

# **Representative Appliances in Energy Datasets**

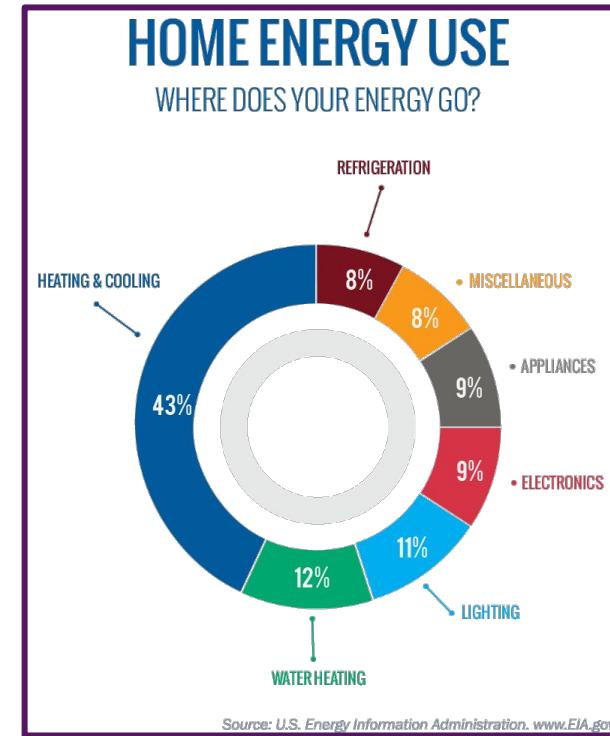
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Date: 12/13/2021**

# Building Energy Usage

Buildings use a lot of energy

Global warming is a threat to Earth

How can technology help?



# 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



# NILM uses real data



Motivation

Overview

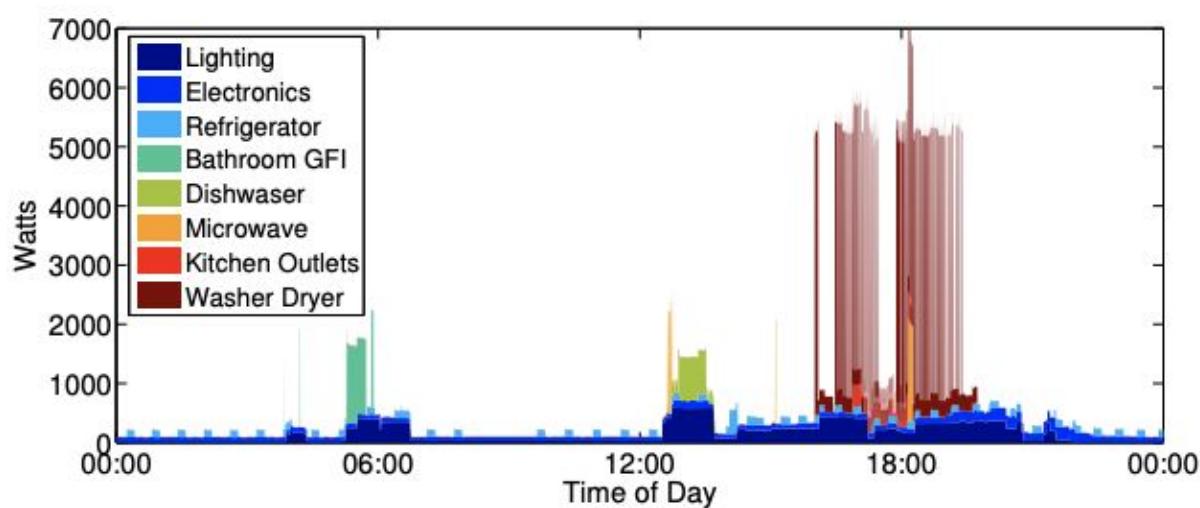
Related Work

Preliminary Results

Moving Forward



# REDD Dataset (2011)



<b>Dataset</b>	<b>Houses</b>
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:

The screenshot shows a Google Scholar search results page for the query "NILM". The search bar at the top contains "NILM". Below the search bar, there are filters: "Articles", "Any time", "Sort by relevance", and "Any type". There are also checkboxes for "include patents" (unchecked) and "include citations" (checked). A "Create alert" button is also present. The search results are displayed in a table format with three columns: title, abstract, and source. The first result is "Neural nilm: Deep neural networks applied to energy disaggregation" by J Kelly, W Knottenbelt, published in Proceedings of the 2nd ACM international ..., 2015 - dl.acm.org. The second result is "[HTML] Nonintrusive load monitoring (NILM) performance evaluation" by S Makonin, F Popowich, published in Energy Efficiency, 2015 - Springer. The third result is "[HTML] Home electrical signal disaggregation for non-intrusive load monitoring (NILM) systems" by M Figueiredo, A De Almeida, B Ribeiro, published in Neurocomputing, 2012 - Elsevier. The fourth result is "NILM techniques for intelligent home energy management and ambient assisted living: A review" by A Ruano, A Hernandez, J Urefia, M Ruano, J Garcia, published in Energies, 2019 - mdpi.com.

Result	Title	Source
1	Neural nilm: Deep neural networks applied to energy disaggregation	[PDF] acm.org
2	[HTML] Nonintrusive load monitoring (NILM) performance evaluation	[HTML] springer.com
3	[HTML] Home electrical signal disaggregation for non-intrusive load monitoring (NILM) systems	[HTML] sciencedirect.com
4	NILM techniques for intelligent home energy management and ambient assisted living: A review	[PDF] mdpi.com

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# How Representative are these NILM Datasets?

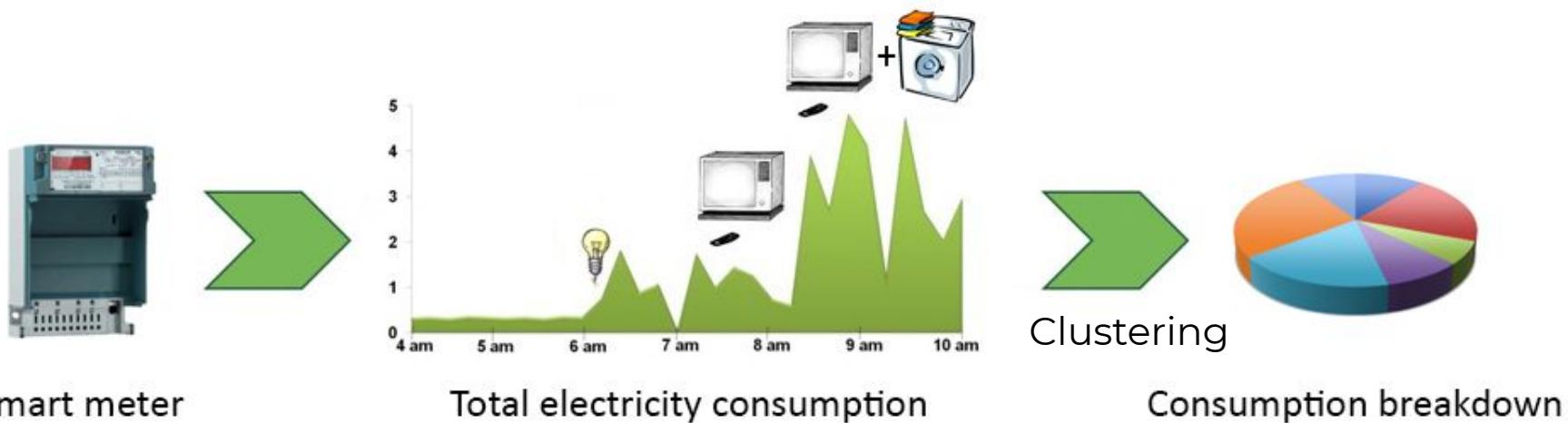


# Plan for Analysis

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

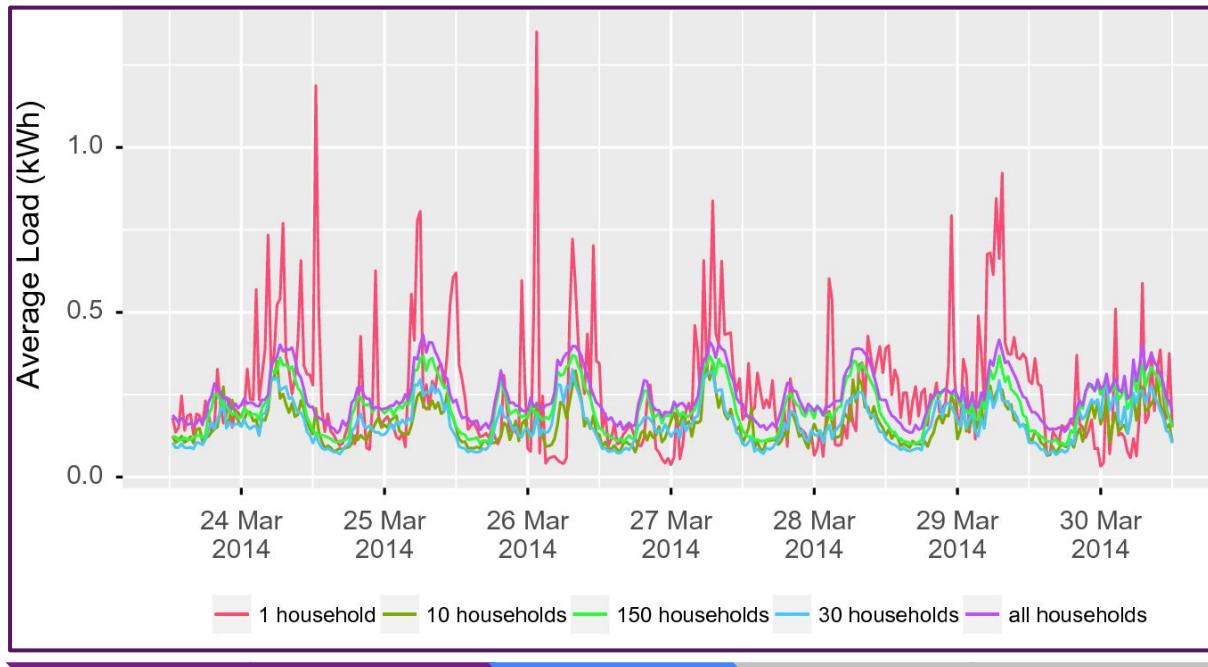
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# Short-Term Load Forecasting



Motivation

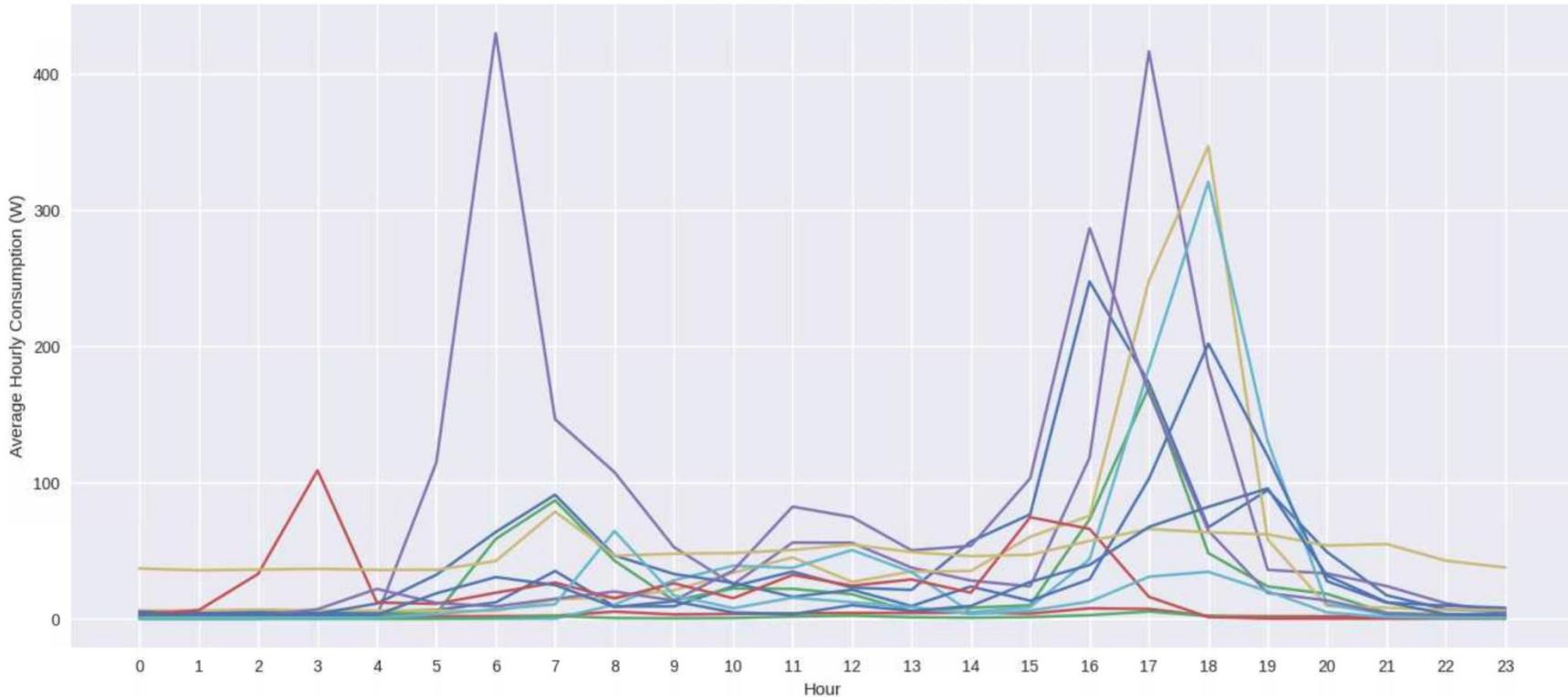
Overview

Related Work

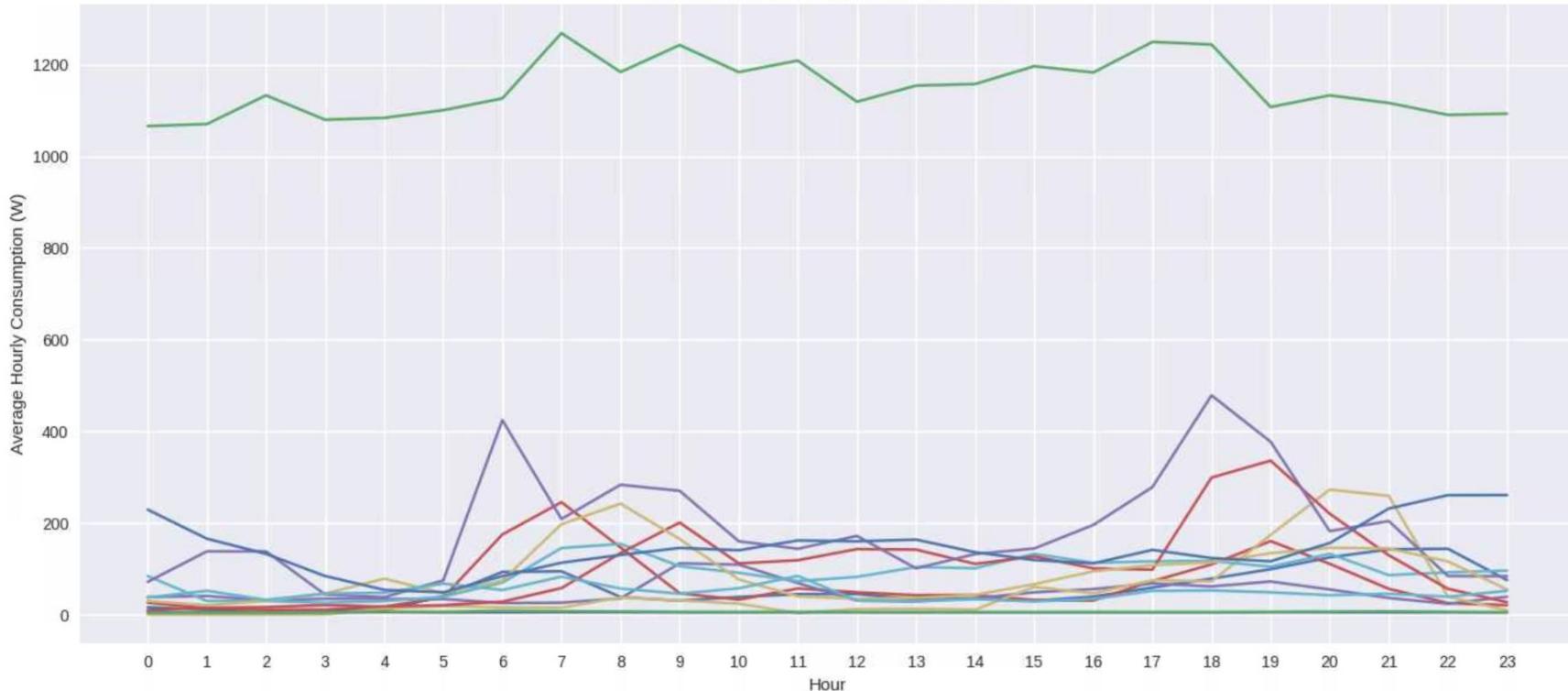
Preliminary Results

Moving Forward

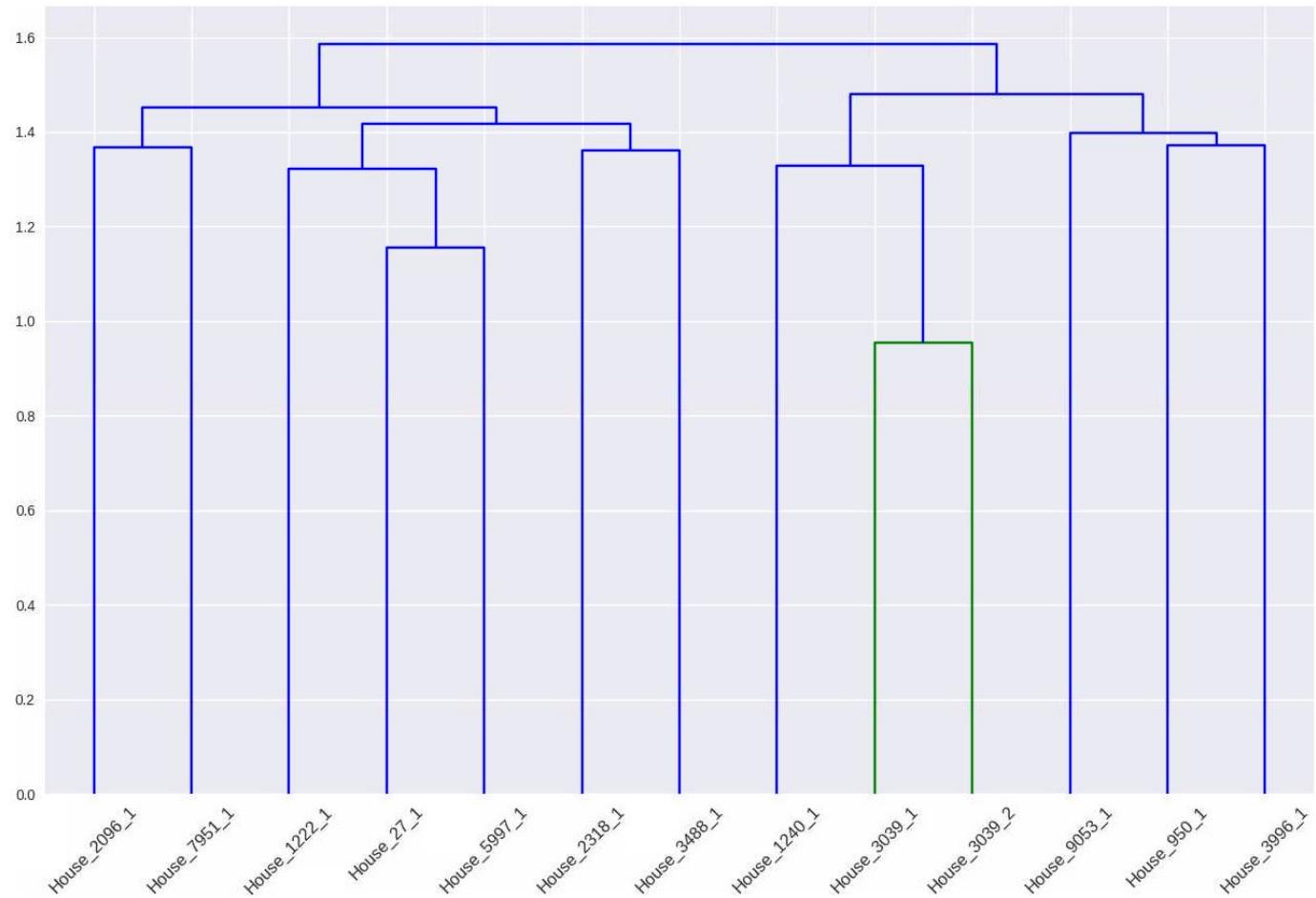
# Preliminary Results: Hourly consumption of stove range



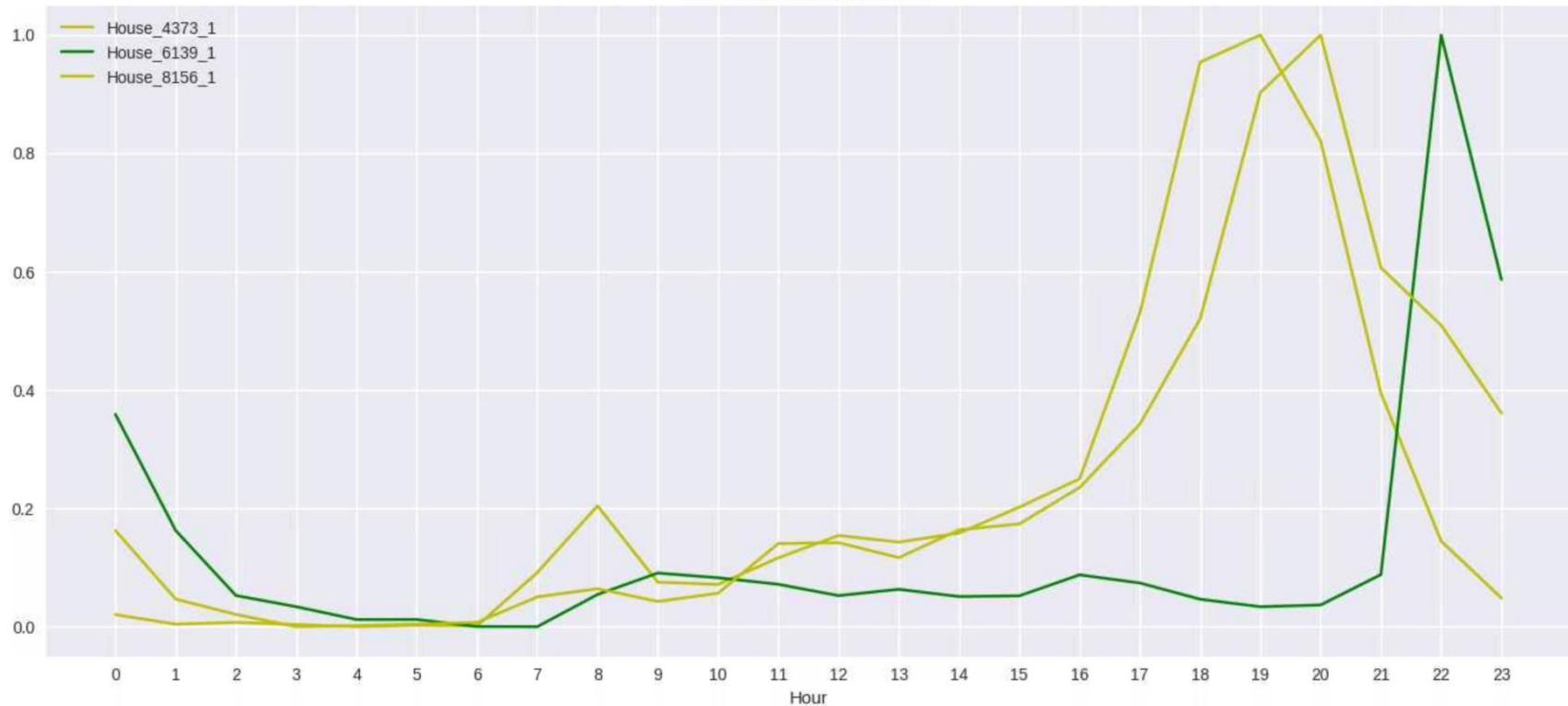
# Preliminary Results: Hourly consumption of waterheater



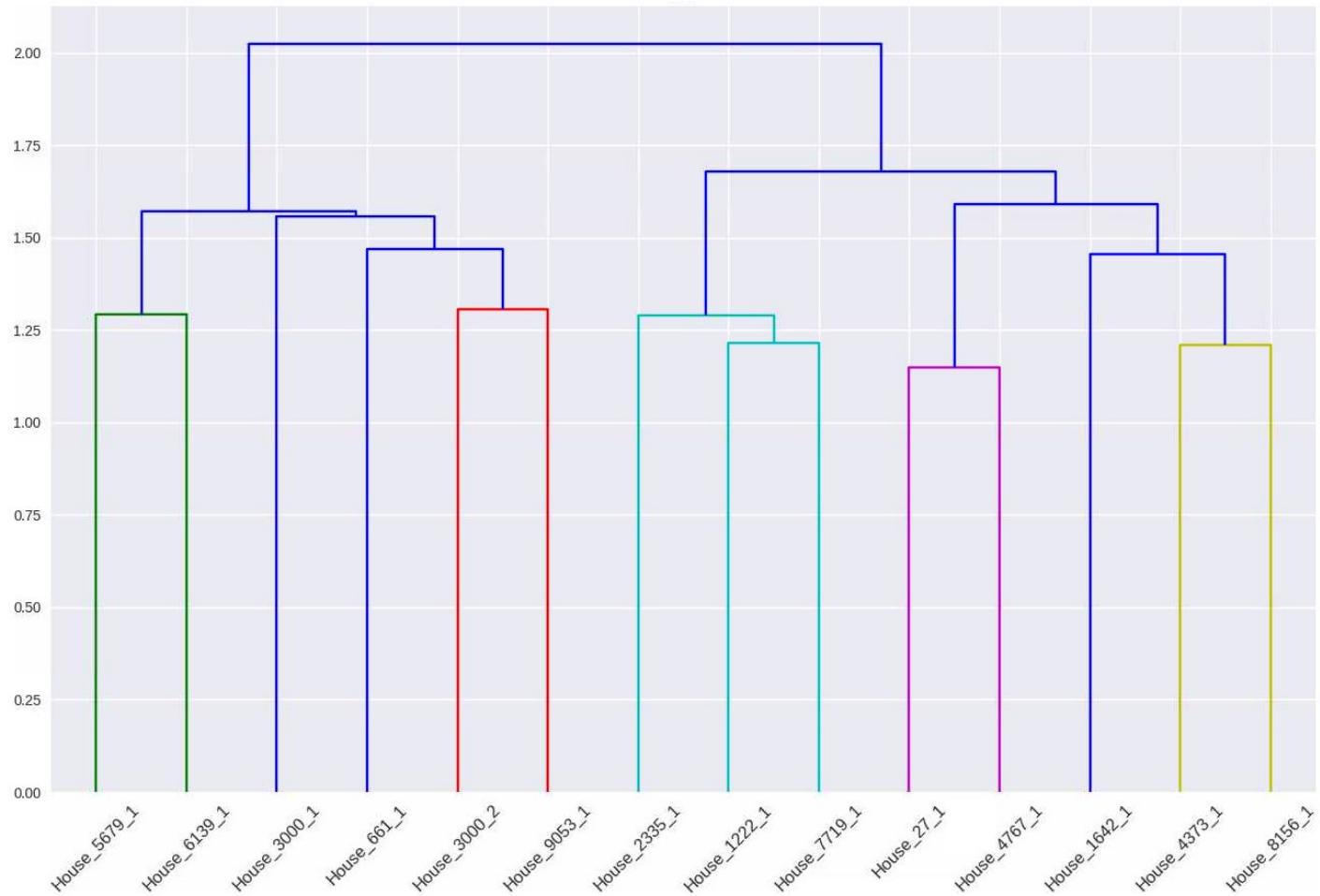
# Preliminary Results: Dendrogram representing waterheater clusters



# Preliminary Results: Hourly consumption of three car chargers



# Preliminary Results: Dendrogram representing car charger clusters



# Conclusions

