RESEARCH POSTER

OPTIMIZING ENERGY CONSUMPTION USING SMART METER DATA

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INTRODUCTION

SMART METERS PROVIDE DETAILED DATA THAT HELPS ANALYZE ENERGY USE AND IMPROVE GRID EFFICIENCY. THIS STUDY USES DATA MINING TECHNIQUES LIKE CLUSTERING AND PREDICTIONS TO UNDERSTAND ENERGY CONSUMPTION, GROUP USERS, AND PREDICT FUTURE DEMAND. THE GOAL IS TO IDENTIFY PATTERNS, PROMOTE SUSTAINABLE ENERGY USE, IMPROVE GRID RELIABILITY, AND CREATE PERSONALIZED SOLUTIONS FOR SAVING ENERGY.

OBJECTIVE

- ANALYZING DETAILED SMART METER DATA.
- Segmenting consumers based on their energy usage patterns.
- Forecasting future energy demand.
- Providing actionable insights for sustainable and efficient energy management.

METHODOLOGY

- DATA PREPROCESSING:
- CLUSTERING ANALYSIS:
- PREDICTIVE MODELING:
- CORRELATION ANALYSIS:

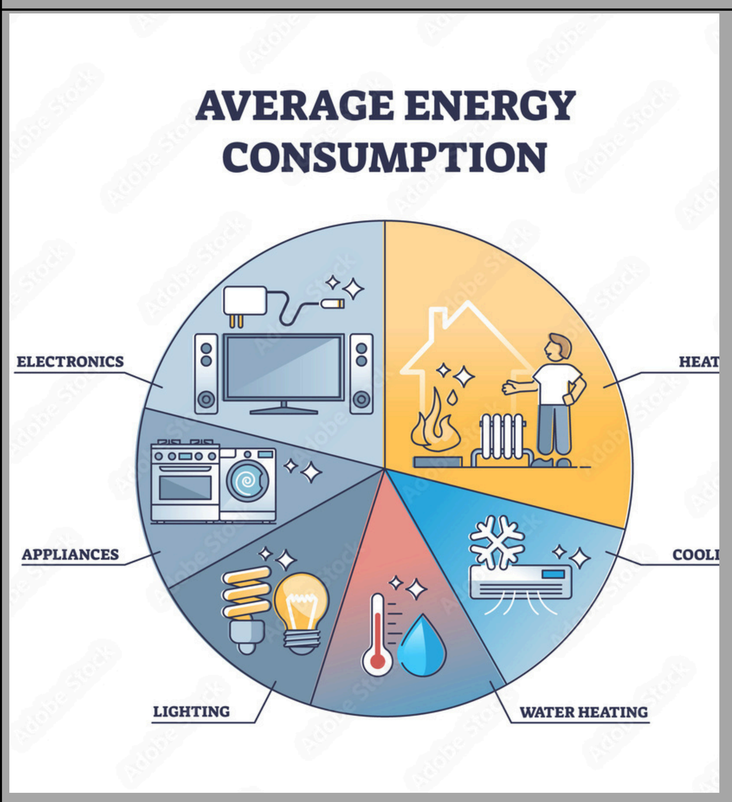
RESULTS/FINDINGS

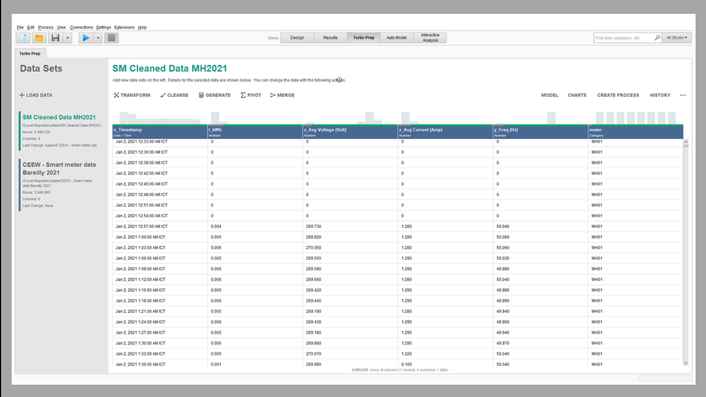
- CONSUMER SEGMENTATION:

- Cluster 0: Low-to-moderate energy consumers, (households and small businesses.)
- Cluster 1: High-energy consumers, (industries and large establishments.)

- Seasonal Patterns: Energy usage peaks in the 4th and 1st quarters due to heating and industrial activity.

- A significant correlation: in Quarter 3 indicates increased energy usage for cooling systems during warmer months.





This dataset contains high-frequency smart meter data collected from the Bareilly district in India during 2021. It includes detailed metrics such as hourly electricity consumption (kWh), voltage, current, and timestamps.

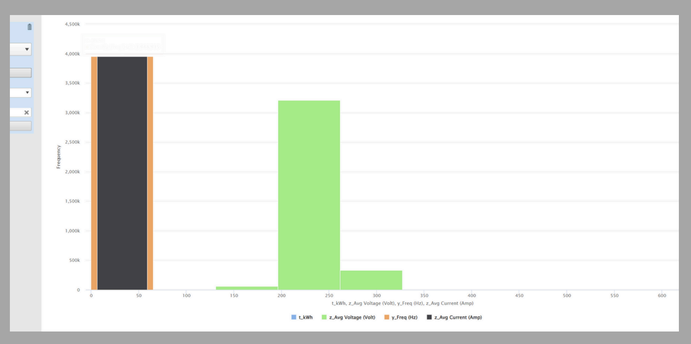


fig-1
Histogram chart of t_kWh,Average Voltage (Volt), Current Average (Amp) Usage

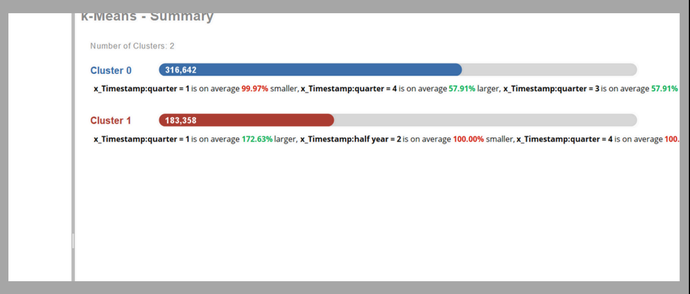


fig-2
Kmeans-Summary: Cluster 0 -Normal Energy Consumption User
Cluster 1 - High Energy Consumption User

ANALYISIS

1. *Data Preprocessing: The dataset was cleaned, normalized, and standardized to ensure accurate analysis.*
2. *Clustering: Using K-Means, we segmented consumers into two clusters based on their energy consumption behaviors.*
   - *Cluster 0: Stable and moderate energy usage.*
   - *Cluster 1: High-energy users, suggesting areas for efficiency improvements.*
3. *Descriptive Statistics: Key statistical measures, such as mean and standard deviation, were calculated to understand data trends.*

CONCLUSION

Summarize your study and let the viewers know two to three key findings. You can also add a description of each that can give them an idea of what comes next. This section can also include any implications of the study, and if there are any actions or recommendations for future study.