Tech Saksham

Case Study Report

Data Analytics with Power BI

"Analysis of Commercial Electricity Consumption in Indian State"

"A.P.C Mahalaxmi College for Women"

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ABSTRACT

The abstract of electricity encompasses its fundamental properties, including electrical charge, current, voltage, and resistance, as well as the principles of electromagnetism. Electricity plays a pivotal role in modern technology, powering devices, systems, and infrastructure essential for daily life. Understanding its abstract concepts facilitates the development of electrical engineering, enabling innovations in areas such as power generation, transmission, and utilization. Moreover, electricity's abstract nature underpins theoretical frameworks that guide research in quantum mechanics and particle physics, contributing to advancements in fundamental science.

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CHAPTER 1

INTRODUCTION

1.1 Problem Statement

The problem statement for electricity could focus on various aspects, depending on the context. Here's one example:

"Increasing demand for electricity coupled with aging infrastructure poses challenges in ensuring reliable and sustainable power supply. This problem statement aims to address issues related to enhancing grid resilience, optimizing energy distribution, integrating renewable sources efficiently, and implementing smart grid technologies to meet the evolving needs of society while mitigating environmental impacts and ensuring affordability."

1.2 Proposed Solution

A proposed solution for electricity could involve a multifaceted approach to address the challenges outlined in the problem statement. Here's one possible solution:

1. **Investment in Renewable Energy**: Increase investment in renewable energy sources such as solar, wind, and hydroelectric power to diversify the energy mix and reduce reliance on fossil fuels.
2. **Grid Modernization**: Implement smart grid technologies to enhance the efficiency, reliability, and resilience of the electricity grid. This includes advanced metering infrastructure, grid automation, and real-time monitoring systems.
3. **Energy Storage**: Develop and deploy energy storage solutions such as batteries, pumped hydro storage, and thermal storage to address intermittency issues associated with renewable energy sources and improve grid stability.
4. **Demand-Side Management**: Encourage demand-side management practices such as time-of-use pricing, energy efficiency programs, and demand response initiatives to optimize energy consumption and reduce peak demand on the grid.
5. **Infrastructure Upgrades**: Invest in upgrading and modernizing aging electricity infrastructure, including transmission and distribution networks, to improve reliability and accommodate the integration of renewable energy resources.
6. **Policy Support**: Implement supportive policies and regulations to incentivize renewable energy deployment, grid modernization, and energy efficiency measures. This may include subsidies, tax incentives, renewable energy targets, and carbon pricing mechanisms.

By implementing these solutions in a coordinated manner, it's possible to ensure a more sustainable, reliable, and resilient electricity system that meets the needs of society while mitigating environmental impacts

1.3 Feature

One key feature of electricity is its ability to be easily transmitted over long distances with relatively little loss of energy. This is made possible by the conductive properties of materials such as copper and aluminum, which allow electrical currents to flow efficiently through wires and cables. Additionally, electricity can be converted into other forms of energy, such as light, heat, or mechanical motion, through devices like light bulbs, heaters, and electric motors. This versatility makes electricity a highly versatile and widely used form of energy in various applications, from powering homes and businesses to driving industrial processes and transportation systems.

1.4 Advantages

The advantages of electricity are numerous and profound:

1. **Versatility**: Electricity can power a wide range of devices and systems, from small household appliances to large industrial machinery, making it incredibly versatile.
2. **Clean Energy**: Electricity generated from renewable sources such as solar, wind, and hydroelectric power is environmentally friendly and produces minimal greenhouse gas emissions, contributing to efforts to combat climate change.
3. **Efficiency**: Electric motors and appliances can be highly efficient, converting a high percentage of energy input into useful work, reducing waste compared to many other forms of energy.
4. **Convenience**: Electricity provides instant power at the flick of a switch, offering unparalleled convenience for lighting, heating, cooling, cooking, and powering electronic devices.
5. **Reliability**: Modern electricity grids are designed to provide reliable power supply, with redundancy and backup systems in place to minimize the risk of outages.
6. **Scalability**: Electricity generation and distribution systems can be scaled up or down easily to meet changing demand, making it adaptable to different population sizes and economic activities.
7. **Accessibility**: Electricity is widely available in urban, suburban, and rural areas, improving living standards and enabling economic development and social progress.
8. **Innovation**: The development of electricity has led to numerous technological advancements and innovations, driving progress in areas such as communication, transportation, healthcare, and entertainment.

Overall, the advantages of electricity make it indispensable to modern life and critical for meeting the needs of a growing global population while minimizing environmental impact.

1.5 Scope

The scope of electricity encompasses various dimensions:

1. **Generation**: This involves producing electricity from various sources such as fossil fuels (coal, natural gas), nuclear energy, renewable sources (solar, wind, hydroelectric), and emerging technologies like tidal and geothermal energy.
2. **Transmission**: Electricity generated at power plants is transmitted over long distances through high-voltage transmission lines to substations and distribution networks.
3. **Distribution**: Distribution networks deliver electricity from substations to end-users, including residential, commercial, and industrial consumers.
4. **Utilization**: Electricity powers a vast array of applications, including lighting, heating, cooling, transportation (electric vehicles), manufacturing processes, communication systems, and electronic devices.
5. **Infrastructure**: This includes the physical infrastructure necessary for electricity generation, transmission, and distribution, such as power plants, substations, transformers, transmission lines, and distribution networks.
6. **Regulation and Policy**: Governments and regulatory bodies establish policies and regulations to ensure the safety, reliability, and affordability of electricity supply, as well as to promote renewable energy deployment and environmental sustainability.
7. **Research and Innovation**: Ongoing research and innovation in areas such as energy storage, grid modernization, smart grid technologies, and renewable energy integration expand the scope of electricity and drive advancements in the field.
8. **Global Impact**: The scope of electricity extends beyond individual countries or regions, with global initiatives aimed at addressing challenges such as energy access, climate change mitigation, and sustainable development.

Understanding the diverse scope of electricity is essential for addressing challenges and opportunities in energy transition, infrastructure development, and sustainable energy use.

CHAPTER 2

SERVICES AND TOOLS REQUIRED

2.1 Services Used

Services related to electricity encompass a broad range of offerings aimed at various aspects of electricity generation, transmission, distribution, and utilization. Here are some key services used in the electricity sector:

1. **Electricity Generation Services**: Companies or utilities that generate electricity from various sources, including fossil fuels (coal, natural gas), nuclear energy, renewable sources (solar, wind, hydroelectric), and emerging technologies like tidal and geothermal energy.
2. **Transmission Services**: Entities responsible for transmitting electricity over long distances through high-voltage transmission lines, ensuring the efficient and reliable transfer of power from generation facilities to substations.
3. **Distribution Services**: Companies or utilities that operate distribution networks to deliver electricity from substations to end-users, including residential, commercial, and industrial consumers. Distribution services also include maintenance and repair of distribution infrastructure.
4. **Energy Retail Services**: Retail electricity providers offer services to end-users, including billing, customer support, energy efficiency programs, and the sale of electricity plans and contracts.
5. **Grid Services**: Providers of grid services offer solutions to optimize grid operations, enhance grid stability, and manage energy flows, including grid monitoring, control systems, demand response, and voltage regulation services.
6. **Energy Management Services**: Companies that offer energy management solutions to optimize energy use, reduce costs, and improve efficiency for commercial, industrial, and residential customers. This includes energy audits, monitoring systems, and energy-saving technologies.
7. **Renewable Energy Services**: Companies specializing in renewable energy offer services related to the development, installation, operation, and maintenance of renewable energy projects, such as solar farms, wind farms, and hydroelectric facilities.

8. **Consulting and Engineering Services**: Consulting firms and engineering companies provide a range of services to support the electricity sector, including feasibility studies, project management, engineering design, and regulatory compliance.

These services play a crucial role in ensuring the reliable, affordable, and sustainable supply of electricity to meet the needs of consumers and support economic development.

2.2 Tools and Software used

Tools:

- **Power BI**: The main tool for this project is Power BI, which will be used to create interactive dashboards for real-time data visualization.
- **Power Query**: This is a data connection technology that enables you to discover, connect, combine, and refine data across a wide variety of sources.

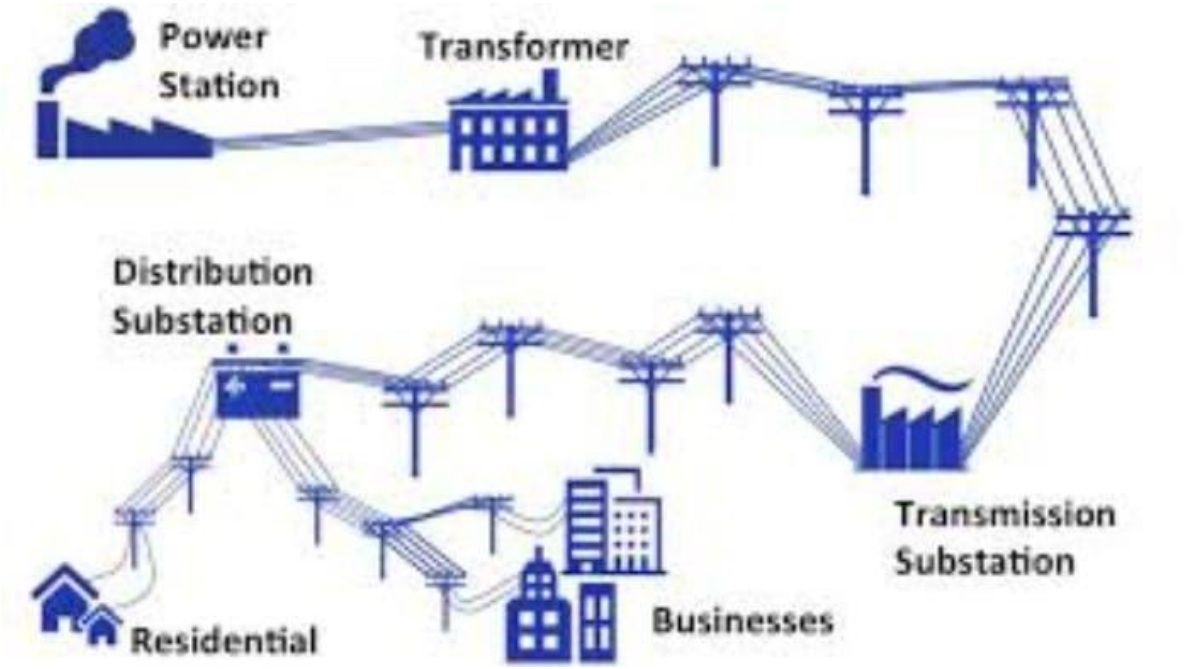
Software Requirements:

- **Power BI Desktop**: This is a Windows application that you can use to create reports and publish them to Power BI.
- **Power BI Service**: This is an online SaaS (Software as a Service) service that you use to publish reports, create new dashboards, and share insights.
- **Power BI Mobile**: This is a mobile application that you can use to access your reports and dashboards on the go.

CHAPTER 3

PROJECT ARCHITECTURE

3.1 Architecture



Here's a high-level architecture for the project:

1. **Data Collection**: Real-time customer data is collected from various sources like bank transactions, customer interactions, etc. This could be achieved using services like Azure Event Hubs or AWS Kinesis.
2. **Data Storage**: The collected data is stored in a database for processing. Azure SQL Database or AWS RDS can be used for this purpose.
3. **Data Processing**: The stored data is processed in real-time using services like Azure Stream Analytics or AWS Kinesis Data Analytics.
4. **Machine Learning**: Predictive models are built based on processed data using Azure Machine Learning or AWS Sage Maker. These models can help in predicting customer behavior, detecting fraud, etc.
5. **Data Visualization**: The processed data and the results from the predictive models are visualized in real-time using Power BI. Power BI allows you to create interactive dashboards that can provide valuable insights into the data.

6. **Data Access**: The dashboards created in Power BI can be accessed through Power BI Desktop, Power BI Service (online), and Power BI Mobile.

This architecture provides a comprehensive solution for real-time analysis of bank customers. However, it's important to note that the specific architecture may vary depending on the bank's existing infrastructure, specific requirements, and budget. It's also important to ensure that all tools and services comply with relevant data privacy and security regulations.

CHAPTER 4

MODELING AND RESULT

Manage relationship

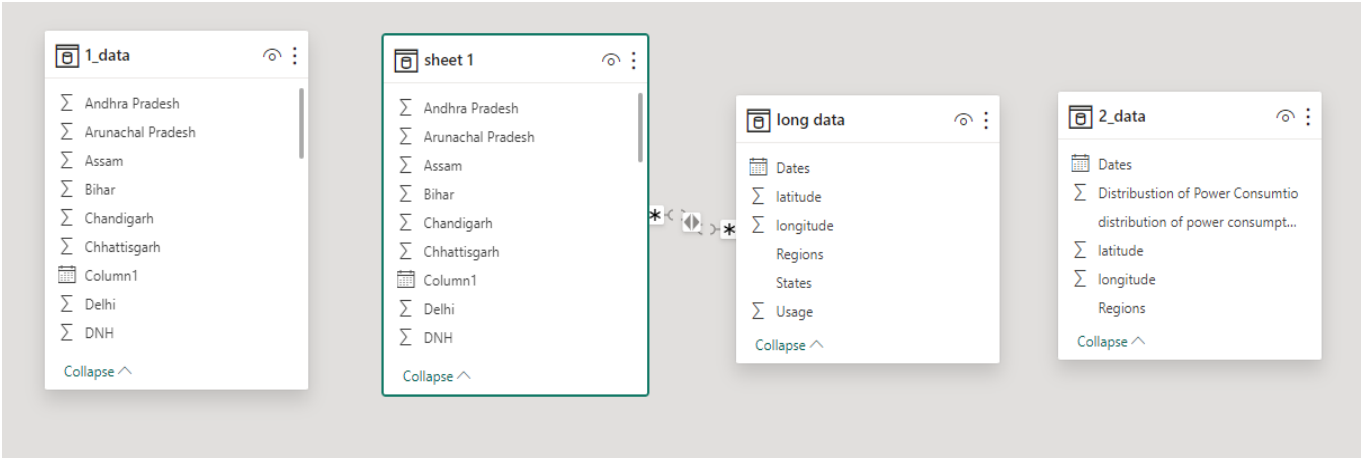
Managing relationships in the electricity sector involves fostering collaboration and communication among various stakeholders to ensure a reliable, efficient, and sustainable supply of electricity. Here's how relationships are managed in different aspects of the electricity sector:

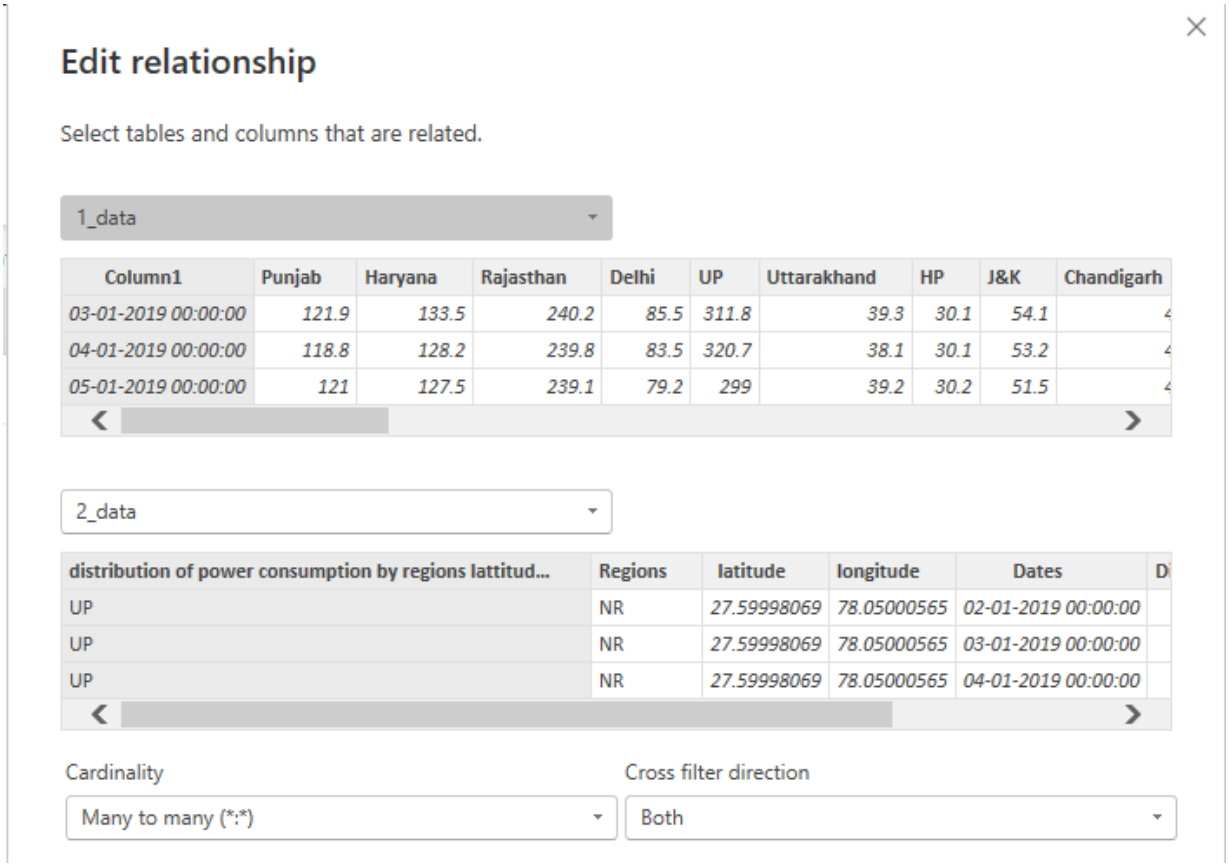
1. **Government and Regulatory Bodies**: Governments and regulatory agencies play a crucial role in overseeing the electricity sector, setting policies, regulations, and standards to ensure safety, reliability, affordability, and environmental sustainability. Managing relationships with these entities involves compliance with regulations, engaging in regulatory proceedings, and advocating for favorable policies.
2. **Utility Companies and Suppliers**: Utility companies responsible for electricity generation, transmission, and distribution maintain relationships with suppliers of equipment, materials, and services necessary for operations. Effective management of these relationships involves procurement, contract negotiation, and ongoing collaboration to ensure the reliability and efficiency of electricity infrastructure.
3. **Grid Operators and System Operators**: Grid operators manage the transmission and distribution grids, ensuring the reliable operation of the electricity system. Managing relationships with system operators involves coordination, communication, and sharing of real-time data to maintain grid stability, manage congestion, and respond to emergencies effectively.
4. **Energy Market Participants**: Electricity markets facilitate the buying and selling of electricity between generators, suppliers, and consumers. Managing relationships with market participants involves negotiating contracts, managing transactions, resolving disputes, and ensuring compliance with market rules and regulations.
5. **Customers and End-Users**: Building and maintaining relationships with electricity customers and end-users are essential for understanding their needs, providing reliable service, and promoting energy efficiency. Utilities engage in customer outreach, education, and support programs to enhance customer satisfaction and loyalty.
6. **Community and Stakeholder Engagement**: Engaging with local communities, stakeholders, and advocacy groups is critical for obtaining support for infrastructure

projects, addressing environmental concerns, and building trust. Effective community engagement involves transparency, communication, and responsiveness to community needs and feedback.

7. **Technology Providers and Innovators**: Collaboration with technology providers, researchers, and innovators is essential for driving technological advancements in the electricity sector, such as renewable energy integration, smart grid technologies, and energy storage solutions. Managing relationships with these stakeholders involves partnerships, research collaborations, and technology adoption initiatives.

Overall, effective management of relationships in the electricity sector requires collaboration, communication, and a commitment to meeting the needs of stakeholders while advancing the goals of reliability, sustainability, and affordability in the provision of electricity services.





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Select tables and columns that are related.

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04-01-2019 00:00:00	118.8	128.2	239.8	83.5	320.7	38.1	30.1	53.2	4
05-01-2019 00:00:00	121	127.5	239.1	79.2	299	39.2	30.2	51.5	4

2_data

distribution of power consumption by regions lattitud...	Regions	latitude	longitude	Dates	D
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Cross filter direction: Both

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04-01-2019 00:00:00	118.8	128.2	239.8	83.5	320.7	38.1	30.1	53.2	4.8	74.8	301.9	239.3	39
05-01-2019 00:00:00	121	127.5	239.1	79.2	299	39.2	30.2	51.5	4.3	69	313.2	228.2	41
06-01-2019 00:00:00	121.4	132.6	240.4	76.6	286.8	39.2	31	53.2	4.3	68.1	320.7	227.4	40
07-01-2019 00:00:00	118	132.1	241.9	71.1	294.2	40.1	30.1	53.3	4	73.1	319.4	230.3	40
15-01-2019 00:00:00	141.1	142.9	185.4	77.8	326.7	34.3	25.6	39.5	3.2	88	290.5	170.2	39
16-01-2019 00:00:00	231.9	180.5	175.3	111.8	399	41	29.4	41.8	6	89.2	299.5	185.1	37
17-01-2019 00:00:00	253.8	196.4	197.2	115.6	412.5	41.7	29.8	42.3	5.6	83.5	282	183.7	36
21-01-2019 00:00:00	207.1	182.9	189.7	112.2	407.9	39.8	28.8	41.7	5.2	87.5	276.7	187.9	35
23-01-2019 00:00:00	136	150.5	227.2	109.3	395.8	41.5	27.3	44.3	4.8	105.7	391.4	219.7	49
25-01-2019 00:00:00	134.3	155.2	232.4	114.2	408.7	40.2	25.7	43.7	5.1	103.7	380.2	218.4	4
26-01-2019 00:00:00	135.9	143.2	229.6	112.7	373.4	35.5	26.2	43.1	4.7	105.8	380.6	219.8	48
27-01-2019 00:00:00	141.2	138.9	226.9	105	341.6	37.9	27	45.3	4.7	98.3	379.4	212.8	48
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17-02-2019 00:00:00	110.7	126.4	235.2	71.6	272.5	40.5	30.9	47.3	3.9	78.4	326.9	237	40
18-02-2019 00:00:00	109.5	125.1	236.6	71.3	268	35.7	30.4	42.9	3.9	78.8	322.6	237.1	39
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23-02-2019 00:00:00	175.9	179.3	256.2	121.6	444.4	46.3	29.2	47.2	5.6	85	389.9	226.3	51
26-02-2019 00:00:00	186.4	188.4	261.6	132.2	438.9	47.7	28.8	42.3	6.4	37.2	393	223.9	50

distribution of power consumption by regions lattitude and longtitudeStates	Regions	latitude	longitude	Dates	Distribustion of Power Consumtio
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UP	NR	27.59998069	78.05000565	04-01-2019 00:00:00	320.7
UP	NR	27.59998069	78.05000565	05-01-2019 00:00:00	299
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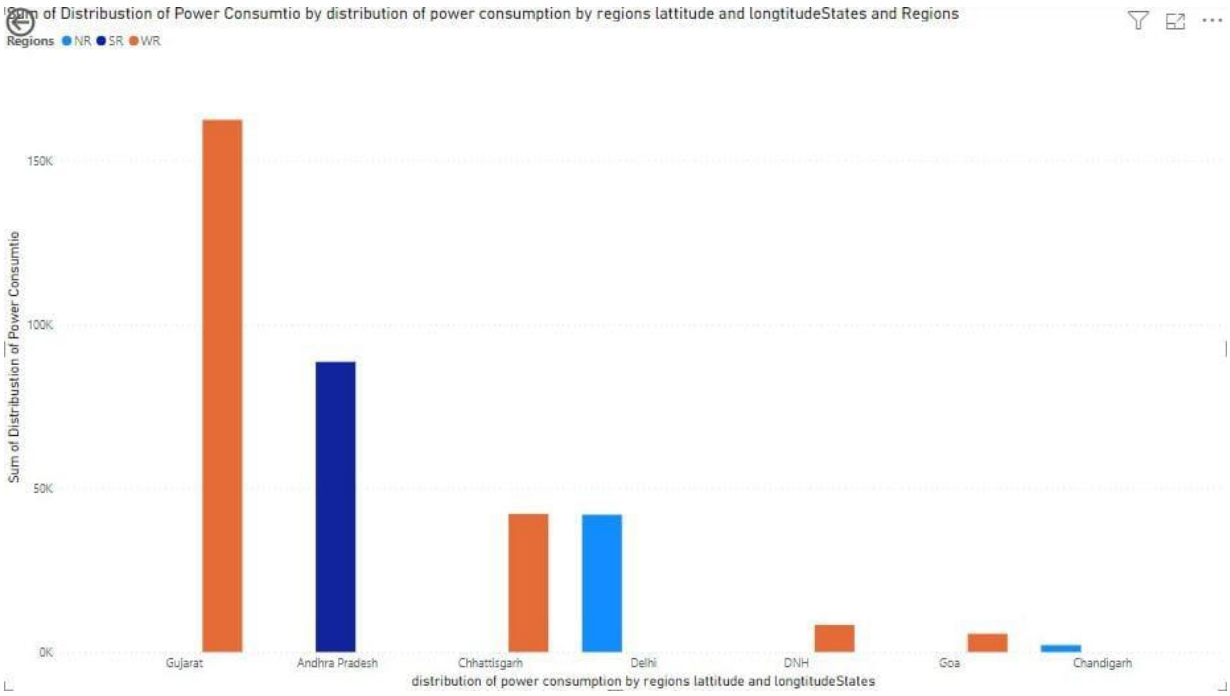
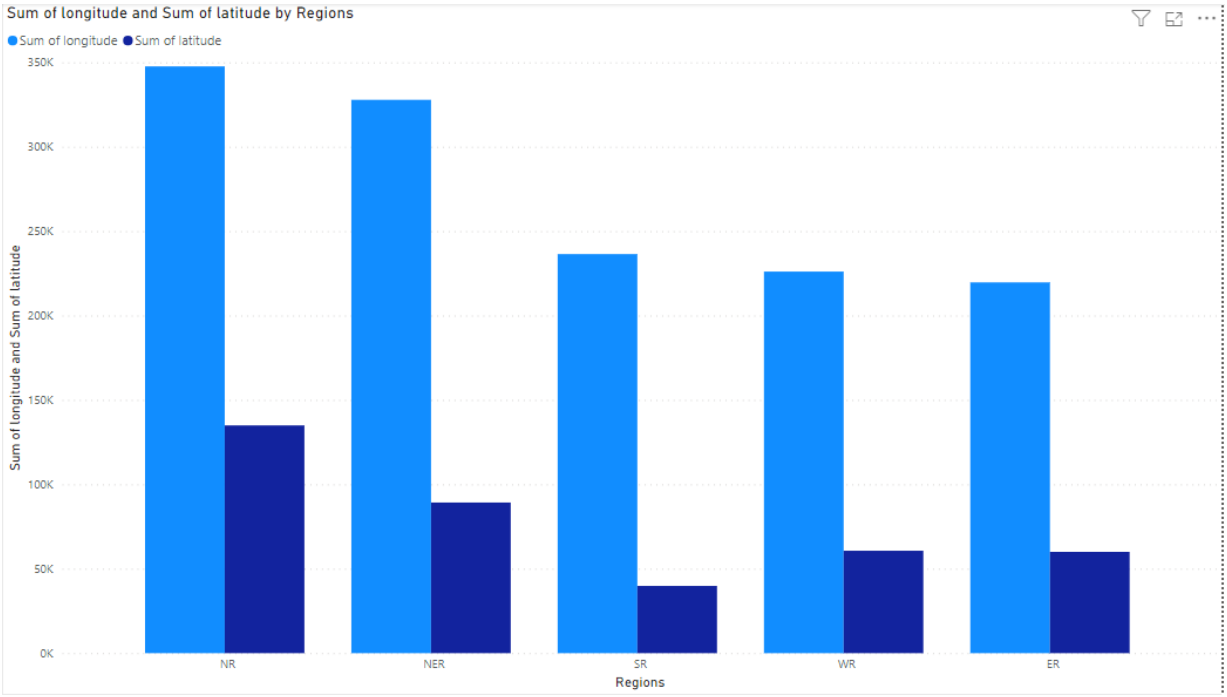
Dashboard

Analysis of Commercial Electricity Consumption In Indian State

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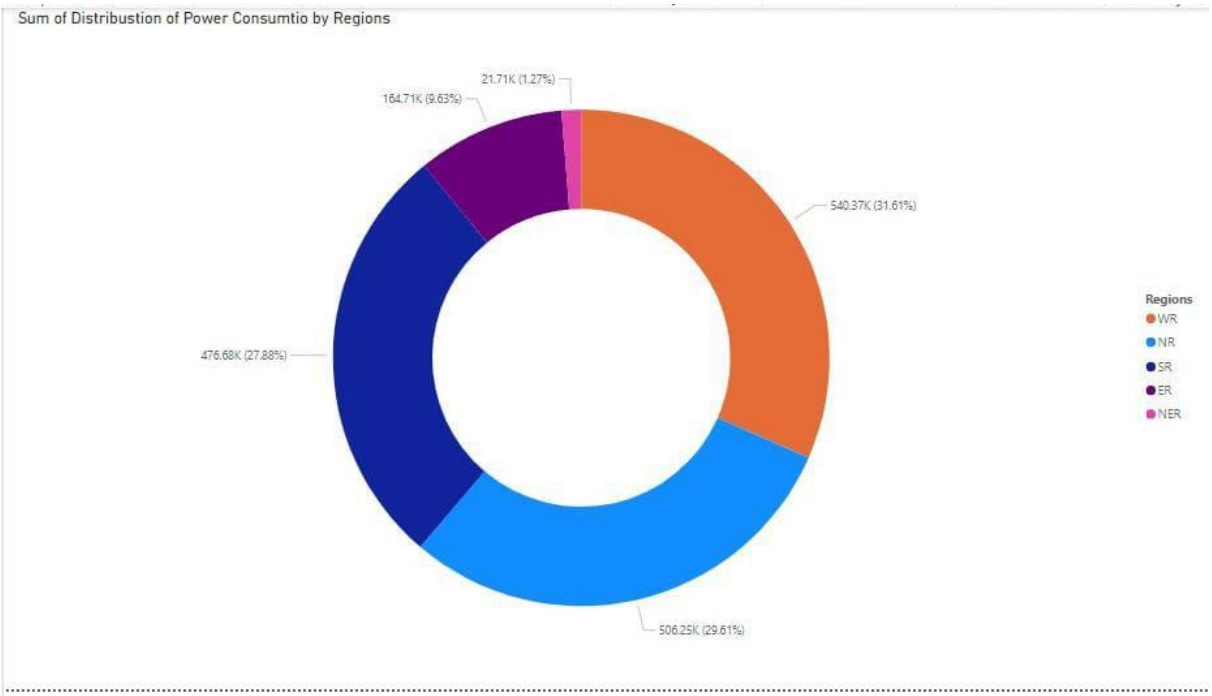
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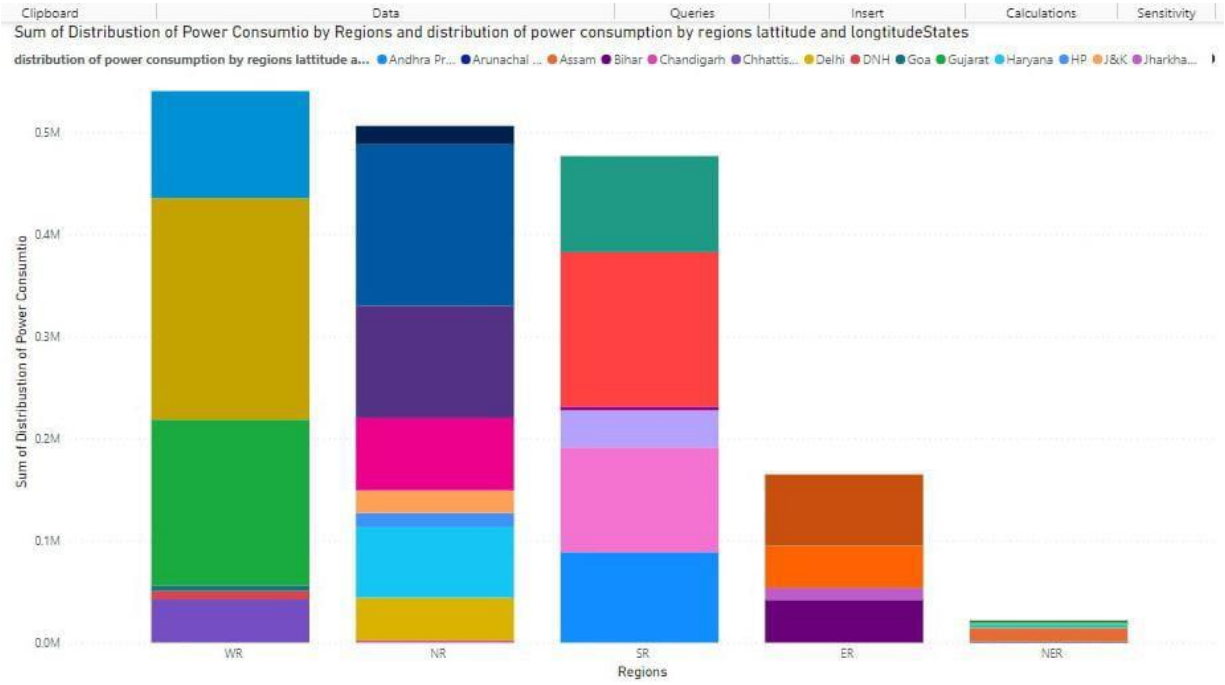
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CONCLUSION

In conclusion, electricity stands as a cornerstone of modern civilization, powering countless aspects of daily life, industry, and innovation. Its transformative impact is undeniable, offering unparalleled convenience, efficiency, and versatility. From lighting up homes to driving industrial processes and enabling technological advancements, electricity plays a pivotal role in shaping societies and economies worldwide.

However, as we move forward, the electricity sector faces significant challenges, including the need to transition towards sustainable energy sources, modernize aging infrastructure, and adapt to evolving consumer demands and technological innovations. Addressing these challenges requires collaborative efforts from governments, industry stakeholders, and communities to ensure a reliable, resilient, and environmentally sustainable electricity supply.

Despite these challenges, the future of electricity holds promise. Advances in renewable energy, smart grid technologies, energy storage, and digitalization offer opportunities to create a more efficient, flexible, and interconnected electricity system. By embracing innovation, fostering cooperation, and prioritizing sustainability, we can unlock the full potential of electricity to drive progress and improve the quality of life for generations to come.

FUTURE SCOPE

The future scope of electricity is vast and holds tremendous potential for transformative advancements across various domains. Here are some key areas where electricity is poised to play a significant role in the future:

1. **Renewable Energy Integration**: The future of electricity will see an increasing integration of renewable energy sources such as solar, wind, and hydroelectric power. Advances in renewable energy technologies, coupled with declining costs, will make renewable energy a dominant component of electricity generation, reducing reliance on fossil fuels and mitigating climate change.
2. **Smart Grid Technologies**: Smart grid technologies will revolutionize the electricity sector by enabling real-time monitoring, control, and optimization of grid operations. This includes advanced metering infrastructure, grid automation, demand response systems, energy storage, and grid-scale integration of distributed energy resources like rooftop solar panels and electric vehicles.
3. **Energy Storage Solutions**: Energy storage technologies, such as batteries, pumped hydro storage, and thermal storage, will play a crucial role in balancing supply and demand, integrating intermittent renewable energy sources, and enhancing grid stability and resilience.
4. **Electrification of Transportation**: The future will witness a significant shift towards electrification in transportation, with the widespread adoption of electric vehicles (EVs) and electrified public transit systems. This will create new opportunities for grid integration, demand management, and vehicle-to-grid (V2G) technologies.
5. **Decentralized Energy Systems**: Decentralized energy systems, including microgrids and community-based renewable energy projects, will empower local communities to generate, store, and manage their electricity more autonomously, fostering energy resilience and sustainability.
6. **Digitalization and IoT**: Digitalization and the Internet of Things (IoT) will enable the development of intelligent energy management systems, predictive analytics, and real-time optimization algorithms, enhancing efficiency, reliability, and flexibility in electricity generation, distribution, and consumption.

7. **Electrification of Industry**: The electrification of industrial processes will lead to greater energy efficiency, reduced emissions, and increased competitiveness in sectors such as manufacturing, agriculture, and resource extraction.
8. **Energy Access and Equity**: Efforts to expand electricity access to underserved populations and bridge the energy access gap in developing countries will continue to be a priority, driven by innovative financing mechanisms, off-grid solutions, and community-led initiatives.

Overall, the future scope of electricity is dynamic and multifaceted, characterized by rapid technological innovation, evolving consumer preferences, and the imperative to transition towards a sustainable energy future. Embracing these opportunities and addressing challenges will be essential to realizing the full potential of electricity in powering the societies of tomorrow.

REFERENCES

https://www.eia.gov/energyexplained/electricity/

LINK

https://github.com/githubtraining/hellogitworld.git