# 🌿 EcoWatts – Smart Home Energy Analyzer

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## Abstract

EcoWatts is a smart home energy analytics system that helps monitor, visualize, and predict electricity usage using data analytics and machine learning. It aims to promote sustainable energy consumption by providing real-time insights and forecasting future usage patterns.

## 1. Introduction

Energy consumption is a critical aspect of modern households. Rising energy costs and environmental concerns necessitate smarter ways to monitor and manage usage. EcoWatts provides users with actionable insights into their electricity consumption patterns using a data-driven approach.

## 2. Literature Review / Existing System

Traditional systems rely on manual tracking or simple smart meters that provide only real-time usage data. EcoWatts enhances this by adding predictive analytics, cost estimation, and appliance-level monitoring.

## 3. System Overview

EcoWatts is designed to analyze smart home energy data, visualize trends, and predict future usage. The system architecture consists of data ingestion, preprocessing, analysis, visualization, and forecasting modules.

## 4. Dataset Description

Dataset Name: energy\_usage\_Dataset.csv (200 records)

|  |  |
| --- | --- |
| Feature | Description |
| Timestamp | Time of data recording |
| Appliance | Device name |
| Usage\_kWh | Power consumed |
| Room | Location of device |
| Mode | Operating mode |
| Temperature (°C) | Room temperature |
| Cost (INR) | Calculated cost |

## 5. Methodology

The methodology includes data collection, preprocessing, exploratory data analysis (EDA), model development, and deployment. Linear Regression is used to forecast energy usage based on past data trends.

## 6. Implementation

The project is implemented using Streamlit for the user interface, Pandas and NumPy for data processing, Matplotlib for visualization, and Scikit-learn for the Linear Regression model.

## 7. Results & Discussion

EcoWatts successfully predicts household energy consumption and provides visualization dashboards that help users identify energy-hungry appliances and manage electricity costs more effectively.

## 8. Future Enhancements

- Integrate IoT sensor data for real-time tracking.  
- Add LSTM deep learning models for better forecasting.  
- Develop a mobile application version.  
- Include carbon footprint tracking.  
- Implement alert system for high power usage.

## 9. Conclusion

EcoWatts contributes to energy efficiency by leveraging data analytics and machine learning to monitor and optimize electricity usage. It encourages sustainable living through informed decision-making.

## 10. References

1. Kaggle Smart Home Energy Datasets  
2. Streamlit Documentation  
3. Scikit-learn Documentation  
4. Matplotlib and Pandas Documentation