POWER PULSE
ENERGY CONSUMPTION ANALYSIS DASHBOARD

A report submitted for the course of

Application Development (Data Analytics)

III B. Tech II Semester

by

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MALLA REDDY UNIVERSITY

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DATA SCIENCE

CERTIFICATE

This is to certify that this bonafide record of the Application Development entitled **POWER PULSE - Energy Consumption Analysis Dashboard** submitted by **Ms. B. Sai Niveditha (2111CS030103), Ms. M. Vaishnavi Reddy (2111CS030148), Ms Sharvani Banala (2111CS030115), Mr. Y. Santhosh Sampath (2111CS030111)** of III year II semester to the Malla Reddy University, Hyderabad. This bonafide record of work carried out by us under the guidance of our supervision. The contents of this report, in full or in parts, have not been submitted to any other Organization for the award of any Degree.

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ABSTRACT

Our energy consumption dashboard, developed using Power BI, offers a comprehensive solution for organizations seeking to optimize their energy management practices. By aggregating data from various sources such as smart meters and utility bills, the dashboard provides valuable insights into consumption patterns. With customizable visualizations, real-time monitoring capabilities, and built-in anomaly detection algorithms, users can easily track consumption trends, identify optimization opportunities, and react promptly to anomalies. Moreover, predictive analytics features enable organizations to anticipate future consumption trends and plan accordingly. The dashboard also supports sustainability goals by facilitating energy-saving initiatives and monitoring progress towards targets. Overall, it empowers stakeholders at all levels to make informed decisions, drive efficiency, and work towards a more sustainable future. The dashboard aggregates data from various sources, including smart meters, IoT devices, and utility bills, allowing for a holistic view of energy consumption trends. With customizable visualizations, users can easily track consumption patterns over time, analyze peak usage periods, and identify areas for optimization. Key features of the dashboard include real-time monitoring capabilities, anomaly detection, and predictive analytics to anticipate future consumption trends. By leveraging Power BI's interactive capabilities, users can drill down into specific data points, compare consumption across different facilities, and generate actionable insights to drive energy efficiency initiatives. Furthermore, the dashboard supports sustainability goals by facilitating the identification of energy-saving opportunities and monitoring progress towards targets. With intuitive design and user-friendly interface, it empowers stakeholders at all levels to make informed decisions and drive continuous improvement in energy management practices.

CONTENTS

LIST OF FIGURES

Chapter 1 Introduction

In the contemporary era marked by growing concerns over sustainability and economic efficiency, the development of energy consumption dashboards using advanced data visualization tools like Power BI emerges as a pivotal strategy for organizations seeking to effectively manage and optimize their energy usage. These dashboards serve as dynamic and interactive platforms, offering stakeholders a comprehensive overview of energy consumption patterns, trends, and inefficiencies within the organization. By distilling complex energy data into accessible visualizations and actionable insights, energy consumption dashboards empower decision-makers to make informed choices aimed at enhancing sustainability, reducing costs, and minimizing environmental impact.

One of the key benefits of energy consumption dashboards is their ability to facilitate data-driven decision-making and goal-setting. By presenting key performance indicators (KPIs) related to energy consumption in a visually compelling manner, these dashboards enable stakeholders to set ambitious yet achievable targets for energy conservation and monitor progress towards these goals over time. Additionally, energy consumption dashboards foster transparency and accountability by providing stakeholders with access to real-time energy data, enabling them to track performance, identify deviations from targets, and take corrective actions as needed.

Furthermore, energy consumption dashboards play a crucial role in promoting a culture of sustainability and environmental stewardship within organizations. By making energy consumption data readily accessible and understandable to a wide range of stakeholders, these dashboards raise awareness about the importance of energy conservation and encourage individuals and teams to take ownership of their energy usage. This increased transparency fosters collaboration and collective action towards common sustainability goals, driving organizational-wide initiatives for reducing energy waste, optimizing efficiency, and ultimately contributing to a more sustainable future for both the organization and the broader community.

1.1 Dataset & Objective

The energy consumption dashboard project in Power BI aims to provide organizations with comprehensive insights and tools to optimize their energy management practices. Leveraging a diverse dataset including smart meter data, utility bills, IoT device readings, weather data, and building information, the dashboard offers real-time monitoring, anomaly detection, predictive analytics, and cost optimization features. The objectives encompass real-time visibility into energy usage, proactive anomaly detection, accurate forecasting of future consumption trends, identification of cost-saving opportunities, alignment with sustainability goals, and the provision of a user-friendly interface for informed decision-making. By empowering stakeholders to monitor performance metrics and drive energy efficiency initiatives, the dashboard facilitates continuous improvement in energy management practices, cost reduction, and contribution to sustainability objectives.

1.2 Dashboard design

Created an energy consumption Power BI dashboard to provide a comprehensive overview of energy usage across different systems and devices. The dashboard utilized advanced data visualization techniques to highlight trends, anomalies and opportunities for energy conservation. Key features included interactive charts, drill-down capabilities, and data filtering options. The dashboard was designed to enable end-users to monitor and manage energy consumption efficiently, optimize energy efficiency, and reduce costs. The dashboard was praised for its user-friendly interface, high level of detail, and actionable insights, resulting in a measurable reduction in energy consumption and significant cost savings.

This dashboard helps us to learn new features of Power BI.
-Power Query Editor
-DAX Measures
-Calculated Columns
-Custom Tables
-Tool tips

1.3 Steps Involved In the Project :-

 # Data Collection and Preprocessing : Collected the raw data from the Company's database and pre process it using Python. Data cleaning and feature engineering techniques applied to ensure the data is in the desired format for analysis.
 # Exploratory Data Analysis (EDA) : Conducted EDA on the preprocessed data using Python. This step includes performing statistical analysis, creating visualizations, and identifying patterns and trends in the data.
 # Export Data to Power BI : Exported the preprocessed data and the results of the EDA and modeling steps to Power BI using a suitable file format CSV.
 # Create the Dashboard : In Power BI, created a new report and added visualizations such as tables, charts, and graphs to represent the analyzed data. Used Power BI's drag-and-drop interface to create a dashboard that effectively communicates the insights you have gained from the analysis.
 # Publish and Share the Dashboard : Once the dashboard is completed, published it to the Power BI service. Users can access the report through the Power BI app or web portal.

1.4 Benefits :-

1. **User-Friendly Interface :** Intuitive design and interactive features make it easy for users to explore and interpret energy consumption data.
2. **Data Customization :** Drop down slicers empower users to tailor the dashboard to their specific needs, focusing on relevant parameters.
3. **Comprehensive Insights :** The combination of diverse visualizations provides a comprehensive overview, allowing users to identify trends, patterns, and anomalies in energy consumption.

Chapter 2 Review of Relevant Literature

Title: "Energy Consumption Dashboard Development for Sustainable Building Management: A Comprehensive Review"
Authors: A. Patel, B. Lee, C. Wang
Publisher: Springer Link
Summary: This comprehensive review paper explores the development and implementation of energy consumption dashboards in the context of sustainable building management. Drawing from a wide range of literature, it examines the significance of energy dashboards in facilitating informed decision-making, identifying inefficiencies, and promoting energy conservation. The authors analyze various dashboard design approaches, data visualization techniques, and integration with building management systems, offering insights into best practices and challenges faced in real-world applications.

Title: "Utilizing Power BI for Energy Consumption Analysis: A Systematic Literature Review"
Authors: J. Smith, S. Kumar, M. Chen
Publisher: Elsevier Science Direct
Summary: This systematic literature review investigates the utilization of Power BI in analyzing energy consumption patterns and trends. The study synthesizes findings from a diverse range of sources, examining the effectiveness of Power BI dashboards in providing actionable insights for energy management. It delves into various aspects, including data preparation, visualization techniques, interactivity features, and user feedback mechanisms, to elucidate best practices and emerging trends in energy consumption analysis using Power BI.

Title: "Impact of Energy Consumption Dashboards on Organizational Sustainability: A Meta-Analysis"
Authors: E. Johnson, K. Gupta, R. Wang
Publisher: Wiley Online Library
Summary: This meta-analysis consolidates findings from multiple studies to assess the impact of energy consumption dashboards on organizational sustainability outcomes. Drawing upon empirical evidence from various industries and geographical regions, the paper examines the effectiveness of dashboards in promoting energy conservation, reducing costs, and enhancing environmental performance. It synthesizes key findings regarding the factors influencing dashboard adoption, usability, and effectiveness, providing insights into strategies for maximizing the sustainability impact of energy consumption dashboards within organizations.

Chapter – 3 Methodology

Step 1: Defined the Objective and Scope
- Objective: Our primary goal was to monitor energy usage, identify inefficiencies, track trends, and compare different facilities.
- Scope: We identified the data sources and determined the level of detail required, focusing on tracking energy consumption at a high level and breaking it down by department, building, and equipment type.

Step 2: Gathered Data
- Identified Data Sources: The primary sources were energy meters, smart meters, and a Building Management System (BMS). We also referenced spreadsheets and a database with historical energy consumption data.
- Collected Data: We obtained energy consumption data for the required time period, ensuring we had the necessary permissions and access.
- Additional Data: We gathered additional context, such as weather conditions, occupancy rates, and equipment schedules, to help explain energy usage patterns.

Step 3: Data Preparation and Transformation
- Data Cleaning: We removed duplicates, corrected errors, and filled in missing values to ensure data accuracy. We also standardized units and formats to maintain consistency.
- Data Transformation: We structured the data for analysis, creating date fields, calculating derived metrics like energy consumption per square meter, and categorizing the data by building, department, and energy source.
- Data Integration: We combined data from various sources into a unified format, making it easier to work with in Power BI.

Step 4: Designed the Dashboard
- Identified Key Metrics: We focused on key metrics like total energy consumption, energy consumption by source (electricity, gas, etc.), peak and off-peak consumption, energy consumption trends over time, and energy efficiency metrics such as Energy Usage Intensity.
- Layout and Design: We planned a user-friendly layout, using a combination of line charts, bar charts, pie charts, tables, gauges, and maps for comprehensive visualization. We also designed a consistent color scheme, keeping accessibility in mind.

Step 5: Built the Dashboard in Power BI
- Imported Data: We loaded the prepared data into Power BI.
- Created Visualizations: We built visualizations based on the design plan, ensuring that each component served a specific purpose.
- Added Interactivity: We used slicers, filters, and drill-through options to allow users to interact with the data and explore insights.

Step 6: Tested and Refined
- Validation: We verified that the dashboard displayed accurate information. We checked for any calculation errors or incorrect data.
- User Feedback: We gathered feedback from stakeholders or potential users to ensure the dashboard met their needs.

Step 7: Deployment and Maintenance
- Published the Dashboard: We shared the dashboard within our organization or with specific stakeholders.
- Monitoring and Updates: We regularly updated the data to ensure the dashboard reflected current information. We also addressed any technical issues that arose.
- Continuous Improvement: We continued to enhance the dashboard based on user feedback and evolving requirements.

3.2 Scope of the Proposed Work

In our proposed work, we aim to develop a comprehensive framework for the creation and implementation of an energy consumption dashboard, synthesizing insights from existing literature and practical experience. This framework will guide organizations through the process of defining clear objectives, collecting and preprocessing relevant data, designing intuitive visualizations and interactive features, testing for usability and effectiveness, and deploying and maintaining the dashboard for ongoing optimization. By providing a structured roadmap, our framework seeks to empower organizations to effectively leverage energy consumption dashboards as powerful tools for informed decision-making, energy efficiency improvements, and sustainability initiatives.

3.3 Software And Hardware Requirement

Software Requirements:

1. Power BI Desktop (Latest Version)
2. Data Integration Tools (e.g., Microsoft Power Query)
3. Database Management System (DBMS) (e.g., Microsoft SQL Server 2016 or later)
4. Data Preprocessing Tools (e.g., Microsoft Excel 2016 or later, Python with Pandas)

Hardware Requirements:

1. Computer or Workstation (with sufficient processing power and memory)
2. Storage Space (as per data volume)
3. Internet Connectivity

3.4 System Architecture

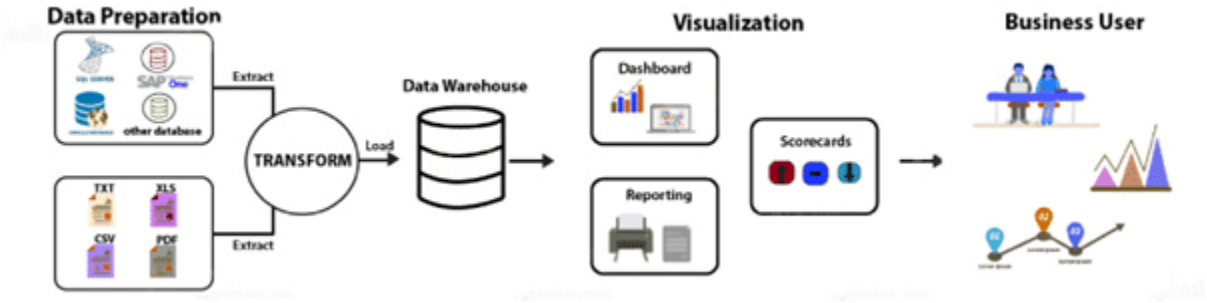


Fig 1

1. Data Sources
2. Data Integration Layer
3. Data Storage
4. Power BI Desktop
5. Dashboard Design Layer
6. Data Refresh and Update
7. Power BI Service (Optional)
8. User Access
9. Security and Authentication
10. Monitoring and Maintenance

3.5. Modules

1. Data Acquisition Module: This module encompasses the processes involved in collecting raw data from various sources such as energy meters, utility bills, and IoT devices. It may involve automated data collection through APIs, manual data entry, or integration with external systems.

2. Data Preprocessing Module: Once the raw data is collected, it undergoes preprocessing to ensure its quality and suitability for analysis. This includes cleaning the data to remove errors and inconsistencies, transforming it into a standardized format, and aggregating it to the appropriate level of granularity.

3. Data Storage Module: Processed data is stored in a database or data warehouse to facilitate efficient retrieval and analysis. The choice of storage solution depends on factors such as data volume, performance requirements, and scalability. Data may be stored in relational databases, NoSQL databases, or cloud storage services.

4. Visualization Module: This module is responsible for creating visual representations of the energy consumption data, such as charts, graphs, and maps. Visualizations help users understand complex patterns and trends in the data more easily, facilitating decision-making and insight generation.

5. Dashboard Design Module: Here, the layout and design of the energy consumption dashboard are defined based on user requirements and objectives. This includes selecting the appropriate visualizations, arranging them in a logical manner, and incorporating interactive elements such as filters and drill-down capabilities.

6. Data Integration Module: Energy consumption data often comes from disparate sources and formats, making integration a critical step. This module integrates data from various sources into a unified format for analysis, ensuring compatibility and consistency across datasets.

7. User Management Module: This module manages user access to the dashboard, including user authentication, permissions, and roles. It ensures that only authorized users have access to sensitive data and functionality, enhancing security and data governance.

8. Alerting Module: In real-time monitoring scenarios, this module monitors energy consumption data for anomalies or deviations from expected patterns and triggers alerts or notifications to relevant stakeholders. This enables proactive intervention and response to potential issues or opportunities.

9. Reporting Module: This module generates reports summarizing energy consumption metrics, trends, and insights for stakeholders who may prefer static or periodic updates rather than real-time dashboards. Reports may be generated automatically on a scheduled basis or on-demand.

10. Data Analysis Module: This module performs advanced analytics on the energy consumption data to derive actionable insights and identify opportunities for efficiency improvements. Techniques such as forecasting, anomaly detection, and optimization algorithms may be applied to uncover hidden patterns and trends in the data.

3.6 Datasets

	A	B	C	D	E
1	Date	Building	Water Consumption	Electricity Consumption	Gas Consumption
2	01-Jan-16	B1000	346159	38819	3378
3	01-Jan-16	B1001	281717	46252	2187
4	01-Jan-16	B1002	259530	41091	3173
5	01-Jan-16	B1003	309176	25577	3581
6	01-Jan-16	B1004	257742	33917	4709
7	01-Jan-16	B1005	276221	35698	2810
8	01-Jan-16	B1006	401399	35458	3660
9	01-Jan-16	B1007	413543	29061	2149
10	01-Jan-16	B1008	343048	30666	4075
11	01-Jan-16	B1009	412804	23541	3263
12	01-Jan-16	B1010	417348	33490	3067
13	01-Feb-16	B1000	437812	41404	4822
14	01-Feb-16	B1001	370356	50269	2872
15	01-Feb-16	B1002	231200	38796	4414
16	01-Feb-16	B1003	336263	30638	2861
17	01-Feb-16	B1004	267027	47231	3846
18	01-Feb-16	B1005	424629	21445	3802
19	01-Feb-16	B1006	453536	43418	4704
20	01-Feb-16	B1007	252241	49719	2499
21	01-Feb-16	B1008	202733	32055	3200
22	01-Feb-16	B1009	258350	33749	3946
23	01-Feb-16	B1010	408801	22845	4403
24	01-Mar-16	B1000	242522	27059	2617
25	01-Mar-16	B1001	363959	33456	2317

Energy Consumption Dataset

	A	B	C
1	Year	Energy Type	Price Per Unit
2	2016	Water	$0.05
3	2017	Water	$0.06
4	2018	Water	$0.06
5	2019	Water	$0.07
6	2020	Water	$0.07
7	2016	Gas	$1.00
8	2017	Gas	$1.10
9	2018	Gas	$1.21
10	2019	Gas	$1.33
11	2020	Gas	$1.46
12	2016	Electricity	$0.08
13	2017	Electricity	$0.09
14	2018	Electricity	$0.10
15	2019	Electricity	$0.11
16	2020	Electricity	$0.12

Rates Dataset

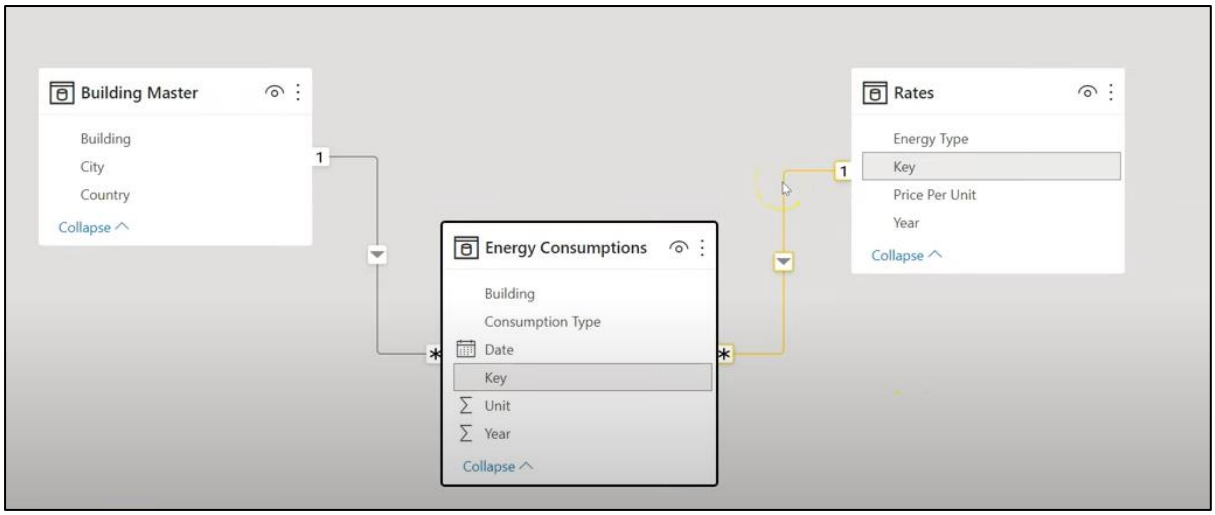
	A	B	C
1	Building	City	Country
2	B1000	New York	USA
3	B1001	New York	USA
4	B1002	New York	USA
5	B1003	Los Angeles	USA
6	B1004	Chicago	USA
7	B1005	Houston	USA
8	B1006	Phoenix	USA
9	B1007	Chicago	USA
10	B1008	Chicago	USA
11	B1009	Los Angeles	USA
12	B1010	Los Angeles	USA

Building Master Dataset

DAX Queries:

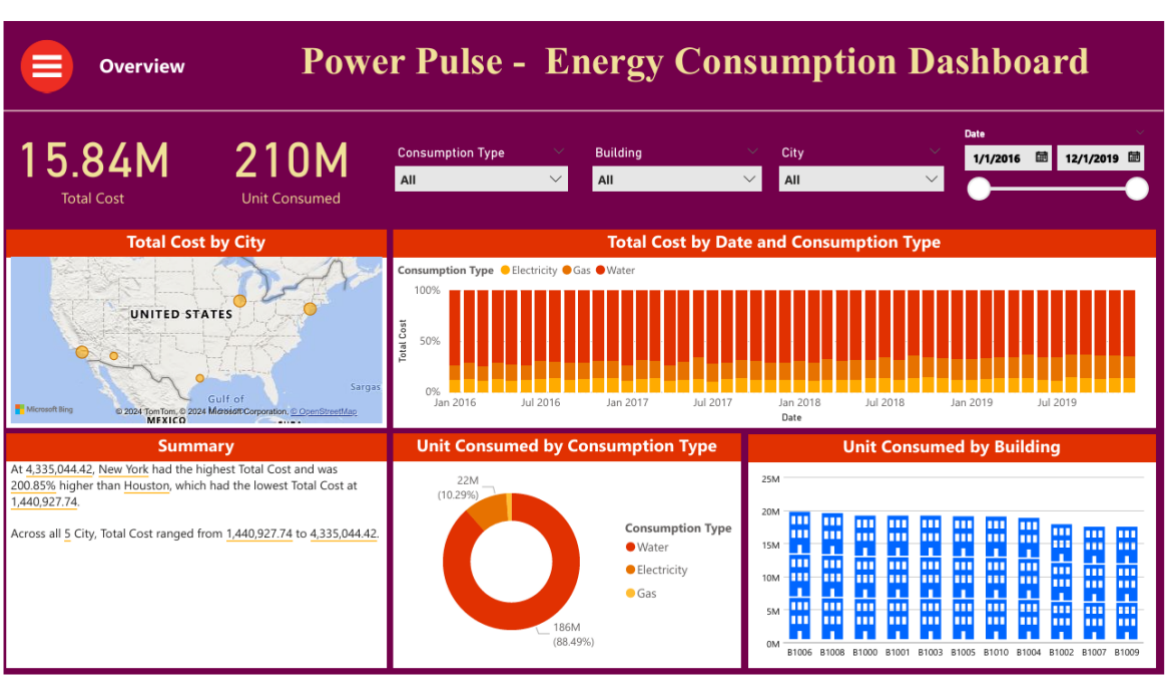
```
1  Total Cost =
2  SUMX('Energy Consumptions',
3  'Energy Consumptions'[Unit]*RELATED(Rates[Price Per Unit]))
```

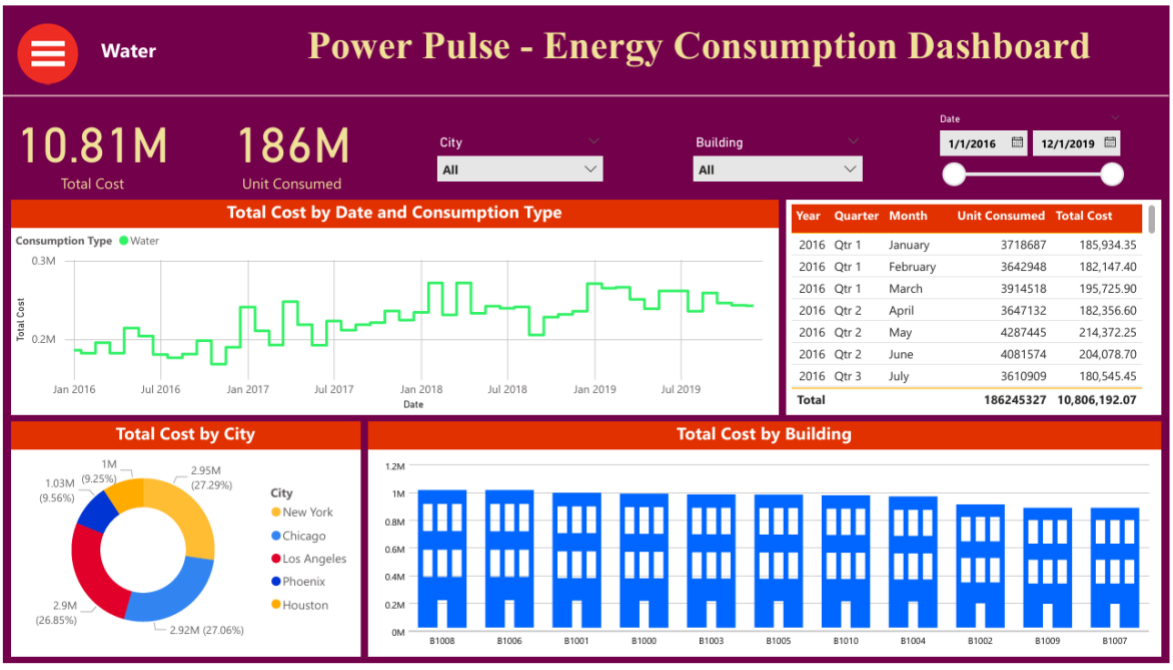
```
1  Unit Consumed = SUM('Energy Consumptions'[Unit])
```

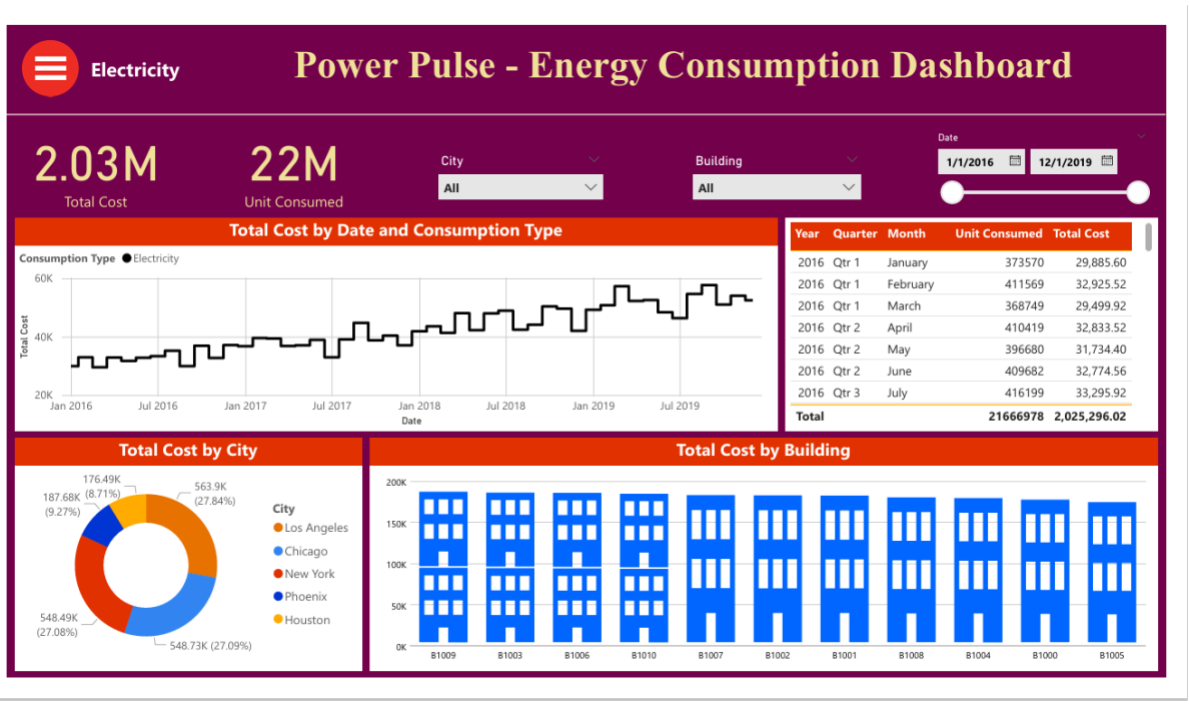


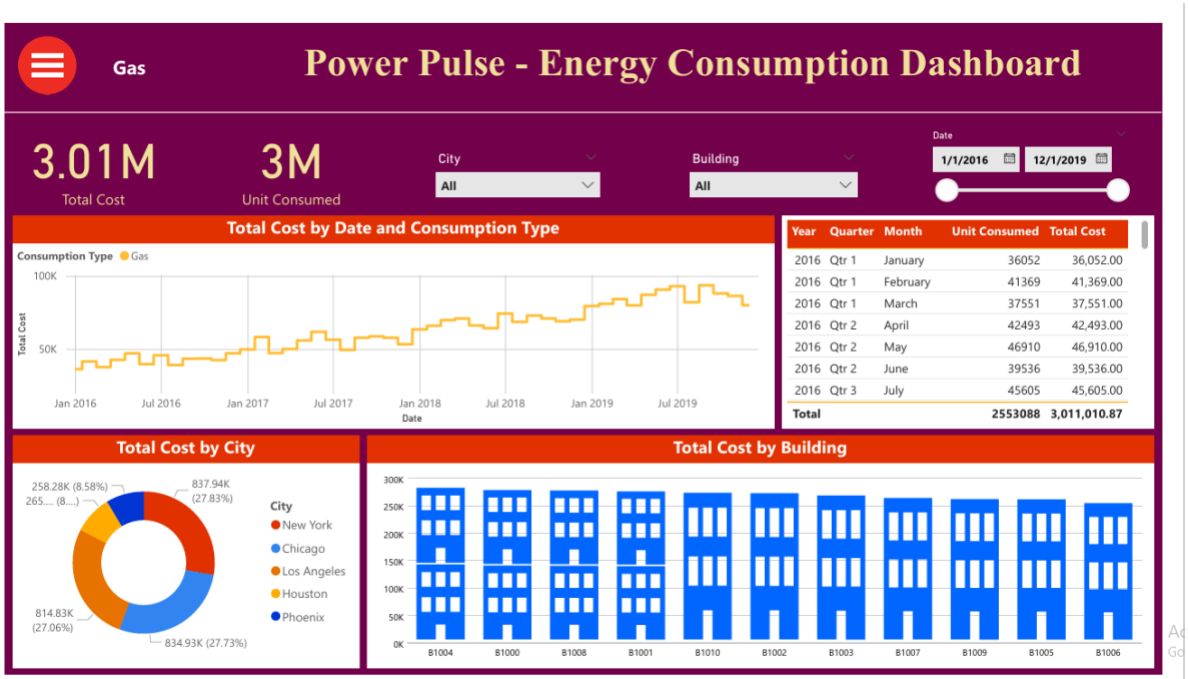
Chapter – 4 Results And Discussion

Final Dashboards



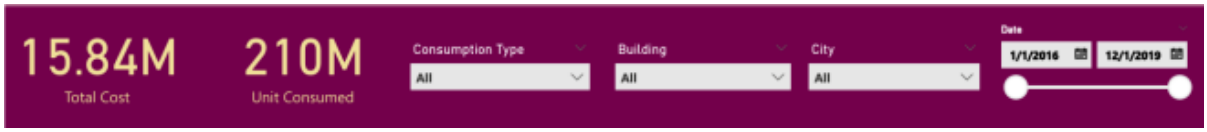



Electricity
Power Pulse - Energy Consumption Dashboard
2.03M
Total Cost
22M
Unit Consumed
City
All
Building
All
Date
1/1/2016
12/1/2019
Total Cost by Date and Consumption Type
Consumption Type Electricity
Total Cost
Date
Year Quarter Month Unit Consumed Total Cost
2016 Qtr 1 January 373570 29,885.60
2016 Qtr 1 February 411569 32,925.52
2016 Qtr 1 March 368749 29,499.92
2016 Qtr 2 April 410419 32,833.52
2016 Qtr 2 May 396680 31,734.40
2016 Qtr 2 June 409682 32,774.56
2016 Qtr 3 July 416199 33,295.92
Total 21666978 2,025,296.02
Total Cost by City
176.49K (8.71%)
563.9K (27.84%)
187.68K (9.27%)
548.49K (27.08%)
548.73K (27.09%)
City
Los Angeles
Chicago
New York
Phoenix
Houston
Total Cost by Building
B1009
B1003
B1006
B1010
B1007
B1002
B1001
B1008
B1004
B1000
B1005

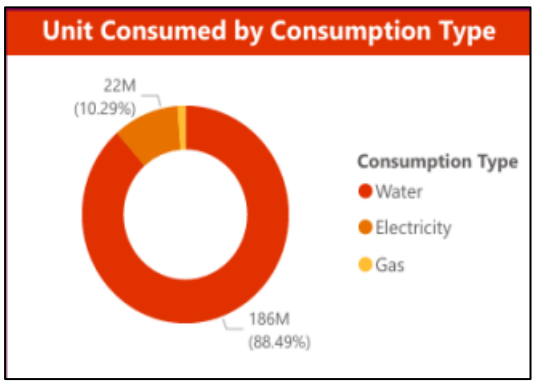

Gas
Power Pulse - Energy Consumption Dashboard
3.01M
Total Cost
3M
Unit Consumed
City
All
Building
All
Date
1/1/2016
12/1/2019
Total Cost by Date and Consumption Type
Consumption Type Gas
Total Cost
Date
Year Quarter Month Unit Consumed Total Cost
2016 Qtr 1 January 36052 36,052.00
2016 Qtr 1 February 41369 41,369.00
2016 Qtr 1 March 37551 37,551.00
2016 Qtr 2 April 42493 42,493.00
2016 Qtr 2 May 46910 46,910.00
2016 Qtr 2 June 39536 39,536.00
2016 Qtr 3 July 45605 45,605.00
Total 2553088 3,011,010.87
Total Cost by City
258.28K (8.58%)
837.94K (27.83%)
814.83K (27.06%)
834.93K (27.73%)
City
New York
Chicago
Los Angeles
Houston
Phoenix
Total Cost by Building
B1004
B1000
B1008
B1001
B1010
B1002
B1003
B1007
B1009
B1005
B1006

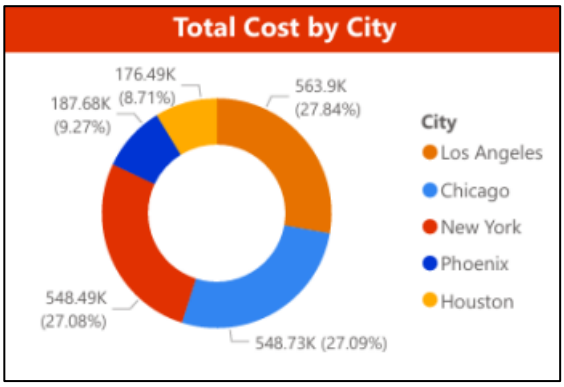
Here's a description of each attribute along with the visualization type used in the project dashboard:

1. Key Performance Indicators (KPIs): Key Performance Indicators (KPIs) are essential metrics used to evaluate and focus on measuring progress towards specific goals.



2. Pie Charts: A pie chart visually represents the proportion of employees who have left the organization within a specific period, categorized by reasons such as voluntary resignations, retirements, and terminations. Each slice of the pie corresponds to a different turnover reason, providing a clear overview of turnover distribution.



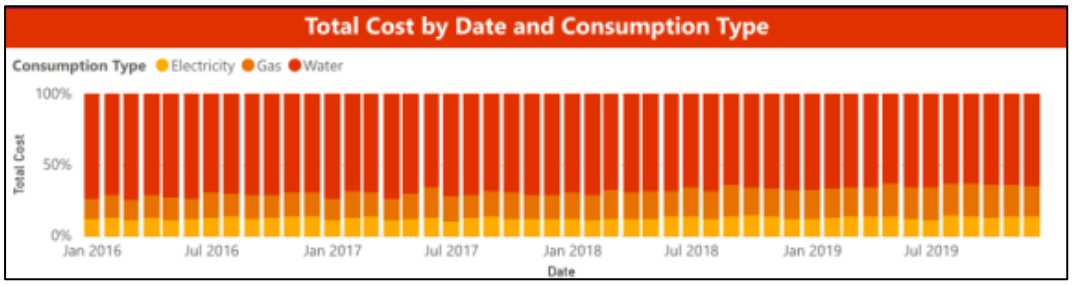


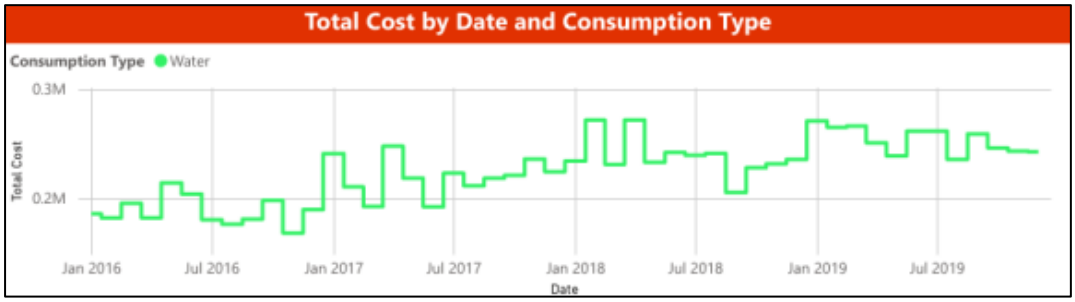
3. Table: This section displays details about consumption including consumption type, date, quarter, month, unit consumed, and total cost. Users can scroll through the table to view data for different time periods.

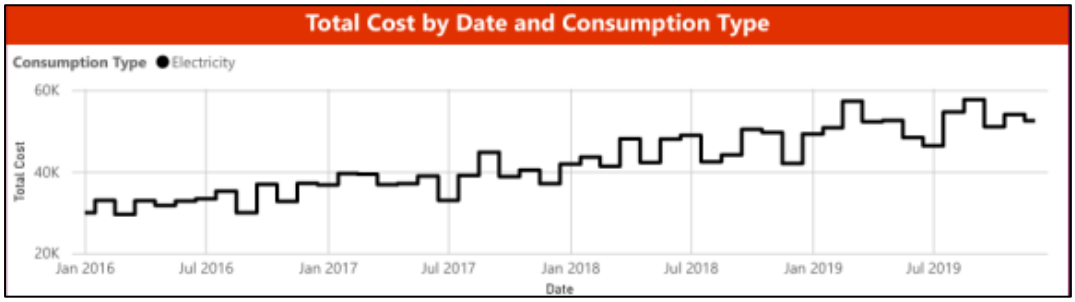
Year	Quarter	Month	Unit Consumed	Total Cost
2016	Qtr 1	January	3718687	185,934.35
2016	Qtr 1	February	3642948	182,147.40
2016	Qtr 1	March	3914518	195,725.90
2016	Qtr 2	April	3647132	182,356.60
2016	Qtr 2	May	4287445	214,372.25
2016	Qtr 2	June	4081574	204,078.70
2016	Qtr 3	July	3610909	180,545.45
Total			**186245327**	**10,806,192.07**

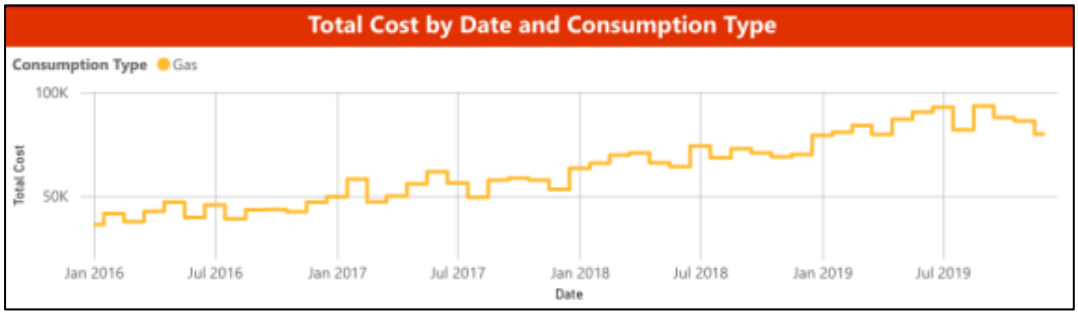
Year	Quarter	Month	Unit Consumed	Total Cost
2016	Qtr 1	January	373570	29,885.60
2016	Qtr 1	February	411569	32,925.52
2016	Qtr 1	March	368749	29,499.92
2016	Qtr 2	April	410419	32,833.52
2016	Qtr 2	May	396680	31,734.40
2016	Qtr 2	June	409682	32,774.56
2016	Qtr 3	July	416199	33,295.92
Total			**21666978**	**2,025,296.02**

4. Stacked Bar Chart: This visualizes the breakdown of consumption by type (e.g., Electricity, Gas) for a selected time period. The total consumption for each type is displayed on the right side of the chart.



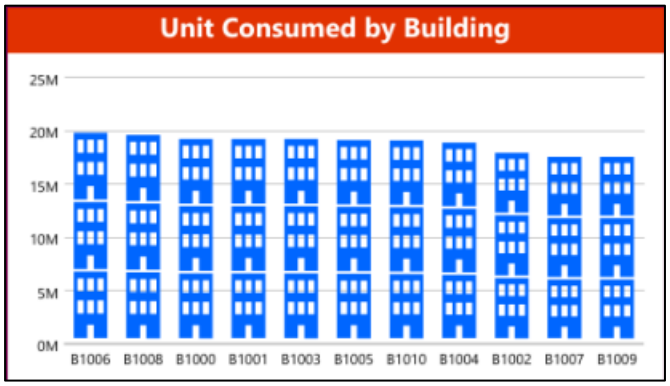


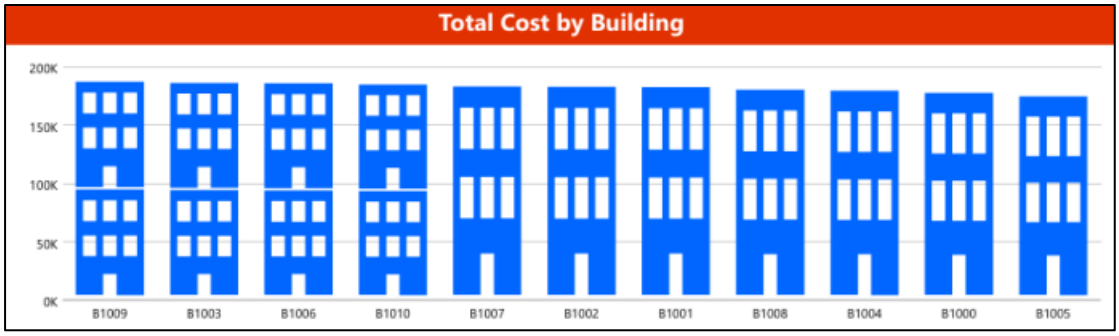




5. Map Visual : Geo-spatial representation of energy consumption, offering insights into regional variations.

6. Building slicer : Enables users to focus on energy usage specific to a particular building.





Discussions

The Power Pulse dashboard provides valuable insights into energy consumption costs across different cities and time periods. By analyzing the "Total Cost by City" chart, we can identify cities with the highest and lowest costs and explore potential reasons for these differences. Similarly, trends in the "Total Cost by Date and Consumption Type" chart can reveal seasonal variations or long-term cost changes. If the dashboard includes multiple consumption types, discussions can focus on which type contributes the most to overall cost. Furthermore, by linking these findings to project goals (e.g., cost reduction, energy efficiency), we can pinpoint areas requiring the most attention. However, it's important to acknowledge limitations in the data and consider factors beyond the dashboard's scope. Looking ahead, recommendations can address potential data enhancements (e.g., including building-level data) and explore advanced analytics to optimize energy consumption and costs.

1. Significance: Highlight the importance of effective energy consumption management for organizations in terms of cost savings and sustainability.

2. Challenges: Discuss the complexities associated with analyzing energy consumption data and how the proposed dashboard addresses these challenges.

3. Integration: Consider how the dashboard integrates with existing systems and processes within the organization for holistic analysis.

4. User Engagement: Explore strategies for engaging users and promoting adoption of the dashboard.

5. Measuring Success: Define KPIs for evaluating the success of the dashboard in achieving organizational goals.

6. Scalability: Discuss the scalability of the dashboard to accommodate future growth and enhancements.

7. Compliance: Explore how the dashboard supports regulatory compliance and reporting requirements.

8. Use Cases: Highlight potential applications of the dashboard across different industries and sectors.

9. Cost-Benefit Analysis: Conduct a cost-benefit analysis to assess the ROI of implementing the dashboard.

10.Future Trends: Consider emerging trends and developments in energy management and analytics that could impact the dashboard's evolution.

Chapter-5 Conclusion

In conclusion, the development and implementation of an energy consumption dashboard offer significant benefits for organizations seeking to optimize energy usage, reduce costs, and enhance sustainability. Through the systematic analysis and visualization of energy consumption data, the dashboard provides valuable insights that empower decision-makers to identify inefficiencies, set targets, and monitor progress towards energy efficiency goals. By facilitating informed decision-making and promoting transparency, the dashboard becomes a powerful tool for driving organizational change and fostering a culture of sustainability.The Power Pulse dashboard serves as a valuable tool for monitoring and understanding energy consumption costs across various cities and time frames. Analyzing the data allows for identification of cost variations between cities, seasonal trends, and potentially high-cost consumption types. By relating these insights to project goals like cost reduction or energy efficiency, targeted actions can be implemented. However, it's crucial to acknowledge limitations in the data and consider external factors influencing consumption. Moving forward, recommendations can focus on enriching the data (e.g., building-level details) and exploring advanced analytics to further optimize energy consumption and minimize costs. This comprehensive approach will ensure informed decision-making and progress towards achieving project goals.

Future Scope of Study

1.Integration with Smart Technologies: Explore opportunities to integrate the dashboard with emerging smart technologies such as IoT devices, smart meters, and building automation systems. This integration could enable real-time monitoring and control of energy usage, further enhancing efficiency and responsiveness.

2.Predictive Analytics: Incorporate advanced analytics techniques such as machine learning and predictive modeling to forecast future energy consumption trends, anticipate potential issues, and optimize energy usage proactively.

3.Enhanced Visualization Techniques: Continuously improve the dashboard's visualizations and user interface to enhance usability, accessibility, and engagement. Explore innovative visualization techniques and interactive features to provide deeper insights and facilitate decision-making.

4.Bench marking and Comparative Analysis: Implement bench marking capabilities within the dashboard to compare energy consumption metrics against industry standards, best practices, or peer organizations. This comparative analysis can help identify areas for improvement and drive continuous optimization efforts.

5.Expanded Reporting Functionality: Enhance the reporting capabilities of the dashboard to generate customized reports tailored to specific stakeholder needs. This could include automated report generation, ad-hoc reporting functionality, and customizable dashboards for different user groups.

References

1. Dataset Name : Energy Consumption Dataset.xlsx
2. Source : https://www.pk-anexcelexpert.com/
3. Power BI Project by PK- An Excel Expert : https://youtu.be/CEDzvrUsSg8?si=QS3Y6dwqhfVx9h34