

MACHINE LEARNING (EV)

***For More
Info :***

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In [1]:

```
pip install pandas numpy matplotlib seaborn scikit-learn prophet
```

Requirement already satisfied: pandas in c:\users\dell\appdata\local\program
s\python\python314\lib\site-packages (2.3.3)

Requirement already satisfied: numpy in c:\users\dell\appdata\local\programs
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ms\python\python314\lib\site-packages (0.13.2)

Collecting scikit-learn

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Collecting prophet

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threadpoolctl>=3.2.0 (from scikit-learn)

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Collecting cmdstanpy>=1.0.4 (from prophet)

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Collecting holidays<1,>=0.25 (from prophet)

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rograms\python\python314\lib\site-packages (from prophet) (4.67.3)

Collecting importlib_resources (from prophet)

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ams\python\python314\lib\site-packages (from python-dateutil>=2.8.2->pandas)
(1.17.0)

Collecting stanio<2.0.0,>=0.4.0 (from cmdstanpy>=1.0.4->prophet)

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Downloading holidays-0.90-py3-none-any.whl (1.4 MB)

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Downloading stanio-0.5.1-py3-none-any.whl (8.1 kB)

Downloading threadpoolctl-3.6.0-py3-none-any.whl (18 kB)

Downloading importlib_resources-6.5.2-py3-none-any.whl (37 kB)

Installing collected packages: threadpoolctl, stanio, importlib_resources, scikit-learn, holidays, cmdstanpy, prophet

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```

Successfully installed cmdstanpy-1.3.0 holidays-0.90 importlib_resources-6.5.2 prophet-1.3.0 scikit-learn-1.8.0 stanio-0.5.1 threadpoolctl-3.6.0
Note: you may need to restart the kernel to use updated packages.

[notice] A new release of pip is available: 25.2 -> 26.0.1
[notice] To update, run: python.exe -m pip install --upgrade pip

```

In [2]: import pandas as pd

sessions = pd.read_csv("charging_sessions.csv")
customers = pd.read_csv("customers.csv") districts = pd.read_csv("districts.csv")

sessions.head()

```

Out[2]: **session_id customer_id station_id session_start_time kwh_charged cost_**

0	S00001	C3806	18	2025-10-04 05:42:00	46.691971
1	S00002	C4931	98	2025-10-19 16:12:00	39.061716
2	S00003	C2250	145	2025-09-14 15:18:00	30.280525
3	S00004	C3790	165	2025-10-06 23:22:00	44.577079
4	S00005	C4834	68	2025-09-26 09:07:00	37.998209

Basic Cleaning

```

In [4]: sessions.drop_duplicates(inplace=True)
sessions['start_time'] = pd.to_datetime(sessions['session_start_time'])

sessions.isnull().sum()

```

```
Out[4]: session_id      0
customer_id    0
station_id     0
session_start_time  0
kwh_charged    0
cost_per_kwh   0
total_cost     0
start_time     0
dtype: int64
```

PART A — FORECASTING DEMAND

```
In [6]: # Step A1 — Aggregate Daily Demand
daily = sessions.groupby(
    sessions['start_time'].dt.date
).size().reset_index(name='sessions')

daily.columns = ['ds', 'y']
daily['ds'] = pd.to_datetime(daily['ds'])
daily['ds']
```

```
Out[6]: 0      2025-08-11
1      2025-08-12
2      2025-08-13
3      2025-08-14
4      2025-08-15
...
85     2025-11-04
86     2025-11-05
87     2025-11-06
88     2025-11-07
89     2025-11-08
Name: ds, Length: 90, dtype: datetime64[ns]
```

```
In [7]: # Step A2 — Train Prophet Model
from prophet import Prophet

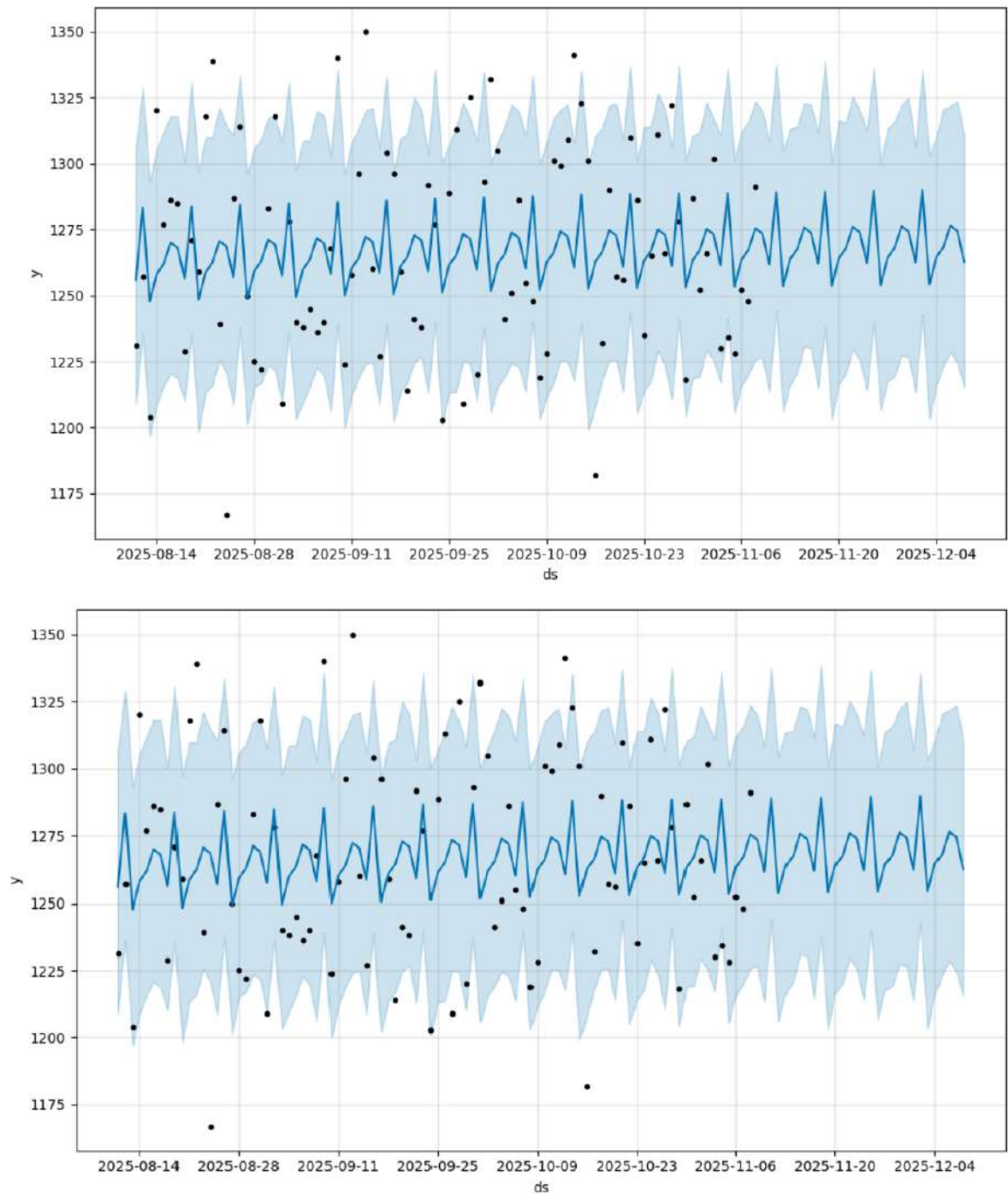
model = Prophet()
model.fit(daily)

future = model.make_future_dataframe(periods=30)
forecast = model.predict(future)

model.plot(forecast)
```

```
C:\Users\DELL\AppData\Local\Programs\Python\Python314\Lib\site-packages\tqdm
\auto.py:21: TqdmWarning: IPProgress not found. Please update jupyter and ipy widgets. See
https://ipywidgets.readthedocs.io/en/stable/user_install.html
  from .autonotebook import tqdm as notebook_tqdm
Importing plotly failed. Interactive plots will not work.
19:26:54 - cmdstanpy - INFO - Chain [1] start processing
19:26:56 - cmdstanpy - INFO - Chain [1] done processing
```

Out[7]:



PART B — REGRESSION (Cost Prediction)

In [12]:

```
#Step B1 — Feature Engineering  
sessions['hour'] = sessions['start_time'].dt.hour  
X = sessions[['kwh_charged','hour']]  
y = sessions['total_cost']
```

In [13]:

```
# Step B2 — Train Model
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestRegressor
from sklearn.metrics import mean_squared_error

X_train,X_test,y_train,y_test = train_test_split(X,y,test_size=0.2)

model = RandomForestRegressor()
model.fit(X_train,y_train)

pred = model.predict(X_test)
print(mean_squared_error(y_test,pred))
```

5.7576598442473784e-05

PART C — CLUSTERING

In [16]:

```
#Step C1 — Aggregate Behavior
cust = sessions.groupby('customer_id').agg({
    'kwh_charged':'sum',
    'session_id':'count',
    'total_cost':'sum'
}).reset_index()

cust.columns = ['customer','energy','sessions','spend']
```

In [18]:

```
#Step C2 — Run KMeans
from sklearn.cluster import KMeans

kmeans = KMeans(n_clusters=3)
cust['cluster'] = kmeans.fit_predict(cust[['energy','sessions','spend']])
cust['cluster']
```

Out[18]:

```
0      1
1      1
2      2
3      1
4      1
..
7995   0
7996   2
7997   0
7998   0
7999   0
Name: cluster, Length: 8000, dtype: int32
```

In []:

**THANK
YOU**