**USER DOCUMENTATION**

1. **Dependencies Required to run the code:**
   1. python3 - <https://www.python.org/downloads/>
   2. jupyter notebook - <https://jupyter.org/install>
   3. pandas library - <https://pandas.pydata.org/getting_started.html>
   4. matplotlib library - https://matplotlib.org/users/installing.html#
2. **Investigations:** 
   1. **Power Usage Investigation**
      1. **Overview, Purpose & Features**

In this investigation, we have access to data collected from the readings of a power meter.

Based on the weekly meter readings, we will investigate if there is a pattern found in each hour of a day or each day of week for usage of electricity based on units.

The Purpose of this Investigation is to understand if we can infer from the data about the relation between the day of week and consumption of electricity.

There are some plots which help us understand about the units consumed for each hour of day. We will also see how many units are consumed each day and how pattern ends during the weekends.

* + 1. **Code overview, features & implementation**

In the code, we read the input file which is a csv, into pandas dataframe and since the datetime format is not suited for calculations, we converted it into standard “%d-%m-%Y %H:%M:%S” for better analysis while reading file into dataframe.

We then plot datetime against meter reading using pyplot.plot() function in matplotlib library. Then we extract date from datetime. This may help us to calculate aggregated usage units each day and may help us in carrying out analysis using pattern found in the week.

Then we calculate total units consumed for each day by getting max reading for each day and subtracting it to max unit of previous day and add new column in dataframe as units. This column identifies as number of units consumed for that day. We keep only the max reading of the day and units consumed calculated for that day.

We also get the day of the week based on the date. Based on the fields that we calculated, we then plot subplots using matplotlib for:

* Date vs units consumed
* Date vs Max meter reading for the day

We also plot bar graph for day of week vs units consumed.

* + 1. **How to use program?**

1. Open terminal, go to your code location and Open Jupyter Notebook using the command in terminal:

jupyter-notebook

2. Open the “Power Usage.ipynb” file in Jupyter Notebook.

3. Run the complete script by clicking on Cell Menu -> Run All.

* 1. **Power Modelling Investigation**
     1. **Overview, Purpose & Features**

In this investigation, we have a new file with information on the appliances in a house of various power ratings, usage of each appliance for each hour and the number of residents in the house.

The purpose of this investigation is to identify the appliances which have major impact on power consumption in the house. Also, to investigate how usage hours and power units of an appliance effect the power consumption in a house.

We will also introduce pricing of solar and electricity and compare how our costs would look with solar vs electricity with current hourly run rate of appliances.

The analysis includes various plots which would help us in understanding the Power usage per appliance and usage in hours for the day. We also have another plot which will indicate the differences in the cost if solar power is used in the house.

* + 1. **Code overview, features & implementation**

In the code, we read the input file and transform into 2-dimensional format so that it is easier for analysis and put the data into pandas dataframe. We then split the hourly usage to columns so they can be used in analysis.

Then we add new column in the dataframe for total hours for each appliance and also for power consumption in kWh using hours and power rating of appliances.

We then add two Subplots for power usage per appliance:

Hourly usage per appliance, and

Power consumption per appliance

This will give an idea how each appliance impacts the usage of power in the house.

We also introduce external information, ie. solar and electricity rate. Then, we calculate rates for each appliance and plot rates for solar & electricity.

* + 1. **How to use program?**

1. Open terminal, go to your code location and Open Jupyter Notebook using the command in terminal:

jupyter-notebook

2. Open the “Power Usage.ipynb” file in Jupyter Notebook.

3. Run the complete script by clicking on Cell Menu -> Run All.

* 1. **Power simulation Investigation**
     1. **Overview, Purpose & Features**

In this investigation, we have access to file as in Investigation 2 but for multiple houses in a locality.

This will help us investigate for an electricity provider, like how we can customize power distribution so that there is a balanced load, and no shortage of electricity. Also, as a homeowner, if opting for alternate sources would help in cost reduction and less frequent power cuts.

The purpose of this investigation is to compare and analyze power usage of electricity in a locality, identify power loads and any provide a solution that would benefit both electricity providers and homeowners.

The analysis includes plots which would help to visualize how various appliances are used in all houses of a locality. Also, we will see how much annually each house can save their money in their electricity if opted for Solar power.

* + 1. **Code overview, features & implementation**

In the code, we read all files of the houses in the locality and transform them into 2-dimensional format so they can be easily imported into pandas dataframe.

Then we create columns in dataframe for total usage hours of appliances, no of resident, and house no which identifies each house.

Then we create subplots for each house representing appliances and their hourly usage.

We then add new calculated columns - consumption per year in kWh, annual solar rate, annual electricity rate for each appliance for each house based on external information on price per kWh for solar and electricity.

We then plot for comparing solar vs electricity annual charges for each house

We calculate and add new column for annual charges % savings.

* + 1. **How to use program?**

1. Open terminal, go to your code location and Open Jupyter Notebook using the command in terminal:

jupyter-notebook

2. Open the “Power Usage.ipynb” file in Jupyter Notebook.

3. Run the complete script by clicking on Cell Menu -> Run All.