MESUREMENT ENERGY CONSUMUPTION:

PHASE-III

Import relevant python packages:

Let's use the electrical meter data to create clusters of typical load profiles for analysis. First we can load our conventional packages.

```
import pandas as pd
import matplotlib.pyplot as plt
import matplotlib
```

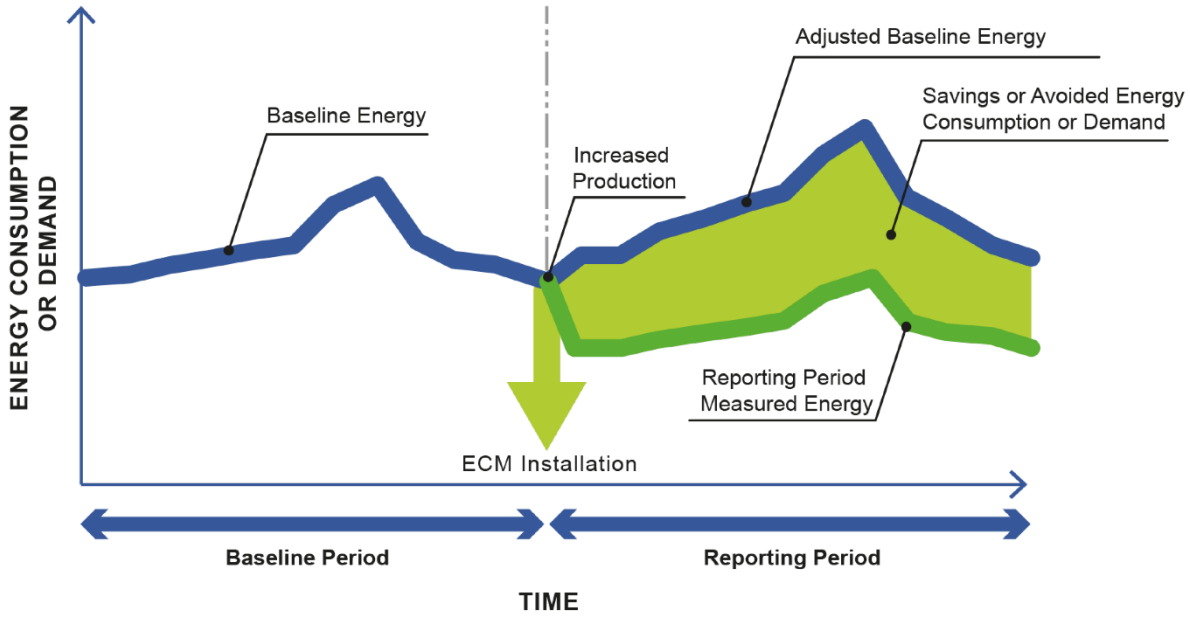
Next let's load all the packages we will need for analysis

```
import sklearn
from sklearn import metrics
from sklearn.neighbors import KNeighborsRegressor
from scipy.cluster.vq import kmeans, vq, whiten
from scipy.spatial.distance import cdist
import numpy as np
from datetime import datetime
```

Electricity Prediction for Measurement and Verification

Prediction is a common machine learning (ML) technique used on building energy consumption data. This process is valuable for anomaly detection, load profile-based building control and measurement and verification procedures.

The graphic below comes from the IPMVP to show how prediction can be used for M&V to calculate how much energy **would have** been consumed if an energy savings intervention had not been implemented.



Load electricity data and weather data

First we can load the data from the BDG in the same as our previous weather analysis influence notebook from the Construction Phase videos

```
elec_all_data = pd.read_csv("electricity.csv",
parse_dates=True)
```

```
elec_all_data.info()
```

OUTPUT:

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 3174 entries, 0 to 3173
Data columns (total 38 columns):
 #   Column                              Non-Null Count  Dtype
---  ------                              --------------  -----
 0   Utility.Number                      3174 non-null   int64
 1   Utility.Name                        3174 non-null   object
 2   Utility.State                       3173 non-null   object
```

```
 3   Utility.Type                          3174 non-null   object
 4   Demand.Summer Peak                    3174 non-null   float64
 5   Demand.Winter Peak                    3174 non-null   float64
 6   Sources.Generation                    3174 non-null   float64
 7   Sources.Purchased                     3174 non-null   float64
 8   Sources.Other                         3174 non-null   float64
 9   Sources.Total                         3174 non-null   float64
 10  Uses.Retail                           3174 non-null   float64
 11  Uses.Resale                           3174 non-null   float64
 12  Uses.No Charge                        3174 non-null   float64
 13  Uses.Consumed                         3174 non-null   float64
 14  Uses.Losses                           3174 non-null   float64
 15  Uses.Total                            3174 non-null   float64
 16  Revenues.Retail                       3174 non-null   float64
 17  Revenue.Delivery                      3174 non-null   float64
 18  Revenue.Resale                        3174 non-null   float64
 19  Revenue.Adjustments                   3174 non-null   float64
 20  Revenue.Transmission                  3174 non-null   float64
 21  Revenue.Other                         3174 non-null   float64
 22  Revenue.Total                         3174 non-null   float64
 23  Retail.Residential.Revenue            3174 non-null   float64
 24  Retail.Residential.Sales              3174 non-null   float64
 25  Retail.Residential.Customers          3174 non-null   float64
 26  Retail.Commercial.Revenue             3174 non-null   float64
 27  Retail.Commercial.Sales               3174 non-null   float64
 28  Retail.Commercial.Customers           3174 non-null   float64
 29  Retail.Industrial.Revenue             3174 non-null   float64
 30  Retail.Industrial.Sales               3174 non-null   float64
 31  Retail.Industrial.Customers           3174 non-null   float64
 32  Retail.Transportation.Revenue         3174 non-null   float64
 33  Retail.Transportation.Sales           3174 non-null   float64
 34  Retail.Transportation.Customers       3174 non-null   float64
 35  Retail.Total.Revenue                  3174 non-null   float64
 36  Retail.Total.Sales                    3174 non-null   float64
 37  Retail.Total.Customers                3174 non-null   float64
dtypes: float64(34), int64(1), object(3)
memory usage: 942.4+ KB
```

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