# SOLAR PLANT DATA ANALYSIS USING MATLAB

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## ● Objective

Apply MATLAB skills to analyze a dataset containing information about weather conditions and electrical consumption. Explore the potential of solar power plant integration based on the given data

## ● Dataset

The inputs for this project are two files; weather.csv and consumption.csv. This data represents a dataset of actual weather conditions measurement and electrical consumption.

# DATA EXTRACTION

**BEFORE**

| time | value |
|---|---|
| '2022-07-25T02:00:00Z' | 2.2781 |
| '2022-07-04T21:45:00Z' | 2.3877 |
| '2022-06-14T17:45:00Z' | 1.8432 |
| '2022-07-28T14:30:00Z' | 9.4926 |
| '2022-07-29T13:00:00Z' | 11.3547 |
| '2022-06-22T05:30:00Z' | 12.0973 |
| '2022-06-12T10:45:00Z' | 2.4089 |
| '2022-08-13T14:45:00Z' | 2.6234 |
| '2022-08-12T04:45:00Z' | 10.8725 |
| '2022-07-02T04:45:00Z' | 2.2881 |
| '2022-08-02T05:30:00Z' | 11.0473 |

**AFTER**

| time | value |
|---|---|
| 25-Jul-2022 02:00:00 | 2.2781 |
| 04-Jul-2022 21:45:00 | 2.3877 |
| 14-Jun-2022 17:45:00 | 1.8432 |
| 28-Jul-2022 14:30:00 | 9.4926 |
| 29-Jul-2022 13:00:00 | 11.3547 |
| 22-Jun-2022 05:30:00 | 12.0973 |
| 12-Jun-2022 10:45:00 | 2.4089 |
| 13-Aug-2022 14:45:00 | 2.6234 |
| 12-Aug-2022 04:45:00 | 10.8725 |
| 02-Jul-2022 04:45:00 | 2.2881 |
| 02-Aug-2022 05:30:00 | 11.0473 |

**Convert the timestamp information to the proper format and set it as the row times.**

# HANDLING NAN VALUES

I implemented a method to handle NaN values that consists in calculating the average value and sobstituiting it to the where there's a NaN

```
% Set the NaN values to the average value since interp1 is not working
aveage = mean(consumption.value(~isnan(consumption.value)));
consumption.value = fillmissing(consumption.value, 'constant', aveage);
```

# DATA JOINING

**Join the weather and consumption tables based on the shared timestamp.**

| time | value |
|---|---|
| 07-Jun-2022 22:15:00 | 6.4192 |
| 07-Jun-2022 22:30:00 | 1.8163 |
| 07-Jun-2022 22:45:00 | 1.8163 |
| 07-Jun-2022 23:00:00 | 6.4192 |
| 07-Jun-2022 23:15:00 | 1.8163 |
| 07-Jun-2022 23:30:00 | 1.8163 |
| 07-Jun-2022 23:45:00 | 1.8163 |
| 08-Jun-2022 00:00:00 | 1.8163 |
| 08-Jun-2022 00:15:00 | 1.8163 |
| 08-Jun-2022 00:30:00 | 6.4192 |
| 08-Jun-2022 00:45:00 | 1.8163 |

| time | cloudCover | humidity | precipitation | solarGHI | temperature | temperature | windSpeed |
|---|---|---|---|---|---|---|---|
| 07-Jun-2022 22:15:00 | 100 | 78 | 0 | 0 | 15.1300 | 15.1300 | 0.5000 |
| 07-Jun-2022 22:30:00 | 100 | 78.5000 | 0 | 0 | 14.8950 | 14.8950 | 0.5000 |
| 07-Jun-2022 22:45:00 | 100 | 79 | 0 | 0 | 14.6600 | 14.6600 | 0.5000 |
| 07-Jun-2022 23:00:00 | 100 | 79.5000 | 0 | 0 | 14.4250 | 14.4250 | 0.5000 |
| 07-Jun-2022 23:15:00 | 100 | 80 | 0 | 0 | 14.1900 | 14.1900 | 0.5000 |
| 07-Jun-2022 23:30:00 | 100 | 80.5000 | 0 | 0 | 13.9700 | 13.9700 | 0.5775 |
| 07-Jun-2022 23:45:00 | 100 | 81 | 0 | 0 | 13.7500 | 13.7500 | 0.6550 |
| 08-Jun-2022 00:00:00 | 100 | 81.5000 | 0 | 0 | 13.5300 | 13.5300 | 0.7325 |
| 08-Jun-2022 00:15:00 | 100 | 82 | 0 | 0 | 13.3100 | 13.3100 | 0.8100 |
| 08-Jun-2022 00:30:00 | 99.5000 | 82 | 0 | 0 | 13.3100 | 13.3100 | 0.7650 |
| 08-Jun-2022 00:45:00 | 99 | 82 | 0 | 0 | 13.3100 | 13.3100 | 0.7200 |

| time | cloudCover | humidity | precipitationl | solarGHI | temperature | temperature | windSpeed | value |
|---|---|---|---|---|---|---|---|---|
| 07-Jun-2022 22:15:00 | 100 | 78 | 0 | 0 | 15.1300 | 15.1300 | 0.5000 | 6.4192 |
| 07-Jun-2022 22:30:00 | 100 | 78.5000 | 0 | 0 | 14.8950 | 14.8950 | 0.5000 | 1.8163 |
| 07-Jun-2022 22:45:00 | 100 | 79 | 0 | 0 | 14.6600 | 14.6600 | 0.5000 | 1.8163 |
| 07-Jun-2022 23:00:00 | 100 | 79.5000 | 0 | 0 | 14.4250 | 14.4250 | 0.5000 | 6.4192 |
| 07-Jun-2022 23:15:00 | 100 | 80 | 0 | 0 | 14.1900 | 14.1900 | 0.5000 | 1.8163 |
| 07-Jun-2022 23:30:00 | 100 | 80.5000 | 0 | 0 | 13.9700 | 13.9700 | 0.5775 | 1.8163 |
| 07-Jun-2022 23:45:00 | 100 | 81 | 0 | 0 | 13.7500 | 13.7500 | 0.6550 | 1.8163 |
| 08-Jun-2022 00:00:00 | 100 | 81.5000 | 0 | 0 | 13.5300 | 13.5300 | 0.7325 | 1.8163 |
| 08-Jun-2022 00:15:00 | 100 | 82 | 0 | 0 | 13.3100 | 13.3100 | 0.8100 | 1.8163 |
| 08-Jun-2022 00:30:00 | 99.5000 | 82 | 0 | 0 | 13.3100 | 13.3100 | 0.7650 | 6.4192 |
| 08-Jun-2022 00:45:00 | 99 | 82 | 0 | 0 | 13.3100 | 13.3100 | 0.7200 | 1.8163 |

# DATA VISUALIZATION

Create a subplot with two plots: one for solar GHI and another for electrical consumption.
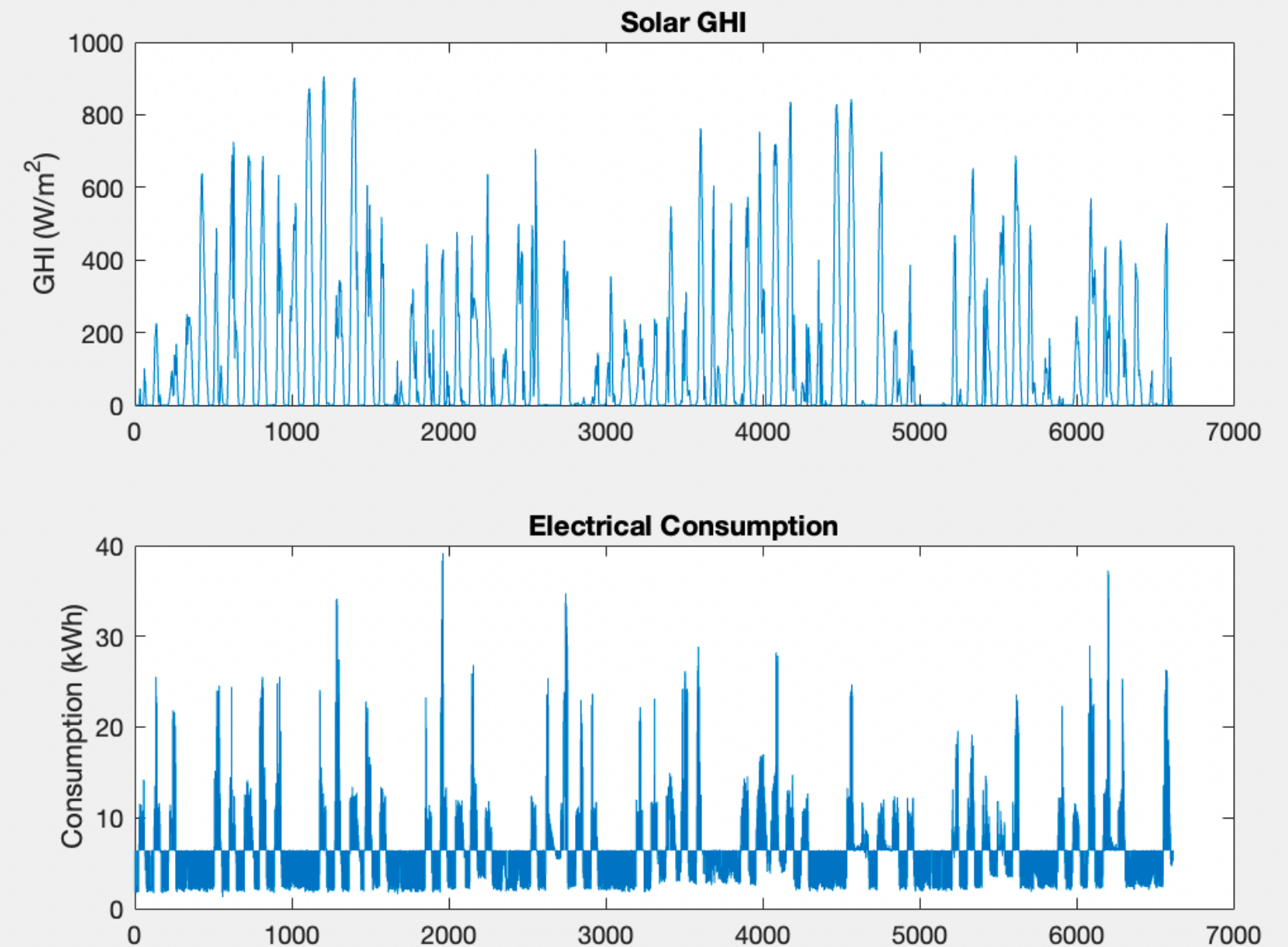
# RESAMPLING

## DAILY

| Time | Sum |
|------|------|
| 07-Jun-2022 | 21.9200 |
| 08-Jun-2022 | 523.9378 |
| 09-Jun-2022 | 662.6388 |
| 10-Jun-2022 | 670.5432 |
| 11-Jun-2022 | 411.8900 |
| 12-Jun-2022 | 421.9358 |
| 13-Jun-2022 | 745.9072 |
| 14-Jun-2022 | 584.9701 |
| 15-Jun-2022 | 645.9179 |
| 16-Jun-2022 | 802.5010 |

## WEEKLY

| Time | Sum |
|------|------|
| 05-Jun-2022 | 2.2909e+03 |
| 12-Jun-2022 | 4.3492e+03 |
| 19-Jun-2022 | 4.3151e+03 |
| 26-Jun-2022 | 4.2204e+03 |
| 03-Jul-2022 | 4.3340e+03 |
| 10-Jul-2022 | 4.5841e+03 |
| 17-Jul-2022 | 4.4704e+03 |
| 24-Jul-2022 | 4.1367e+03 |
| 31-Jul-2022 | 4.1080e+03 |
| 07-Aug-2022 | 4.5210e+03 |

**Resample the data using retime() to obtain total daily and weekly consumption.**

```
newTable = timetable(weatherconsumption.time, weatherconsumption.value);
dailyTotal = retime(newTable, 'daily', 'sum');
weeklyTotal = retime(newTable, 'weekly', 'sum');
```
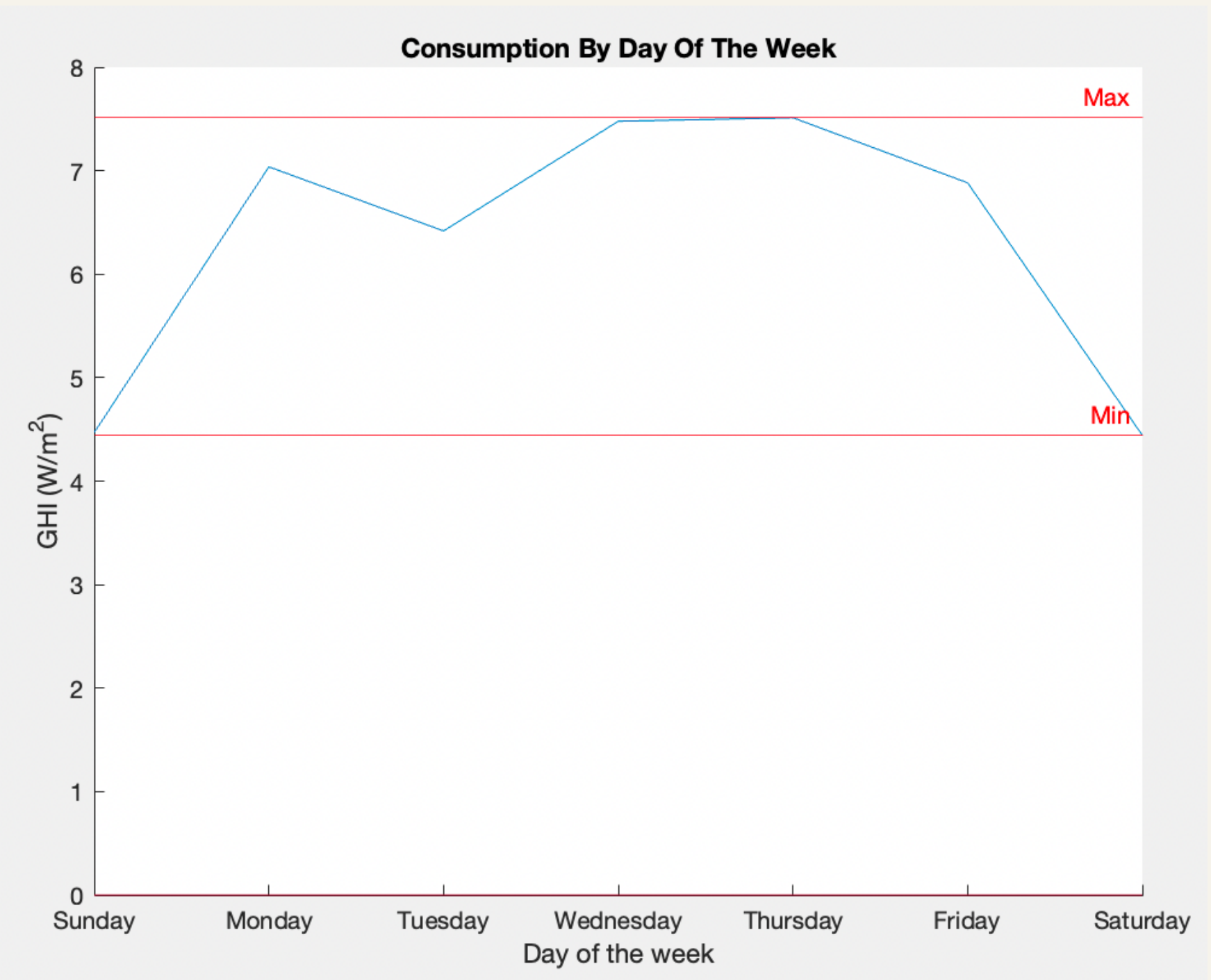
# GROUPING AND ANALYSIS

**1** Apply groupsummary() to evaluate total consumption by day of the week

**2** Plot the average and deviation of consumption by day of the week

**3** Identify and annotate vertical lines for the maximum and minimum day of the week consumption



Consumption By Day Of The Week

# INTEGRATION WEEK/DAY

| | 1<br>Time | 2<br>Consumption | 3<br>DoF | 4<br>WeekOfYear |
|---|---|---|---|---|
| 1 | 07-Jun-2022 22:... | 6.4192 | 3 | 24 |
| 2 | 07-Jun-2022 22:... | 1.8163 | 3 | 24 |
| 3 | 07-Jun-2022 22:... | 1.8163 | 3 | 24 |
| 4 | 07-Jun-2022 23:... | 6.4192 | 3 | 24 |
| 5 | 07-Jun-2022 23:... | 1.8163 | 3 | 24 |
| 6 | 07-Jun-2022 23:... | 1.8163 | 3 | 24 |
| 7 | 07-Jun-2022 23:... | 1.8163 | 3 | 24 |
| 8 | 08-Jun-2022 00:... | 1.8163 | 4 | 24 |
| 9 | 08-Jun-2022 00:... | 1.8163 | 4 | 24 |
| 10 | 08-Jun-2022 00:... | 6.4192 | 4 | 24 |
| 11 | 08-Jun-2022 00:... | 1.8163 | 4 | 24 |
| 12 | 08-Jun-2022 01:... | 1.8163 | 4 | 24 |
| 13 | 08-Jun-2022 01:... | 1.8163 | 4 | 24 |

**Retrieve week number and day of the week as new parameters**

# TOTAL WEEKLY CONSUMPTION

- **Plot and visualize the total weekly consumption**

- **Save the total weekly consumption data in a CSV file**

| DoF | GroupCount | sum_Var1 |
|-----|------------|----------|
| 1 | 960 | 4290.3 |
| 2 | 945 | 6755.5 |
| 3 | 871 | 6160.9 |
| 4 | 960 | 7178.7 |
| 5 | 960 | 7210.9 |
| 6 | 960 | 6607.4 |
| 7 | 960 | 4265.3 |

csv

dayOfWeekConsumption.csv

# THANK YOU

**Presented By : Stefano Gentile**