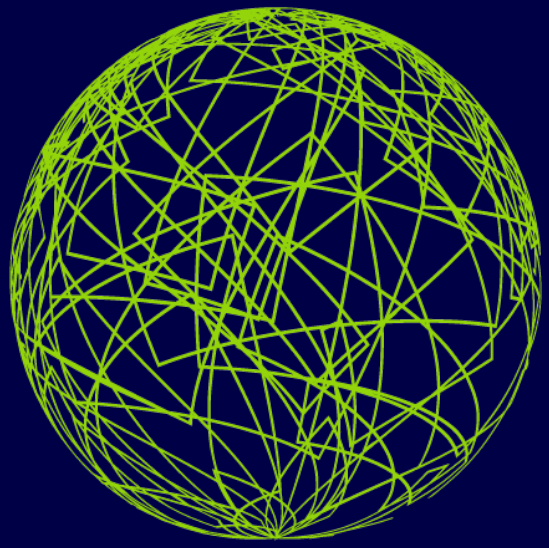

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New Approach to Mini-Grid Configuration: Leveraging Geospatial Data

November 14, 2018

The mini-grid industry is governed by a set of factors among which ‘the market’ remains arguably the most dynamic and complex.

- Regulatory Framework
- Access to Finance
- Technology
- Market

Understanding the complexity of the market and the characteristics of consumers is critical to the viability of an off-grid project.

Understanding critical insights about the market facilitate effective deployment of off-grid system to service the most promising communities.

Market

Any viable mini-grid project need to answer the following questions regarding the market:

- What is the best community to deploy the system?
- How many customers are in that community?
- What is their energy need?
- What is the ability to pay?
- How is the competitive landscape?
- What are the existing payment infrastructure?
- What is mobile phone penetration in that community?

Outline

I. About Fraym

II. Geospatial Data for Mini-Grid

III. Demo - Nigeria

IV. The Impact

ABOUT FRAYM

1. Our Story
2. Our Data & Technology

Fraym was born out of frustration. Before Fraym, we faced one consistent and fundamental challenge — the lack of actionable data at local and regional levels to make strategic decisions and drive operational performance.

ABOUT FRAYM || METHODS

Acquire Data

geo-tagged household surveys

remote sensing data

satellite imagery

On-Board Data

compile clean

harmonize geospatially-enable

Produce Data Layers

machine learning proprietary algorithms

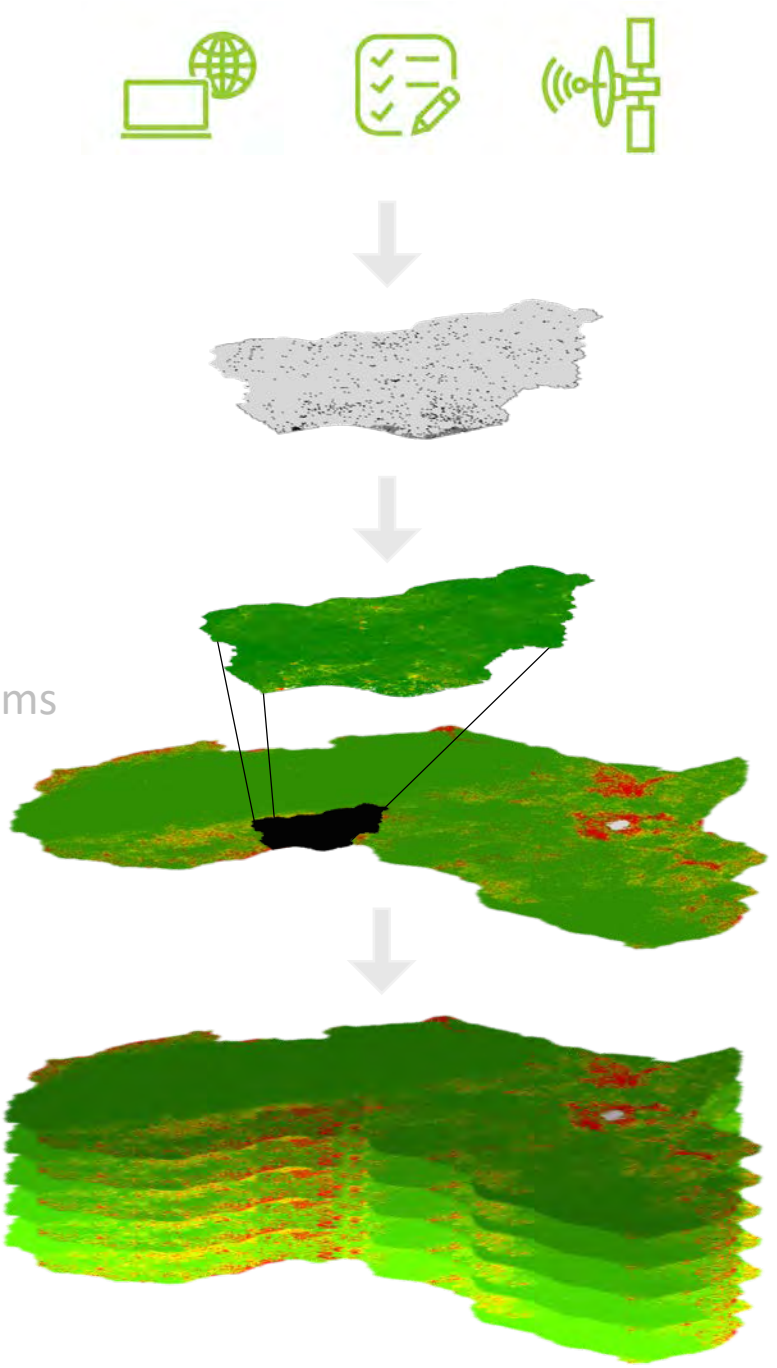
artificial intelligence automation

Deliver to Customers

data layer APIs

front-end tools

analytic services



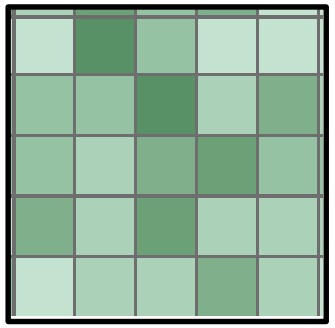
GEOSPATIAL DATA FOR MINI-GRID DEVELOPERS

1. Where are the best communities for mini-grid?
2. What is consumers' ability to pay for power?
3. How is the competitive landscape?

ANALYSIS || OVERVIEW

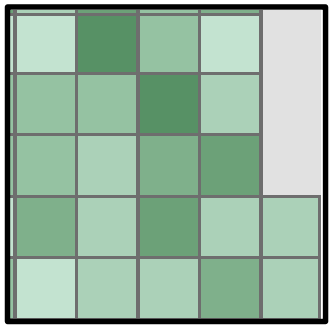
First, we apply decision filters and proprietary data to **identify ideal communities** for mini-grid development.

Filter #1: Electricity Access



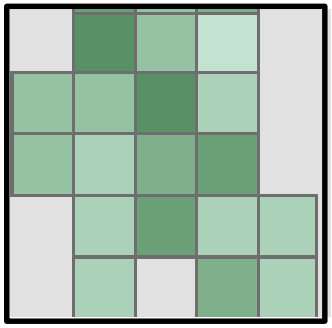
We prioritize areas that are 10 to 20 km away from the national grid.

Filter #2: Residential Demand



We exclude areas without mobile network coverage.

Filter #3: Ability to Pay



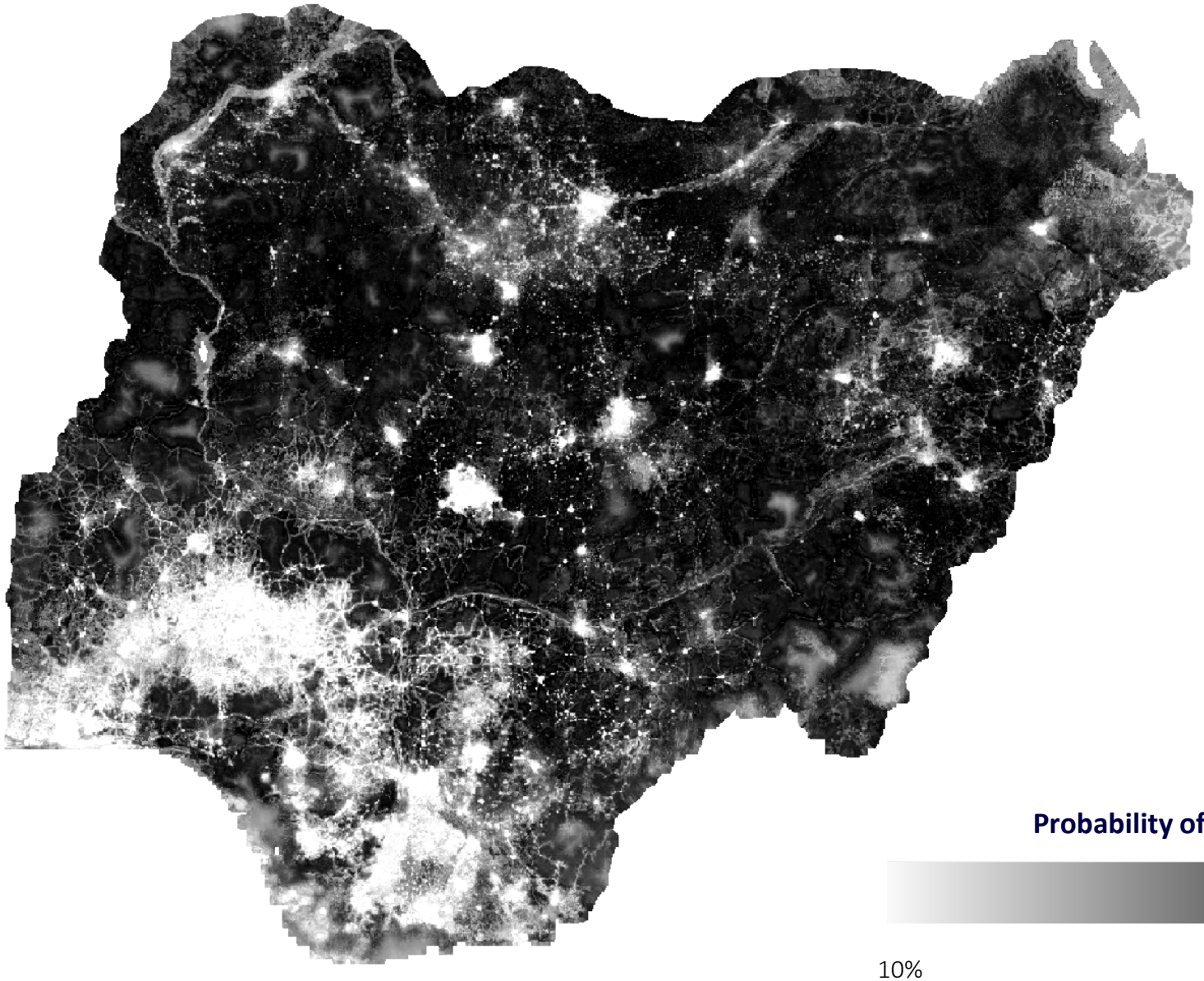
We also exclude areas where household spending is less than $75/month

Profile Attributes

We add other customized demographic indicators, e.g.:

- Agricultural employment
- Crops produced
- Population density
- Energy sources
- Energy spending
- Solar panel ownership
- Household assets
- Other data according to client's unique product and preferences

Then, we identify target communities that are off-grid.



Using Fraym's unparalleled repository of household survey data, we quantify the latent demand for power among off-grid customers.

Generator ownership

No

Median household income

<50%

A

Consumers in group A do not have a generator and are in the bottom half of households by total consumption.

>50%

B

These consumers are above the median overall consumption and do not have a generator in their household.

Yes

C

Households with generators are considered separately as they tend to own consumer electronics at much higher rates in both on and off grid homes.

ANALYSIS || CALCULATING DEMAND

Next, Fraym uses the profiles to calculate total residential demand by community – down to the 1 km^2.

Fraym estimates off-grid demand at 1 km^2 scale by multiplying breakdowns of how people fit into each consumer class by spatial population totals, and estimates for electricity demand for each consumer segment.

30% A
45% B
25% C

x

500 people

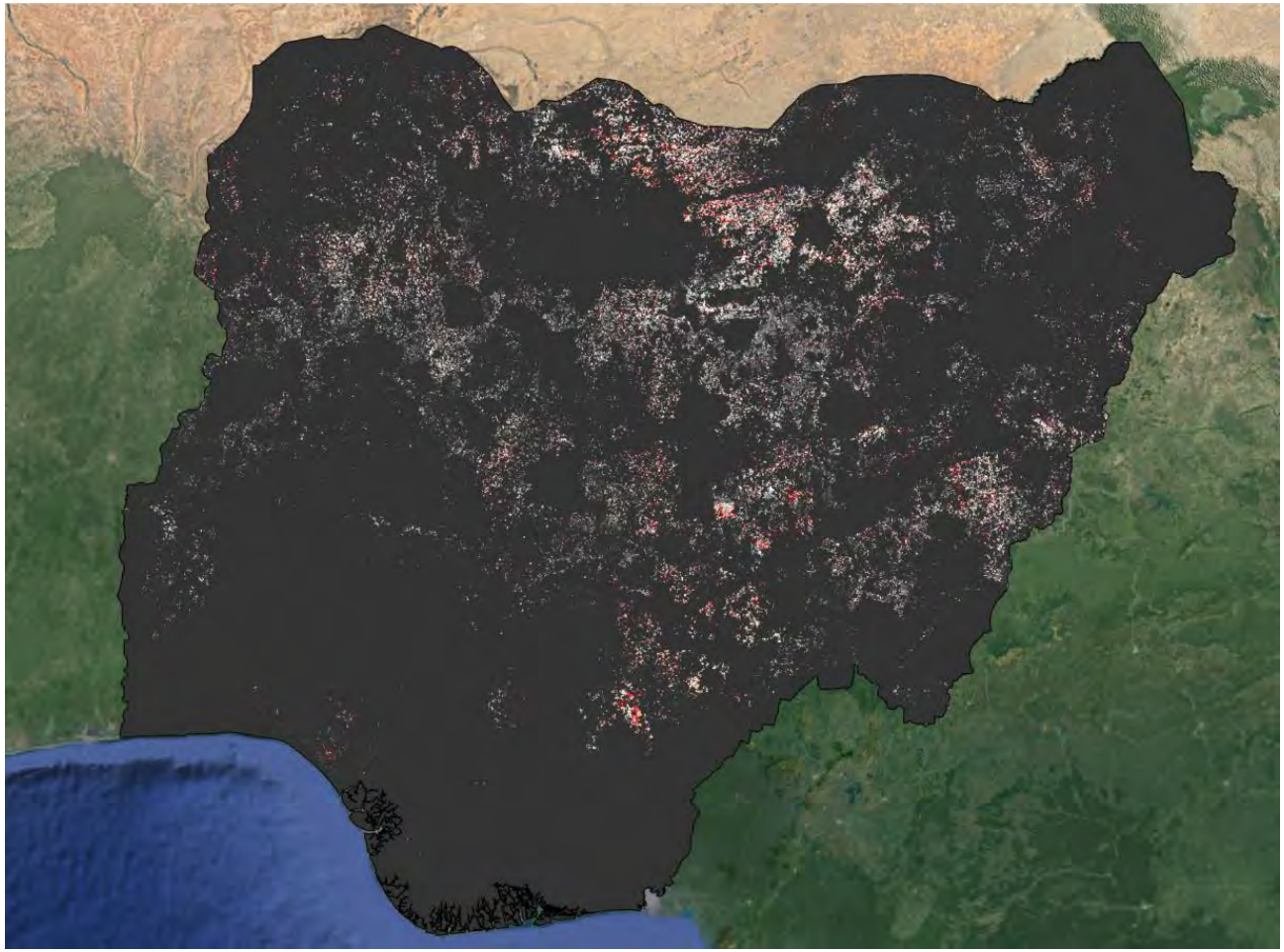
x

53.2 Wh per capita A
62.2 Wh per capita B
111.6 Wh per capita C

=

35.9 kWh
Daily Aggregate Demand
Per 1 x 1 km Cell

Fraym combines these together to map of the residential demand for power in off-grid communities.



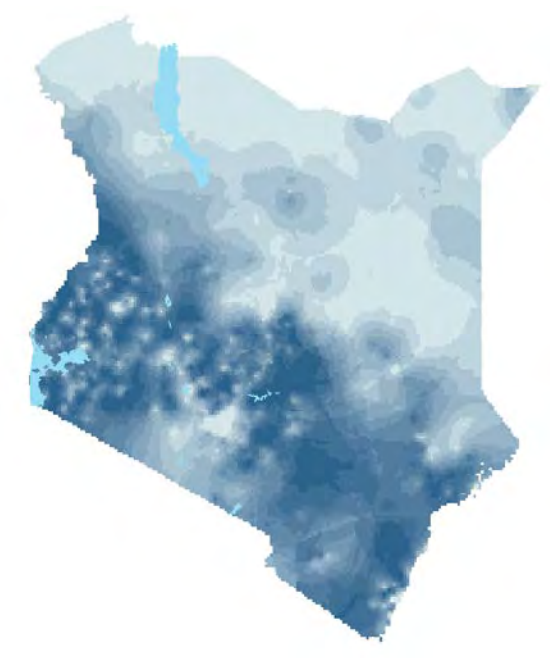
Note: Demand is shown in kWh for areas with a less than 5% probability of being connected to electric grid.
See slide 10 for how the consumer information aggregates to produce total demand.

ANALYSIS || ADDITIONAL LAYERS

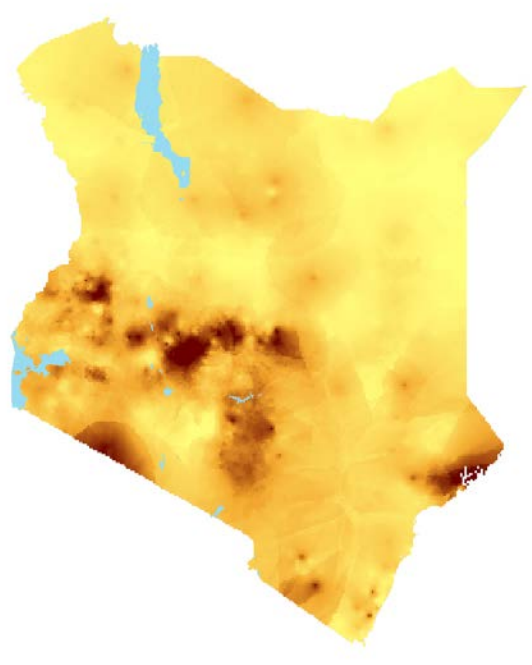
And we include key characteristics like mobile phone coverage, agricultural-based income, solar panel ownership, etc., to inform the final, tailored customer profile.

Current Mobile Phone Coverage

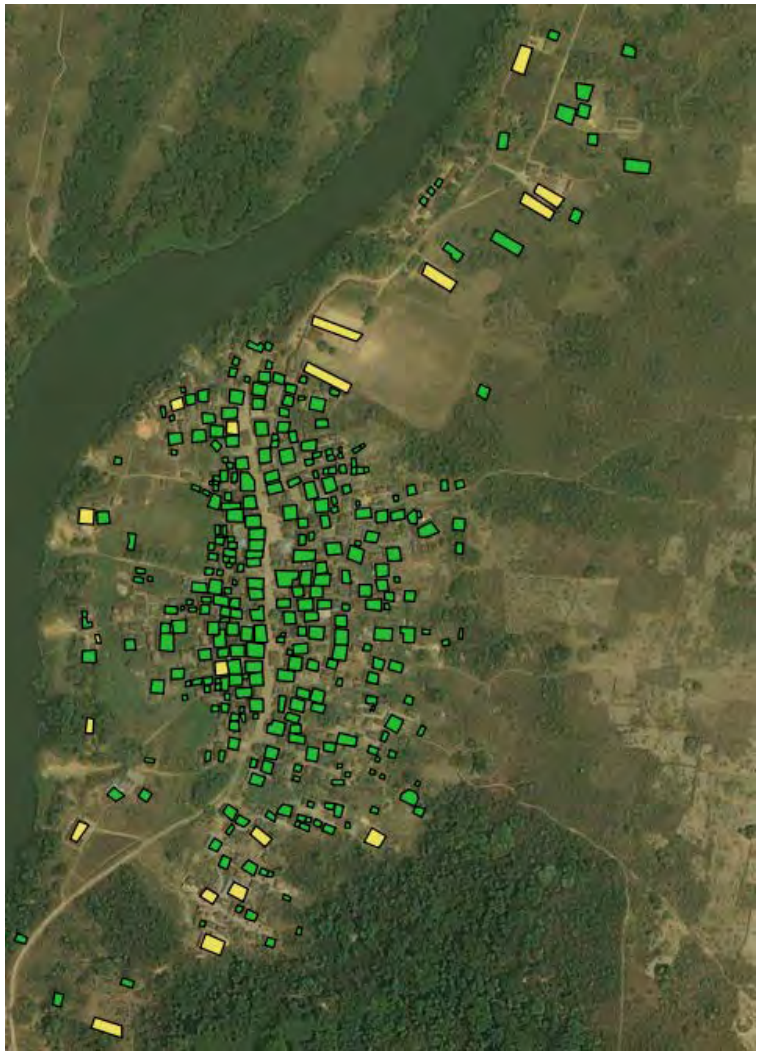
Percent of Population Involved in Agriculture



Percent of Population Owning Solar Panels



Further, for selected sites, we use rich satellite imagery for detailed site scoping to assess demand from commercial and productive-use customers.



Fraym built an image analysis algorithm to detect and classify buildings from high resolution satellite imagery.

Buildings were classified based on size and proximity to the community center. Residential buildings tend to be smaller and tightly clustered together. Commercial and industrial (C/I) buildings are larger and tend to be on the outer edges of the communities.

Between 7 and 15 percent of buildings in the deep-dive communities are classified as C/I.

Commercial/industrial building

Residential building

Note: Fraym took measures to exclude school buildings from C/I classification.

ANALYSIS || COMMUNITY LEVEL

Finally, we validate site population and demand estimates, pinpoint high concentrations of promising structures, and provide an in-depth community profile.

Potential Site: 500m x 500m

Population (est):	1,350
Structures:	309
Health Clinics:	1
Schools:	0
Water Points:	7

Monthly Expenditures:	438,000 TZS/hld
Spending:	89,000 TZS/person

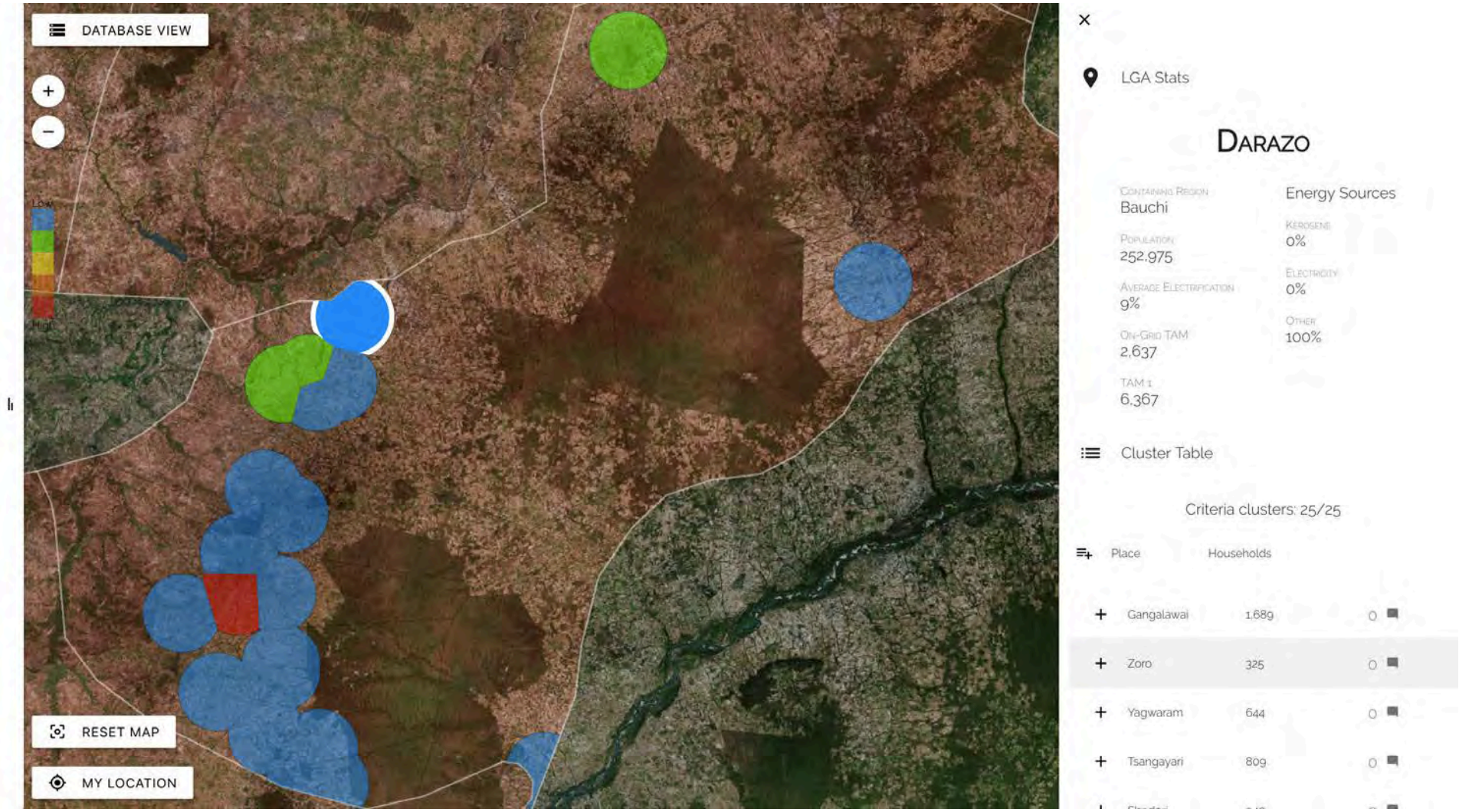
The best sites are **now ready for an in-person site assessment**. And the entire process is completed at a **fraction of the time and cost** of a traditional site selection approach.

DEMO – NIGERIA

1. Where is the unconnected population?
2. What is their demographic profile?
3. What is their ability to pay for power?

DEMO || NIGERIA

We provide off-grid players an interactive map to identify best communities to deploy their systems to.



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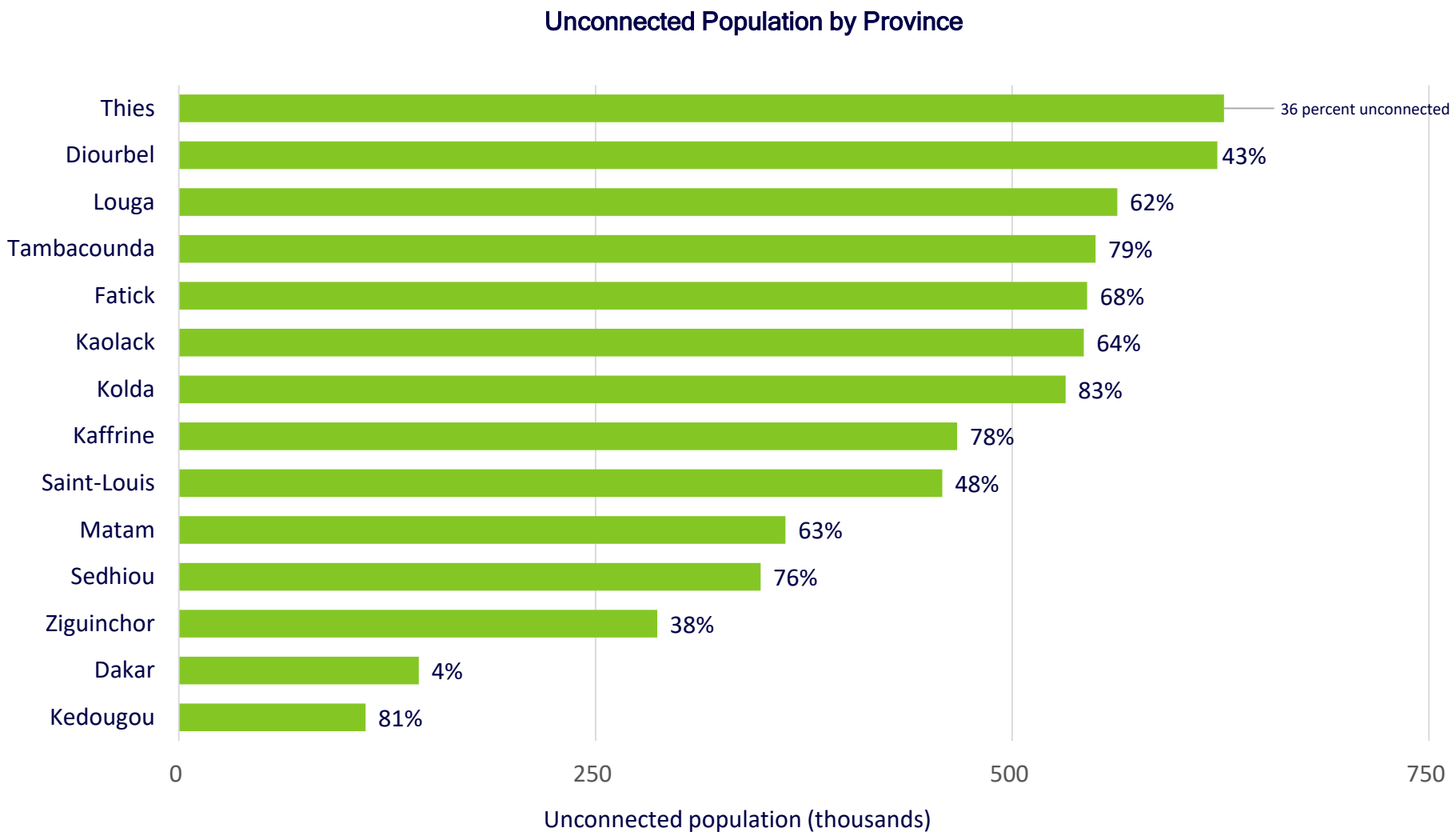
THE IMPACT

1. Assessing the real demand
2. Designing policies

IMPACT || UNCONNECTED

We determined which provinces had the highest percentage of unconnected population.



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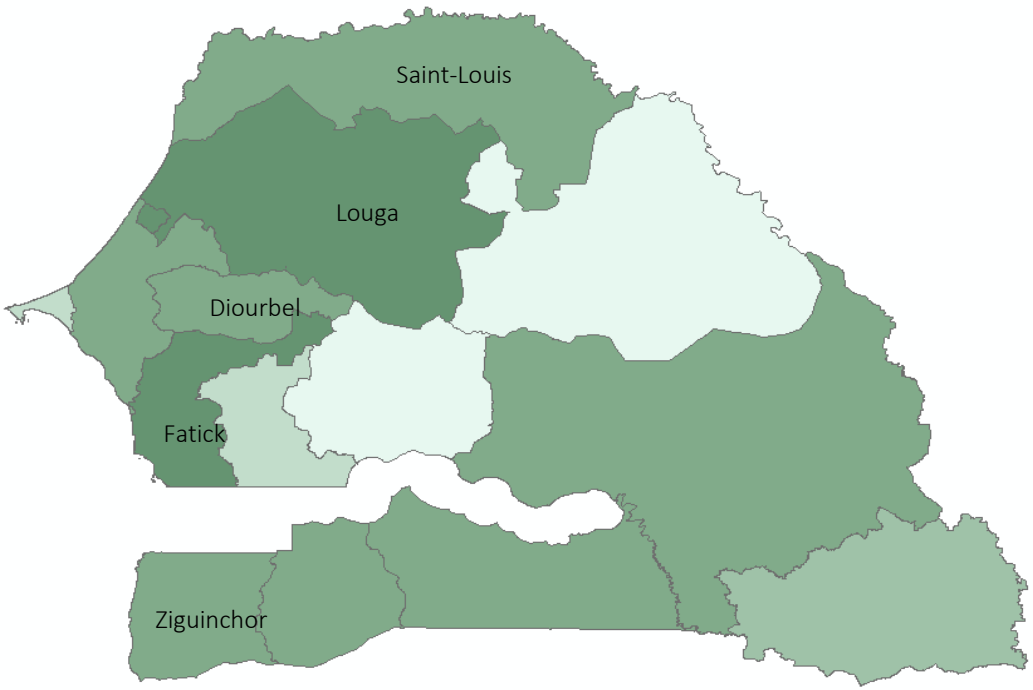
IMPACT || ABILITY TO PAY

Fraym mapped the target unconnected population's ability to pay by evaluating household assets, such as televisions.



Population with off-grid television owners (2015)

3,500 — 68,000

* Note: Off-grid television owners are people who live in households with a television but are not connected to the electricity grid.

1. About a third of Senegal's unconnected population—2.4 million people--lives in provinces that are close to Dakar (within 150 km). The connectivity rate for these areas is only 48%.

2. However, **these areas have unconnected residents who indicate a significant willingness and ability to pay for electricity.** For example, many of these un-connected residents have televisions, indicating that they are purchasing off-grid power sources.

3. The areas with high concentrations of people with demand and ability to pay for power should be the first targets for rural electrification.

IMPACT || OVERVIEW

Fraym's proprietary data platform makes it possible for companies, and policy makers to get tailored and unprecedented local insight for the highest impact

Target the Priority Communities	Through a geospatial lens, we now have the ability to take a closer look at communities with the greatest need. We can map concentrations of target consumers with precision down to 1x1 km—illustrating critical hotspots of customer potential. Doing this, we can also isolate strong indicators to assess the community readiness for off-grid.
Inform Business Models	Moreover, geospatial data provides a birds eye view into households ability to pay for power in each community. It also provides an insight into the availability of payment infrastructure in the community to inform companies about the need to develop localized location methods.
Guide Policy Decisions	Finally, geospatial data provide policy makers with actionable insights into the need of the market and the capacity of the private sector. In doing so, it can enable decision makers with a framework to make policy recommendations.

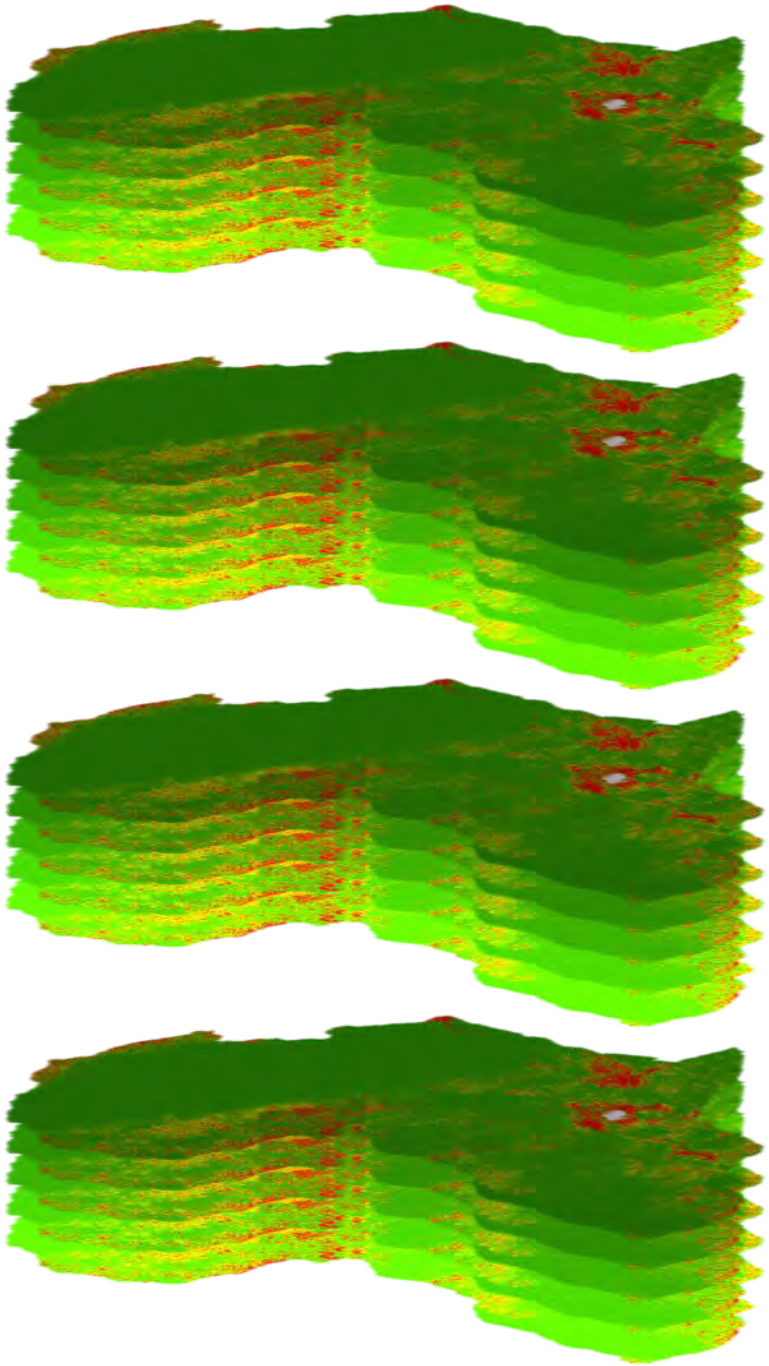
OFFERINGS

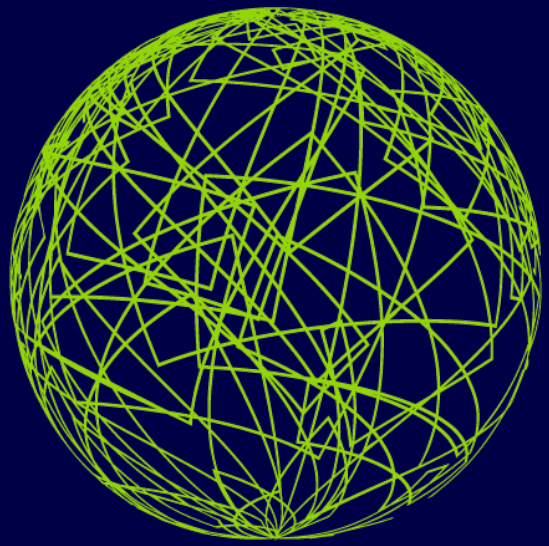
Population & Demographics		
Population	Household Size	Income
Poverty Index	Vulnerability Index	Language
Ethnicity	Religion	Place Names

Economy		
Consumer Segments	Electricity Access	Employment Sector
A/B Consumers	Bank Acct Owner	Car Owner
C1/C2 Consumers	Moped Owner	Livestock Owner
D/E Consumers		

Health & Education		
Adult Literacy	Primary Education	Secondary Education
Distance to Clinic	Child Vaccination	Obesity Rate
Water Source	Sanitation	

Behavior		
Mobile Phone Own	Radio Listen	TV View
Computer Own	Internet	Newspaper Reader
Health Spending	Household Spending	Consumer Goods Spending





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