HOME ENERGY MANAGEMENT

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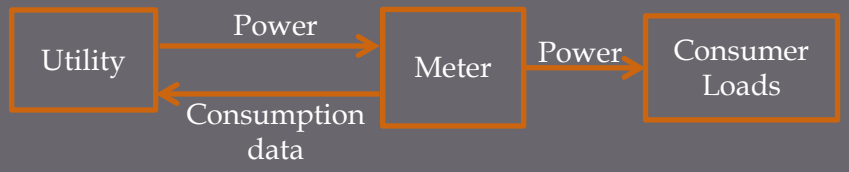
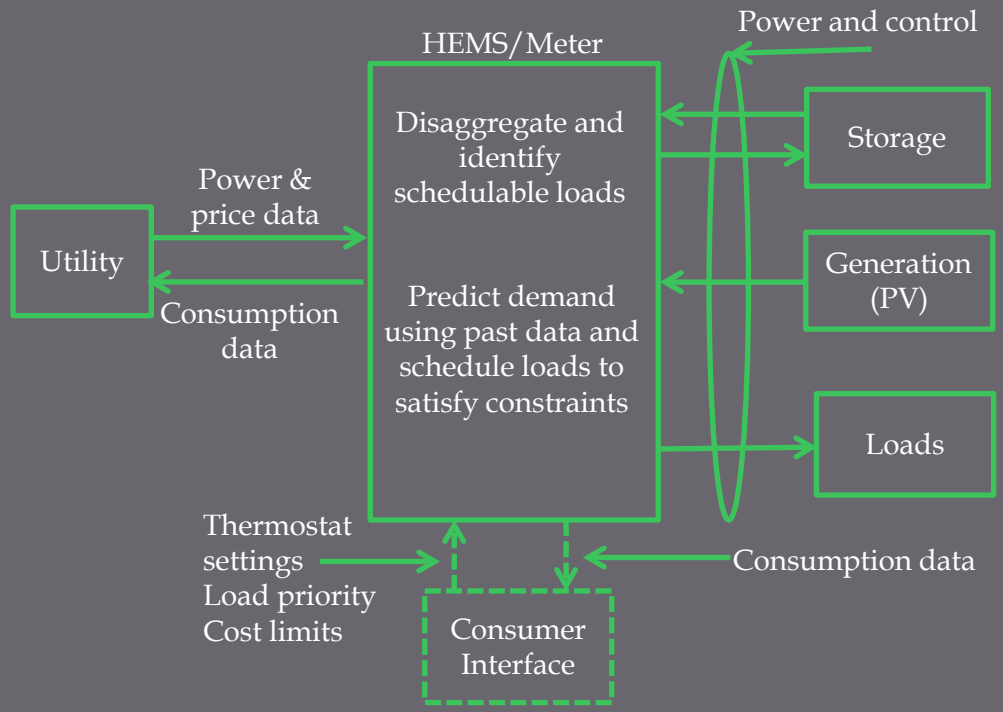
Current energy consumption Model



Proposed model



Need for energy management

- Air conditioning loads (HVAC in general) are one of the big consumers of energy and can draw significant power even at night (depending on location) . Shifting loads to off peak/night times should be managed to avoid new peaks.
- Using just price signals to implement demand response can correlate normally uncorrelated loads creating new power peaks.
- Managing generation (PV) and storage with load scheduling can help with peak shaving .

Challenges

Disaggregation is ideally implemented as a non intrusive, low cost procedure utilizing measurements at a single point, challenges to achieving these are

Parameter selection:

- Measuring current/power is intrusive, measuring only voltage avoids intrusion but cannot measure power consumption.
- Using other parameters (reactive power, power factor, harmonics) requires dedicated hardware

Sampling rate:

- Current smart meters provide average power measurements every 15 minutes which does not provide much information for disaggregation.
- High frequency sampling is expensive and creates data transfer and storage issues.

Generation:

- Using only power measurements to identify loads (E.g. EV identification) will fail if the measurements include generation (PV).

Training:

- Disaggregation and load identification requires a database of appliance parameter signatures for algorithm training which does not currently exist

Goals

- Identify EV loads from low frequency (15 minute) whole home power measurements.
- Find least intrusive method with lower sampling rates (1- $1/60^{th}$ Hz) requiring minimum training to identify loads that can be scheduled.
- Predict power demands using past consumption data.
- Develop HEMS algorithms using predicted load, generation , storage and price data to schedule loads.