**Instructions Manual**

**This documentation provides usage instructions for the transformer overloading evaluation algorithm with selected heat pump and EV penetration levels.**

1. **Data Preparation:**

* You need to prepare 2 Excel files in the “.xlsx” extension:

1. RAW\_AMI.xlsx
2. RAW\_TC.xlsx

* **RAW\_AMI.xlsx:**

This is the file to store one-year hourly AMI data for all the customers in a feeder. The format of the file is as follows:

Headers: Time, Meter ID.

A table of numbers with numbers

Description automatically generated with medium confidence

Data Format:

Time: MM/DD/YYYY hh:mm

Meter ID: Meter ID, can be a string

* **RAW\_TC.xlsx**

This is the file to store transformer specifications and transformer-customer connectivity in a feeder. The format of the file is as follows:

A screenshot of a table

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Headers: Meter ID, Transformer ID, Transformer size (KVA)

Data Format:

Meter ID: Meter ID labels are identical to AMI data.

Transformer ID: Transformer ID that the meter is connected to (string).

Transformer Size: transformer kVA; the picture shows the format that CFU provided, but it can also be a single-digit number to represent the KVA rating.

1. **Algorithm Usage:**

Open **Raw Data processing.py** to generate input data. You should get two files: **AMI\_Data.xlsx** and **transformer\_customer\_info.xlsx**.

Open **Customer profile** **Gen\_EV\_HP.py** for aggregated load profile generation. You need to specify the penetration level (percentage) of the EV and heat pump (They can be zero).

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Run the rest of the code, and you will get a file in the output folder called “Final Aggregated Data\_EVPenLevel\_{Pen\_Level\_EV} and HPPenLevel\_{Pen\_Level\_HP}.xlsx

The value of {Pen\_Level\_EV} and {Pen\_Level\_HP} will be the same as the one you set. You may change the penetration level and generate multiple profiles.

Next, open **Transformer overloading.py**. Change the Penetration Level to the file that you generated in the previous step.

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Run the rest of the code, you will get an Excel file in the output folder called “Transformer\_Load\_Analysis\_Results\_pen\_level\_{Pen\_Level\_EV} and {Pen\_Level\_HP}.xlsx” with your specified penetration levels.

This file contains three sheets. The first one is the maximum load per transformer over a year. The second one is the count of overloads per transformer over a year. The third one is the monthly overload breakdown for each transformer.