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.

**BACKGROUND | INDUSTRY DRIVERS**

- **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.

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

**ANALYSIS || RESIDENTIAL DEMAND**

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

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

- **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.
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.

\[
\begin{align*}
30\% \text{ A} & \times 500 \text{ people} \times 53.2 \text{ Wh per capita A} = 35.9 \text{ kWh} \\
45\% \text{ B} & \times 500 \text{ people} \times 62.2 \text{ Wh per capita B} \\
25\% \text{ C} & \times 500 \text{ people} \times 111.6 \text{ Wh per capita C}
\end{align*}
\]

Daily Aggregate Demand Per 1 x 1 km Cell
Fraym combines these together to map 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 the electric grid. See slide 10 for how the consumer information aggregates to produce total demand.
And we include key characteristics like mobile phone coverage, agricultural-based income, solar panel ownership, etc., to inform the final, tailored customer profile.
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.

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

<table>
<thead>
<tr>
<th>Population (est):</th>
<th>1,350</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structures:</td>
<td>309</td>
</tr>
<tr>
<td>Health Clinics:</td>
<td>1</td>
</tr>
<tr>
<td>Schools:</td>
<td>0</td>
</tr>
<tr>
<td>Water Points:</td>
<td>7</td>
</tr>
</tbody>
</table>

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.
1. Where is the unconnected population?
2. What is their demographic profile?
3. What is their ability to pay for power?
We provide off-grid players an interactive map to identify best communities to deploy their systems to.
THE IMPACT

1. Assessing the real demand
2. Designing policies
We determined which provinces had the highest percentage of unconnected population.
Fraym mapped the target unconnected population’s ability to pay by evaluating household assets, such as televisions.

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%.

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.

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

*Note: Off-grid television owners are people who live in households with a television but are not connected to the electricity grid.*
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
- Poverty Index
- Ethnicity
- Household Size
- Vulnerability Index
- Religion
- Income
- Language
- 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
- Distance to Clinic
- Water Source
- Primary Education
- Child Vaccination
- Sanitation
- Secondary Education
- Obesity Rate

## Behavior
- Mobile Phone Own
- Computer Own
- Health Spending
- Radio Listen
- Internet
- Household Spending
- TV View
- Newspaper Reader
- Consumer Goods Spending
Contact
Ali Djire
a.djire@fraym.io