Signals of Energy Demand: Publicly Available Data to Predict Energy Consumption Needs Based on Population Demographics

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Introduction

Motivation

As distributed energy resources become more prevalent, there is an ever-growing need to understand and predict how energy consumption needs will change over time. This prediction often relies on the analysis of private, costly data or data hosted on multiple platforms. To address these challenges, this project aims to collect and organize free, publicly available energy consumption and population demographics data into an open-source database that can be used for exploratory and hypothesis driven research. Additionally, an initial linear model was developed to quantify the impact of various local economic and demographic parameters on energy consumption including population size, income, utility rates, etc.

Use Cases

Database

- Exploratory data analysis
- Hypothesis driven research
- Data visualization

Linear Model

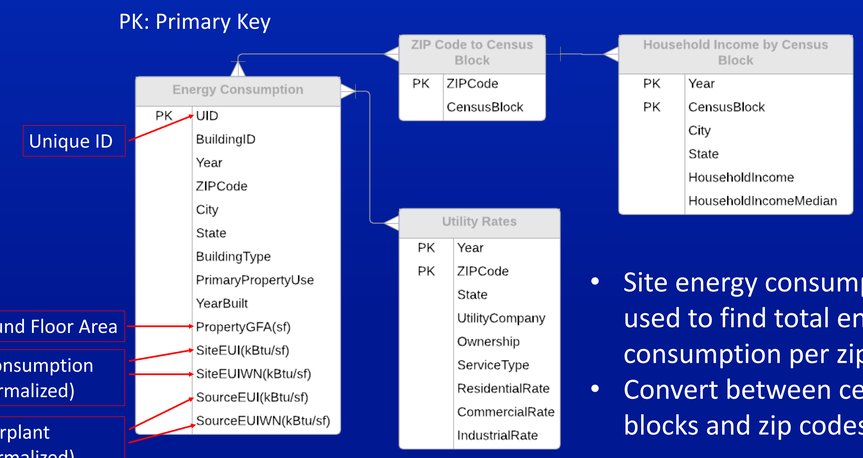
- Quantifying significance of variables
- Insights into future data collection

Methods

Data Sourcing

- Data from 10 large cities in the US
- Energy consumption data reported by municipalities
- Economic and demographic data from US Census

Database Structure



- Site energy consumption used to find total energy consumption per zip code
- Convert between census blocks and zip codes

Linear Regression Model

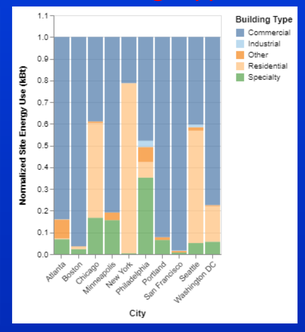
$$Energy = A(weather) + B(city) + C(zip) + D(income) + E(utility\ rate) + F(building\ type) + \cdots + Z(etc.)$$

- Each coefficient indicates the impact of the parameter, where 0 indicates no relationship

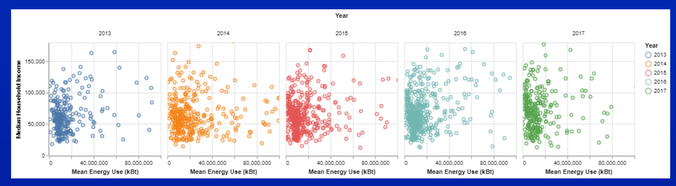
Results

Property Use

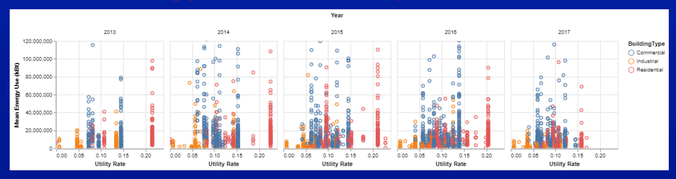
Building Type



Mean Energy Use vs. Median Income



Mean Energy Use vs. Utility Rate



Future Work

Data

- Wider range of cities/towns across country
- Population changes year over year
- More sophisticated demographic data
- Store on cloud for easier access and sharing

Modeling

- Investigate other statistical models

Acknowledgements
Thank you Niels Hanson, Dave Beck, Kelly Thornton, and Jim Pfaendtner. All packages used and developed in this work are open source and can be found at the following web address: https://github.com/kmpg-capstone-2019