Possibilities of Submetering Analysis

Tuomo Kareoja

IOT Analytics

October 14, 2019

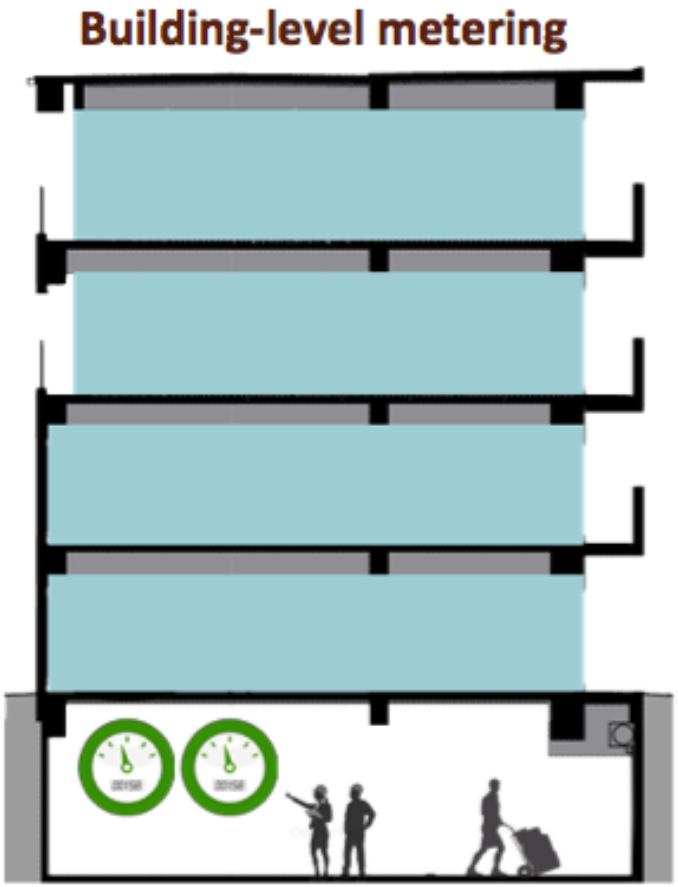
IOT ANALYTICS

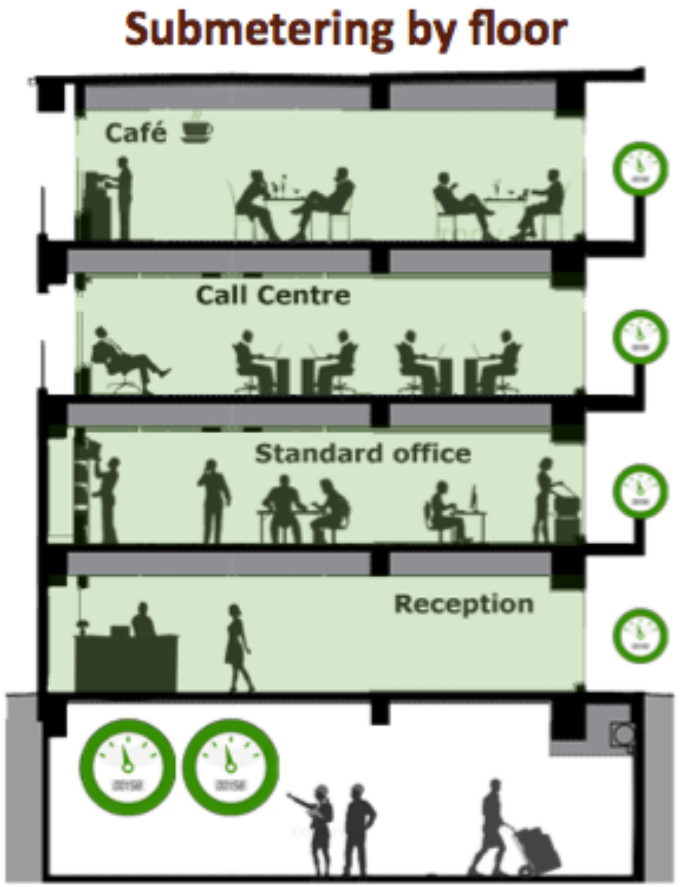
Agenda

- Background
  - What is Submetering?
  - What are the Possibilities of Submetering for IOT?
- Analysis
  - The Data
  - Basic Stats
  - Missing Data and Other Problems
- Possible Applications
  - Predictive Analytics
  - Dashboards
- Recommendations

IOT ANALYTICS

What is Submetering?





IOT ANALYTICS

What are the Possibilities of Submetering for IOT?

Connected Submeters give a real time reading of the energy use in different parts of buildings or even different device groups

IOT ANALYTICS

What are the Possibilities of Submetering for IOT?

Connected Submeters give a real time reading of the energy use in different parts of buildings or even different device groups

This means that we can...

1. Make it easier to save energy by finding out what is actually using it

What are the Possibilities of Submetering for IOT?

Connected Submeters give a real time reading of the energy use in different parts of buildings or even different device groups

This means that we can...

1. Make it easier to save energy by finding out what is actually using it
2. Pinpoint possible failure points fast and precisely

What are the Possibilities of Submetering for IOT?

Connected Submeters give a real time reading of the energy use in different parts of buildings or even different device groups

This means that we can...

1. Make it easier to save energy by finding out what is actually using it
2. Pinpoint possible failure points fast and precisely
3. Easily gather data for future analysis

IOT ANALYTICS

The Data

- Minute level readings from 3 submeters and overall energy usage between December 2006 and November 2010 in a house in Sceaux

Sceaux

IOT ANALYTICS

The Data

- Minute level readings from 3 submeters and overall energy usage between December 2006 and November 2010 in a house in Sceaux
- The three submeters cover the kitchen, the laundry room and the combination of the water-heater and air-conditioning

Sceaux

IOT ANALYTICS

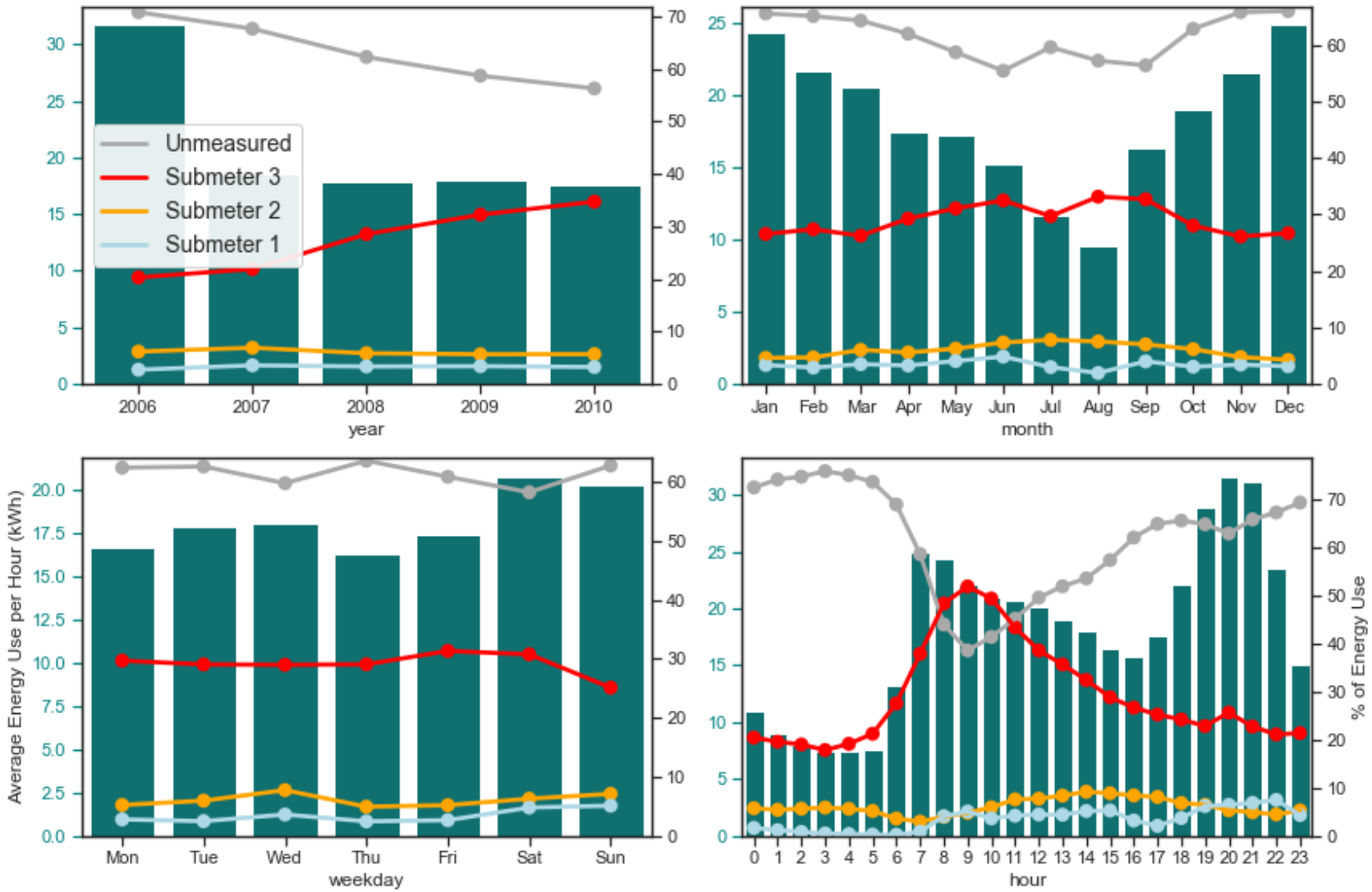
The Data

- Minute level readings from 3 submeters and overall energy usage between December 2006 and November 2010 in a house in Sceaux
- The three submeters cover the kitchen, the laundry room and the combination of the water-heater and air-conditioning
- Electricity use not covered by submeters can be calculated by deducting the submeter readings from overall electricity use

Sceaux

IOT ANALYTICS

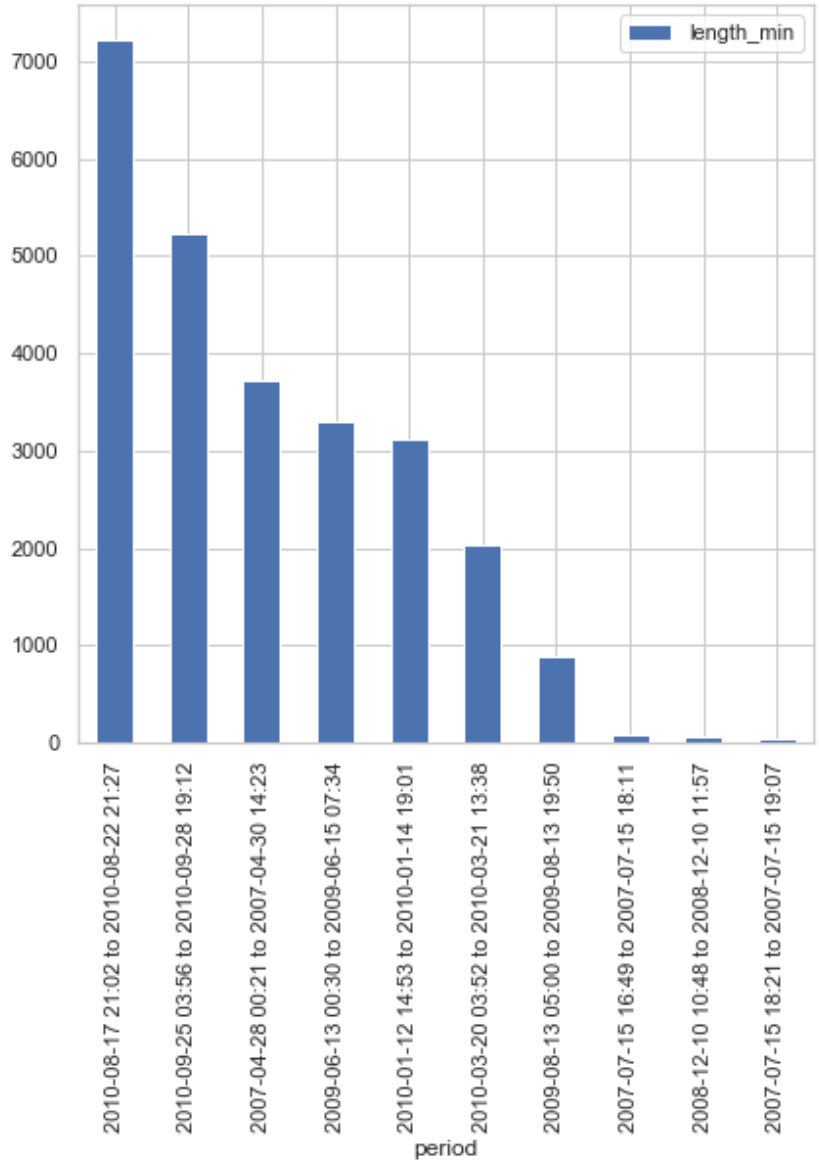
Basic Stats



IOT ANALYTICS

Missing Data and Other Problems

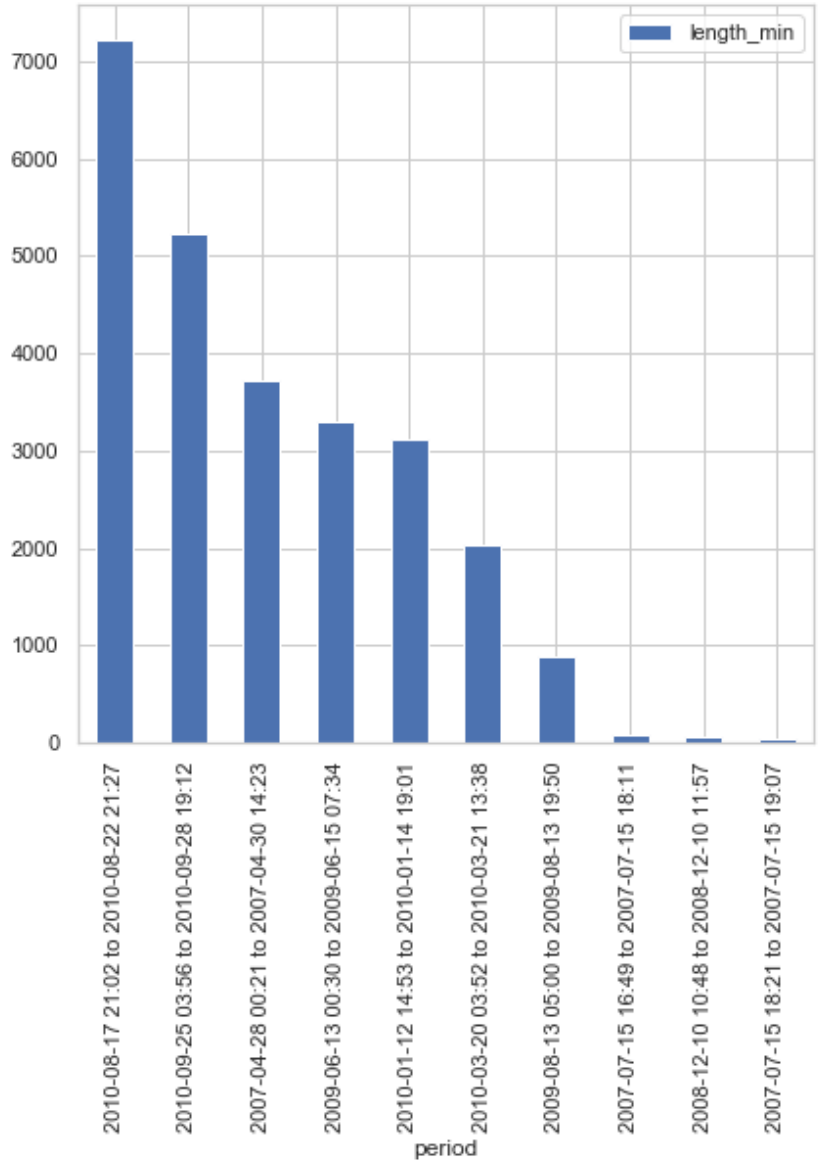
- 1.25 % of values missing. Sometimes in stretches over a day
  - Fixed with a predictive model



IOT ANALYTICS

Missing Data and Other Problems

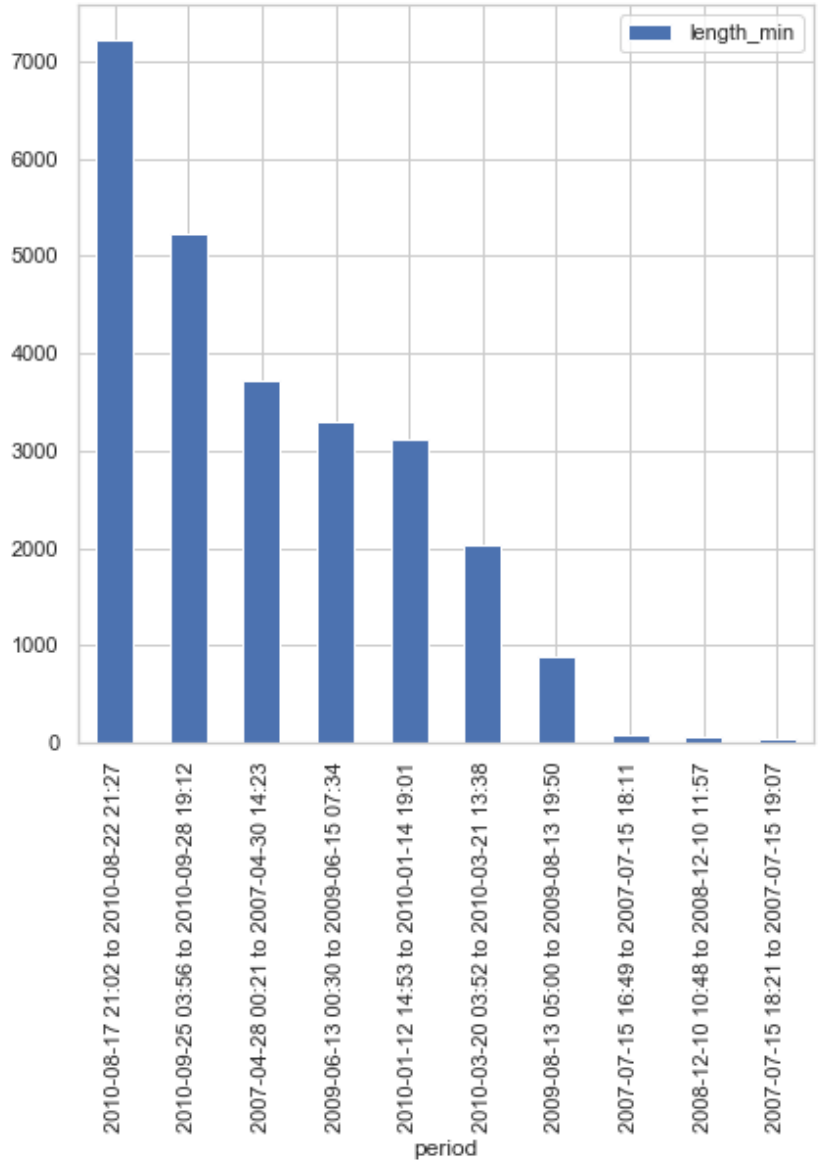
- 1.25 % of values missing. Sometimes in stretches over a day
  - Fixed with a predictive model
- Grouping of submeters is based on room and not function
  - Refrigerator is in the laundry room
  - Water heater and air-conditioner not separated



IOT ANALYTICS

Missing Data and Other Problems

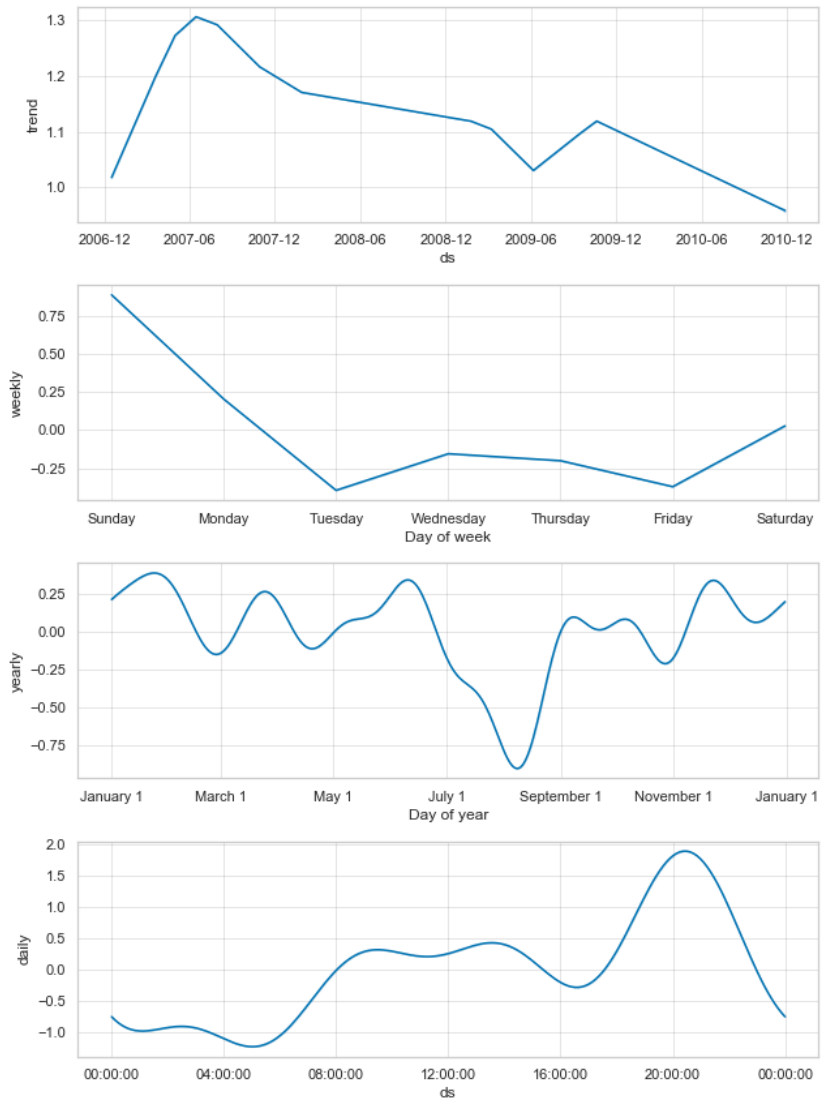
- 1.25 % of values missing. Sometimes in stretches over a day
  - Fixed with a predictive model
- Grouping of submeters is based on room and not function
  - Refrigerator is in the laundry room
  - Water heater and air-conditioner not separated
- Electricity use not covered by submeters makes up over half of the energy consumption



IOT ANALYTICS

Predictive Analytics

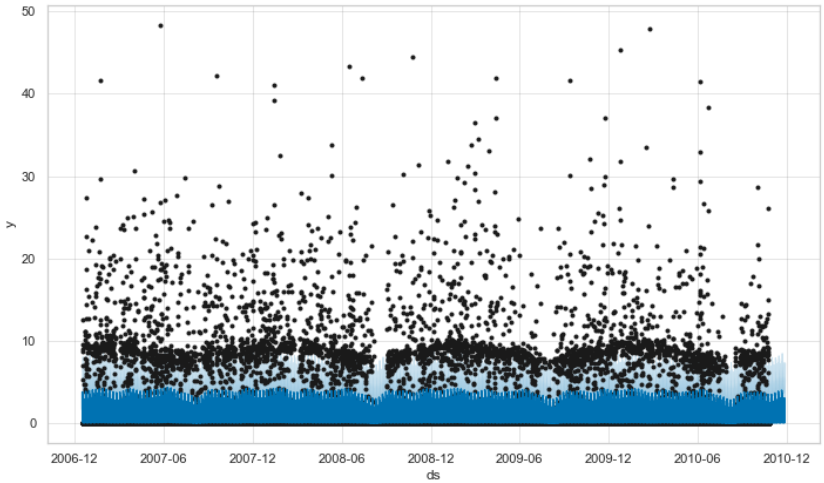
- Multiple seasonal patterns easily modeled



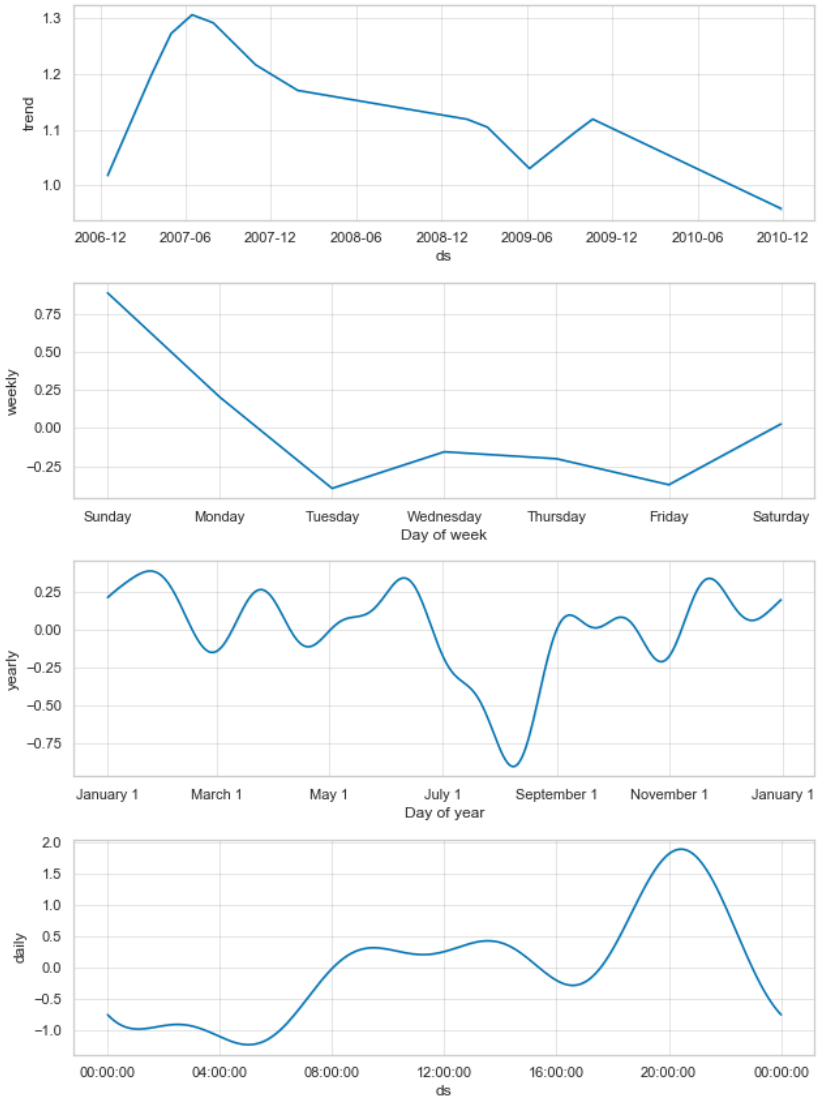
IOT ANALYTICS

Predictive Analytics

- Multiple seasonal patterns easily modeled
- Minute level data impossible to model ⇒ have to aggregate
- Hourly level realistic in overall use and daily level in submeters



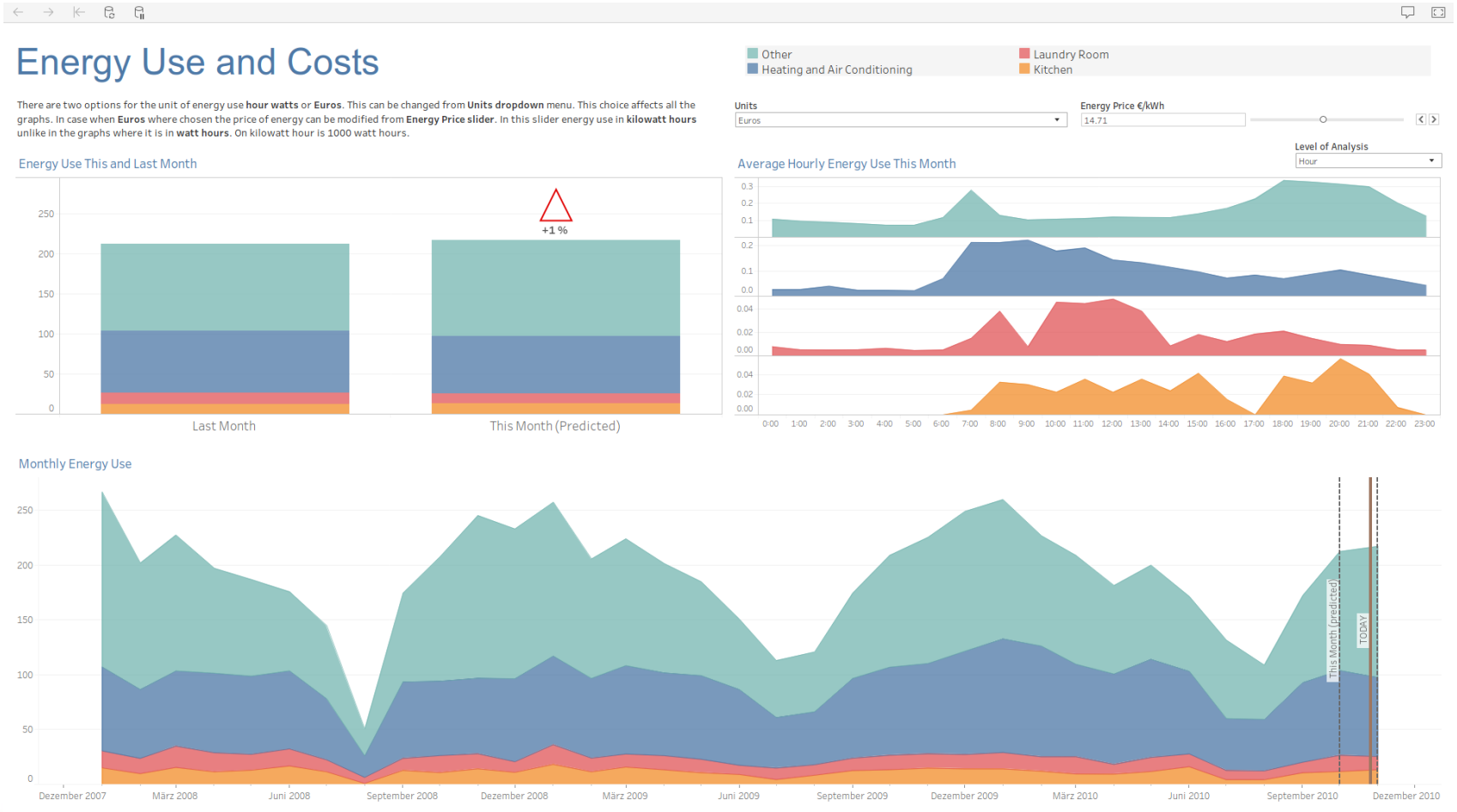
Submeter-level energy use has distinctive on/off states that are impossible to predict



IOT ANALYTICS

Dashboards

- Dashboard for the breakdown of electricity use by period combined with predictions



IOT ANALYTICS

Recommendations

1. Predictive models of energy use possible with caveats

Recommendations

1. Predictive models of energy use possible with caveats
   - Minute level impossible to predict

IOT ANALYTICS

Recommendations

1. Predictive models of energy use possible with caveats
   - Minute level impossible to predict
   - Hourly level possible to predict with overall energy use, but not with submeters

IOT ANALYTICS

Recommendations

1. Predictive models of energy use possible with caveats
   - Minute level impossible to predict
   - Hourly level possible to predict with overall energy use, but not with submeters
2. The data lends itself nicely to customer facing dashboards, but...

IOT ANALYTICS

Recommendations

1. Predictive models of energy use possible with caveats
   - Minute level impossible to predict
   - Hourly level possible to predict with overall energy use, but not with submeters
2. The data lends itself nicely to customer facing dashboards, but...
   - Submeter groupings should be more intuitive and grouped by use rather that location

Recommendations

1. Predictive models of energy use possible with caveats
   - Minute level impossible to predict
   - Hourly level possible to predict with overall energy use, but not with submeters
2. The data lends itself nicely to customer facing dashboards, but...
   - Submeter groupings should be more intuitive and grouped by use rather that location
   - What is the right number of submeters?

The End

Questions?