



# ENERGY IOT ANALYSIS

Project Process and Initial Data Analysis/Recommendations

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# WHAT WE WILL COVER

- Background
- Objective/Goals
- Data Management
- Data Summary
- Known Data Issues
- Data Summary
- Recommendations
- Questions



# BACKGROUND

## CONTEXT OF PROGRAM

Your Goal: Offer highly efficient Smart Homes that provide owners with power usage analytics enabling them with more insight to drive smart power usage decisions.

We will analyze sample data collected by existing power sub-meters to determine and recommend useful analytics (metrics) and visualizations to empower Smart Home owners with a greater understanding and control of their power usage.



# OBJECTIVE/GOALS

## SUMMARY OF REQUEST FOR IOT ANALYTICS

For this project, IOT Analytics will:

- Analyze a very large set of energy usage data from existing sub-meters for a period of 47 months provided by your team (2007 - 2010)
- Provide an overview of the data analysis
- Provide recommendations for useful analytics (metrics) and visualizations you can provide to your Smart Home owners to help them intelligently manage their home power usage based on our analysis



# DATA MANAGEMENT

## DATA SECURITY DURING COURSE OF PROJECT

You customer data is protected by:

- Username and password protection to your cloud hosted database, to which access is provided to our data analyst by your company;
- Username and password protection on the data analyst's laptop, which is also protected through hard drive encryption software
- All customer data will be removed from IOT Analytics hardware upon project analysis completion
- In adherence with any additional requirements based on your own internal data security and handling compliance requirements

# DATA SUMMARY

## DESCRIPTION AND LOCATION OF PROJECT DATA

Data utilized for analysis is located in a MySQL database hosted in Amazon Web Services for which access is provided to IOT Analytics by your company

- Data for analysis is stored in your MySQL database named: Dataanalytics
- Located at: data-analytics-2018.cbrosir2cswx.us-east-1.rds.amazonaws.com

Data included for analysis:

- 2,075,259 measurements gathered from a house located in Sceaux (7km from Paris, France) between December 2006 and November 2010 (47 months)
- Each measurement includes:
  - DateTime Stamping so we know when the measurement was taken
  - Global household minute-averaged active (useful) and reactive (loss) power usage in kilowatt's, voltage in volts, and current intensity in amperes
  - Sub-meter 1 – kitchen (dishwasher, oven, microwave) – watt-hour of active energy
  - Sub-meter 2 – laundry room (washing machine, tumble dryer, refrigerator, and a light) – watt-hour of active energy
  - Sub-meter 3 - Water heater and air conditioner – watt-hour of active energy



# KNOWN DATA ISSUES

## ISSUES AND REMEDIATION PLAN

- 2006 – 2010 Data Provided
  - 2006 had 21,992 observations versus average across 2007-2010 of 500,000 per year
    - Excluding 2006 since mostly incomplete representation of the year's usage
  - 2010 had 457,394 observations
    - Including even though incomplete due to predominantly complete coverage of the year
- Out of the 2,027,288 observations, 240 included N/A values
  - Excluding these records from final analysis

# DATA SUMMARY

## STATISTICAL SUMMARY OF ANALYZED DATA

Year	Number of Observations
2007	521609
2008	526845
2009	521260
2010	457334
NA	240

### Global\_active\_power

Min. : 0.076

Median : 0.594

Mean : 1.083

Max. : 11.122

### Global\_reactive\_power

Min. : 0.0000

Median : 0.1000

Mean : 0.1236

Max. : 1.3900

### Global\_intensity

Min. : 0.200

Median : 2.600

Mean : 4.591

Max. : 48.400

### Voltage

Min. : 223.2

Median : 241.0

Mean : 240.8

Max. : 254.2

### Sub\_metering\_1

Min. : 0.000

Median : 0.000

Mean : 1.121

Max. : 88.000

### Sub\_metering\_2

Min. : 0.000

Median : 0.000

Mean : 1.289

Max. : 80.000

### Sub\_metering\_3

Min. : 0.000

Median : 1.000

Mean : 6.448

Max. : 31.000



# RECOMMENDATIONS

## ENHANCEMENTS FOR MEASUREMENT DATA

- Use Case: Observe product efficiencies/inefficiencies
  - Add more granular metering options to track individual major components for each sub-meter enabling home owners to monitor power usage over time to identify degrading performance relative to required power to operate
- Use Case: Budgeting Usage
  - Add more granular metering options to track individual major components for each sub-meter enabling home owners to “budget” power consumption on a periodic basis to reduce their “carbon footprint” over predefined time periods.
- Use Case: Report Surges for Safety
  - Add more granular metering options to track individual major components for each sub-meter enabling home owners to identify unwarranted spikes in energy usage by appliance as a potential indicator for power surges which may indicate potential for fire hazard

# QUESTIONS

