Comparative Analysis of Electricity Demand Patterns in Bihar and Jharkhand

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ABSTRACT: In the two Indian states of Bihar and Jharkhand, the paper offers a comparative study of recent trends, drivers, and forecasts in the short term regarding electricity demand on the trade. Taking into account monthly peak demand and annual energy data (2005-2025) from national and regional databases and from resource adequacy reports, the study quantifies the current demand levels and its current growth rates and levels with the supply-side preparedness aspect. As per the Paper, Bihar, within the peak demand context (both state and system), is way bigger than that of Jharkhand, as of early 2025. Both states are thus witnessing an increase in demand with economic development, electrification, and cooling. The Paper then delves into instruction for transmission planning, distribution loss measures, renewable integration, and policy ideas on ensuring a reliable and affordable supply under the renewable purchase obligation scheme.

INDEX TERMS:- Renewable energy; Electricity demand; peak demand; CEA;

I. INTRODUCTION

Electricity demand has slowly become one of the key signs of economic progress, industrial development, and everyday life improvements in modern society. In developing areas like eastern India, the steady rise in population, urban growth, industrial expansion, and rural electrification has genuinely reshaped how electricity is used. Among the eastern Indian states, Bihar and Jharkhand stand out as two major regions with different social conditions and industrial layouts so they work well for a side-by-side study of electricity demand behaviour.

Bihar is among the more densely populated states in India, and it mainly leans on agriculture along with household-based consumption[1], [2]. Over the last few years, Bihar has seen a noticeable upward trend in electricity demand because urbanization has moved fast, electrification programs from the government[3], [4] have expanded, living conditions are improving, and commercial work has grown. Still, the state remains under pressure from power availability issues, transmission infrastructure gaps, difficulties in managing peak usage, and uneven energy access especially in rural districts.[5], [6]

Jharkhand, meanwhile, is mineral-heavy and more industrially structured, with large coal reserves and a strong base of steel units, mining activities, and other manufacturing processes[7], [8]. Because of this, Jharkhand's electricity demand profile looks quite different from Bihar's. The state tends to show greater industrial electricity requirements, yet domestic use and agricultural consumption do not stall either; they keep increasing in a steady way as socio-economic activity grows and electrification reach keeps widening.[9], [10]

A comparative study of electricity demand patterns in Bihar and Jharkhand matters a lot, because it helps in understanding how regional energy consumption behaves, how the load moves over time, where the demand comes from by sector, and what the future electricity needs could be.[1], [11], [12] With this kind of analysis, policymakers, power utilities ,and researchers can actually craft better strategies for

energy planning, expansion of power generation, demand-side management, and also for keeping electricity distribution systems sustainable and steady.[13], [14]

This research paper intends to look at and compare the electricity demand characteristics of Bihar and Jharkhand, using whatever statistical records and energy usage data are available.[15] The focus is on the drivers that tend to shape electricity demand, such as population growth, industrial advancement, urban growth, economic activities, and rural electrification.[16] It also revisits older demand trends, compares the way peak loads change, and checks how electricity is used across different sectors in both states.[17], [18]

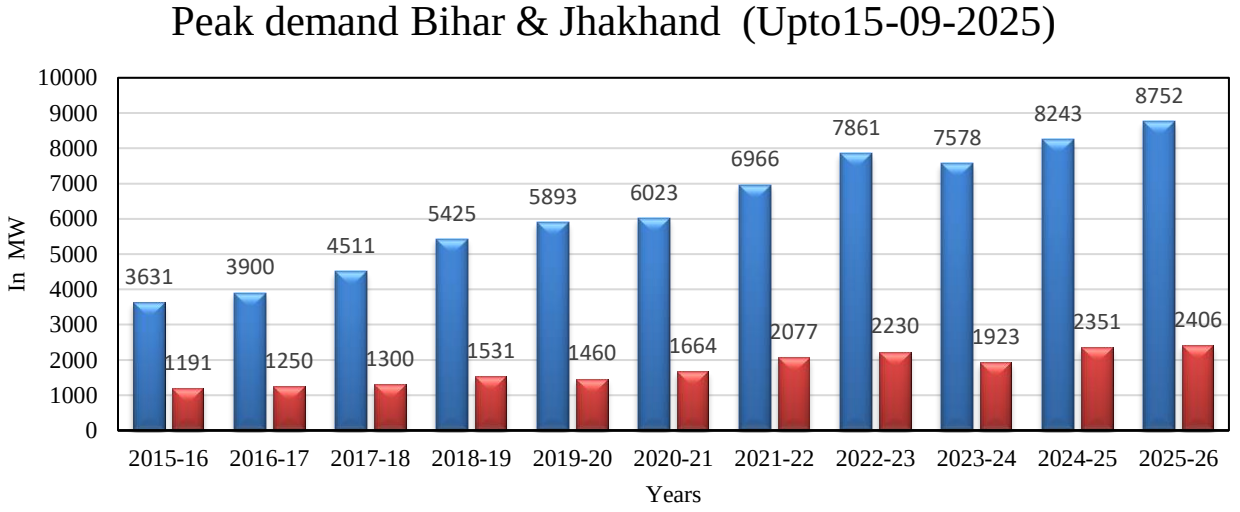
India's electricity consumption and peak demand have risen rapidly in the last decade, driven by economic activity, household electrification, and increasing cooling loads. States differ widely in size, industrial structure, and electrification trajectories; Bihar and Jharkhand provide a useful comparison because they are neighboring states with different economic bases (Bihar: large population, expanding services and agriculture electrification; Jharkhand: mineral- and industry-oriented economy with significant captive generation).[19] Understanding the differences in demand magnitude, seasonality, and forecast growth is essential for state transmission and distribution planning and for meeting renewable and reliability targets. National datasets (CEA, Energy Statistics) and regional demand series supply the primary empirical basis for this comparison[20], [21], [22], [23]

Industrialization, digitalization, and electrification have halted the spike of demand for electricity in India. Simultaneously, the national policy had set sights on installing 500 GW of non-fossil fuel capacity by 2030,[19], [24], [25] the localization of solar manufacturing, and the modernization of the grids. Newer installed capacities are created much faster than decarbonization of the generation mix, thus creating a wider distance between an inspiringly cleaner capacity mix and a still aggressively coal-heavy generation mix. [26], [27], [28]This study has tackled quantifying the capacity trends separating RE from non-RE sources while understanding their drivers and implications.[29], [30], [31]

Overall, the outcomes of this side-by-side case study are expected to offer useful indications for regional energy planning and to support the building of dependable and sustainable power systems in eastern India.[32], [33], [34] Also, this work may help government departments and electricity boards in framing workable policies to improve supply dependability, reduce the demand–supply mismatch, and encourage more careful and efficient energy utilization in Bihar as well as Jharkhand.[19], [35], [36], [37].

II. METHODOLOGY

The study uses several data sources to compare electricity demand in Bihar and Jharkhand. Monthly peak demand data from 2005 to March 2025 is taken from CEIC and Central Electricity Authority (CEA) datasets, which provide detailed state-level time series. Forecast and planning documents, such as the CEA's resource adequacy reports, the 20th Electric Power Survey (EPS), and state-level transmission plans for Bihar and Jharkhand, are also used. In addition, information from state utilities—Bihar State Power Holding Company Limited (BSPHCL) and Jharkhand Bijli Vitran Nigam Ltd (JBVNL)—is included to understand organizational and operational context. Supporting information from Wikipedia and other reports is used where required.



Source:-MNRE & CEA

Figure 1:- Yearly Peak Demand of Bihar & Jharkhand

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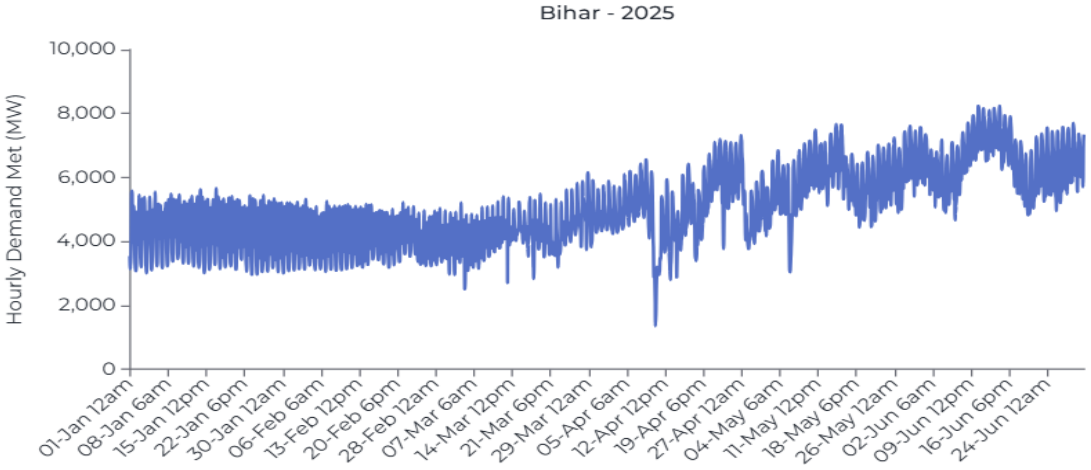

(*Source*:-https://iced.niti.gov.in/energy/electricity/distribution/national-level-consumption/load-curve)

Figure 2:- Monthly peak demand in Bihar (Last 6th month upto 24-07-2025)

The analysis is based on a few key metrics. First, the monthly peak demand in megawatts (MW) is compared to study the magnitude of demand and seasonal variations. Second, growth trends are calculated using the Compound Annual Growth Rate (CAGR). Two time windows are considered: 2015–2024 to capture the long-term trend, and 2023–2025 to check short-term acceleration. Third, future demand projections are taken from state forecasts and the CEA/EPS 20th survey, along with transmission upgrade plans, to assess near- to medium-term requirements. Finally, a qualitative assessment is made by reviewing the financial and operational health of state utilities, upcoming projects, generation mix, and renewable energy targets such as the Renewable Purchase Obligation (RPO).

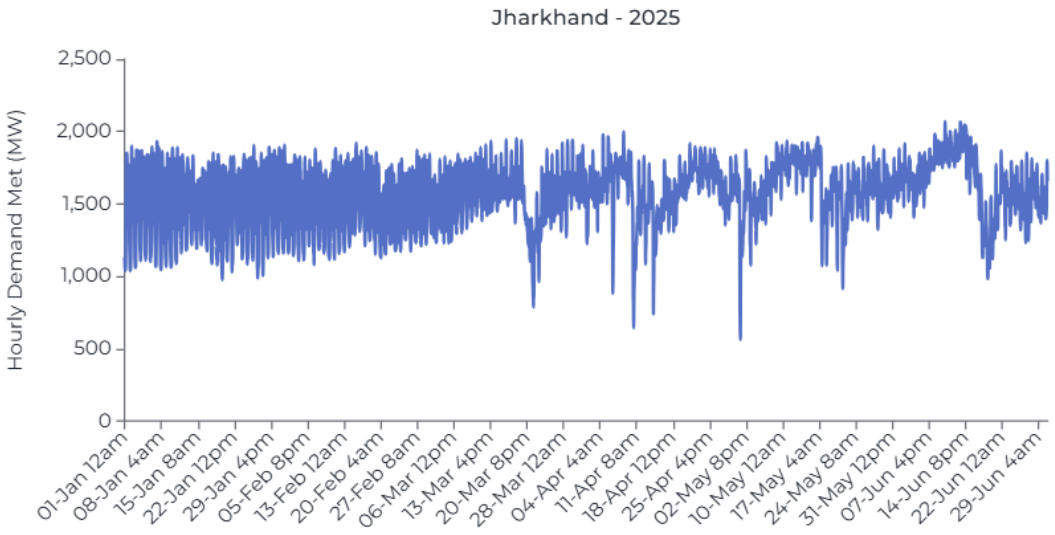

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Figure 3:- Monthly peak demand in Jharkhand (Last 6th month upto 24-07-2025)

There are some limitations to this study. Publicly available data sometimes reports electricity demand only at the regional level (e.g., the Eastern Region), which requires assumptions when breaking down the data into state-level series. Where possible, CEIC and CEA monthly state-level data are used to reduce this problem. Projections and forecasts also have uncertainties, since they are based on scenarios. In reality, demand may differ due to changes in the economy, unusual weather patterns, or shifts in government policy.

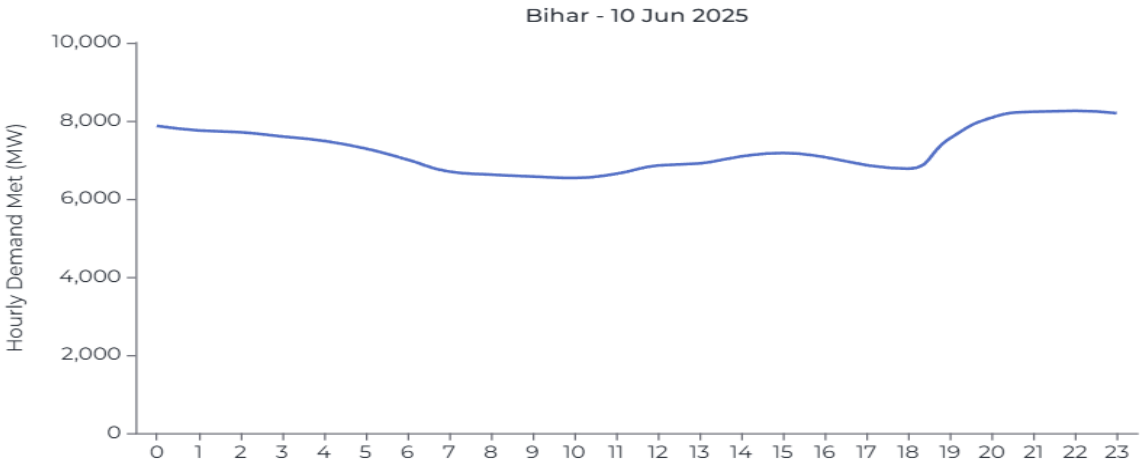

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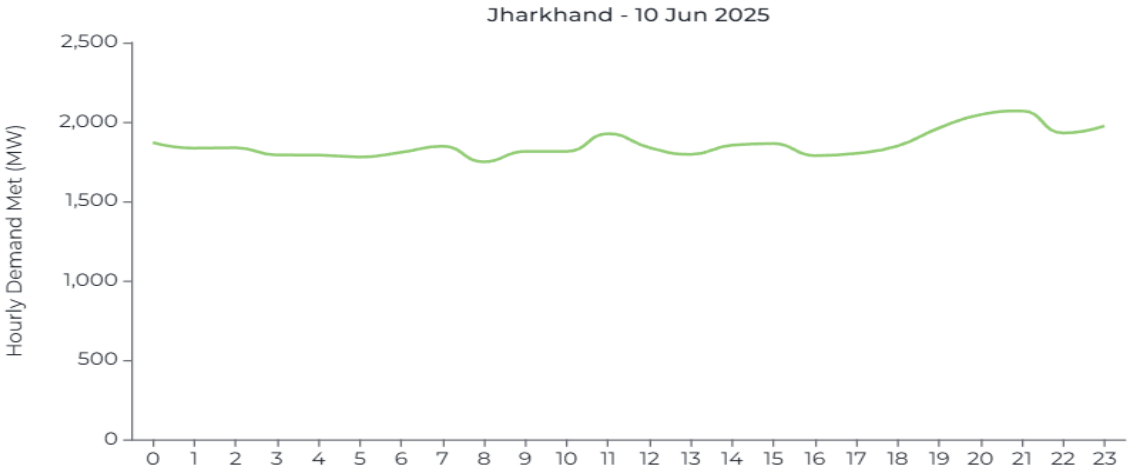
Figure 4:- hourly peak demand in Bihar (Last 6th month upto 24-07-2025)



(Source:-https://iced.niti.gov.in/energy/electricity/distribution/national-level-consumption/load-curve)

Figure 5:- Hourly peak demand in Jharkhand (Last 6th month upto 24-07-2025)

As reported by the Central Electricity Authority, the total renewable energy-based electricity generation capacity now stands at 203.18 GW. The achievement is a testimony to India's increased commitment to clean energy and its forward march toward a greener future. With an incredible 24.2 GW increase in total renewable energy installed capacity (13.5%) between October 2023 and October 2024, India reached the 203.18 GW mark against the earlier 178.98 GW. In addition, in 2024, taking into account nuclear energy, India's total non-fossil fuel capacity was 211.36 GW, as opposed to 186.46 GW in 2023.MNRE.

Table no 1: Comparison of Electricity Demand in Bihar and Jharkhand

Parameter	Bihar	Jharkhand
Peak Demand (Mar 2025)	6,518 MW	2,223 MW
Historical Peak (till 2024)	6,700 MW	2,295 MW
Growth Rate (CAGR projection)	Strong growth; demand expected to nearly triple by 2035 (18,708 MW)	6.4% CAGR (2023–2030)
Key Demand Drivers	Large population, urbanization, household electrification, and commercial loads	Industrial loads, the mining sector, and growing household consumption
Major Challenges	Transmission upgrades, reducing distribution losses, and integrating renewables	Resource adequacy, industrial load management, and renewable integration

A. Current demand levels (Up to Mar 2025)

i. **Bihar** - reported peak demand for the eastern/Bihar series was **6,518 MW** in March 2025 (monthly reported value). Bihar's regional peak has reached higher values in 2024 (record high noted in some datasets)

ii. **Jharkhand** - reported peak demand for the state was **2,223 MW** in March 2025. Jharkhand's historical peak is much lower than Bihar's, with an all-time recorded high of around 2,295 MW in May 2024 in the referenced series

B. Recent growth and projections

i. **Jharkhand**: The CEA resource-adequacy report for Jharkhand estimates a **CAGR of around 6.4%** (2023–24 to 2029–30) in one projection line, indicating robust growth driven by industry and rising consumption.
ii. **Bihar**: state transmission planning and reporting indicate aggressive growth expectations; a recent transmission upgrade plan was prepared to meet a projected demand of **18,708 MW by FY 2034–35**, implying a multi-year doubling from 2025 levels under CEA planning assumptions. This plan includes substantial transmission investments (₹12,869 crore) to handle the projected growth.

III. RESULTS AND DISCUSSION

In March 2025, Bihar's peak electricity demand was about 6,518 MW, while Jharkhand's was about 2,223 MW. Bihar's demand is nearly three times higher than Jharkhand's, mainly due to its larger population and rapid electrification. Growth trends show that Jharkhand's demand is increasing at a CAGR of 6.4%, driven by industrial load. Bihar is projected to reach 18,700 MW by 2034–35, requiring major transmission expansion. The CEA resource-adequacy report for Jharkhand estimates a CAGR of around 6.4% (2023–24 to 2029–30) in one projection line, indicating robust growth driven by industry and rising consumption. Bihar state transmission planning and reporting indicate aggressive growth expectations. A recent transmission upgrade plan was prepared to meet a projected demand of 18,708 MW by FY 2034–35, implying a multi-year doubling from 2025 levels under CEA planning assumptions. This plan includes substantial transmission investments (₹12,869 crore) to handle the projected growth

IV. CONCLUSION

As of Mar 2025, Bihar's peak demand (6,518 MW) is substantially higher than Jharkhand's (2,223 MW). Both states are expected to see continued growth — Jharkhand with CEA-reported near-term CAGRs around 6–6.4% and Bihar with ambitious transmission planning to meet projected demand of 18,708 MW by FY2034–35 (CEA Report). Meeting these demands requires coordinated transmission upgrades, distribution loss reduction, and careful integration of renewable energy and flexibility resources

Bihar currently has much higher demand than Jharkhand, but both states are experiencing steady growth. Bihar's challenge: upgrading transmission and reducing distribution losses to meet rapidly rising demand. Jharkhand's challenge: ensuring resource adequacy and integrating renewables while supporting its industrial base. Both states need stronger grid planning, loss reduction, and renewable integration to meet future electricity needs reliably

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