# ENERGY AND WATER CONSUMPTION ANALYSIS FOR BUILDINGS IN LA

Team Members: Yash Kansal, Meera G K, Yeyan Wang, Crystal Wang, Shweta Joshi

# PROJECT OVERVIEW

**GOAL:** For buildings in Los Angeles, California, identify energy and water use trends, patterns, and relationships within the data for various building types

**DELIVERABLES:** Actionable insights for the city to establish policies for reducing energy use, water use and Carbon emissions from buildings

**RESOURCE:** Open Source Data from the City of LA *thru Existing Buildings Energy & Water Efficiency (EBEWE) Program administered by Los Angeles Department of Building and Safety (LADBS)*

# DATA OVERVIEW

### *COLUMNS USED*

Carbon Emissions (Metric Ton CO2e)

Occupancy (%)

Property Type

Gross Building Floor Area (sq-ft)

Total Water Use (kgal)

Weather Normalized Site EUI (kBtu/sq-ft)

Weather Normalized Source EUI (kBtu/sq-ft)

Year Built

### *DATA CLEANING*

Drop rows with “Not Available” or “`NaN`” values

Changed data types to “`float`” for columns with numerical values

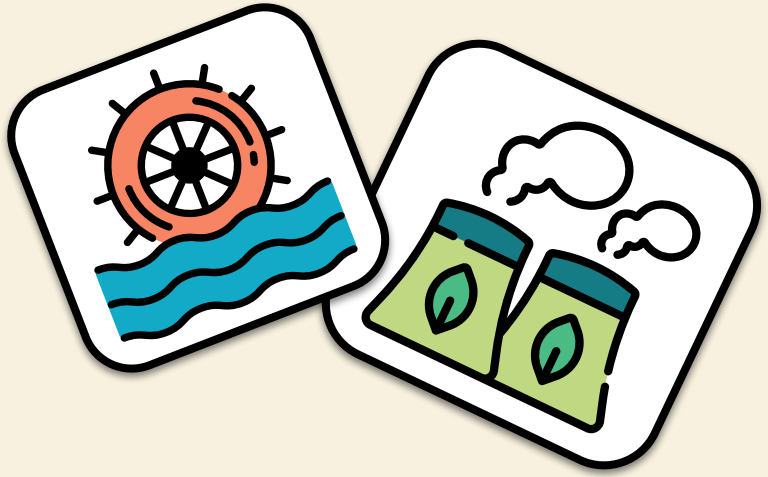
Dropped buildings with “`0`” occupancy

Only kept building types with > 300 data points

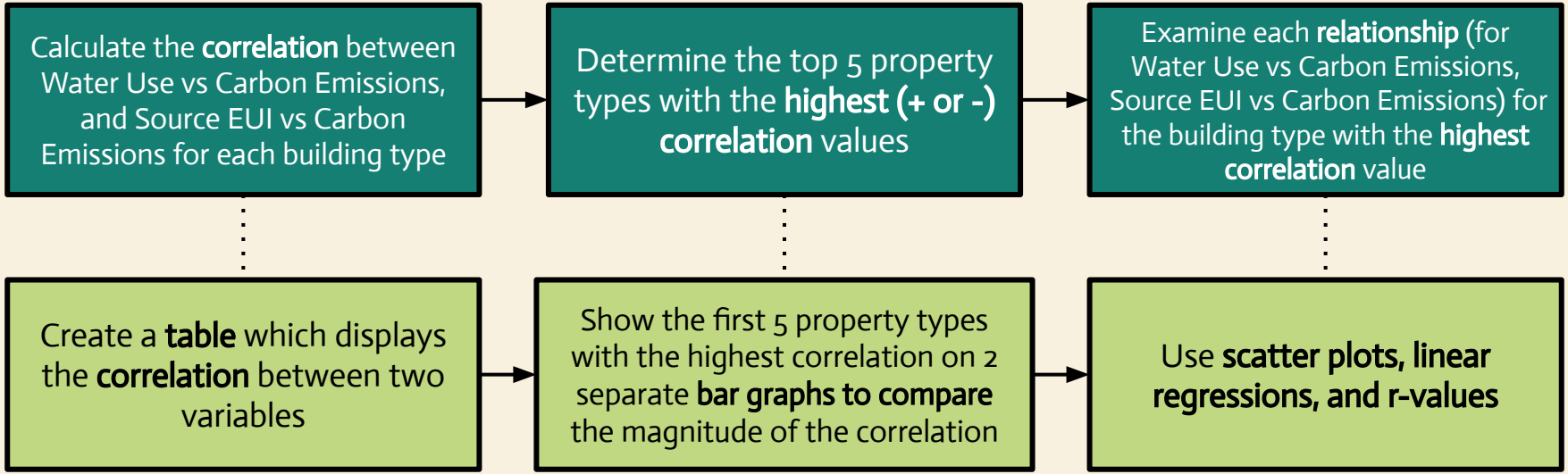
Final Dataframe used for Analysis = **`buildings_df`**

# QUESTION 1

Which 5 property types have the highest correlation between Water Use and Carbon Emissions, and Source Energy Use Intensity (Source EUI) and Carbon Emissions?

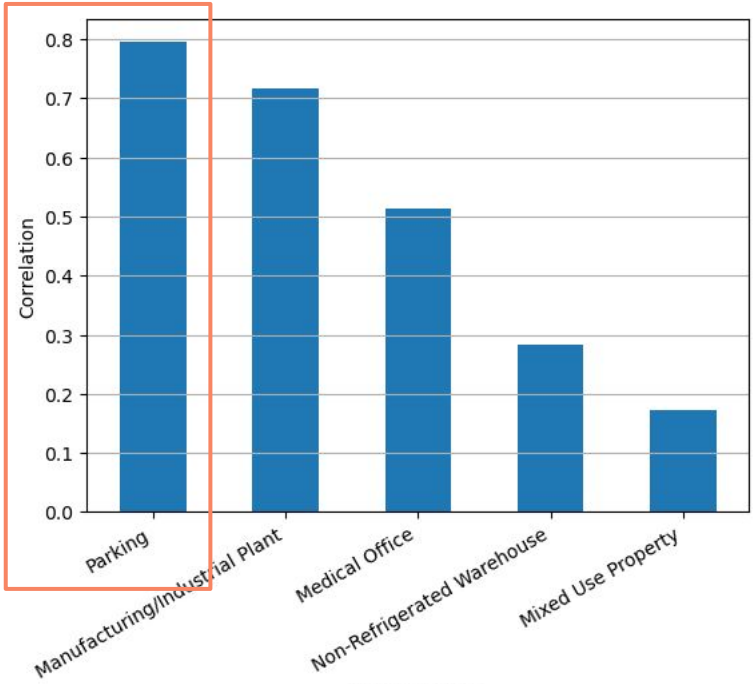


# PROCEDURES OF ANALYSIS

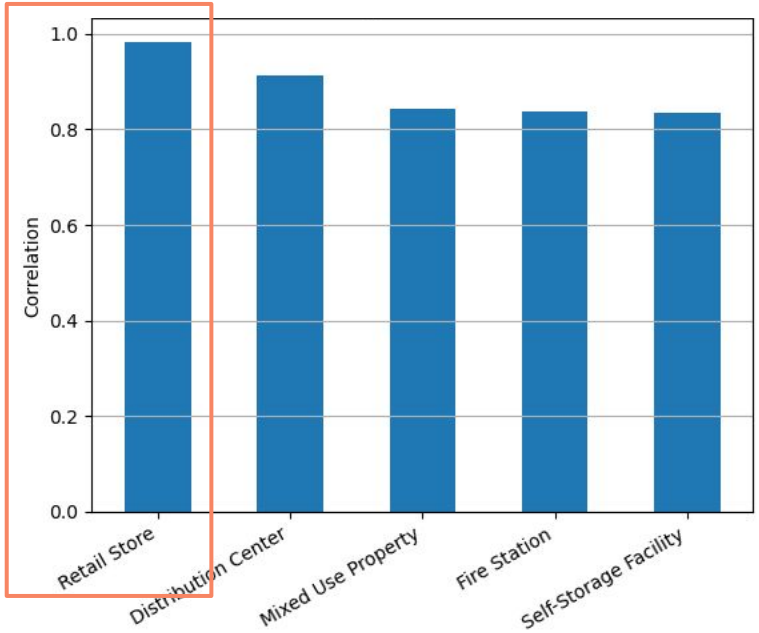


# CORRELATIONS

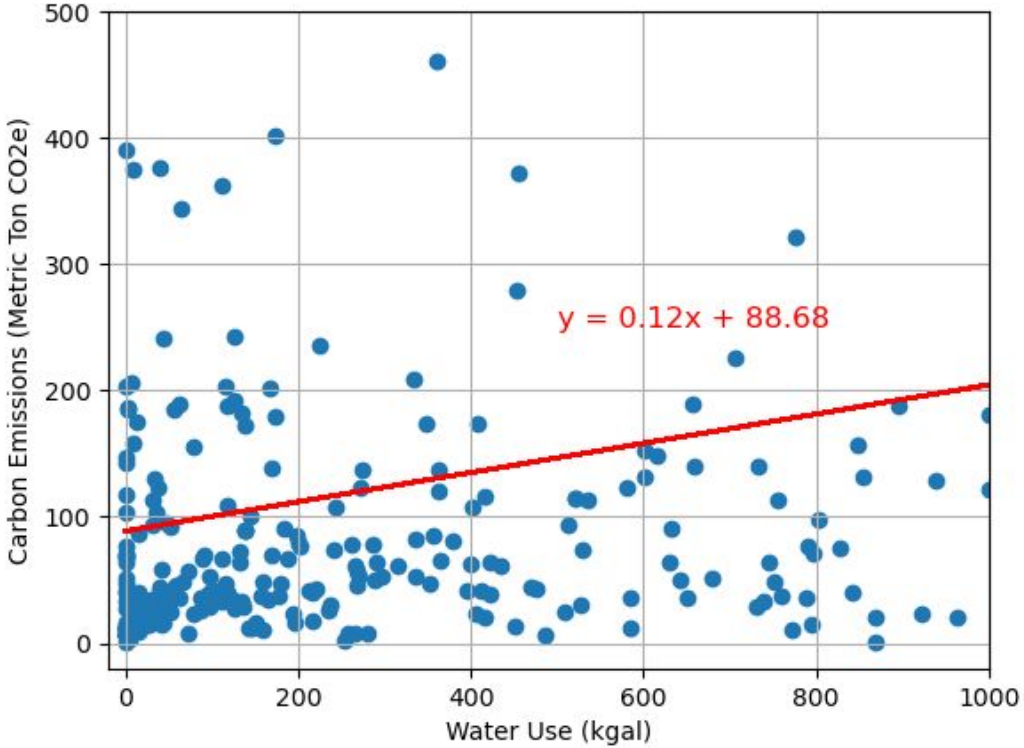
Correlation of Water Use vs Carbon Emissions




Correlation of Source EUI vs Carbon Emissions

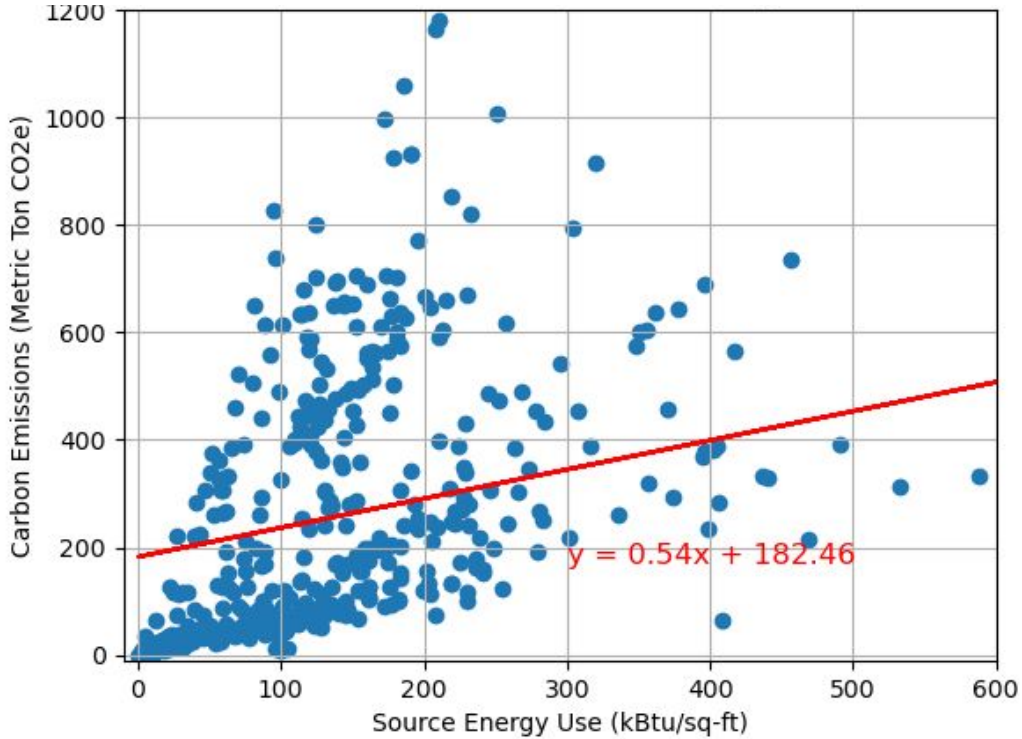


# WATER USE vs CARBON EMISSIONS FOR PARKINGS




R-value = 0.717

# SOURCE EUI vs CARBON EMISSIONS FOR RETAIL STORES




R-value = 0.983

# QUESTION 2

What property type has highest source energy use intensity and water use per square footage for buildings built after the year of 2000?

# **Procedures** and **Methods**

Filter the dataframe to show buildings **built only after 2000**

## Water Use

Determine the **median water use for each building type** and print the property type with the highest water use per sq-ft

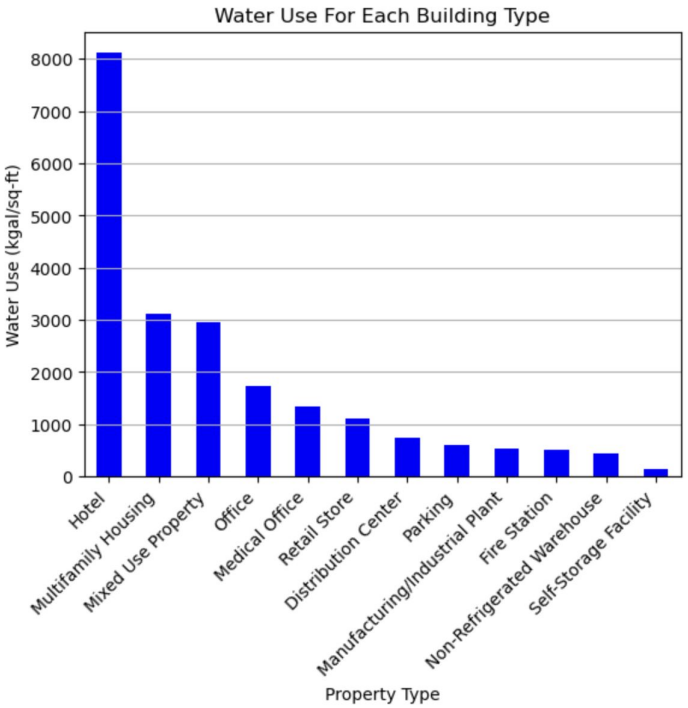
Plot a **bar chart** to compare the median water use for each building type

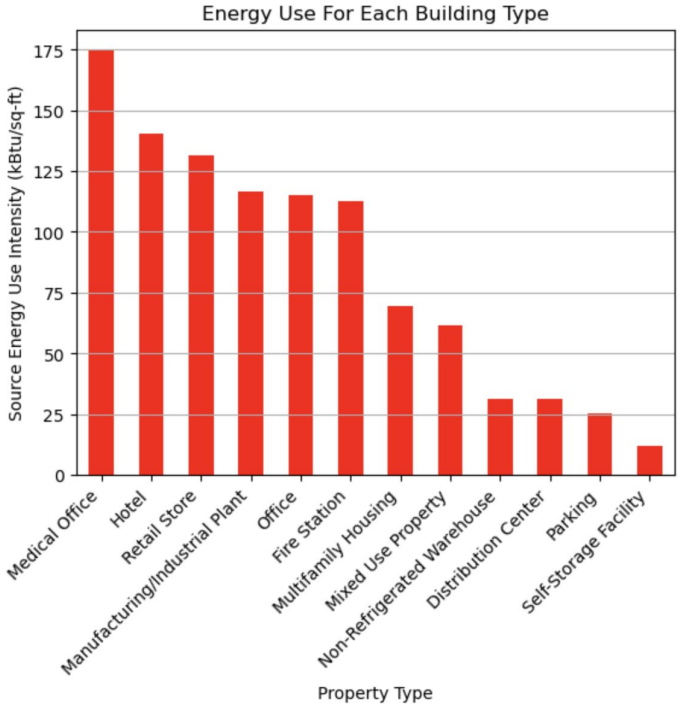
## Energy Use

Determine the **median Source EUI** for each building type and print the property type with the highest Source EUI

Plot a **bar chart** to compare the median Source EUI for each building type

# ANALYSIS

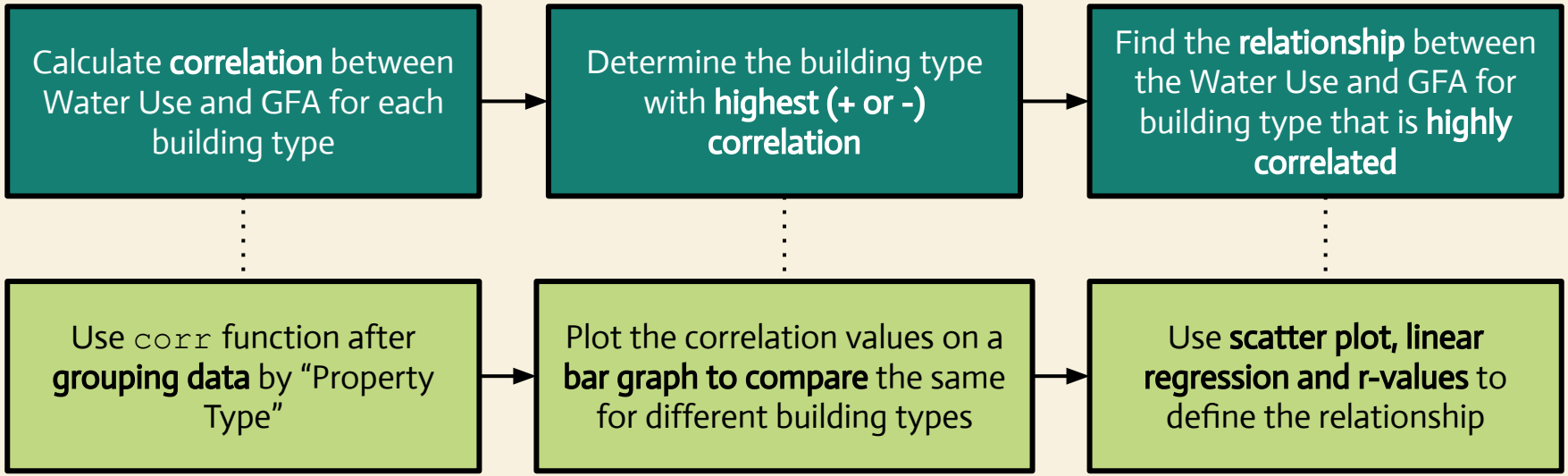

Water Use For Each Building Type
Water Use (kgal/sq-ft)
8000
7000
6000
5000
4000
3000
2000
1000
0
Hotel
Multifamily Housing
Mixed Use Property
Office
Medical Office
Retail Store
Distribution Center
Parking
Manufacturing/Industrial Plant
Fire Station
Non-Refrigerated Warehouse
Self-Storage Facility
Property Type


Energy Use For Each Building Type
Source Energy Use Intensity (kBtu/sq-ft)
175
150
125
100
75
50
25
0
Medical Office
Hotel
Retail Store
Manufacturing/Industrial Plant
Office
Fire Station
Multifamily Housing
Mixed Use Property
Non-Refrigerated Warehouse
Distribution Center
Parking
Self-Storage Facility
Property Type

# QUESTION 3

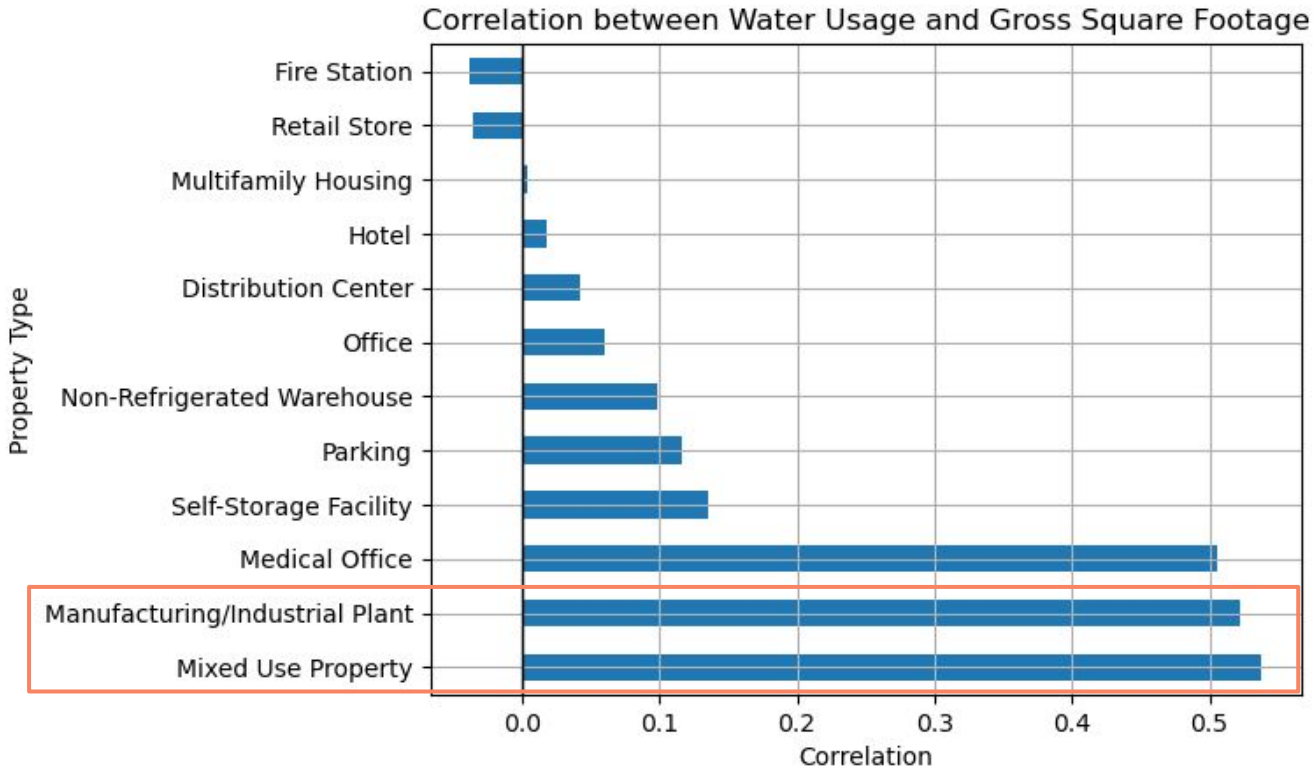
Does any property type have a correlation between Water Use and Gross Building Floor Area (GFA), and if there is a correlation, what is the relationship between for building type with highest correlation value?

# Procedure



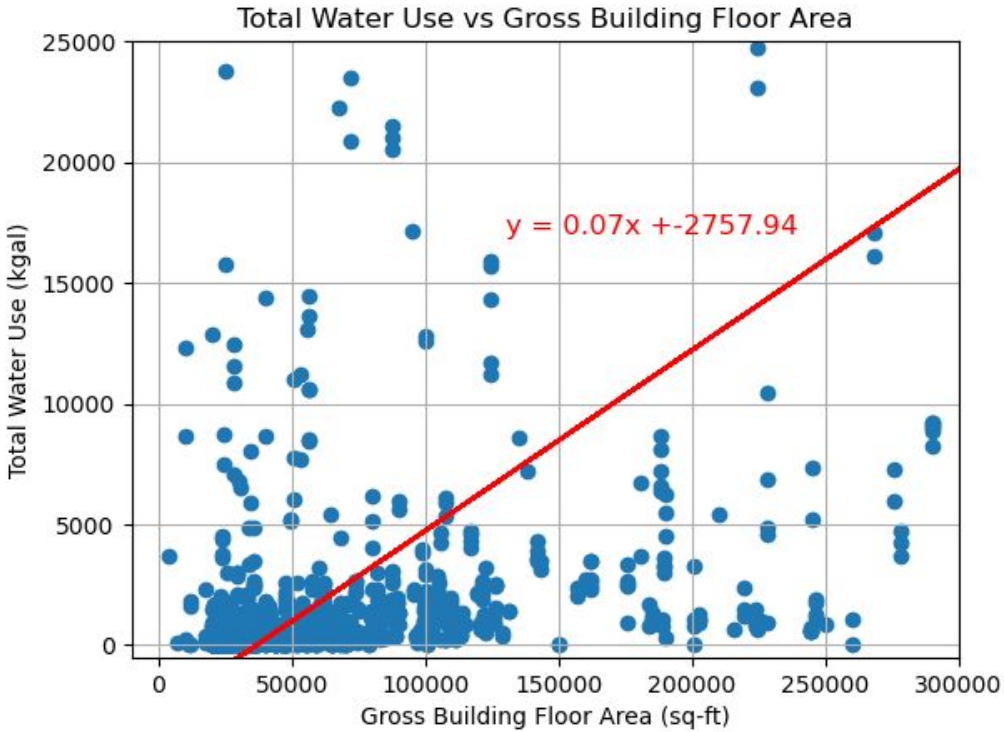

# *and* Methods

# **Correlation** per **Property Type**



# Relationship

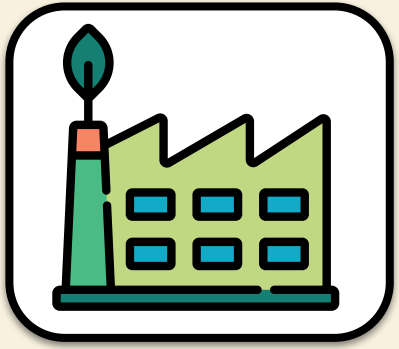
*between*
**Total Water Use**
and **Gross Building Floor Area**
for **Manufacturing/Industrial Plants**



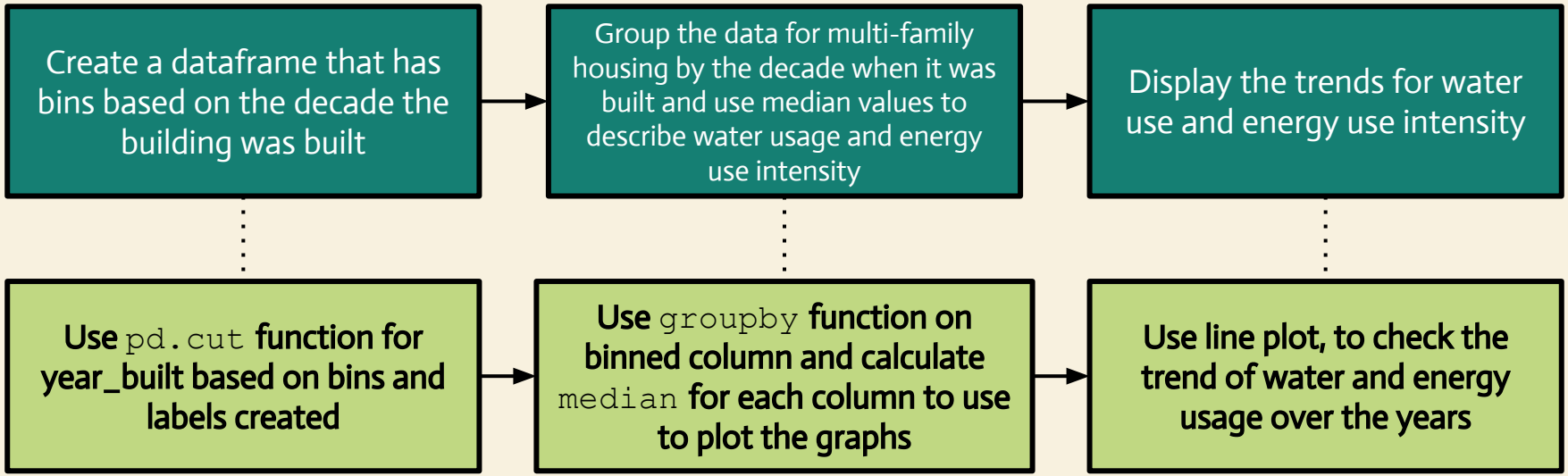

R-Value = 0.52174

# QUESTION 4

For multi-family housing building type, check if there is a relationship between year built and source EUI, as well as year built and water use per square foot?

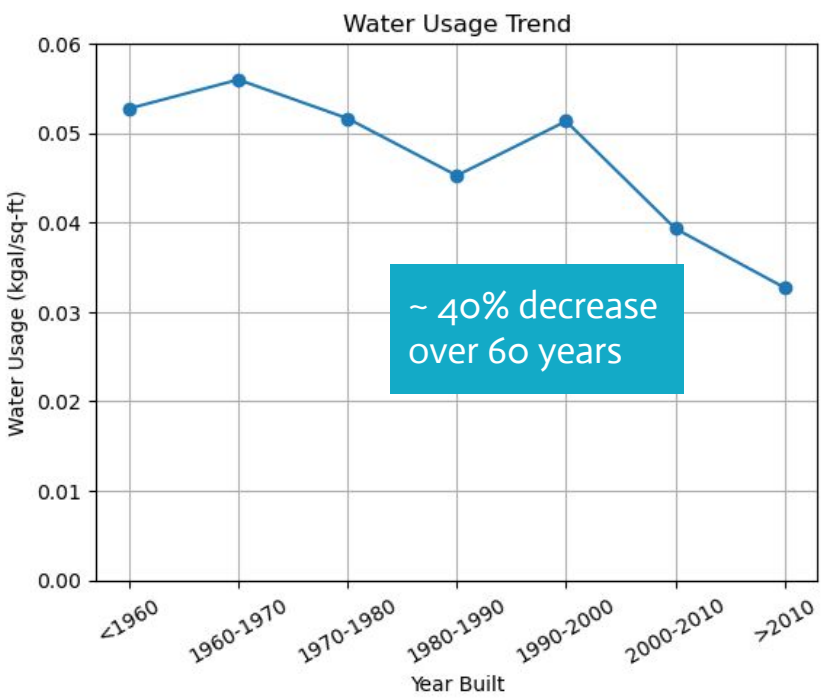


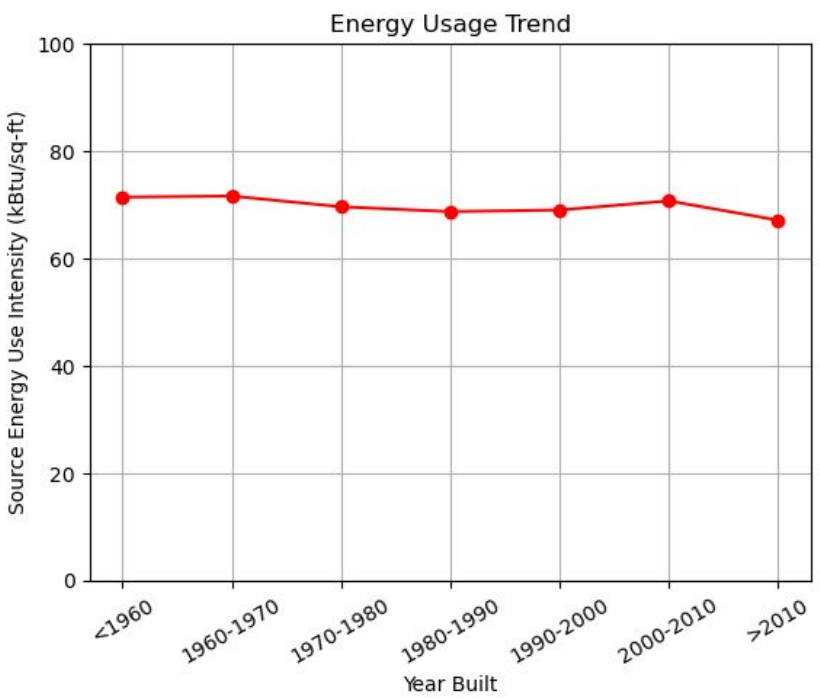
# Procedure




# *and* Methods

# **ANALYSIS** *of Water and Energy Usage Trend*



# Findings *and* Conclusion

**Question 1: CO2e vs Water & Energy**

1. Water Use - Parking Lots and Manufacturing Plants have strong correlation values (>0.7)
2. Energy Use -
   a. Retail Stores have the highest correlation (>0.9)
   b. Other property types also have high correlation value (>0.8)

**Question 2: Highest Water & Energy use per Property Type**

1. Hotel has the highest water consumption per sq-ft (8115.6 kgal/sq-ft)
2. Medical office has the highest Source EUI (168.6 kBtu/sq-ft), with Hotel a close second

# Findings *and* Conclusion

**Question 3: GFA vs Water Use**

1. Mixed Use Property, Manufacturing/Industrial Plant and Medical Offices have strong correlations (>0.5)

**Question 4: Trend - Water and Energy**

1. Water use intensity showed ~40% decrease over 60 years
2. Energy use didn't show much change over the last 60 years

# IMPLICATIONS

For most building types, **reduce energy use to reduce carbon emissions**; but for parkings, manufacturing plants and medical offices, reducing water use would also be helpful.

Focus on reducing energy and water use of **new hotels**

For mixed use buildings, manufacturing plants and medical offices, focus efforts on **water conservation at larger properties**

For multi-family housing, **energy use trend needs to improve** while the water use trend should continue or improve

# THANKS!

Any Questions?

# RESOURCES

- Socrata Energy and Water Consumption open source data for the City of Los Angeles: https://dev.socrata.com/foundry/data.lacity.org/9yda-i4ya