

Case Study Report

Data Analysis with Power BI

“Analysis of Commerical Eletricity Consumption in India”

“Sri Paramakalyani College-Alwarkurichi”

NM ID	Name
8D71E65C6427DE58B904B1AACFD2C536	SRILAKSHMI N

Trainer Name : R UMAMAHESWARI

Master Trainer: R UMAMAHESWARI

ABSTRACT

The energy demand has been increasing over the years in India, which may result from its rapid economic growth trajectory. In this case study, examines the direction of the Granger-causal relationship between electricity consumption and economic growth at the state and sectoral levels in India. In doing so, the panel co-integration tests with the structural break, the heterogeneous panel causality test, and the panel VAR-based impulse-response model are employed. The study covers overall economic growth and growth in agricultural and industrial sectors for eighteen major Indian states for the period from 2023 to 2024. The results support a long-term relationship between economic growth and electricity consumption only in the agriculture sector. Further, the results provide evidence for unidirectional Granger causality flowing in the direction of overall economic growth to electricity consumption at the aggregate state level. However, at the sectoral level, there is a unidirectional causal relationship running from electricity consumption to economic growth for the agriculture sector, and economic growth to electricity consumption for the industrial sector.

INDEX

S.no	Table of contents
1.	Chapter 1 : Introduction
2.	Chapter 2: Power Consumption
3.	Chapter 3: Electricity Transmission and Distribution
4.	Chapter 4: Final Result
5.	Conclusion
6.	Future Scope
7.	Reference link

Chapter 1

Introduction

India's power consumption increased by over 8 percent, reaching 127.79 Billion Units (BU) in February, compared to the same period last year, according to government data. The data revealed that power consumption for February 2023 was 118.29 BU, which is higher than the 108.03 BU recorded in February 2022. The month of February 2024 had 29 days since it is a leap year, resulting in a slightly higher growth rate of power consumption. The highest supply in a day, or peak power demand met, increased to 222 GW in February 2024, while it stood at 209.76 GW in February 2023 and 193.58 GW in February 2022.

Experts suggest that power consumption and demand surged in February due to the low mercury levels, particularly in north India. The extended cold wave led to an increased use of heating equipment, such as heaters, blowers, and geysers, resulting in higher power demand and consumption.

The power ministry had anticipated the country's electricity demand to reach 229 GW during summer last year, but it did not reach that level in April-July due to unseasonal rainfall. However, peak supply touched a new high of 224.1 GW in June before dropping to 209.03 GW in July. Peak demand was the highest in August 2023, at 238.82 GW, followed by 243.27 GW in September, 222.16 GW in October, 204.77 GW in November 2023, 213.79 GW in December 2023, and 222.73 GW in January 2024.

Industry experts suggest that power consumption was affected in March, April, May, and June last year due to widespread rainfall, while consumption grew in August, September, and October, mainly due to humid weather conditions and an increase in industrial activities ahead of the festive season.

Experts predict a steady power consumption growth due to improvements in economic activities and the anticipated early onset of summer in March.

Chapter 2

Power Consumption

Peak power demand estimated to rise 7% to 260 GW this summer: Report:

Peak power demand in the country is estimated to rise by seven per cent year-on-year to 260 GW this summer, according to a senior official. The peak power demand during the summer of 2023 touched 243 GW against a projection of 229 GW. "We expect the peak power demand this year (in summers) at 260GW," Central Electricity Authority Chairperson Ghanshyam Prasad told reporters on the sidelines of the Fourth Edition of Lineman Diwas in the capital. The power ministry had estimated the country's electricity demand to touch 229 GW during summers in 2023, but it did not reach the projected level in April-July due to unseasonal rainfall. Peak supply, however, touched a new high of 224.1 GW in June before dropping to 209.03 GW in July.

Peak demand touched 238.82 GW in August 2023, while it was 243.27 GW in September, 222.16 GW in October, 204.77 GW in November, 213.79 GW in December 2023, and 222.73 GW in January 2024. Power consumption was affected in March, April, May and June last year due to widespread rainfall. The power consumption grew in August, September and October, mainly due to humid weather conditions and also a pick-up in industrial activities ahead of the festive season. Delivering a keynote address at Lineman Diwas, Prasad said, "Linepersons of the power sector are the strongest pillar of our nation's power system. The observance of Lineman Diwas emphasises our profound appreciation for their dedication and relentless service, he noted. The purpose behind recognising the hard work of these frontline workers is to educate them on safety and inspire them to persist in their exemplary efforts, he added.

On the occasion, Union Minister of New and Renewable Energy RK Singh, in a special video message, said, "Lineman Diwas serves as a highly effective platform facilitating the exchange of ideas and the sharing of Safety Best Practices among the participants". "We are grateful to the linemen who go above and beyond to ensure uninterrupted power supply for the functioning of the country's technological, industrial, and social infrastructure."

The initiative aims to honour the frontline heroes of the Indian Power Sector. The Linemen by establishing it, as a nationwide tradition for all state and private transmission and distribution companies to celebrate a dedicated day as Lineman Diwas. This endeavour served as a significant morale booster for the frontline workers in the power sector, providing them with well-deserved recognition and appreciation.

Over 150 linemen and line women from over 40 state and private transmission and distribution companies from Andhra Pradesh, Bihar, Gujarat, Haryana, Jharkhand, Karnataka, Jammu and Kashmir, Maharashtra, Madhya Pradesh, Odisha, Punjab, Rajasthan, Uttar Pradesh, Uttarakhand and Delhi visited the National capital to participate in the celebration.

The theme for the Lineman Diwas celebration was 'Seva, Suraksha, Swabhiman', signifying the dedication, service and sacrifice of the frontline heroes of the power sector. "We take pride in spearheading this nationwide initiative and are delighted to witness overwhelming participation from more than 40 Transmission and Distribution companies uniting to honour the dedication and service of these frontline workers of the power sector," Tata Power Delhi Distribution Ltd CEO Ganesh Srinivasan said.

India sees higher peak in electricity demand as power consumption surges

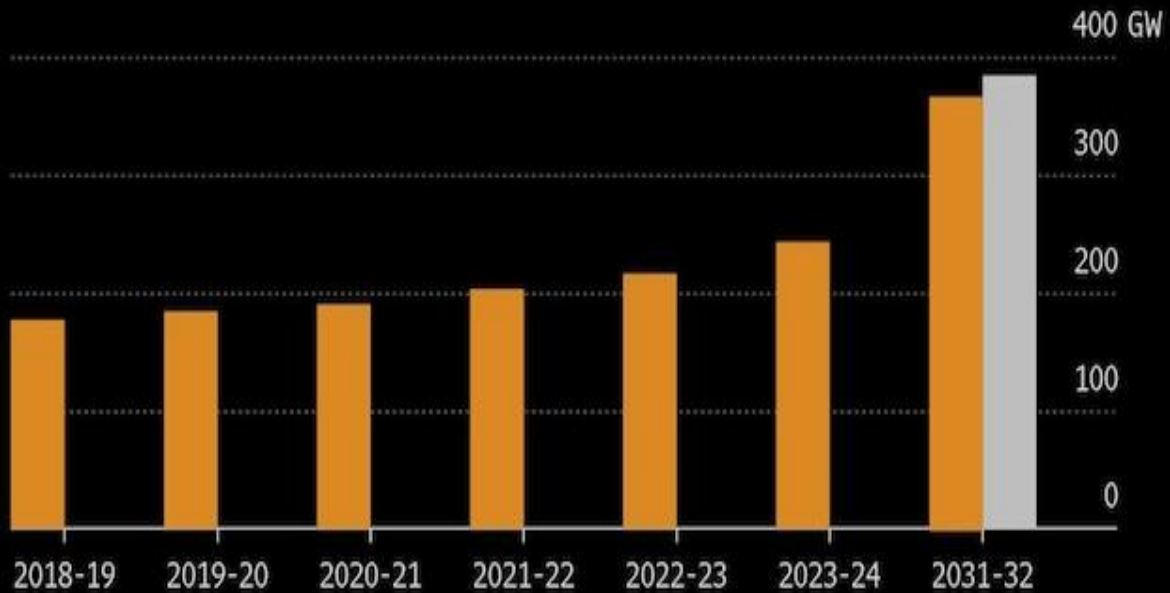
India has raised its forecast on peak electricity demand as energy consumption continues to outpace expectations, pushing the nation to expand its giant coal fleet.

Government officials now expect electricity demand to surge to a high of 384 gigawatts in the 12 months through March 2032, a 5 per cent increase on an estimate issued in May, according to people familiar with the details. A review of forecasts was carried out after a sharp rise in demand last year, when searing temperatures prompted higher use of air conditioners and pumps for irrigation, said the people, who requested anonymity as they were not authorized to speak publicly.

India's power ministry didn't immediately respond to a request for comment.

India's Rising Electricity Demand

India has lifted a forecast for peak electricity demand in 2031-2032 from an earlier projection issued in May



Source: Central Electricity Authority, India

Bloomberg

Electricity demand in India rose 7 per cent in 2023 and is likely to average growth of 6 per cent a year through 2026 on higher economic activity, according to the International Energy Agency. “Over the next three years, India will add electricity demand roughly equivalent to the current consumption of the UK,” the IEA said in a report last month.

Peak demand last year reached 243 gigawatts, surging past the power ministry’s projections of 229 gigawatts. In response, India announced in December it would add almost 88 gigawatts of new thermal power capacity — the majority of which will be coal-fired plants-by early 2032, about two-thirds more than had previously been planned.

Chapter 3

Electricity Transmission and Distribution

Capacity	Substations (MVA)	Transmission lines (circuit km)	c.km / MVA ratio
HVDC \pm 220 kV & above	22,500	15,556	0.691
765 kV	197,500	36,673	0.185
400 kV	292,292	173,172	0.707
220 kV	335,696	170,748	0.592
220 kV & above	847,988	396,149	0.467

India lit up at night. This image, courtesy of NASA, was taken by the crew of Expedition 29 on 21 October 2011. It starts over Turkmenistan, moving east. India begins past the long wavy solid orange line, marking the lights at the India-Pakistan borderline. New Delhi, India's capital and the Kathiawar Peninsula are lit. So are Mumbai, Hyderabad, Chennai, Bangalore and many smaller cities in central and southern India, as this International Space Station's video shifts south-eastward through southern India, into the Bay of Bengal. Lightning storms are also present, represented by the flashing lights throughout the video. The pass ends over western Indonesia.

The total length of high voltage (HV) transmission lines (220kV and above) would be enough to form a square matrix of area 266 km² (i.e. a square grid 16.3 km on a side, so that on average there is at least one HV line within a distance of 8.15 km) over the entire area of the country. This represents a total of almost 20% more HV transmission lines than that of the United States (322,000 km (200,000 mi) of 230 kV and above). However the Indian grid transmits far less electricity.^[232] The installed length of transmission lines of 66 kV and above is 649,833 km

(403,788 mi) (on average, there is at least one ≥ 66 kV transmission line within 4.95 km across the country). The length of secondary transmission lines (400 V and above) is 10,381,226 km (6,450,595 mi) as of 31 March 2018. The spread of total transmission lines (≥ 400 V) would be sufficient to form a square matrix of area 0.36 km^2 (i.e. on average, at least one transmission line within 0.31 km distance) over the entire area of the country. In a future grid dominated by decentralized power generation like solar and wind power, unscientific expansion of the electrical grid would yield negative results due to [Braess's paradox](#).

The all-time maximum peak load met was 182,610 MW on 30 May 2019. The maximum achieved [demand factor](#) of substations is nearly 60% at the 220 kV level. However, the [operational performance](#) of the system is not satisfactory in meeting peak electricity loads. This has led to the initiation of detailed [forensic engineering](#) studies, with a plan to make capital investments in a [smart grid](#) that maximizes the utility of the existing transmission infrastructure.

The introduction of an [availability based tariff](#) (ABT) originally helped to stabilize the Indian transmission grids. However, as the grid transitions to power surplus the ABT has become less useful. The [July 2012 blackout](#), affecting the north of the country, was the largest power grid failure in history as measured by the number of people affected.

India's aggregate transmission and commercial (ATC) losses were nearly 21.35% in 2017–18. This compares unfavorably to the total ATC loss in the [electricity sector of the United States](#), which was only 6.6% out of 4,404 billion kWh electricity supplied during the year 2018. The Indian government set a target of reducing losses to 17.1% by 2017 and to 14.1% by 2022. A high proportion of non-technical losses are caused by illegal tapping of lines, faulty electric meters and fictitious power generation that underestimates actual consumption and also contributes to reduced payment collection. A case study in Kerala estimated that replacing faulty meters could reduce distribution losses from 34% to 29%.

Electricity generation

India has recorded rapid growth in electricity generation since 1985, increasing from 179 TW-hr in 1985 to 1,057 TW-hr in 2012. The majority of the increase came from coal-fired plants and non-conventional [renewable energy](#) sources (RES), with the contribution from natural gas, oil, and hydro plants decreasing in 2012–2017. The gross utility electricity generation (excluding imports from Bhutan) was 1,484 billion kWh in 2021–22, representing 8.1% annual growth compared to 2020–2021. The contribution from renewable energy sources (including large hydro) was nearly 21.7% of the total. In 2019–20, all the incremental electricity generation is contributed by renewable energy sources as the power generation from fossil fuels decreased. During the year 2020–2021, the utility power generation decreased by 0.8% (11.3 billion kWh) with a reduction in power generation from fossil fuels by 1% and power generation from non-fossil sources is more or less same of the previous year. In 2020–21, India exported more electricity than it imported from neighboring countries.¹ Solar power generation in 2020–21, occupied third place after coal and hydropower generations surpassing wind, gas and nuclear power generations. In 2022–23, renewable power generation was 22.47% of total utility power generation when total utility power generation increased by 8.77% to 1614.70 billion kWh.

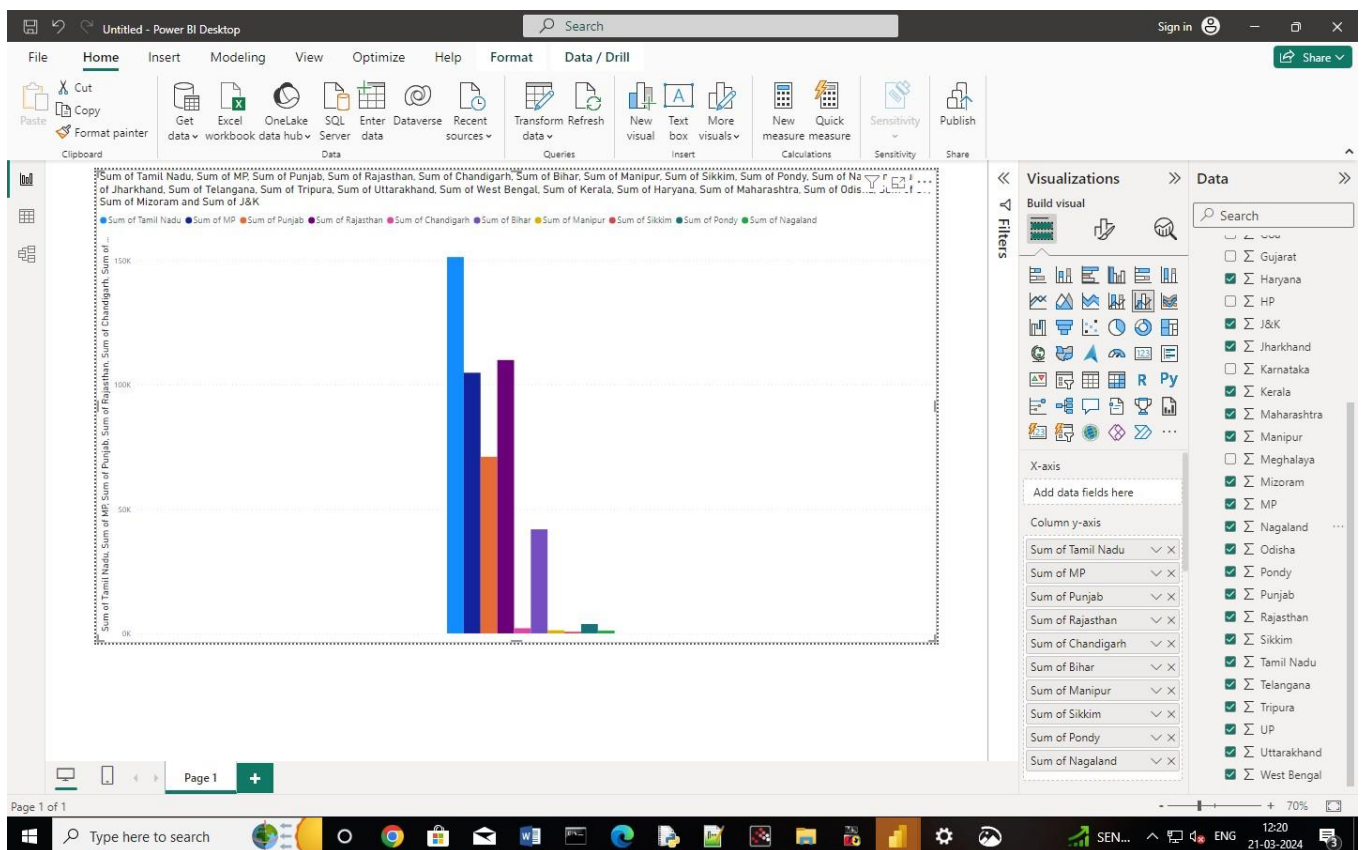
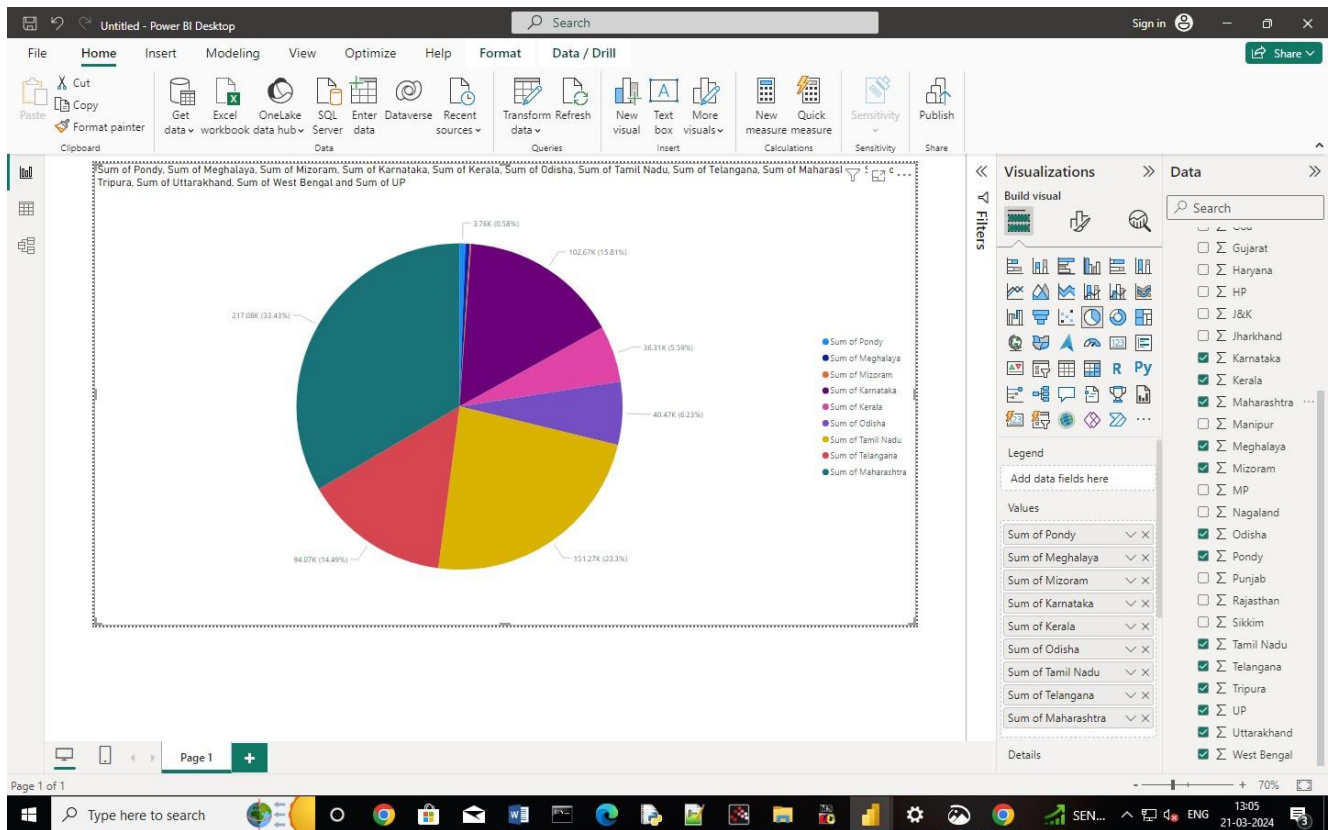
Chapter 4

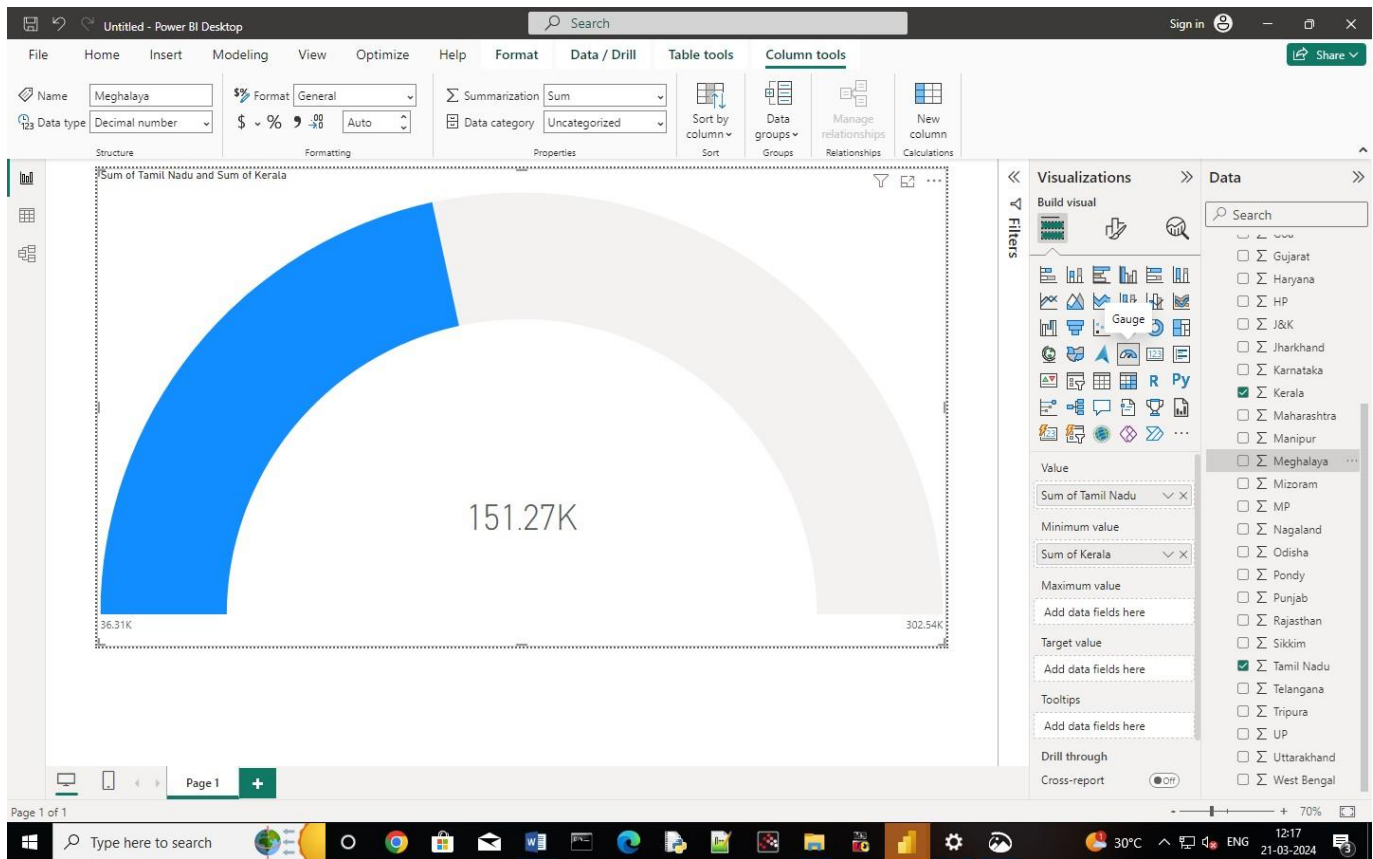
Final Result

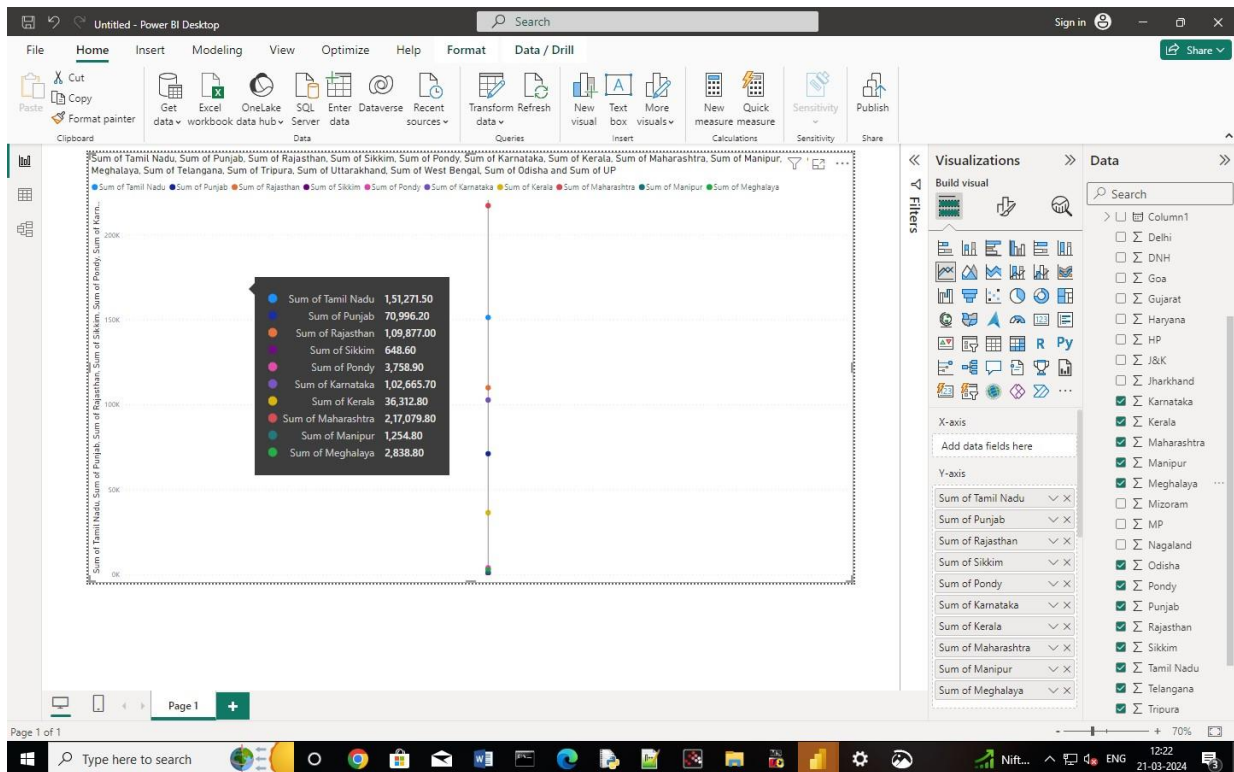
The screenshot displays the Microsoft Power BI Desktop interface. The main workspace contains a data table with 10 columns and 10 rows of data. The columns represent various states and union territories of India, and the rows represent different time periods (Year, Quarter, Month, Day). The data values are numerical, representing sums of various metrics.

The right-hand pane shows the 'Visualizations' and 'Data' sections. The 'Visualizations' section includes a 'Build visual' button and a list of visualization types (Bar, Line, Pie, etc.). The 'Data' section shows a list of fields, including 'Sum of Delhi', 'Sum of Gujarat', 'Sum of West Bengal', 'Sum of J&K', 'Sum of Mizoram', 'Sum of Nagaland', 'Sum of Tamil Nadu', 'Sum of Telangana', 'Sum of Rajasthan', 'Sum of Pondy', 'Sum of MP', 'Sum of Manipur', and 'Sum of Kerala'. The 'Filters' section is also visible, showing a list of filters applied to the data.

Sum of Delhi	Sum of Gujarat	Sum of West ...	Sum of J&K	Sum of Mizo...	Sum of Naga...	Sum of Tamil...	Sum of Telan...	Sum of Rajas...	Sum of Pondy
85.80	319.50	106.20	52.50	1.90	2.20	265.30	204.20	234.10	6.50
253.00	2.70	72.70	428.60	313.90	21.70	5.00	164.60	18.60	30.00
3.40	70.20	2019	Qtr 1	January	2	78.70	82.30	Sum of DNH	Sum of HP
Sum of Tripura	Sum of Odisha	Year	Quarter	Month	Day	Sum of Chha...	Sum of Bihar		
85.50	316.70	110.20	54.10	1.80	2.20	285.20	204.50	240.20	6.50
Sum of Delhi	Sum of Gujarat	Sum of West ...	Sum of J&K	Sum of Mizo...	Sum of Naga...	Sum of Tamil...	Sum of Telan...	Sum of Rajas...	Sum of Pondy
253.60	2.40	73.60	419.60	311.80	23.40	4.90	170.10	18.20	30.10
Sum of MP	Sum of Mani...	Sum of Kerala	Sum of Mah...	Sum of UP	Sum of Assam	Sum of Chan...	Sum of Andhi...	Sum of DNH	Sum of HP
3.60	67.90	2019	Qtr 1	January	3	78.80	82.00	Sum of DNH	Sum of HP
Sum of Tripura	Sum of Odisha	Year	Quarter	Month	Day	Sum of Chha...	Sum of Bihar		
83.50	301.90	106.80	53.20	1.70	2.20	270.30	201.20	239.80	6.40
Sum of Delhi	Sum of Gujarat	Sum of West ...	Sum of J&K	Sum of Mizo...	Sum of Naga...	Sum of Tamil...	Sum of Telan...	Sum of Rajas...	Sum of Pondy
259.30	2.40	73.40	395.80	320.70	21.70	4.80	165.20	16.70	30.10
Sum of MP	Sum of Mani...	Sum of Kerala	Sum of Mah...	Sum of UP	Sum of Assam	Sum of Chan...	Sum of Andhi...	Sum of DNH	Sum of HP
3.50	66.30	2019	Qtr 1	January	4	74.80	82.90	Sum of DNH	Sum of HP
Sum of Tripura	Sum of Odisha	Year	Quarter	Month	Day	Sum of Chha...	Sum of Bihar		
79.20	313.20	107.00	51.50	1.80	2.30	286.80	201.70	239.10	6.60
Sum of Delhi	Sum of Gujarat	Sum of West ...	Sum of J&K	Sum of Mizo...	Sum of Naga...	Sum of Tamil...	Sum of Telan...	Sum of Rajas...	Sum of Pondy
228.20	2.70	75.40	411.10	299.00	22.50	4.30	167.40	17.60	30.20
Sum of MP	Sum of Mani...	Sum of Kerala	Sum of Mah...	Sum of UP	Sum of Assam	Sum of Chan...	Sum of Andhi...	Sum of DNH	Sum of HP
3.50	65.80	2019	Qtr 1	January	5	69.00	77.00	Sum of DNH	Sum of HP
Sum of Tripura	Sum of Odisha	Year	Quarter	Month	Day	Sum of Chha...	Sum of Bihar		
76.60	320.70	106.40	53.20	1.90	2.30	298.30	194.90	240.40	7.20
Sum of Delhi	Sum of Gujarat	Sum of West ...	Sum of J&K	Sum of Mizo...	Sum of Naga...	Sum of Tamil...	Sum of Telan...	Sum of Rajas...	Sum of Pondy
227.40	2.70	75.40	408.60	286.80	21.70	4.30	171.20	18.60	31.00







Conclusion

Energy conservation is the effort to reduce energy consumption by using less energy or using renewable energy. Energy conservation can be achieved by: Using energy more efficiently, Reducing the amount of service used, and Using renewable energy.

Energy conservation can bring about significant economic benefits, including: cost savings, job creation in the renewable energy sector, and local economic growth.

Energy consumption can be attributed to many reasons, including: social behavior, economic conditions, and the pattern of energy consumption.

Energy is a very important natural resource that should be saved because it's not free.

Future Scope

The future scope of a project is the potential opportunities and prospects in a specific field, industry, or career. It's important to consider because it helps individuals make informed decisions about their education, career, and personal development.

A project scope is a way to set boundaries on a project and define exactly what goals, deadlines, and project deliverables will be worked towards. The documentation of a project's scope is called a scope statement or terms of reference. A project scope statement includes: timeline, budget, assigned tasks, project stakeholders, and workflow strategies.

Reference link

<https://www.iea.org › reports › electricity-consumption>