Plugging into the Future: An Exploration of Electricity Consumption Patterns

1. INTRODUCTION

1.1 Overview

India is the world's third-largest producer and third-largest consumer of electricity. The national electric grid in India has an installed capacity of 370.106 GW as of 31 March 2020. Renewable power plants, which also include large hydroelectric plants, constitute 35.86% of India's total installed capacity. During the fiscal year (FY) 2019–20, the total electricity generation in the country was 1,598 TWh, of which 1,383.5 TWh generated by utilities. The gross electricity consumption per capita in FY2019 was 1,208 kWh.

In 2015-16, electric energy consumption in agriculture was recorded as being the highest (17.89%) worldwide. The per capita electricity consumption is low compared to most other countries despite India having a low electricity tariff.

In light of the recent COVID-19 situation, when everyone has been under lockdown for the months of March to June the impacts of the lockdown on economic activities have been faced by every sector in a positive or a negative way.
The dataset is exhaustive in its demonstration of energy consumption state wise.

Analysing Electricity Consumption in India from Jan 2019 till December 5, 2020. This dataset contains a record of Electricity consumption in each states of India, here we are going to analyse State wise , Region wise and Overall Electricity consumption in India.

1.2 Purpose

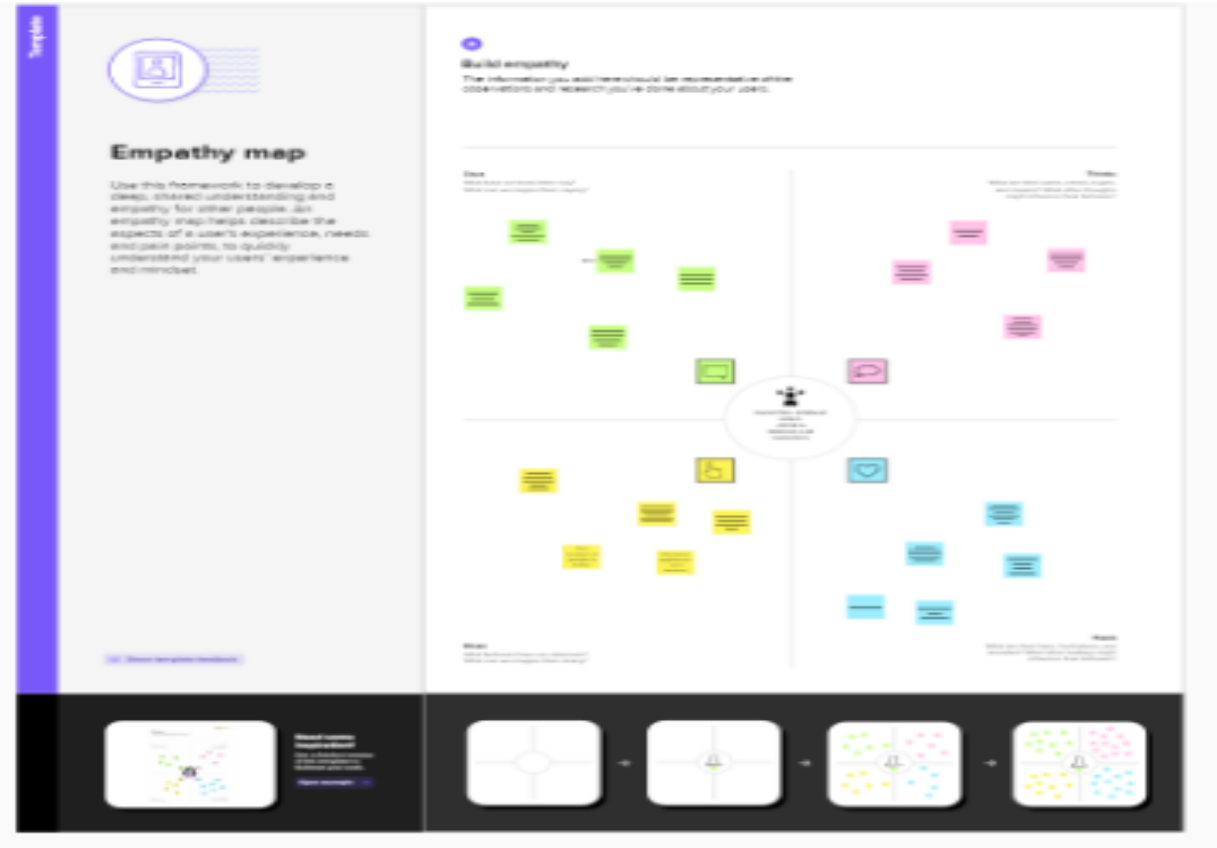
As per the usage of electricity, Electricity consumption patterns of a consumer may vary significantly within consumer groups due to various factors like weather condition, temperature, their lifestyle, etc. It is difficult to discover the behavioral attributes of consumers without advanced data analysis and mining techniques. From the analysis of electricity consumption patterns, user electricity consumption profile can be formed. On the basis of electricity consumption usage and patterns, the new challenges as well as opportunities to load forecasting also comes out for this research area. According to different forecast extents and resolutions, Load forecasting is classified into three categories i.e. short-term load forecasting (1 hour to 1 week), medium-term load forecast (1 week to 1 month), long-term load forecast (month to years). From these categories, Short term

load forecasting using smart meter data is very much important which intensely affects the resource planning and control operation of the power utility.

2. PROBLEM DEFINITION & DESIGN THINKING

2.1 Empathy Map

An empathy map is a widely-used visualization tool within the field of UX and HCI practice. In relation to empathetic design, the primary purpose of an empathy map is to bridge the understanding of the end user.

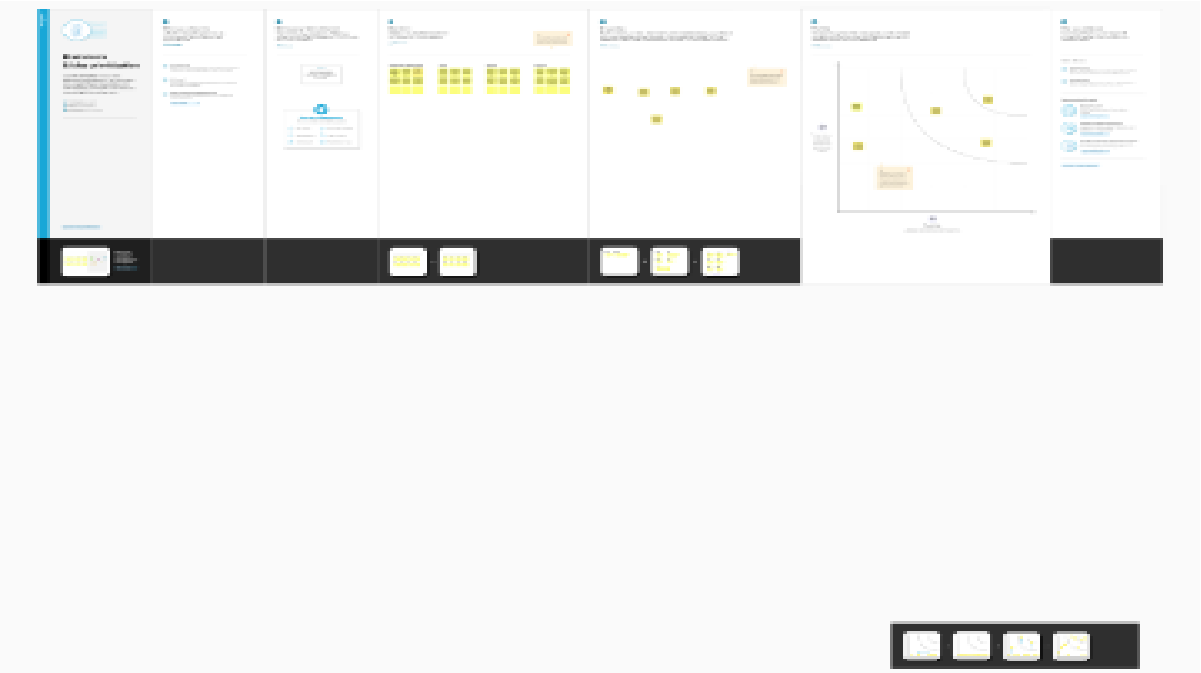


2.2 Ideation and Brainstorming Map

- **Brainstorming**: A technique where the basic premise is to get a group together and have them share their ideas freely, without judgement. The goal is to generate as many ideas as possible, regardless of whether they are good or bad. Once the brainstorming session is over, the group can evaluate the ideas and narrow them down to the best ones.

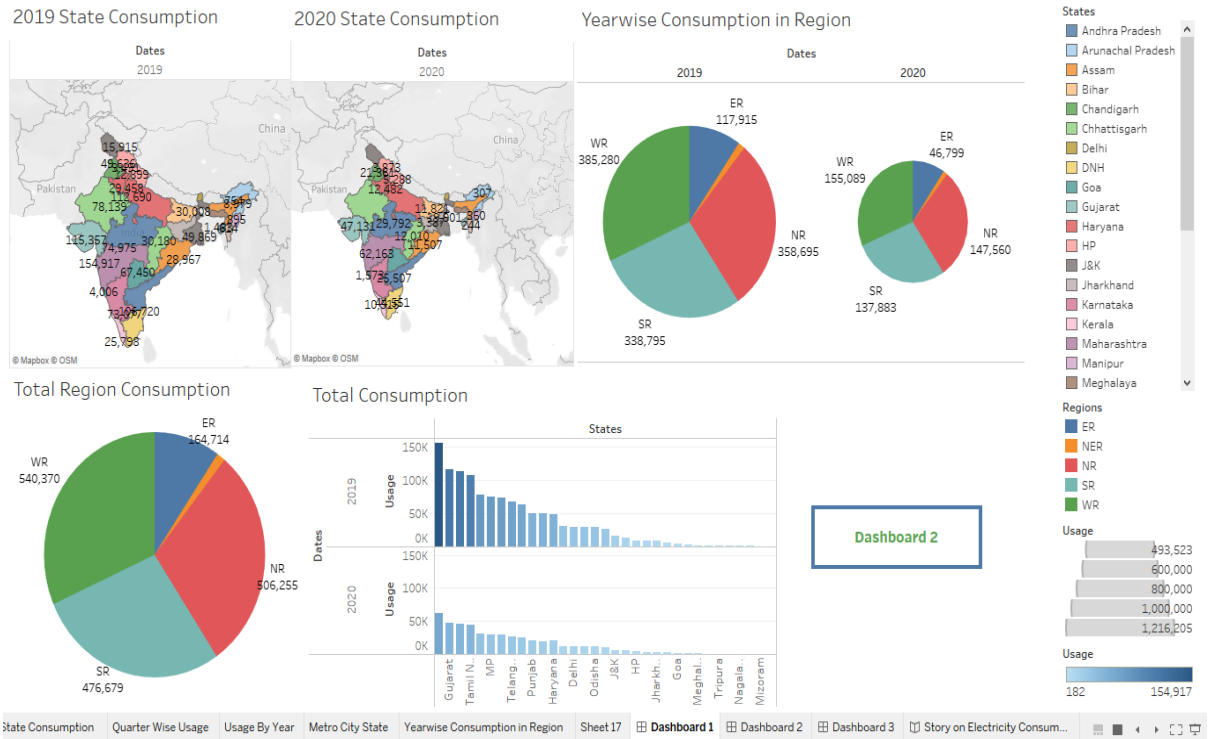
- **Idea mapping**: This process begins with brainstorming a central idea and then developing said idea by adding related concepts and details. The result is a map or diagram that visually captures the relationships between ideas. This technique can be used individually and in

groups, and it is an effective way to generate a large volume of ideas quickly. Idea mapping is often used in business, engineering, and design, where creativity is essential for success.



3. RESULT

Dashboard 1



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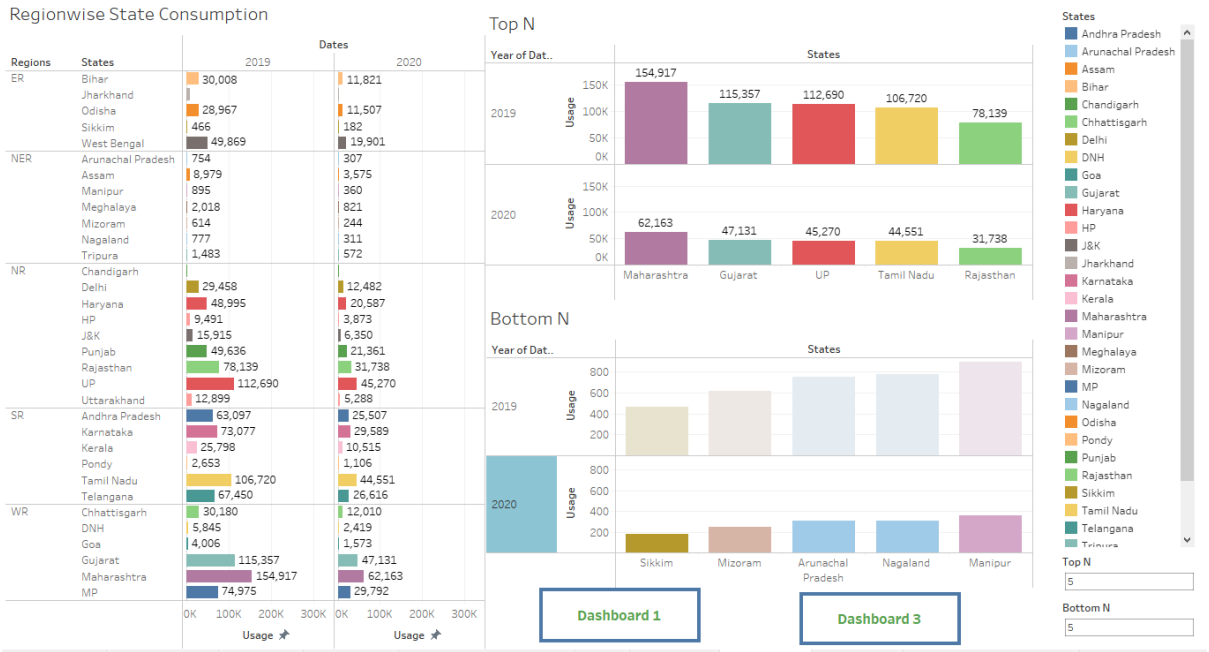

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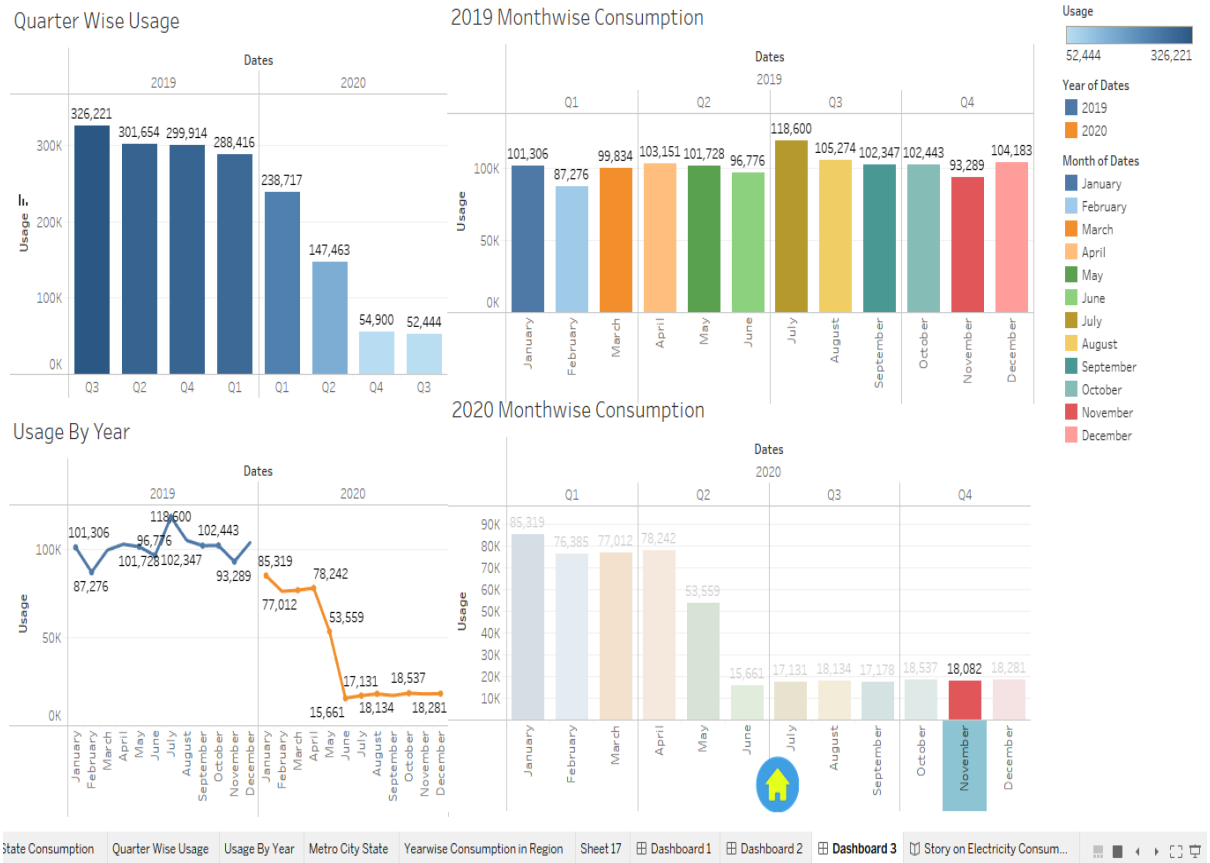
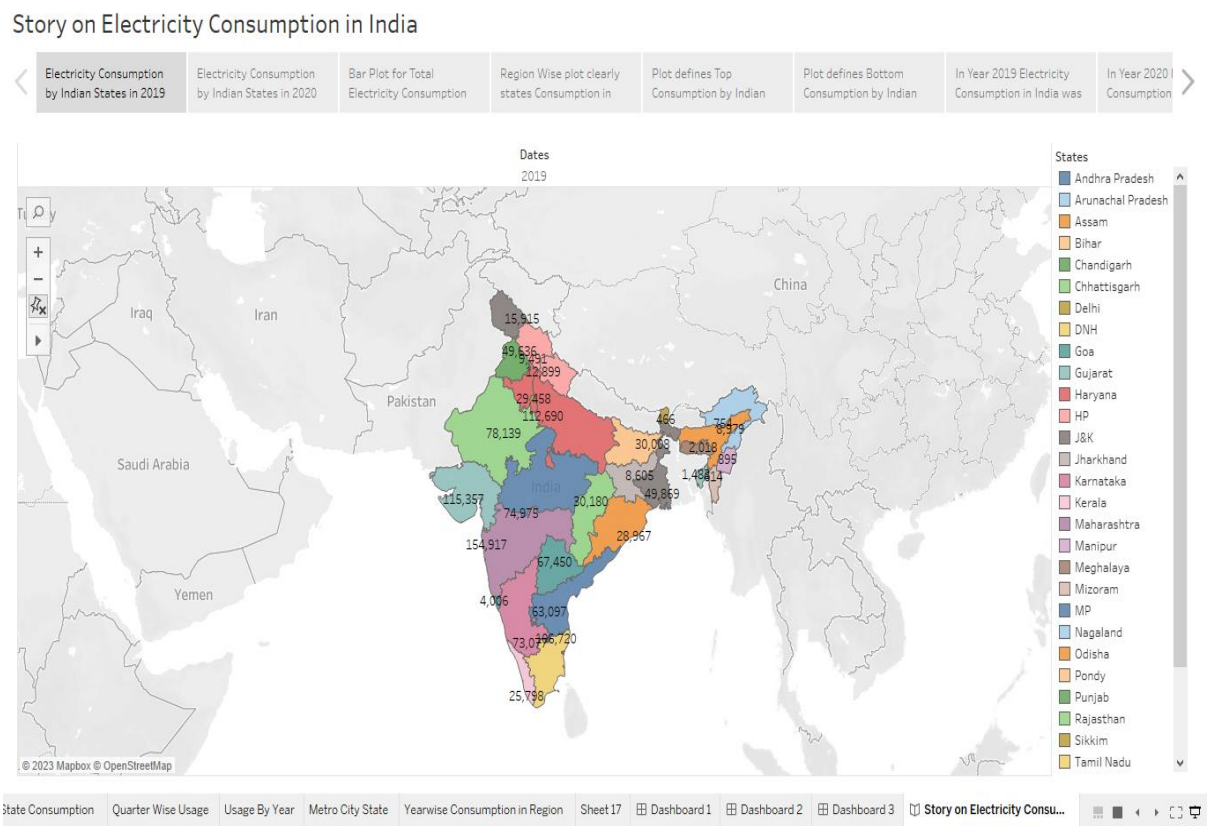


Story 1



Web Page

4. ADVANTAGES & DISADVANTAGES

Advantages:

The immense electrical power consumption of the manufacturing industry is a considerable cost factor for manufacturing enterprises and a serious problem for environment and society. Corporate values, public relations, energy-related costs, and legal requirements are therefore leading to an increasing energy awareness in enterprises . At the same time, trends toward the Industrial Internet of Things, Industry 4.0, smart manufacturing, and cyber-physical production systems allow to collect energy data in real time and at machine level, from smart meters or machine-integrated sensors. Furthermore, research on big data provides methods and technologies to analyze data of huge volume and high velocity, as it is the case with power consumption data. However, even though research suggests a variety of goals and measures for analyzing power consumption data, the full potential of available data is rarely exploited .

Disadvantages:

One of the strengths of this study is that it is the first urban study within the GCC countries that used 15-minute electricity consumption data to analyze the consumption patterns of households. Previous studies conducted within the region used either monthly or 24-hour resolution data that was not enough to capture daily consumption patterns and peak periods of electricity demand.

However, this study is that it only used 2019 data for analysis. Unfortunately, the 2018 data was incomplete.

5. APPLICATIONS

The energy consumptions pattern and its sustainability influence the urban agglomerations and population growth in cities . There are many studies and literature, which address the ways of sustainability and energy efficiency in cities and urban environments. The development of economic, social and environmental sectors is the tackle point to achieve effective sustainability in an urban environment “triple bottom line”. Modern cities become a target for the urban population due to the effectiveness in providing resources for all kinds of services (e.g., water, food, energy) in order to meet the livelihood requirements . The metabolism theory considers the cities like a living organism, which can be represented by different growth stages in their life cycle such as childhood, youth, maturity, aging, disease, or renewing youth . According to this theory, the city needs resources and energy for implementation of the metabolism energy flows .

6. CONCLUSION

There was a considerable increase in the peak domestic consumption, as the peak load reached 3320 MW in 2017 with an annual increment rate of 4.9%. Regarding energy efficiency, the value of total electrical energy losses reached 13% in 2017; around 90% of this loss occurred in the electrical distribution stage. Geographical distribution of the household electrical power shows that the east and middle parts of Amman have low consumption levels compared to the west residential parts. The energy consumption pattern has an inverse relation with the population distribution, family size, and building characteristics in the city. This is clearly identified by addressing the downtown region that has the lowest energy consumption and the highest-density population, while the western part has the highest energy consumption and low-population density. These variations can be referred to as differences in social and economic behaviors of inhabitants in both high-density and low-density population areas.

This analysis reflects the influence of several factors that should be taken into account in energy sustainability strategies. Energy consumption is influenced by the characteristics of households which include building size, household income, total energy cost, and building characteristics (e.g., building design, age, location, and using thermal insulation system for buildings).

7. FUTURE SCOPE

Electric vehicles (EVs) are becoming increasingly popular as a more sustainable and cost-effective alternative to traditional gasoline-powered cars. With the automotive industry rapidly evolving, it's important to stay up to date on the EV models that are available in 2023.