

# Using Remote Sensed Data to Predict Residential Electricity Demand in Kenya



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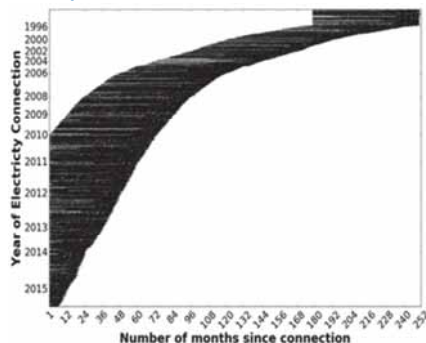
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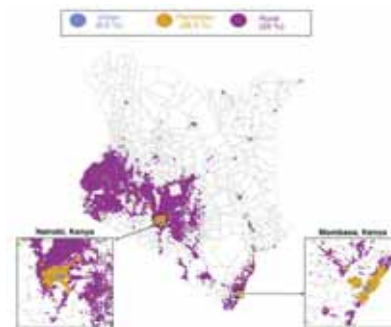
## Research Questions

- R1. How has electricity demand of individual households grown over time in Kenya?
- R2. What visual information in satellite images correlates with electricity demand?
- R3. How well can we classify electricity consumption from satellite images?

## Data: 6 years of monthly consumption for 135K customers



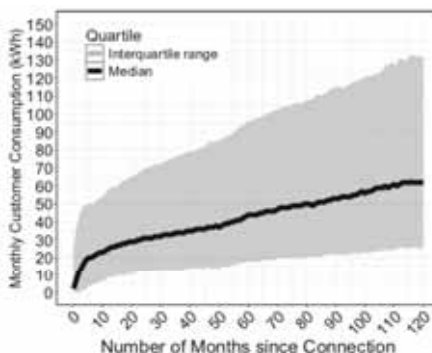
Spatial distribution by urbanization level



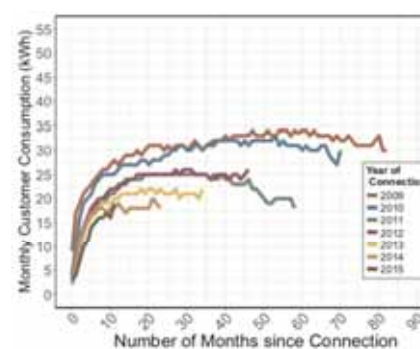
## R1. Consumption Highlights

- i. Consumption grows with experience.
- ii. Recently electrified customers are reaching steady-state more quickly than previous customers.
- iii. The steady-state consumption is increasingly less.
- iv. Urban customers use 50 % more electricity than rural counterparts.

## Overall Trend



## Rural Trend



## R2. Visual Features in satellite images correlated with Demand

- i. Growth in volume and frequency of satellite imagery.
- ii. Economic development visible in images (i.e. buildings, roads).
- iii. Economic development is correlated with electricity consumption.

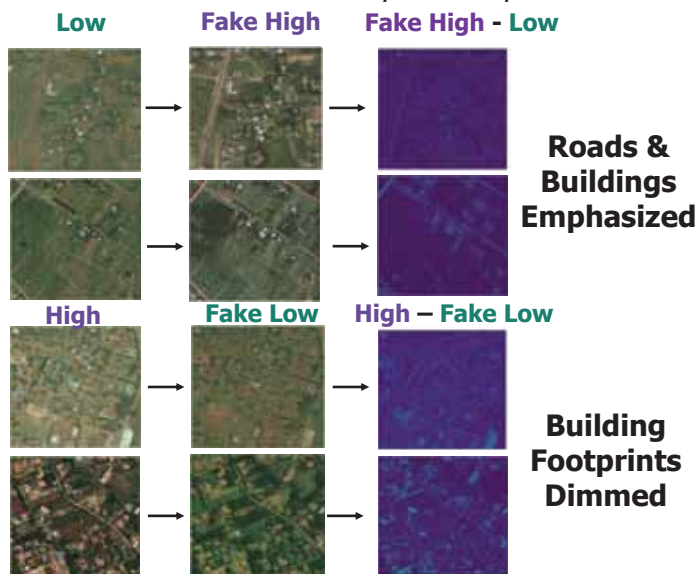
### Objectives

**Identify** the relevant features from satellite imagery using data driven techniques.

**Quantify** the value of satellite imagery in Demand Prediction.

### Cycle Generative Adversarial Network (cycleGAN)

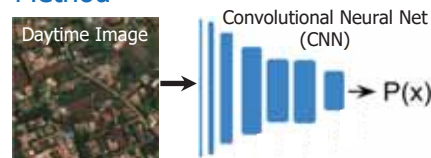
Model converts image of low consumption region to that of a high-consumption region and vice-versa.



## R3. Demand Prediction

- i. Incorporate demand estimates into electricity planning.
- ii. Support selection of electrification technology (grid vs standalone).
- iii. Optimize system design & sizing.

### Method



### Accuracy

	Daytime Images	Night Lights
Classification		
Low vs Medium	<b>0.67</b>	<b>0.58</b>
Low vs High	<b>0.76</b>	<b>0.74</b>

## Future Work & Implications

- i. Individual building prediction.
- ii. Incorporate nodal demand into electrification planning.
- iii. Evaluate impact of demand on technology choice selection.

## Acknowledgements

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