

Proposal: Mapping the Intensity of Energy Use Across Boston University

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1. Dataset and datasets processing

1.1 The main datasets

➤ BERDO

(annual)- https://data.boston.gov/dataset?q=berdo&sort=score+desc%2C+metadata_modified+desc

This dataset mainly contains the energy usage amount for each building.

➤ Property assessment (this will have a lot of bldg.

data)- <https://data.boston.gov/dataset/property-assessment>

This dataset mainly contains the property assessment for each building.

1.2 Datasets processing

In order to utilize the data from both datasets, we combine the two datasets, that is using the address in Berdo dataset to find the matching building property in Property assessment dataset. We have finished this task and got a .csv file which have every property we need for each building (746 buildings in total).

2. The main question we want to investigate

2.1 What factors effects building EUI the most ?

Mehology: Multiple Regression Analysis, to be specific, we can build a multiple variables regression model and compute the weights for each variable. By analyzing the weights, we can know how these factors affect the energy consumption

The factors we choose to analyze is:

➤ Year built

➤ Building Structural classification (material)

A Struct Steel	C Brick/Concrete	E Metal
B Reinforced Concrete	D Wood/Frame	R Residential

- Building Property Type
- Levels in the structure (NUM_FLOORS)
- Land area in square feet (legal area)

2.2 How weather affects the EUI of buildings?(How much HDD/CDD or temperature effects EUI e.g. 1 average degree higher adds x to EUI)

Actually, we only have annual data and the fixed percent usage for each month for every building, it is hard use those data to get how weather affects the EUI of specific type of buildings, because we do not have the specific EUI usage uniquely for each building every month...

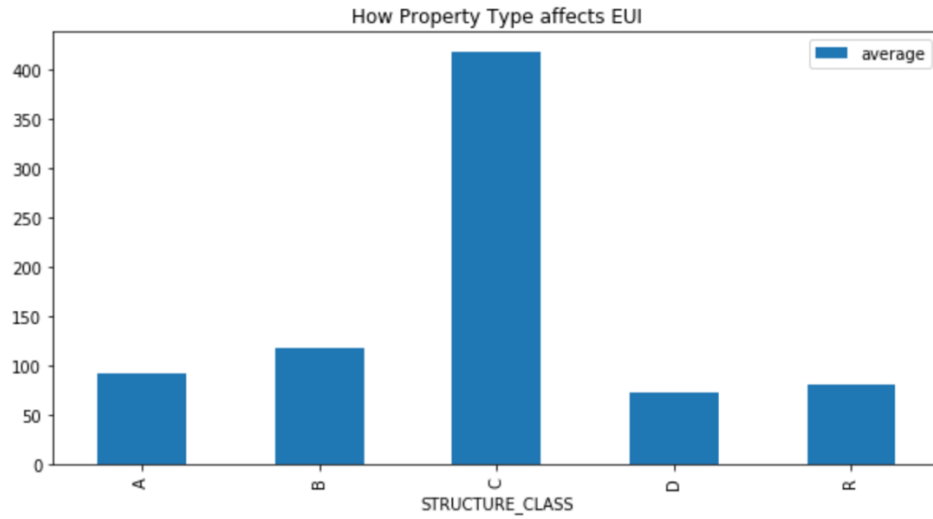
2.3 How can we predict the energy consumption(EUI) ?

3. What we have done so far: What factors effects building EUI the most ?

3.1 Which kind of building structure (material) is more energy-consuming?

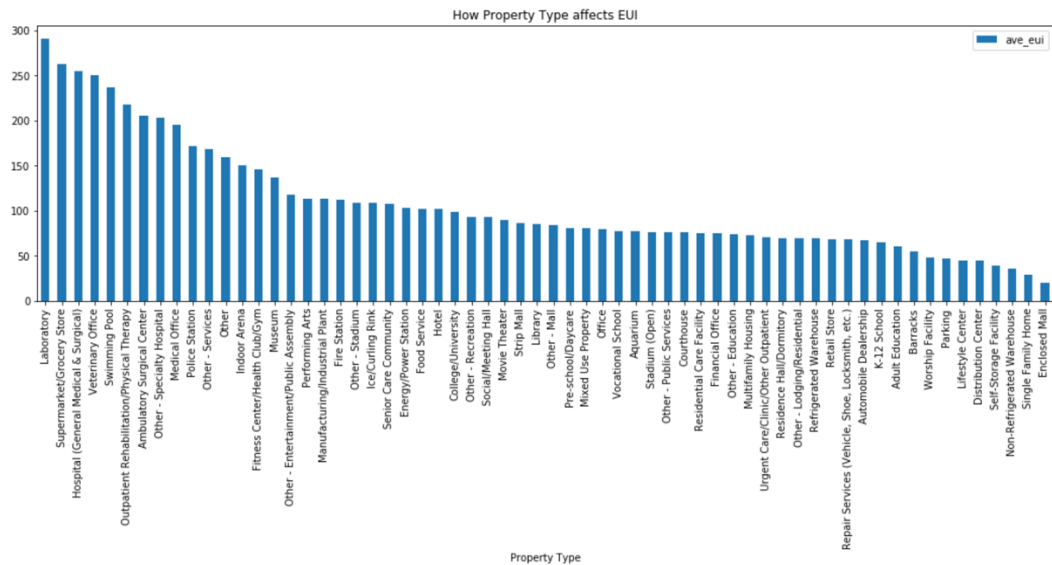
		EUI	count	average
STRUCTURE_CLASS				
	A	4998.0	54.0	92.555556
	B	13024.6	111.0	117.338739
	C	150096.6	359.0	418.096379
	D	2177.5	30.0	72.583333
	R	3957.0	49.0	80.755102

Img1: Structure class and average EUI



Img2: How property structure affects EUI

3.2 Which kind of building type is more energy-consuming ?



Img3: How property type affects EUI

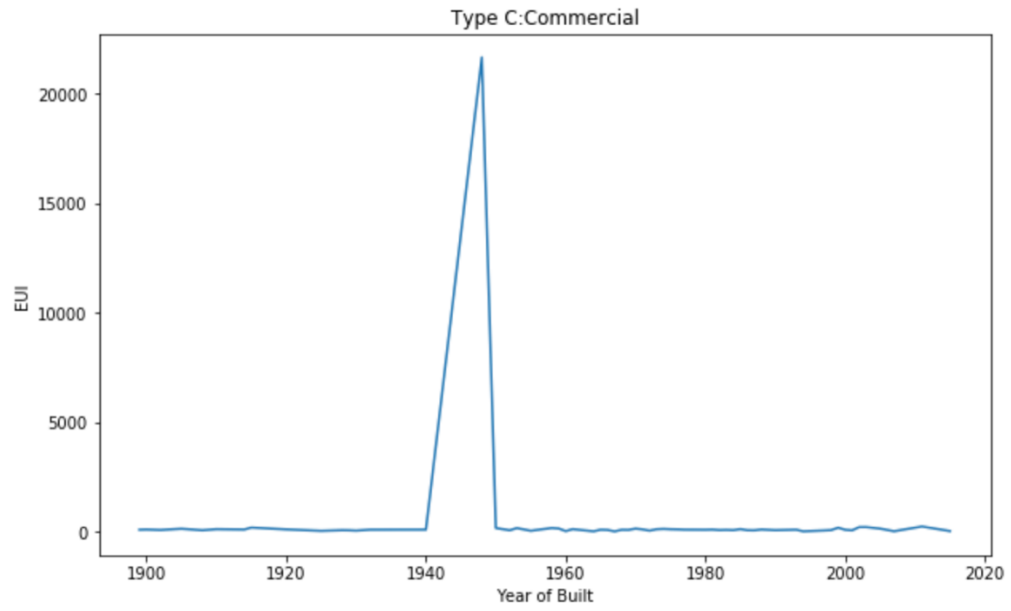
The Top 10 energy-consuming property:

	ave_eui
Property Type	
Laboratory	291.385294
Supermarket/Grocery Store	262.393750
Hospital (General Medical & Surgical)	255.321429
Veterinary Office	250.100000
Swimming Pool	237.120000
Outpatient Rehabilitation/Physical Therapy	217.900000
Ambulatory Surgical Center	205.900000
Other - Specialty Hospital	203.700000
Medical Office	195.704762
Police Station	171.695455

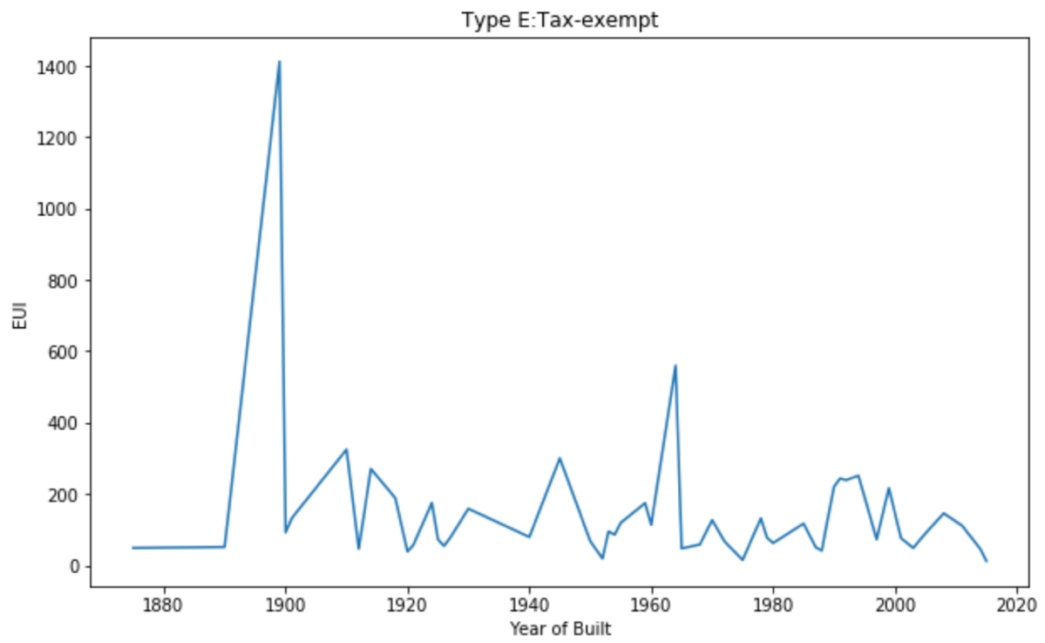
Img4: Top 10 energy-consuming property

3.3 How buildings' energy usage varies with "year built" ? Do the buildings built earlier consume more energy?

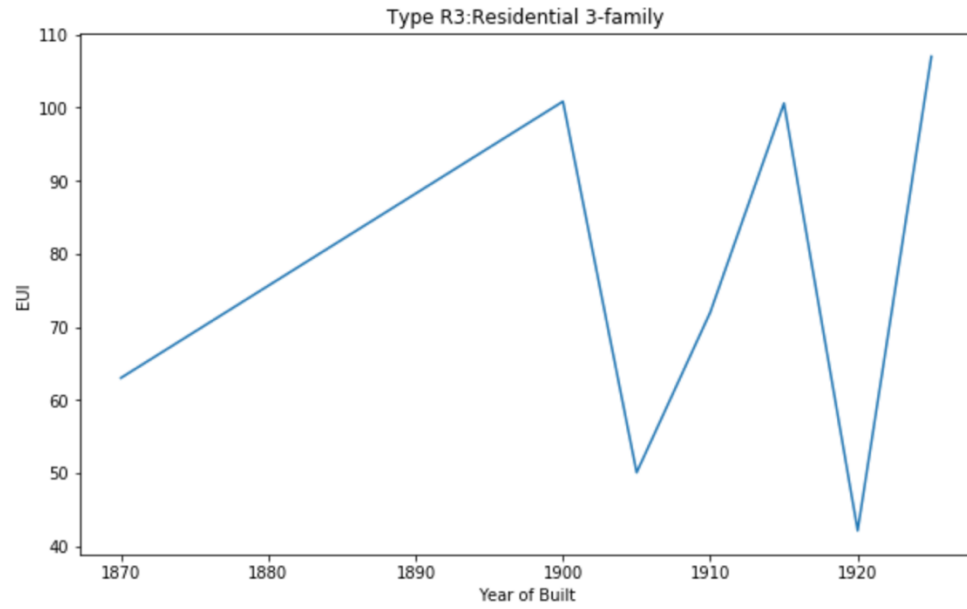
There are some figures in the end showing the energy usage varies with year built. And from those figures, we cannot get to the conclusion that buildings built earlier consume more energy.



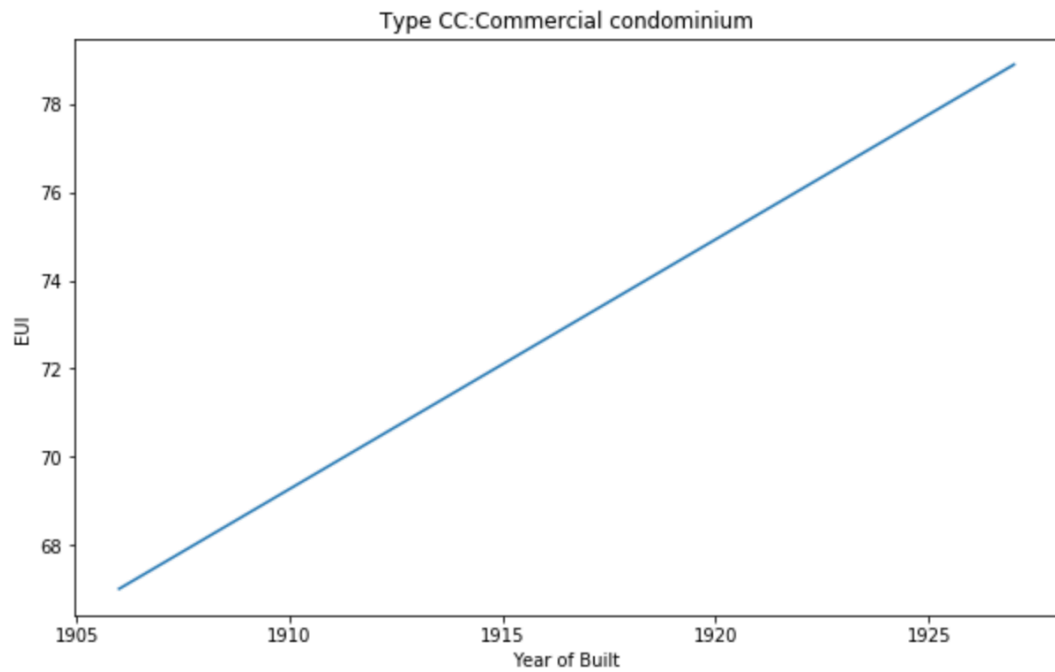
Img5: How year of built affects EUI in type C



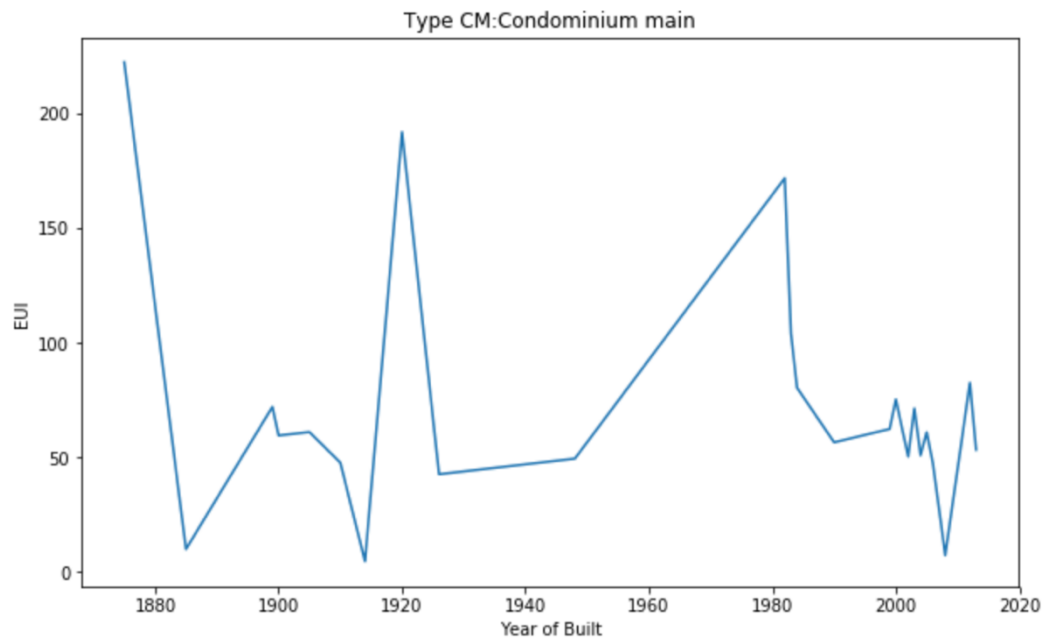
Img6: How year of built affects EUI in type E



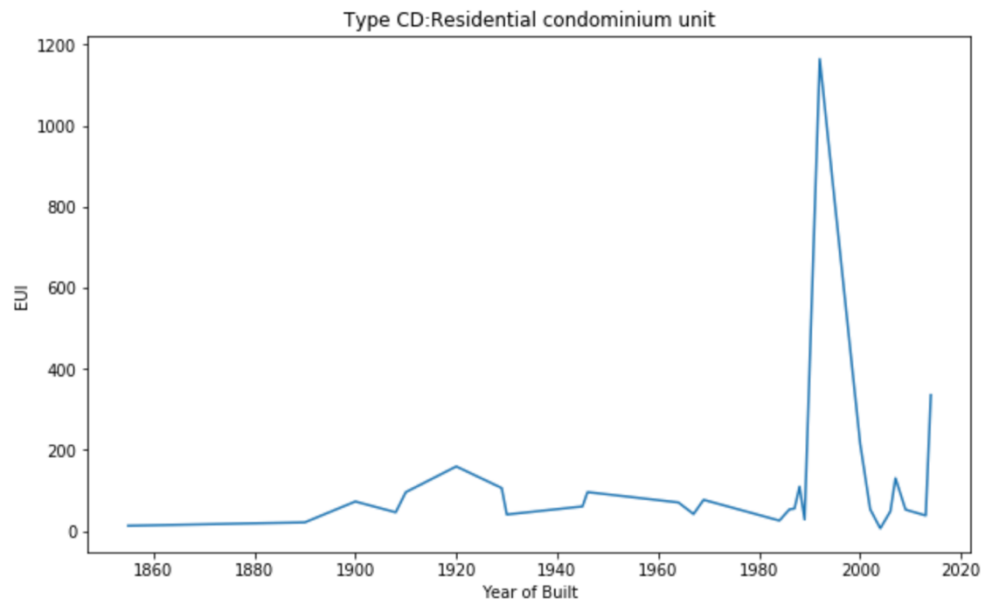
Img7: How year of built affects EUI in type R3



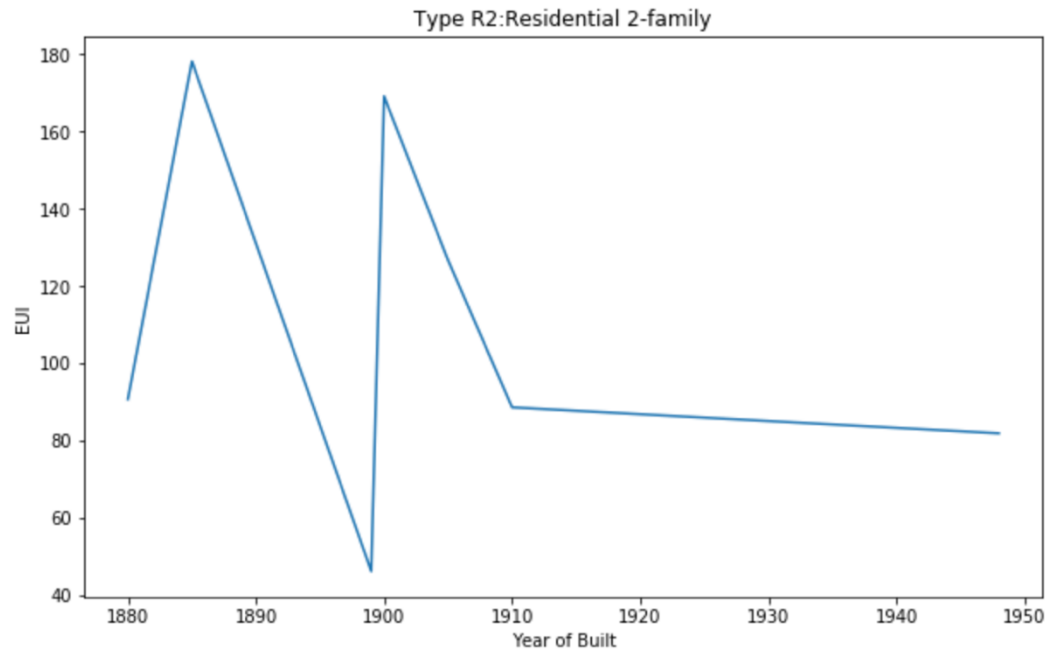
Img8: How year of built affects EUI in type CC



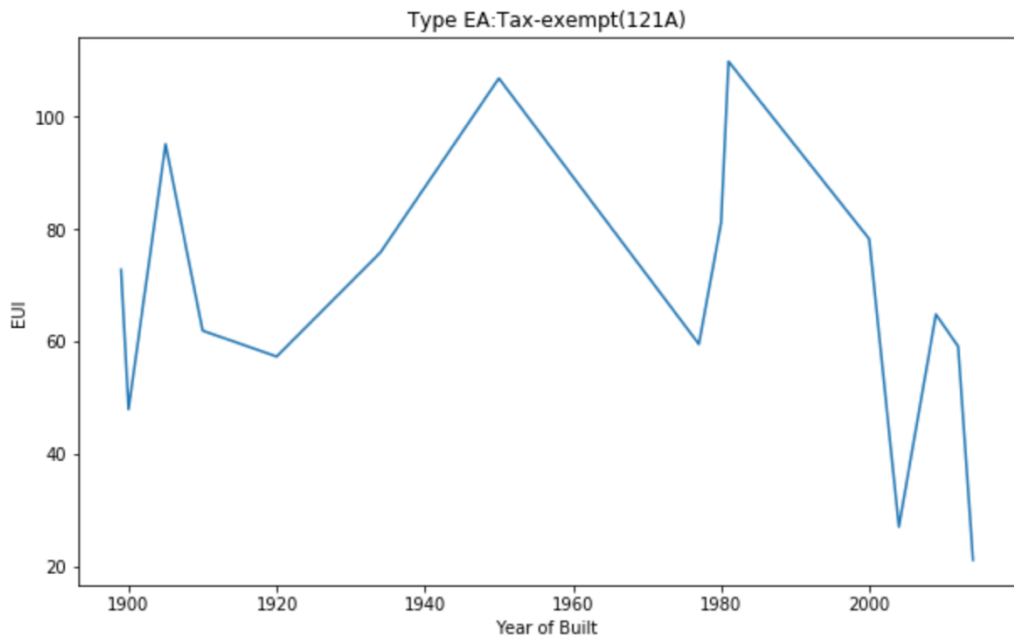
Img9: How year of built affects EUI in type CM



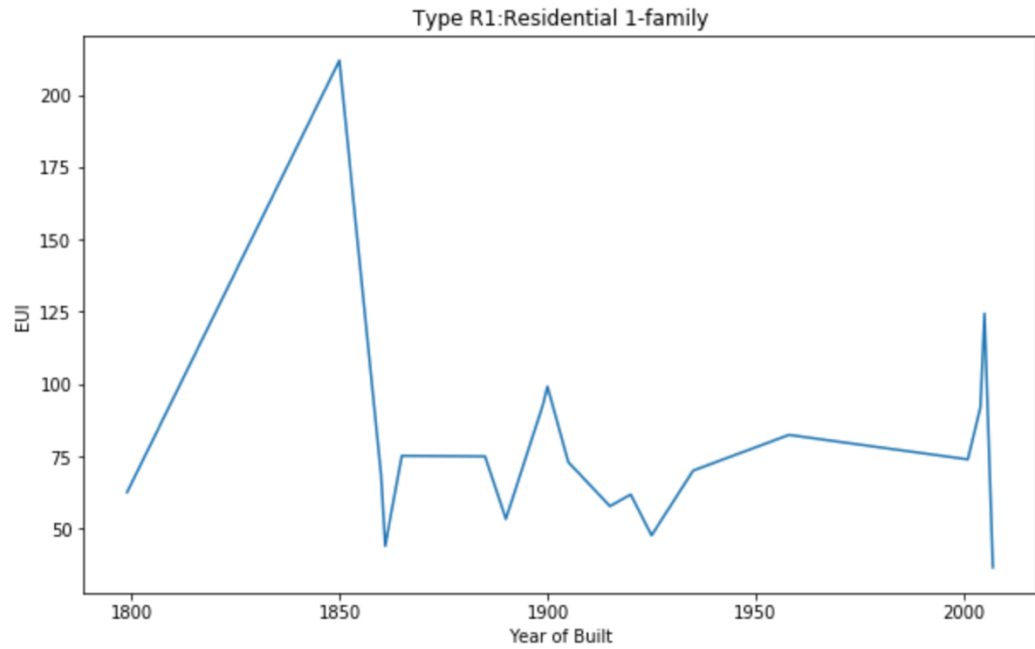
Img10: How year of built affects EUI in type CD



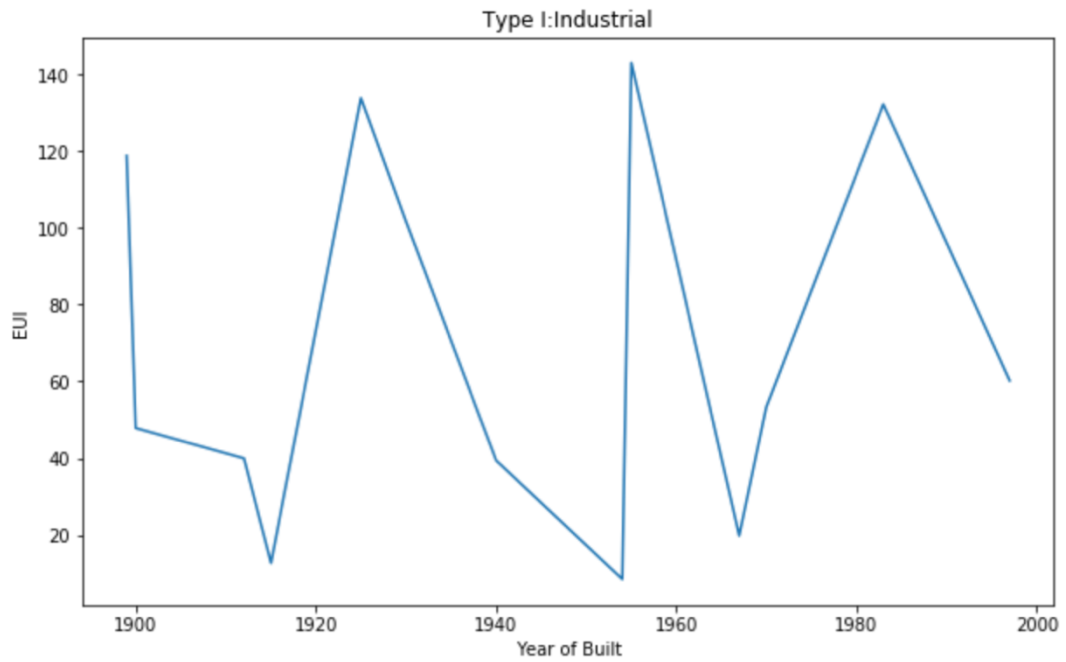
Img11: How year of built affects EUI in type R2



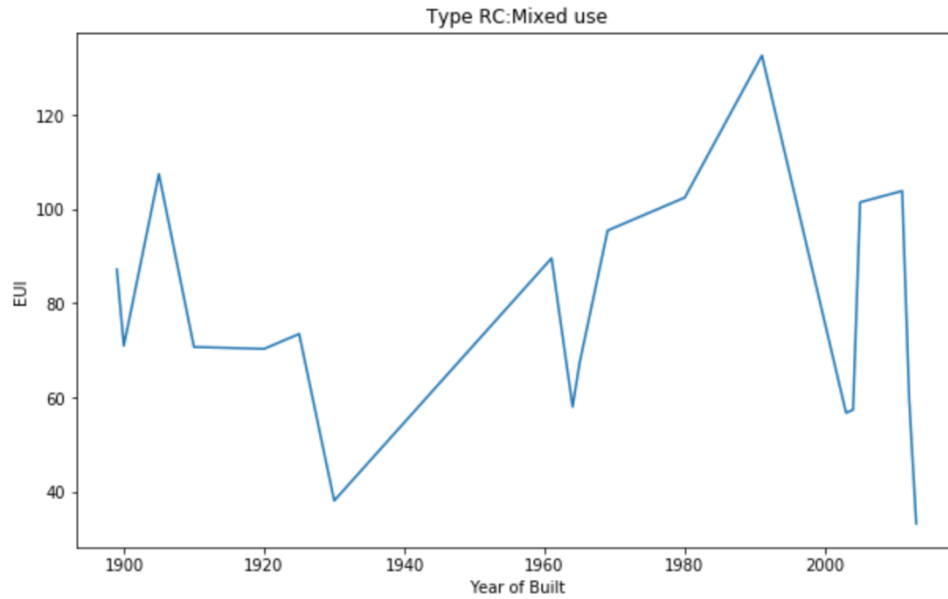
Img12: How year of built affects EUI in type EA



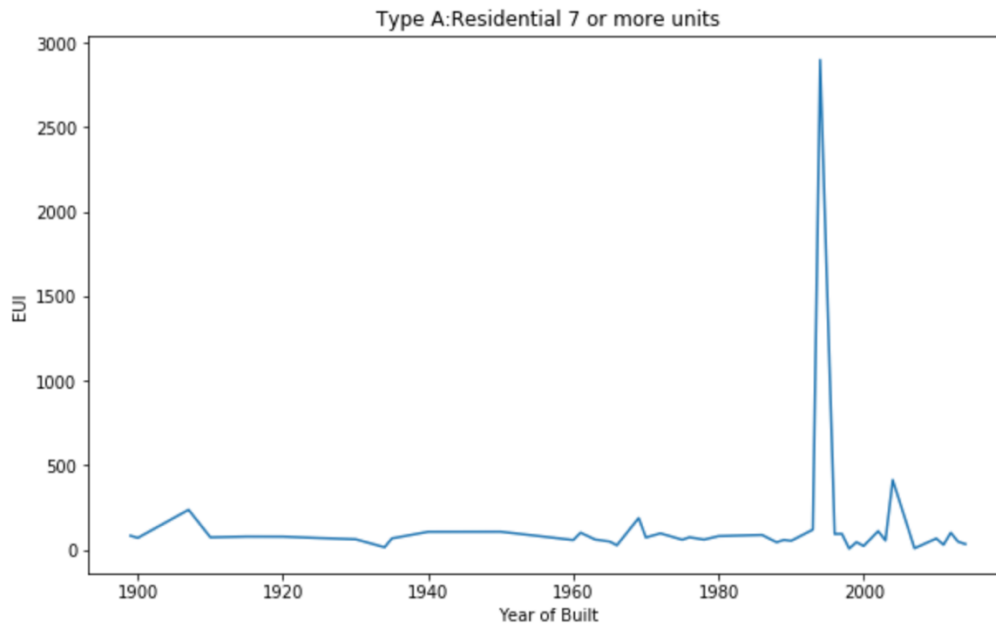
Img13: How year of built affects EUI in type R1



Img14: How year of built affects EUI in type I



Img15: How year of built affects EUI in type RC



Img16: How year of built affects EUI in type A

We noticed that in some graphs, some buildings's EUI are abnormally too high in 2017, so we decided to ignore those data in the future analyze.

4. Plan for the work you will do before the next report

4.1 For second question (How weather affects the EUI of buildings?)

Methology: statics analysis

- We plan to use the weather data from DegreeDays (<http://www.degreedays.net/>).
- We plan to compare the EUI in 2015, 2016 and 2017 for different building types, and calculate **the rate of EUI change** for each building type during these years.
- Using the weather data to analyze **the rate of EUI change** during these years, for example, in 2015, the weather was colder than normal so the EUI that year was higher than others.
- We plan to analyze **the rate of EUI change** among different building types.

4.2 For third question: Multiple Regression Analysis

Methology: Multiple Regression Analysis

- Normalize the features(year built/material type/ property type/number of floor/ land area)
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