PROJECT REVIEW

Predicting Future Energy Consumption using Machine Learning technique for Tamil Nadu State on any specific day.

SUBMITTED TO:

SATHISHKUMAR.K

VIT UNIVERSITY

VELLORE

SUBMITTED BY:

Yash Shingavi **Reg. No. 20BEE0213**

ACKNOWLEDGMENT

The completion of our project was successful. However, this project would not have been possible without the help and guidance of **Dr**. **SATHISHKUMAR.K** We would like to show our gratitude to sir for giving us an excellent chance to learn more through our project and helping us in our numerous consultations with sir. We would also like to extend our gratitude to all those who have directly and indirectly helped us complete our project.

Many, especially our classmates and team members, have made some valuable comment suggestions that inspired us to make it better, Also wethank the **VIT institution** and the almighty for gracing us with blessings.

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ABSTRACT

This project is about **Predicting Future Energy Consumption using Machine Learning technique for Tamil Nadu State on any specific day** in **PYTHON**. This project uses state-of-the-art **Linear Regression** techniques to predict the future energy consumption. Due to the advancements of electricity dependent machinery, the excessive growth of power consumption has increased exponentially. Therefore, analysis and prediction of the energy consumption system will offer the future demand for electricity consumption and improve the power distribution system. On account of several challenges of existing energy consumption prediction models that are limiting to predict the actual energy consumption properly. Thus, to conquer the energy prediction method, this project analyzes 2 years of energy consumption data collected on an hourly basis, from 2-Jan-2019 to 31-Dec-2020 from the governmental site POCOSO (Power System Operation Corporation Ltd.).

INTRODUCTION

Matching electrical energy consumption with the right level of supply is crucial, because excess electricity supplied cannot be stored, unless converted to other forms, which incurs additional costs and resources. At the same time, underestimating energy consumption could be fatal, with excess demand overloading the supply line and even causing blackouts. Clearly, there are tangible benefits in closely monitoring the energy consumption of buildings — be they office, commercial or household.

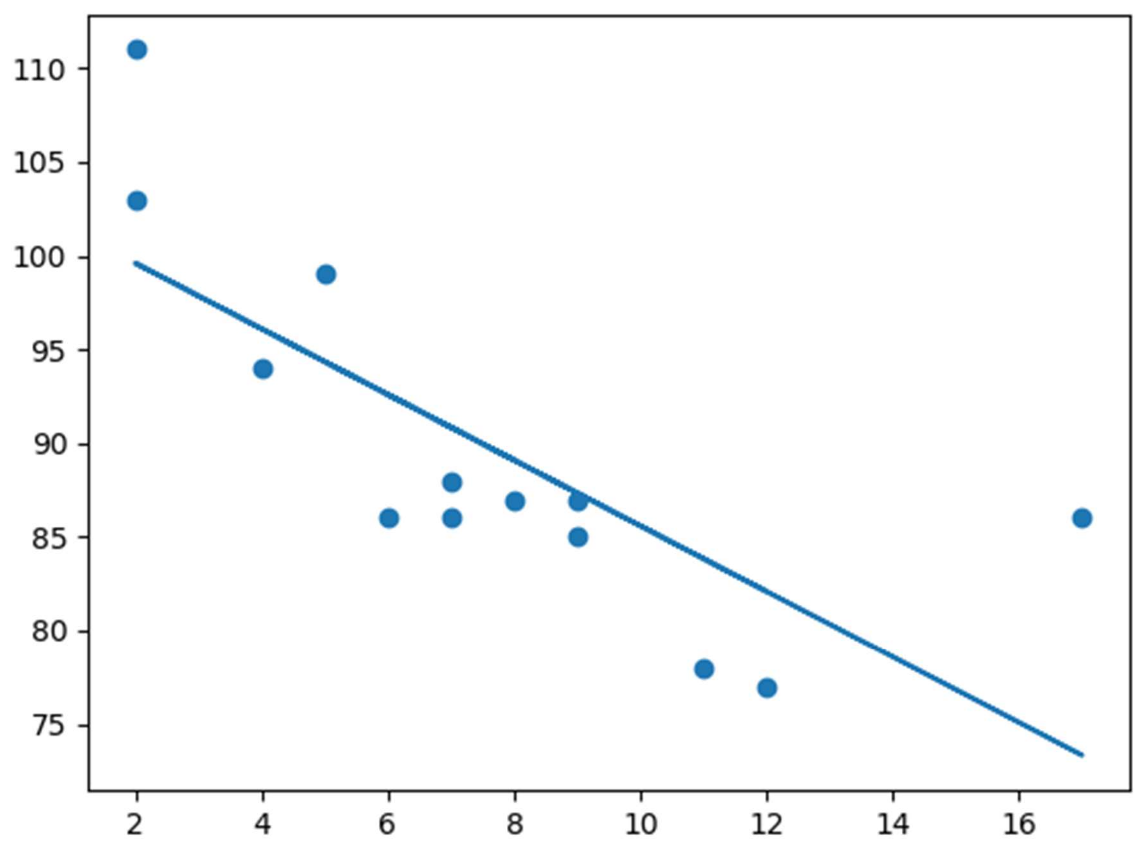
With the advent of machine learning, accurately predicting future energy consumption becomes increasingly possible. Accurate predictions provide two-fold benefits: first, managers gain key insights into factors affecting their building's energy demand, providing opportunities to address them and improve energy efficiency. Secondly, forecasts provide a benchmark to single out anomalously high/low energy consumption and alert managers to faults within the building.

However, the difficulty lies in the non-linearity and volatility of real-time energy usage, which is highly susceptible to changes in external factors. For instance, ambient temperature is known to significantly influence a building's energy demand via heating and air-conditioning. Furthermore, there can be unexpected surges and drops in energy consumption due to equipment failure, supply failure, or simply random fluctuations that are difficult to be explained.

ALGORITHM

Linear Regression is a machine learning algorithm based on **supervised learning**. It performs a **regression task**. Regression models a target prediction value based on independent variables. It is mostly used for finding out the relationship between variables and forecasting. Different regression models differ based on – the kind of relationship between dependent and independent variables they are considering, and the number of independent variables getting used.

Linear regression uses the relationship between the data-points to draw a straight line through all them. This line can be used to predict future values.



METHODOLOGY

1. Data Collection

→ Data was collected for span of 2 years of energy consumption data collected on an hourly basis, from 2-Jan-2019 to 31-Dec-2020
from the governmental site POCOSO (Power System Operation Corporation Ltd.).

2.Data Preparation

→ Wrangle data and prepare it for training
→ Cleaning the data that may require it (remove duplicates, correct errors, deal with missing values, normalization, data type conversions, etc.)
→ Split into training and evaluation sets

3.Choose a Model

→ Among all the algorithms we used linear regression algorithm.

4.Train the Model

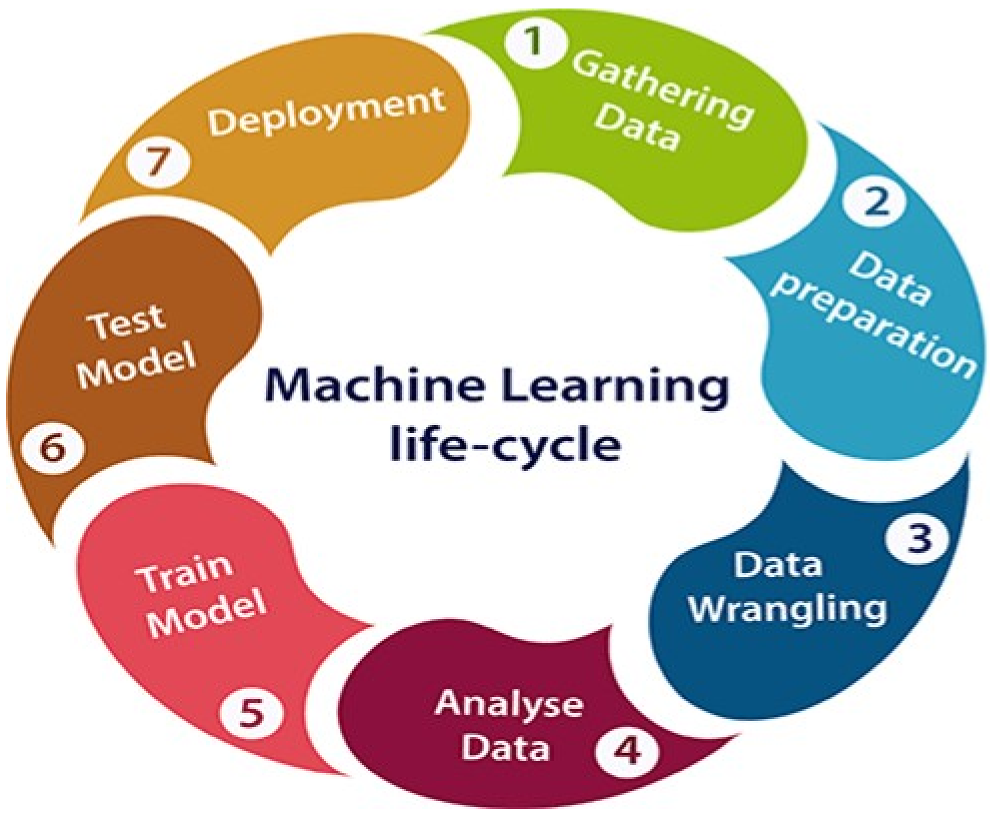
→ The goal of training is to answer a question or make a prediction correctly as often as possible
→ Linear regression: algorithm would need to learn values for m (or W) and b (x is input, y is output)
→ Each iteration of process is a training step

5.Evaluate the Model

→ Uses some metric or combination of metrics to "measure" objective performance of model
→ Test the model against previously unseen data
→ This unseen data is meant to be somewhat representative of model performance in the real world, but still helps tune the model (as opposed to test data, which does not)
→ Train eval split is 80/20 in our project

6.Make Predictions
→ Using further (test set) data which we have, until this point, been withheld from the model (and for which class labels are known), are used to test the model; a better approximation of how the model will perform in the real world

7.Model Deployment
→ We will be deploying our model locally on our own server and check the functionality.



IMPLEMENTATION

SOFTWARE USED AND ITs DETAILS:

This project has been executed in **Python**. It is a high-performancelanguage for technical computing. It integrates computation, visualization, and programming in an easy-to-use environment where problems and solutions are expressed in familiar mathematical notation. Typical uses include:

- Math and computation
- Algorithm development
- Modelling, simulation, and prototyping
- Data analysis, exploration, and visualization
- Scientific and engineering graphics
- Application development, including Graphical User Interfacebuilding

Apart from Python we have also used HTML, CSS and JavaScript for creating and navigating of webpages

Our Python Code and it's importance:

Importing All the Required Libraries:

```
app.py > ...
from flask import Flask, render_template, request, flash, url_for
from sklearn.linear_model import LinearRegression
import numpy as np
import pandas as pd
from sklearn.model_selection import train_test_split

```

Reading the Dataset:

```
# loading the csv data to a Pandas DataFrame
dataset_data = pd.read_csv('MODIFIED.csv')
X = dataset_data[['DAY', 'MONTH', 'YEAR']]
Y = dataset_data['Power']
```

Training and Testing Our Model:

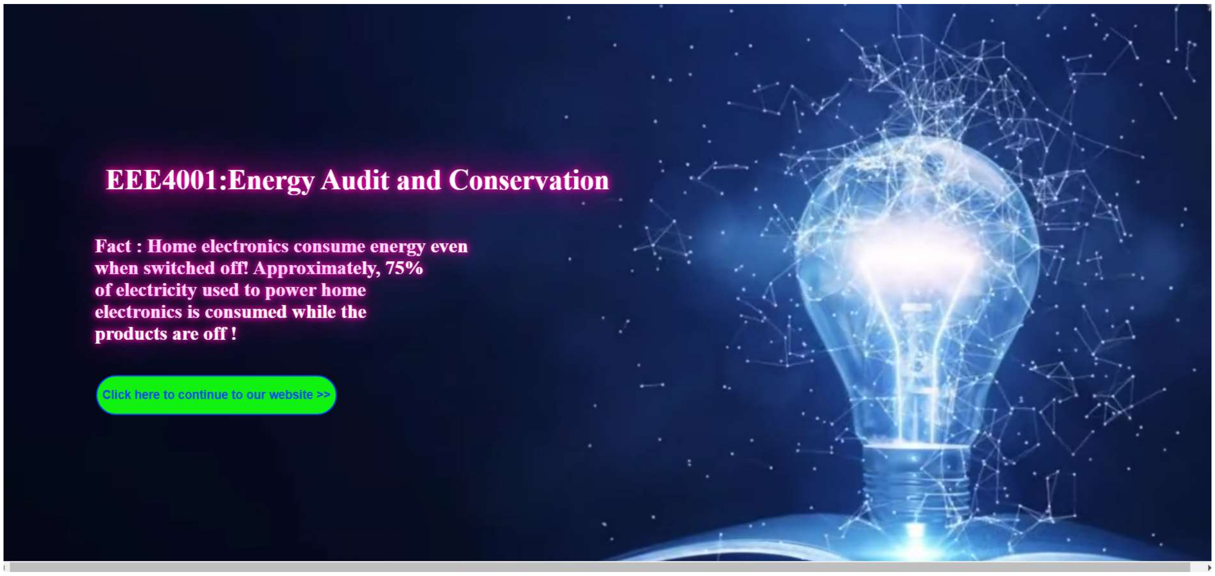
```python
Y = dataset_data['Power']
X_train, X_test, y_train, y_test = train_test_split(X, Y)
regressor = LinearRegression()
regressor.fit(X_train, y_train)
predicted = regressor.predict(X_test)
print(X_test)
```

Local Deployment:

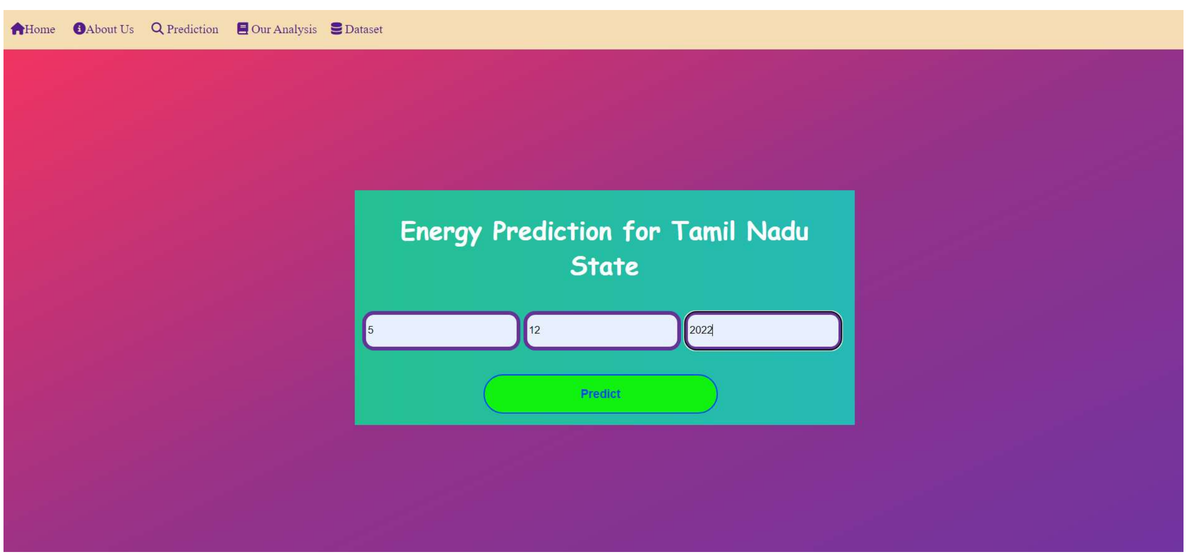
```python
df = pd.DataFrame({'Actual': y_test, 'Predicted': predicted})
print(df)
graph = df.head(25)

app = Flask(__name__)


@app.route('/')
def intro1():
    return render_template('intr.html')


@app.route('/index')
def index():
    return render_template('index1.html')


@app.route('/ack')
def ack():
    return render_template('aboutus1.html')


@app.route('/res')
def res():
    return render_template('research1.html')


@app.route('/data')
def data():
    return render_template('data1.html')


@app.route('/result', methods=['POST'])
def result():
    input_data = [int(x) for x in request.form.values()]
    input_data_as_numpy_array = np.asarray(input_data)
    input_data_reshaped = input_data_as_numpy_array.reshape(1, -1)
```

EXECUTION

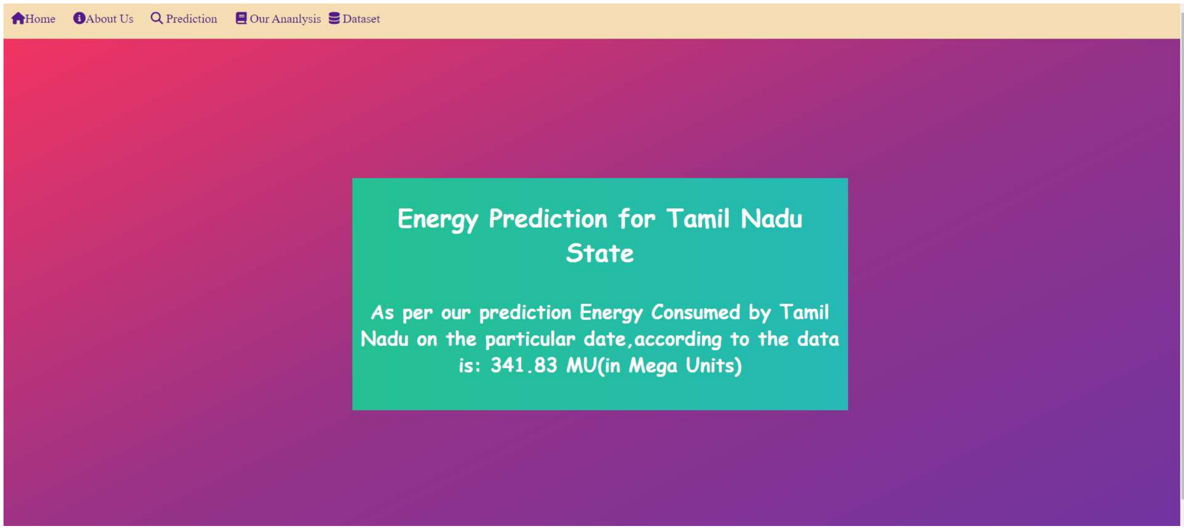
Cover Page:



Prediction Page:



Result Page: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Prediction
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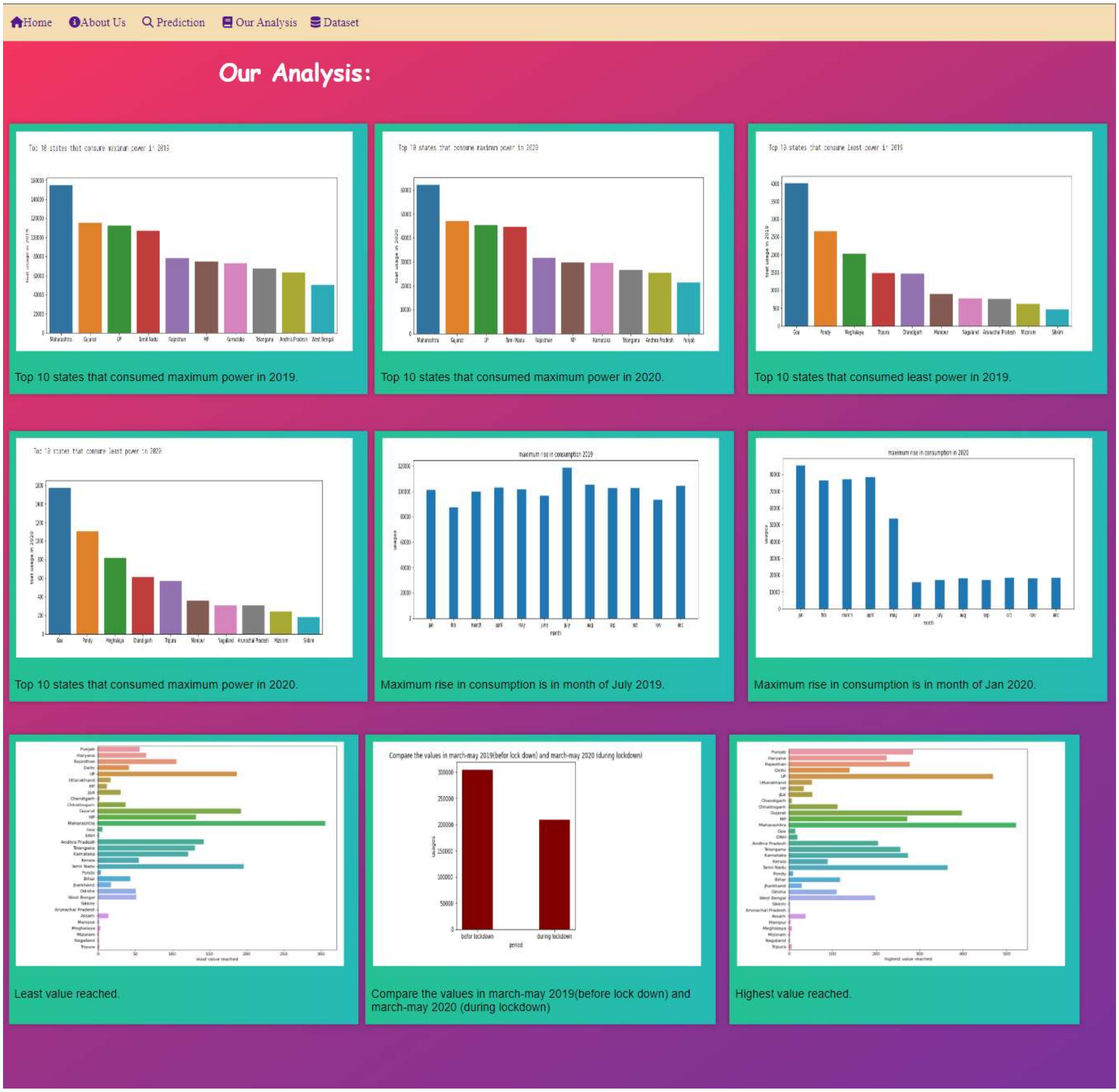
Dataset
Energy Prediction for Tamil Nadu State
As per our prediction Energy Consumed by Tamil Nadu on the particular date,according to the data is: 341.83 MU(in Mega Units)

Analysis Page:



RESULTS AND DISCUSSION

We see that accuracy of model is 0.7 out of 1.It was able to predict the energy consumption on particular day in future using past data. Also we have performed some data analysis like the Top 10 states that consumed maximum power in 2019, Top 10 states that consumed maximum power in 2020, Maximum rise in consumption is in month of July 2019, Maximum rise in consumption is in month of Jan 2020, Compare the values in march-may 2019(before lock down) and march-may 2020 (during lockdown) etc.

CONCLUSION

By strategically consuming energy based on usage predictions and external conditions buildings can be more profitable, more efficient, and more sustainable. Forecasting a building's energy usage can serve as a preliminary assessment tool for facility managers and building automation systems to identify any differences between projected and actual energy consumption. In order to forecast energy demand, facility managers, and building commissioning projects use accurate energy consumption projections to adopt energy-saving strategies and improve the operations of chillers, boilers, and energy storage devices.

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