The Alcalá building

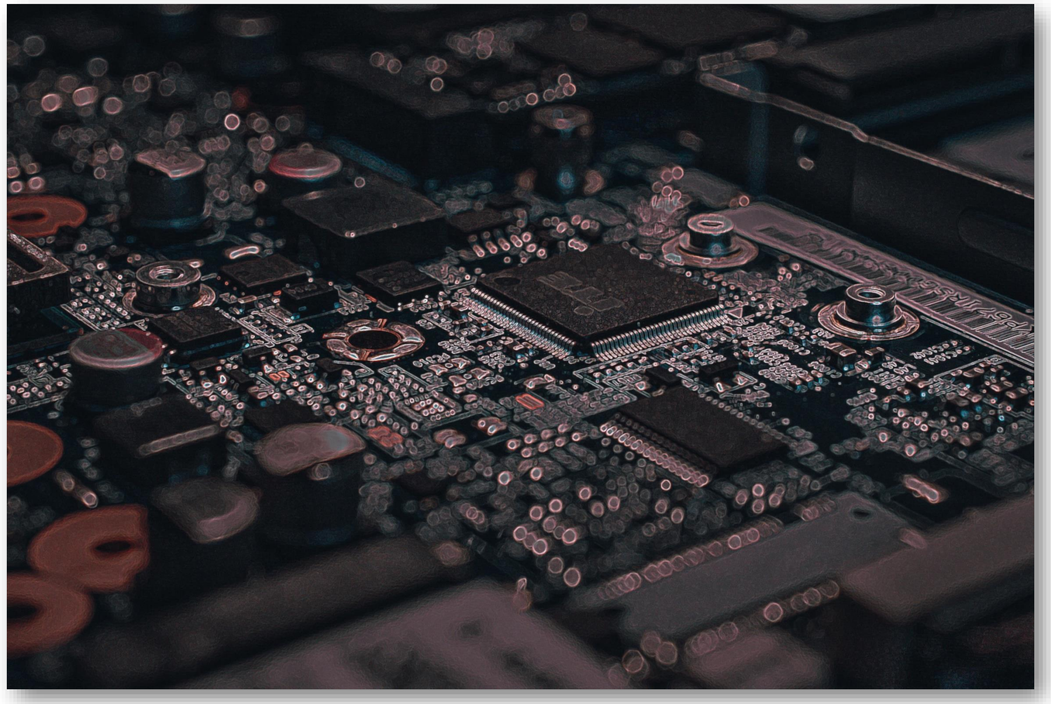
Alban STEFF

Introduction Sensors and Data

Two types of sensor technologies are installed in this building:
Wi-Fi sensors and smart meters.

2 + 1 datasets generated :

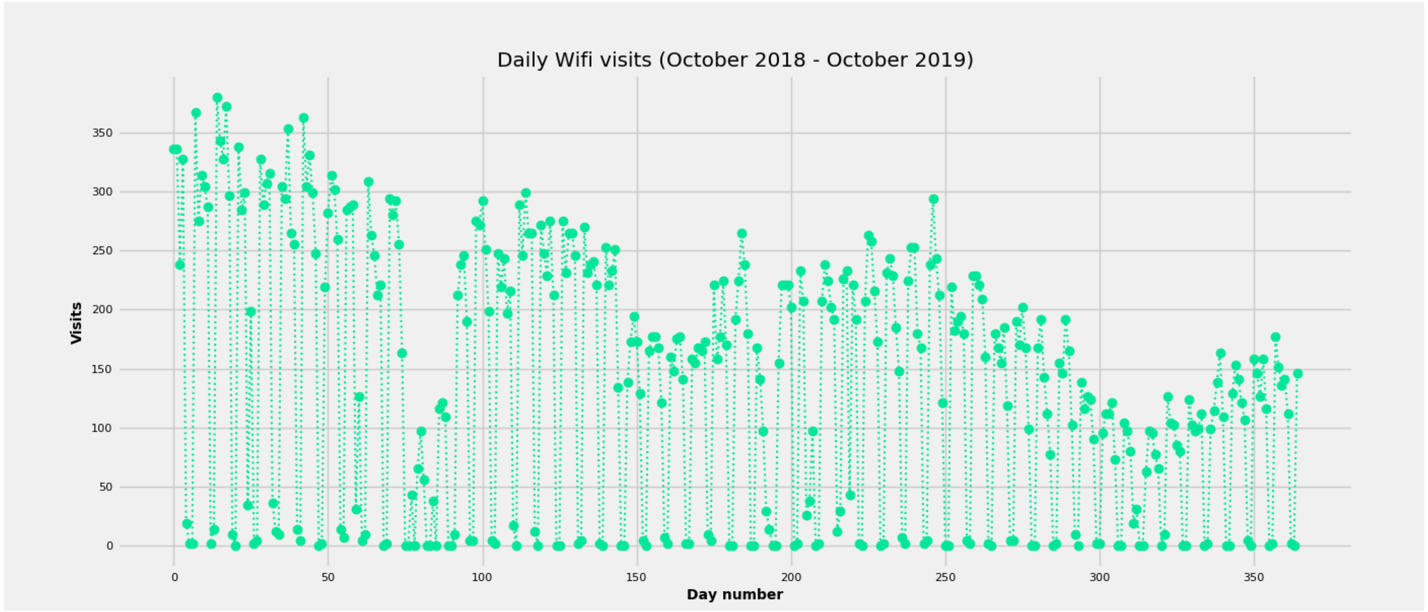
- *Electrical energy consumption*
- *Wifi visits*
- *Weather data of Madrid*

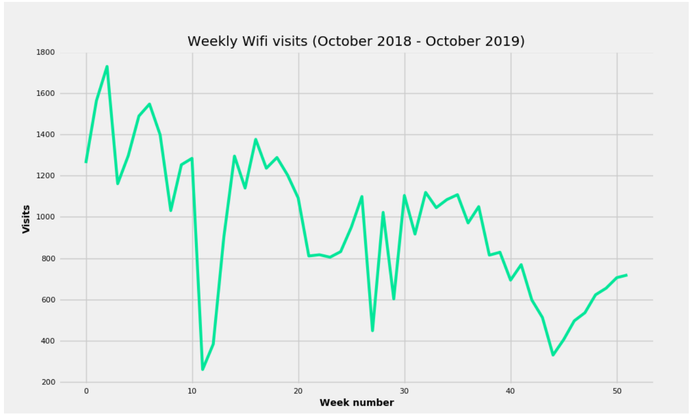


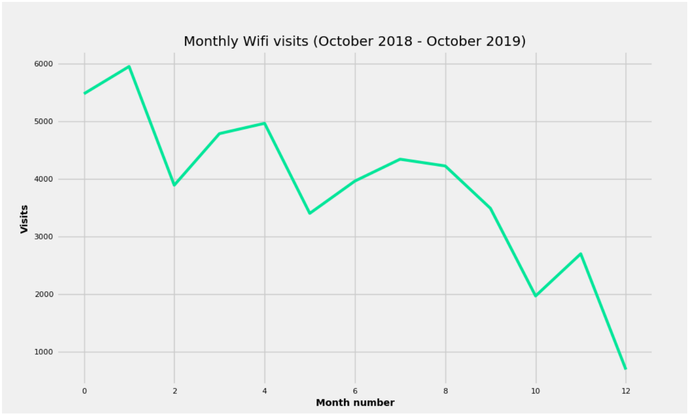
Let’s start with problem 1

“Summarize electrical energy consumption and Wi-Fi visits over various windows of time”

Wifi visits Daily, weekly, monthly

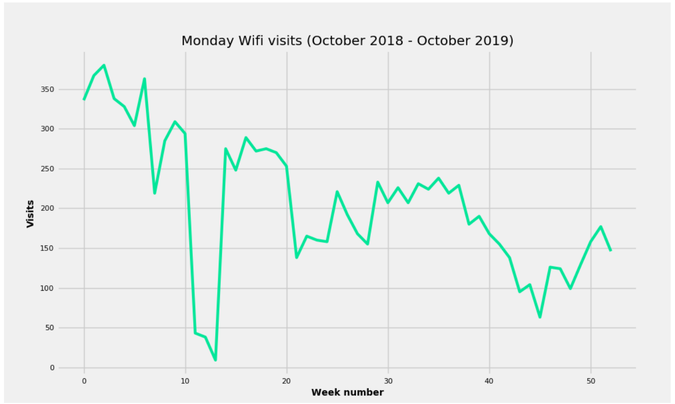


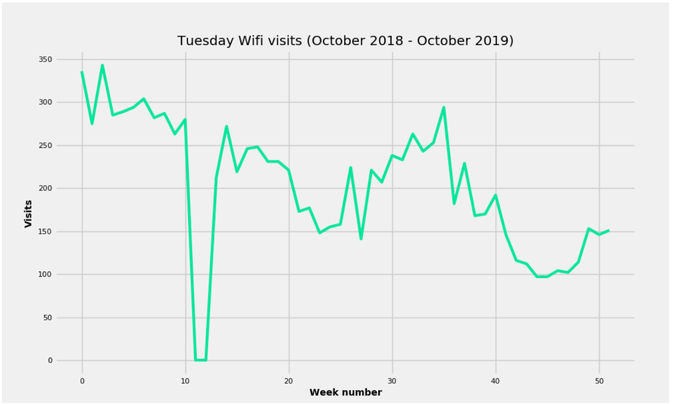


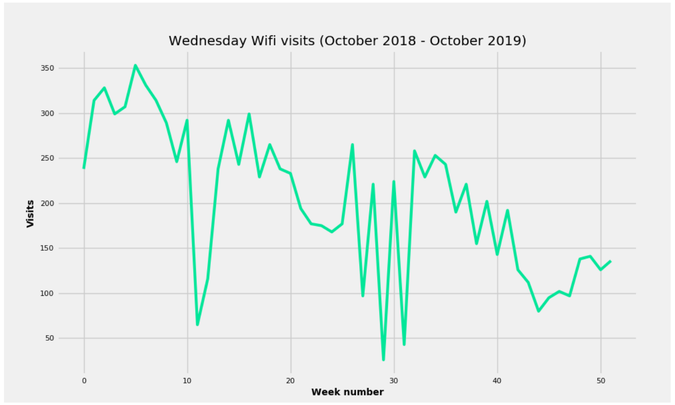


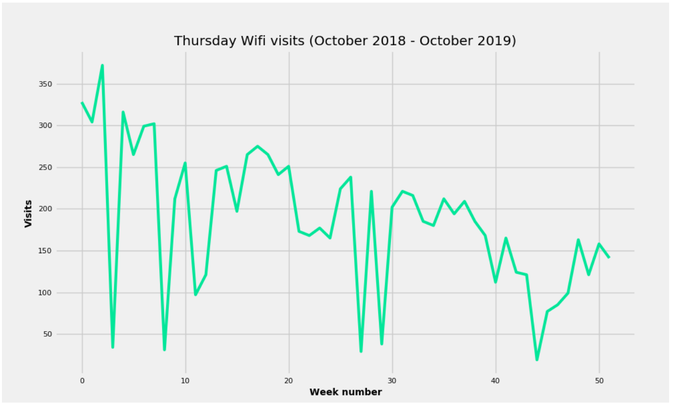
Wifi visits

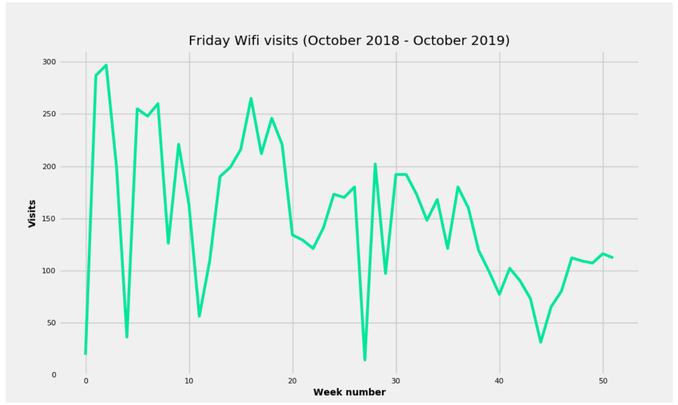
What is the distribution of the visits over the days of the week (Monday to Friday)?





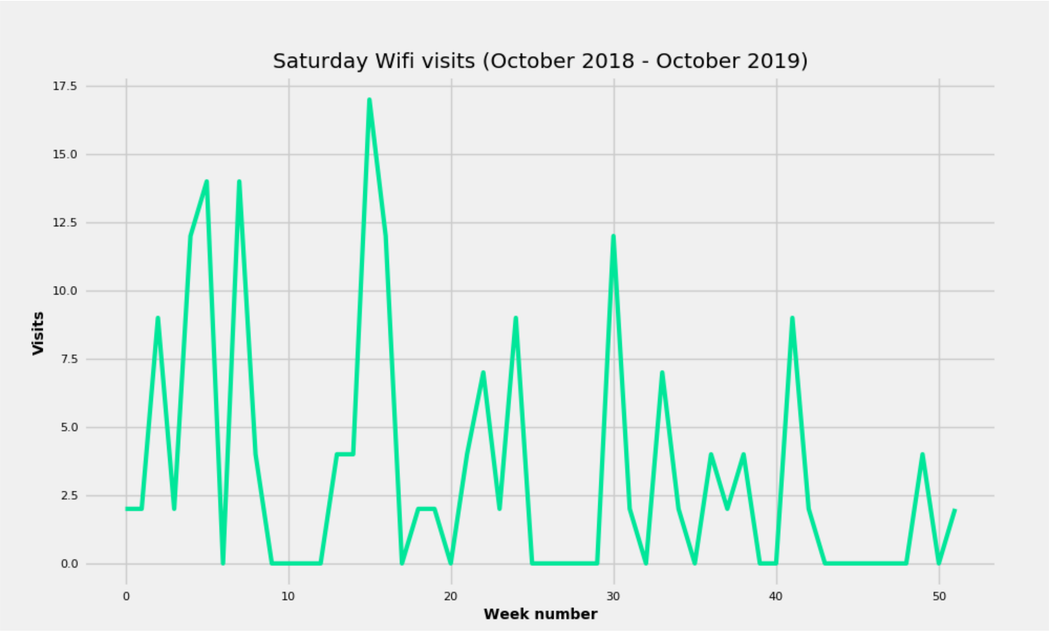


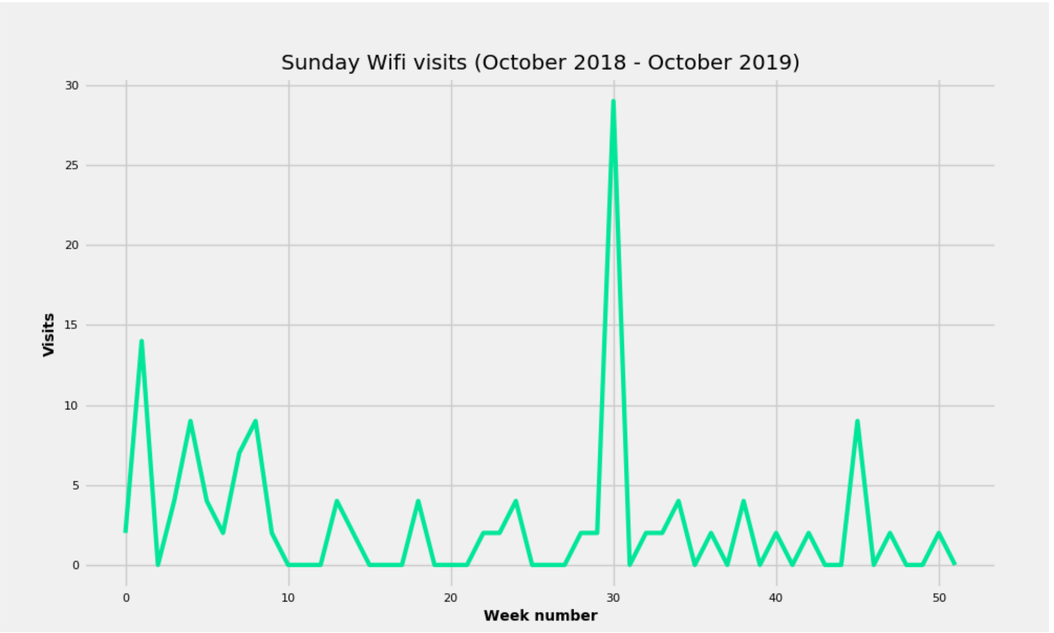




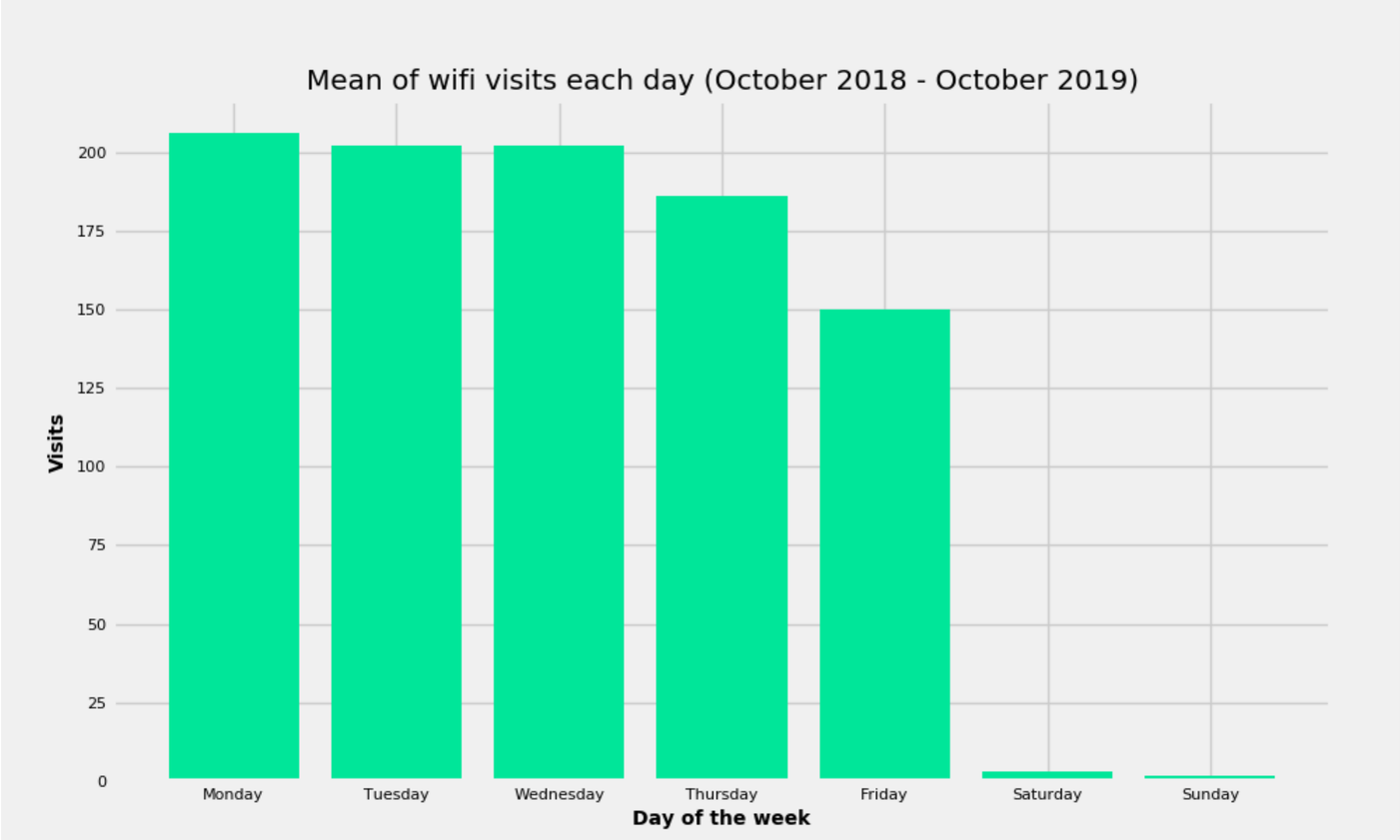
Wifi visits

What is the distribution of the visits over the weekend ?

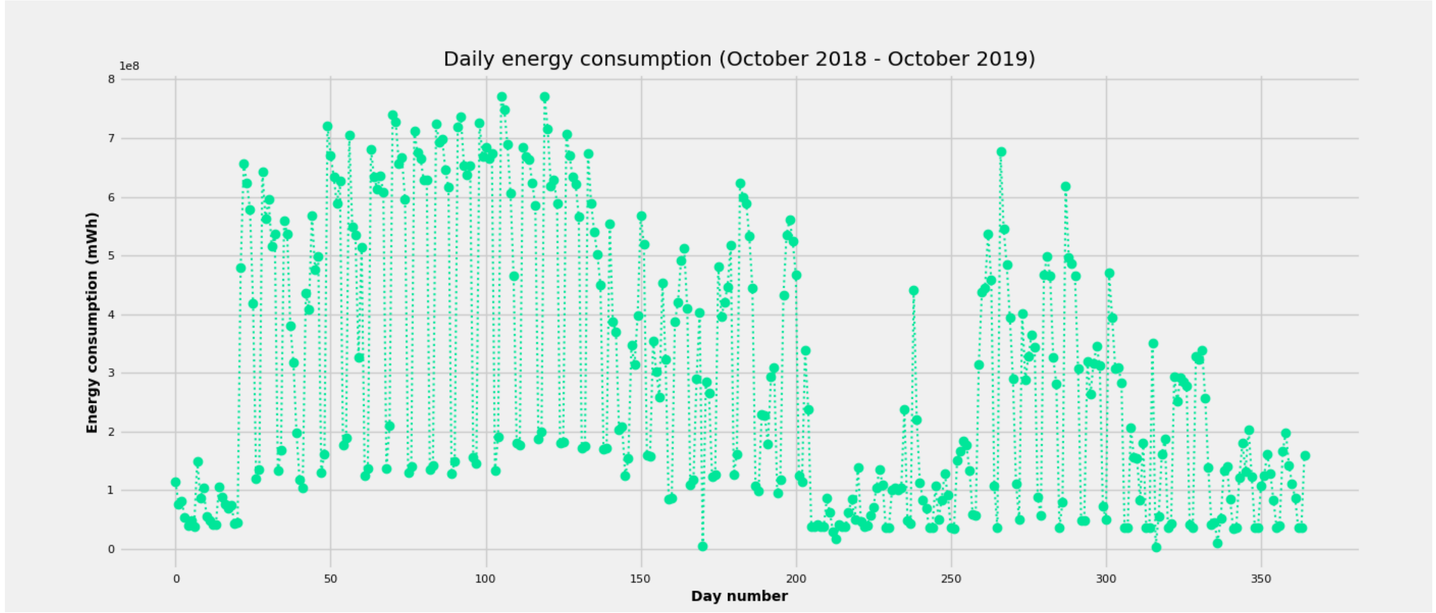


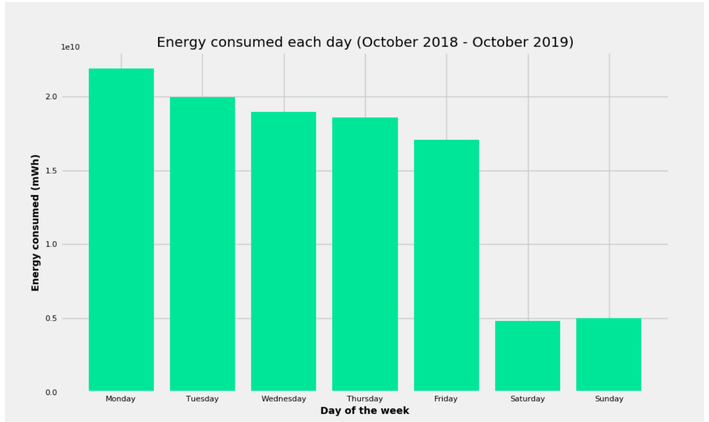


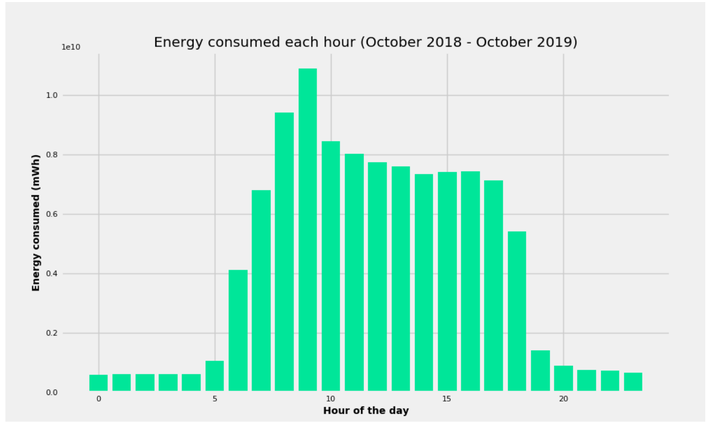
Wifi visits Summary



Energy consumption **Daily, Weekly, Hourly**

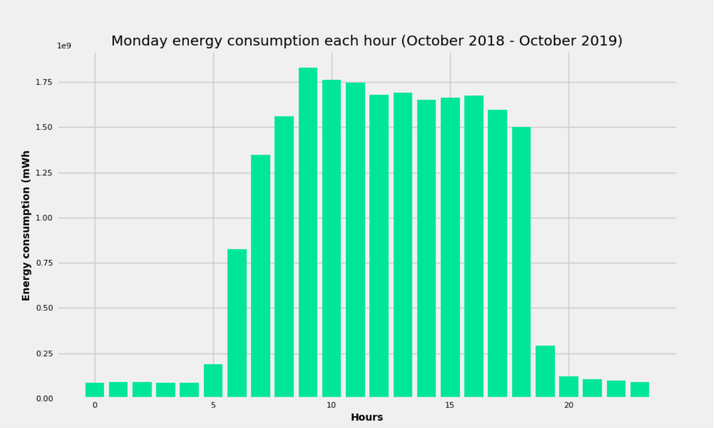


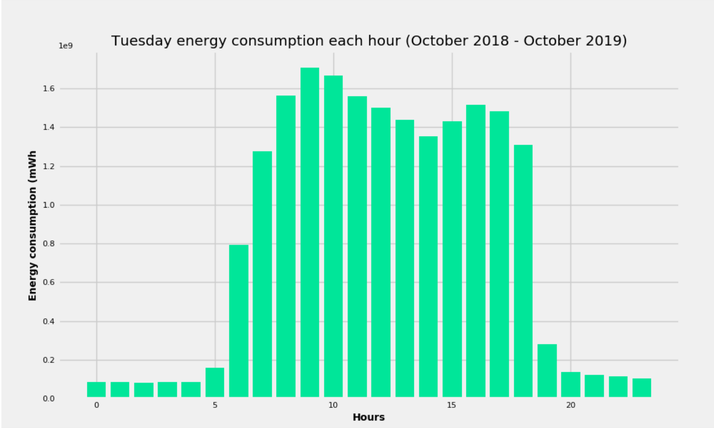


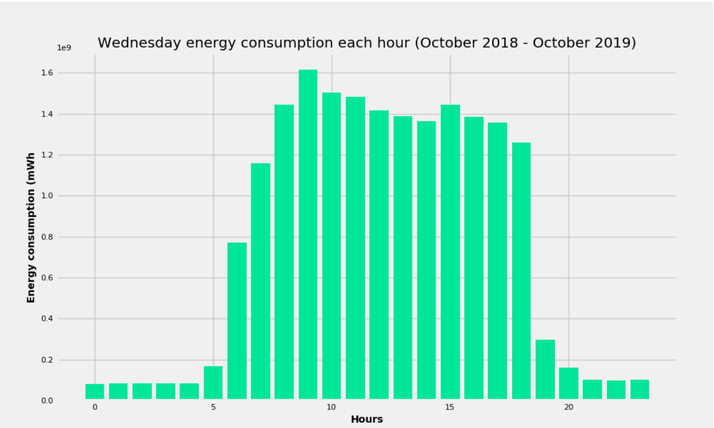


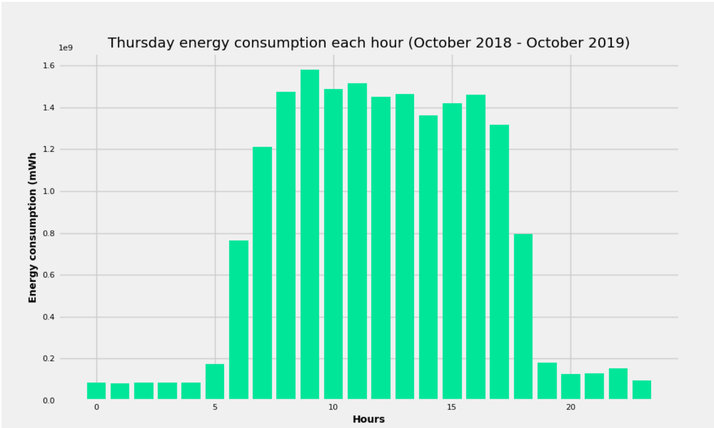
Energy consumption

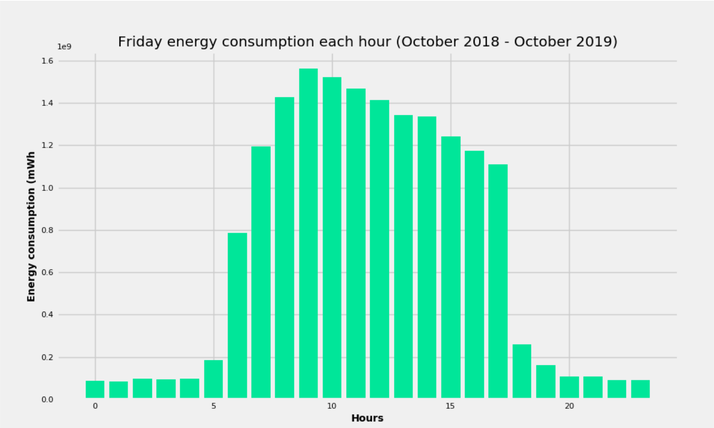
Energy consumption during the weekdays





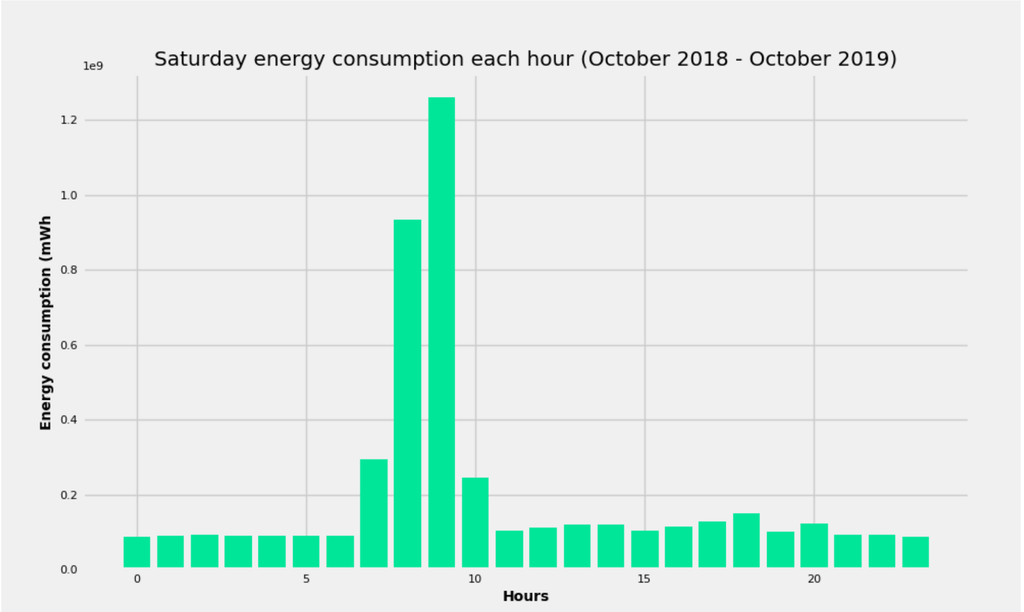


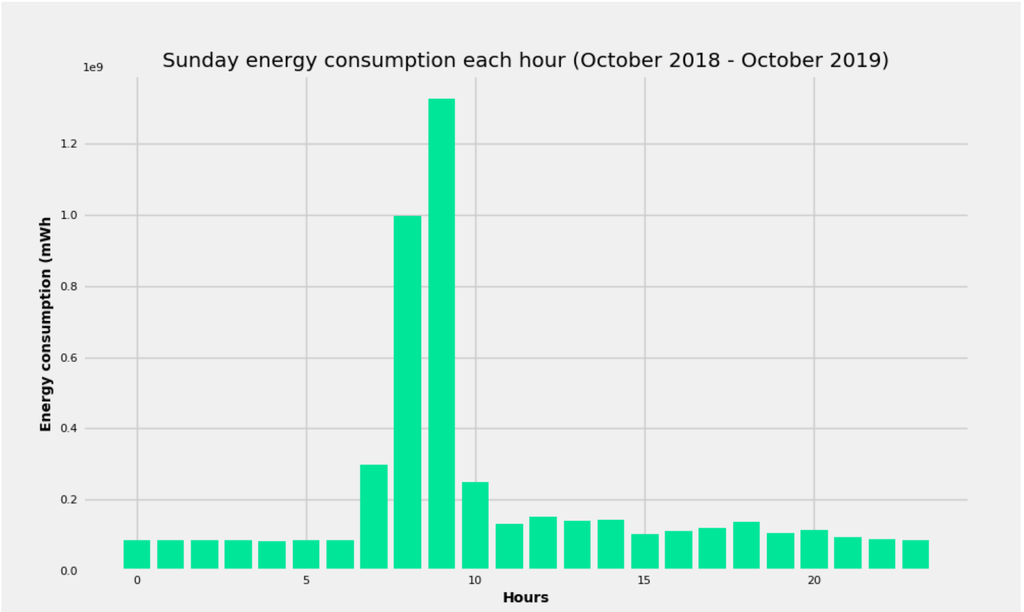


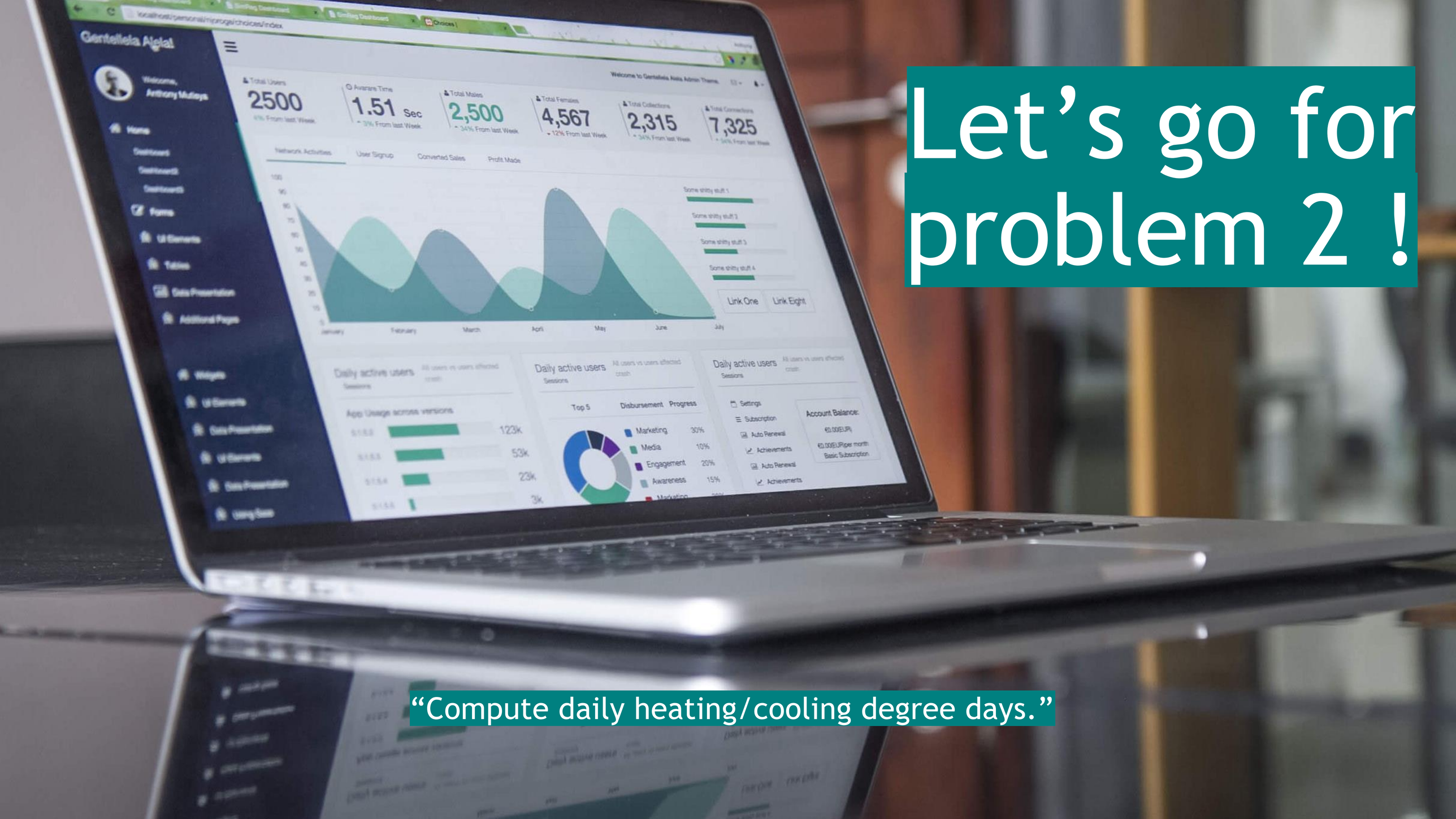


Energy consumption

Energy consumption during the weekend

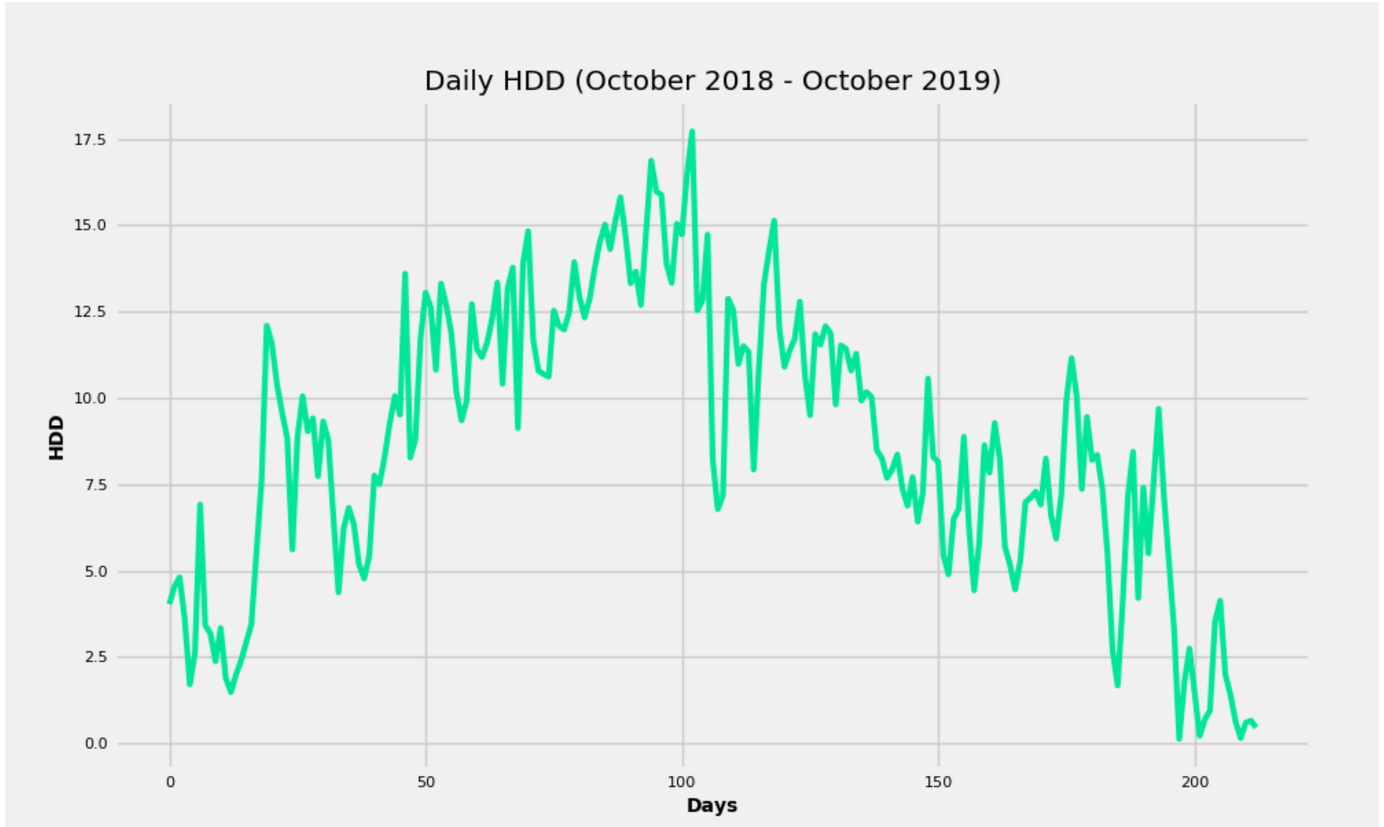





Let’s go for problem 2 !
“Compute daily heating/cooling degree days.”

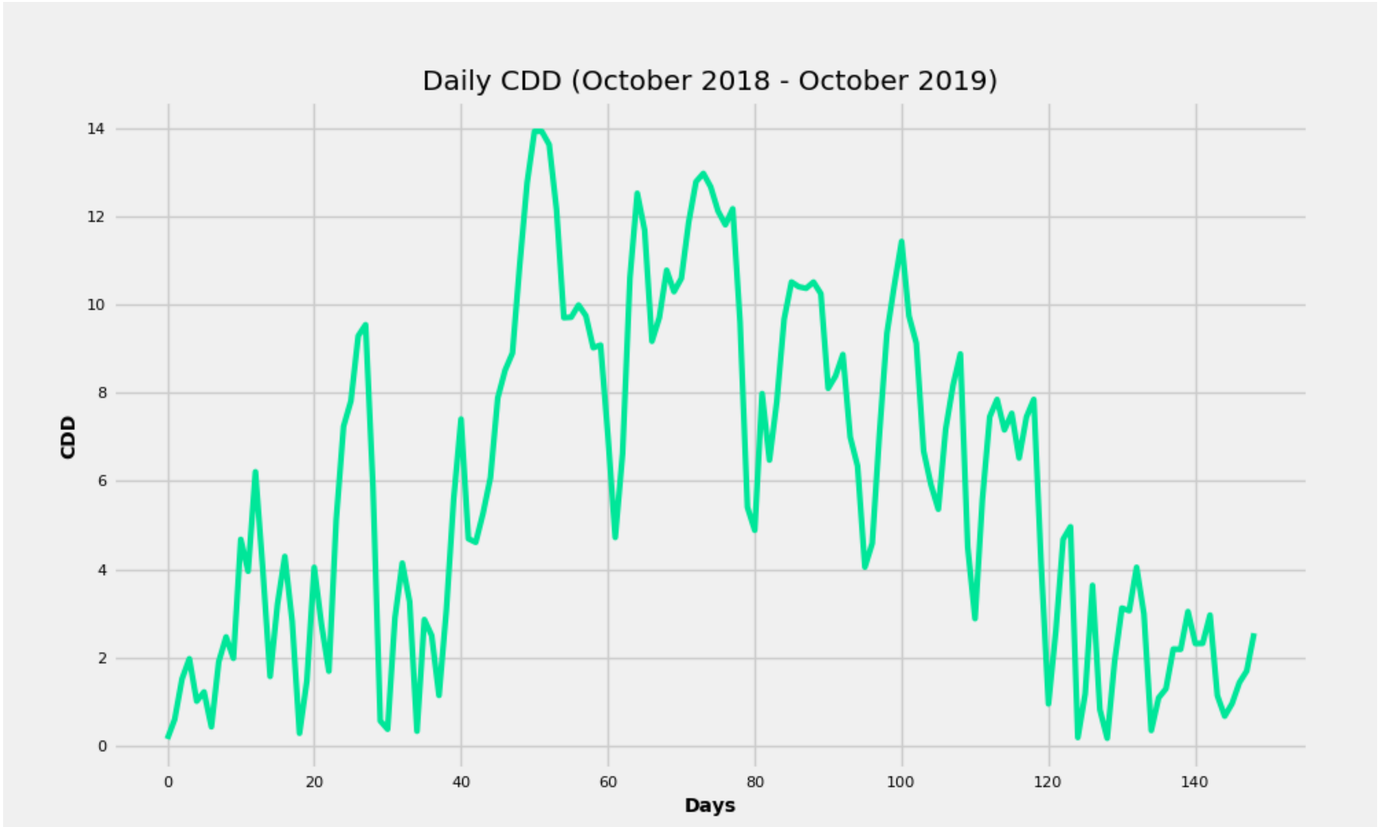
Degree days

Plot the Heating Degree Days (HDD)



Degree days

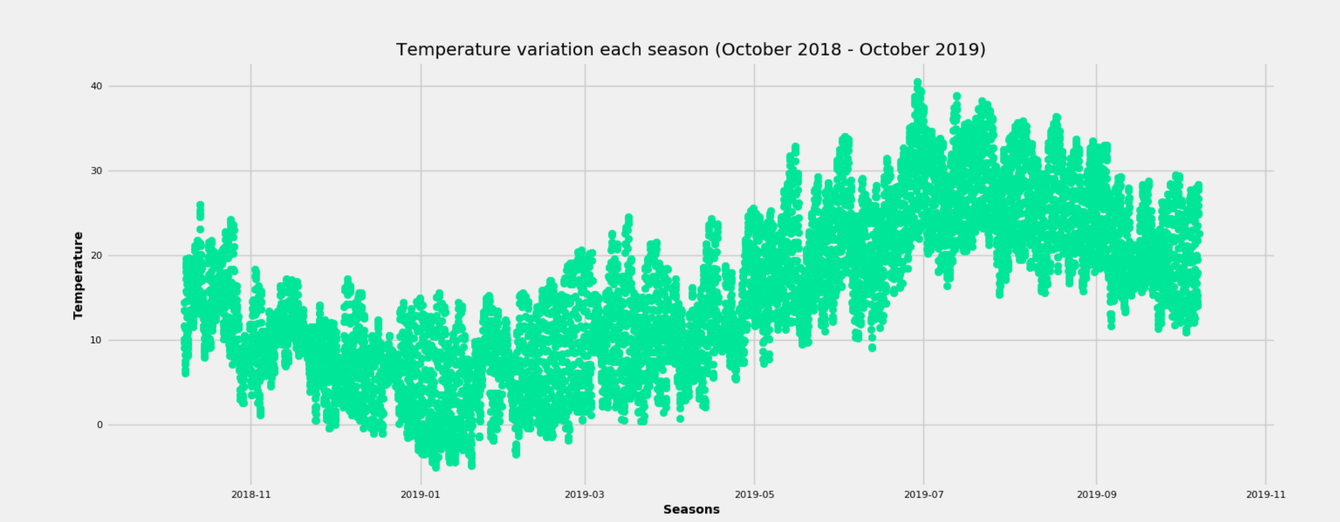
Plot the Cooling Degree Days (CDD)

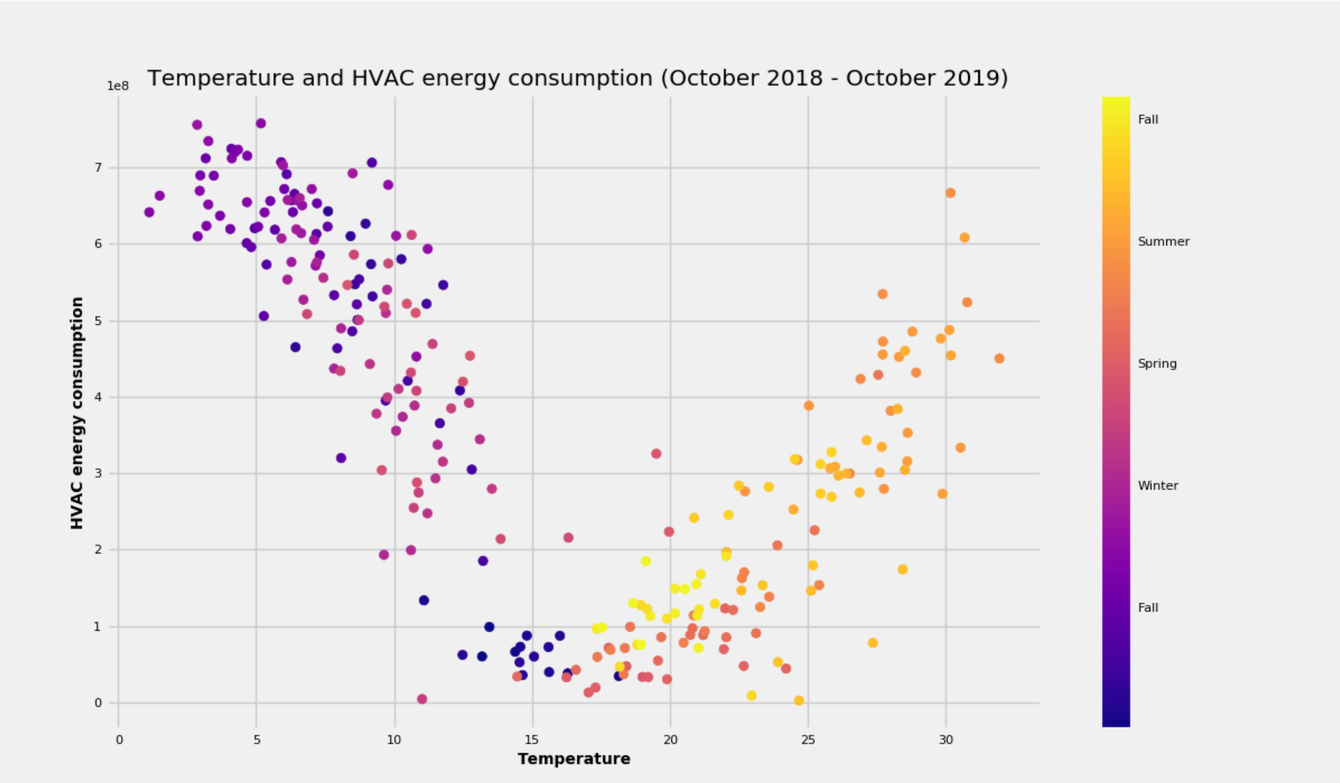


Let’s go for problem 3 !
“Expose statistical relationships between the variables”

Statistical relationships

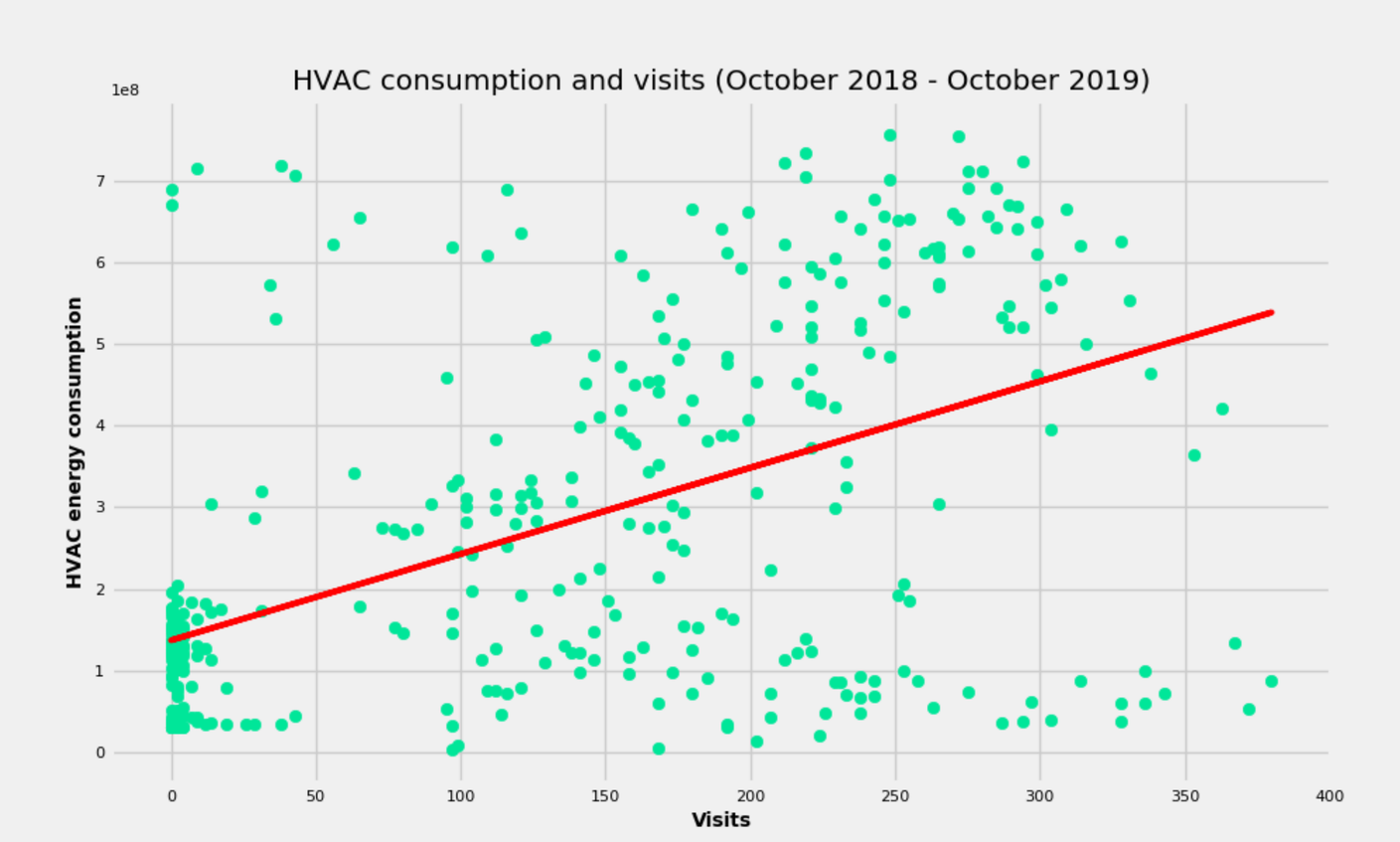
Temperature variations with time





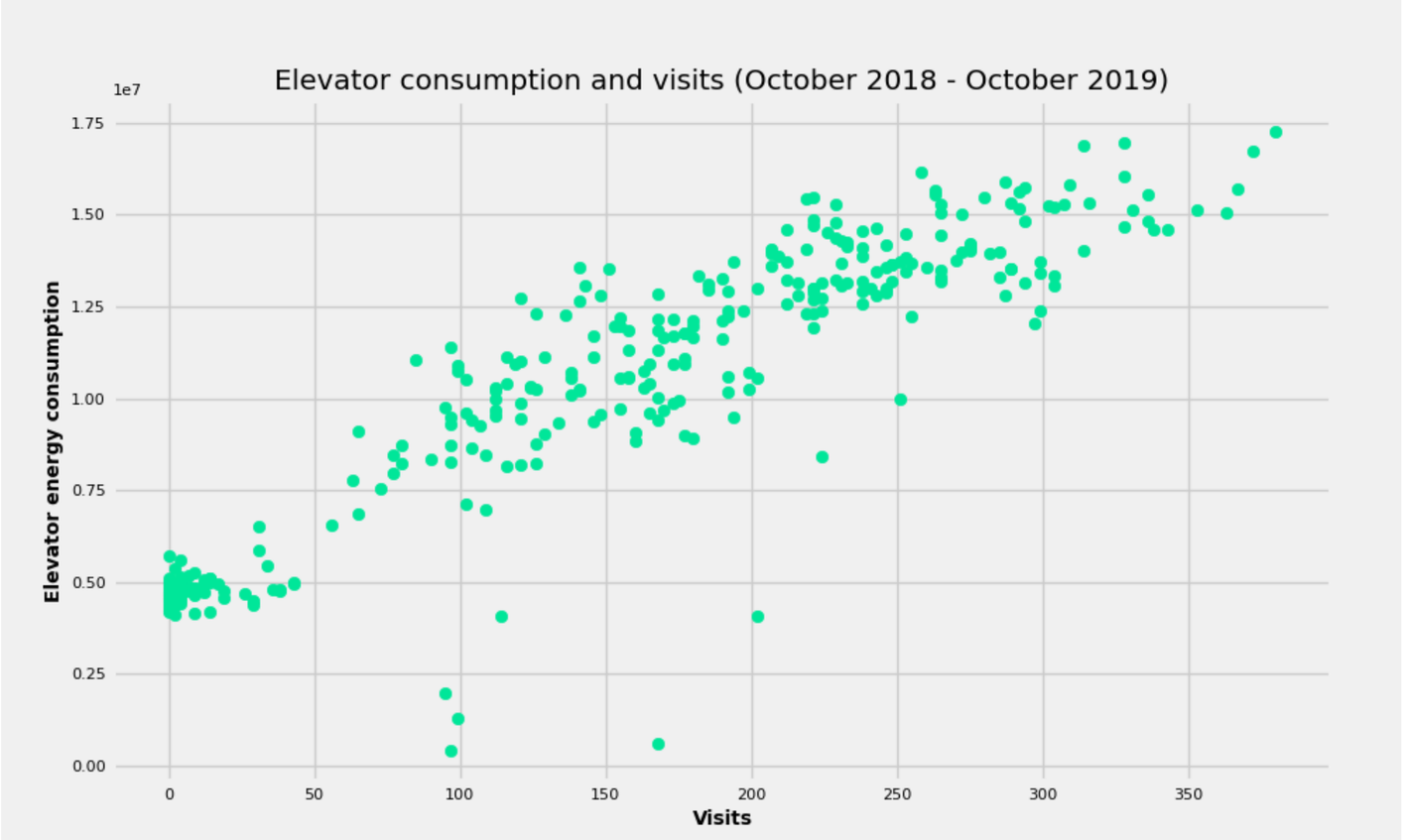
Statistical relationships

HVAC energy consumption and number of visits



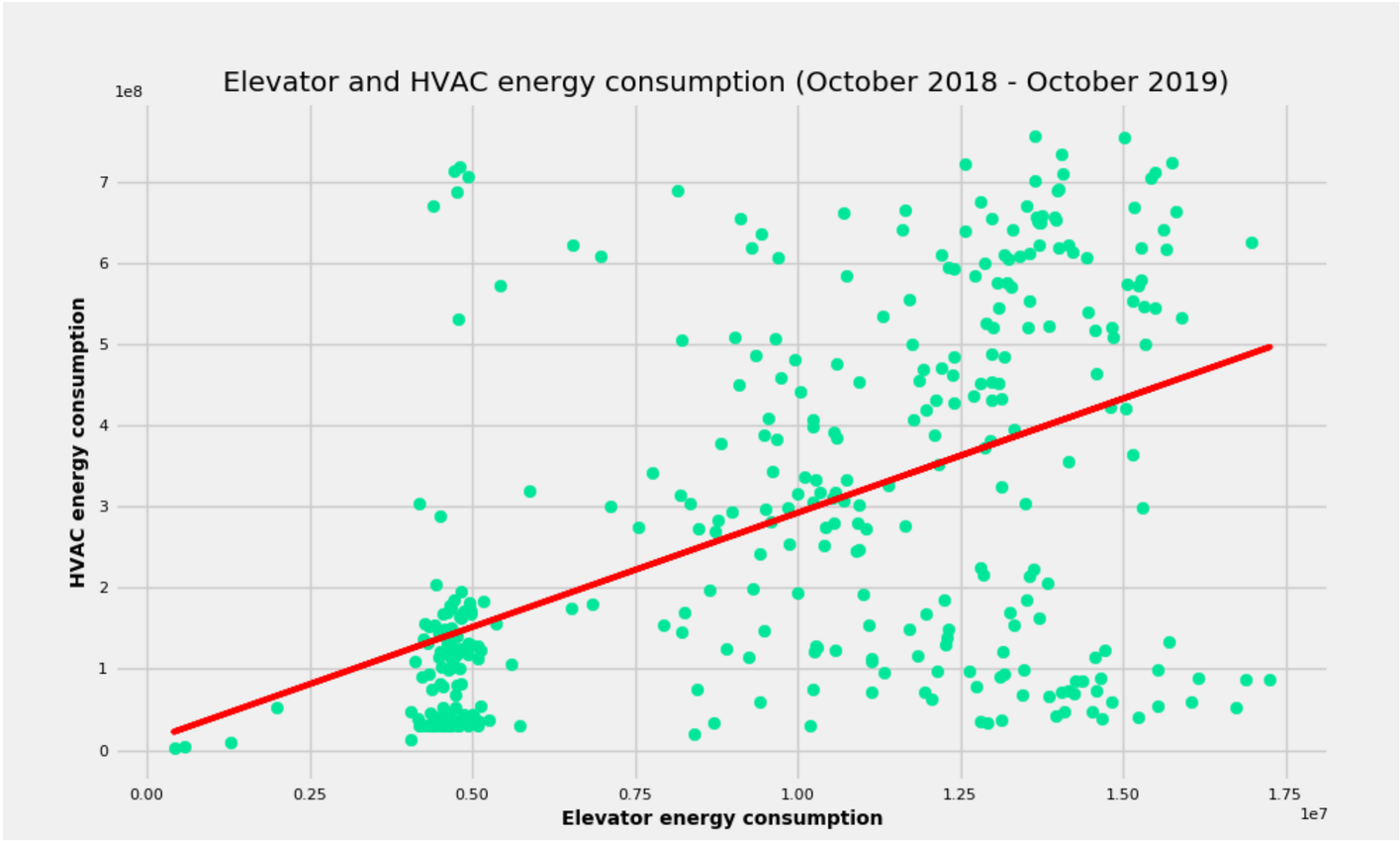
Statistical relationships

Elevator energy consumption and number of visits



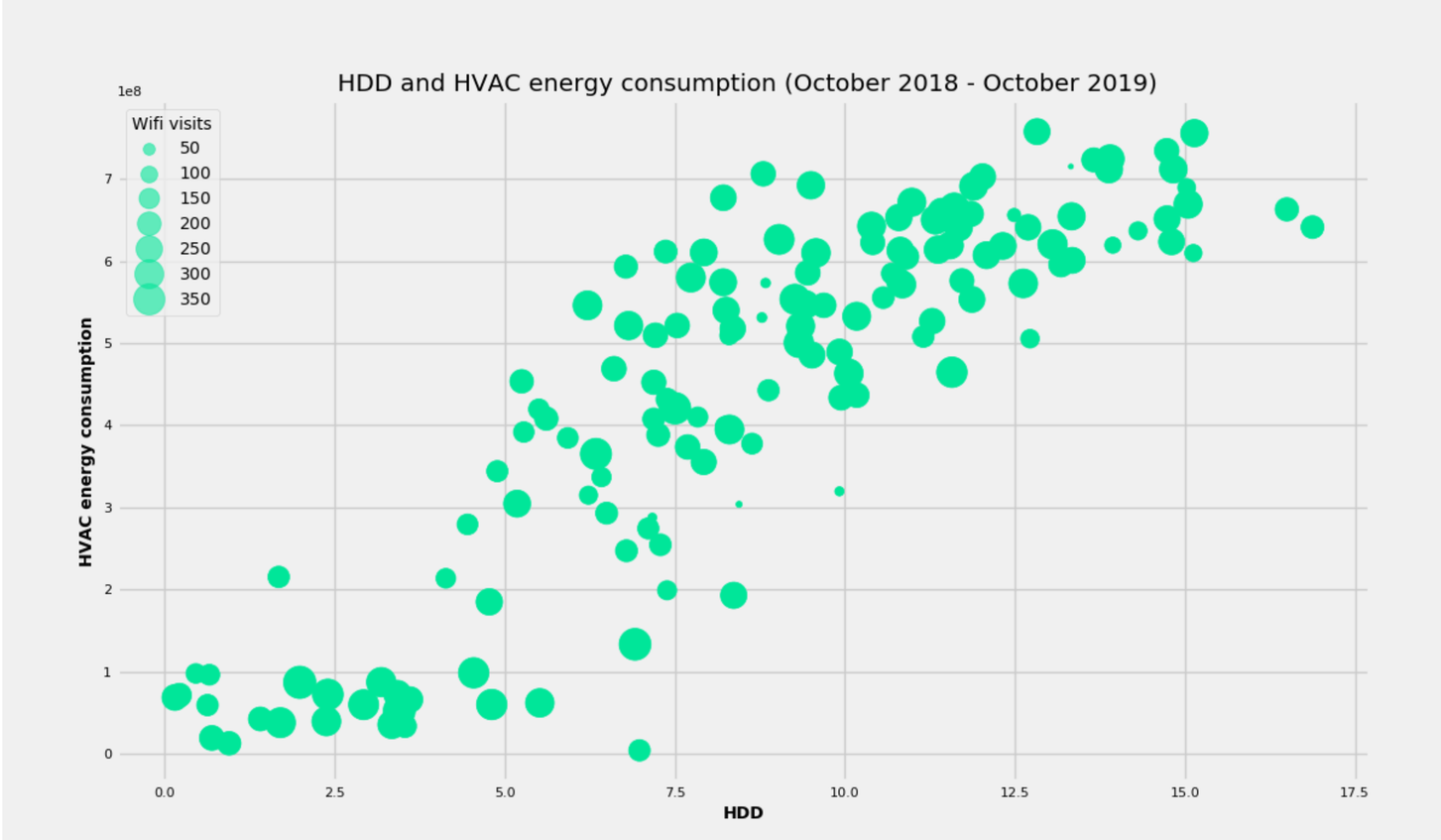
Statistical relationships

Elevator energy consumption and HVAC energy consumption



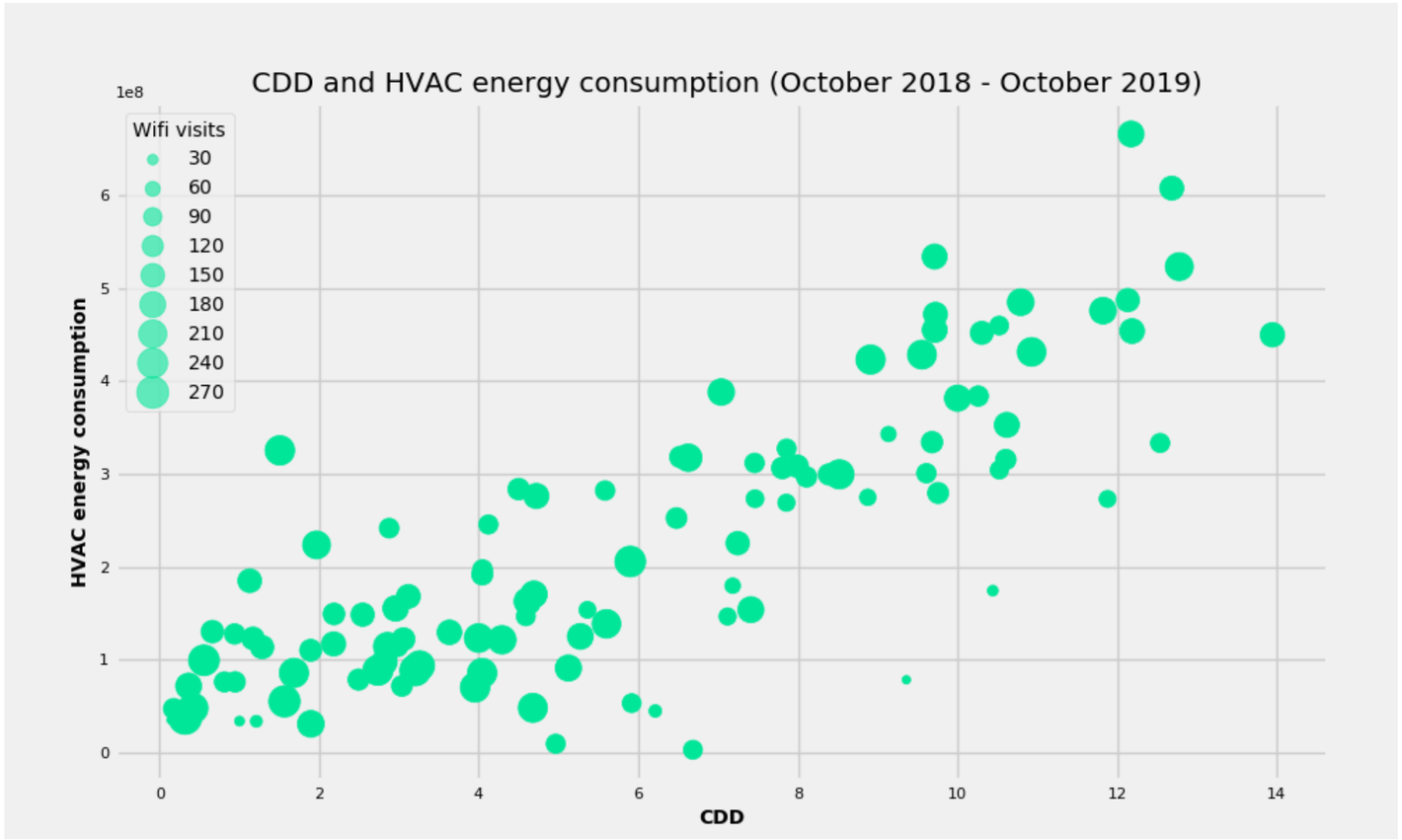
Statistical relationships

HDD, HVAC energy consumption and number of visits



Statistical relationships

CDD, HVAC energy consumption and number of visits

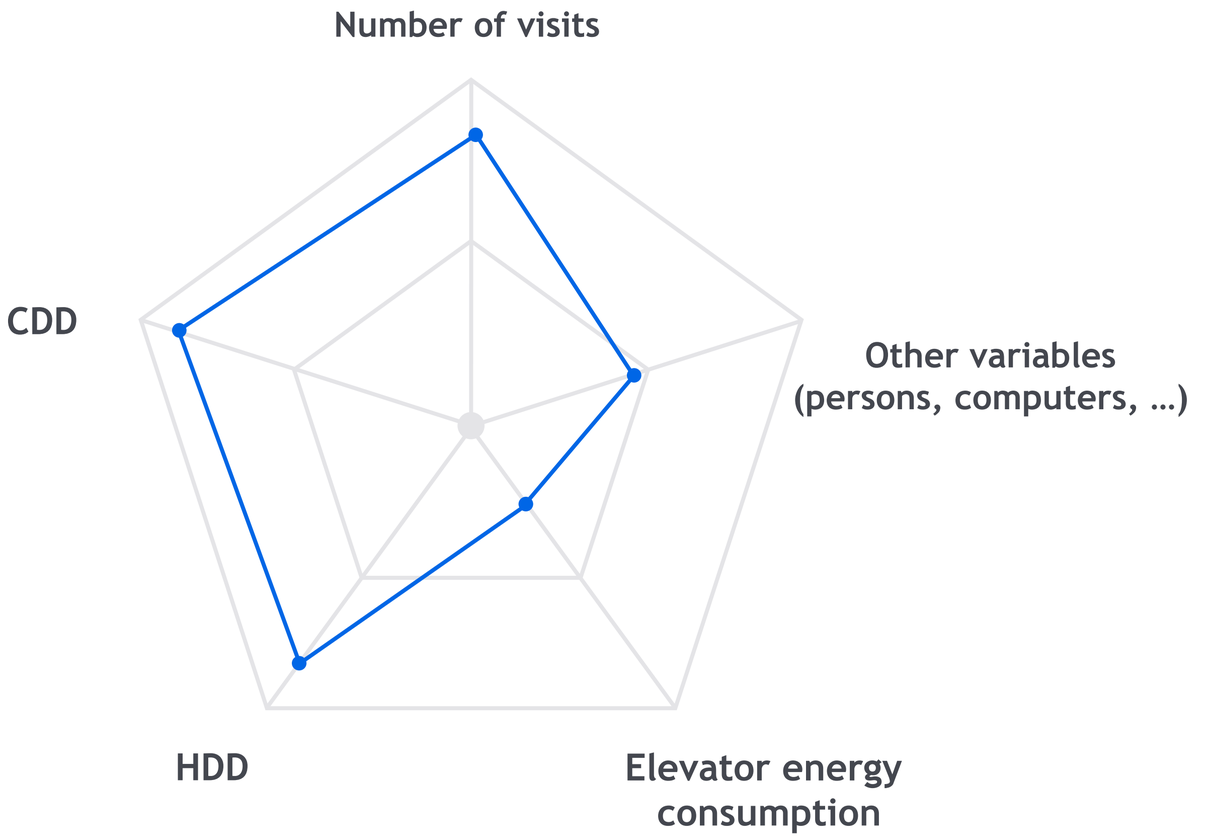


Let’s go for problem 4 !
“Can we optimize the energy consumption of the HVAC system and the building thermal comfort ?”

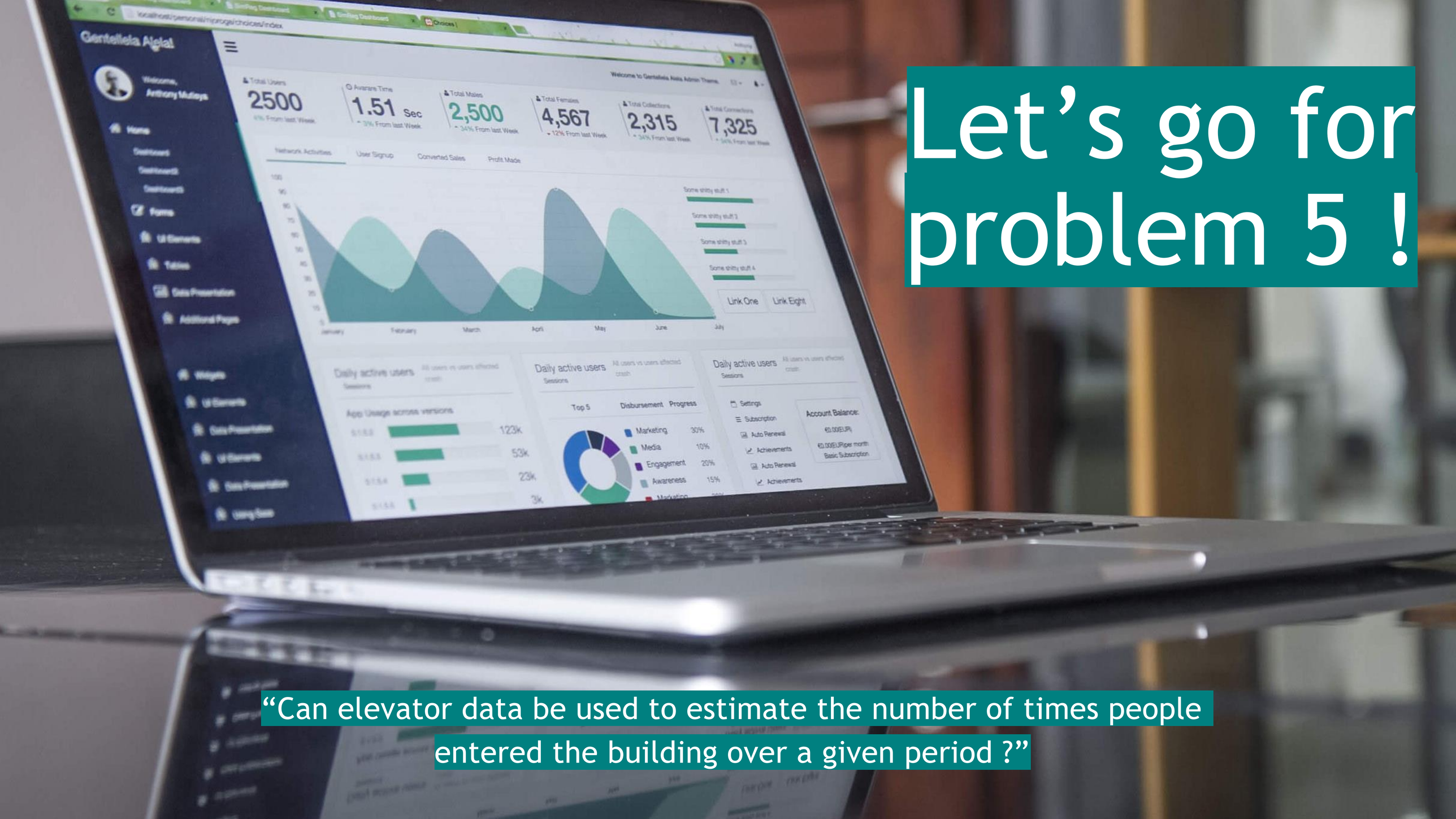
Optimization for **HVAC system**

Is the data provided sufficient to start optimizing the energy consumption of the HVAC system and thermal comfort ?
Suggest possible actions to undertake in order to reduce the energy consumption of the HVAC system while maintaining or improving thermal comfort.

What other variables should be measured in order to realize this goal ?



Legend :
Center : unrelated to HVAC energy consumption
Extremity : related to HVAC energy consumption


Let’s go for problem 5 !
“Can elevator data be used to estimate the number of times people entered the building over a given period ?”

Elevator data alone

To what extent can elevator data alone be used to estimate the number of times people entered the building over a given day ?

Elevator data and visits

Is it possible to estimate the number of times people entered the building over a given hour using available data?

Example

We can use wifi visits to estimate the amount of persons inside the building at a given hour.
The following code is an example :

```
energy_for_one_day = elevator['consumption'][0]
energy_at_this_hour = eec['energy_consumed'][16]
visits_for_one_day = wifi['visits'][0]
persons_inside = int((energy_at_this_hour / energy_for_one_day) * visits_for_one_day)
date = str(eec['local_time'][16].year) + "-" + str(eec['local_time'][16].month) + "-" + str(eec['local_time'][16].day)
print("Persons inside on the : " + date + " at " + str(eec['local_time'][16].hour) + "H : " + str(persons_inside))
```

Images Sources

- Slide 1 : Photo by Chris Barbalis on Unsplash
- Slide 2 : Photo by Alexandre Debiève on Unsplash
- Transition slides : Photo by Carlos Muza on Unsplash
- Last slide : Photo by Kelly Sikkema on Unsplash

thanks!
Tombow ABT
Acid Free
N15