**DATA ANALYSIS ON POWER-CO DATA**

A Project Report submitted in partial fulfillment of the requirements for the Data Science Certificate Program.

by

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**ABSTRACT**

In the evolving energy sector, data-driven decision-making is crucial for optimizing operations, improving customer retention, and maximizing profitability. This report presents a comprehensive data analysis of PowerCo’s energy consumption patterns, pricing structures, and customer behavior to uncover critical insights. The study involves data preprocessing, trend analysis, margin evaluation, and predictive modeling to identify factors influencing energy demand and customer churn. Key findings reveal seasonal fluctuations in consumption, disparities in profit margins across different customer segments, and forecasted trends in energy demand and retention. The analysis provides actionable recommendations for enhancing pricing strategies, optimizing resource allocation, and improving customer satisfaction. This report serves as a foundation for future predictive modeling and strategic decision-making at PowerCo.

**TABLE OF CONTENTS**

**Abstract…………………………………………………………………………… 3**

**List of Figures .…………………………………………………………………… 5**

**Chapter 1. Introduction…………………………………………………………... 6**

**1.1 Problem Definition**

**1.2 Expected Outcome**

**Chapter 2. Objective……………………………………………………………….. 8**

**Chapter 3. Data Cleaning and Preprocessing……………………………………. 10**

**Chapter 4. Key findings…………………………………………………………… 12**

**4.1. Consumption Trend Analysis**

**4.2. Margin Analysis**

**4.3. Forecast Analysis**

**4.4. Churn Analysis**

**Chapter 5. Conclusion……………………………………………………………….. 15**

**LIST OF FIGURES**

|  |  |  |
| --- | --- | --- |
|  |  | **Page No.** |
|  | Introduction |  |
|  | Objective |  |
|  | Data Cleaning and Preprocessing |  |
|  | Key findings |  |
|  | Conclusion |  |

**CHAPTER 1**

**INTRODUCTION**

**CHAPTER 1 INTRODUCTION**

* 1. **Problem Definition:**

PowerCo collects extensive data on energy consumption, customer demographics, and operational metrics. However, the company faces challenges in extracting meaningful insights from this raw data. The lack of proper data analysis can result in inefficient resource allocation, high operational costs, and suboptimal customer service. Through data analysis, this project seeks to:

1. Identify trends in energy consumption across different customer segments.
2. Detect potential inefficiencies in power distribution and resource management.
3. Develop predictive models to forecast future energy demand.
4. Provide recommendations for improving efficiency and customer satisfaction.

By leveraging statistical analysis and data visualization techniques, this project will transform raw data into valuable insights that can support PowerCo in making informed business decisions.

* 1. **Expected Outcome:**

1. **Comprehensive Data Insights** – A detailed overview of PowerCo’s client and pricing data, highlighting key attributes and trends.
2. **Data Quality Assessment** – Identification and handling of missing values, duplicates, and inconsistencies to ensure accurate analysis.
3. **Energy Consumption Trends** – Visualization of usage patterns across different customer segments.
4. **Pricing Strategy Evaluation** – Analysis of how pricing structures impact customer behavior and retention.
5. **Churn Analysis** – Identification of factors contributing to customer churn, helping PowerCo develop retention strategies.
6. **Predictive Modeling Foundation** – A cleaned dataset ready for future machine learning applications, such as demand forecasting and customer segmentation.

**CHAPTER 2**

**OBJECTIVE**

**CHAPTER 2 OBJECTIVE**

The primary objectives of this analysis are:

* **Data Exploration and Cleaning:** To thoroughly examine the dataset, identify inconsistencies, remove duplicates, and handle missing values to ensure high data quality.
* **Energy Consumption Analysis:** To identify trends and patterns in energy consumption across different customer segments, including residential and business users, and understand seasonal variations.
* **Pricing Strategy Evaluation:** To assess the impact of different pricing structures on customer retention and satisfaction, determining which models lead to increased stability and loyalty.
* **Churn Analysis:** To analyze factors contributing to customer churn, including contract length, billing consistency, and pricing changes, to identify potential retention strategies.
* **Predictive Modeling Foundations:** To prepare the dataset for future machine learning applications such as demand forecasting, customer segmentation, and churn prediction, enabling PowerCo to make proactive decisions.
* **Operational Efficiency Improvement:** To identify inefficiencies in power distribution and resource allocation and provide actionable recommendations for optimization.
* **Customer Experience Enhancement:** To offer insights into improving customer service, reducing dissatisfaction, and increasing retention through targeted engagement strategies.

**CHAPTER 3**

**DATA CLEANING AND PREPROCESSING**

**CHAPTER 3 DATA CLEANING AND PREPROCESSING**

* Checked for missing values: No missing records found.
* Identified duplicate records and removed them.
* Converted date-related columns into appropriate datetime formats.
* Standardized categorical variables for consistency.

**CHAPTER 4**

**KEY FINDINGS**

**CHAPTER 4 KEY FINDINGS**

**4.1. Consumption Trend Analysis**

* Energy consumption patterns vary significantly across different customer segments, with industrial clients exhibiting the highest usage.
* Seasonal variations show peak consumption during winter and summer months, indicating high demand for heating and cooling.
* Customers with long-term contracts tend to have more stable consumption patterns compared to short-term contract holders.
* High-energy consumers are often associated with discounted pricing structures, leading to potential revenue optimization opportunities.

**4.2. Margin Analysis**

* The profit margin is highly influenced by contract type, with premium plans yielding higher margins compared to discounted or variable-rate plans.
* Certain customer segments contribute disproportionately to revenue while others, despite high consumption, operate on thin margins.
* Discounted pricing strategies attract more customers but reduce overall profitability, requiring a balance between acquisition and retention.
* Customers with frequent contract modifications show lower profit margins, indicating potential inefficiencies in pricing strategies.

**4.3. Forecast Analysis**

* Predictive models indicate a steady increase in energy demand, especially in urban areas, aligning with population growth and industrial expansion.
* Forecasted churn rates suggest that pricing adjustments and improved service quality could significantly reduce customer loss.
* Machine learning-based forecasting suggests that high-consumption customers are likely to maintain or increase their usage, whereas low-usage customers may be more prone to churn.
* Anomalies in forecasted demand highlight potential operational inefficiencies that may need proactive intervention.

**4.4. Churn Analysis**

* Customers with shorter contracts and frequent modifications are more likely to churn.
* Number of people leaving based on services.
* High energy prices and inconsistent billing cycles contribute to customer dissatisfaction.
* Retaining high-value customers requires personalized contract offers and better service reliability.

**CHAPTER 5**

**CONCLUSION**

**CHAPTER 5 CONCLUSION**

**This analysis provides a data-driven approach to understanding PowerCo’s customer behaviour, pricing impact, and churn risks. By leveraging these insights, PowerCo can make informed decisions to enhance operational efficiency, improve customer satisfaction, and ensure sustainable growth in the competitive energy market.**