

ELECTRICITY GENERATION AND CONSUMPTION IN MAHARASHTRA: AN ANALYSIS OF TRENDS AND PATTERNS

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Article Info	ABSTRACT
Article History: Received: 18th Sep 2025 Accepted: 02nd Oct 2025 Published: 17th Oct 2025 Keywords: Electricity Generation, Electricity Consumption, Renewable Energy, Maharashtra, Energy Trends, Energy Patterns, Sustainable Energy, Energy Efficiency.	This study examines electricity generation and consumption trends in Maharashtra. The state's electricity generation capacity has grown significantly. Total installed capacity reached 38,601 MW as of March 2024. Thermal sources dominate the energy mix. Renewable energy sources are gaining traction. Share of renewable energy increased from 8.1% to 16.8% between 2014-15 and 2023-24. The study identifies growing demand for electricity. Industrial and economic growth drive electricity demand. The study provides insights into Maharashtra's electricity sector. It highlights the importance of renewable energy and energy efficiency. The findings are relevant for India's energy transition. Maharashtra's experience can inform national energy policies. The study contributes to the understanding of India's electricity sector. It provides a framework for analyzing electricity trends and patterns. The study's findings are useful for researchers and policymakers. The study's methodology can be applied to other states in India. The study's results have implications for India's energy future.

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Introduction

The electricity sector is a crucial component of Maharashtra's economy, driving industrial growth, agricultural productivity, and social development. As one of the most industrialized and populous states in India, Maharashtra's electricity demand is substantial, and its energy mix is diverse. The state's electricity generation and consumption patterns are influenced by its industrial, agricultural, and domestic sectors. Maharashtra's energy landscape is characterized by a dominance of thermal power plants, but there is a growing emphasis on renewable energy sources. The state has set ambitious targets for renewable energy capacity addition, and various policies and initiatives are being implemented to promote sustainable energy development.

This research paper aims to analyze the trends and patterns in electricity generation and consumption in Maharashtra, providing insights into the opportunities and challenges in meeting the growing demand for electricity while ensuring sustainable development. The study will examine the state's energy mix, growth drivers, and challenges, contributing to the understanding of Maharashtra's electricity sector and informing policy decisions aimed at promoting sustainable energy development. The significance of this study lies in its potential to provide valuable insights for policymakers, regulators, and stakeholders, helping them make informed decisions about the state's energy future. As India's electricity sector undergoes significant changes, driven by growing demand, technological advancements, and environmental concerns, Maharashtra's experience can provide valuable lessons for other states and countries.

The electricity sector in Maharashtra is evolving rapidly, with a focus on renewable energy, energy efficiency, and sustainable development. This study will contribute to the understanding of the state's energy landscape and inform strategies for meeting its growing electricity demand in a sustainable manner. With a growing population and increasing economic activity, Maharashtra's electricity sector will continue to play a vital role in the state's development.

Objectives of the Study:

The main objectives are:

1. Analyse the trends and patterns in electricity generation and consumption in Maharashtra.
2. Identify the growth drivers and challenges in meeting the growing demand for electricity in Maharashtra.
4. Evaluate the opportunities and challenges in promoting sustainable energy development in the state.
5. Provide insights and recommendations for policymakers, regulators, and stakeholders to inform decision-making and strategy development for Maharashtra's electricity sector.

Period of the Research Paper:

The study covers the period from **2014-15 to 2023-24**, analyzing trends and patterns in electricity generation and consumption in Maharashtra during this 10-year period. Additionally,

the study also includes data up to December 2024, where available, to provide more recent insights into the state's electricity sector.

Research Methodology:

This study uses a quantitative research approach, relying on secondary data sources to analyze trends and patterns in electricity generation and consumption in Maharashtra. The research data collected is Government reports and publications, Official statistics from Maharashtra State Electricity Board, Maharashtra Energy Development Agency, and Central Electricity Authority, Industry reports and publications and Academic journals and research papers.

Scope of the Study:

The study is limited to the state of Maharashtra, India. The study covers a period of 10 years, from 2014-15 to 2023-24. The study focuses on electricity generation and consumption trends, patterns, and challenges in Maharashtra. The study covers various sectors, including industrial, agricultural, and domestic. The study explores the Trends and patterns in electricity generation and consumption, Energy mix and the role of different energy sources, Growth drivers and challenges in the electricity sector and Opportunities and challenges in promoting sustainable energy development.

Limitations of the Study:

This research paper limited access to detailed and up-to-date data on Maharashtra's electricity sector. The study is limited to Maharashtra, India, and may not be generalizable to other regions. The study covers a specific period (2014-15 to 2023-24) and may not capture more recent developments. The study relies on secondary data sources, which may have limitations and biases. The study focuses on the electricity sector and may not capture the broader energy landscape.

DISCUSSES THE RESEARCH PAPER:

This research paper provides an in-depth analysis of the trends and patterns in electricity generation and consumption in Maharashtra, India. The study highlights the state's growing demand for electricity, driven by industrial and economic growth.

Analysis of Trends and Patterns in Electricity Generation and Consumption in Maharashtra:

Maharashtra's electricity consumption has been increasing steadily, with a total consumption of 155,518 GWh in 2023, up from 142,088 GWh in 2022. The state's electricity demand is expected to grow at a CAGR of 4.08% from 2024-25 to 2033-34. Maharashtra has a total installed capacity of 41 GW, with coal accounting for about 60% and renewable energy accounting for 18%. The state aims to generate 40% of its electricity from renewable sources by

2030. With a per capita energy consumption of 1,239 kWh, Maharashtra ranks among the top ten states in terms of energy consumption

Electricity Generation:

Maharashtra is a leading state in India's power and energy sector, with a total installed capacity of over 44 GW. The state generates electricity from various sources, including thermal, hydroelectric, wind, solar, and biomass energy.

Table No. 1
Source-wise installed capacity (MW)

Sr. No.	Source	2022	2023	2024	% Change in 2024 over 2023
1	In the State	37,348	37,422	38,601	3.1
2	Thermal	20,966	20,066	20,366	1.5
3	Renewable	10,502	11,476	12,355	7.7
4	Hydro	3,061	3,061	3,061	0.0
5	Natural gas	2,819	2,819	2,819	0.0
6	Central sector allocation	7,944	7,944	8,323	4.8

Sources: Economic Survey of Maharashtra 2024-25.

The above table no 1 shows the Source-wise installed capacity (MW). The Renewable energy capacity increased by 7.7% from 2023 to 2024, indicating a strong shift towards sustainable energy sources. Thermal energy capacity grew at a slower rate of 1.5% from 2023 to 2024. Hydro and natural gas capacities remained unchanged from 2023 to 2024. Central sector allocation increased by 4.8% from 2023 to 2024.

The growth in renewable energy capacity suggests a positive trend towards reducing dependence on fossil fuels and mitigating climate change. The data indicates a mix of energy sources, with a growing share of renewables and a stable presence of thermal, hydro, and natural gas. The Continue to promote and incentivize renewable energy development to achieve sustainability goals. Explore opportunities to optimize thermal energy capacity and reduce environmental impact. Assess the potential for increasing hydro and natural gas capacities to further diversify the energy mix.

Table No. 2
Source-Wise Electricity Generated (MU)

Sr. No.	Source	2021-22	2022-23	2023-24	2024-25	% Change in 2023-24 over 2022-23
1	In the State	1,29,660	1,33,274	1,43,746	1,04,274	7.9
2	Thermal	98,871	1,03,420	1,10,426	81,118	6.8
3	Renewable	18,520	21,468	24,098	14,698	12.3
4	Hydro	6,144	5,956	5,252	3,996	(-)11.8
5	Natural gas	6,125	2,430	3,970	4,462	63.4
6	Central sector allocation	39,581	43,933	45,275	33,192	3.1

Sources: Economic Survey of Maharashtra 2024-25.

The above table no. shows the Source-Wise Electricity Generated (MU). The Renewable energy generation increased by 12.3% from 2022-23 to 2023-24, indicating a strong growth trend. The Thermal energy generation grew at a slower rate of 6.8% from 2022-23 to 2023-24. Hydro energy generation declined by 11.8% from 2022-23 to 2023-24. Natural gas generation increased significantly by 63.4% from 2022-23 to 2023-24.

The Support policies and incentives for renewable energy development to achieve sustainability goals. Explore opportunities to optimize thermal energy generation and reduce environmental impact. Investigate the reasons for the decline in hydro energy generation and take corrective measures.

Electricity Consumption:

Maharashtra's electricity consumption is a significant aspect of its energy landscape.

Table No. 3
Sector-Wise Electricity Consumption (MU)

Sr. No.	Sector	2021-22	2022-23	2023-24	2024-25	% Change in 2023-24 over 2022-23
1	Industrial	53,373	58,842	62,687	32,359	6.5
2	Agriculture	36,242	37,481	40,927	16,026	9.2
3	Domestic	30,699	32,773	34,935	20,373	6.6
4	Commercial	11,347	14,303	15,687	8,732	9.7
5	Public Services	5,897	6,111	6,450	3,391	5.5
6	Railways	179	248	356	185	43.5
7	Other	1,042	1,006	1,012	574	0.6
8	All	1,38,779	1,50,764	1,62,054	81,640	7.5

Sources: Economic Survey of Maharashtra 2024-25.

The above table no. 3 shows the Sector-Wise Electricity Consumption in million units. The overall growth of total electricity consumption increased by 7.5% from 2022-23 to 2023-24. The Commercial sector showed the highest growth rate of 9.7% from 2022-23 to 2023-24. The agriculture sector Grew at a rate of 9.2% from 2022-23 to 2023-24. The Railways sector experienced significant growth of 43.5% from 2022-23 to 2023-24.

Invest in infrastructure development to meet the growing demand for electricity. Promote energy-efficient practices and technologies to manage demand and reduce strain on the grid. The develop sector-specific strategies to address unique challenges and opportunities in each sector.

Per Capita Ultimate Consumption of Electricity:

Maharashtra's per capita ultimate consumption of electricity is 1,110.2 units, significantly higher than the national average of 824.6 units. This indicates a strong demand for electricity in the state, driven by its large industrial and agricultural sectors.

Table No. 3

Per Capita Ultimate Consumption of Electricity (U)

Sr. No.	Sector	2021-22		2022-23		2023-24	
		Maharashtra	India	Maharashtra	India	Maharashtra	India
1	Commercial	90.8	71.0	113.5	84.9	123.6	90.4
2	Industrial	427.0	273.0	467.1	302.5	493.8	314.4
3	Agriculture	289.9	163.8	297.5	176.6	322.4	194.9
4	Domestic	245.6	248.4	260.1	255.7	275.2	268.0
5	All	1,110.2	824.6	1,196.7	916.0	1,276.5	966.4

Sources: Economic Survey of Maharashtra 2024-25.

Maharashtra's per capita ultimate consumption of electricity varies across sectors, with industrial consumption being the highest, followed by agriculture and domestic sectors. The state's per capita electricity consumption is higher than the national average, indicating its strong industrial and economic growth. The data shows a steady increase in electricity consumption across all sectors in Maharashtra, with the industrial sector consuming the most electricity, followed by agriculture and domestic sectors. The state's high per capita consumption reflects its relatively high level of industrialization and urbanization. Overall, the data suggests that Maharashtra's economic development and industrial growth are driving electricity demand.

Demand and Supply of Electricity:

Maharashtra's electricity demand is increasing with a Compound Annual Growth Rate (CAGR) of 4.08% from 2024-25 to 2033-34. To meet this growing demand reliably and affordably, the state needs to plan its capacity expansion strategically, either by investing in power generation or procuring power from other sources.

Table No. 3
Demand and Supply of Electricity (MW)

Sr. No.	Source	Demand	Supply	Surplus
1	2021-22	21,221	21,750	529
2	2022-23	22,779	390	390
3	2023-24	23,105	23,811	706
4	2024-25	22,422	23,266	844

Sources: Economic Survey of Maharashtra 2024-25. (MW – Million W)

The above table no 3 shows the Maharashtra's electricity demand has been increasing, with 21,221 MW in 2021-22, 22,779 MW in 2022-23, 23,105 MW in 2023-24, and 22,422 MW in 2024-25. The state's electricity supply has consistently exceeded demand, resulting in a surplus of 529 MW in 2021-22, 706 MW in 2023-24, and 844 MW in 2024-25. This surplus capacity ensures a reliable power supply, supporting economic growth and development. However, the data for 2022-23 seems incorrect, with a supply of 390 MW and a surplus of 390 MW, which may require further verification. Overall, Maharashtra's electricity supply has been stable, with a surplus capacity to meet peak demand.

Renewable Energy:

Maharashtra is a leader in India's power and energy sector, with a strong focus on renewable energy.

Table No. 4
Capacity of Renewable Energy in Maharashtra (MW)

Sr. No.	Source	Potential capacity	2022	2023	2024
1	Wind	98,210	5,011	5,011	5,222
2	Bagasse Co-Generation	3,917	2,339	2,407	2,690
3	Solar	64,320	2,522	3,429	5,102
4	Small Hydro Projects (SHP)	786	370	370	370
5	Biomass	2,630	215	215	215
6	Industrial waste	898	42	42	42
7	Urban solid waste		3	3	17
Total		1,70,761	10,502	11,476	13,658

Sources: Economic Survey of Maharashtra 2024-25.

The above table no 4 shows the Maharashtra's renewable energy capacity has been growing, with a total potential capacity of 1,70,761 MW. As of 2024, the state's renewable energy capacity stands at 13,658 MW. The data indicates a significant increase in solar energy capacity, with a growth of over 100% from 2022 to 2024. Wind energy and bagasse co-generation also contribute substantially to the state's renewable energy mix. Maharashtra has vast potential for renewable energy growth, and the state is making progress in tapping this potential.

Other Forms of Energy:

Petroleum and Natural Gas:

Mahanagar Gas Ltd., Maharashtra Natural Gas Ltd. and Gas Authority of India Ltd. (GAIL) are the operating entities of Piped Natural Gas (PNG) connections and Compressed Natural Gas (CNG) stations in the State. Information of PNG connections and CNG stations is given in

Table No. 5
Information of PNG connections and CNG stations

Sr. No.	Particulars	2021-22		2022-23		2023-24	
		Maharashtra	India	Maharashtra	India	Maharashtra	India
1	CNG Stations (No.)	571	4,433	741	5,666	964	6,861
2	CNG Sales (000MT)	811.7	3,968.0	1,022.3	5,102.7	1,130.1	5,661.1
3	PNG Connections (00)	2,332.6	9,350.7	2,846.1	11,083.6	3,623.5	12,982.6
4	Domestic	2,327.4	9,302.6	2,840.6	11,029.2	3,617.6	12,922.5
5	Industrial	0.5	13.2	0.9	16.6	1.0	18.8
6	Commercial	4.7	34.9	4.7	37.8	4.9	41.4

Sources: Economic Survey of Maharashtra 2024-25.

The above table no.5 shows the Maharashtra has seen significant growth in CNG infrastructure, with CNG stations increasing from 571 in 2021-22 to 964 in 2023-24. CNG sales have also risen from 811,700 MT in 2021-22 to 1,130,100 MT in 2023-24. PNG connections have grown from 2,332,600 in 2021-22 to 3,623,500 in 2023-24, with the majority being domestic connections (3,617,600). The data indicates a steady increase in the adoption of cleaner fuels like CNG and PNG in Maharashtra, contributing to a reduction in pollution and dependence on traditional fuels.

Consumption of Petroleum products:

The State ranks second (9.4%) in consumption of petroleum products in India, after Gujarat (10.5%). Consumption of major petroleum products are given in Table No. 6.

Table No. 6.
Consumption of major petroleum products

Sr. No.	Consumption of major petroleum products	2023-23		2023-24	
		Maharashtra	India	Maharashtra	India
1	Naphtha	328	12,127	377	13,864
2	Liquefied Petroleum Gas (LPG)	3,364	28,504	3,426	29,650
3	Motor Spirit/Gasoline (MS)	3,815	34,976	4,068	37,219
4	Superior Kerosene Oil (SKO)	6	490	4	479
5	Aviation Turbine Fuel (ATF)	1,125	7,378	1,468	8,247
6	High Speed Diesel (HSD)	9,291	85,900	9,931	89,653
7	Light Diesel Oil (LDO)	107	726	122	783
8	Furnace Oil (FO)	667	6,185	546	5,645
9	Hot Heavy Stock (HHS)/ Low	154	773	187	873
11	Lubricants/Grease	450	3,737	487	4,076
11	Bitumen	586	8,041	617	8,838
12	Others	1,059	34,185	802	33,943
Total		20,951	2,23,022	22,035	2,33,270

Sources: Economic Survey of Maharashtra 2024-25.

The above table no. 6 shows the consumption of major petroleum products in Maharashtra and India reflects the country's growing energy demands. In Maharashtra, the total consumption of petroleum products increased from 20,951 thousand metric tons in 2022-23 to 22,035 thousand metric tons in 2023-24. High Speed Diesel (HSD) and Motor Spirit/Gasoline (MS) are the most consumed products, indicating a high demand for transportation fuels. Liquefied Petroleum Gas (LPG) consumption is also significant, suggesting widespread use for cooking and industrial purposes. The data highlights Maharashtra's reliance on petroleum products for energy needs, with implications for energy security and environmental sustainability. The state's consumption patterns are influenced by its large industrial base, growing population, and increasing mobility needs. With HSD consumption reaching 9,931 thousand metric tons and MS consumption at 4,068 thousand metric tons in 2023-24, the state is likely to continue experiencing high demand for these fuels.

Conclusion:

Maharashtra's electricity consumption has been increasing steadily, with a total consumption of 155,518 GWh in 2023. The state's electricity demand is expected to grow at a CAGR of 4.08% from 2024-25 to 2033-34. Renewable energy capacity has grown significantly, with a 7.7% increase from 2023 to 2024. The state aims to generate 40% of its electricity from

renewable sources by 2030. Maharashtra's per capita ultimate consumption of electricity is 1,110.2 units, significantly higher than the national average. The study emphasizes the importance of renewable energy and energy efficiency in meeting the state's growing electricity demand. Overall, the research paper provides valuable insights for policymakers, regulators, and stakeholders, informing strategies for sustainable energy development in Maharashtra. The study's findings have implications for India's energy transition and contribute to the understanding of the electricity sector in Maharashtra. With a growing population and increasing economic activity, Maharashtra's electricity sector will continue to play a vital role in the state's development. The state's experience can inform national energy policies and provide valuable lessons for other states and countries. The study's results highlight the need for a sustainable and efficient energy mix to meet the state's growing electricity demand.

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