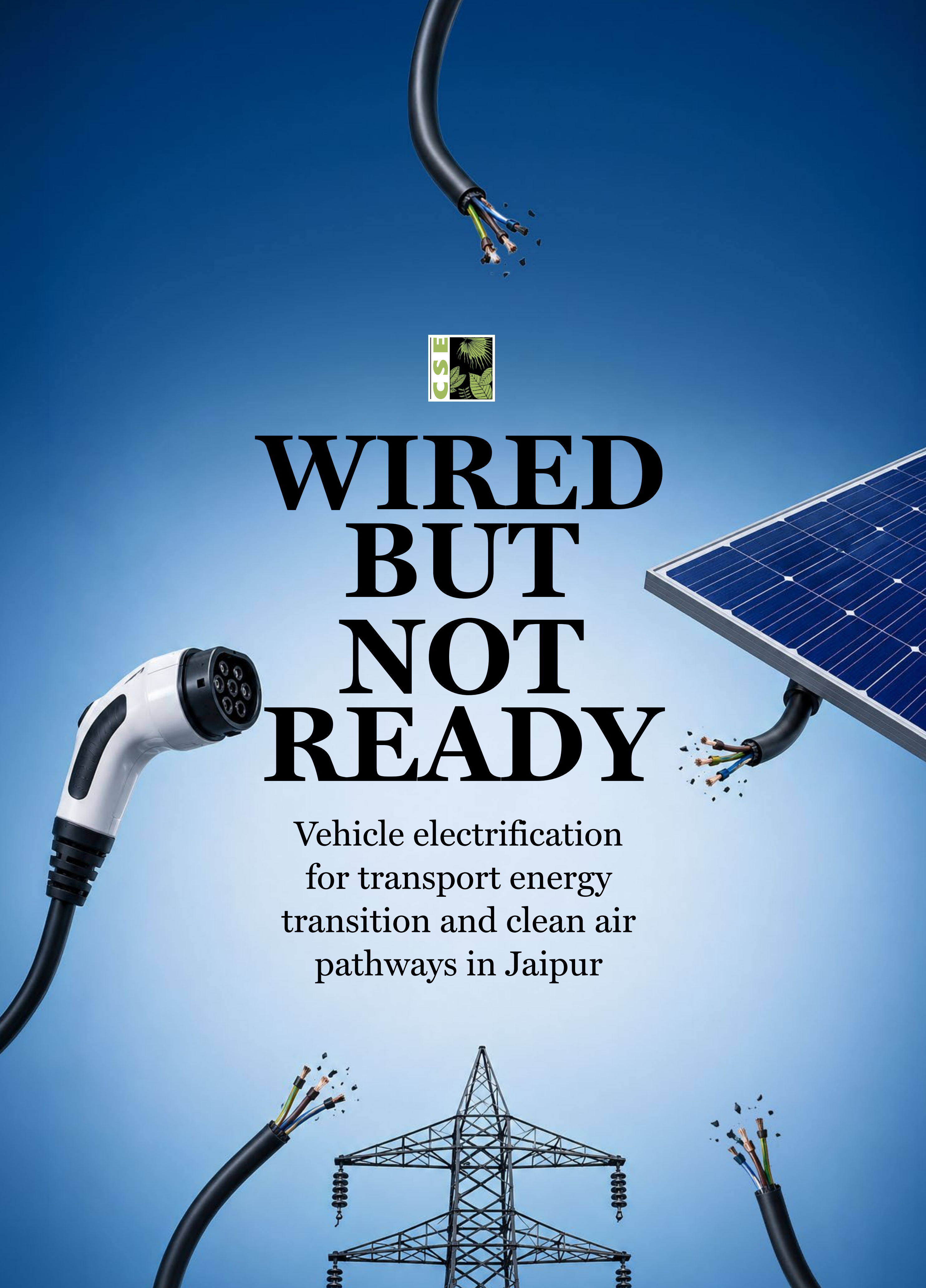


WIRED BUT NOT READY

Vehicle electrification for transport energy transition and clean air pathways in Jaipur

WIRED BUT NOT READY

Vehicle electrification for transport energy transition and clean air pathways in Jaipur

Authors: Anumita Roychowdhury and Kalyani Tembhe

Lead research and analyses: Kalyani Tembhe

Geospatial mapping: Jyoti Kumari

Editor: Yashita Mishra

Cover design: Ajit Bajaj

Layout: Surender Singh

Production: Rakesh Shrivastava and Gundhar Das

© 2026 Centre for Science and Environment

Material from this publication can be used, but with acknowledgement.

Maps in this report are indicative and not to scale.

Citation: Anumita Roychowdhury and Kalyani Tembhe 2026, *Wired but not ready: Vehicle electrification for transport energy transition and clean air pathways in Jaipur*, Centre for Science and Environment, New Delhi

Published by
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi 110062
Phone: 91-11-40616000
E-mail: cse@cseindia.org
Website: www.cseindia.org

CONTENTS

The Spotlight

Driven by the growing pollution and energy impacts of rapid vehicle growth, cities in Rajasthan urgently require an accelerated transition towards zero-tailpipe emissions, making vehicle electrification a top priority. Rajasthan's clean air and electric vehicle pathways explicitly intersect by prioritizing electric vehicle (EV) initiatives and infrastructure support for designated "non-attainment" cities, such as Jaipur, Udaipur, Jodhpur, Kota, Alwar and the rest of the regions. Since accelerated electrification can deliver massive emission reductions, ambitious zero-tailpipe emission targets are essential to meeting local clean air goals.

To maximize these near-term air quality dividends and climate change benefits, the state's transport electrification strategy must be aggressively integrated with broader clean energy and power sector transformation plans to successfully accelerate the zero-emissions transition.

The Rajasthan State Electric Vehicle (EV) policy has set segment-wise electrification targets and offers incentive packages to support consumers, manufacturing, and charging infrastructure. While the ongoing efforts to implement the policy need to be assessed against these targets to identify the action gaps, it is equally necessary to contextualize this transition within the broader state and city energy trajectories. This requires tracking real progress in reducing transport fuel consumption to increase the share of electricity, especially clean electricity. From this perspective, it is essential to understand the energy trends in the transport sector and the potential of electrification to drive low-pollution, low-carbon growth in the state.

The underlying premise is that the current incentive-based approach is insufficient to build a scalable market on its own and to enable an effective energy transition. Instead, regulatory mandates and time-bound electrification targets are necessary to build momentum and catalyze a true energy transition. However, as the market begins to expand due to zero-emission mandates, charging levers must be strengthened to enable quicker uptake of electricity to displace oil. While several enablers must be developed simultaneously, charging infrastructure remains the most critical intervention point to build consumer confidence and catalyze demand. Scaling this infrastructure requires structural and systemic planning, alongside requisite public and private investments in the electricity system.

Accordingly, the Centre for Science and Environment (CSE) has conducted this diagnostic assessment to review ground-level changes in Jaipur's EV charging network to understand on-the-ground realities. The objective of this study is to document and analyze the evidence base to identify specific challenges regarding vehicle fleet electrification, current and projected electricity requirements for electrification, and the access to and affordability of electricity for charging, while highlighting the priority actions needed to make electrification operationally feasible across Jaipur's diverse vehicle fleet and charging typologies.

Electrification is climbing steadily in Jaipur, reaching 12 per cent for private two-wheelers and 10 per cent for private cars by April 2026. The three-wheeler segment is leading the fleet's electrification, jumping from 13 per cent in 2024–25 to an impressive 31 per cent in 2025–26. Overall registrations for passenger three-wheelers saw an astronomical 244 per cent increase due to heavy reliance on paratransit. Despite successes in personal and paratransit vehicles, high-mileage commercial segments remain severely under-electrified, hovering around 1 per cent for cabs and around 1 per cent for buses. A true energy transition requires aggressively targeting cabs and buses to reach near 100 per cent electrification.

Ground realities show that Jaipur is vastly outpacing national Central Electricity Authority (CEA) forecasts of overall power consumption, driven by demand across several sectors. Jaipur's actual power consumption for 2024–25 reached 6,781 million units (MU), surpassing the CEA's projected demand for 2027–28 a full three years early. This indicates that the demand growth assumptions driving current infrastructure planning structurally underestimate the city's trajectory.

Unlike the state level—where agriculture drives winter daytime peaks—Jaipur's demand is overwhelmingly driven by the commercial or industrial (50 per cent) and residential (47 per cent) sectors. Consequently, Jaipur experiences its highest demand during the summer months, marked by dual daily peaks in the late morning and late evening.

- **Energy requirements in business-as-usual (BAU) scenario:** CSE has developed bottom-up projections calibrated to Jaipur's actual urban capacity. Home charging load is projected to rise gradually from approximately 95.4 MU in 2029–30 to 279 MU by 2054–55, which can largely be absorbed via existing residential feeder upgrades. Hub or public charging hits 210 MU by 2029–30 and 420 MU by 2054–55, while depot charging reaches 4.5 MU by 2029–30 and 8.7 MU by 2054–55.
- **Electrification plus modal shift energy requirements:** Electricity demand rises much more steeply due to massive absolute EV penetration. Home

charging surges to 200 MU by 2029–30 and 1,867 MU by 2054–55. Hub or public charging skyrockets to 347 MU by 2029–30 and 2,375 MU by 2054–55, while depot charging jumps to 74 MU by 2029–30 and 1,325 MU by 2054–55.

While gradual growth under the BAU scenario might be manageable with standard infrastructure upgrades, the accelerated electrification scenario presents a severe infrastructural hurdle. To manage the magnitude and pace of load growth expected by the 2030s and 2040s, proactive planning of distribution infrastructure is required immediately—well before the demand materializes. This urgency is critical, as Jaipur's actual 2024–25 electricity consumption has already exceeded the CEA's 2027–28 projected demand by a three-year margin.

Fleet electrification delivers deep reductions in local air pollutants: As stated earlier, electrifying vehicle fleets represents the largest per-vehicle emissions reduction opportunity and offers the best air quality dividends per unit of public investment. Under an ambitious scenario, total PM2.5 emissions from Jaipur's on-road fleet will drop to approximately 21 tonnes by 2054–55, representing a 72 per cent reduction against the 74 tonnes expected under BAU. CO_2 emissions will reduce by 67 per cent, and NOx by 77 per cent. This translates into measurable, near-term air quality dividends for congested corridors as electric two-wheelers displace petrol combustion at scale.

Impending power load curve spikes and hyper-local grid stress: Fleet electrification at scale will radically reshape national demand load curves in ways that current infrastructure planning has not accounted for. According to the estimates of Niti Aayog, by 2070, EV charging is projected to create severe national demand spikes of approximately 150 GW during night time hours and 100 GW during the afternoon.[1] The electrical grid must accommodate a projected 70/30 split for private EV charging—70 per cent of demand will be met via home charging, while 30 per cent will rely on the public charging network.[2] The pressure on public infrastructure will be concentrated, not dispersed—and cities like Jaipur, which already anchor state-level public charging demand, will feel it first.

1.1 Accelerating Jaipur's EV charging transition: Key findings and way forward

This assessment shows that Jaipur's EV charging ecosystem is not held back by an absence of policy instruments. The Rajasthan Electric Vehicle Policy (REVP) 2022,[3] the Solar Energy Policy 2019,[4] the Rajasthan Integrated Clean Energy Policy 2024,[5] progressive RERC regulatory amendments (culminating in virtual net metering and BESS recognition),[6] the updated Time-of-Day (ToD) tariff structure,[7] the Rajasthan (Urban Area) Building Bye-Laws 2025,[8] and Jaipur

Vidyut Vitran Nigam Limited's (JVVNL) implementation circulars on rooftop solar and hybrid inverters[9] collectively constitute a regulatory architecture that is well ahead of most Indian states. The primary gap lies in what this framework has not yet operationalized at the city level. Closing this gap is the objective of the next phase of REVP implementation, requiring a convergence agenda with clear priorities and assigned responsibilities.

Jaipur is already running ahead of its grid planning assumptions: Jaipur is already the epicenter of public charging demand within Rajasthan. In 2024–25, public charging stations under JVVNL consumed 9.03 MU annually, with a staggering 90 per cent of this energy (8.13 MU) consumed by stations located exclusively within Jaipur City Circle. By November 2025, 345 of the 605 total charging stations under JVVNL were located in Jaipur. The city's actual power consumption has already exceeded the CEA's 2027–28 demand forecast by three years. This is not a future risk to be modeled but a present condition that makes the operationalization gap identified above the most urgent infrastructure priority in the state. Closing it requires targeted interventions across charging typologies, grid readiness and institutional coordination.

Need grid preparedness and granular assessments: At the high-voltage transmission level, Jaipur is securely integrated into the state grid. However, actual charging readiness is dictated by granular, downstream distribution networks—specifically 33/11 kV substations, 11 kV feeders, and distribution transformers. Consequently, infrastructure planning must move beyond state-level transmission maps and rely on localized feeder-level distribution evaluations. Authorities must assess readiness at the feeder or sub-division level using granular data, including transformer spare capacity, feeder-wise loading profiles and outage records.

The grid shows a promising 48 per cent reduction in outage duration (SAIDI), dropping from 170.44 minutes per quarter in FY 2023–24 to 88.17 minutes in FY 2025–26. In contrast, the System Average Interruption Frequency Index (SAIFI) has largely stagnated at a moderate 5.5 to 6.3 interruptions per quarter, which needs to improve significantly. This means that, on average, a consumer on this grid loses power about five to six times every three months (roughly twice a month). For commercial fleets (e-rickshaws, cabs, and buses), repeated short interruptions are devastating; they disrupt charging sessions, cause queueing inefficiencies, and directly result in income loss and delayed fleet turnaround times.

Home charging and the apartment complex barrier: Home charging is the primary fueling pathway for private two-wheelers and cars, which dominate Jaipur's current EV fleet. Currently, this relies heavily on a market workaround where charge point operators (CPOs) partner with developers to install 7.4 kW chargers on existing domestic connections, avoiding the regulatory complexities, mandatory sub-meters, and industrial demand charges associated with formal EV connections.

To scale effectively before EV penetration becomes a crisis, home charging requires tariff parity, active integration with rooftop solar and Battery Energy Storage Systems (BESS), and proactive distribution infrastructure upgrades in older areas to prevent peak demand spikes. While the Rajasthan (Urban Area) Building Bye-Laws 2025 mandate EV-ready parking and minimum plot norms for new constructions, they leave an access gap for EV owners in older residential developments.

Furthermore, while the Ministry of Power's September 2024 guidelines[10] recognize the right of apartment residents to install private chargers, implementation remains inconsistent—a point elevated to a constitutional question in the Supreme Court case *Rachit Katyal vs Union of India*. To resolve this, JVVNL should issue a dedicated operational circular for apartment-level EV charging with defined timelines for load assessments, clear cost-sharing arrangements, and an explicit pathway for housing societies to participate in the virtual net metering (VNM) framework. This does not require new regulation, as the Rajasthan Electricity Regulatory Commission (RERC) Third Amendment Regulations 2025 already provide the VNM mechanism.[11] What is needed is an operational circular that makes the pathway visible and actionable for residents and housing societies alike.

Public, hub and commercial charging: The public charging network is currently sparse and spatially concentrated, creating significant challenges for commercial users. Jaipur's Comprehensive Mobility Plan (Draft, February 2026) identifies the critical need for strategic, demand-driven charging locations that integrate with existing transit routes, rather than relying on unplanned, dispersed siting.[12]

The electrification of commercial fleets—specifically cabs and three-wheelers, which require predictable daily ranges and brief turnaround times—is actively stalled by network design constraints. The current network is dominated by slow AC chargers and heavily restricted by an effective 44 kW load ceiling on low tension (LT) connections. Because the state routes EV charging into the Medium Industrial category, a CPO deploying a 60-kW fast charger must take a 44-kW LT load line to avoid high tension (HT) thresholds, forcing hardware to operate permanently at throttled speeds.

To address this, DC fast charging must become a planning priority rather than an aftermarket addition. With only 27 stations in the JCC carrying loads above 50 kW, the absence of a reliable fast-charging tier will become a binding constraint, particularly as the three-wheeler segment has already accelerated to 31 per cent penetration. JVVNL and the state EV nodal agency should identify 10 to 15 strategic hub charging locations at transit nodes and commercial centers, ensuring each has a sanctioned HT load capable of supporting at least two DC fast chargers with on-site solar and BESS provisions. The CPO-level upstream infrastructure reimbursement of up to Rs 5 lakh per station under REVP 2022 must be reinstated and restructured as an upfront capital disbursement—not a DISCOM-routed reimbursement—to incentivize early-mover CPOs at these locations.

Bus depot charging ecosystem: Bus electrification, sitting at just 4 per cent in 2024–25 and merely 1.1 per cent in 2025–26, masks the immense scale of infrastructure required if Jaipur is to shift modal shares toward public transport. Under an electrification plus modal shift scenario, bus depot charging energy demand will reach approximately 74.7 MU by 2029–30. This requires multiple high-capacity depot sites, each with concurrent HT connections and solar-BESS integration, to be planned and grid-connected well before fleet procurement decisions are made.

Consequently, bus depot charging must be treated as a capital investment pipeline, not a point-in-time deployment. JVVNL, REDA and the transport department must jointly create a bankable financing and procurement template—accessible to municipal operators lacking dedicated project development capacity—that packages existing Solar Energy Policy captive provisions, REVP reimbursements and hybrid inverter orders.

Solar-EV convergence opportunities: The regulatory foundation for integrating solar power with EV charging is already in place. The Rajasthan Solar Energy Policy 2019 permits captive solar generation at charging stations, allows open access procurement, grants a 100 per cent exemption from transmission and wheeling charges for ten years for projects up to 25 MW, and permits energy banking annually at a 10 per cent adjustment charge, though withdrawal is restricted during peak hours.[13] The FY 2025–26 tariff order reinforces this by replacing the previous single-band nighttime rebate with a three-band time-of-day structure. The new structure applies a 5 per cent surcharge during the morning ramp-up (06:00–08:00), a 10 per cent rebate during the mid-day solar window (12:00–16:00), and a 10 per cent surcharge during the evening peak (18:00–22:00), sending a clear economic signal to shift grid loads into solar-rich mid-day hours.[14]

Despite these provisions, standalone CPOs cannot leverage this framework due to exorbitant HT connection costs, complex metering requirements and lapse of REVP reimbursements. The gap between policy intent and ground-level deployment is structural, not technical, as the TDPL–Tata Power hub demonstrates. Transitioning from ad-hoc co-hosting models to scalable deployment requires three specific interventions. RERC should issue a suo-motu order permitting sub-metering of EV loads behind existing HT connections. The state government and JVVNL should publish a roster of government-owned premises with HT connections made available via competitive tender, and the REVP reimbursement of Rs 5 lakh must be restructured from a DISCOM-routed disbursement into an upfront capital grant administered through a dedicated state EV fund.

Beyond commercial hubs, Jaipur's 68.5 MW of installed residential rooftop solar from the PM Surya Ghar scheme alone generates an estimated 3,01,000 kWh daily, sufficient to cover approximately 2,00,000 two-wheeler charges. All necessary regulatory instruments, including mid-day ToD rebates, virtual net metering, and formal recognition of BESS, are already active. What is missing is an explicit institutional convergence mechanism. JVVNL and REDA must issue a joint circular, or update the REVP, to create a combined rooftop solar plus EV charger package with a streamlined application process, simplified metering, and a single financing window drawing on both solar and EV subsidies.

Overcoming barriers for CPOs and enhancing coordination: CPOs face compounded hurdles, including throttled equipment performance, exorbitant HT connection costs (Rs 7–8 lakh versus Rs 3–4 lakh for LT), halted infrastructure subsidies, and billing inconsistencies. Several regulatory safeguards are urgently needed to alleviate these constraints.

Create a dedicated EV tariff category: Building on the FY 2026–27 tariff order (Rs 6/unit, zero fixed charges), the RERC must create a standalone EV charging tariff category featuring an explicit load band extending to at least 200 kW on LT supply. Implementing a hard-coded meter code will eliminate the 44-kW operational ceiling.

Enable sub-metering for existing HT connections: The RERC should issue a *suo-motu* order explicitly permitting the sub-metering of EV charging loads behind existing HT connections. Mirroring Karnataka's guidelines[15], this allows entities like petrol pumps to seamlessly host CPO equipment without forcing operators to bear the cost of separate HT connections.

Leverage public assets for CPO deployment: The state government and JVVNL must compile and publish a roster of government-owned premises and public land parcels equipped with existing HT connections, making them available via competitive tenders to replicate successful co-hosting models.

Restructure capital disbursements: The currently lapsed Rs 5 lakh upstream infrastructure reimbursement must be restructured from a DISCOM-routed reimbursement into an upfront capital disbursement administered via a dedicated state EV fund.

User experience and institutional coordination: Grid readiness is currently undermined by a fragmented user experience. The lack of interoperability, unified payment systems, and real-time discoverability platforms deters adoption and artificially reduces station utilization. The state must mandate a common discoverability platform aggregating real-time availability across all CPO networks.

Urban planning and charging deployment: Charging network design needs to be integrated with urban planning. The February 2025 Vidhan Sabha announcement of six operational zones for Jaipur's 45,508 registered e-rickshaws, with designated parking and charging locations within each zone, is the most concrete example in the city of a cross-departmental coordination mechanism that links vehicle regulation, parking allocation, and charging infrastructure in a single administrative framework. For this to translate into functional infrastructure, each zone requires dedicated low-voltage connections under the EV tariff, proper weatherproofing, and defined maintenance protocols. JVVNL should be formalized as an infrastructure-delivery partner in this process, and the model must be extended to e-auto aggregation points featuring battery swapping.

Need coordinated action: A critical missing piece is overcoming the siloed operations of JVVNL, REDA, JDA, and the transport department. The state must operationalize a joint protocol that treats parking, charging, and grid reliability as a single integrated problem, delivered through a dedicated city-level implementation framework, such as a charging infrastructure cell within JVVNL's Jaipur operations or a joint sub-committee of the REVP nodal agency. The six newly announced e-rickshaw zones are an immediate test case for this model, requiring JVVNL to be formalized as an infrastructure-delivery partner rather than a passive connection provider. Getting this coordination right for e-rickshaws creates the template for every commercial segment that follows.

Section 1:
Growing motorization and electrification of fleet

Rapid motorization in Jaipur: Jaipur's motorization is growing as fast as Delhi's, making the case for zero emissions transition increasingly urgent. Compared to 2019–20 levels, private two-wheeler registrations in Jaipur grew by 37 per cent and private car registrations rose by over 86 per cent in 2025–26—comparable to Delhi's respective growth rates of 40 per cent and 37 per cent over the same period.

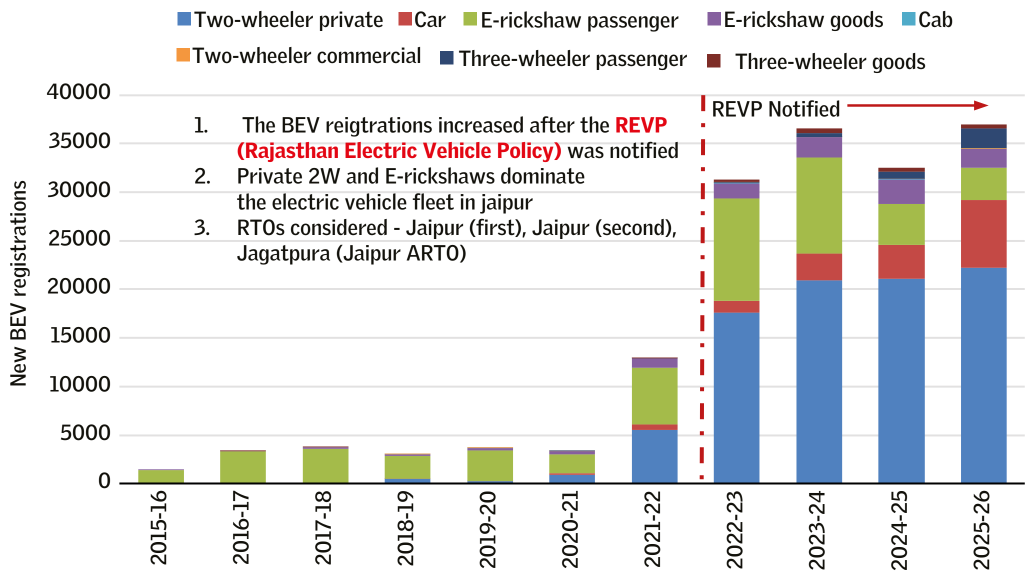
Passenger three-wheelers saw an astronomical 244 per cent increase in registrations. The new registrations in 2025–26 were comparable to that of Delhi, even though area-wise Delhi is at least three times larger than Jaipur. This spike is directly correlated with historically low bus registrations, forcing a reliance on paratransit to fill the public transport gap. The passenger three-wheeler segment is leading the fleet electrification charge, jumping from 13 per cent EV penetration in 2024–25 to an impressive 31 per cent in 2025–26.

The yearly registration of buses has remained consistently low through 2024–25, with only 641 new buses registered in 2025–26, which explains the rapid penetration of IPT and paratransit *(see Graph 2: Jaipur vehicle segment-wise registrations and electrification).*

The direct implication of such high motorization is increased congestion. According to TomTom Traffic Index, Jaipur was the sixth most congested city in the country, only two places below Delhi, and lost around 121 hours during rush hour in 2025.[16] This adversely affects not only the economy but also clean air and climate goals. Increased fine particulate matter levels directly increase on-road air pollution exposure and disproportionately raise the exposure of the communities residing near busy roads. Congestion and idling also increases NOx levels, which gives rise to both ozone and secondary aerosols. The consequence is a compounding cycle of congestion, emissions and economic cost, with no self-correcting mechanism in the absence of proactive policy intervention.

Fleet electrification—growing from a small baseline: The Rajasthan Electric Vehicle Policy (REVP) 2022 was notified by the state's Transport and Road Safety

Graph 1: Jaipur city year-wise and vehicle category wise new BEV registrations



Data source: Vahan dashboard, as accessed on 21 April, 2026

Department in 2022.[17] Since then, EV penetration has accelerated from a very small baseline but the trend is largely stable.

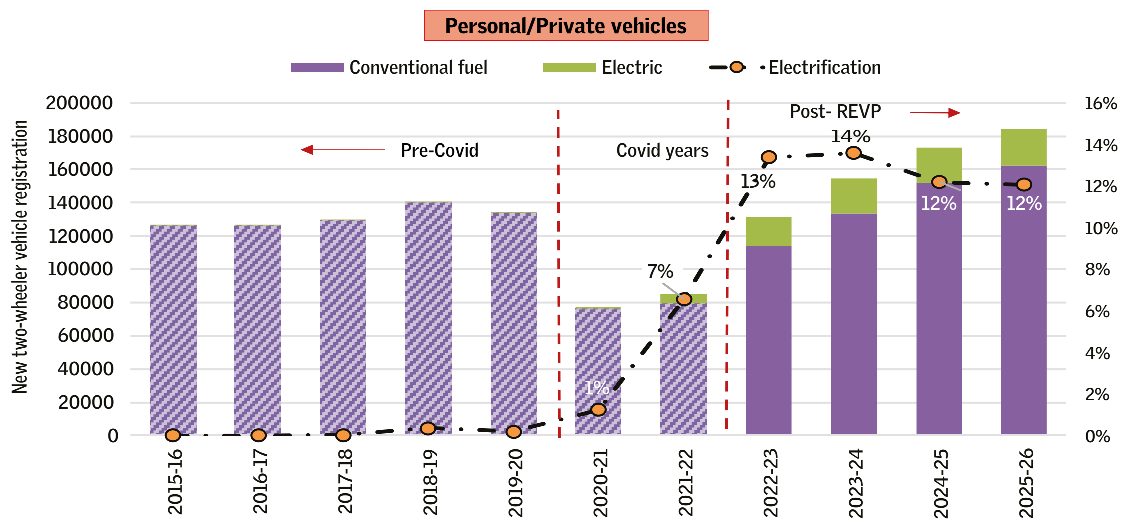
Fleet electrification has increased at both the Rajasthan state and Jaipur city levels. Overall, fleet electrification in Rajasthan rose from merely 2.6 per cent in 2021–22 to around 6.9 per cent in 2025–26. At the Jaipur city level, it increased from 9 per cent in 2021–22 to 12.5 per cent in 2025–26.

As per VAHAN registration data, Rajasthan has not registered any vehicles under the luxury cab or taxi category in the last five years, despite being a prominent luxury tourism destination for both domestic and international visitors. This likely reflects a combination of classification gaps in the VAHAN framework and the predominance of aggregator-operated fleets that may register vehicles under broader cab categories, and warrants further investigation.

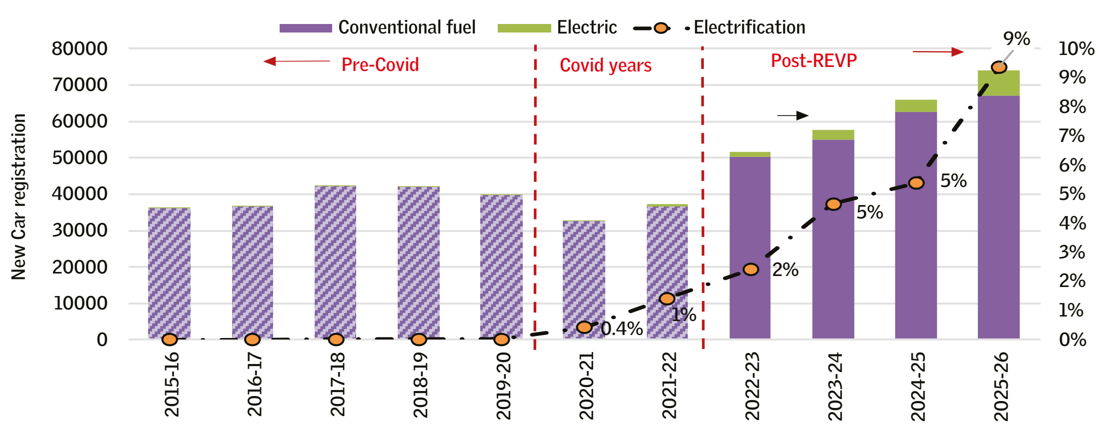
Jaipur's electrification numbers are encouraging but unevenly distributed. As of 2025–26, EV penetration in Jaipur reached 12 per cent for private two-wheelers, 31 per cent for passenger three-wheelers, and 9 per cent for private cars—all above Rajasthan's state-level averages. The passenger three-wheeler segment has accelerated from 13 per cent in 2024–25 to 31 per cent in 2025–26, reflecting the economics of high-mileage commercial operation. However, electrification in the cab segment remains at around 1 per cent and bus electrification too stands at only 1 per cent, despite these segments covering the highest daily kilometers per vehicle and offering the largest potential for emissions reduction per unit of fleet investment. The uneven distribution of electrification across segments reflects, in part, the uneven development of the charging infrastructure that serves them *(see Graph 1: Jaipur city year-wise and vehicle category wise new BEV registrations).*

As of April 2026, Jaipur city witnessed one of the highest levels of vehicle electrification in Rajasthan since the implementation of REVP 2022. The private vehicle segment saw a steady increase in electrification, with EV penetration reaching 12 per cent in private two-wheelers and 10 per cent electrification in private cars in 2025–26. The latter marked a significant increase from 5 per cent in the previous financial year *(see Graph 2: Jaipur vehicle segment-wise registrations and electrification).*

Graph 2: Jaipur vehicle segment-wise registrations and electrification

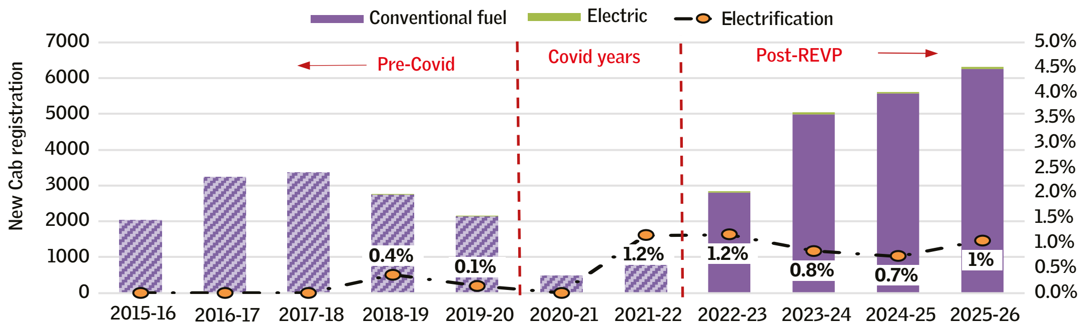


(a) Private car

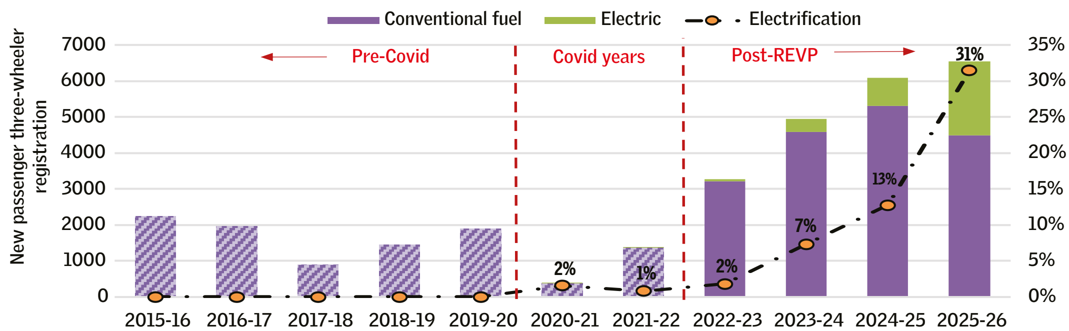


Intermetiate Public Transport and Paratransit vehicles

(c) Cab/Taxi

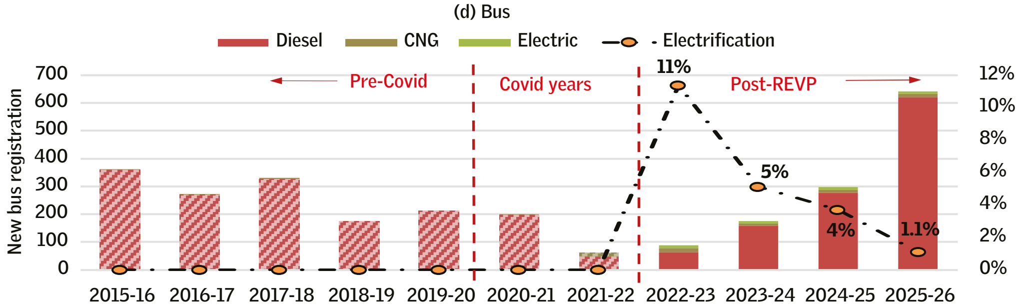


(d) Passenger three-wheeler

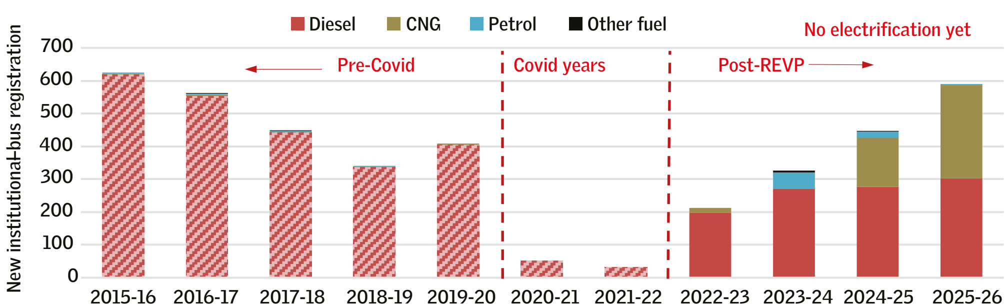


Public Transport Vehicles

(d) Bus



(e) Bus-Institutional



REVP : Rajasthan Electric Vehicle Policy.
Data source: Vahan dashboard, as accessed on 21 April, 2026

The numbers are even better for passenger three-wheeler segment, with 13 per cent EV penetration in 2024–25 and 31 per cent in 2025–26. These numbers are optimistic, given the high kilometers covered by the segment on a daily basis. However, a true energy transition requires 100 per cent electrification, particularly of the segments that cover the highest daily kilometers, such as passenger three-wheeler vehicles *(see Graph 2: Jaipur vehicle segment-wise registrations and electrification).*

With that perspective, the cab and bus segments in Jaipur still have a long way to go. Electrification remains limited, with only around 1 per cent electrification in both segments in 2025–26. Their low level of electrification makes them the next policy target, not only because they are a high mileage segment, but also because they represent the largest per-vehicle emissions reduction potential. Once charging infrastructure is in place, their electrification could also deliver the highest modal shift and air quality dividends per unit of public investment.

Understanding the infrastructure implications of the electrification agenda—and the corresponding clean and climate benefits—is important not only to make a case for vehicle electrification, but also to encourage renewable energy penetration at household and institutional levels. The electrification of Jaipur's transport sector is deeply intertwined with its power grid. A core implication is that EV infrastructure planning must be coupled with increased renewable energy penetration at both household and institutional levels to ensure the transition is genuinely clean and yields real climate benefits.

Section 2:
EVs and demand for electricity in Jaipur

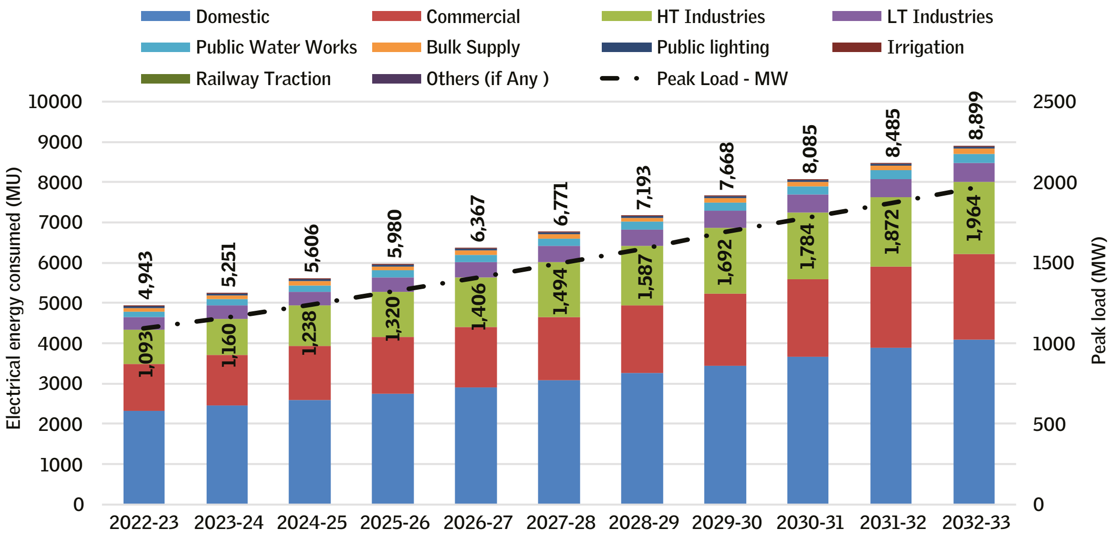
EV growth and economy-wide electrification: Rapid economy-wide electrification is the primary driver for energy demand. According to NITI Aayog's latest power sector insights, electricity consumption is set on a significantly steeper trajectory nationally. Driven by high EV penetration, increased reliance on electric industrial heating (such as heat pumps and electric boilers) and a shift toward electric cooking, electricity's share in final energy consumption is projected to surge from approximately 21 per cent in 2025 to nearly 40 per cent under the current policy scenario (CPS), and up to 60 per cent in the net zero scenario (NZS) by 2070.[18]

The growing EV market will also impact the national demand load curve. By 2050, even within the conservative CPS, NITI Aayog assumes national EV penetration to reach 60 per cent for cars and cabs, 90 per cent for three-wheelers, 80 per cent for buses and 100 per cent for two-wheelers. Under the NZS, these ambitions rise to 70 per cent for cars, 95 per cent for cabs, 100 per cent for three-wheelers, and 90 per cent for buses. By 2070, this massive fleet electrification will create severe spikes in the electricity demand profile, peaking at around 150 GW during night time hours and again at 100 GW during the afternoon.[19]

According to the Central Electricity Authority's (CEA) 20th Electric Power Survey, Jaipur's electrical energy demand is expected to grow by 36.8 per cent between 2024–25 and 2029–30, alongside a 36.7 per cent increase in peak demand, largely driven by the residential and commercial sectors[20] *(see Graph 3: Jaipur city electricity consumption and peak load).*

However, actual data reveals a stark contrast to these projections. Jaipur city's power consumption for 2024–25 reached 6,781 MU, already surpassing the 20th Electric Power Survey's projected demand for 2027–28—a full three years ahead of the CEA's own forecast. This is not a marginal overshoot; it signals that the demand-growth assumptions underlying current infrastructure planning are structurally underestimating Jaipur's trajectory. Any EV charging infrastructure rollout plan will require a realistic projection before it is even implemented. Rising

Graph 3: Jaipur city electricity consumption and peak load

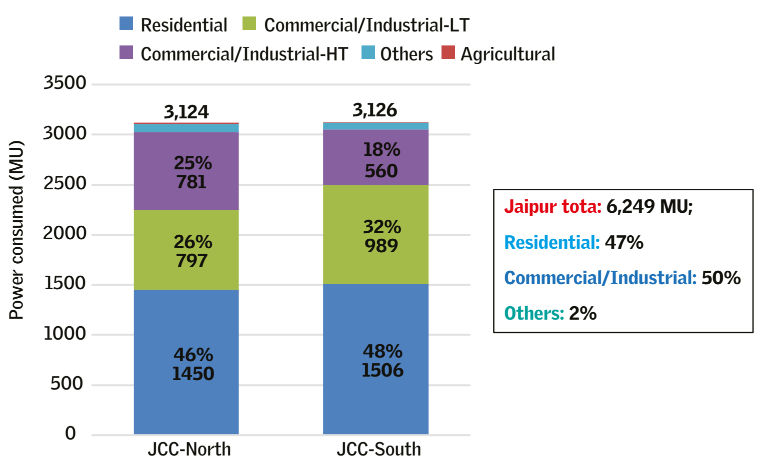


Data Source: 20th Electric Power Survey, CEA

ambient temperatures and subsequent cooling requirements will further push the overall summer demand and daily peak loads higher at the city level.

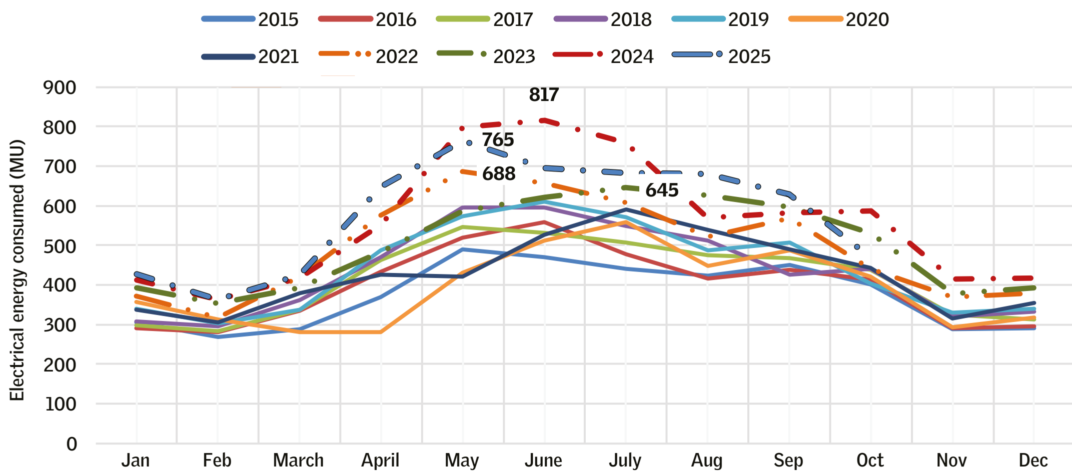
According to JVVNL's energy records for 2024–25, Jaipur City Circle's total power demand stood at 6,781.12 MU, with consumed power (excluding losses) at 6,249 MU. Approximately 47 per cent of this energy was consumed by the residential sector, and 50 per cent by the commercial and industrial sectors *(see Graph 4: Jaipur city sector-wise energy consumed (2024–25))*.

Graph 4: Jaipur city sector-wise energy consumed (2024–25)



Source: Jaipur Vidyut Vitran Nigam Limited.

Graph 5: Jaipur city monthly power consumption (LU)



Data Source: Jaipur Vidyut Vitran Nigam Limited.

Electricity consumer profile: Currently, at the state level, the highest consumer of power is the agriculture sector, driven by heavy reliance on irrigation for rabi cropping during winter months; the hourly demand peaks are around 9 am to 2 pm.

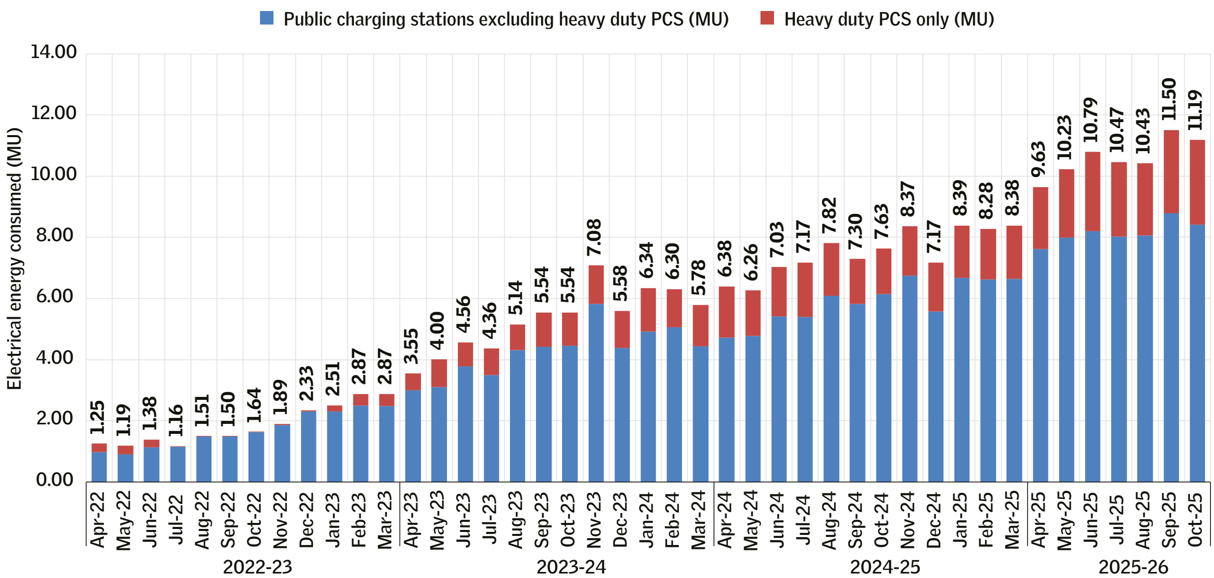
However, at the Jaipur city level, the residential and the commercial or industrial sectors are the heavy consumers of power. This also inadvertently shifts the demand peaks for the city as compared to the state. According to JVVNL, the peak demand gets shifted to summer months with two daily peaks—late morning and late evening *(see Graph 5: Jaipur city monthly power consumption (LU)).*

While national estimates provide a macro perspective, ground realities in Jaipur paint a picture of demand growth that is vastly outpacing these forecasts *(see Graph 3: Jaipur city electricity consumption and peak load).*

Meeting the demand—home charging vs. public infrastructure: To manage this surging demand, it is vital to understand how charging will be distributed. The 20th Electric Power Survey assumes a 70/30 split for private vehicle segments (two-wheelers and cars)—around 70 per cent of EV charging demand will be fulfilled by home charging, while the remaining 30 per cent will rely on the public charging network (commercial fleets, whose primary fuelling requirements rely on captive and hub charging, are analyzed separately).[21]

The public charging network is already demonstrating localized stress. In 2024–25, public charging stations under JVVNL consumed 9.03 MU annually, with a

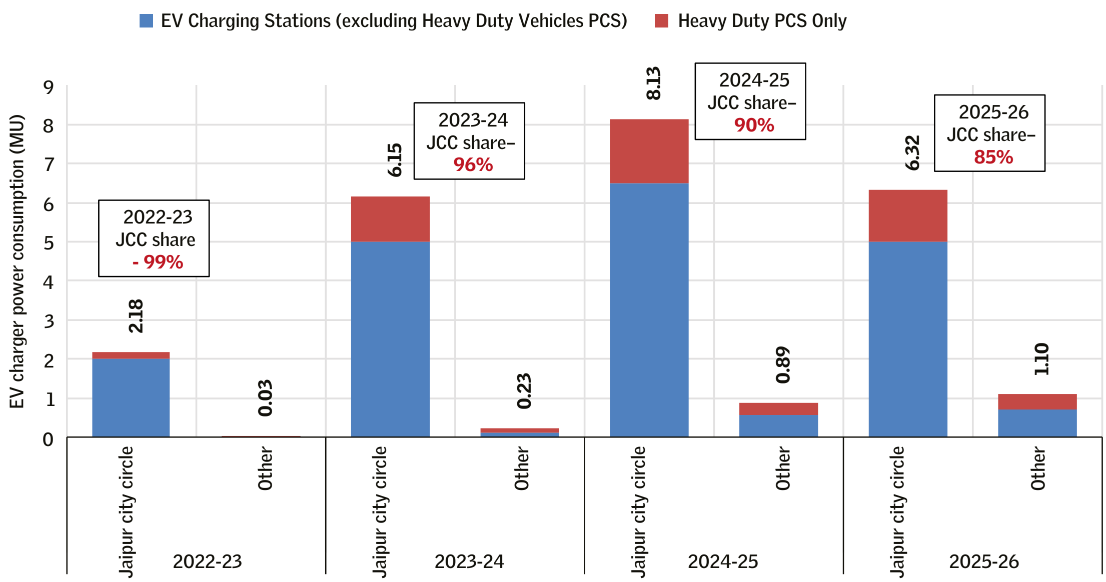
Graph 6: JVVNL public charging stations electrical energy consumption (MU)



Data Source: Jaipur Vidyut Vitran Nigam Limited, as accessed on October 2025

massive 90 per cent of this energy (8.13 MU) consumed by stations within Jaipur City Circle alone. By October 2025, the network's monthly energy consumption had reached around 1 MU *(see Graph 6: JVVNL PCS electrical energy consumption (MU))*.

Graph 7: EV public charging stations power consumed by Jaipur city versus other areas under JVVNL jurisdiction



Data Source: Jaipur Vidyut Vitran Nigam Limited, as accessed on October 2025

Although the share of energy consumed by the public charging network outside Jaipur city has steadily increased since the REVP's implementation—growing from just 1 per cent in 2022–23 to roughly 15 per cent by October 2025—Jaipur remains the epicenter. By November 2025, 345 (332 active) of the 605 total charging stations under JVVNL were located in Jaipur city *(see Graph 7: EV public charging stations power consumed by Jaipur city versus other areas under JVVNL jurisdiction).*

Charge point operators naturally invest where demand is highest to ensure the solvency of their investments. Lower utilization rates force operators to increase service charges, thereby raising the per-unit cost of charging, which deters commercial users (like cabs and three-wheelers) from transitioning to EVs. Furthermore, while the Rajasthan Electricity Regulatory Commission (RERC) has revised tariffs for public charging stations, residential and institutional/commercial charging rates remain identical to their standard respective categories, offering no financial incentive to install separate sub-meters for home EV charging.

Section 3:
Understanding power demand for EVs

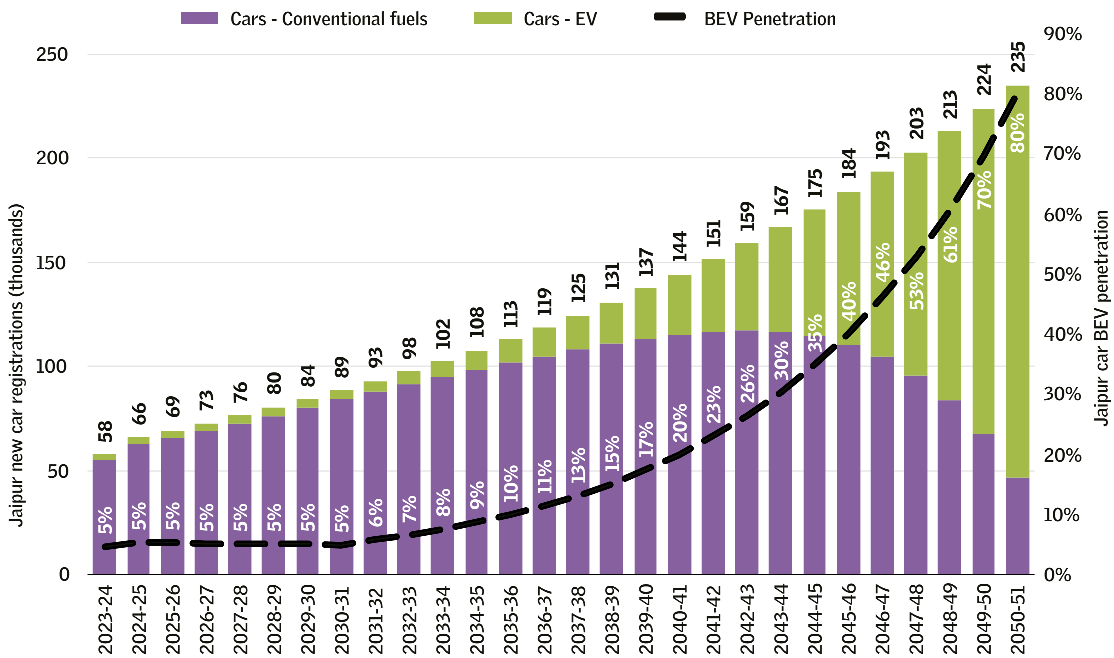
Methodological shifts and future projections: The CEA's demand methodology assumes that at least 70 per cent of EV charging demand for private vehicles—specifically private two-wheelers and cars—will be met through home charging. Meanwhile, commercial segments like cabs and passenger three-wheelers are assumed to be served primarily through captive and hub charging facilities.

The CEA's vehicle registration projection methodology extrapolates future new vehicle registrations based on national-level growth trends and aggregate demand drivers, which are then applied to a city's base-year registration volumes. However, when applied to Jaipur, this approach produces registration trajectories that grow without any systemic policy constraint. By 2049–50, the annual registration volumes under the CEA methodology reach scales that are broadly comparable to present-day Delhi, with two-wheeler registrations exceeding several hundred thousand units per year and car registrations approaching similar orders of magnitude *(see Graph 8: Jaipur city new car registrations 2049–50—if CEA methodology is applied and Graph 9: Jaipur city new two-wheeler registrations 2049–50—if CEA methodology is applied).*

This is not an adequate planning scenario for Jaipur for several reasons. Such top-down methods treat both mega cities and smaller cities equally without differentiating the ground-level imperatives in cities. This often creates the risk of over inflating the city-based numbers. For instance, a mega city like Delhi is spatially at least three times larger than Jaipur and has a substantially higher population base.

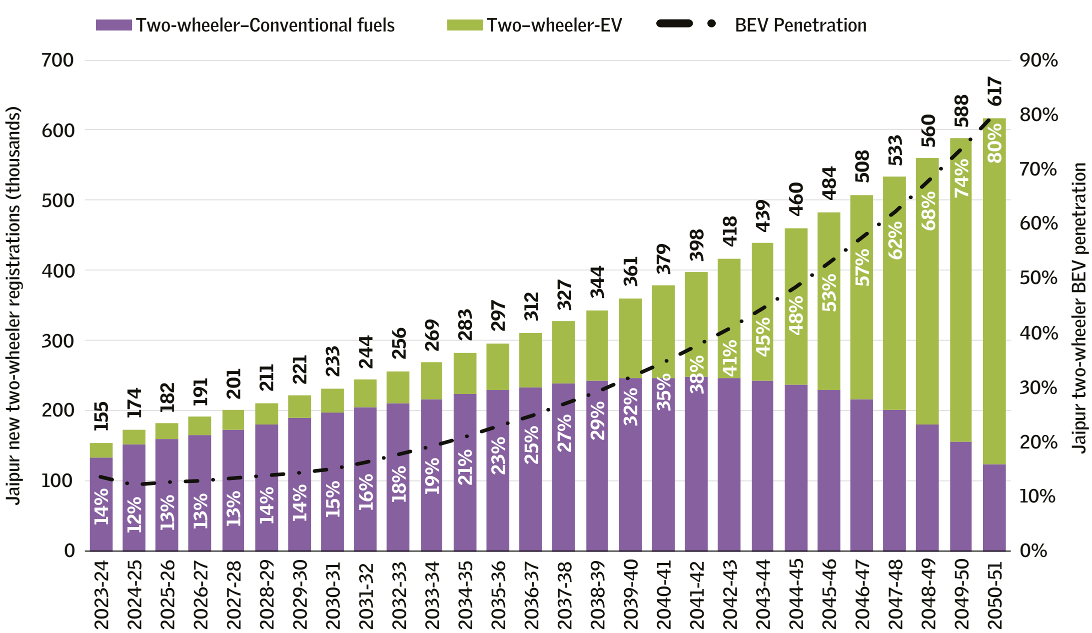
A projection that yields comparable vehicle registration volumes for a significantly smaller city reflects the absence of demand constraints in the CEA model, rather than likely demand conditions. There can be city-specific development that can act as a modifier of motorization and electrification. For instance, Delhi has benefited from CNG mandates for commercial fleets enforced over the past two decades and is now graduating towards much higher level of electrification targets. There

Graph 8: Jaipur city new car registrations 2049-50—if CEA methodology is applied



Source: CSE analysis based on CEA methodology

Graph 9: Jaipur city new two-wheeler registrations 2049-50—if CEA methodology is applied



Source: CSE analysis based on CEA methodology are stricter regulations for old vehicle scrappage, along with a more mature metro network and bus system that can, with support of policy, effect modal shifts and suppress private vehicle demand in ways that have no direct equivalent in Jaipur.

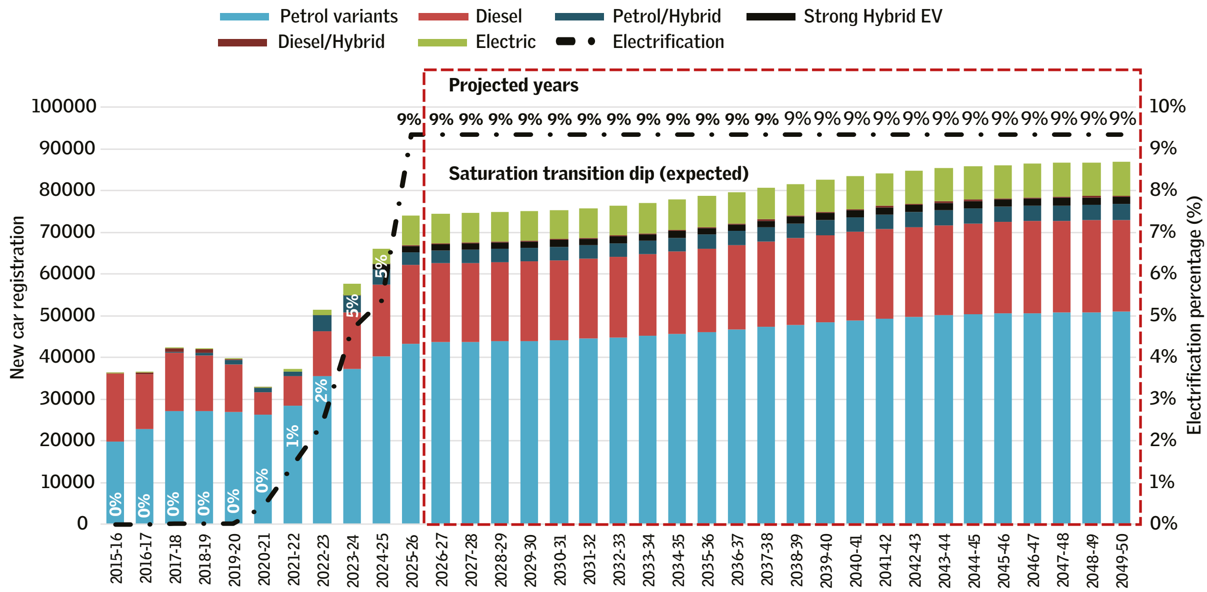
Moreover, Jaipur's road network, parking infrastructure and spatial capacity impose absolute physical limits on motorization that are not accounted for in the CEA methodology. Projecting registration growth unconstrained by these limits produces numbers that would be physically unrealizable long before the projection horizon is reached.

CSE's bottom-up estimates: This study develops its own business-as-usual (BAU) and "electrification plus modal shift" scenarios, carefully calibrated to Jaipur's actual urban capacity. The full scenario assumptions and outputs are documented in Appendix A and Appendix B respectively.

In a BAU scenario, this projection uses actual observed registration counts from 2025–26 as the base. It projects each vehicle segment forward using an S-curve that reflects typical urban development—ownership rises quickly through the middle phase of urbanization and gradually levels off as the market matures; the city's infrastructure and demographic demand hit a natural ceiling. This ceiling is derived from two interplay forces, the city's carrying capacity for each vehicle type (benchmarked against comparable Indian cities at similar development stages) and the trajectory of real income growth. Because rising GDP per capita directly expands the share of households capable of affording and sustaining private vehicles (like cars and two-wheelers), the long-run saturation level moves upward as Jaipur gets richer *(see Graph 10: Jaipur: Projections for cars in BAU scenario (2049–50) and Graph 11: Jaipur: Projections for two-wheelers in BAU scenario (2049–50))*.

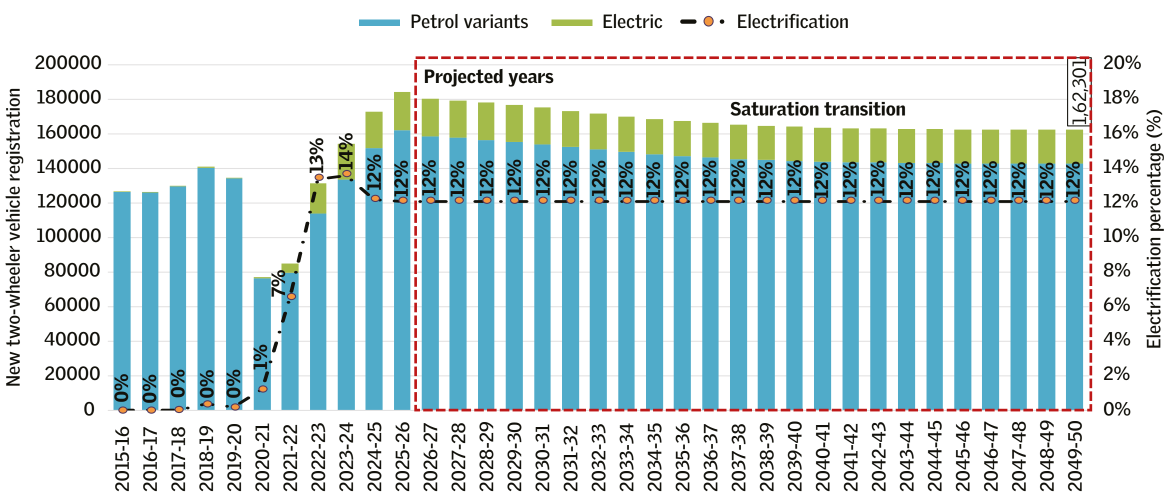
The electrification plus modal shift scenario—more accelerated change: This scenario builds on the same demand and income foundation as the BAU but layers two structural interventions on top. First, the long-run saturation levels for private vehicles are moderated, while public transport fleet capacity is allowed to grow further. This reflects the shift in travel demand projected under the technology scenario of Jaipur's Comprehensive Mobility Plan (CMP) 2026—specifically, the CMP documents a reduction in two-wheeler and car mode shares alongside an increase in public transport and Intermediate Public Transport (IPT) shares. Second, the new sales incorporate ambitious electrification goals to align with that of Niti Aayog *(see Graph 12: Jaipur: Projections for cars in scenario of electrification and modal shifts (2049–50) and Graph 13: Jaipur: Projections for two-wheelers in scenario of electrification and modal shifts 2049–50))*.

Graph 10: Jaipur: Projections for cars in BAU scenario (2049–50)



Source: CSE analysis based on CSE method

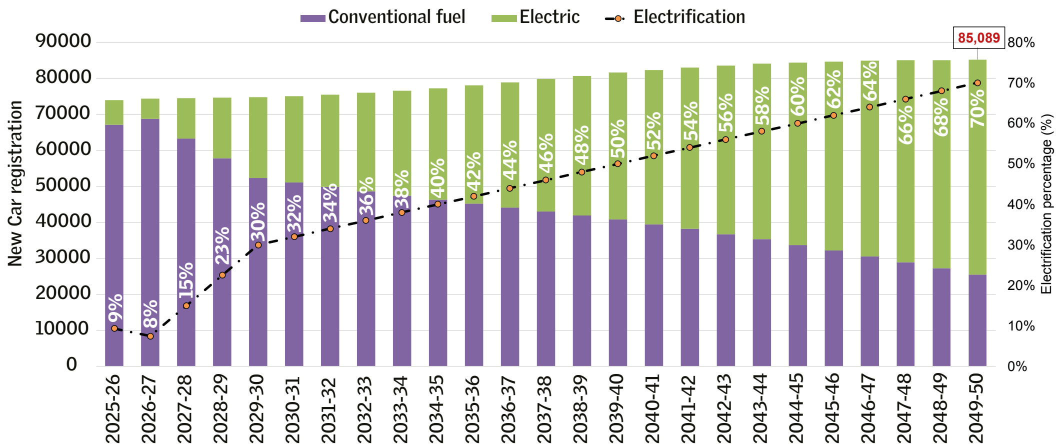
Graph 11: Jaipur: Projections for two-wheelers in BAU scenario (2049–50)



Source: CSE analysis based on CSE methodology

On-road stock trajectories: The on-road stock trajectories for private two-wheelers and cars show significant differences between the two scenarios *(see Graph 14: Jaipur: Two-wheeler on-road stock under BAU scenario and electrification plus modal shift scenario and Graph 15: Jaipur: Car on-road stock under BAU scenario and electrification plus modal shift scenario).*

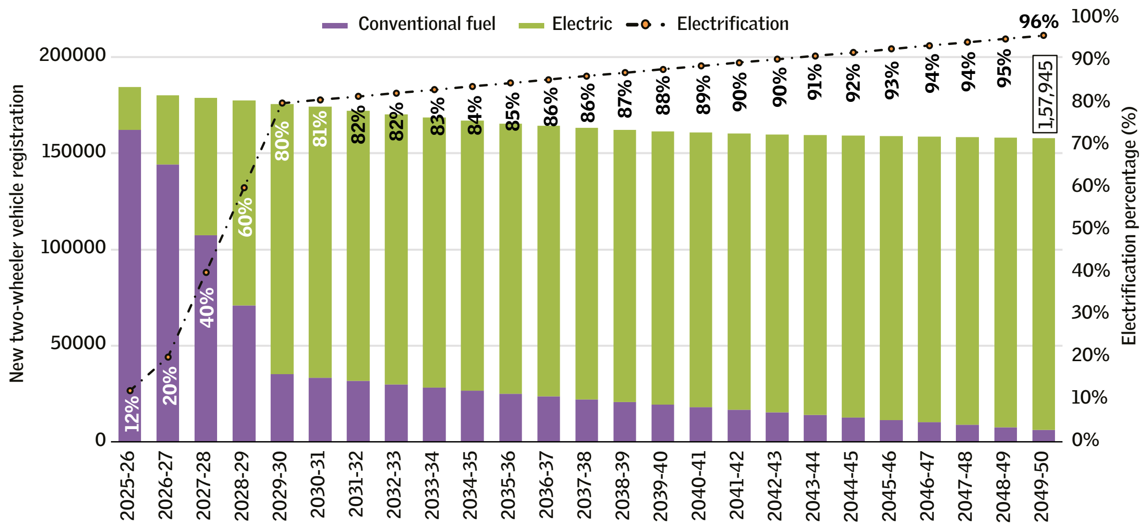
Graph 12: Jaipur: Projections for cars in scenario of electrification and modal shifts (2049–50)



Assumptions for Car:
1. Electrification for **2030** - **30%;**
2. Electrification for 2055 - **80%**
3. **Car modal share** for 2024 - **11.4%**
4. **Car modal share** for 2055 - **10.5%**

Source: CSE analysis

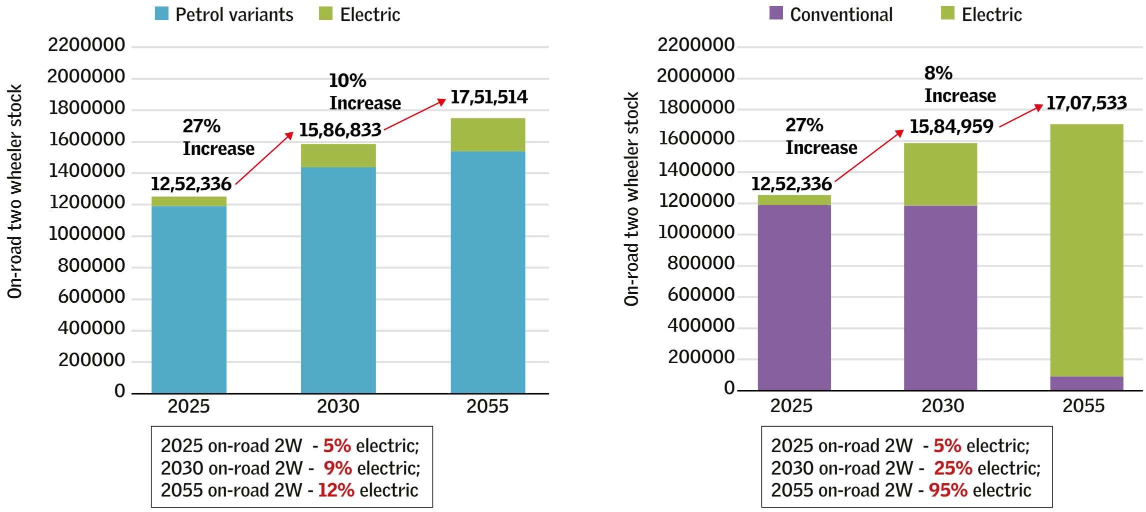
Graph 13: Jaipur: Projections for two-wheelers in scenario of electrification and modal shifts 2049–50)



Assumptions for 2W :
1. Electrification for **2030** - **80%;**
2. Electrification for **2055** - **100%**
3. **2W modal share** for 2024 - **34.1%**
4. **2W modal share** for 2055- **31.8%**

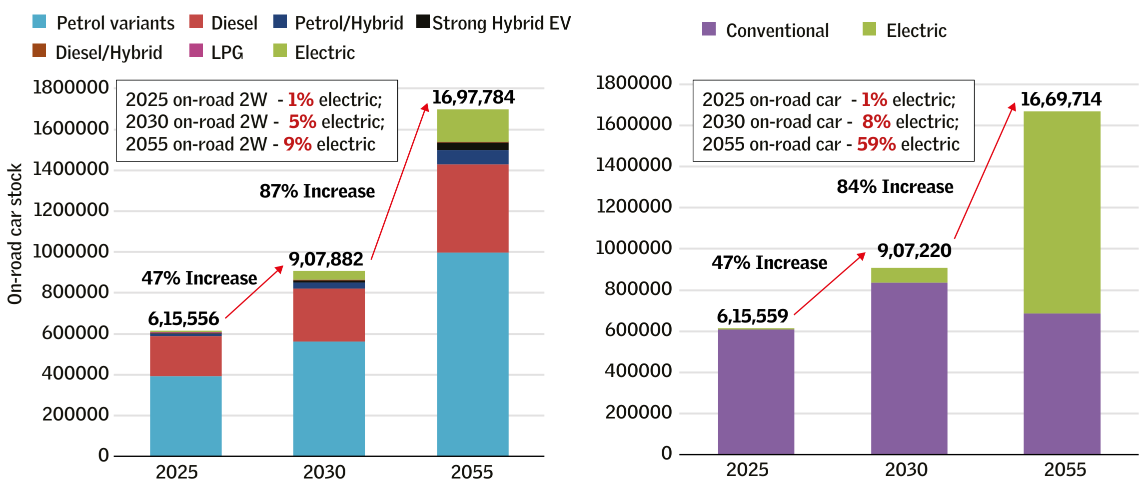
Source: CSE analysis based on CSE methodology

Graph 14: Jaipur: Two-wheeler on-road stock under BAU scenario and electrification plus modal shift scenario



Source: CSE analysis based on CSE methodology

Graph 15: Jaipur: Car on-road stock under BAU scenario and electrification plus modal shift scenario



Source: CSE analysis based on CSE methodology

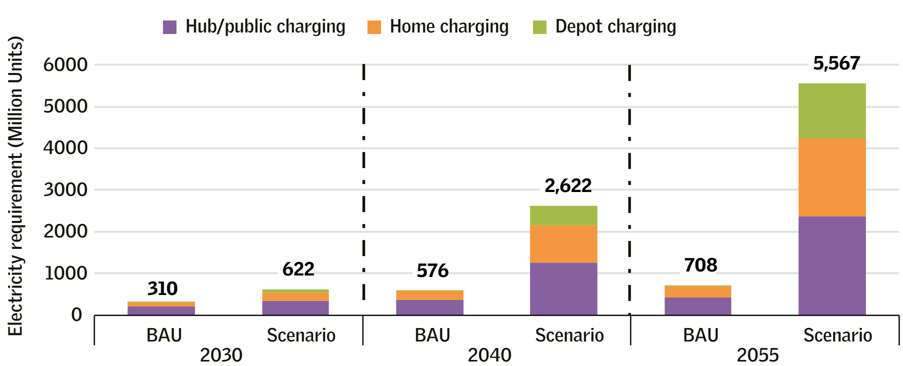
- Under the BAU scenario, the two-wheelers on-road stock grows steadily through the projection period, driven by a near-mature market.
- Conversely, the electrification plus modal shift scenario diverges from the mid-2030s onward; EV penetration ramps up, and the public transport scenario (as defined by the CMP) begins to actively suppress overall motorization growth.
- The car on-road stock follows a different pattern altogether, as new sales have only just begun to ramp up.

Energy demand implications and grid challenges: The energy demand implications of these two diverging trajectories are highly significant, fundamentally changing the nature of the grid challenge. Under the BAU scenario, combined energy requirement for home charging of private two-wheelers and cars is about 75 per cent of the total energy demand for these two segments, aligning with the CEA assumption that captive and hub charging will serve the commercial fleet's primary fueling needs.

Under BAU, this is projected at approximately 95.4 MU in 2029–30, rising to around 279 MU by 2054–55. For hub or public charging, the BAU electricity requirements are 210 MU by 2029–30 and 420 MU by 2054–55. Depot charging requirements are projected at 4.5 MU by 2029–30 and 8.7 MU by 2054–55. Crucially, under BAU, the home charging load grows gradually and can largely be absorbed through network augmentation along existing residential feeder lines.

Electrification plus modal shift energy requirements: Under this ambitious scenario, home charging figures rise much more steeply due to significantly higher EV penetration, reaching 200 MU in 2029–30 and nearly 1,867 MU by 2054–55. Hub or public charging requirements surge to 347 MU by 2029–30 and 2,375 MU by 2054–55. Depot charging needs to jump to 74 MU by 2029–30 and 1,325 MU by 2054–55. These dramatic increases reflect the combined effect of higher absolute registrations and a much larger EV share within those registrations *(see Graph 16: Power requirement due to vehicle electrification).*

Graph 16: Power requirement due to vehicle electrification



Source: CSE analysis based on CSE methodology

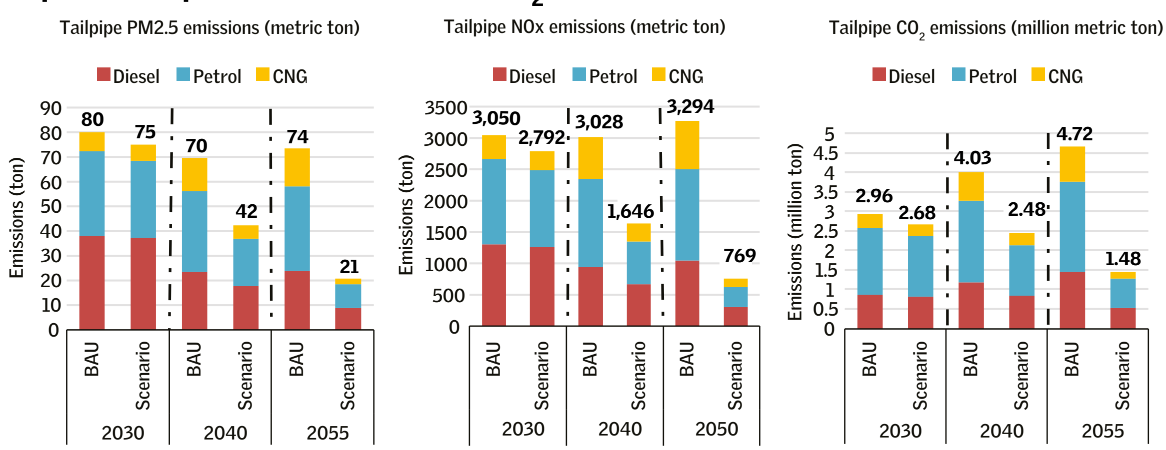
Thus, while gradual growth under BAU might be manageable with existing infrastructure upgrades, the accelerated electrification scenario presents a severe infrastructural hurdle. Under this ambitious pathway, the magnitude and pace of load growth by 2040s will require proactive planning of distribution infrastructure well before the demand actually materializes. This urgency is amplified by current realities—Jaipur's actual electricity consumption in 2024–25 has already exceeded the CEA's projected demand for 2027–28 by a margin of three years.

The emissions implications of the two scenarios are equally stark. Under the BAU trajectory, total $PM_{2.5}$ emissions from the on-road fleet are projected at approximately 74 tonnes in 2054–55, with CO_2 emissions at around 4.72 million metric tonnes (MMT) and NOx at approximately 3,294 tonnes. Under the electrification plus modal shift scenario, the corresponding figures reduce to around 21 tonnes of $PM_{2.5}$, 1.48 MMT of CO_2 and 769 tonnes of NOx, representing reductions of around 72 per cent, 67 per cent and 77 per cent respectively *(see Graph 17: Comparison of PM, NOx and CO_2 emissions)*.

For a city that already ranked among the six most congested in the country in 2025, with communities along high-traffic corridors bearing a disproportionate share of on-road pollution exposure, these are not abstract long-term benefits. They translate into near-term air quality dividends, as even the electrification of private two-wheeler segment, the largest in the fleet, begins to displace petrol combustion.

Against this backdrop, the challenge and solutions related to EV charging will have to be located for infrastructure preparedness and for meeting the demand for electricity to drive EVs in the state. The Rajasthan Electric Vehicle Policy (REVP) 2022 has already made detailed provisions related to EV charging that needs assessment for further reforms to enable effective transition *(see box: Rajasthan Electric Vehicle Policy 2022: Key features related to charging)*.

Graph 17: Comparison of PM, NOx and CO_2 emissions



Source: CSE analysis based on CSE methodology

RAJASTHAN ELECTRIC VEHICLE POLICY 2022: KEY FEATURES RELATED TO CHARGING

The Rajasthan Electric Vehicle Policy (REVP) 2022, notified by the state's Transport and Road Safety Department on August 31, 2022, came into effect on September 1, 2022. Designed for a five-year period (ending September 2027), the policy marks a critical step by the Government of Rajasthan to promote electric vehicle (EV) adoption. Key features related to EV charging are as follows:

De-licensed activity: The installation of charging stations was de-licensed, removing the need for special permissions.

Private charging: Charging at residences and offices is permitted using existing electrical connections.

Public network expansion: Public charging stations are actively promoted across urban, rural and highway areas through various ownership models (DISCOM-owned, privately owned or public-private partnerships). Placements are strategically determined by vehicle density and utility.

Open access: Charge point operators (CPOs) are permitted to purchase power from any source via the open access route, per the Open Access Regulations of 2016.

Regulatory governance: Jaipur Vidyut Vitran Nigam Limited (JVVNL) was appointed as the state nodal agency (SNA) for charging infrastructure, holding the authority to cap service charges levied by public charging stations (PCS).

Land use and connections: Land conversion requirements are waived for charging stations up to a government-specified area limit. Furthermore, the state government committed to streamlining the application and processing timelines for electricity connections.

Building norms: The Rajasthan Model Building Bye-Laws 2025 amended the 2016 regulations to introduce specific land-use norms for both domestic and public charging facilities. Beyond these operational amendments, the REVP offers direct financial incentives to promote public charging and battery swapping infrastructure.

Tax reimbursements: State Goods and Services Tax (SGST) on fast electric vehicle supply equipment (EVSE) procured by private enterprises for public stations is reimbursable up to a specific amount for a designated number of stations.

Upstream infrastructure subsidy: CPOs establishing fast public charging or swapping stations can claim a 100 per cent reimbursement on the upfront costs paid to the DISCOM for upstream electricity infrastructure. This is capped at Rs 5 lakh per station based on actual costs and is applicable to the first 100 public fast charging or swapping stations installed during the policy period (note: In practice, as of early 2026, the disbursement of this reimbursement had effectively ceased).

Investment promotion: The Rajasthan Investment Promotion Scheme (RIPS) 2019 identifies EV charging and swapping stations as a thrust sector. Enterprises investing Rs 25 lakh or more are eligible for—A five-year term loan or a 5 per cent interest subsidy on equipment investments (up to Rs 2 lakh annually) from RBI-approved financial institutions, or a capital subsidy equal to 20 per cent of equipment investments (up to Rs 4 lakh). The policy emphasizes innovation and ecosystem development. EV startups can access support under the Rajasthan Startup Policy 2015, which includes sustenance allowances, seed funding, marketing assistance and pilot-stage funding.

The Department of Information Technology and Communication may also issue targeted challenges under the "Challenge for Change" programme to procure EV-related solutions worth up to Rs 1 crore. Additionally, the government envisions establishing industry-led E-Mobility Centres of Excellence, partnering with academic institutions to advance research, localization and technologies suited to Indian conditions (such as high-temperature performance). Together, these provisions build the financial and institutional ecosystem required to scale charging infrastructure statewide.

Electricity tariff and time-of-day structure: The power tariff for EV charging is determined by the Rajasthan Electricity Regulatory Commission (RERC) through periodically issued tariff orders. The standardized energy charge of Rs 6 per unit for public charging stations—first established in the statewide tariff order dated February 6, 2020—has been retained across successive tariff orders, although the accompanying time-of-day (ToD) and fixed charge structures have been progressively updated.

Under the 6 February, 2020 order, fixed charges were levied based on sanctioned load—Rs 40 per HP per month for LT connections, and Rs 135 per kVA per month for HT connections. The 2020 order also provided a ToD rebate of 15 per cent on energy charges during off-peak hours (11:00 PM to 6:00 AM) to incentivize night-time charging. The FY 2025–26 tariff order replaced this single-band rebate with a three-band ToD structure, broadening the economic signals for managed charging beyond the nighttime window—a 5 per cent surcharge during the morning ramp-up (6:00–8:00 AM), a 10 per cent rebate during the mid-day solar window (12:00–4:00 PM), and a 10 per cent surcharge during the evening peak (6:00–10:00 PM).

The FY 2026–27 tariff order, effective 1 April, 2026, went further still, abolishing fixed charges on EV charging connections entirely across both LT and HT categories. With the Rs 6 per unit energy charge now the sole billing component, Rajasthan becomes the first state in India to move to a purely consumption-linked tariff structure for public charging stations—a change that directly reduces the cost burden on low-utilization stations during the critical early deployment phase.

To enhance transparency across this evolving tariff framework, RERC has directed DISCOMs to develop a mobile application providing users with real-time data on charging infrastructure, including slot availability, charger types, available load, distance and final applicable tariffs inclusive of ToD rebates and service charges.

Renewable energy framework for EV charging: The Rajasthan Solar Energy Policy, 2019 seamlessly complements the EV policy by explicitly promoting renewable energy (RE)-based charging and swapping infrastructure. It offers land allotments at a 50 per cent concessional rate for the first 500 RE-based charging stations installed within the policy's first five years.

CPOs are allowed to establish captive renewable energy plants on their premises or procure RE through open access from generators within the state. The policy permits yearly banking of renewable energy (April to March), subject to a 10 per cent banking charge adjusted in kind. However, energy drawal during DISCOM-determined peak hours is restricted, as well as any unutilized banked energy lapses at the end of the banking year.

Further financial incentives include:
Electricity duty exemption: RE power producers supplying captive electricity to EV charging stations are exempt from electricity duty for seven years from their commercial operation date.

Transmission and wheeling exemption: Solar, wind and hybrid projects set up for captive use or third-party sale within the state (up to 25 MW per plant, within an overall state cap of 500 MW) receive a 100 per cent exemption from transmission and wheeling charges for ten years from the station's commissioning, subject to policy timelines. These benefits apply equally to battery swapping stations.

Building bye-laws and urban planning norms: The spatial and permitting dimensions of EV infrastructure in Jaipur are primarily governed by the Rajasthan (Urban Area) Building Bye-Laws, 2025, which amended the 2016 regulations to introduce specific EV land-use norms. Two provisions are particularly vital for Jaipur's infrastructure planning.

Minimum space requirements: The 2025 Bye-Laws dictate minimum plot and road-width specifications. Two-wheeler, three-wheeler and four-wheeler charging stations require a minimum plot area of 100 m^2 with a 12 m road frontage. E-bus and truck charging stations demand a minimum of 500 m^2 with an 18 m frontage. This establishes a clear siting baseline for public agencies and CPOs securing land in dense urban areas.

Mandatory EV parking: At least 10 per cent of the required parking area in new constructions must be designated for EV charging. This integrates EV-readiness directly into the approval process for new residential, commercial and mixed-use buildings, treating charging capacity as essential infrastructure rather than an optional amenity. This creates a dual framework—new buildings are inherently EV-ready, while existing buildings can utilize current electrical infrastructure without needing land conversions or special permits.

Section 4: Decoding charging systems: Home, public, hub and bus depot

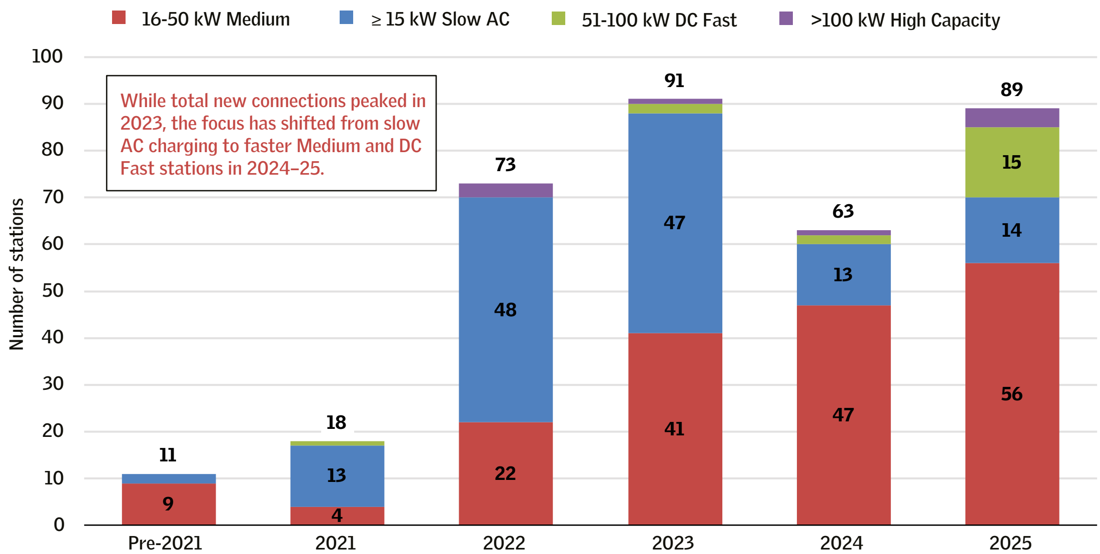
The transition to an effective EV charging ecosystem in Jaipur faces distinct, segment-specific hurdles. Scaling home charging requires achieving tariff parity, solar integration and proactive grid upgrades in older residential areas. Meanwhile, public and hub charging networks are bottlenecked by structural regulatory constraints and land availability. Despite these barriers, the network is gradually evolving towards high-capacity fast charging, propelled by major operators and innovative co-hosting models.

Home charging systems: The critical enabling condition for realising the benefits of electric mobility at the residential level is making home charging both economically viable and physically accessible. This is particularly vital for lower and middle-income segments that dominate private two-wheeler ownership in Jaipur. Currently, residential EV charging is billed under the prevailing domestic tariff category with no sub-metering incentive or separate EV-specific rate, unlike the distinct tariff category that exists for public charging stations.

In this context, rooftop solar integration at the household level is not merely an environmental co-benefit but a direct cost management lever. A residential consumer with a rooftop solar system—now enabled to integrate battery storage through a hybrid inverter under JVVNL's February 2026 order—can effectively charge their two-wheeler or car at the marginal cost of solar generation rather than the retail domestic tariff. This is highly advantageous during the mid-day solar hours, which the FY 2025–26 time-of-day (ToD) structure already incentivizes through a 10 per cent rebate between 12:00 and 16:00.[22] For apartment residents and tenants without rooftop access, the virtual net metering framework introduced under the RERC Third Amendment Regulations, 2025, opens a parallel pathway to the same cost benefit through collective participation in remotely sited solar installations.[23] For home charging to scale at the rate implied by ambitious electrification scenarios, two enabling conditions beyond tariff design must be addressed.

Spatial and building norms: The availability of dedicated charging points within residential premises needs to be mandated and incentivized through building regulations. Currently, charging availability is uneven across Jaipur's housing

Graph 18: Year-wise JCC EV charging station connections by load category, 2019–2025 (November)



Source: Jaipur Vidyut Vitran Nigam Limited.

typologies, with standalone houses better placed than multi-storey apartment complexes. The Rajasthan (Urban Area) Building Bye-Laws, 2025, have made a start by requiring EV-ready parking provisions, but this applies prospectively to new construction and does not address Jaipur's existing housing stock.[24]

Distribution infrastructure: The distribution infrastructure in predominantly residential feeders needs to be assessed and augmented ahead of EV penetration reaching a critical threshold. This is especially important in older parts of the city, where transformer loading is already high, to ensure overnight charging loads do not create peak demand spikes that the current network cannot absorb.

Both conditions argue for early coordination between JVVNL, the Jaipur Development Authority and the state's EV nodal agency, rather than relying on reactive network reinforcement after demand has already materialized. The constraints to realising even this enabling potential go beyond tariff design and feeder augmentation, and are examined further in the charging accessibility section.

Public charging—network growth and current status: As of November 2025, Jaipur City Circle (JCC) had 345 EV charging station connections released by JVVNL, under the dedicated EV tariff category. Of these, 332 are active and 13 are disconnected, which serves as a small but notable early signal of viability stress in a network that is still scaling.

The year-wise growth of connections tells its own story. The network expanded from a combined 11 stations before 2021 to 18 in 2021, 73 in 2022, 91 in 2023, 63 in 2024 and 89 in 2025 (up to November). The sharpest expansion coincided with the first year of REVP implementation, before moderating as the market tests demand-viability thresholds *(see Graph 18: Year-wise JCC EV charging station connections by load category, 2019–2025 (November)).*

Network design—load profile and the LT/HT structural divide: The load-based profile of the JCC charging network reveals a structure that is predominantly slow to medium in charging capacity. However, this distribution is not simply a function of market maturity; it reflects a specific regulatory constraint that has shaped deployment decisions across the network.

Of the 345 JCC connections as of November 2025, 269 are active (status R), 13 are disconnected, and 63 are flagged as new connections pending commissioning. Among the 269 active connections:

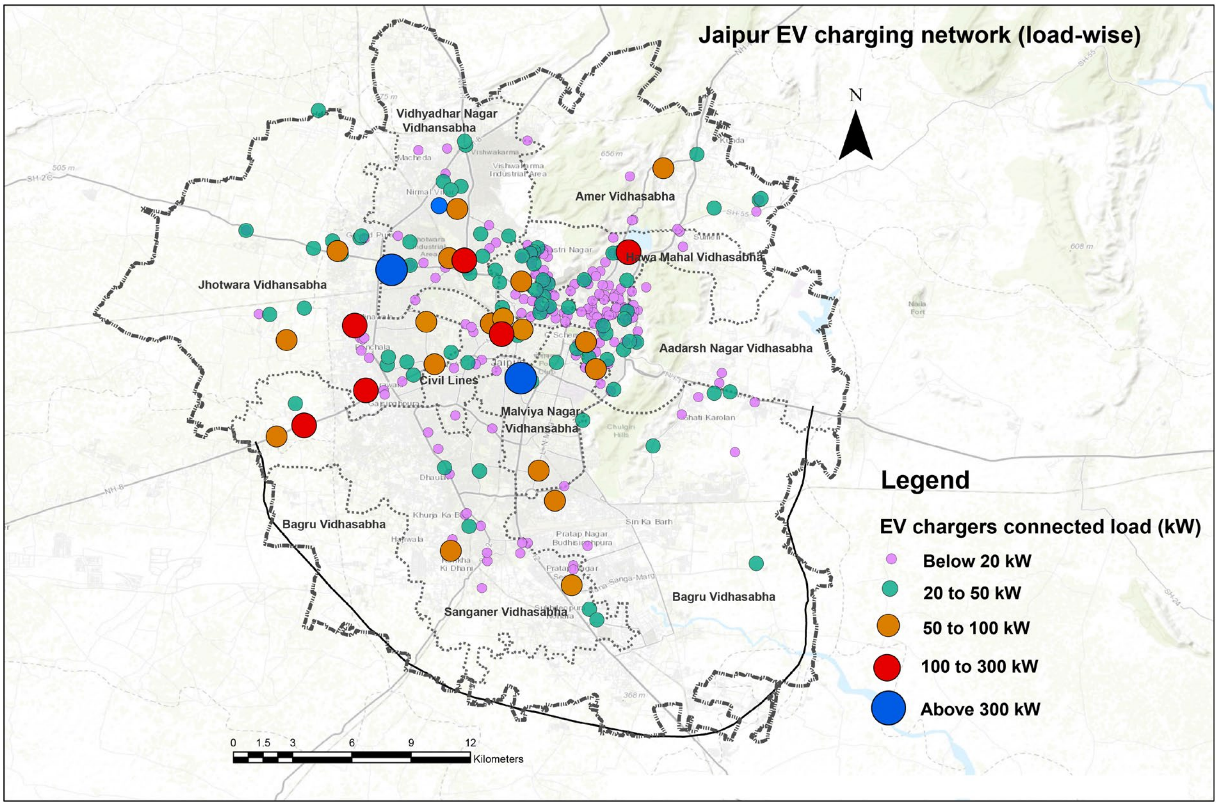
- 123 carry a sanctioned load of 15 kW or below, broadly corresponding to slow AC charging suitable for two-wheelers, e-rickshaws and overnight car charging.
- 131 fall in the 16 to 50 kW range, representing medium-speed AC and entry-level DC fast charging.
- Only seven active stations carry loads between 51 and 100 kW, and eight exceed 100 kW.

The total sanctioned load across all 345 JCC connections is approximately 9,307 kW, averaging 27 kW per connection. Notably, seven of the 15 active stations above 50 kW were commissioned in 2025 alone, compared to a cumulative total of eight in all prior years *(see Map 1: Jaipur city circle load-wise EV charging stations and Graph 19: Load category distribution of JCC charging stations (November 2025)).*

An analysis of JCC connections by tariff category uncovers the structural mechanism driving this load profile. Of the 345 connections, 331 are on the low tension (LT) EV tariff (9900-series), carrying a total sanctioned load of approximately 6,915 kW and averaging 20.9 kW per connection. The remaining 14 are on high tension (HT) tariff categories (9910/9911-series), carrying a combined load of approximately 2,393 kW and averaging 170.9 kW per connection. Despite representing only 4 per cent of JCC connections by count, HT stations carry 26 per cent of the total sanctioned load—reflecting that HT connections are disproportionately the high-capacity fast-charging sites in the network.

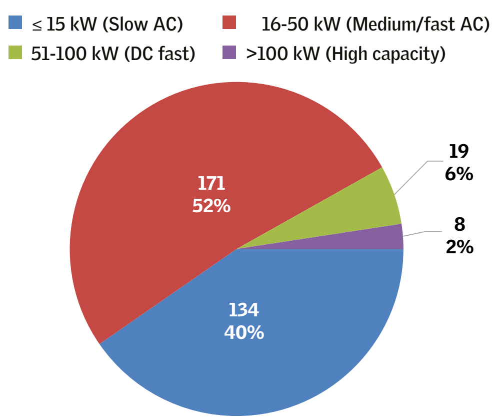
Addressing the constraint of the 44-kW regulatory ceiling: The distribution of sanctioned loads across the JCC network reveals a hard ceiling at approximately

Map 1: Jaipur city circle load-wise EV charging stations



Data source: Jaipur Vidyut Vitran Nigam Limited.

Graph 19: Load category distribution of JCC charging stations (November 2025)



Source: Jaipur Vidyut Vitran Nigam Limited

44 kW that is regulatory in origin, not demand-driven. Because Rajasthan's Electricity Supply Code 2021 routes EV charging stations into the Medium Industrial tariff category (LT-6) in the absence of a dedicated standalone EV classification, the applicable contract demand ceiling is 50 kVA. At a standard power factor of 0.9, this translates to approximately 44 kW, the point above which DISCOMs are required to release the connection as HT supply with significantly higher upstream infrastructure costs attached.

The network data makes this ceiling visible in two ways. Two LT connections in the JCC are sanctioned at exactly 44 kW, reflecting operators deliberately capping their sanctioned load at the threshold to remain on the cheaper LT connection. A further 22 LT connections carry loads between 45 and 100 kW, above the effective ceiling yet remaining on the LT tariff, with a combined sanctioned load of approximately 1,644 kW. These represent either inconsistent DISCOM enforcement or connections sanctioned before the ceiling was applied consistently across the circle.

The operational consequence is most acute for stations deploying 60 kW DC fast chargers under a 44-kW sanctioned load. Such a charger runs permanently below 75 per cent of its rated capacity, delivering the charging speed of a 44-kW unit from 60-kW hardware. For the EV driver, this means a charger that is slower than its specification implies. For the CPO, it means higher-specification capital equipment running at a chronic performance deficit, eroding both the utilization economics and the service quality needed to build commercial user confidence.

The FY 2026–27 tariff order's abolition of fixed charges on EV connections reduces the recurring cost differential between LT and HT supply and is a meaningful step toward making the HT route more financially accessible. However, the one-time upstream infrastructure cost gap between LT connections (Rs 3–4 lakh) and HT connections (Rs 7–8 lakh) remains unchanged, and the 44-kW load ceiling is a function of the Supply Code classification, not the tariff order. Resolving it requires RERC to create a standalone EV charging tariff category with a hard-coded meter code and an explicit load band extending to at least 200 kW on LT supply, a change that would eliminate the ceiling entirely and allow hardware to operate at rated capacity without forcing operators across the HT threshold.

Hub charging and industry trends—overcoming the HT barrier: Despite these constraints, the trend in new JCC connections is unambiguous. HT's share of annual new connections has risen from 3 per cent in 2022 to 11 per cent in 2025. Ten new HT connections commissioned in 2025 carried approximately

908 kW—more than the total HT load added in all prior years combined. The network is scaling up the speed ladder not because the regulatory constraint has been resolved, but in spite of it.

The identity of the operators leading this HT expansion is highly instructive. GreenCell Express and Thinkers Doers Pvt Ltd (TDPL) together account for two of the three active HT connections with loads above 100 kW—GreenCell at 690 kW (commissioned in 2022) and TDPL at 135 kW (commissioned in 2022). The 2025 cohort of HT connections includes Indofast Swap Energy (three connections totalling approximately 294 kW), Sun Mobility (107 kW active), Bhagwati Insecticides Limited (120 kW), KP Automotives (70 kW) and Shyampuriya Indian Oil (100 kW). Shyampuriya Indian Oil illustrates the Oil Marketing Company (OMC) co-hosting model directly, where a petrol pump operator uses its existing HT site infrastructure to host EV charging. Conversely, operators without pre-existing HT site assets are predominantly constrained to the LT band and the throttled charging performance that follows *(see Map 2: Jaipur city circle EV charging network by type).*

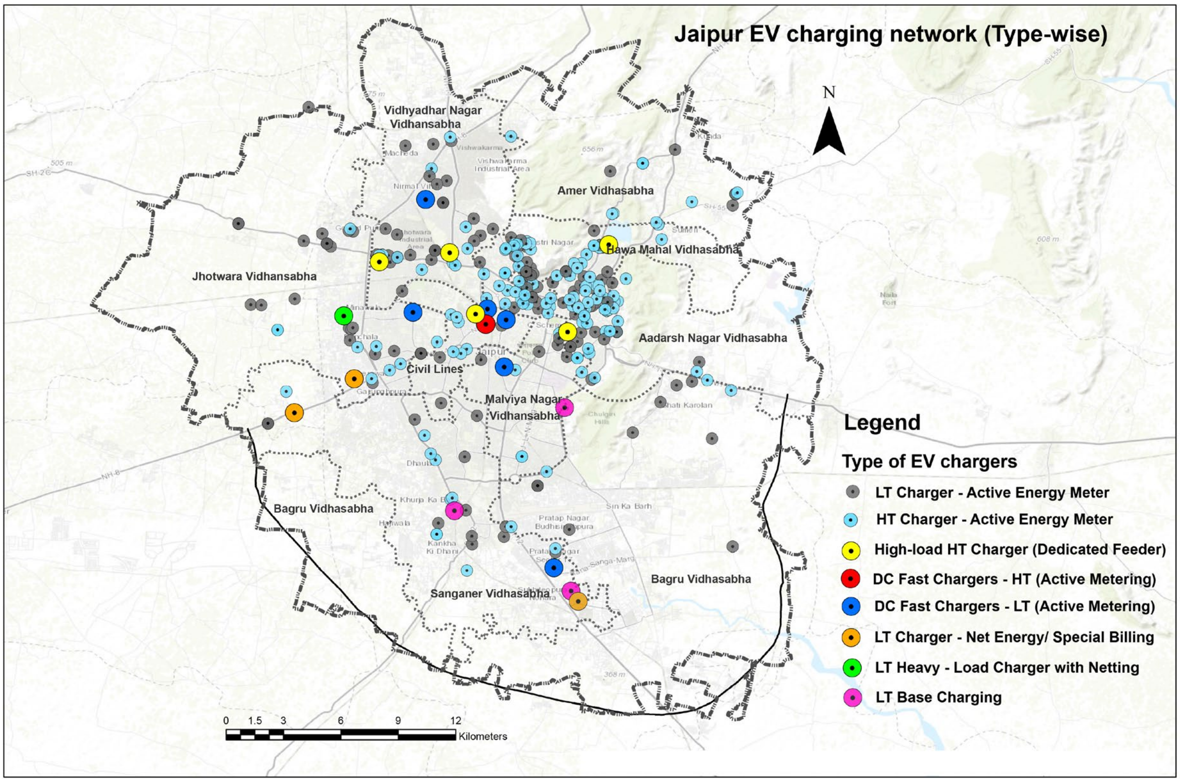
Commercial fleet coverage gap and electricity load imperatives: It is necessary to understand the critical role of public charging for commercial vehicles, the structural barriers currently hindering fleet electrification and the massive impending impact on electricity demand.

Jaipur's current public charging network is structurally inadequate for commercial fleets. Dominated by slow-to-medium chargers and constrained by a 44-kW regulatory ceiling, the network serves merely for "top-ups" rather than primary fuelling. This infrastructure gap is actively stalling the electrification of high-mileage cabs. If the city shifts to an ambitious electrification pathway, hub charging energy demand will skyrocket to 2,375 MU by 2054–55, necessitating a transformative, rather than incremental, overhaul of the grid and charging infrastructure.

While the current load profile of Jaipur's EV charging network is not atypical for a developing market, it carries severe, direct implications for commercial segments—specifically cabs and passenger three-wheelers—that depend on fast turnaround times to remain profitable.

Currently, the majority of the network's growth is concentrated in the medium-speed (16–50 kW) bracket. Of the 152 stations commissioned across 2024 and 2025, 103 fall into this medium-capacity range. Although this indicates the network

Map 2: Jaipur city circle EV charging network by type



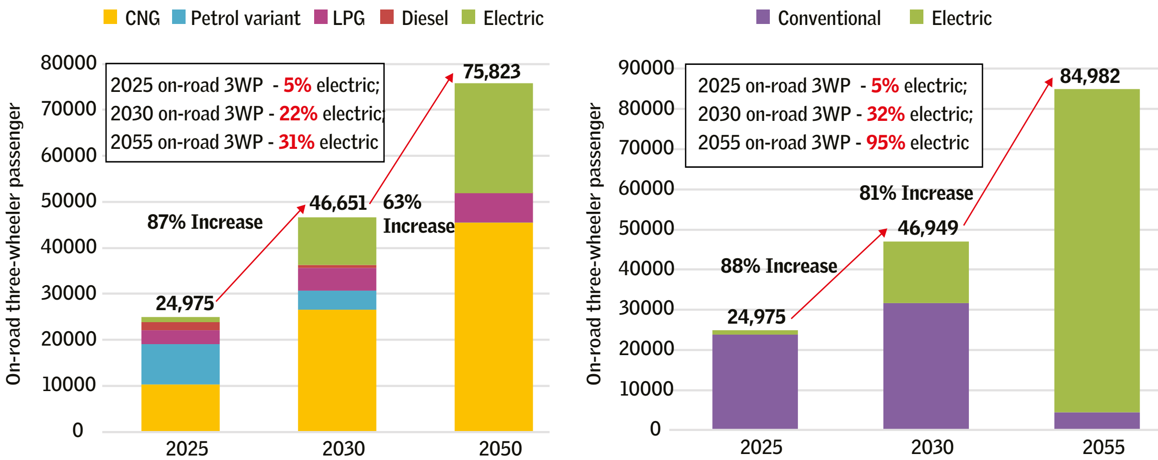
Data source: Jaipur Vidyut Vitran Nigam Limited.

is gradually moving up the speed ladder, it is failing to do so at the pace or capacity level that commercial users require. A major structural constraint exacerbating this issue is the 44-kW low tension (LT) ceiling, which forces a significant share of recently commissioned fast chargers to operate well below their rated capacity.

Consequently, the current infrastructure cannot reliably serve high-mileage commercial users at the necessary scale or speed. Because slow and medium AC infrastructure dominates the landscape, public charging in Jaipur is currently only suited for "top-up" charging, rather than serving as the primary fuelling mechanism for commercial fleets.

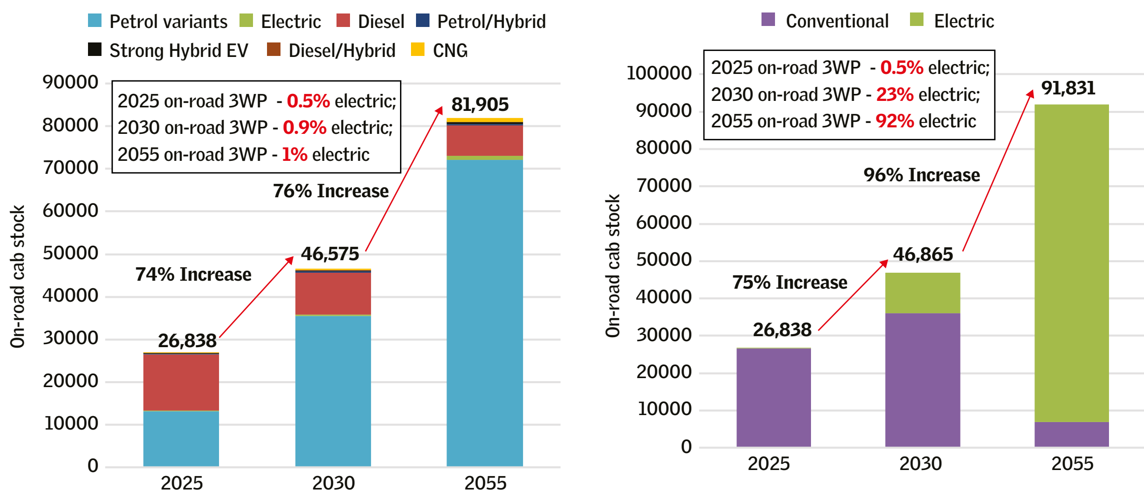
Segment-specific impacts—cabs vs. three-wheelers: The severity of this public and hub charging gap becomes starkly apparent when comparing the current infrastructure against the potential scale of the commercial fleet. Under a business-as-usual (BAU) scenario, both the cab and passenger three-wheeler segments are projected to experience continued growth *(for detailed baseline data, refer to Appendix A for BAU scenario assumptions and Appendix B for electrification* *plus modal shift scenario assumptions).* Passenger three-wheelers' segment is currently on a much faster electrification trajectory, having already reached a 31 per cent EV penetration rate in 2025–26. In sharp contrast, the on-road stock for cabs remains almost entirely reliant on internal combustion engines (ICE) *(see Graph 20: Jaipur passenger three-wheeler on-road stock under BAU scenario and electrification plus modal shift scenario and Graph 21: Jaipur cab on-road stock under BAU scenario and electrification plus modal shift scenario).*

Graph 20: Jaipur passenger three-wheeler on-road stock under BAU scenario and electrification plus modal shift scenario



Source: CSE analysis based on CSE methodology

Graph 21: Jaipur cab on-road stock under BAU scenario and electrification plus modal shift scenario



Source: CSE analysis based on CSE methodology

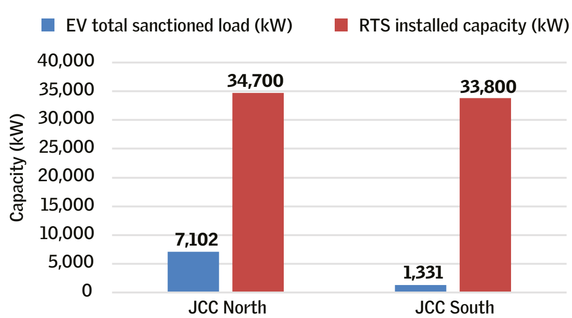
Gaps in spatial distribution and the network proposed by the Comprehensive Mobility Plan: The spatial distribution of Jaipur City Circle (JCC) charging stations is highly uneven in ways that critically impact commercial fleet coverage. Currently, the charging infrastructure is heavily clustered in specific central zones, creating significant blind spots elsewhere. The AEN Ramganj subdivision alone accounts for 64 of the 332 active stations, representing nearly 20 per cent of the entire JCC network. This is closely followed by Nahari Ka Naka with 37 stations and Sanjay Market with 26 stations.

Collectively, these three subdivisions account for approximately 38 per cent of all JCC connections. This dense clustering broadly corresponds to the walled city and adjoining commercial corridors where e-rickshaw and passenger three-wheeler activity is at its highest *(see Map 2: Jaipur city circle EV charging network by type)*.

While this central concentration is commercially rational for serving three-wheelers, it creates severe coverage gaps in the newer residential and peripheral areas of the city, which is precisely where private two-wheeler and car EV penetration is growing the fastest.

At the circle level, a pronounced North-South asymmetry exists. As of November 2025, JCC North accounts for an overwhelming 277 of the 332 stations, carrying a total sanctioned load of approximately 7,102 kW. In stark contrast, JCC South hosts only 55 stations with around 1,331 kW of load. This disparity is particularly striking given that installed residential rooftop solar capacity is almost identical across the two circles—34.7 MW in the North and 33.8 MW in the South. Ultimately, while the solar energy potential is evenly distributed across the city, the charging infrastructure to harness it is not *(see Graph 22: Circle-wise distribution of JCC charging stations and RTS installations)*.

Graph 22: Circle-wise distribution of JCC charging stations and RTS installations



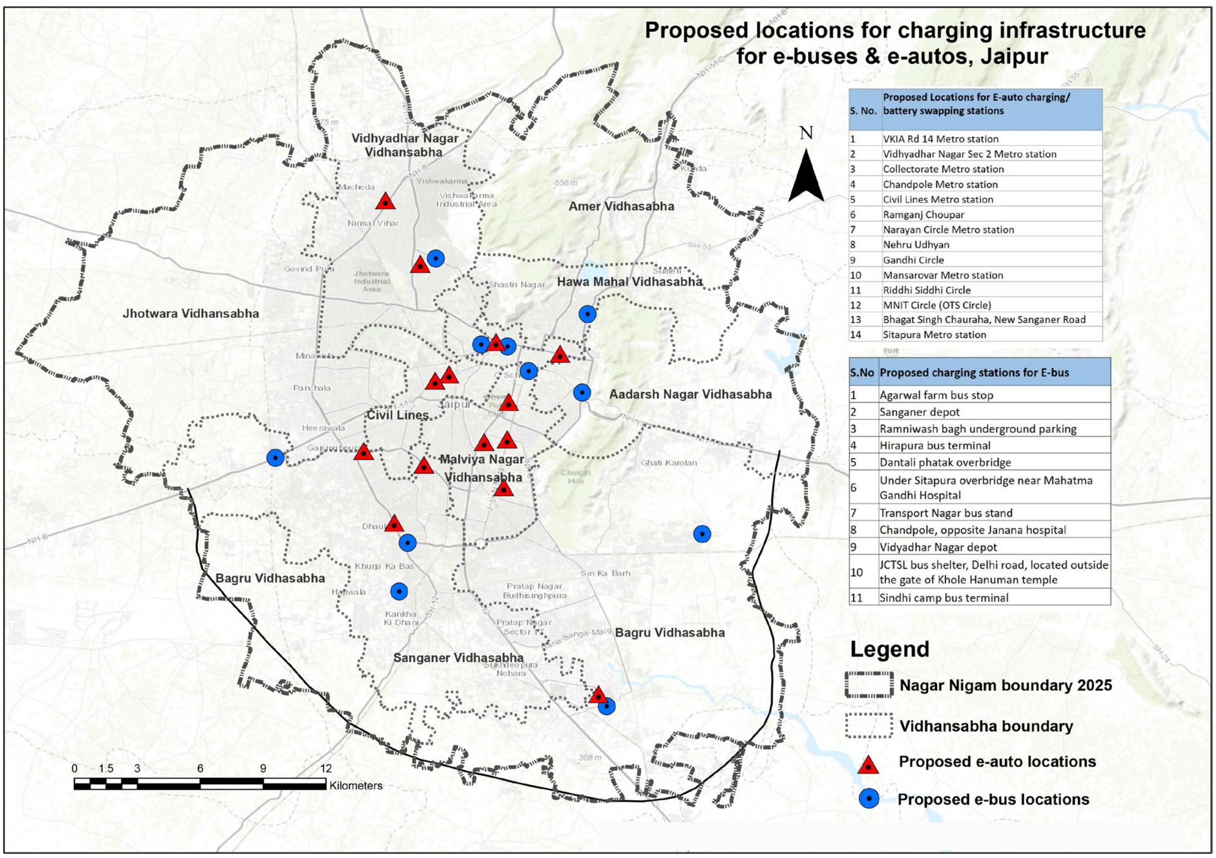
Note: RTS installed capacity is almost identical across both circles, but EV charging stations are five times more concentrated in JCC North.

Source: Jaipur Vidyut Vitran Nigam Limited

The Jaipur Comprehensive Mobility Plan (Draft, February 2026), prepared by the Jaipur Development Authority, directly identifies the spatial gaps and proposes a corrective framework to balance the network. The CMP's recommendations aim to shift the focus from the walled-city concentration toward a more transit-oriented, commercial aggregation model *(see Map 3: Proposed EV charging locations in Jaipur Comprehensive Mobility Plan 2026)*.

The CMP designates 14 specific locations tailored for e-auto charging and battery swapping stations. These are strategically concentrated at metro stations and major traffic nodes across the city, including VKIA Road 14, Vidhyadhar Nagar, Collectorate, Chandpole, Civil Lines, Ramganj Chaupar, Narayan Circle, Mansarovar, Riddhi Siddhi Circle, MNIT Circle and Sitapura Metro. Notably, none of these critical nodes currently host high-capacity charging infrastructure.

Map 3: Proposed EV charging locations in Jaipur Comprehensive Mobility Plan 2026



Source: Jaipur Comprehensive Mobility Plan 2026

Acknowledging that the current clustered distribution of the charging network has been shaped, in part, by the historical absence of designated charging and parking for the e-rickshaw fleet, the CMP proposes ten dedicated "no-e-rickshaw" corridors across high-capacity arterials and grade-separated roads.

While the CMP's proposed network perfectly complements the existing clusters, translating these 14 proposed locations into functional infrastructure presents its own challenges. Executing this plan requires urgent upstream connection and tariff category reforms. This is because aggregating multiple charging units at these 14 transit sites will result in loads that inevitably cross the effective high tension (HT) threshold under the current Supply Code classification, subjecting operators to significant regulatory and financial barriers.

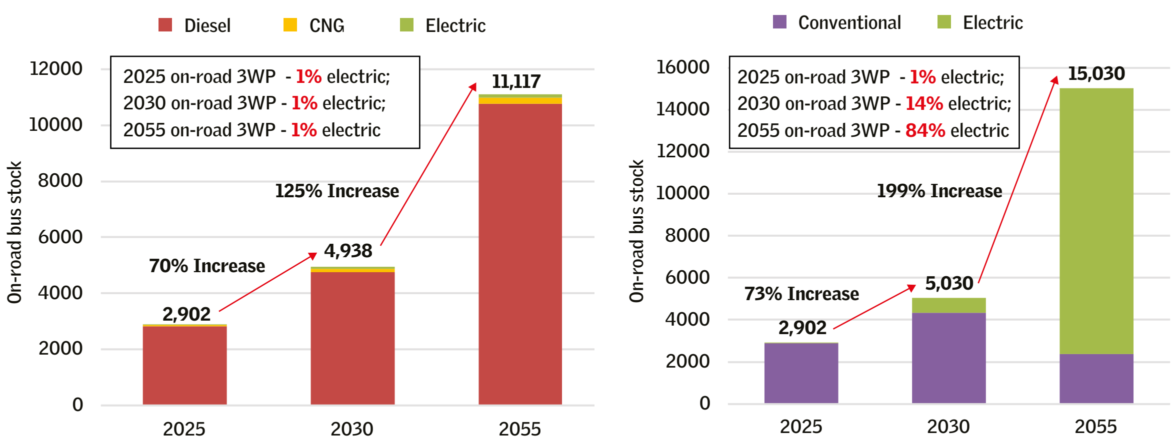
For cabs, absence of a reliable fast-charging network is itself a primary structural barrier to electrification. Fleet operators and individual cab owners absolutely require predictable daily ranges and brief turnaround times. A network dominated by slow and medium AC chargers, heavily restricted by the 44-kW effective LT ceiling, simply cannot guarantee the operational efficiency needed by these drivers. The electrification of these commercial fleets will drastically alter Jaipur's electricity demand profile, making proactive grid planning an absolute imperative.

Under the BAU scenario, energy demand for hub and public charging is projected to reach approximately 210 MU in 2029–30, rising to around 420 MU by 2054–55.

Under the electrification plus modal shift scenario, these load requirements escalate dramatically. Energy demand would hit approximately 347 MU in 2029–30 and surge to 2,375 MU by 2054–55 *(see Graph 16: Power requirement due to vehicle electrification).* This nearly twenty-fold difference in near-term projections between the two scenarios perfectly illustrates the scale of the impending challenge. It highlights that supporting an ambitious modal shift will require the deployment of hub charging infrastructure—and the corresponding electricity load provisions—to be implemented on a transformative rather than incremental scale.

Depot charging—need proactive planning in Jaipur's e-bus transition: Depot charging occupies a distinct position within the electric vehicle accessibility framework because it operates entirely outside the market-mediated logic of charge point operator (CPO)-led public infrastructure. It does not rely on

Graph 23: Jaipur bus on-road stock under BAU scenario and electrification plus modal shift scenario



Source: CSE analysis

consumer footfall, retail pricing signals or individual user discovery. Instead, it is captive, predictable and high-volume, designed to serve a concentrated fleet at a fixed location under institutional ownership or management.

For precisely this reason, depot charging development in Jaipur cannot be left to the same market forces that are gradually expanding the public charging network. It requires deliberate infrastructure planning, robust regulatory enablement and tailored financing arrangements—elements that the current Rajasthan Electric Vehicle Policy (REVP) framework has only partially addressed.

Jaipur is only just beginning its electric bus programme, and current numbers reflect a significant legacy deficit in public transit capacity. As of 2024–25, bus electrification in the city stood at a mere 4 per cent, which further decreased to 1.1 per cent in 2025–26. Up until 2024–25, year-wise new bus registrations have remained well below what a city of Jaipur's population and congestion levels would require for a functional public transport network (with the city registering around 600 buses only in 2025–26). However, on-road stock projections illustrate a massive upcoming divergence depending on the city's policy pathway.

Under the BAU scenario, the bus fleet grows slowly and remains predominantly ICE-based through the near term. If the city pursues an ambitious modal shift, the number of electric buses must scale drastically *(see Graph 23: Jaipur bus on-road stock under BAU scenario and electrification plus modal shift scenario).*

As Jaipur scales its e-bus numbers, the corresponding electricity demand for depot charging will surge, creating unique infrastructural challenges. Under the BAU trajectory, depot charging energy demand is projected at approximately 4.5 MU in 2029–30, rising to around 8.7 MU by 2054–55.

Under the electrification plus modal shift scenario, these figures escalate to approximately 74.7 MU in 2029–30 and a staggering 1,325 MU by 2054–55. This nearly twenty-fold difference in the near-term reflects the transformative—rather than incremental—scale of bus electrification required under scenario conditions *(refer to Appendix A for BAU scenario assumptions and Appendix B for electrification plus modal shift scenario assumptions).*

This massive scale of energy demand carries direct infrastructure implications that distinguish bus depot charging from every other charging modality discussed in this report. Multiple high-capacity chargers operating simultaneously during pre-shift and post-shift windows will impose intense, concentrated loads on local feeders and transformers. This is completely unlike the more dispersed and time-extended load profiles typical of public or home charging.

Furthermore, unlike public charging stations—which can be flexibly sited to optimize proximity to stronger substation nodes—bus depots are strictly constrained in their locations by operational route structures, terminal proximity and land availability. Consequently, Jaipur must shift how it currently conceives infrastructure sequencing under the REVP—proactive engagement from JVVNL in feeder reinforcement planning must precede fleet procurement decisions, rather than reactively following the procurements.

Leveraging solar integration with depot charging: The regulatory framework to manage these immense loads through depot-level solar integration is largely in place. The Rajasthan Solar Energy Policy, 2019, permits captive renewable energy plants within depot premises and allows for renewable power procurement through open access, complete with transmission and wheeling charge exemptions for ten years.

Crucially, the Rajasthan Electricity Regulatory Commission's (RERC) formal recognition of Battery Energy Storage Systems (BESS) as part of a renewable generation system, coupled with JVVNL's February 2026 hybrid inverter order, enables depot-level "solar-plus-storage" configurations. This allows depots to store mid-day solar generation and discharge it during early morning and late-night charging windows, perfectly addressing the inherent mismatch between peak solar hours and bus fleet charging schedules.

For a public operator running a large e-bus fleet, this solar-BESS integration directly reduces the per-unit cost of energy, directly improving the operational viability of the fleet and ensuring transit affordability for passengers.

What is currently missing is a standardized financing and procurement template. Such a template would package these existing provisions into a bankable project structure accessible to municipal and state transport operators, who currently lack dedicated project development capacity. Developing this template—whether through JVVNL, the Rajasthan Renewable Energy Corporation Limited (REDA) or a joint state-level task force—is among the most immediate infrastructure policy actions required to unlock depot charging at scale in Jaipur.

Regulatory support for charge point operators (CPOs): The constraints identified across the charging network represent the operational reality that CPOs encounter when deploying public fast-charging infrastructure in Jaipur. The deployment patterns that have subsequently emerged are a result of these constraints.

In the residential segment, CPOs partnering with pan-India residential developers install a single 7.4-kW AC charger for approximately every five vehicles in a housing society, utilizing the building's existing domestic connection. This approach works because it remains below every threshold where the regulatory complexity of EV charging connections becomes material. There is no industrial demand charge trigger, no mandatory EV tariff sub-meter and no upstream infrastructure cost recovery requirement. As a result, the domestic connection pathway is clean, fast and administratively routine. Pan-India builder contracts have allowed this model to be replicated in Jaipur alongside other states without requiring any Rajasthan-specific regulatory engagement. Ultimately, this is the market's solution to the absence of a workable policy pathway for residential charging.

Unlike the residential sector, the public fast-charging segment is more challenging.

Exorbitant upstream costs and subsidy failures: When operators must cross the threshold and take an HT connection—as is necessary for any multi-charger hub or site with an aggregated load above 44 kW—the upstream infrastructure cost jumps significantly from approximately Rs 3–4 lakh for an LT connection to Rs 7–8 lakh for an HT connection. While the REVP 2022 provided a Rs 5 lakh per-station upstream infrastructure reimbursement for the first 100 public fast charging stations to offset precisely this differential, as of early 2026, this reimbursement is no longer being disbursed. This is a consequence of DISCOM financial constraints, rather than any policy withdrawal.

The metering and billing disconnect: The cost problem is severely compounded by a metering issue. Since there is no hard-coded EV tariff category in the DISCOMs' billing systems, DISCOM field officials processing connection applications lack a standard workflow for issuing an EV category meter. The result in practice is highly inconsistent. Some officials are unaware that the category exists, while others default to the nearest standard industrial or commercial category. CPOs routinely encounter non-acknowledgement of the EV tariff at the point of connection, resulting in stations operating on the wrong meter and billing category with no straightforward rectification path. This is not a problem of individual competence; it is what occurs when a tariff category exists in an RERC order but has never been operationalized in DISCOM billing software and standard operating procedures.

Section 5:
Vehicle fleet electrification and grid reliability

Grid reliability and EV charging readiness: Electric vehicle (EV) charging infrastructure planning is fundamentally shaped by the hierarchical structure of the electricity grid—from high-voltage transmission systems down to the low-voltage distribution transformers that ultimately serve charging points. At the transmission level, the Rajasthan Rajya Vidyut Prasaran Nigam Limited (RVPN) transmission map (132 kV and above, as on 30 April 2025, referenced in Appendix C) confirms that Jaipur is served by a multi-voltage backbone including 765 kV, 400 kV and 220 kV infrastructure, with multiple grid-supply substations visible in the Jaipur inset, establishing that bulk power availability is not a constraint for EV charging scale-up in the city. Notably, the RVPN map also shows several approved, but not yet commissioned, 220 kV and 400 kV lines in and around the Jaipur zone. JVVNL should cross-reference these upcoming grid-supply points when finalizing the siting of fast-charging hubs and bus depot connections, so that high-load charging infrastructure is positioned to benefit from imminent transmission augmentation rather than competing for capacity on currently loaded feeders.

This integration indicates that, in aggregate, the city is not constrained by state-level bulk power scarcity or availability. From a planning perspective, this upstream connectivity reduces the risk of systemic supply bottlenecks for high-demand uses, such as fast-charging hubs, depot charging for buses and commercial fleets, and clustered public charging infrastructure—provided that downstream distribution constraints are addressed in parallel. Furthermore, these transmission maps serve an important technical purpose—they help identify likely grid-supply zones where high-capacity charging demand will ultimately aggregate, and they provide a technical basis for prioritizing detailed data requests from the local distribution utility (JVVNL).

Need distribution-level granularity: Transmission-level adequacy does not automatically translate into charging readiness on the ground. The feasibility, speed and cost of deploying chargers in specific neighborhoods depend primarily on the condition of the downstream distribution network, particularly 33/11 kV substations, 11 kV feeders and distribution transformers (DTs). Crucial parameters—such as transformer spare capacity, feeder loading during evening peaks, voltage regulation and planned augmentation schedules—determine whether chargers can be connected quickly or if they will require extensive network reinforcement.

Because these critical factors are often not clearly visible on state-level transmission maps, charger siting and phasing within Jaipur needs to be guided by granular, distribution-level assessments using utility data. This granularity is essential to ensure reliability, cost efficiency and equitable access to charging infrastructure. Furthermore, zone-level compliance with regulatory benchmarks does not imply uniform reliability performance across all pockets of the city. Jaipur comprises multiple circles, divisions and feeder networks with potentially uneven and variable reliability characteristics. Therefore, to effectively assess charging readiness, evaluations must move to the feeder or sub-division level, relying on detailed data such as feeder-wise loading profiles, DT capacities, outage records, interruption cause categorizations and planned capital works. True charging readiness must be defined by a combined framework of capacity adequacy, interruption frequency, outage duration and restoration responsiveness.

Current status of power reliability: The status of power reliability in the Jaipur Zone provides a mixed but improving picture, tracked via SAIDI (System Average Interruption Duration Index) and SAIFI (System Average Interruption Frequency Index). Between FY 2023–24 and FY 2025–26 (up to Q2), the network experienced significant growth—the number of 11 kV feeders increased from 5,640 to 6,565, and the consumer base expanded from approximately 32.2 lakh to 36.2 lakh. Crucially, reliability improvements have occurred in parallel with this network growth, which is a highly significant indicator from a system planning perspective.

The data indicates that SAIDI (outage duration) has reduced significantly from 170.44 minutes in FY 2023–24 Q1 to 88.17 minutes in FY 2025–26 Q2, representing nearly a 48 per cent reduction in the average outage duration per consumer per quarter. When converted to hours, SAIDI ranges from approximately 2.84 hours per quarter at its peak down to approximately 1.47 hours per quarter in the most recent period. This reduction reflects improved restoration performance and operational efficiency. It also provides a reasonable approximation of the baseline grid-related downtime exposure for charging infrastructure that lacks redundancy or backup arrangements. Overall, the improving SAIDI trend provides a positive signal for a phased EV charging scale-up in Jaipur.

In contrast, SAIFI (interruption frequency) has remained within a relatively narrow band of approximately 5.5 to 6.3 interruptions per quarter for most periods, only notably declining to 4.10 in FY 2025–26 Q2. This indicates that while restoration time has improved, the frequency of supply interruptions remains moderate *(see Table 1: SAIFI and SAIDI trends—Jaipur zone).*

Table 1: SAIFI and SAIDI trends—Jaipur zone

Year	Quarter	11 kV feeders	Consumers	SAIFI	SAIDI (minutes)
2023–24	Q1	5,640	32,23,158	6.25	170.44
2023–24	Q2	5,696	32,66,328	6.11	134.08
2023–24	Q3	5,733	33,41,393	5.53	111.24
2023–24	Q4	5,804	33,82,446	5.87	114.74
2024–25	Q1	5,873	34,17,159	5.82	123.33
2024–25	Q2	5,913	34,73,177	5.57	106.93
2024–25	Q3	5,972	35,28,281	6.18	109.40
2024–25	Q4	6,122	35,65,921	6.02	103.52
2025–26	Q1	6,444	35,99,343	6.25	111.85
2025–26	Q2	6,565	36,22,504	4.10	88.17

Source: Rajasthan Electricity Regulatory Commission

Implications for EV charging typologies and the need for safeguards for reliability: From an EV charging planning perspective, the reliability trends have differentiated implications across various charger typologies. For high-utilization DC fast charging and fleet depots, the frequency of interruptions (SAIFI) can be just as critical as the overall duration (SAIDI). The persistence of moderate SAIFI values underscores the necessity of incorporating reliability safeguards into the design of high-capacity charging hubs and fleet infrastructure to ensure sustained service availability and economic viability. Repeated short interruptions can heavily disrupt charging sessions, create queueing inefficiencies and negatively affect fleet turnaround times, even if the aggregate outage duration is declining. Furthermore, even one to three hours of quarterly outage exposure can materially affect charger utilization and operator revenue if concentrated during peak usage windows.

Consequently, planning must adapt to these vulnerabilities:

- **High-criticality infrastructure:** Sites such as bus depots, fleet aggregation hubs and arterial-corridor DC fast charging stations require robust reliability safeguards. These sites should be proactively prioritized near stronger substation nodes, ring-fed systems (where available) or locations with demonstrated feeder stability. Establishing operational coordination protocols with the distribution utility for rapid restoration is also highly advisable for these critical locations.

- **Medium-criticality infrastructure:** Facilities like public charging clusters and workplace charging stations can be expanded under present reliability conditions, provided that phased capacity augmentation and load management strategies are incorporated.
- **Low-criticality infrastructure:** Destination AC charging, where vehicle dwell times are typically long, is comparatively less sensitive to short-duration outages and may not require additional reliability layering beyond standard network adequacy checks.

Supply reliability for charging access: Charging accessibility is not only about physical proximity to a charger. From the user's perspective, a charger that faces supply interruption is functionally no different from one that does not exist. While the reliability section of this report establishes the zone-level SAIDI and SAIFI baseline in detail, these aggregate metrics do not capture the full picture. The improving SAIDI trajectory is a positive signal for overall charging scale-up, but the persistence of moderate SAIFI values carries differentiated implications across various user categories.

For a private two-wheeler user charging overnight at home, a short-duration supply interruption is largely a nuisance. The vehicle may lose some charging progress, but the overall impact on next-day range is limited due to the small battery sizes involved. For an e-rickshaw, cab and passenger three-wheeler driver whose vehicle is their primary income source, depending on a full overnight charge for the next day's operation is critical. Even a one-hour interruption during peak charging hours can directly translate into a reduced operational range and a direct loss of income.

For those relying on public or depot chargers to turn around vehicles for subsequent shifts, interruption frequency is just as critical as duration. Repeated short interruptions disrupt charging sessions, create queueing inefficiencies, and adversely affect vehicle availability in ways that daily operational planning cannot easily absorb. For DC fast charging hubs serving cabs and commercial vehicles, even the current SAIDI levels of approximately 1.5 to 2.8 hours per quarter can materially affect charger utilization and operator revenue, if outages are concentrated during peak usage windows. Supply reliability for EV charging is inherently a differentiated problem that demands a differentiated response. Infrastructure, such as bus depots, commercial fleet aggregation points and arterial-corridor fast charging hubs, must be prioritized near stronger substation nodes or ring-fed feeder systems.

The integration of battery storage at these critical sites provides a vital technical buffer against short-duration supply interruptions that would otherwise disrupt charging sessions. This is now formally enabled through the RERC's recognition of BESS as part of a renewable energy generating system, alongside JVVNL's February 2026 hybrid inverter order.

At the residential level, this same BESS integration pathway allows private users with rooftop solar to continue charging using stored energy during short outages, effectively decoupling home charging availability from feeder-level interruption frequency.

Importantly, these solutions are not speculative future options. They are available under the current regulatory framework and merely require consumer-level awareness coupled with accessible financing mechanisms to take hold at scale.

Interoperability and the user experience gap: Another critical dimension of charging accessibility—often missed by raw infrastructure data—is the severe fragmentation of the user experience across various CPO networks. Jaipur's public charging network is currently spread across multiple operators, each utilizing proprietary applications, different payment systems and variable real-time availability tracking.

For a first-time EV car buyer or a cab driver considering the switch to electric mobility, the inability to locate, authenticate and pay at a nearby charger through a single, unified interface acts as a significant practical deterrent. This fragmentation reinforces range anxiety, even in areas where charging infrastructure nominally exists. Furthermore, while the Ministry of Power's 2024 guidelines have addressed interoperability standards in principle, station-level implementation remains incomplete, particularly for the older AC-based stations that dominate Jaipur's network.

This user experience gap also heavily impacts operators. The 13 disconnected stations in the network are a concrete indicator of the viability stress CPOs face when low utilization fails to recover capital costs.

The absence of a common discoverability platform that aggregates real-time availability across all networks compounds this issue by artificially reducing the effective utilization of stations that are fully operational. The cumulative picture emerging from these dimensions is that charging accessibility in Jaipur is not constrained by a single missing intervention, but rather by the complete absence of a coordinating framework that connects the various actors controlling the relevant levers. Currently, control is siloed; JVVNL controls grid connections, metering arrangements, and the EV tariff framework.

The Rajasthan Energy Development Agency (REDA) and the state's EV nodal agency control rooftop solar (RTS) and EV policy instruments. The Jaipur Municipal Corporation and the Jaipur Development Authority (JDA) control land use, parking regulations, and building bye-laws. The transport department controls e-rickshaw registration, zoning and stand allocation.

While each agency has taken positive steps within its own domain—JVVNL has improved the RTS facilitation framework, the Transport Department has initiated e-rickshaw zoning, the building bye-laws have introduced EV-ready parking provisions for new constructions, and RERC has progressively expanded net metering, virtual net metering (VNM) and BESS frameworks—these efforts remain disjointed.

What is critically missing is a joint operational protocol, ideally formalized through a coordination mechanism between JVVNL, JDA and the Transport Department under the REVP. This protocol must treat the entire parking-charging-supply-reliability chain as a single, integrated problem and assign clear responsibilities for each link.

The foundation for this convergence is already in place. The ongoing Rajasthan power sector reforms—including distribution strengthening, feeder segregation programmes, the expansion of RERC's net metering and VNM frameworks and the updated time-of-day (ToD) tariff structure—provide a solid grid-side basis. Additionally, the PMSG-MBY programme's 68.5 MW of installed residential solar in the JCC serves as a robust distributed energy resource base. Furthermore, the e-rickshaw zoning initiative offers a proven model of cross-departmental coordination. If expanded to include JVVNL as an active infrastructure-delivery partner, this could serve as the template for integrated charging access planning across all commercial segments.

Ultimately, what this convergence requires is a dedicated city-level implementation vehicle. Whether structured as a dedicated charging infrastructure cell within JVVNL's JCC operations, a joint sub-committee of the REVP nodal agency, or a time-bound pilot programme, this vehicle is essential to translate existing policy and regulatory instruments into tangible, ground-level charging access for both private and commercial users across Jaipur's diverse urban typologies.

The instruments are already in place. The coordination architecture is the only missing piece.

Section 6:
Vehicle fleet electrification and grid reliability

Solar integration and the convergence opportunity: The case for integrating renewable energy into Jaipur's public and hub charging network is both economically and operationally compelling. Existing regulations already offer strong provisions for CPOs. Under the Rajasthan Solar Energy Policy 2019, CPOs are explicitly permitted to establish captive renewable energy plants within their charging station premises. They are also allowed to procure renewable power through open access, benefiting from a 100 per cent exemption from transmission and wheeling charges for ten years for solar, wind, and hybrid projects up to 25 MW set up for captive use. Furthermore, the FY 2025–26 time-of-day (ToD) structure reinforces this by applying a 10 per cent rebate on energy charges between 12:00 and 16:00, creating a direct cost incentive for mid-day, solar-aligned charging.

The Rajasthan Integrated Clean Energy Policy, 2024, capitalizes on the state's position as the national leader in installed solar capacity and as of February 2026, Rajasthan, with 38728.22 MW of installed solar capacity, accounted for around 27 per cent of nation-wide solar capacity. The policy promotes renewable energy-based EV charging stations and mandates adherence to the Ministry of Power and CEA standards. This allows charging service providers to (a) set up renewable generation within premises for captive use and (b) draw renewable power through open access to avail benefits under the policy. It also flags grid integration priorities by aiming to make the grid flexible, using measures like demand-side management and time-of-day tariffs.[25]

Complementing this, the draft RERC (Demand Flexibility/Demand Side Management) Regulations, 2026, operationalize grid management through two levers—moving demand away from expensive peak periods to low-cost, solar-surplus hours, allowing the grid to absorb excess renewable generation, and lowering aggregate consumption through efficient appliances and industrial processes.

Together, these two levers are intended to reduce DISCOMs' dependence on costly peaking power, with the resulting savings in power purchase costs expected to ease the overall tariff burden on consumers—though the extent of savings will ultimately depend on the degree of consumer participation and the pace of smart metering rollout.[26] For Jaipur, accelerating fleet electrification will require simultaneously harnessing grid-connected and distributed renewable energy, supported by integrated Battery Energy Storage Systems (BESS), to build a resilient, future-ready grid.

The integration of solar power into Jaipur's EV charging network presents a massive economic and operational opportunity. While regulatory provisions already exist to support CPOs in establishing captive renewable energy—such as open access permissions and transmission charge exemptions—structural and financial barriers severely limit standalone deployments. As demonstrated by the successful Thinkers Doers–Tata Power hub, co-hosting with an entity that provides land, a high tension (HT) connection and captive solar is currently the only viable way to bypass these hurdles. To truly enhance solar-EV integration across the city and tap into the vast 68.5 MW of installed residential rooftop solar, policymakers must introduce specific interventions, such as sub-metering allowances, public asset utilisation and restructured upfront capital disbursements *(see Case study: Rajasthan's First Tata Power Charging Hub—The Thinkers Doers Model).*

On-site solar paired with battery storage can meaningfully reduce the per-unit cost of energy for CPOs. This integration is now formally enabled at the consumer level through JVVNL's February 2026 hybrid inverter order and the RERC's formal recognition of Battery Energy Storage Systems (BESS), as part of a renewable energy generating system. Reducing this energy cost is the most direct lever available for lowering the service charges that currently deter commercial EV adoption. Visible evidence that this model is already operational in Jaipur City Circle (JCC) network—where site conditions permit—can be seen in the Thinkers Doers–Tata Power station and various Oil Marketing Company (OMC)-operated HT stations that integrate rooftop solar at their forecourts.

To enhance solar power integration for EV charging and move this model from a one-off partnership to a replicable template across Jaipur, three specific policy interventions are required:

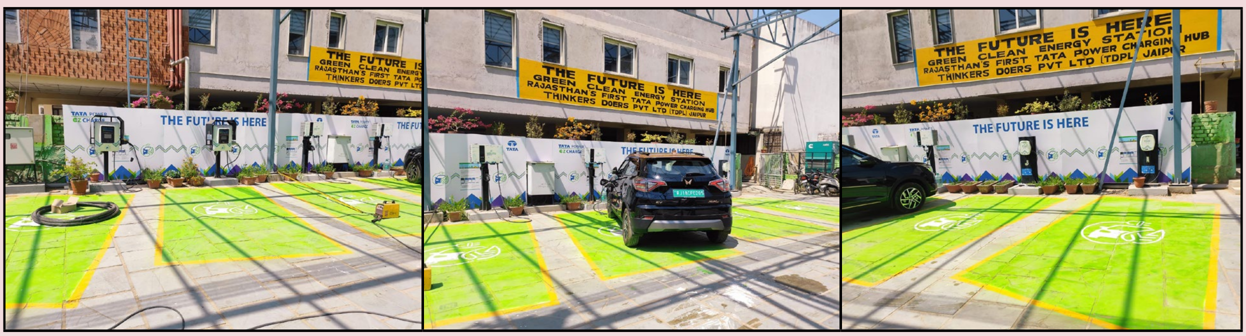
Explicit sub-metering allowance: RERC should issue a suo-motu order explicitly permitting the sub-metering of EV charging loads behind existing HT connections at commercial, institutional, and industrial premises (a provision already available in Karnataka under KERC's 2024 guidelines).[27]

CASE STUDY: RAJASTHAN'S FIRST TATA POWER CHARGING HUB—THE THINKERS DOERS MODEL

The Thinkers Doers Pvt Ltd (TDPL) charging hub in Jaipur—self-described in its own signage as Rajasthan's first Tata Power Charging Hub and a "Green Clean Energy Station"—offers the most concrete available illustration of what the co-hosting model can deliver in practice, and of the conditions that make it possible in the first place.

Developed through a partnership between TDPL and Tata Power, the facility brings together multiple Tata Power EZ Charge AC charging units alongside higher-capacity DC fast chargers across purpose-built, demarcated green bays. Tata Power's role was limited to the supply and commissioning of the charging equipment. Crucially, TDPL contributed the three inputs that the regulatory environment currently makes prohibitively difficult for a standalone CPO to assemble—the land, the high tension (HT) electricity connection and captive solar energy integrated into the site's power supply. The resulting 135-kW station operates well above the approximately 44-kW effective low tension (LT) threshold—which would otherwise force a single-operator deployment into a permanently throttled configuration. The station is fully operational, commercially branded and actively serving users (*see images: Solar integrated high tension charging hub in collaboration with Thinkers Doers and Tata Power*).

Solar integrated high tension charging hub in collaboration with Thinkers Doers and Tata Power



Source: Tata Power

Structural barriers and enhancing solar-EV integration: What the TDPL model demonstrates is not simply that solar-integrated fast charging is technically feasible in Jaipur; the regulatory framework for captive solar and open access under the Rajasthan Solar Energy Policy 2019 has already established that in principle. Rather, it demonstrates that the conditions enabling it are structural rather than technical. A host entity with pre-existing HT connectivity, owned land and on-site solar generation capacity can seamlessly absorb the three cost and process barriers—the HT connection, the upstream infrastructure expenditure and the solar integration—that individually and cumulatively prevent most CPOs from deploying at an equivalent scale.

Without such a host, a CPO seeking to build an equivalent facility independently faces daunting obstacles—an HT connection cost of Rs 7–8 lakh (against an LT alternative of Rs 3–4 lakh), the lapse of the Rs 5 lakh upstream infrastructure reimbursement under REVP 2022 (which is no longer being disbursed), and the operational hurdle of securing an EV tariff meter from DISCOM field officials for whom no standard processing workflow exists. In other words, the TDPL hub works because it externalizes the costs that the regulatory framework has not adequately managed.

The FY 2026–27 tariff order's abolition of fixed charges on EV connections reduces the recurring cost burden for CPOs who do take HT connections, but does not address the one-time upstream infrastructure cost that remains the primary financial deterrent to independent deployment.

This would allow entities with HT connectivity to host CPO equipment without the CPO requiring a separate HT connection of its own.

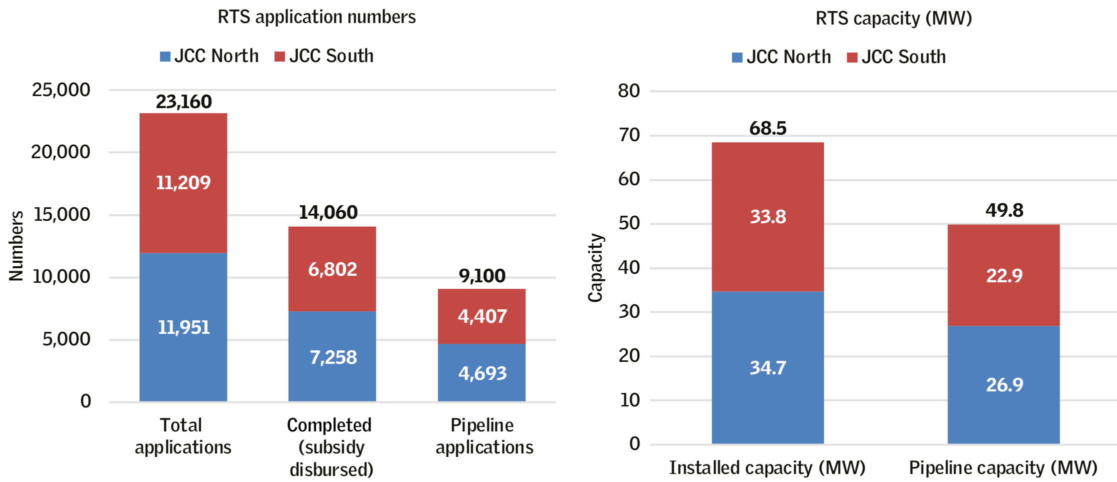
Leverage public assets: The state government and JVVNL should compile and publish a list of public land parcels and government-owned premises with existing HT connections. These should serve as priority sites for CPO deployment under competitive tender, directly replicating the TDPL land-and-connection model through public assets.

Restructuring capital disbursements: The upstream infrastructure reimbursement under REVP 2022 must be restructured, from a reimbursement routed through DISCOM operating budgets (which are structurally unable to process it at scale) into an upfront capital disbursement through a dedicated state EV fund, administered by JVVNL as the nodal agency. Together, these three changes would make the private partnership arrangement demonstrated by TDPL accessible as a standard deployment pathway for CPOs operating across Jaipur's commercial and highway corridors, without requiring the lucky coincidence of a willing institutional co-host at each location.

Bridging the distributed solar gap: Beyond commercial hubs, Jaipur possesses a massive foundation of distributed residential solar power. As of November 2025, JCC North and South together recorded 23,160 applications under the PM Surya Ghar: Muft Bijli Yojana (PMSG-MBY) scheme. Of these, 14,060 applications had reached subsidy disbursal—representing a completion rate of approximately 61 per cent—yielding a total installed residential rooftop solar (RTS) capacity of 68.5 MW. This capacity is split roughly equally between the North (34.7 MW) and South (33.8 MW) circles. Additionally, 9,100 applications carrying approximately 49.8 MW of pipeline capacity were at various stages of processing. Because these figures cover only residential installations under PMSG-MBY (commercial and institutional rooftop solar is accounted for separately), the total distributed solar capacity in the city is actually much higher *(see Graph 24: PMSG-MBY application and installation pipeline for JCC North and South)*.

Overall, the sheer scale of this installed capacity offers incredible charging potential. At the installed base of 68.5 MW, assuming 5.5 peak sun hours and 80 per cent system efficiency, the existing residential RTS in JCC generates an estimated 3,01,000 kWh per day. In indicative terms, this is enough energy to cover approximately 2,00,000 full two-wheeler charges or around 43,000 partial car charges daily.

Graph 24: PMSG-MBY application and installation pipeline for JCC North and South



Note: RTS – Rooftop solar

Source: Jaipur Vidyut Vitran Nigam Limited

The policy and regulatory instruments required to connect this distributed solar base with the charging network—such as improved net metering tariffs, virtual net metering, BESS integration and hybrid inverter permissions—are now formally in place. What is currently missing is an explicit convergence mechanism within JVVNL's operational framework and within the REVP that makes the solar-to-EV pathway visible and actionable for both CPOs and residential consumers. Filling this gap through an updated REVP provision or a dedicated JVVNL-REDA joint circular remains the most actionable near-term recommendation to emerge from the combined analysis of Jaipur's charging infrastructure and distributed solar data.

Section 7: Way forward

Jaipur is not held back by an absence of policy. The REVP 2022, Solar Energy Policy 2019, Rajasthan Integrated Clean Energy Policy 2024, Building Bye-Laws 2025, the FY 2025–26 time-of-day tariff, and progressive RERC amendments culminating in virtual net metering and BESS recognition collectively constitute a regulatory architecture that is well ahead of most Indian states. The FY 2026–27 tariff order goes further still, abolishing fixed charges on EV charging connections entirely and making Rajasthan the first state to move to a purely consumption-linked tariff structure for public charging stations. The primary gap is not legislative. It lies in what this framework has not yet operationalized at the city level. Closing that gap requires targeted interventions across charging typologies, grid readiness and institutional coordination.

Act on grid stress before demand forces the issue: Distribution infrastructure planning in Jaipur must move ahead of EV penetration, not behind it. The city already absorbs 90 per cent of JVVNL's public charging energy demand within its Jaipur City Circle—8.13 MU of 9.03 MU in 2024–25—and hosted 345 of 605 JVVNL stations as of November 2025. The city's actual power consumption has already exceeded the CEA's 2027–28 demand forecast by three years, before the EV surge has properly begun.[28] NITI Aayog projects that by 2070, EV charging alone could create national demand spikes peaking at approximately 150 GW at night and 100 GW in the afternoon, with 30 per cent of private EV demand dependent on exactly the kind of public network that Jaipur is already stretching.[29]

The immediate requirement is not to wait for feeder failure but to commission granular, sub-division-level load assessments now, while headroom to plan still exists. Crucial parameters like transformer spare capacity, feeder loading during evening peaks, voltage regulation profiles and planned augmentation schedules determine whether chargers can be connected promptly or will require extensive network reinforcement. JVVNL should treat the 33/11 kV substations and feeders serving the highest-density EV zones as priority augmentation candidates in the next capital works cycle, and should cross-reference RVPN's approved 220 kV and 400 kV lines in and around the Jaipur zone when finalizing the siting of fast-charging hubs and bus depot connections, positioning high-load infrastructure to benefit from imminent transmission augmentation rather than competing for capacity on currently loaded feeders.

The grid shows a promising 48 per cent reduction in outage duration (SAIDI), dropping from 170.44 minutes per quarter in FY 2023–24 to 88.17 minutes in FY 2025–26. In contrast, interruption frequency (SAIFI) has remained moderate at 5.5 to 6.3 interruptions per quarter, declining only to 4.10 in the most recent period. For commercial fleets (passenger three-wheeler, e-rickshaws, cabs and buses), repeated short interruptions disrupt charging sessions, create queueing inefficiencies, and translate directly into income loss and delayed fleet turnaround. High-criticality sites such as bus depots, fleet aggregation hubs and arterial DC fast charging corridors must therefore be proactively sited near stronger substation nodes or ring-fed feeder systems, and integrated with battery storage to buffer against short-duration supply interruptions—a configuration now formally enabled through RERC's recognition of BESS and JVVNL's February 2026 hybrid inverter order.[30]

Resolve the apartment complex barrier for home charging: Home charging is the primary fueling pathway for private two-wheelers and cars, which dominate Jaipur's current EV fleet. The existing market workaround of CPOs partnering with developers to install 7.4 kW chargers on domestic connections, avoiding sub-metering requirements and industrial demand charges cannot scale at the pace that ambitious electrification scenarios imply. The Rajasthan (Urban Area) Building Bye-Laws 2025 mandate EV-ready parking for new construction but leave an access gap for the existing housing stock.[31] The Ministry of Power's September 2024 guidelines recognize the right of apartment residents to install private chargers,[32] but implementation remains inconsistent—a point elevated to a constitutional question in *Rachit Katyal vs Union of India*. JVVNL should issue a dedicated operational circular for apartment-level EV charging, specifying defined timelines for load assessments, clear cost-sharing arrangements and an explicit pathway for housing societies to access the virtual net metering framework already available under the RERC Third Amendment Regulations 2025.[33] No new regulation is required; what is missing is an operational circular that makes this pathway visible and actionable for residents and societies alike.

Home charging must also be proactively integrated with rooftop solar and BESS. A residential consumer with a rooftop solar system, now enabled to integrate battery storage through a hybrid inverter under JVVNL's February 2026 order, can charge at the marginal cost of solar generation rather than the retail domestic tariff, particularly during the mid-day window that the FY 2025–26 ToD structure already incentivizes through a 10 per cent rebate.[34] Distribution infrastructure in older residential feeders must be assessed and augmented ahead of EV penetration reaching a critical threshold, to prevent overnight charging loads from creating peak demand spikes the current network cannot absorb. Both requirements argue for early coordination between JVVNL, JDA and the state's EV nodal agency, rather than reactive reinforcement after demand has already materialized.

Make DC fast charging a planning priority, not an aftermarket addition: The public charging network is structurally inadequate for commercial fleets. Dominated by slow-to-medium AC chargers and constrained by an effective 44 kW load ceiling on LT connections—an artefact of the Electricity Supply Code 2021 routing EV stations into the Medium Industrial tariff category in the absence of a dedicated standalone classification—the network serves only for top-ups rather than primary fueling. This is actively stalling cab electrification. With only 27 stations in the JCC carrying loads above 50 kW, the absence of a reliable fast-charging tier will become a binding constraint as three-wheeler penetration, already at 31 per cent, continues to accelerate. Jaipur's Comprehensive Mobility Plan (Draft, February 2026) directly identifies this siting gap and proposes a corrective spatial framework, designating 14 specific locations for e-auto charging and battery swapping at metro stations and major traffic nodes.[35]

RERC must create a standalone EV charging tariff category with a hard-coded meter code and an explicit load band extending to at least 200 kW on LT supply, eliminating the 44-kW operational ceiling. Building on the FY 2026–27 tariff order, which has already abolished fixed charges on EV connections, a significant and welcome step, this dedicated category would resolve both the recurring cost burden and the operational constraint together. JVVNL and the state EV nodal agency should identify 10 to 15 strategic hub charging locations at transit nodes and commercial centres, ensuring each has a sanctioned HT load capable of supporting at least two DC fast chargers with on-site solar and BESS provisions. The CPO-level upstream infrastructure reimbursement of up to Rs 5 lakh per station under REVP 2022 must be reinstated and restructured as an upfront capital disbursement—not a DISCOM-routed reimbursement—to incentivize early-mover CPOs at these locations.

Treat bus depot charging as a capital investment pipeline: Bus electrification stands at just 4 per cent in 2024–25 and 1.1 per cent in 2025–26—figures that mask the infrastructure scale required if Jaipur is to shift modal shares meaningfully toward public transport. Jaipur is only just beginning its electric bus programme, and current numbers reflect a significant legacy deficit in public transit capacity. Under an electrification plus modal shift scenario, bus depot charging energy demand will reach approximately 74.7 MU by 2029–30, requiring multiple high-capacity depot sites, each with concurrent HT connections and solar-BESS integration, planned and grid-connected well before fleet procurement decisions are made.

Depot charging cannot be left to the same market forces that are gradually expanding the public charging network. It requires deliberate infrastructure planning, robust regulatory enablement and tailored financing arrangements. JVVNL, REDA and the transport department must jointly develop a bankable financing and procurement template—accessible to municipal operators that lack dedicated project development capacity—that packages Solar Energy Policy captive provisions, REVP reimbursements and the hybrid inverter order into a single coherent mechanism. Proactive engagement from JVVNL in feeder reinforcement planning must precede fleet procurement decisions, rather than reactively following them.

Formalize the solar-EV convergence pathway: The regulatory foundation for integrating solar power with EV charging is already in place. The Rajasthan Solar Energy Policy 2019 permits captive solar generation at charging stations, allows open access procurement, grants a 100 per cent exemption from transmission and wheeling charges for ten years for projects up to 25 MW, and permits energy banking annually at a 10 per cent adjustment charge.[36] The FY 2025–26 ToD structure reinforces this with a 10 per cent rebate between 12:00 and 16:00, sending a clear economic signal to shift grid loads into solar-rich mid-day hours. Despite these provisions, standalone CPOs cannot leverage this framework due to exorbitant HT connection costs, complex metering requirements and the effective lapse of REVP reimbursements. The TDPL–Tata Power hub demonstrates that the model works when a host entity provides land, an HT connection and captive solar, but this requires a willing institutional co-host that most CPOs cannot find independently.

Three specific interventions are required to make this a replicable template:

- First, RERC should issue a suo-motu order explicitly permitting sub-metering of EV charging loads behind existing HT connections at commercial, institutional and industrial premises, a provision already in place in Karnataka under KERC's 2024 guidelines,[37] allowing entities with HT connectivity to host CPO equipment without the CPO requiring a separate HT connection of its own.
- Second, the state government and JVVNL should compile and publish a roster

of government-owned premises and public land parcels with existing HT connections, made available via competitive tender as priority CPO deployment sites, directly replicating the TDPL land-and-connection model through public assets.
- Third, the Rs 5 lakh upstream infrastructure reimbursement under REVP 2022 must be restructured from a DISCOM-routed reimbursement, which DISCOM operating budgets are structurally unable to process at scale, into an upfront capital disbursement through a dedicated state EV fund with JVVNL as the nodal agency.

Beyond commercial hubs, Jaipur's 68.5 MW of installed residential rooftop solar under the PM Surya Ghar scheme, generating an estimated 3,01,000 kWh daily, sufficient to cover approximately 2,00,000 two-wheeler charges, represents an enormous distributed energy resource base that remains disconnected from the charging network. All necessary regulatory instruments are active, including mid-day ToD rebates, virtual net metering, BESS recognition and the February 2026 hybrid inverter permission. What is missing is an explicit institutional convergence mechanism. JVVNL and REDA must issue a joint circular, or update the REVP, to create a combined 'rooftop solar plus EV charger' package with a streamlined application process, simplified metering and a single financing window drawing on both solar and EV subsidies.

Mandate interoperability and a common discoverability platform: The 13 disconnected stations in the JCC network are an early signal of viability stress in a market where low utilization fails to recover capital costs. Fragmented CPO networks—each with proprietary applications, different payment systems and variable real-time availability tracking—compound this by artificially suppressing the effective utilization of stations that are fully operational. For a first-time EV user or a cab driver considering electrification, the inability to locate, authenticate and pay at a nearby charger through a single interface reinforces range anxiety even where infrastructure nominally exists. The state must mandate a common discoverability platform aggregating real-time availability across all CPO networks, and enforce the Ministry of Power's 2024 interoperability standards consistently across the older AC-based stations that dominate Jaipur's network.

Align urban planning with charging network design: The February 2025 Vidhan Sabha announcement of six operational zones for Jaipur's 45,508 registered e-rickshaws, with designated parking and charging locations within each zone, is the most concrete example in the city of a cross-departmental coordination mechanism that links vehicle regulation, parking allocation and charging infrastructure in a single administrative framework. For this to translate into functional infrastructure, each zone requires dedicated low-voltage connections under the EV tariff, proper weatherproofing and defined maintenance protocols. JVVNL must be formalized as an infrastructure-delivery partner in this process, and the model must be extended to e-auto aggregation points featuring battery swapping, consistent with the CMP's proposed network of 14 dedicated e-auto charging and swapping locations at metro stations and major traffic nodes across the city.

Establish a dedicated city-level implementation vehicle: The foundational missing piece is the absence of a joint operational protocol between JVVNL, REDA, JDA and the transport department. Each agency has taken positive steps within its own domain—JVVNL has improved the rooftop solar facilitation framework, the transport department has initiated e-rickshaw zoning, the building bye-laws have introduced EV-ready parking provisions for new construction, and RERC has progressively expanded net metering, VNM and BESS frameworks. These efforts remain disjointed. The entire parking-charging-supply-reliability chain must be treated as a single integrated problem, with assigned responsibilities for each link.

The state must operationalize a joint protocol through a dedicated city-level implementation mechanism, whether structured as a charging infrastructure cell within JVVNL's JCC operations, a joint sub-committee of the REVP nodal agency or a time-bound pilot programme anchored to a specific commercial segment. The foundation for this is already in place; ongoing distribution strengthening and feeder segregation, the expansion of RERC's VNM framework, the updated ToD tariff, 68.5 MW of installed residential solar in the JCC and the e-rickshaw zoning initiative is a proven cross-departmental template. The policy and infrastructure levers exist. The coordination architecture to translate them into tangible, ground-level charging access across Jaipur's diverse urban typologies is the only piece that remains to be built.

Appendices

Appendix A: Segment-wise Business-As-Usual (BAU) scenario outputs

Projection methodology

Vehicle registrations are projected forward using a sigmoid (S-curve) growth function for each segment, calibrated to the 2025–26 base year from VAHAN registration data. The S-curve reflects the empirical pattern of motorization in Indian cities—rapid growth through the middle phase of urban development followed by a gradual leveling off as the market approaches saturation. The pace and ceiling of this ramp are governed jointly by two forces; firstly, the city's carrying capacity for each vehicle type as benchmarked against comparable Indian cities, and secondly the real per capita income growth for private vehicle segments (Car, Cab, and 2W), where rising incomes expand the share of households that can afford and sustain vehicle ownership. The income trajectory is anchored to Jaipur's GDDP from the Rajasthan Economic Review 2023–24[38] and projected forward using IMF World Economic Outlook (October 2024)[39] baseline growth rates, following the Gompertz-style income-motorization relationship documented in Singh, Mishra and Banerjee (2020)[40] and B. Ajay Krishna (2025).[41]

Survival function

The on-road fleet at each future year is built by applying a logistic survival function to historical and projected registration cohorts, following the form used in Pandey and Venkataraman (2014),[42] adapted for Jaipur's tier-2 city context. The survival function governs the rate at which older vehicles retire from the fleet, a critical determinant of both fleet size and emissions, since older BS3 and BS4 vehicles emit several times more per kilometer than newer BS6 entrants. Median vehicle lifetimes (L50) and steepness parameters (α) are calibrated *(see Table 1: Median vehicle lifetimes (L50) and steepness parameters (α)).*

Table 1: Median vehicle lifetimes (L50) and steepness parameters (α)

Segment	Median lifetime (L50)	Steepness ($)
2W, 3W, E-rickshaw, Cab	10.1 years	−2.9
Car	19.8 years	−5.2
Bus, Bus-inst, LCV, Truck, Off-road	13.0 years	−4.5

These parameters reflect the observation that in Jaipur, as in other Indian cities, two-wheelers and three-wheelers turn over faster than cars, while heavy vehicles and buses are retained longer due to higher capital cost and fleet management practices.

Stock caps

Population- and income-modulated stock caps are imposed to ensure projections remain grounded in the city's realistic carrying capacity. The cap per 1,000 population rises linearly from the base year observed rate to a 2055 ceiling, with Car, Cab, and 2W additionally modulated by the GDP per capita index so that the ceiling itself rises as incomes grow. The caps applied are mentioned below *(see Table 2: Segment-wise registration caps per 1000 population)*.

Table 2: Segment-wise registration caps per 1000 population

Segment	2025–26 observed (per 1,000)	2055 ceiling (per 1,000)
2W	464	700
Car	131	480
E-rickshaw (passenger)	5.8	50
Passenger three-wheeler	6.6	50
Bus	2.0	6.0

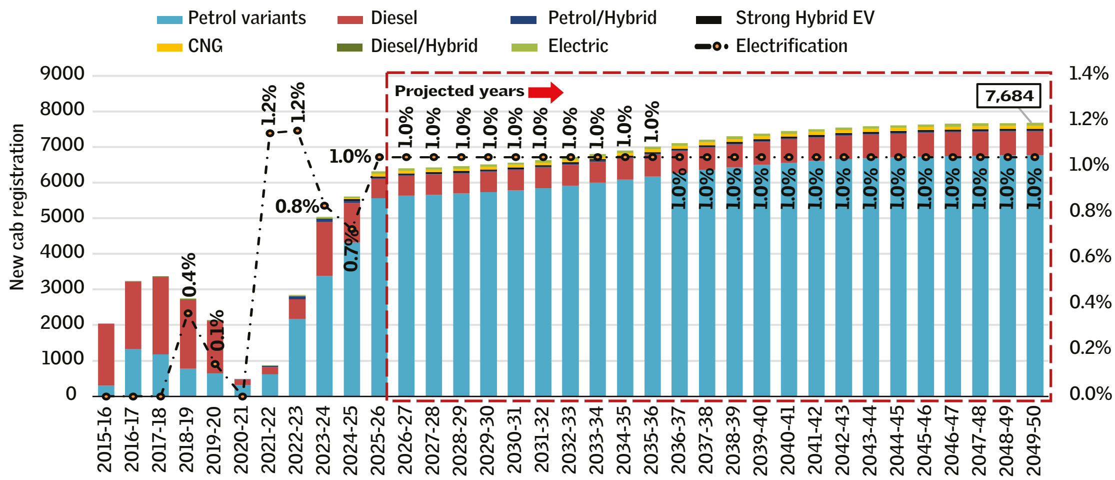
Two segments are excluded from population-based caps. Off-road equipment (tractors and construction machinery) serves peri-urban and rural areas within the RTO boundary, making an urban population ratio methodologically inappropriate. Trucks are similarly excluded as freight demand is driven by economic activity rather than residential population. For all other segments, cap enforcement tapers gradually over 20 years from the base year to avoid unrealistic single-year cliffs in the projection.

BAU fuel mix

Under BAU, the fuel mix of new registrations in each segment is held constant at the 2025-26 base year observed shares from VAHAN data. No additional electrification policy beyond what is already visible in current registration trends is assumed.

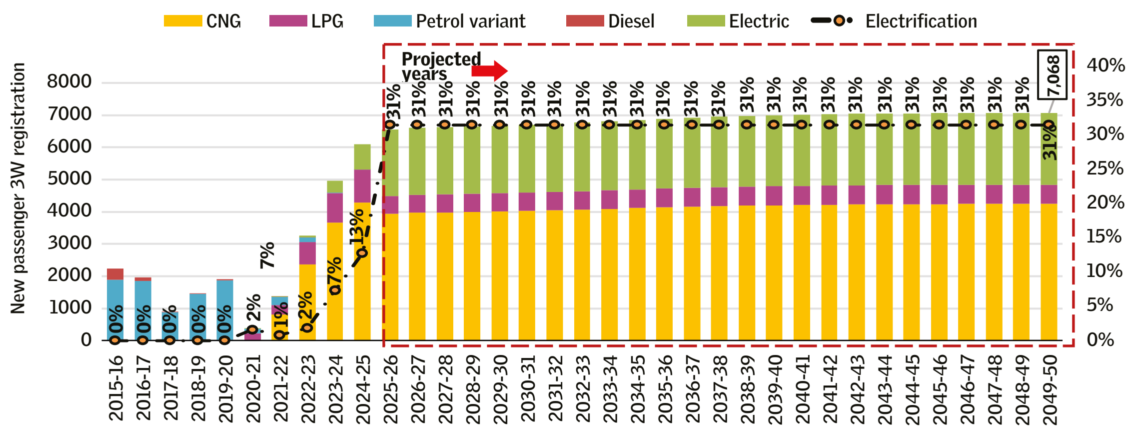
The modal share assumptions for BAU follow Jaipur CMP 2026[43] (Table 3.8 and Table 3.18), as shown below *(see Table 3: Modal share assumption for BAU)*.

Graph 1: Jaipur cab BAU projections till 2049–50



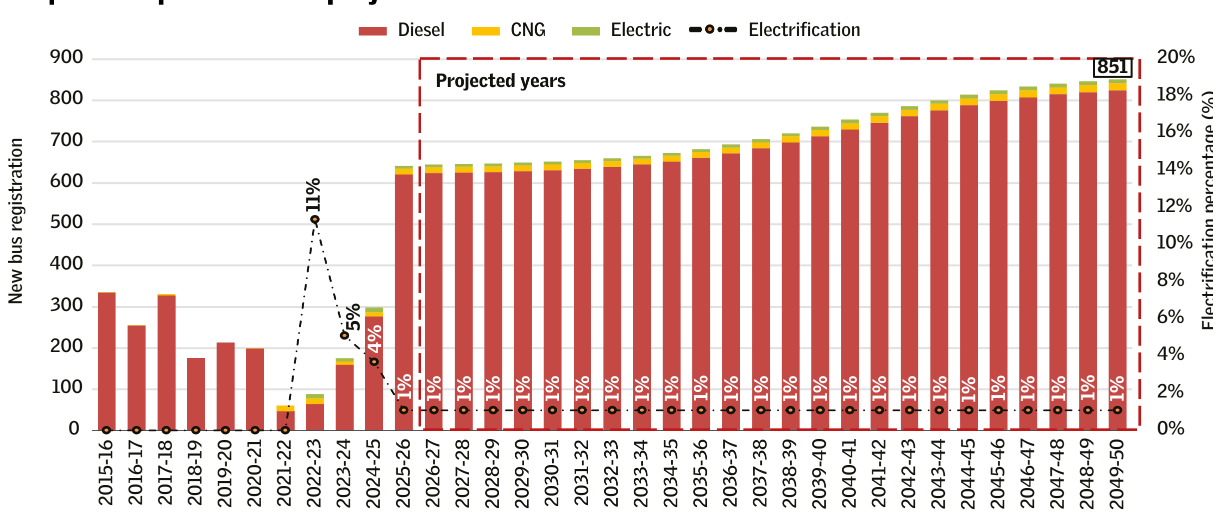
Source: CSE analysis

Graph 2: Jaipur passenger three-wheeler BAU projections till 2049–50



Source: CSE analysis

Graph 3: Jaipur bus BAU projections till 2049–50



Source: CSE analysis

Table 3: Modal share assumption for BAU

Mode	Base 2024	BAU 2055
Car	11.4%	12.1%
2W	34.1%	36.9%
Auto Rickshaw (IPT)	16.4%	15.1%
PT (bus + e-rick + shared)	15.2%	14.0%
Cycle	2.7%	2.5%
Walk	20.2%	19.4%

Source: Jaipur CMP, 2026

Note that under BAU these mode shares do not alter registration projections directly—they inform the context but do not rescale vehicle counts, since BAU carries forward current market momentum without structural policy intervention.

The following graphs showcase the segment-wise vehicle registrations projected till 2049–50 under a business-as-usual (BAU) condition.

Appendix B: Electrification plus modal shift scenario outputs

The Public Transportation (PT) scenario applies two structural interventions on top of the BAU baseline. First, EV penetration targets are imposed on new registrations for each segment, ramping linearly from 2030 interim targets anchored to the NITI Aayog–RMI (2021)[44] roadmap to 2055 end-state targets drawn from the Jaipur CMP 2026 Technology Scenario (Table 3.20). Second, the composition of the motorized vehicle pool is gradually shifted to reflect the Jaipur CMP 2026 modal share targets for 2055, translated from trip shares to registration-level scale factors through the full physical chain of passenger-kilometers, vehicle occupancy, and annual VKT per vehicle, ensuring that the high occupancy of buses (approximately 35 passengers per vehicle) and e-rickshaws is correctly accounted for rather than applying trip shares directly to registration counts. The stock caps remain identical to BAU—the PT scenario assumes the same ultimate carrying capacity for each segment, but reaches it along a cleaner and more transit-oriented trajectory.

Table 1: Modal share assumption for electrification plus modal shift scenario

Mode	Base 2024	PT Scenario 2055
Car	11.4%	10.5%
2W	34.1%	31.8%
Auto Rickshaw (IPT)	16.4%	15.6%
PT (bus+e-rick+shared)	15.2%	18.4%
Cycle	2.7%	4.7%
Walk	20.2%	19.0%

Source: Jaipur CMP, 2026

The scenarios assume segment-wise EV penetration for years 2029–2030 and 2049–50 as follows:

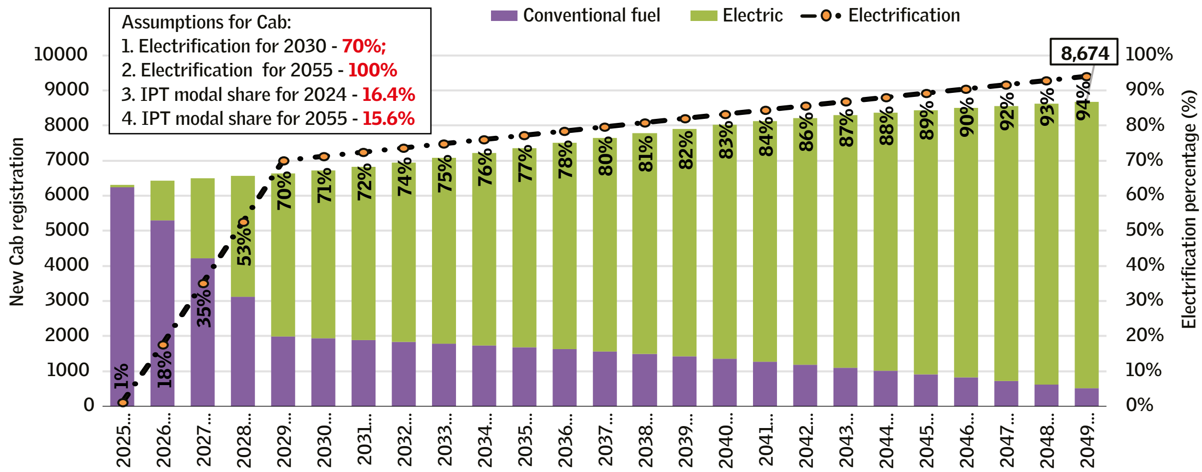
Table 2: Electrification target assumptions

Vehicle segment	2030 electrification target	2055 electrification target
Private two-wheeler	80%	100%
Private car	30%	80%
Passenger three-wheeler	80%	100%
Cab	70%	100%
Bus	40%	100%

Sources: NITI Aayog–RMI (2021) for 2030 targets; Jaipur CMP 2026 Table 3.20 for 2055 targets

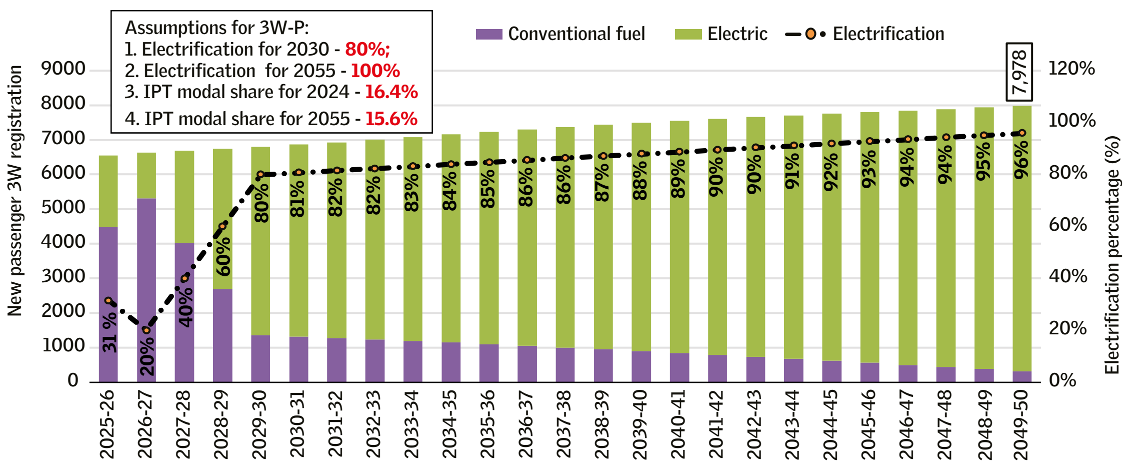
The following graphs showcase the segment-wise vehicle registrations projected till 2049–50 under electrification plus modal shift scenario condition.

Graph 1: Jaipur cab scenario projections till 2049–50



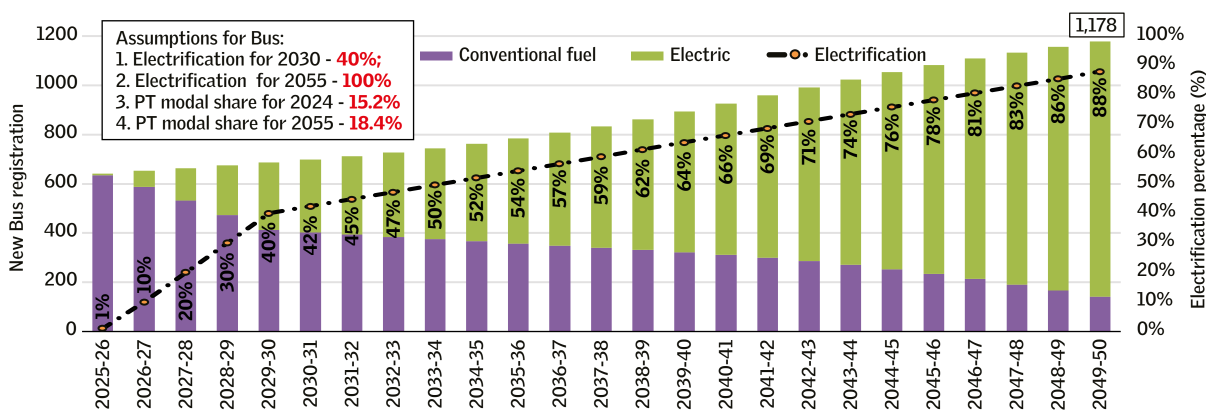
Source: CSE analysis

Graph 2: Jaipur passenger three-wheeler scenario projections till 2049–50



Source: CSE analysis

Graph 3: Jaipur bus scenario projections till 2049–50

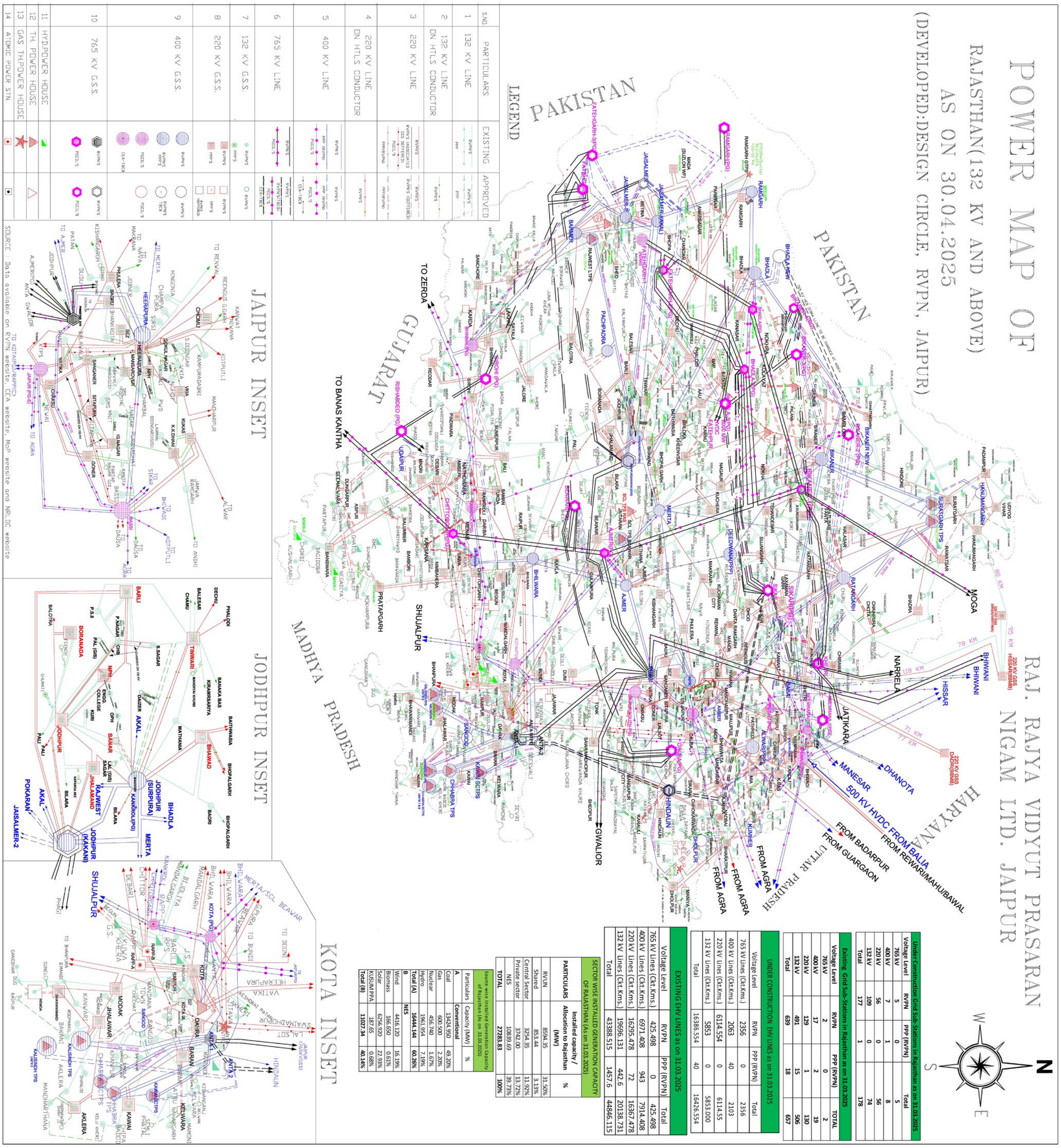


Source: CSE analysis

Appendix C: Transmission maps

Power map of Rajasthan (132 kV and above)

Map 1: Power map of Rajasthan (132 kV and above



References

1 NITI Aayog, 2026. Scenarios Towards Viksit Bharat and Net Zero - Sectoral Insights: Power (Vol. 7), *Government of India*. Accessed at https://niti.gov.in/sites/default/files/2026-02/Scenarios-Towards-Viksit-Bharat-and-Net-Zero-Sectoral-Insights-Power.pdf

2 CEA 2022. Report on twentieth electric power survey on India (Volume I), *Central Electricity Authority*. Accessed at https://cea.nic.in/wp-content/uploads/ps___lf/2022/11/20th_EPS____Report___Final___16.11.2022.pdf

3 Anon 2022. Rajasthan Electric Vehicle Policy (REVP) 2022, *Transport and Road Safety Department, Government of Rajasthan*. Accessed at https://istart.rajasthan.gov.in/public/pdf/REVP_2022.pdf

4 Anon 2019, Rajasthan Solar Energy Policy, 2019, *Energy Department, Government of Rajasthan*. Accessed at https://jankalyanfile.rajasthan.gov.in/Content/UploadFolder/OrderEntry/Rajasthan_Urja_Vikas_Nigam_Ltd/2022/Policy/O_131219_fcc851bd-0757-4fb6-b3c4-2e4306c9099c.pdf

5 Anon 2024, Rajasthan Integrated Clean Energy Policy 2024, *Energy Department, Government of Rajasthan*. Accessed at https://rising.rajasthan.gov.in/storage/app/public/files/pdf/rajasthan-integrated-clean-energy-policy.pdf

6 Anon 2025, (Grid Interactive Distributed Renewable Energy Generating Systems) (Third Amendment) Regulations, Notification No. RERC/Secy./Reg./ 159, Rajasthan Electricity Regulatory Commission, Government of Rajasthan. Accessed at https://rerc.rajasthan.gov.in/rerc-user-files/regulations

7 Anon2025,RERCPetitionNo.RERC2303/2025,2304/2025,2305/2025,*Rajasthan Electricity Regulatory Commission, Government of Rajasthan*. http://jankalyanfile.rajasthan.gov.in/Content/UploadFolder/DepartmentMaster/9/2025/Oct/30409/9149fb6c6-f0d3-4e88-9527-8361a8a092a4.pdf

8 Anon 2025, Master Development Plan -2025 Jaipur Region. *Jaipur Development Authority, Government of Rajasthan*. Accessed at https://jda.rajasthan.gov.in/content/dam/raj/udh/development-authority/jda-jaipur/pdf/MDP/Vol4.pdf

9 Rakesh Ranjan 2026, Rajasthan allows hybrid inverters in Rooftop solar systems to support grid stability, *Mercom*. Accessed at https://www.mercomindia.com/rajasthan-allows-hybrid-inverters-in-rooftop-solar-systems-to-support-grid-stability

10 Anon 2024, Guidelines for EV charging infrastructure 2024, *Ministry of Power*. Accessed at https://sansad.in/getFile/annex/266/AU1587_y7ofyg.pdf?source=pqars

11 Anon 2025, (Grid Interactive Distributed Renewable Energy Generating Systems) (Third Amendment) Regulations, Notification No. RERC/Secy./Reg./ 159,

Rajasthan Electricity Regulatory Commission, Government of Rajasthan. Accessed at https://rerc.rajasthan.gov.in/rerc-user-files/regulations

12 Anon 2026, Comprehensive mobility plan for Jaipur City, *Jaipur Development Authority, Government of Rajasthan*. Accessed at https://jdaservice.rajasthan.gov.in/pdf/others/Jaipur_CMP_Report_022026.pdf

13 Anon 2019, Rajasthan Solar Energy Policy, 2019, *Energy Department, Government of Rajasthan*. Accessed at https://jankalyanfile.rajasthan.gov.in/Content/UploadFolder/OrderEntry/Rajasthan_Urja_Vikas_Nigam_Ltd/2022/Policy/O_131219_fcc851bd-0757-4fb6-b3c4-2e4306c9099c.pdf

14 Anon 2025, RERC Petition No. RERC 2303/2025, 2304/2025, 2305/2025, *Rajasthan Electricity Regulatory Commission, Government of Rajasthan*. http://jankalyanfile.rajasthan.gov.in/Content/UploadFolder/DepartmentMaster/9/2025/Oct/30409/9149fb6c6-f0d3-4e88-9527-8361a8a092a4.pdf

15 KERC 2024, Streamlining of Procedure for Installation of EV (Electric Vehicle) Charging Units, *Karnataka Electricity Regulatory Commission, Government of Karnataka*. Accessed at https://kerc.karnataka.gov.in/uploads/media_to_upload1722331998.pdf

16 Anon 2026, Tom Tom traffic index. Accessed at https://www.tomtom.com/traffic-index/city/jaipur

17 Anon 2022. Rajasthan Electric Vehicle Policy (REVP) 2022, *Transport and Road Safety Department, Government of Rajasthan*. Accessed at https://istart.rajasthan.gov.in/public/pdf/REVP_2022.pdf

18 NITI Aayog, 2026. Scenarios Towards Viksit Bharat and Net Zero - Sectoral Insights: Power (Vol. 7), *Government of India*. Accessed at https://niti.gov.in/sites/default/files/2026-02/Scenarios-Towards-Viksit-Bharat-and-Net-Zero-Sectoral-Insights-Power.pdf

19 NITI Aayog, 2026. Scenarios Towards Viksit Bharat and Net Zero - Sectoral Insights: Power (Vol. 7), *Government of India*. Accessed at https://niti.gov.in/sites/default/files/2026-02/Scenarios-Towards-Viksit-Bharat-and-Net-Zero-Sectoral-Insights-Power.pdf

20 CEA 2024. Report on twentieth electric power survey on India (Volume III - Megacities), *Central Electricity Authority*. Accessed at https://cea.nic.in/wp-content/uploads/ps____lf/2025/01/20th_EPS_Vol_III_Megacities_Report.pdf

21 CEA 2022. Report on twentieth electric power survey on India (Volume I), *Central Electricity Authority*. Accessed at https://cea.nic.in/wp-content/uploads/ps____lf/2022/11/20th_EPS_____Report____Final____16.11.2022.pdf

22 Anon 2025, RERC Petition No. RERC 2303/2025, 2304/2025, 2305/2025, *Rajasthan Electricity Regulatory Commission, Government of*

Rajasthan. http://jankalyanfile.rajasthan.gov.in/Content/UploadFolder/DepartmentMaster/9/2025/Oct/30409/9149fb6c6-f0d3-4e88-9527-8361a8a092a4.pdf

23 Anon 2025, (Grid Interactive Distributed Renewable Energy Generating Systems) (Third Amendment) Regulations, Notification No. RERC/Secy./Reg./ 159, Rajasthan Electricity Regulatory Commission, Government of Rajasthan. Accessed at https://rerc.rajasthan.gov.in/rerc-user-files/regulations

24 Anon 2025, Master Development Plan -2025 Jaipur Region. *Jaipur Development Authority, Government of Rajasthan*. Accessed at https://jda.rajasthan.gov.in/content/dam/raj/udh/development-authority/jda-jaipur/pdf/MDP/Vol4.pdf

25 Anon 2024, Rajasthan Integrated Clean Energy Policy 2024, *Energy Department, Government of Rajasthan*. Accessed at https://rising.rajasthan.gov.in/storage/app/public/files/pdf/rajasthan-integrated-clean-energy-policy.pdf

26 Anon 2026, Draft Rajasthan Electricity Regulatory Commission (Demand Flexibility (DF)/Demand Side Management (DSM) Regulations, 2026, *Rajasthan Electricity Regulatory Commission, Government of Rajasthan*. Accessed at https://www.eqmagpro.com/wp-content/uploads/2026/02/DOC-1-12_compressed.pdf

27 KERC 2024, Streamlining of Procedure for Installation of EV (Electric Vehicle) Charging Units, Karnataka Electricity Regulatory Commission, Government of Karnataka. Accessed at https://kerc.karnataka.gov.in/uploads/media_to_upload1722331998.pdf

28 CEA 2024. Report on twentieth electric power survey on India (Volume III - Megacities), *Central Electricity Authority*. Accessed at https://cea.nic.in/wp-content/uploads/ps___lf/2025/01/20th_EPS_Vol_III_Megacities_Report.pdf

29 NITI Aayog, 2026. Scenarios Towards Viksit Bharat and Net Zero - Sectoral Insights: Power (Vol. 7), *Government of India*. Accessed at https://niti.gov.in/sites/default/files/2026-02/Scenarios-Towards-Viksit-Bharat-and-Net-Zero-Sectoral-Insights-Power.pdf

30 Rakesh Ranjan 2026, Rajasthan allows hybrid inverters in Rooftop solar systems to support grid stability, *Mercom*. Accessed at https://www.mercomindia.com/rajasthan-allows-hybrid-inverters-in-rooftop-solar-systems-to-support-grid-stability

31 Anon 2025, Master Development Plan -2025 Jaipur Region. *Jaipur Development Authority, Government of Rajasthan*. Accessed at https://jda.rajasthan.gov.in/content/dam/raj/udh/development-authority/jda-jaipur/pdf/MDP/Vol4.pdf

32 Anon 2024, Guidelines for EV charging infrastructure 2024, *Ministry of Power*. Accessed at https://sansad.in/getFile/annex/266/AU1587_y7ofyg.pdf?source=pqars

33 Anon 2025, (Grid Interactive Distributed Renewable Energy Generating Systems) (Third Amendment) Regulations, Notification No. RERC/Secy./Reg./ 159, Rajasthan Electricity Regulatory Commission, Government of Rajasthan. Accessed at https://rerc.rajasthan.gov.in/rerc-user-files/regulations
34 Anon 2025, RERC Petition No. RERC 2303/2025, 2304/2025, 2305/2025, *Rajasthan Electricity Regulatory Commission, Government of Rajasthan*. http://jankalyanfile.rajasthan.gov.in/Content/UploadFolder/DepartmentMaster/9/2025/Oct/30409/9149fb6c6-f0d3-4e88-9527-8361a8a092a4.pdf
35 Anon 2026, Comprehensive mobility plan for Jaipur City, *Jaipur Development Authority, Government of Rajasthan*. Accessed at https://jdaservice.rajasthan.gov.in/pdf/others/Jaipur_CMP_Report_022026.pdf
36 Anon 2019, Rajasthan Solar Energy Policy, 2019, *Energy Department, Government of Rajasthan*. Accessed at https://jankalyanfile.rajasthan.gov.in/Content/UploadFolder/OrderEntry/Rajasthan_Urja_Vikas_Nigam_Ltd/2022/Policy/O_131219_fcc851bd-0757-4fb6-b3c4-2e4306c9099c.pdf
37 KERC 2024, Streamlining of Procedure for Installation of EV (Electric Vehicle) Charging Units, Karnataka Electricity Regulatory Commission, Government of Karnataka. Accessed at https://kerc.karnataka.gov.in/uploads/media_to_upload1722331998.pdf
38 Anon 2024, Economic Review 2023–24, *Statistics Department, Government of Rajasthan, Jaipur*. Accessed at https://finance.rajasthan.gov.in
39 Anon 2024, World Economic Outlook: Policy Pivot, Rising Threats, International Monetary Fund. Accessed at https://www.imf.org/en/publications/weo/issues/2024/10/22/world-economic-outlook-october-2024
40 Namita Singh, Trupti Mishra, Rangan Banerjee 2020, Projection of Private Vehicle Stock in India up to 2050, *Transportation Research Procedia*. Accessed at https://www.sciencedirect.com/science/article/pii/S2352146520305329?via%3Dihub
41 B. Ajay Krishna 2025, Projections of private vehicle ownership, energy demand and vehicular emissions — a study of metropolitan cities in India, *Journal of the Asia Pacific Economy*. Accessed at https://doi.org/10.1080/13547860.2024.2333095
42 Apoorva Pandey, Chandra Venkataraman 2014, Estimating emissions from the Indian transport sector with on-road fleet composition and traffic volume, *Atmospheric Environment*. Accessed at https://doi.org/10.1016/j.atmosenv.2014.08.039
43 Anon 2026, Comprehensive mobility plan for Jaipur City, *Jaipur Development Authority, Government of Rajasthan*. Accessed at https://jdaservice.rajasthan.gov.in/pdf/others/Jaipur_CMP_Report_022026.pdf
44 Anon 2021, Mobilising Finance for EVs in India: A Toolkit of Solutions to Mitigate Risks and Address Market Barriers, *NITI Aayog and RMI India*. Accessed at: https://www.niti.gov.in/sites/default/files/2021-01/RMI-EVreport-VF_28_1_21.pdf

As motorization surges, Jaipur stands at a critical crossroads where accelerating fleet electrification offers significant potential for cleaner air and climate mitigation. While the city boasts a progressive regulatory framework for electric vehicles (EVs)—including the Rajasthan Electric Vehicle Policy 2022 and cutting-edge Solar Energy Policies—there is a widening 'operationalization gap' at the city level. Charging infrastructure remains the most vital intervention point to stimulate dormant demand for EVs. Unlocking this demand requires treating EV charging not as an aftermarket addition, but as a core capital investment pipeline. By leveraging its massive residential solar base and identifying strategic high-capacity charging hubs, Jaipur can build the consumer confidence needed to catalyze a genuine zero-emissions transition.

Jaipur's actual power consumption has already surpassed 2027–28 national forecasts, signalling that current electricity infrastructure planning underestimates EV-driven demand. To prevent impending grid stress Jaipur must move beyond standard upgrades toward proactive, granular modernization of its downstream distribution networks, specifically at the feeder and transformer levels. The path forward requires a transformative 'convergence agenda' that integrates solar power directly into the charging ecosystem. While personal EVs will rely on home charging, which faces 'apartment complex barriers,' commercial fleets are currently affected by a sparse public network and regulatory load ceilings that throttle fast-charging hardware. Targeted interventions can incentivize charging operators and accelerate the EV transition.

Centre for Science and Environment
41, Tughlakabad Institutional Area, New Delhi 110 062
Phone: 91-11-40616000 Fax: 91-11-29955879
E-mail: cse@cseindia.org Website: www.cseindia.org