Smart Electricity Meters

- Record and communicate whole-house electricity consumption (e.g., hourly or every 15 minutes)
- Worldwide deployment expected to reach over 600 million meters in 2016 (according to Berg Insight)
- Hourly measurements enable time-of-use billing which can help reduce peak demand
- Smart meter analytics can lead to improved forecasting, money-saving tips for customers, etc.

Smart Meter Analytics

- Input: hourly whole-house smart meter time series and outdoor temperature
- Output:
  - For each customer: simple visualization, histograms, temperature sensitivity analysis, daily load shapes
  - Across customers: clustering, comparison with neighbourhood

Example 1: Temperature Sensitivity Analysis via Degree-Day Plots

- For climates with a summer and winter
- Step 1: fit piecewise regression lines for 10th, 50th and 90th percentiles of hourly consumption as a function of temperature
- Step 2: obtain base load from 10th percentile regression lines
- Step 3: obtain heating and cooling gradients from the 90th percentile regression lines
- Step 4: obtain heating and cooling setpoints from the 90th percentile regression lines

Example 2: Daily Load Shapes via Time Series Auto-Correlation

- Idea: take whole-house smart meter time series (black) and remove the effect of temperature via time-series autocorrelation with temperature as the exogenous variable (blue)
- Then plot the average consumption at each hour of the day

System Architecture

- All algorithms implemented inside the database using PostgreSQL + MADLib

System Functionalities

- Customer Dashboard
  - Your consumption (blue) vs. neighbourhood average (yellow)
  - Personalized feedback
- Analyst Dashboard
  - Histograms, temperature sensitivity, daily load shapes for all customers
  - Clustering based on load shapes
  - Feedback rule engine

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For More Information