

Spatial Pattern of Electricity Consumption in Ahilyanagar District: A Tahsil-Wise Geographical Analysis

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Abstract: Electricity is a fundamental input for modern economic development, agricultural productivity, urban growth, and improvement in quality of life (World Bank, 2019; Sen & Ganguly, 2017). The spatial distribution of electricity consumption reflects variations in population density, economic structure, agricultural activities, industrial concentration, and infrastructural development (Singh, 2015; CEA, 2022). The present study analyzes the tahsil-wise spatial pattern of electricity consumption in Ahilyanagar District, Maharashtra, using secondary data obtained from district-level records. Sector-wise electricity use under Domestic, Commercial, Industrial, Public Lighting, Agriculture, and Others has been examined along with per capita electricity consumption and number of electricity connections (Government of Maharashtra, 2023). The study reveals significant inter-tahsil disparities in total and per capita electricity consumption. Nagar tahsil records the highest total electricity consumption, while Parner shows the highest per capita electricity consumption, confirming the strong relationship between electricity use and regional development (Agarwal & Kumar, 2018; Mishra, 2020). Agriculture dominates electricity use in most tahsils due to extensive irrigation and groundwater pumping (Patil & Deshmukh, 2021). The paper highlights spatial inequalities in energy access and utilization and suggests policy implications for balanced regional development and sustainable energy planning.

Keywords: Electricity consumption, spatial pattern, per capita consumption.

1. INTRODUCTION

Electricity is universally recognized as a core driver of economic development, agricultural modernization, industrial expansion, and improvement in human life (World Bank, 2019). Regions with higher electricity access and consumption generally exhibit higher productivity, improved social infrastructure, and greater urbanization (Sen & Ganguly, 2017). In India, electricity consumption has increased rapidly due to population growth, industrialization, irrigation development, and rising household demand (CEA, 2022).

The spatial pattern of electricity consumption reflects the interaction between natural resources, agricultural practices, settlement structure, industrial development, and infrastructure availability (Singh, 2015). Maharashtra is one of the most power-consuming states due to its strong industrial base and extensive irrigated agriculture, particularly sugarcane cultivation (Government of Maharashtra, 2023).

Ahilyanagar District presents a unique geographical setting where dry plateau regions coexist with canal-irrigated sugar belt areas, leading to sharp inter-tahsil variation in electricity consumption. However, very limited micro-level (tahsil-wise) studies exist for this district. Therefore, the present study attempts a spatial geographical analysis of electricity consumption at tahsil level, which is essential for regional planning and sustainable energy management.

2. REVIEW OF LITERATURE

Several scholars have examined electricity consumption from geographical, economic, and regional development perspectives.

Singh (2015) emphasized that spatial disparities in electricity consumption closely correspond with industrial growth and irrigation intensity. Agarwal and Kumar (2018) observed that states with higher per capita electricity consumption also show higher Human Development Index (HDI) values.

Mishra (2020) analyzed district-wise electricity consumption in Maharashtra and found agriculture to be the dominant consumer in rural districts with extensive sugarcane cultivation. Patil and Deshmukh (2021) highlighted the rapid growth of agricultural pump-set electricity consumption in Western Maharashtra due to groundwater exploitation.

At the national level, the Central Electricity Authority (CEA, 2022) reported that agriculture accounts for nearly 18–20% of India's total electricity consumption, while domestic and industrial sectors dominate urban demand. World Bank (2019) also emphasized that uneven electricity access is a major cause of regional economic inequality.

However, no comprehensive tahsil-wise geographical study focusing on Ahilyanagar District was found. This research therefore fills an important regional research gap.

3. OBJECTIVE

- To analyze the tahsil-wise spatial pattern of total and sector-wise electricity consumption in Ahilyanagar District.
- To examine the variation in per capita electricity consumption and its relationship with regional development among the tahsils of Ahilyanagar District.

4. DATABASE AND METHODOLOGY

4.1. Data Source

The study is entirely based on secondary data obtained from district-level electricity consumption records (Socio-Economic Abstract of Ahilyanagar District- Nov 2025). The dataset includes:

- Domestic consumption
- Commercial (low power use)
- Industrial
- Public lighting
- Agriculture
- Others
- Total electricity consumption
- Per capita electricity consumption (kWh)
- Number of electricity connections (in lakhs)

4.2. Methodology

- Data was classified tahsil-wise.
- Sector-wise percentages were computed.
- Per capita consumption levels were compared.
- Tahsils were classified into high, medium, and low electricity consumption zones.
- Geographic interpretation was applied to explain spatial patterns.

4.3. Study Area

Ahilyanagar District is located in the western part of Maharashtra and forms part of the Deccan Plateau. The district extends between 18°02' N to 19°09' N latitude and 73°09' E to 75°05' E longitude. It is bounded by Nashik district to the north, Beed and Osmanabad to the south, Pune to the west, and Aurangabad to the east.

The district comprises 14 tahsils: Akole, Sangamner, Kopergaon, Rahata, Shrirampur, Newasa, Shevgaon, Pathardi, Nagar, Rahuri, Parner, Shrigonda, Karjat, and Jamkhed.

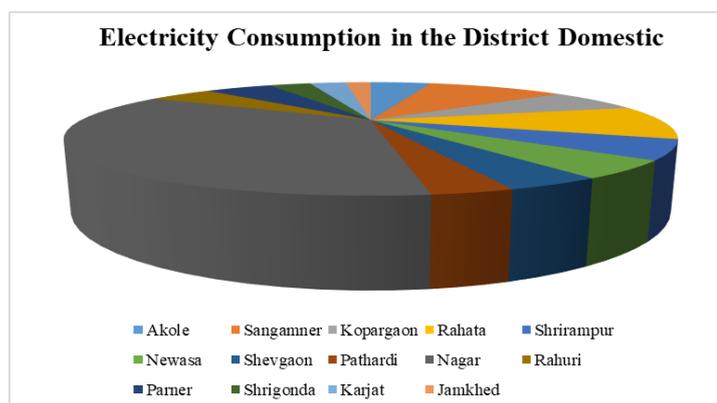
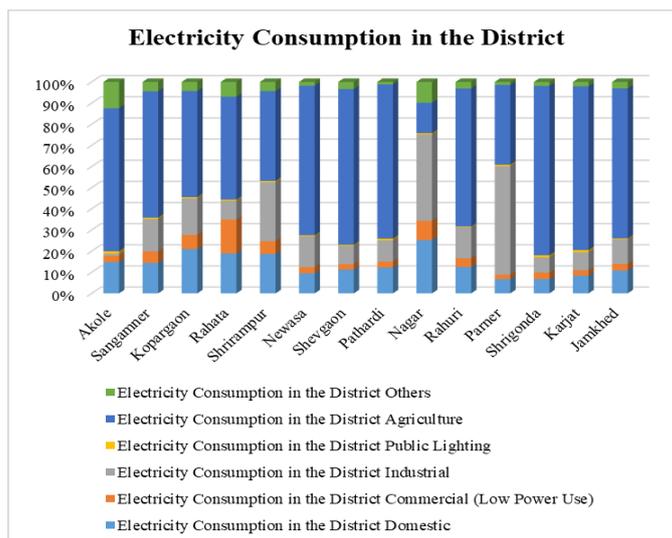
Agriculture is the dominant economic activity, supported by canals, lift irrigation, and groundwater. Sugar industries, dairy units, and service activities are concentrated in selected tahsils such as Nagar, Shrirampur, Rahata, Rahuri, and Sangamner.

5. RESULTS AND DISCUSSION

Electricity consumption in the district shows a strong dominance of the **agricultural sector**, which alone accounts for the highest share of total power use (15, 46,509 units), indicating the wide use of electric pumps for irrigation. The **industrial sector** is the second major consumer (6,83,939 units), with the highest concentration in **Nagar and Parner tahsils**, reflecting industrial development. **Domestic electricity use** is highest in **Nagar**, showing its urban character, while **commercial consumption** is prominent in **Rahata, Sangamner, and Nagar** due to trade and service activities. **Public lighting consumption remains very low** compared to other sectors, indicating limited urban infrastructure in most tahsils. Overall, the pattern highlights clear **spatial variation in sector-wise electricity consumption across the district**, influenced mainly by agriculture, urbanization, and industrialization.

Electricity Consumption in the District						
Tahsil	Domestic	Commercial (Low Power Use)	Industrial	Public Lighting	Agriculture	Others
Akole	20310	4006	1390	1539	92592	17029
Sangamner	45221	17194	48100	2049	187787	13939
Kopargaon	29868	9555	24640	803	71422	6165
Rahata	44073	37561	20672	1302	113878	16297
Shrirampur	25046	8126	37528	752	57002	5877
Newasa	21850	6773	33704	1048	163276	4081
Shevgaon	17709	3962	13698	775	115841	5298
Pathardi	14684	3357	12072	984	87427	1460
Nagar	162250	58911	262660	3768	93073	63174
Rahuri	20763	6817	24615	487	108499	5156
Parner	21909	6961	168509	2222	123780	4575
Shrigonda	13805	6324	14800	1926	163940	3814
Karjat	12084	3789	12342	1501	112218	3030
Jamkhed	8501	2431	9209	317	55774	2398
Total	458073	175767	683939	19473	1546509	152293

Source: Socio-Economic Abstract of Ahilyanagar District: November 2025



Domestic electricity consumption in the district shows significant spatial variation among tahsils. It is highest in Nagar tahsil (1,62,250 units), reflecting high urban population, dense residential settlements, and better household electrification. Tahsils such as Sangamner and Rahata also record relatively high domestic consumption due to growing urbanization. In contrast, Jamkhed (8,501 units) and Karjat (12,084 units) show the lowest domestic consumption, indicating low population density, rural settlement patterns, and limited household electricity use. Overall, domestic electricity consumption closely follows the pattern of urban growth and population concentration in the district.

6. AGRICULTURAL ELECTRICITY CONSUMPTION

Agricultural electricity consumption dominates the district with **1,546,509 units**, accounting for more than **50% of total electricity use**. Tahsils such as Sangamner (187,787 units), Newasa (163,276 units), Shrigonda (163,940 units), and Parner (123,780 units) show extremely high agricultural consumption.

This is primarily due to:

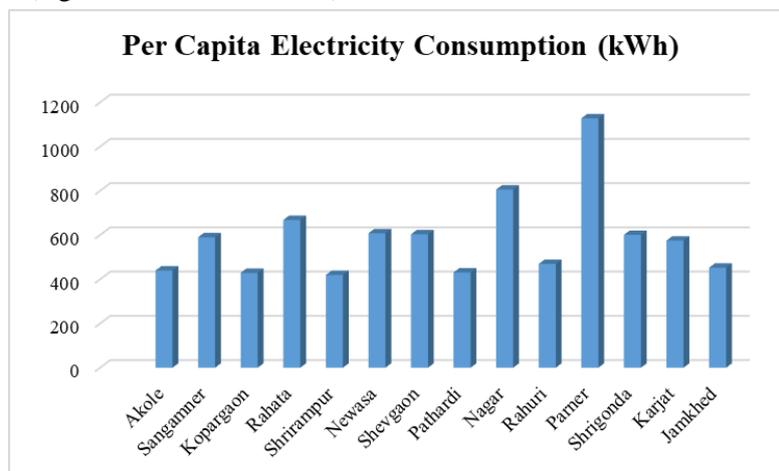
- Extensive **sugarcane cultivation**
- Heavy dependence on **tube wells and lift irrigation**
- Limited rainfall reliability
- Expansion of **canal irrigation networks** (Mishra, 2020; Government of Maharashtra, 2023)

Patil and Deshmukh (2021) observed that indiscriminate groundwater pumping using electric motors has significantly increased rural electricity demand in Western Maharashtra. The present study confirms the same trend in Ahilyanagar district.

6.1. Per Capita Electricity Consumption

Parner tahsil records the **highest per capita electricity consumption (1127.73 kWh)**, followed by Nagar (805.66 kWh) and Rahata (668.02 kWh). High per capita electricity consumption is generally associated with:

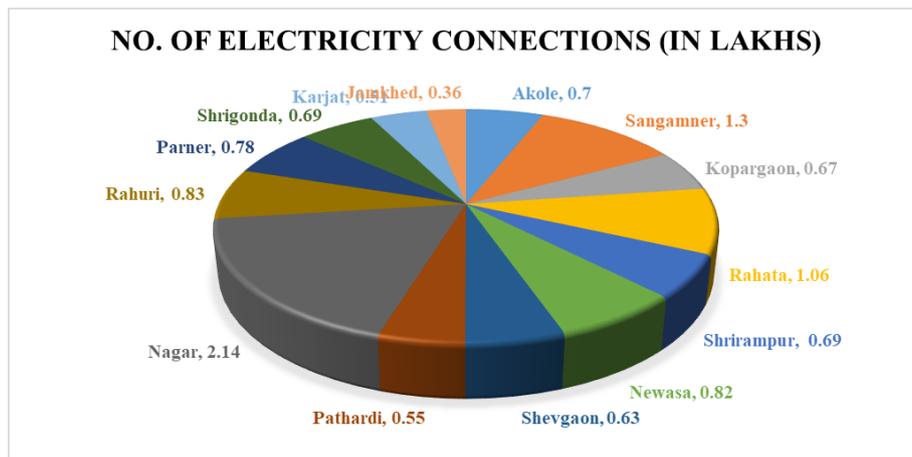
- Industrial employment
- Mechanized agriculture
- Higher household income
- Urban lifestyle (Agarwal & Kumar, 2018)



In contrast, Jamkhed (452.31 kWh) and Shrirampur (419.4 kWh) fall in the low per capita consumption category, reflecting:

- Economic backwardness
- Rain-fed agriculture
- Lower industrial base
- Lower quality of energy infrastructure

These findings strongly support the **electricity–development linkage theory** proposed by Sen and Ganguly (2017).



The distribution of electricity connections in the district shows a clear urban–rural disparity. Nagar tahsil has the highest number of electricity connections (2.14 lakh), followed by Sangamner (1.30 lakh) and Rahata (1.06 lakh), indicating higher population concentration, urbanization, and industrial activity in these tahsils. Jamkhed (0.36 lakh) and Karjat (0.51 lakh) record the lowest number of connections, reflecting their predominantly rural character, lower population density, and weaker economic base. Overall, the pattern of electricity connections closely corresponds with the level of urban development and economic activity across the tahsils.

6.3. Spatial Pattern of Electricity Consumption

The spatial distribution of electricity consumption in Ahilyanagar District exhibits a **distinct core–periphery pattern**.

6.4. High Consumption Zone

Nagar, Parner, and Sangamner form the high consumption core. These tahsils are characterized by:

- Urban-industrial concentration
- Sugar mills and agro-processing industries
- Dense road and market networks
- High population density

According to Singh (2015), such regions act as **energy growth poles**, attracting both industrial and population concentration.

6.5. Moderate Consumption Zone

Rahata, Rahuri, Newasa, and Shrigonda fall under this category. These tahsils show:

- Balanced agriculture–industry structure
- Canal irrigation support
- Growing service sector

6.6. Low Consumption Zone

Jamkhed, Karjat, Pathardi, and Shevgaon display:

- These areas show characteristics of **energy poverty**, as defined by World Bank (2019).

6.7. Findings

- Nagar tahsil acts as the electricity consumption nucleus of the district.
- Parner shows exceptionally high per capita electricity consumption, indicating mechanized agriculture and industrialization.
- Agriculture alone consumes over half of district electricity, confirming findings by Mishra (2020).
- Jamkhed is the most energy-deficient tahsil, indicating development imbalance.
- Strong correlation exists between electricity consumption, irrigation intensity, and urban development, confirming Sen and Ganguly’s (2017) model.

7. CONCLUSION

The spatial pattern of electricity consumption in Ahilyanagar District clearly reflects the district's uneven economic development, irrigation structure, and industrial concentration. Agriculture remains the dominant electricity-consuming sector due to large-scale sugarcane cultivation and expanding groundwater irrigation. Urban-industrial tahsils such as Nagar and Sangamner emerge as electricity-intensive regions, while tahsils like Jamkhed and Karjat continue to lag behind.

The study confirms earlier national and state-level research (CEA, 2022; Government of Maharashtra, 2023; World Bank, 2019) that electricity consumption is a strong indicator of regional development. For achieving balanced regional growth, targeted power infrastructure investment, promotion of renewable energy in agriculture, and industrial decentralization are urgently needed.

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