

# Analysis of Submetered Household Energy Consumption

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# Agenda

- ▶ Smart Market Challenge
- ▶ Deep Analytics
- ▶ Deliverables
- ▶ Elaboration
- ▶ Data Overview
- ▶ Data Cleaning
- ▶ Approach
- ▶ Recommendations
- ▶ Appendix

# Smart Market Developer Challenge

Will smart home owner benefit from submetering units based on:

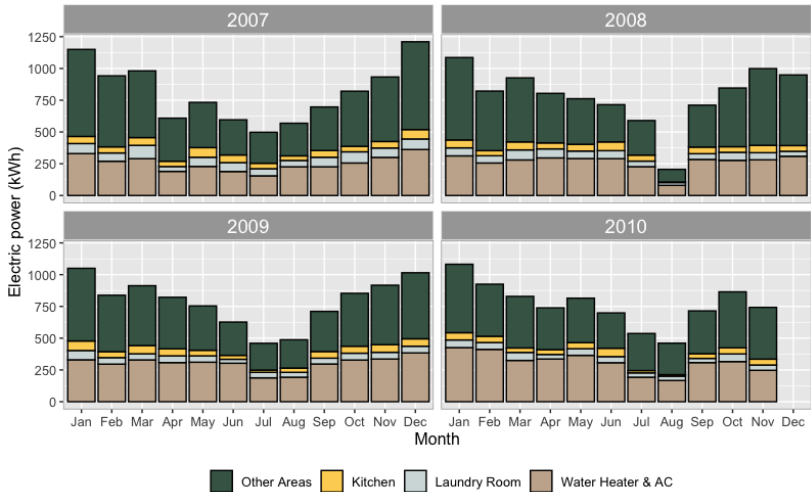
- ▶ payoff despite installation and maintenance expenses
- ▶ more rational energy usage
- ▶ go-green reputation
- ▶ collaboration with developers team on SW product

Can smart home buyer take advantage of anonymous selling own data records?

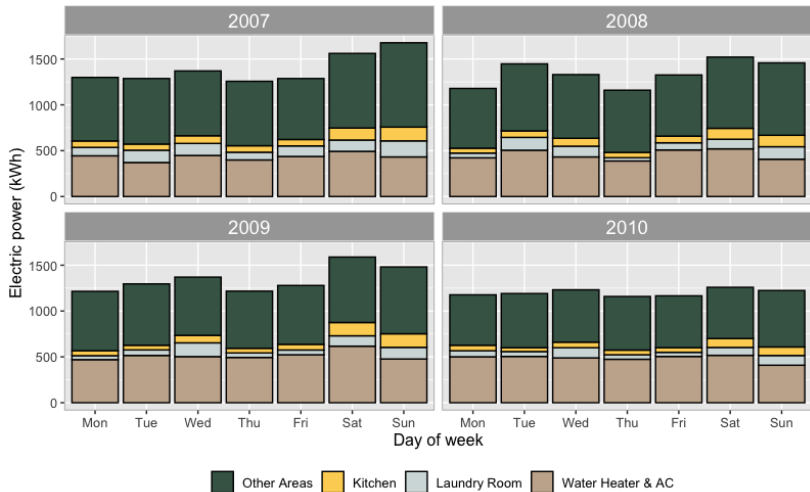
# Analysis

- ▶ Electric power consumption reports in kWatt/hour and € terms
- ▶ Detailed energy records based on appliance nature and house location
- ▶ Prediction of future electric power usage trends

# Energy Usage (by month)



# Energy Usage (by day of week)



# Deliverables

Based on data analysis the whole commercially viable product can be created by developers team and include the following components:

- ▶ Dashboard software development
- ▶ Implementation & Testing
- ▶ Security and privacy safeguard system
- ▶ Technical support service
- ▶ Automated maintenance

# Elaboration

- ▶ Development of savings strategies
- ▶ Correction of negative household behaviour patterns



# Data Overview

- ▶ Date is collected from 1 household located in Sceaux (7km of Paris, France)
- ▶ Timestamps span 47 months
- ▶ Measurements of energy consumption are performed at one-minute sampling rate
- ▶ Submeterings are described by house area and appliance type
- ▶ Timestamps contain nearly 1.25% of rows with missing values

E.g. there is missing value for April 28 (Saturday), 2007 (not leap year)

# Data Cleaning

- ▶ Proper measurement metric (units conversion)
- ▶ Extracting only relevant variables (Active Power, Submeters, Data, Time)
- ▶ Introducing of additional variables (rest power)
- ▶ Data storage and security considerations (database)

# Approach

- ▶ Missing values treatment
- ▶ Adjustment of proper granularity level
- ▶ Predictive modelling

## Recommendations

- ▶ Gas submeter can be advised for consideration as overall gas consumption can compromise kitchen performance. Depending on cooking preferences (mainly using gas powered hot plates) kitchen data would be biased.
- ▶ Eating outside may reduce energy consumption in the kitchen area. Collection of catering bills on monthly basis could facilitate kitchen associated data quality.

# Appendix

## Energy 101

Active Power  $P$  [Watt] is the actual power which is dissipated in the circuit.

Produces heat in heater, light in lamps and torque in motor

Reactive Power  $Q$  [VAR] is useless power which only flows between the source and load

Stored in the circuit, and it is discharged by the induction motor, transformer or by solenoids.