**Goal**

The paper’s goal is to provide a detailed overview of our data, outline our choice of sensors and their capabilities, and describe the basic software tools we have developed to gather data.

**Data Collection Sources**

We collect data from a variety of different sources, including, electricity usage at the mains panel, each circuit, and plug load. Additionally, we gather data from multiple weather, motion, door, wall switch, and thermostat sensors, as well as electricity generation data from solar panels and wind turbines.

**Data Collection Types**

We focus on high-resolution from three homes (Home A, Home B and Home C) and the data types are as follows.

1, Electricity at the Mains Panel: average real and apparent power every second for the home and each circuit at the mains panel

2, Electricity at Outlets: real power usage every few seconds from nearly all of the home’s plug loads

3, Wall Switch Events: on-off-dim events at nearly all of the home’s wall switches

4, average electricity generation from solar panels and micro wind turbines every five seconds

5, Thermostat Events, Motion Events and Door Events: a variety of events related to energy consumption, including motion sensing, door/trigger sensing, and thermostat sensors

6, Weather Station Data: environmental data every minute via weather sensors both inside and outside the home

**Potential Use**

After we obtain the datasets, we are going to do the following things.

1st, **Cost Optimization**. Use Home A’s aggregate electricity data to quantify the potential for savings using today’s market-based pricing plans and batteries. A machine learning-based model can be used to predict aggregate consumption for Home A using multiple features, including the weather data we collect. Finally, Use our microgrid data to quantify the effect of energy storage at grid-scale.

2nd, **Demand Flattening**. Use a Least Slack First (LSF) scheduling policy, which schedules loads in ascending order of their remaining slack—the time which they may remain off without affecting their objective. Home electricity data, plug load and circuit data for eight background loads, and our temperature and humidity data from our weather sensors are used to evaluate LSF’s potential for demand flattening.

3rd, **Load Monitoring**. Use AutoMeter to disaggregate a home’s electricity usage each second using low resolution data from Insteon wall switch events and iMeter plug loads. The approach endows low-cost Home Automation (HA) systems originally designed for actuation with new sophisticated load monitoring capabilities.

4th, **Renewable Prediction**. Use multiple models for predicting future renewable generation using weather forecasts from the National Weather Service. The model uses solar radiation and wind speed from our weather station to predict solar and wind generation. Models using machine learning techniques can include a variety of other forecast features.

5th, **Privacy**. How our homes’ aggregate electricity leaks information about the activities of its occupants, and privacy-preserving protocols that enable utilities to bill for usage without revealing occupant behavior

6th, **NILM**. Non-intrusive load monitoring (NILM) that focuses on large scale scenarios—greater than 100 loads—with many relatively low-power loads, e.g., less than 50 watts (W), which is a common characteristic of modern homes. Our data might also be useful in developing and evaluating new disaggregation algorithms for electricity data. A histogram of the number of per-second readings that fall within a concurrent power event across all circuits in Home A on a single day. We also need to deal with the case where they simultaneously change power.

**Software Tools**

We already have our own data and don’t have to use software tools to get data.

**How to build simulator:**

Even though we can get the power consumption and energy supply data from some sustainable homes, we cannot control the on/off status of those appliances used in these home and those backup energy supply devices, such as batteries and solar panel. Thus we need a simulator so that we can directly simulate and compare the results of various conditions.

Tool to implement the simulator….

Functions:

1. Import the input data
2. Set the condition parameters, such as the guard band of energy consumption. We can also assume that we have batteries, solar panel or wind panel.
3. Schedule the on/off status of the appliances in the homes according to constrains.
4. Show the energy use of the whole day and account the total costs.