Representative Appliances in Energy Datasets

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Building Energy Usage

Buildings use a lot of energy

Global warming is a threat to Earth

How can technology help?

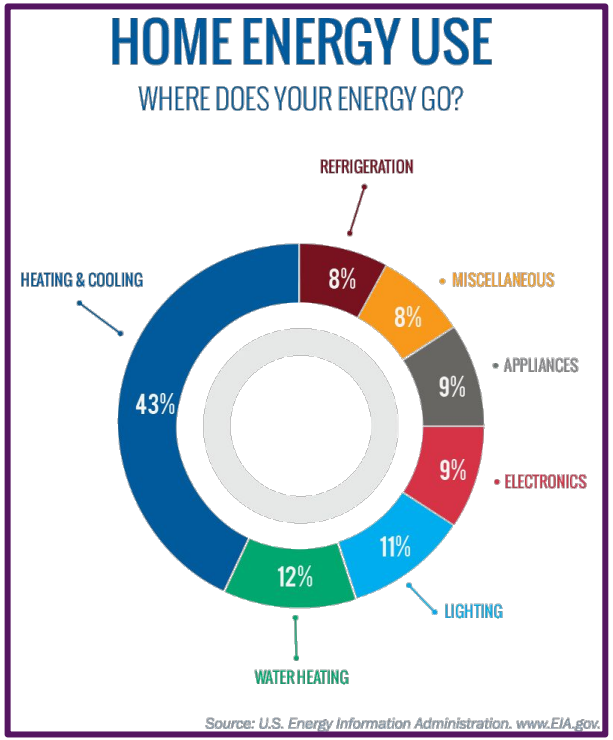


Image source: https://www.tipmont.org/news/item/understanding-your-energy-usage-to-lower-your-bill

Non-Intrusive Load Monitoring (NILM)

Non-intrusive Load Monitoring: Disaggregate building-scale loads

Aggregate load: total building energy

Disaggregate load: energy used by a single device

NILM Benefits:

- Up to 15% reduction in energy consumption
- Balance grid supply & demand
- Economic and environmental concerns

Image source: https://www.informetis.com/en/company/technology/

NILM uses real data

Image source: https://www.bloomberg.com/news/articles/2014-06-10/your-outlet-knows-how-smart-meters-can-reveal-behavior-at-home-what-we-watch-on-tv

REDD Dataset (2011)

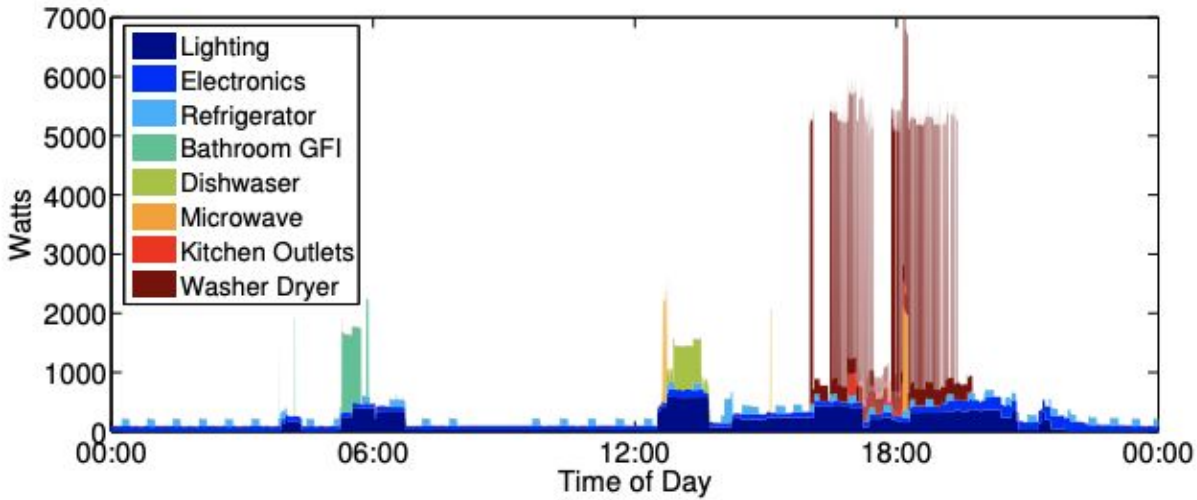
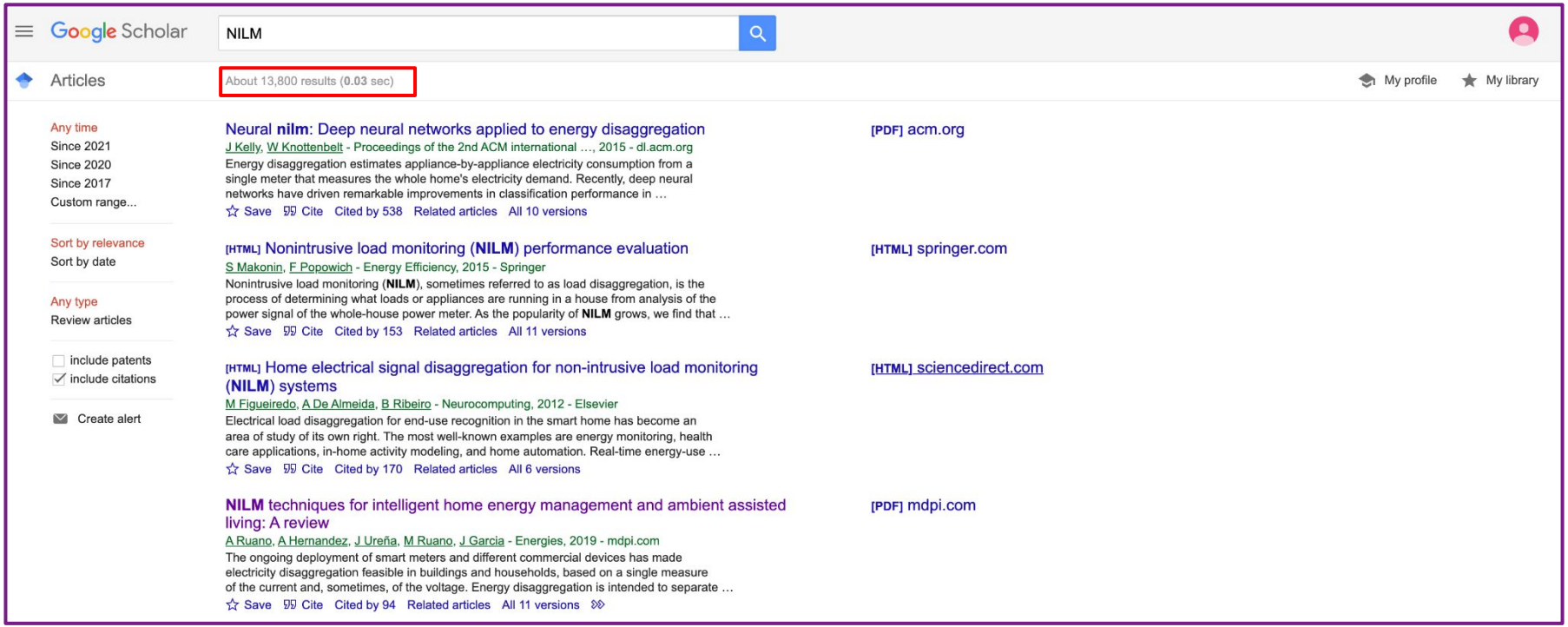


Image source: https://people.csail.mit.edu/mattjj/papers/kddsust2011.pdf

Dataset	Houses
REDD (2011)	6
Smart* (2012)	3
AMPds (2013)	1
iAWE (2013)	1
UK-DALE (2014)	5
SustData (2014)	50
Dataport (2014)	722
DRED (2015)	1
PLAID (2017)	64
MORED (2020)	13

Only a few datasets for all this work:



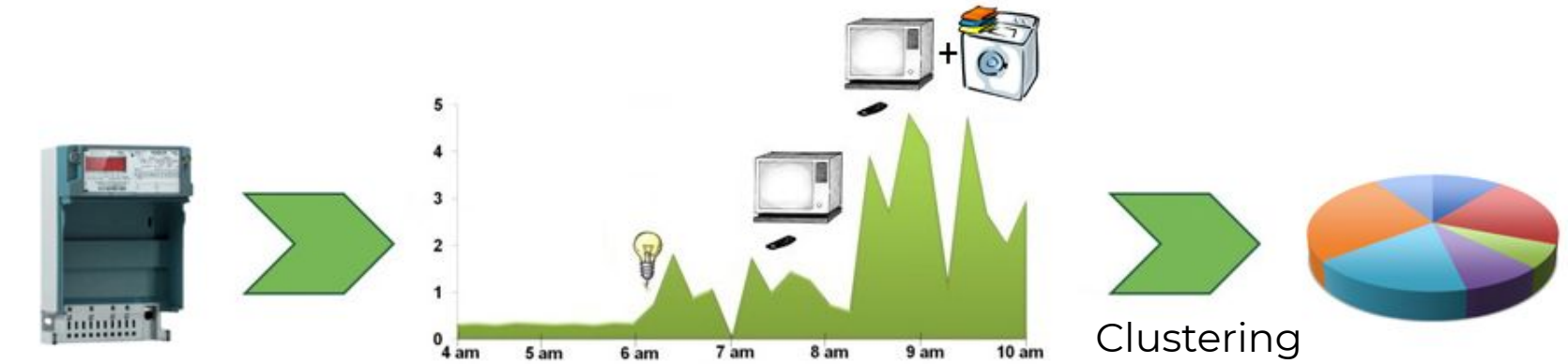
How Representative are these NILM Datasets?

Image source: https://medium.com/analytics-vidhya/overfitting-detection-prevention-848e6adeabf8

Plan for Analysis

1. Extract data from largest available NILM dataset (Dataport)
2. Cluster appliances to see if all are similar
    a. Hierarchical clustering with Dynamic Time Warping
    b. Agglomerative clustering with complete & ward linkage
    c. Affinity Propagation
3. Assuming different, how different?
    a. Determine significance of variance
4. If there are major outliers, does removing them and running clustering yield better results on NILM tasks? Are some datasets more impacted by outliers?

Clustering to Disaggregate



Motivation | Overview | **Related Work** | Preliminary Results | Moving Forward

Image source: https://www.vs.inf.ethz.ch/edu/abstract.html?file=../edu/theses/hs-2013-beckelc2

Short-Term Load Forecasting

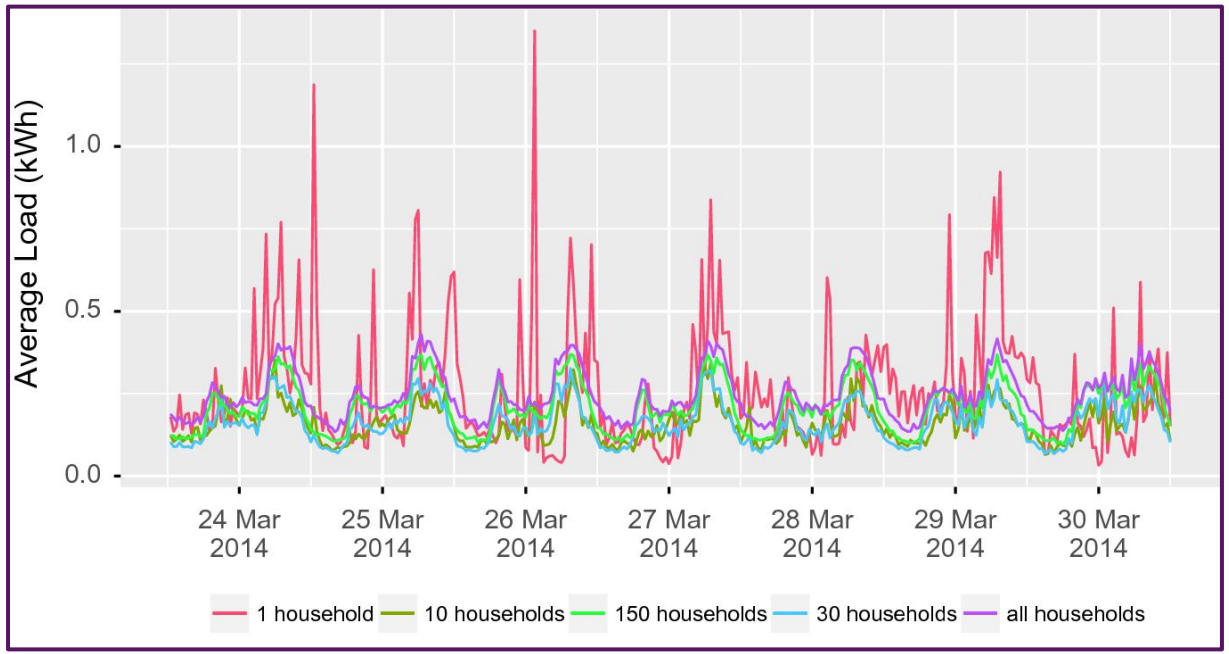
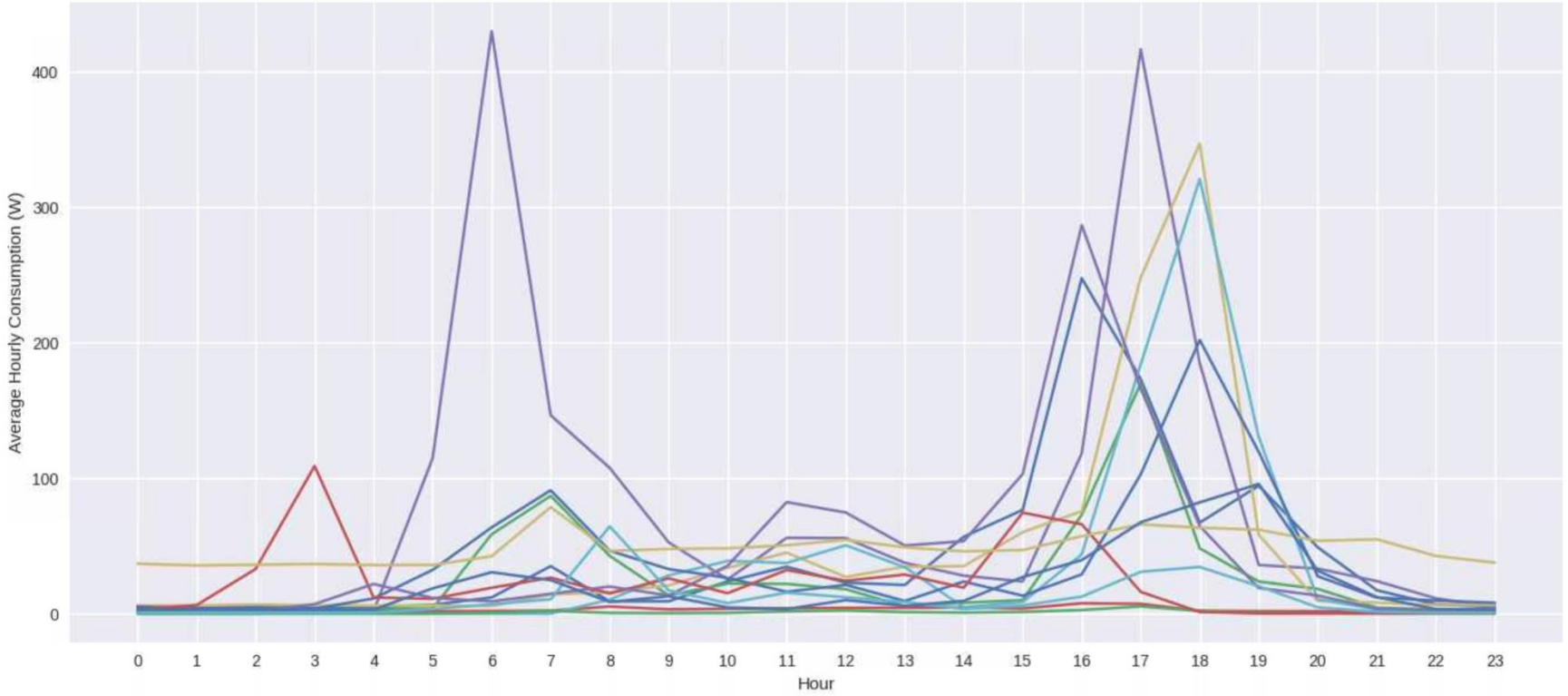
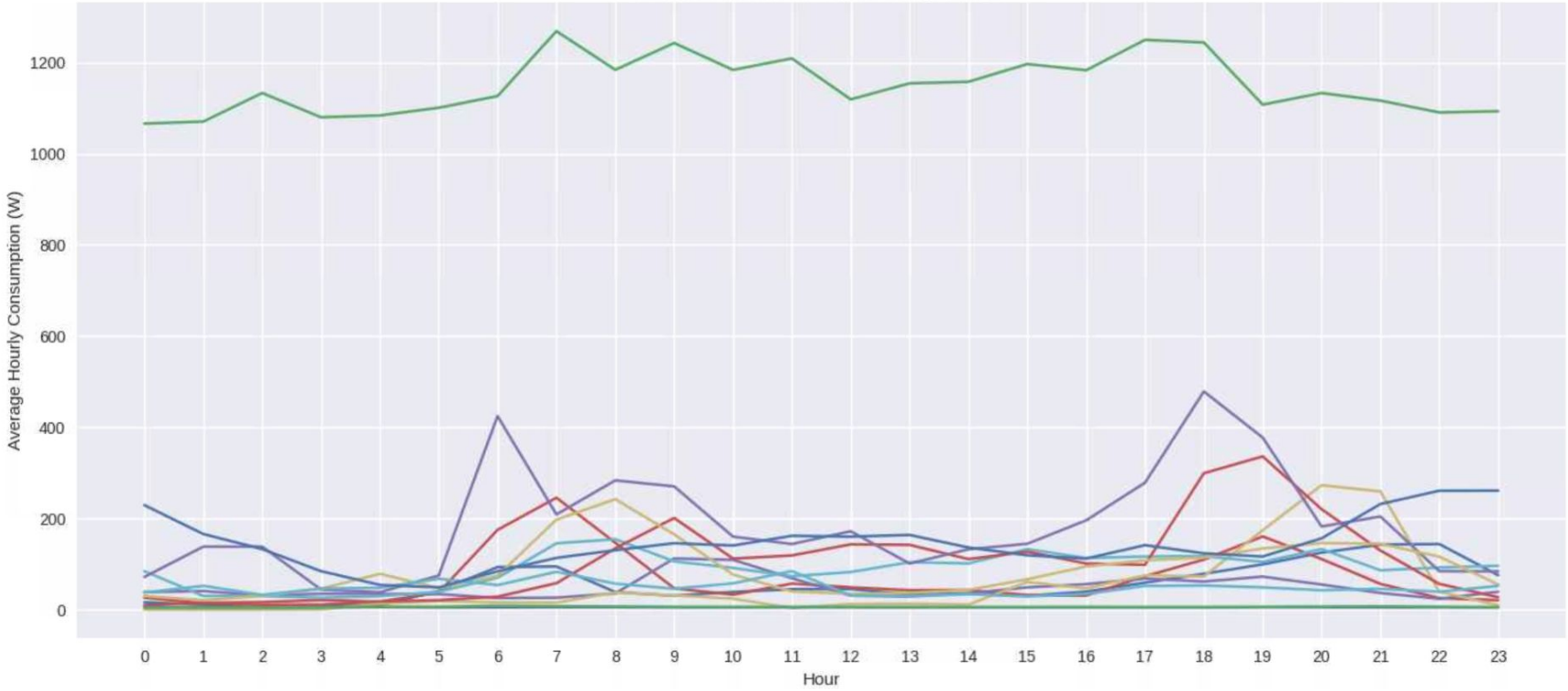


Image source: https://link.springer.com/chapter/10.1007/978-3-030-28669-9_2

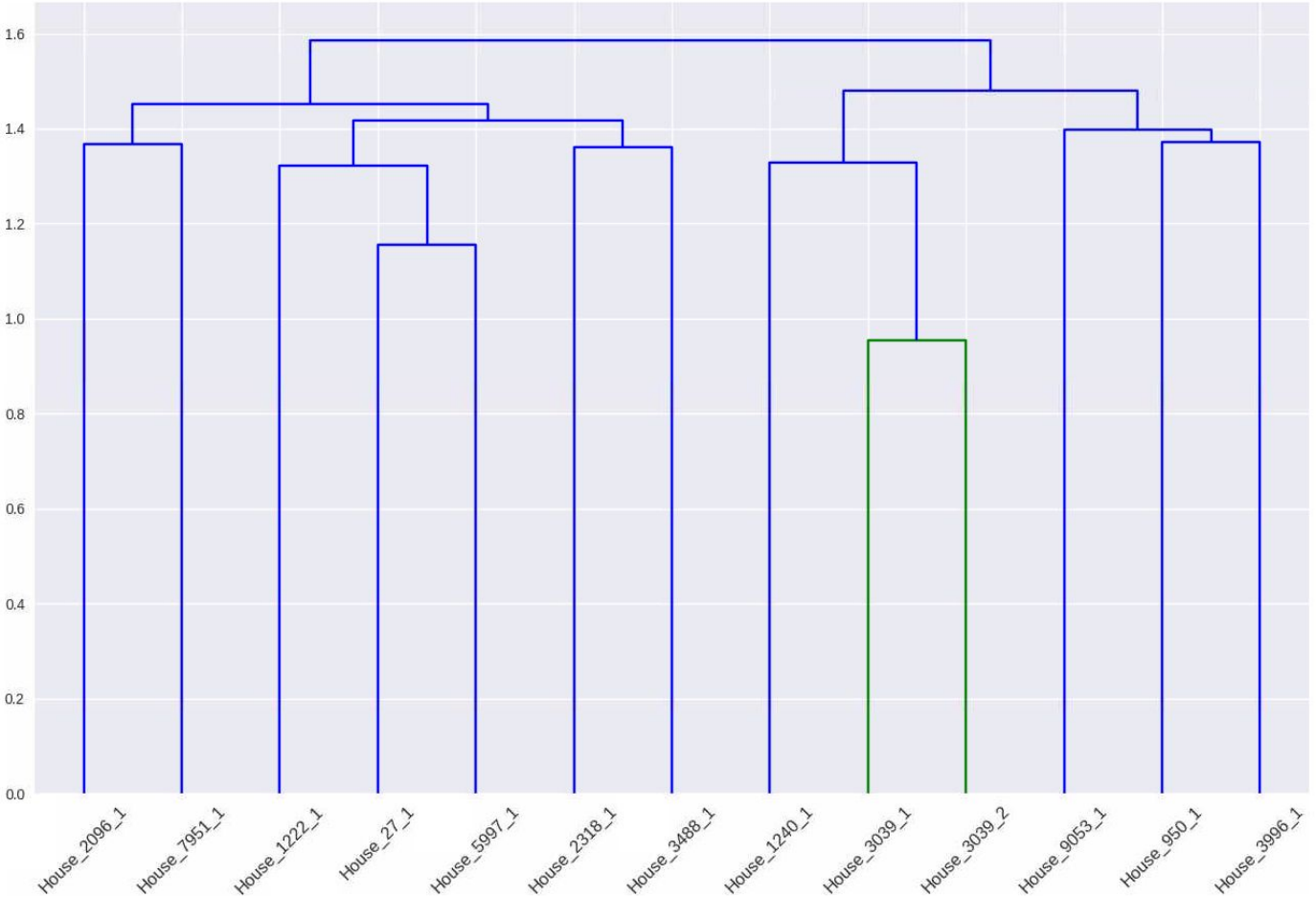
Preliminary Results: Hourly consumption of stove range



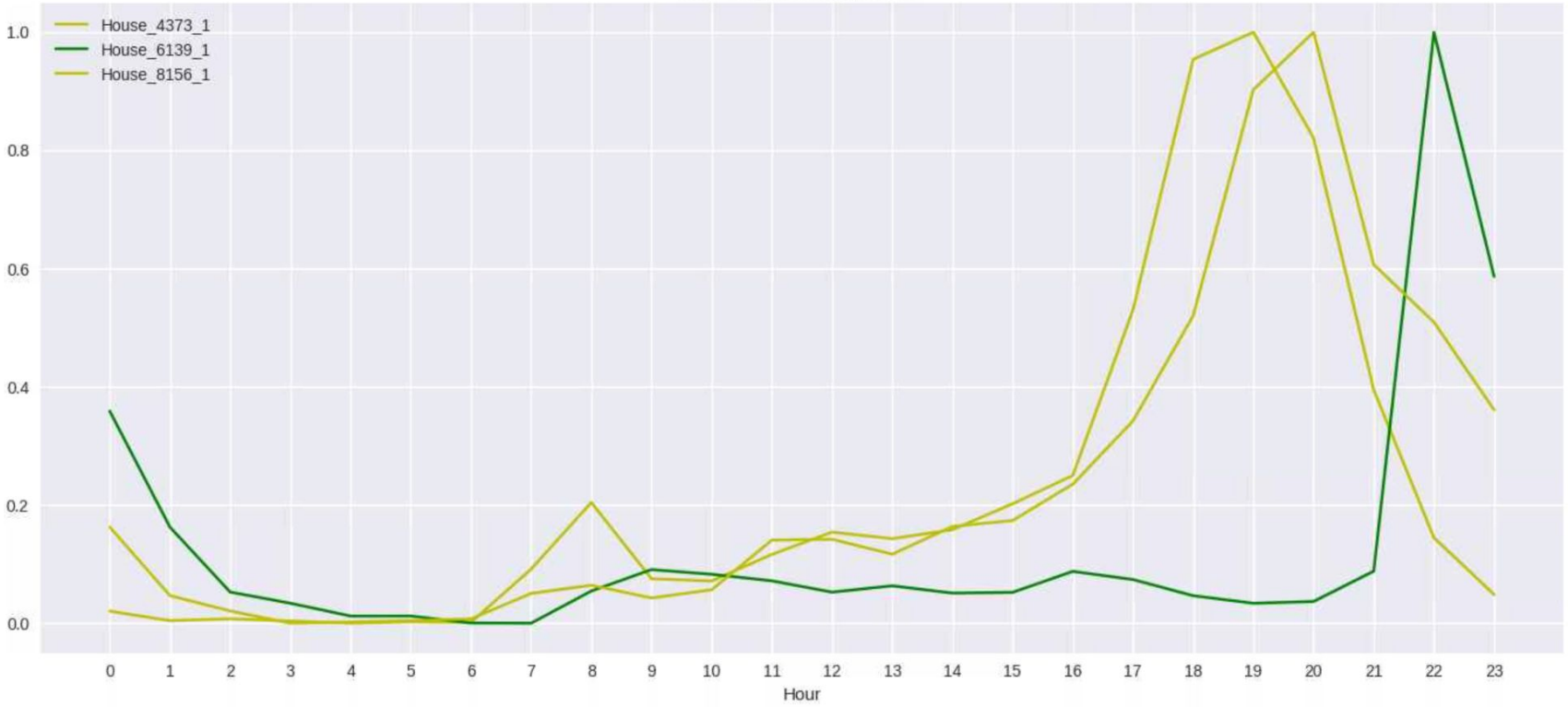
Preliminary Results: Hourly consumption of waterheater



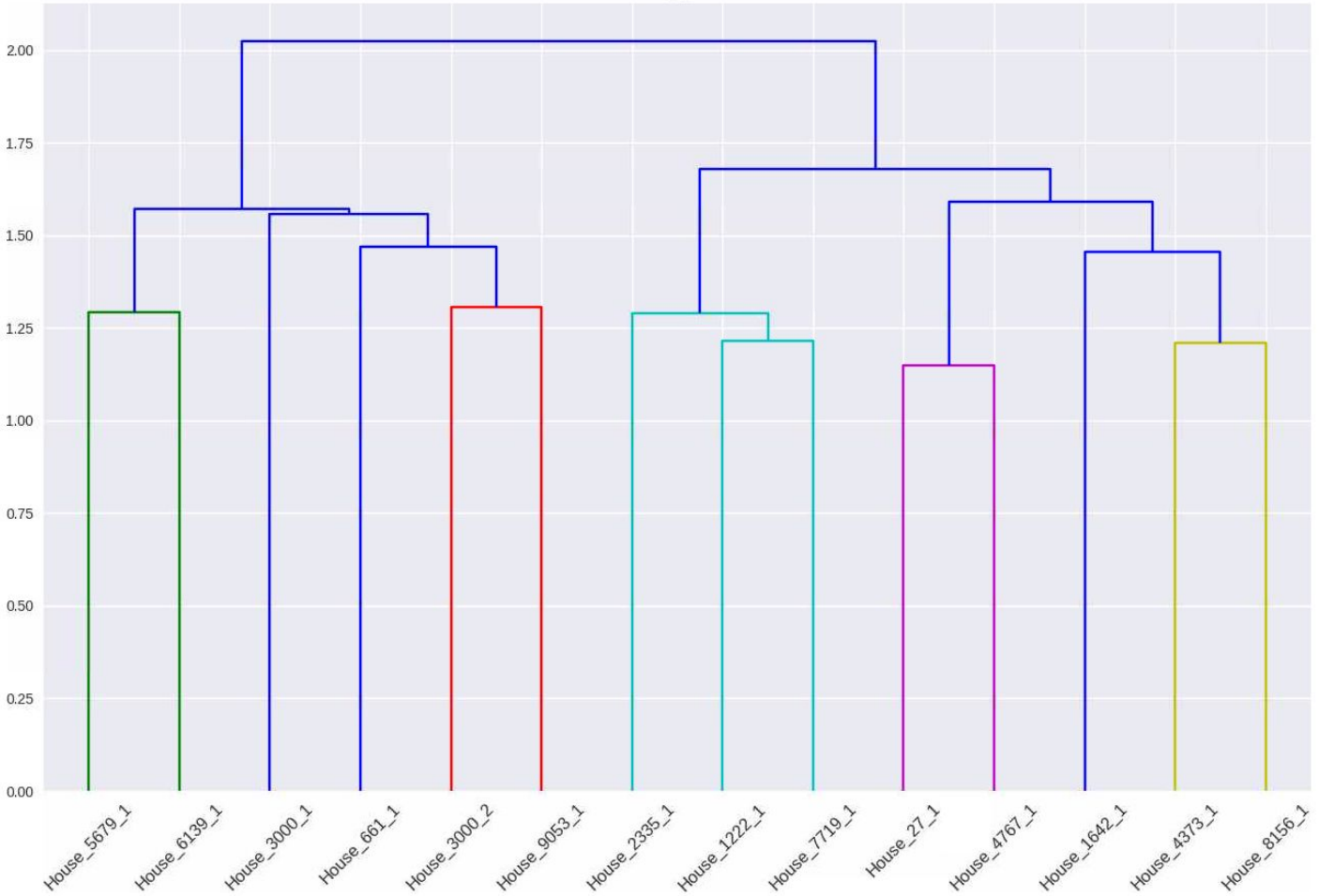
Preliminary Results: Dendrogram representing waterheater clusters



Preliminary Results: Hourly consumption of three car chargers



Preliminary Results: Dendrogram representing car charger clusters



Conclusions