Method

Motivation:
notes: we want to find the appliance being used therefore able to more accurately target consumer electronics or encourage consumers to make more deliberate decisions towards appliances which have less energy consumption signatures. Or automate devices through some sort of energy demand software.

To disaggregate smart meter data the standard approach is to install individual plugs to send utility specific data for each device it is expensive (50 dollars each plug) therefore we want to accurately report it without installing hardware therefore we would use NILM. At the household level given a smart meter can report minute to minute hour to hour consumption can desegregate this to device level data without having to have plugs installed on appliances in-the home.

This is an analytical approach an alternative to hardware approach (high-priced) traditional sub-metering), where the upside is to have the same level of information on appliances in the house using a computer algorithm cost effectively, efficiently aggregate demand-response data.

SIGNAL ACQUISITION --> FEATURE EXTRACTION --> APPLIANCE CLASSIFICATION

1. acquisition of the whole building load measurements
2. pulling out features or patterns in the load measurement data that can be used to distinguish individual appliances
3. analysing extracted features to discern appliance specific load from the whole building load data.

2) FEATURE EXTRACTION
Two main classes of appliance power signatures/features:

- Steady State
- Transient State

Both approaches refer to identifying changes in the operation when an appliance modulates from one operational state or level to another, but the two approaches differ in what data they focus on.

- Steady state signature is one of most widely used signatures in literature, refers to step changes in the steady-state active and/or reactive power consumption levels. Easy to use, does not require fast sampling data and works well on large ON/OFF alliances such as water heaters and air-conditioners.
- Transient appliance signatures more complicated, refers to unique features such as shape, duration, size, harmonics (frequencies) of transient power fluctuations of appliances that can be used to distinguish different appliances. These short-term

transient fluctuations usually occur immediately after changes in an appliance's operating state (e.g. OFF/ON) and before a new stead-state is reached. Although transient analysis gives more precise information, extracting this type of signature requires high-frequency data sampling. As a result, more resources are needed to construct and maintain a complex transient signature database.

Transient state analysis might be more suited to appliances which do not have clear on/off signatures or may have multiple power levels attached to them.

3)APPLIANCE CLASSIFICATION
In general, NILM algorithms can be categorized as event-based or non-event-based.

- Event-based refer to approaches that rely on edge detection algorithms to detect occurrences of events, such as an appliance turning ON/OFF or a change in operating mode. The extracted features around the neighbourhood of the event points are then classified using "supervised ML" algorithms