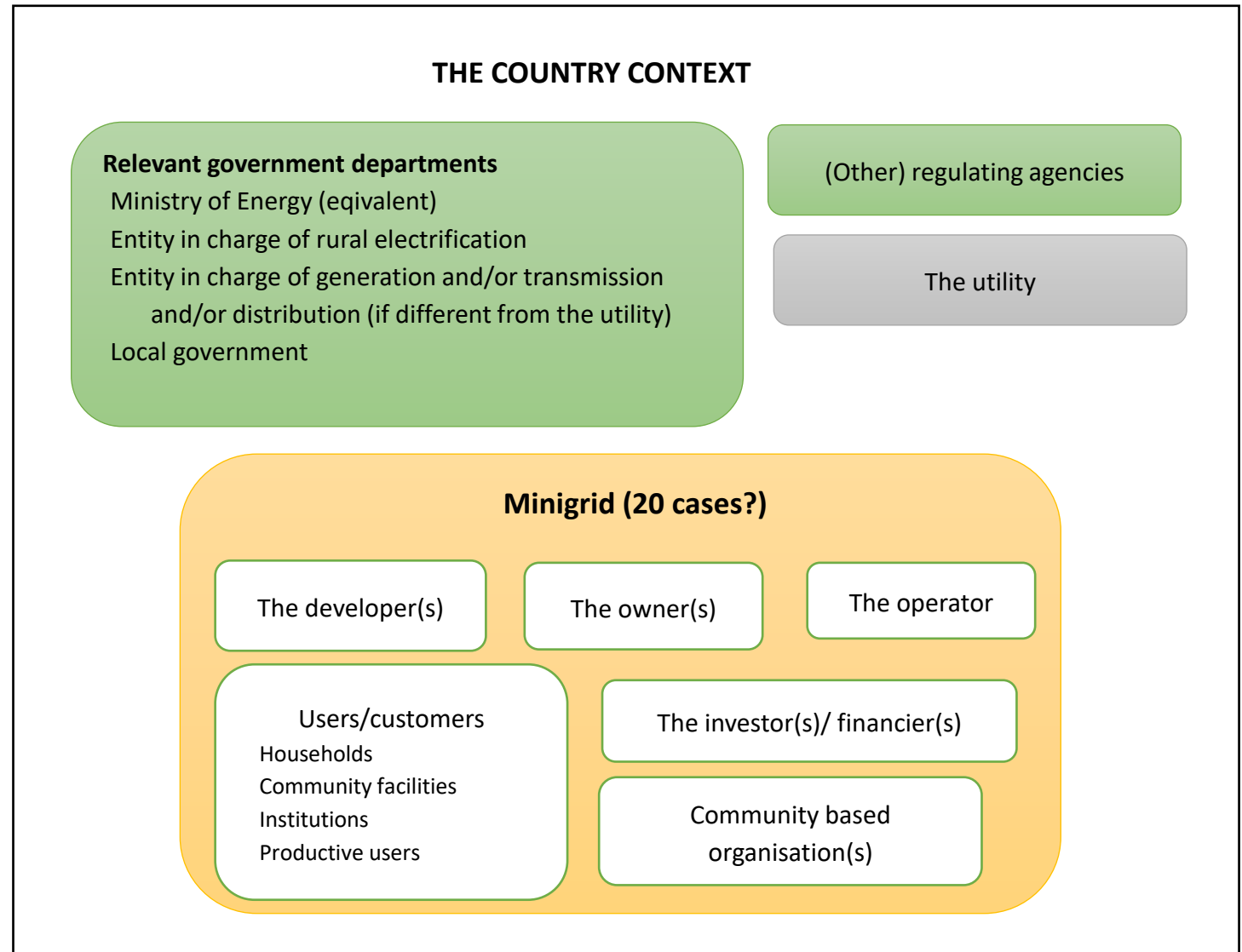
*Hybrid Mini grid(Solar and Wind) In Ndenda Island,.*



[eonsongo@cfia.network](mailto:eonsongo@cfia.network); [aokoko@cfia.network](mailto:aokoko@cfia.network);  
[bonjala@cfia.network](mailto:bonjala@cfia.network); [rnyumba@cfia.network](mailto:rnyumba@cfia.network);  
[mkausya@cfia.network](mailto:mkausya@cfia.network)

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# Sampling process



# The Sample

		Ownership model					TOTAL
		Publicly owned	Privately owned	Public Private Partnership	Community owned	Other (e.g. faith-based org)	
Technology	Hydro	0	1	0	0	0	1
	Solar PV		11		1		12
	Fuel oil						0
	Geothermal						0
	Biomass		0				0
	Natural gas	0					0
	Wind						0
	Hybrid	1	1				2
TOTAL		1	13	0	1	0	15