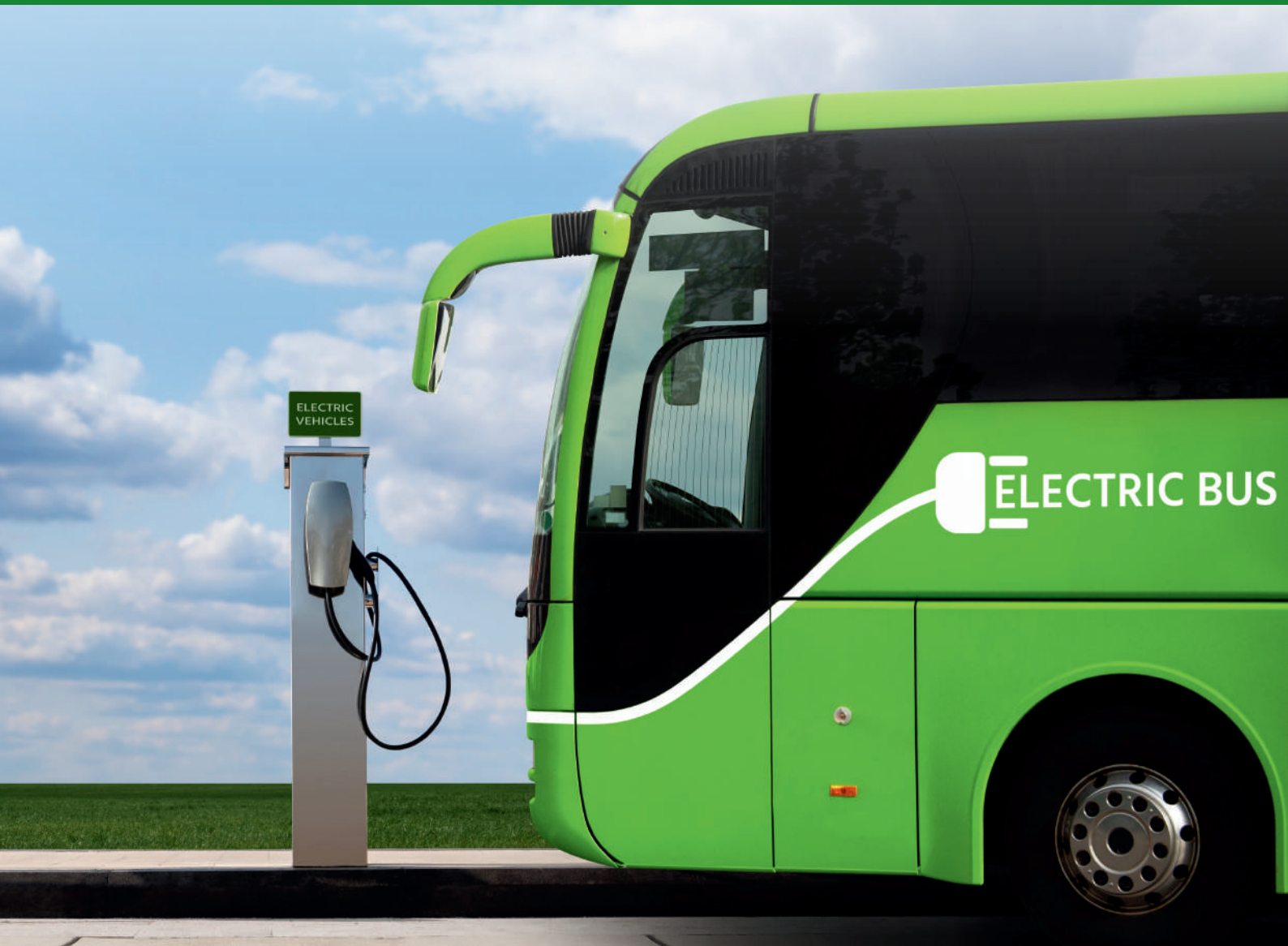
Power Foundation of India

Incidence of Electric Bus Charging on DISCOMs' Network and Scope for Optimal Power Purchase

2025

Report by: Power Foundation of India



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Acknowledgements: We extend our sincere gratitude to Mr. Amal Sinha (Group CEO, BSES Delhi DISCOMs), Mr. Abhishek Ranjan (CEO, BSES Rajdhani Power Ltd.), Mr. Dwijadas Basak (CEO, Tata Power Delhi Distribution Ltd.), Mr. Brajesh Kumar (COO, BSES Yamuna Power Ltd.) and other Officials of Delhi DISCOMs for their valuable insights, comments, and suggestions that have greatly enriched this report.

Disclaimer: The views and opinions expressed in this report are based on information shared by Delhi DISCOMs, internal analysis, and other sources considered reliable. However, they have not been independently verified. While every effort has been made to ensure accuracy and completeness, PFI assumes no responsibility or liability for errors, omissions, or the accuracy of the information contained herein. Readers are advised to exercise their own judgment and rely on multiple sources before making decisions based on this report.

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Report by: Power Foundation of India
(A Society under the Aegis of the Ministry of Power, Government of India)

Incidence of Electric Bus Charging on DISCOMs' Network and Scope for Optimal Power Purchase

August 2025

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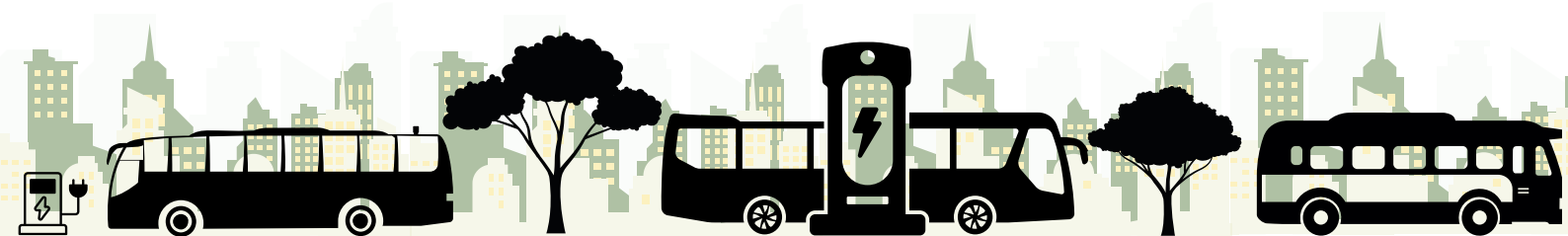

Foreword

Dr. Srikant Nagulapalli, IAS

Director General

Power Foundation of India

India's energy transition is among the most ambitious in the world, and electric mobility is a key pillar of this journey. It is essential to achieve the national goal of Net-Zero emissions by 2070. Road transport is one of the largest sources of CO_2 emissions. Electrification of vehicles, therefore, holds a central place in India's clean energy strategy, as it not only helps reduce emissions but also lower dependence on imported fossil fuels.

To promote electric mobility, the Government of India has introduced several supportive policies and incentives. These include subsidies for purchasing electric vehicles under the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme, Production Linked Incentive (PLI) schemes for domestic manufacturing of vehicles and battery cells, tax concessions for EV chargers and charging stations, and capital subsidies to Oil Marketing Companies (OMCs) for establishing public charging infrastructure.

At the same time, the rapid growth of electric vehicles presents new challenges for the power sector. Distribution Companies (DISCOMs), already managing rising non-solar hour peak electricity demand, must now prepare to integrate large electric fleets into the grid. Unplanned charging could add to short-term peak loads, increasing the need for costly power procurement during peak hours.

In this context, PFI has undertaken this important study, which addresses the critical issue of optimising peak demand and reducing power purchase costs for DISCOMs. Such initiatives are vital for ensuring that India's e-mobility transition remains economically viable.

Acknowledgements

Amal Sinha, Group CEO,
BSES Delhi DISCOMs

BSES is committed to powering a greener, smarter, and more resilient energy future for Delhi, ultimately benefiting consumers with reliable, cost-effective, and environmentally responsible energy solutions. In this direction, this Report of PFI will certainly support DISCOMs in achieving its target.

Abhishek Ranjan, CEO,
BSES Rajdhani Power Ltd.

PFI has done commendable work of addressing the core issue of optimisation of Peak Demand of DISCOMs through collaboration with BRPL, which will be fruitful for the consumers of Delhi at large.

Dwijadas Basak, CEO,
TATA Power
Delhi Distribution Ltd.

TPDDL, in its continuous efforts of give impetus to clean and green technology initiatives, is leading as a front-runner utility in the country by scaling up its electric vehicle fleet. PFI Report will definitely help in optimising the Charging of the Electric Fleet.

Brajesh Kumar, COO,
BSES Yamuna Power Ltd.

PFI has actively engaged with Delhi DISCOMs and has come out with very pertinent recommendations for managing peak demand in Delhi. The study findings will help DISCOMs and policymakers in creating a sustainable and resilient power infrastructure ecosystem for the benefit of our esteemed customers.

Anshuman Srivastava
Executive Director,
Power Foundation of India

I commend the efforts of the PFI for producing this comprehensive and forward-looking analysis. The insights from this report will be valuable for all stakeholders as we work together to deliver on India's energy aspirations.

Praveen Kumar Singh
Senior Advisor,
PFI

Dr. Sambit Basu
Head - Research,
PFI

E-mobility is the need of the hour, but it is struggling with core issues, such as charging at Peak hours at a costlier rate and non-rationalised tariffs for charging EVs, etc. This report makes a timely and valuable contribution by addressing these very questions in a structured and data-driven manner.

About the Author

Himanshu Chawla
Head - Regulatory (Senior Specialist),
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Himanshu Chawla has an experience of around 16 years in the Power Sector across various domains and has served in various capacities at State Electricity Regulatory Commissions (DERC & HERC), Essar Power (Commissioning of 2X600 MW Power Plant) and ICRA (Consultancy) wherein he has effectively utilised his Techno-Commercial Educational qualifications of Management, Engineering and Climate Change from University of British Columbia. His last position was Joint Director (Tariff-Engineering) in DERC.

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An Engineering Graduate with an MBA in Power Management and over 10 years of experience in the Power Sector focusing on policy.

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Executive Summary

The Government of India has been actively promoting the transition to electric mobility through policy and financial interventions such as the Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) scheme, Production Linked Incentives (PLI) for Electric Vehicle and battery manufacturing, and capital subsidies for the development of public charging infrastructure. These efforts are aimed at enabling India to achieve its target of 30% EV market share by 2030 (EV30@30).

According to the Central Electricity Authority (CEA), nearly 491 lakh EVs are expected to be on the road by FY 2031-32, translating into an additional annual electricity demand of 27,000 MU and a peak demand of 5,000 MW. Within this shift, electric buses (E-buses) represent a critical segment, both for their environmental benefits and for the challenges they pose to the electricity distribution system.

While the operation of E-buses compared to conventional Internal Combustion Engine (ICE) based buses offers significant reductions in urban pollution, their charging demand is highly intermittent and often coincides with peak electricity requirements. In Delhi, this overlap has compelled distribution companies (DISCOMs) to rely on expensive short-term power purchases to meet the additional load, placing a direct financial burden on utilities and, ultimately, on consumers. Simultaneously, the rapid growth in E-bus fleets has triggered a surge in applications for new electricity connections for E-bus depots. DISCOMs are, therefore, required to invest in distribution network upgrades, while also supplying power at regulated cross-subsidised tariffs, further intensifying the pressure on their financial viability.

This study, undertaken jointly by Power Foundation of India (PFI) and Delhi's three DISCOMs - BSES Rajdhani Power Limited (BRPL), BSES Yamuna Power Limited (BYPL), and Tata Power Delhi Distribution Limited (TPDDL) - is the first of its kind to analyse the impact of E-bus charging on peak demand of Delhi using actual half-hourly operational data. The analysis draws upon detailed feeder-level consumption patterns at E-bus depots, Power Purchase cost data across short, medium and long-term contracts, and demand profiles across consumer categories.

Extensive consultations with DISCOM officials, site visits to multiple E-bus depots, and discussions with stakeholders, including the Delhi Transport Corporation (DTC) and bus aggregators such as Tata Motors, enriched the study with practical insights into operational models and stakeholder responsibilities.

The findings clearly establish that **the major portion of E-bus charging demand coincides with the system peak of Delhi's DISCOMs**, resulting in the additional procurement of short-term power at an average cost of approximately Rs. 8.50/kWh. However, the analysis also reveals a significant opportunity for optimisation. Since E-buses typically remain at depots longer than their actual charging time, shifting charging schedules to align with the availability of cheaper long-term power can reduce peak load pressures without requiring additional capital expenditure. Such optimisation measures alone could result in cumulative savings of approximately Rs. 638 crore by FY 2030 for Delhi's targeted E-bus charging load of 500 MW.

The study also highlights the role of Battery Energy Storage Systems (BESS) as an enabler of cost optimisation and peak shaving. The deployment of double-cycle BESS at strategic locations can address both afternoon and nighttime peaks, offering combined network and Power Purchase cost savings. Depending on the funding mechanism, the projected savings by FY 2030 range from Rs. 751 crore (without Power System Development Fund (PSDF) support) to over Rs. 1,366 crore (with PSDF support). Even under a single-cycle peak-demand use case, BESS delivers substantial financial benefits, with savings exceeding Rs. 1,700 crore in scenarios where PSDF funding is available.

Key Recommendations

To translate these opportunities into actionable measures, the Report recommends:

a) **Optimisation of Charging Schedules:** Aligning E-bus charging slots with long-term power availability to minimise short-term power purchases and reduce DISCOMs' overall Power Purchase Costs.

b) Strategic Deployment of BESS: Installing short-duration storage at depots, with DTC providing land at zero cost and funding drawn from the Power System Development Fund (PSDF) to avoid consumer burden.

c) Tariff and Regulatory Support: Tariff for EV Charging Station and its Time-of-Day (ToD) pricing framework by Delhi Electricity Regulatory Commission (DERC) should align with the guidelines issued by Ministry of Power.

d) Stakeholder Coordination: Mandating aggregators to share future load projections with DISCOMs and requiring DTC to adopt revised charging schedules to optimise system costs.

The evidence shows that adopting these measures can deliver substantial financial savings, enhance system reliability, and lower the Average Cost of Supply (ACoS) for consumers. Moreover, the approach developed in Delhi provides a replicable framework for other Indian cities as they expand their E-bus fleets.

With coordinated policy, regulatory, and operational interventions, India can achieve its EV adoption goals while ensuring that the power sector remains cost-effective and resilient.


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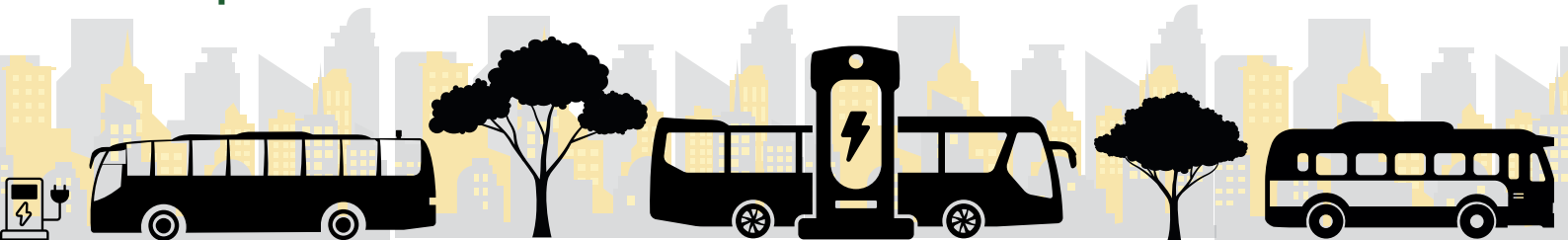

Abbreviations

ABR	Average Billing Rate
ACoS	Average Cost of Supply
ARR	Aggregate Revenue Requirement
BESS	Battery Energy Storage System
BRPL	BSES Rajdhani Power Ltd.
BYPL	BSES Yamuna Power Ltd.
CAPEX	Capital Expenditure
CEA	Central Electricity Authority
DISCOM	Distribution Company
DTC	Delhi Transport Corporation
E-Bus	Electric Bus
FAME	Faster Adoption and Manufacturing of (Hybrid) and Electric Vehicle
GoI	Government of India
GoNCTD	Government of National Capital Territory of Delhi
GW	Giga-watt
kWh	kilo-Watt hour
MoP	Ministry of Power
MU	Million Units
MVA	Mega Volt Ampere

Abbreviations

MW	Mega Watt
NDA	Non- Disclosure Agreement
NCT	National Capital Territory
PLI	Production Linked Incentive
PPA	Power Purchase Agreement
PSDF	Power System Development Fund
PX	Power Exchange
SOC	State of Charging
STPP	Short- term Power Power Purchase
ToD	Time of Day
TPDDL	Tata Power Delhi Distribution Limited
TRANSCO	Transmission Company

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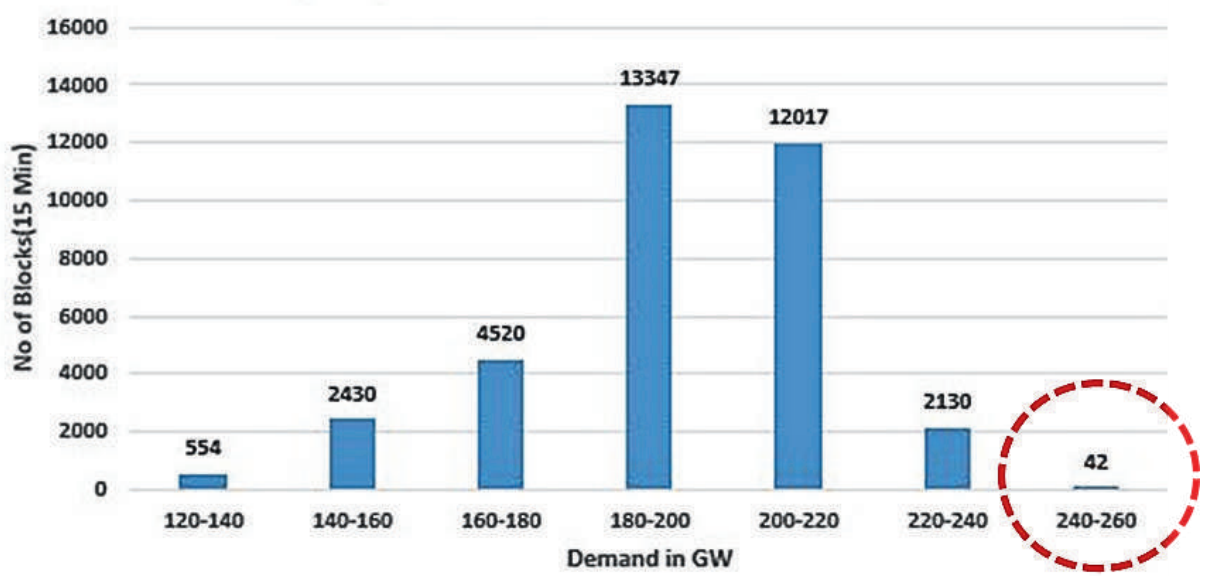
100% ELECTRIC.
100% ELECTRIC.
0%

Background

India's electricity peak demand has grown significantly—from 157 GW in FY 2015–16 to 250 GW in FY 2024–25 (CEA). However, peak demand occurs only for a very limited duration, approximately 0.1% of the total annual hours (or 42 time blocks), as illustrated in Figure 1 below.

Figure 1: Frequency Distribution of Demand in FY 2024-25



Source: Grid Controller of India, PSP Reports, Time Series Data

DISCOMs are mandated under Section 43 of the Electricity Act, 2003 ("Duty to Supply on Request") to maintain sufficient network capacity to meet such peaks, incurring corresponding Power Purchase and network costs.

The Hon'ble Supreme Court, in its judgment dated May 19, 2023, in KC Ninan v. Kerala State Electricity Board, reinforced this obligation by ruling that *"the owner or occupier has the statutory right to demand electricity for the premises under their use or occupation."*[1]

Section 43 casts duty of Universal Service Obligation on DISCOMs and timely supply of electricity connection to consumers. Further, Hon'ble Madras High Court vide its judgement dtd. 27/09/2013 in the matter of T.M. Prakash vs The District Collector, Tiruvannamalai held that access to electricity should be construed as a Human Right. Denial of the same, upon even satisfying the requirements, would amount to violation of Human Rights. A similar stance was taken regarding the right to electricity by the High Courts of Kerala, Calcutta and Himachal Pradesh.

Thus, a 24X7 supply of electricity has to be provided by DISCOMs even to those consumers who require intermittent power, that too during the Peak Period, like electric bus charging stations. Now, to provide such power, reliance is done on costly short term power purchase which is not fully recovered directly from such consumers, explained in subsequent part of the report.

[1] *Supreme Court Judgment dated 19/05/2023*

Figure 2: Delhi Load Duration Curve FY 2022-23 (Delhi SLDC)

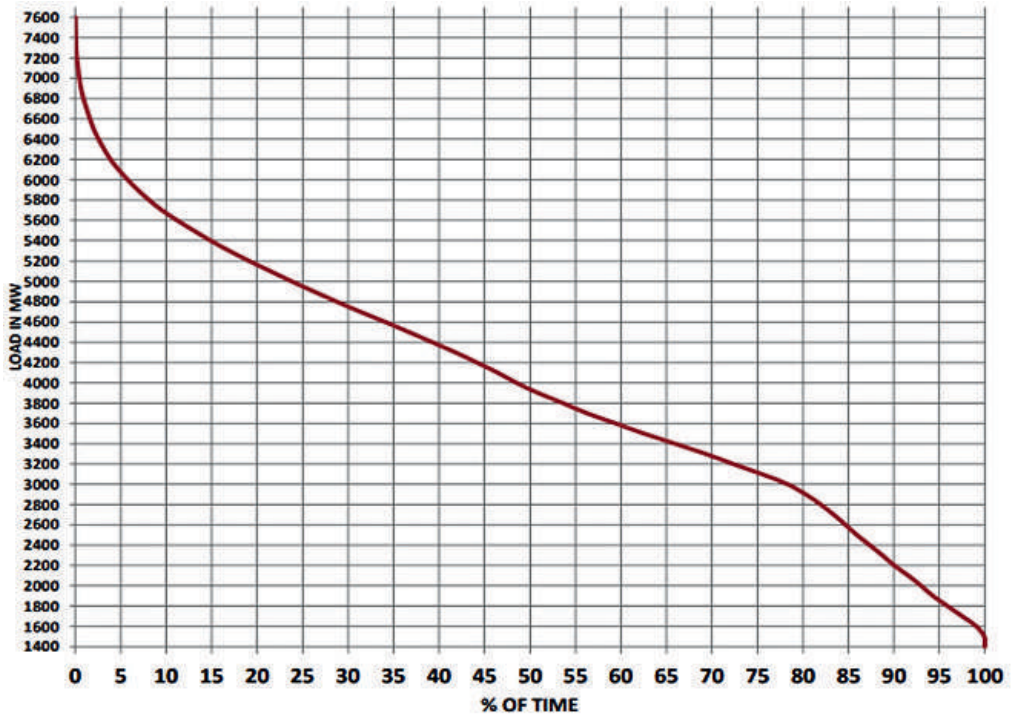


Figure 3: Frequency Distribution of Demand in FY 2022-23 (Delhi SLDC)

LOAD REMAINED ABOVE IN MW	DURATION IN HOURS	(%) OF TIME
7600	1.00	0.01
7500	2.50	0.03
7400	4.50	0.05
7300	7.50	0.09
7200	15.50	0.18
7100	28.00	0.32
7000	39.50	0.45
6900	55.75	0.64
6800	79.75	0.91
6700	110.00	1.26
6600	142.00	1.62
6500	178.25	2.03
6400	225.25	2.57
6300	279.75	3.19
6200	340.50	3.89
6100	418.00	4.77
6000	506.25	5.78

An analysis of the **Load Duration Curve for Delhi DISCOMs** (FY 2022–23 and FY 2023–24) highlights the disproportionate cost burden of short-duration peaks. [Refer to Figure 2-7]

- In **FY 2022–23**, Delhi recorded a peak demand of **7,695 MW**. However, an incremental load of ~800 MW was required for only 80 hours in the year (1% of the time).
- A similar trend was observed in **FY 2023–24**, where peak demand reached **7,438 MW**, with an incremental ~1,000 MW required for only **113 hours in the year (1% of the time)**.

To meet this differential load demand, DISCOMs relied on costly **short-term power procurement at an average cost of Rs. 8.50/kWh** (as per Delhi DISCOMs' data), as stipulated in the following figures.

Figure 4: Delhi Load Duration Curve FY 2023-24 (Delhi SLDC)

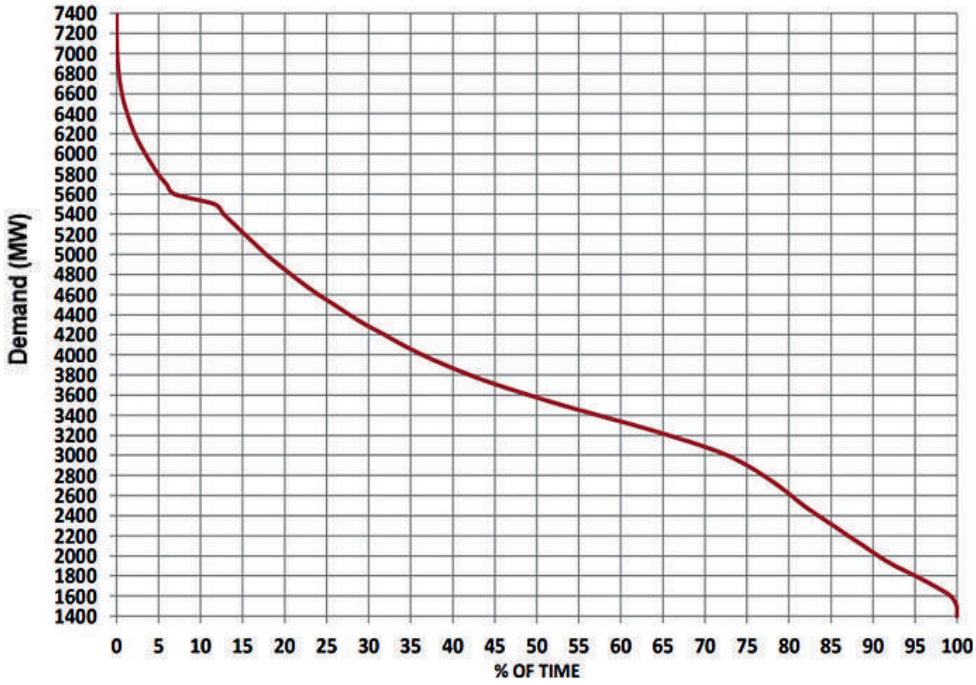


Figure 5: BRPL Load Duration Curve FY 2023-24 (Delhi SLDC)

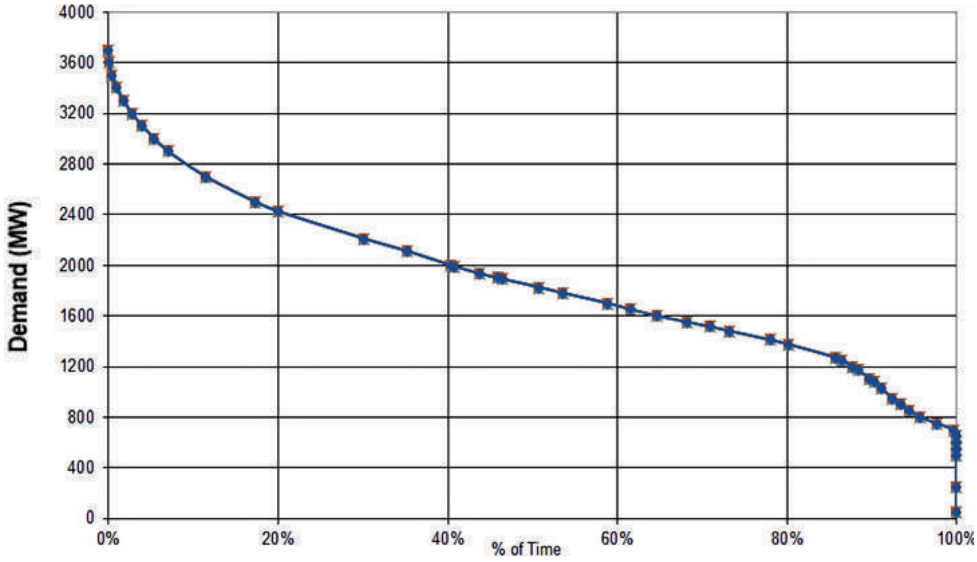


Figure 6 : TPDDL Load Duration Curve FY 2023-24 (Delhi SLDC)

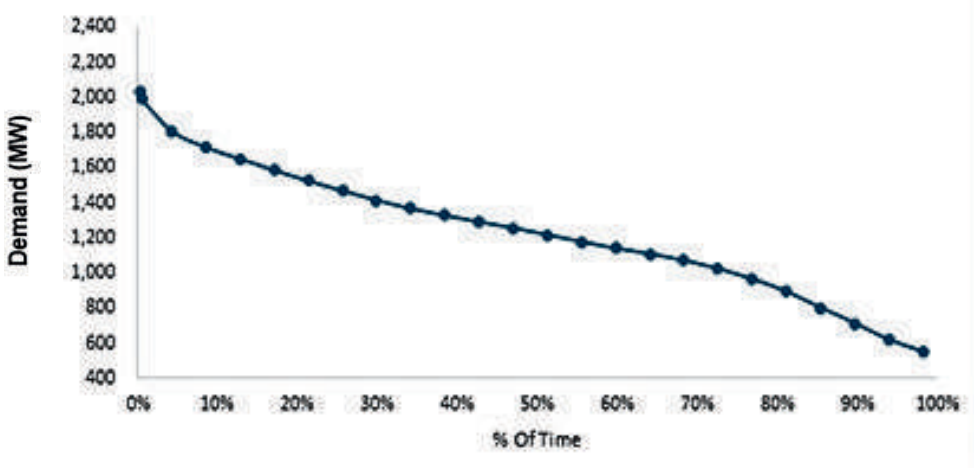
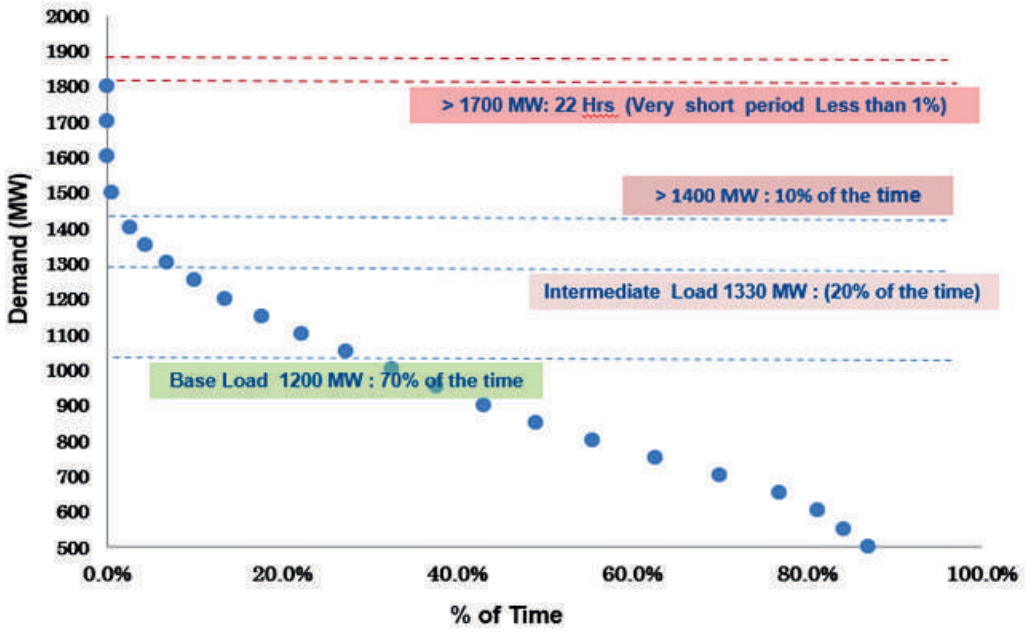


Figure 7: BYPL Load Duration Curve FY 2023-24 (Delhi SLDC)



Further analysis reveals that Delhi's peak demand is concentrated in May to August (Figure 8), typically during 1–3 PM and 10 PM –2 AM (Figure 9).

Figure 8: Delhi Peak Demand in FY 2024-25 & FY 2023-24 (Delhi SLDC)

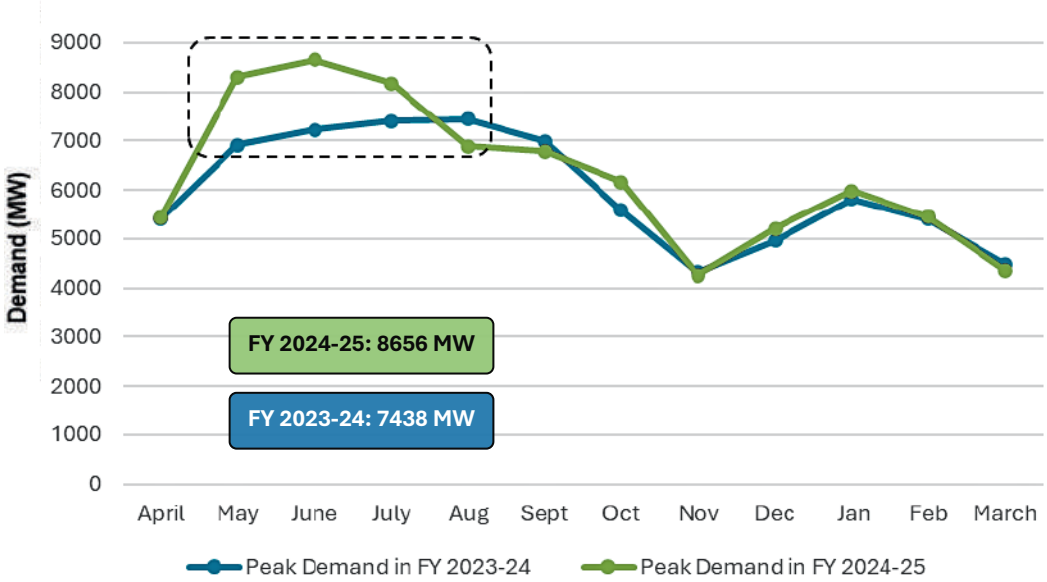
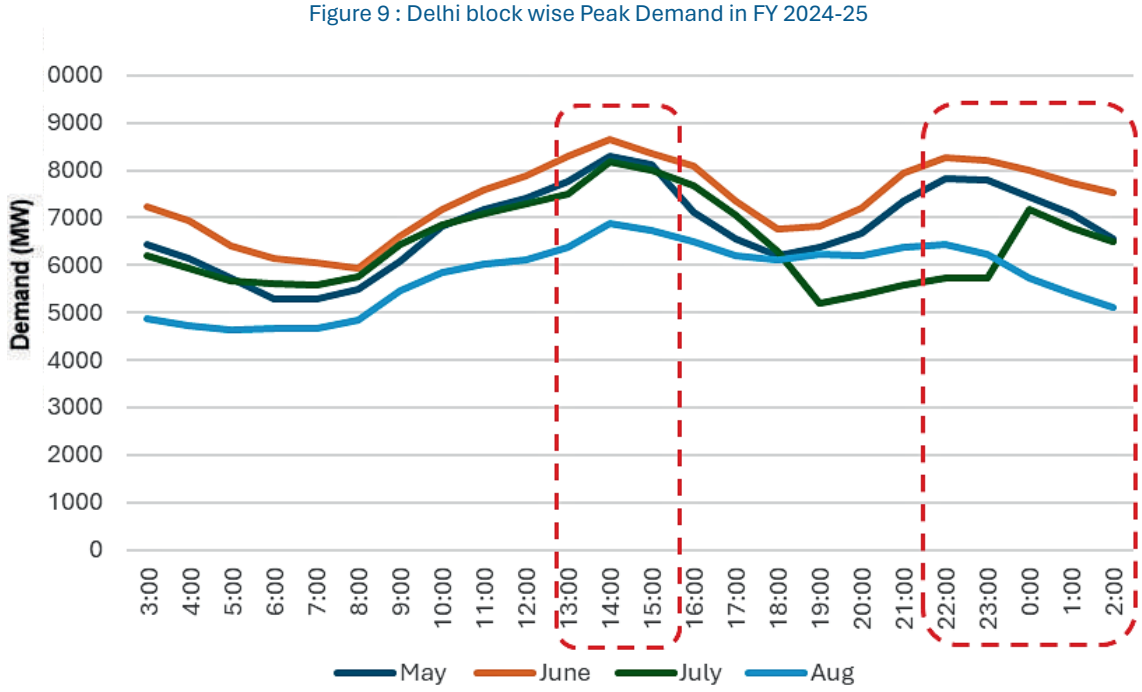


Figure 9 : Delhi block wise Peak Demand in FY 2024-25



In FY 2024–25, Delhi DISCOMs incurred **Rs. 3,000 crore** on short-term power purchase, of which **Rs. 1,400 crore** was spent in these four months (May-August). Notably, **Rs. 750 crore** was incurred during just the 5–6 peak hours. In specific peak time slots in June and July 2024, **short-term power was procured by DISCOMs at a rate of Rs. 10/kWh.**

Table 1 : Short Term rate in Peak hours (Rs./kWh) in FY 2024-25

June 2024			
Time Block	BRPL	TPDDL	BYPL
2100-2130	9.67	10.00	10.00
2130-2200	9.62	10.00	10.00
2200-2230	9.65	10.00	10.00
2230-2300	9.76	10.00	10.00
2300-2330	9.77	10.00	10.00
2330-2400	9.76	10.00	10.00
0000-0030	9.88	9.84	10.00
0030-0100	9.83	9.50	10.00
July 2024			
2100-2130	9.67	10.00	10.00
2130-2200	9.62	10.00	10.00
2200-2230	9.65	10.00	10.00
2230-2300	9.76	10.00	10.00
2300-2330	9.77	10.00	10.00
2330-2400	9.76	10.00	10.00
0000-0030	9.88	10.00	9.58
0030-0100	9.83	9.52	8.51

Charging Ahead: The Electric Fleet Revolution

The Government of India, with the objective of reducing emissions from both private and public transportation and improving air quality, has been actively promoting the adoption of Electric Vehicles (EVs). Key initiatives include subsidies for EV purchases under the FAME India scheme, Production Linked Incentive (PLI) schemes for domestic vehicle and battery cell manufacturing, tax benefits for EV chargers and charging stations, and capital subsidies to Oil Marketing Companies for developing public EV charging infrastructure.

Over the past decade, EVs have witnessed exponential growth of around 97% (Figure 11). In FY 2024–25, EVs accounted for approximately 8% of total vehicle sales (Figure 10). With continued policy support, incentives, and the government's sustained push toward green mobility, EV adoption is expected to accelerate further in the coming years, leading to a substantial rise in energy demand.

India is also among the few nations endorsing the global **EV30@30** campaign, which aims to achieve at least 30% of new vehicle sales as electric by 2030 (NITI Aayog).

Figure 10: Surgence of EV (% of the total)

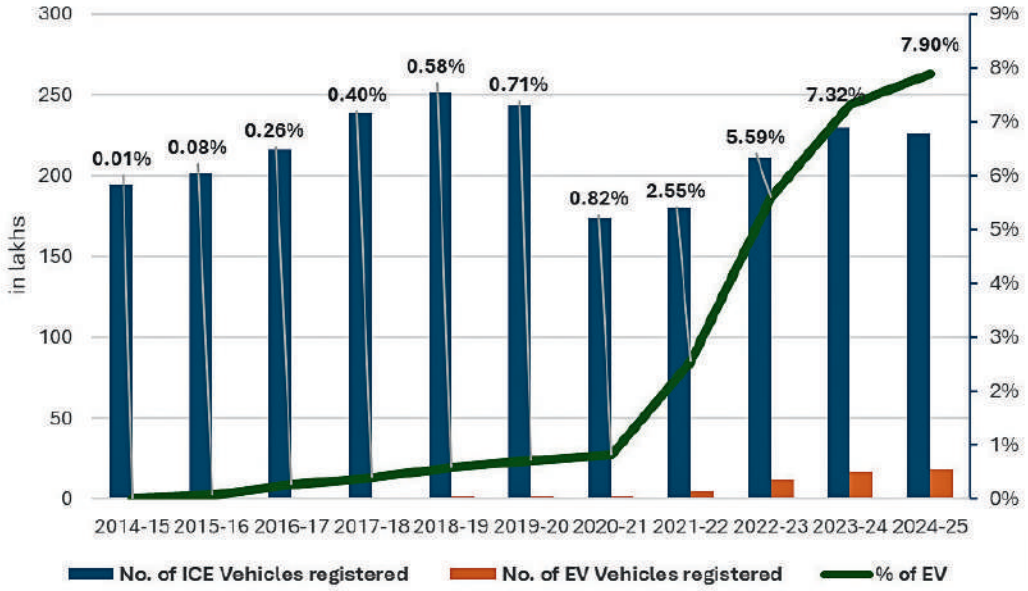
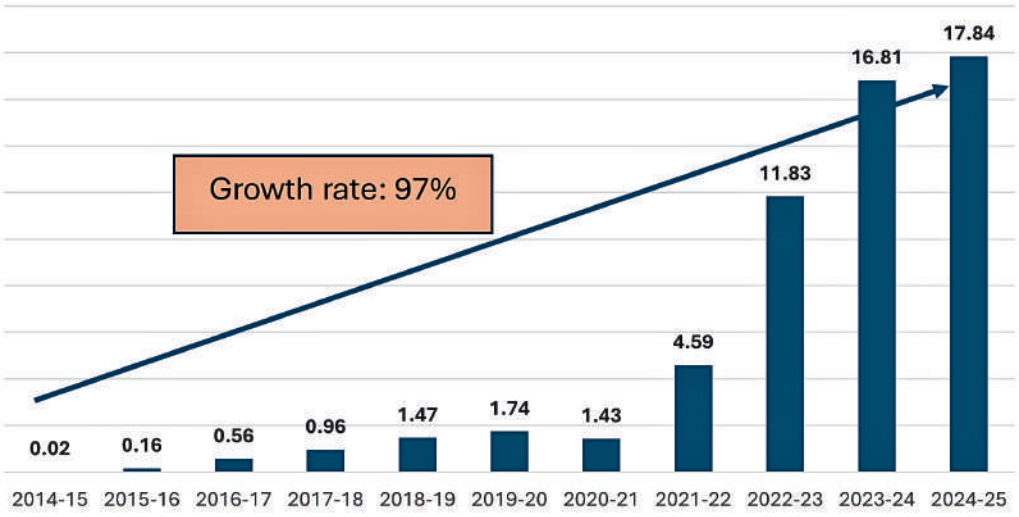


Figure 11: No. of EV registered (in lakhs)



The Central Electricity Authority (CEA), in its 20th Electric Power Survey (EPS[2]), has assessed the impact of EV penetration on electricity demand. It estimates that by FY 2031–32, the number of EVs will reach approximately 491 lakh (around 14% of total vehicles), contributing to a power consumption of 27,000 MU out of the total projected consumption of 24,73,736 MU at the all-India level, with an associated peak demand of 5,000 MW. Separately, OmniScience Capital[3] projects EV penetration to rise to about 1,620 lakh units by FY 2034–35, up from 39 lakh in FY 2023–24, leading to power consumption of approximately 159,000 MU by FY 2034–35.

Data indicates that the majority of EVs in operation comprise two-wheelers, three-wheelers, and four-wheelers, which, according to the guidelines of the Ministry of Power (MoP)[4], do not require a separate electricity connection. Owners can charge these vehicles using their existing residential or commercial connections. However, electric buses are significant Energy guzzlers and are typically charged through dedicated feeders at E-bus depots (please refer to Box-1 for details). Any increase in the number of E-buses has a direct impact on distribution companies (DISCOMs), as it raises the connected load or necessitates new connections through network augmentation or infrastructure expansion. Accordingly, E-buses have been considered for this study, as DISCOMs maintain relevant data on connected load and energy consumption.

BOX-1

E- BUS PARAMETERS (12 METRE)

- Capacity of Battery: 268 kW[5]
- DC Fast Chargers of 240 kW each
- Charging time: ~2 hrs (80% charge in 1 hr)
- Range of E-bus ~ 230 km
- Operational hours of E-bus: 8 hr, Single trip
- Li-ion Battery with a useful life of 8 years, depending on State Of Charge (SOC)
- No. of charges available per E-bus at the Depot: 1:5
- Charger Cost: ~ Rs. 14-15 lakh

(Source- *Report on "THE ROAD AHEAD FOR PRIVATE ELECTRIC BUSES IN INDIA", Shakti Foundation & USAID*)

The deployment of E-buses offers significant environmental benefits compared to Internal Combustion Engine (ICE) buses; however, without proper planning, the rapid growth of EV adoption could pose challenges for grid stability and the cost economics of DISCOMs. Since charging demand often arises at the convenience of users, it may coincide with system peak periods, thereby increasing overall peak demand and compelling DISCOMs to rely on expensive short-term power procurement. In the absence of appropriate price signals, unregulated EV charging has the potential to increase the overall cost of electricity.

[2] *CEA- 20th Electric Power Survey of India (Volume-I)*
[3] *Omniscience Capital Report "Power Sector: Electricity Consumption Projections for 2035"*
[4] *MoP Guidelines for Installation and Operation of Electric Vehicle Charging Infrastruture-2024*
[5] *"The Road Ahead for Private Electric Buses in India: Case of Non Urban Routes" New Delhi: SGArchitects; Council on Energy, Environment and Water; and Institute for Transportation and Development Policy, India.*

For example, in Delhi, the current tariff schedule issued by the Delhi Electricity Regulatory Commission (DERC) does not levy fixed charges for connections associated with EV charging stations. The applicable energy charges are Rs. 4.00/kVAh for supply at high tension (HT) and Rs. 4.50/kWh for supply at low tension (LT), which are significantly lower than the Average Cost of Supply (ACoS) for DISCOMs.

Since no Tariff Order has been issued by the DERC regarding Aggregate Revenue Requirement (ARR) after 30th September 2021, reliance has been placed on the latest Tariff Petitions admitted by DERC on 7th June 2024 for FY 2024-25[6]. DISCOM-wise Average Billing Rate (ABR) as a percentage of ACoS for EV Charging Stations (EVCS) is tabulated below:

Table 2: Comparison of ABR of EVCS with ACoS of DISCOMs (Rs./kWh)

DISCOMs	Average Cost of Supply (ACoS)	Average Billing Rate (ABR) for EVCS	ABR (EVCS) percentage of ACoS (%)	Tariff for EVCS as per MoP Guidelines (Sept'24)	
				Solar Hours	Non-Solar Hours
BRPL	9.90	4.11	41%	6.93	12.87
BYPL	8.67	4.19	48%	6.07	11.28
TPDDL	9.55	4.52	47%	6.69	12.42
Total	**9.50**	**4.25**	**45%**	**6.65**	**12.35**

It is observed that the ABR for EV Charging Stations is only 45% of the ACoS in Delhi, which is not in line with the provisions of Tariff Policy 2016, mandating that the Tariff should be within ±20% of the ACoS for all Tariff categories, and Guidelines issued by MoP, as tabulated in Table 2.

To address these concerns, DISCOMs continuously strive to optimise peak demand and flatten the load curve, thereby managing both Power Purchase and Network Costs - expenses ultimately borne by consumers. Since DISCOMs' coincident peaks aggregate into state-level peaks and further into the national peak, effective management at the distribution level is critical for ensuring system-wide cost efficiency and reliability.

[6] *DERC - ARR Tariff Petition by DISCOMs for FY 2024-25*

Need for this Study

This study has been undertaken for the distribution utilities in Delhi, **BSES Rajdhani Power Limited (BRPL), BSES Yamuna Power Limited (BYPL), and Tata Power Delhi Distribution Limited (TPDDL)**, with the objective of analysing the behaviour of electricity peak demand and assessing the impact of E-bus charging on the same. The Power Foundation of India (PFI) collaborated with the DISCOMs in Delhi to access feeder-level data relating to E-bus depots, along with actual Power Purchase cost information on a half-hourly basis.

In line with data confidentiality requirements, Non-Disclosure Agreements (NDAs) were executed with the DISCOMs.

The DISCOMs subsequently shared detailed feeder-level information on a half-hourly basis for the months of June, July, and December 2023, along with data for June and July 2024. The dataset included the total demand met by each DISCOM, average feeder loading (in kW), long-term and short-term (power exchange and bilateral) quantum, as well as associated Power Purchase Quantum & Cost data.

Snapshot of the NDA signed between the Delhi DISCOMs and PFI is as follows:

Impact Assessment Study, majorly related to Power Purchase Cost, Cross-subsidisation levels due to Electric Buses Charging Pattern, wherein Actual data related to Feeder catering EV Depot Load, and Power Purchase for Delhi DISCOMs were considered.

BOX 2

ABOUT DISCOMS IN DELHI

- **BSES Rajdhani Power Limited (BRPL)** distributes electricity across an area of approximately **700 sq. km**, catering to around **30 lakh consumers** in 22 divisions spread across South and West Delhi. With a consumer density of nearly **4,325 per sq. km,** BRPL reported **AT&C losses of 6.58% in FY 2023–24**[7]**.**
- **Tata Power Delhi Distribution Limited (TPDDL)** serves the Northern and Northwestern regions of Delhi, covering an area of approximately **510 sq. km** and supplying electricity to over **20 lakh consumers**. The utility achieved **AT&C losses of 5.91% in FY 2023–24.**
- **BSES Yamuna Power Limited (BYPL)** operates in the South-East, North-East, and Central parts of Delhi, distributing power across an area of nearly **200 sq. km.** It serves close to **19 lakh consumers** in 14 divisions, with a high consumer density of **9,518 per sq. km,** and recorded **AT&C losses of 7.16% in FY 2023–24.**

[7] *PFC- 13th Integrated Rating of DISCOMs*

Subsequently, a series of meetings and site visits were held with officials of the DISCOMs. A summary of these interactions is provided below:

A. With BSES DISCOMs (BRPL & BYPL)

Date	Venue	Key Discussion
Feb 7, 2024	PFI Office	Kick-off meeting; discussion on line of action and project timelines
Aug 12, 2024	PFI Office	Meeting with BRPL & BYPL officials
Aug 22, 2024	BRPL Corporate Office; Nehru Place E-bus Depot	Meeting at BRPL Corporate Office followed by joint site visit to E-bus Depot (~100 buses, 20 DC fast chargers)
Dec 3, 2024	PFI Office	Review of PFI's observations and analysis; finalization of next steps
Apr 17, 2025	PFI Office	Discussion on draft report and modelling of network cost deferral
Aug 1, 2025	PFI Office	Review and discussion of the final draft report

B. With TPDDL

Date	Venue	Purpose / Key Discussion
Feb 7, 2024	PFI Office	Kick-off meeting; discussion on line of action and project timelines
Jul 26, 2024	TPDDL Office, Technology Centre (CENNET), Pitampura; DTC E-bus Depot, Wazirpur	Meeting at TPDDL office followed by joint site visit with TPDDL and Tata Motors officers to Wazirpur E-bus Depot (~125 buses, 25 DC fast chargers)
Nov 29, 2024	PFI Office	Review of PFI's observations and analysis; finalization of next steps
May 13, 2025	PFI Office	Discussion on draft report and modelling of network cost deferral
Aug 1, 2025	Online Meeting	Discussion on the final draft report

Analysis of peak demand data for Delhi (Figure 12) indicates that peak demand typically occurs twice daily—first during the afternoon between 2:30 PM and 5:30 PM and again during the night between 9:00 PM and 3:00 AM.

Figure 12: Peak Demand block-wise Delhi DISCOMs June, 2024

Jun-24	Peak Demand		
Time Block	BRPL	TPDDL	BYPL
0000-0030	2.44%	2.38%	2.42%
0030-0100	2.39%	2.34%	2.38%
0100-0130	2.34%	2.28%	2.33%
0130-0200	2.29%	2.23%	2.28%
0200-0230	2.23%	2.18%	2.23%
0230-0300	2.18%	2.13%	2.17%
0300-0330	2.12%	2.07%	2.11%
0330-0400	2.07%	2.02%	2.06%
0400-0430	2.01%	1.96%	1.99%
0430-0500	1.96%	1.91%	1.94%
0500-0530	1.90%	1.84%	1.88%
0530-0600	1.82%	1.78%	1.83%
0600-0630	1.75%	1.72%	1.79%
0630-0700	1.71%	1.68%	1.77%
0700-0730	1.67%	1.65%	1.74%
0730-0800	1.65%	1.64%	1.71%
0800-0830	1.64%	1.63%	1.67%
0830-0900	1.65%	1.63%	1.66%
0900-0930	1.70%	1.71%	1.70%
0930-1000	1.78%	1.85%	1.78%
1000-1030	1.85%	1.94%	1.84%
1030-1100	1.91%	2.02%	1.92%
1100-1130	1.97%	2.08%	1.98%
1130-1200	2.01%	2.13%	2.04%
1200-1230	2.06%	2.19%	2.10%
1230-1300	2.11%	2.23%	2.14%
1300-1330	2.14%	2.16%	2.16%
1330-1400	2.20%	2.25%	2.20%
1400-1430	2.27%	2.34%	2.25%
1430-1500	2.33%	2.40%	2.29%
1500-1530	2.35%	2.43%	2.32%
1530-1600	2.34%	2.42%	2.35%
1600-1630	2.32%	2.38%	2.34%
1630-1700	2.26%	2.33%	2.29%
1700-1730	2.20%	2.25%	2.23%
1730-1800	2.11%	2.15%	2.17%
1800-1830	2.02%	2.07%	2.10%
1830-1900	1.96%	2.01%	2.04%
1900-1930	1.94%	1.98%	1.99%
1930-2000	1.98%	1.99%	1.99%
2000-2030	2.04%	2.01%	2.01%
2030-2100	2.11%	2.03%	2.05%
2100-2130	2.20%	2.05%	2.09%
2130-2200	2.29%	2.16%	2.18%
2200-2230	2.38%	2.26%	2.28%
2230-2300	2.45%	2.34%	2.36%
2300-2330	2.47%	2.38%	2.42%
2330-2400	2.47%	2.39%	2.44%

Based on the schedule of E-buses provided by the Delhi Transport Corporation (DTC), it has been observed that the charging load for E-buses predominantly occurs during night hours, between 11:00 PM and 2:00 AM, when buses return to their depots for charging. This load gradually declines as the buses leave for service operations. A second notable increase in charging demand is recorded during midday, beginning around 1:30 PM , when buses return for booster charging. This elevated load typically continues until 4:00 PM , after which it reduces as the buses resume service for evening operations.

In contrast to the load profiles of consumer categories such as domestic, commercial, industrial, and others, which are generally spread across various time periods and are not concentrated solely during peak demand windows, the charging demand of electric vehicles tends to align with specific peak periods. This pattern is particularly pronounced during the summer months, when E-buses charging coincides with high system demand.

Table 3: Block wise Peak Demand E-bus Charging for June 2024

Jun-24	Peak Demand			E-Bus Charging		
Time Block	BRPL	TPDDL	BYPL	BRPL	TPDDL	BYPL
1300-1330	2.14%	2.16%	2.16%	3.20%	3.69%	3.65%
1330-1400	2.20%	2.25%	2.20%	3.40%	3.88%	3.73%
1400-1430	2.27%	2.34%	2.25%	3.37%	3.95%	3.73%
1430-1500	2.33%	2.40%	2.29%	3.52%	4.00%	3.75%
1500-1530	2.35%	2.43%	2.32%	3.49%	4.03%	3.98%
1530-1600	2.34%	2.42%	2.35%	3.51%	3.90%	3.61%
1600-1630	2.32%	2.38%	2.34%	2.93%	3.71%	2.85%
2100-2130	2.20%	2.05%	2.09%	1.99%	2.66%	3.33%
2130-2200	2.29%	2.16%	2.18%	3.07%	3.91%	4.06%
2200-2230	2.38%	2.26%	2.28%	3.85%	3.76%	3.62%
2230-2300	2.45%	2.34%	2.36%	3.42%	3.20%	3.51%
2300-2330	2.47%	2.38%	2.42%	2.76%	3.77%	4.10%
2330-2400	2.47%	2.39%	2.44%	3.11%	4.17%	4.17%
0000-0030	2.44%	2.38%	2.42%	3.53%	3.91%	3.43%
0030-0100	2.39%	2.34%	2.38%	3.71%	3.81%	2.90%
0100-0130	2.34%	2.28%	2.33%	3.27%	3.98%	3.30%
0130-0200	2.29%	2.23%	2.28%	3.00%	3.71%	3.52%

From Table 3, it appears that the charging pattern of E-buses coincides with the peak demand periods of the DISCOMs.

Furthermore, with the Delhi Government projecting a fleet of 12,000 E-buses by FY 2029–30, the corresponding annual electricity consumption from these E-buses is expected to be as follows:

Table 4: E-bus Details

Particulars	Value	UoM
No. of E-bus projected in FY 2029-30 in Delhi	12,000	Nos
No. of plies in a day	2	Nos
Battery capacity	268 (12-m) 200 (9-m)	kW
Charging Time	3	hrs
Consumption (annual) in FY 2029-30	**3,343**	**MU**

Approach of the study

A detailed working model of E-bus operations was analysed, outlining the roles and responsibilities of the key stakeholders, including the **Delhi Transport Corporation (DTC), E-bus aggregators (Tata Motors Limited, JBM Auto & Ashok Leyland)**, and the DISCOMs.

Additionally, **the demand curves of Delhi DISCOMs** for **June 2023, July 2023, December 2023, June 2024, and July 2024** were analysed to study seasonal demand patterns across summer and winter months, as shown in Figures 13-15. Further, the **daily E-bus charging load** was plotted against the **overall daily demand of the DISCOMs**, supplemented by **heat maps of E-bus charging vis-à-vis total load** for December 2023 and June 2024 across all three DISCOMs.

Figure 13: BRPL Demand Curve for June 2023, July 2023, December 2023, June 2024 and July 2024

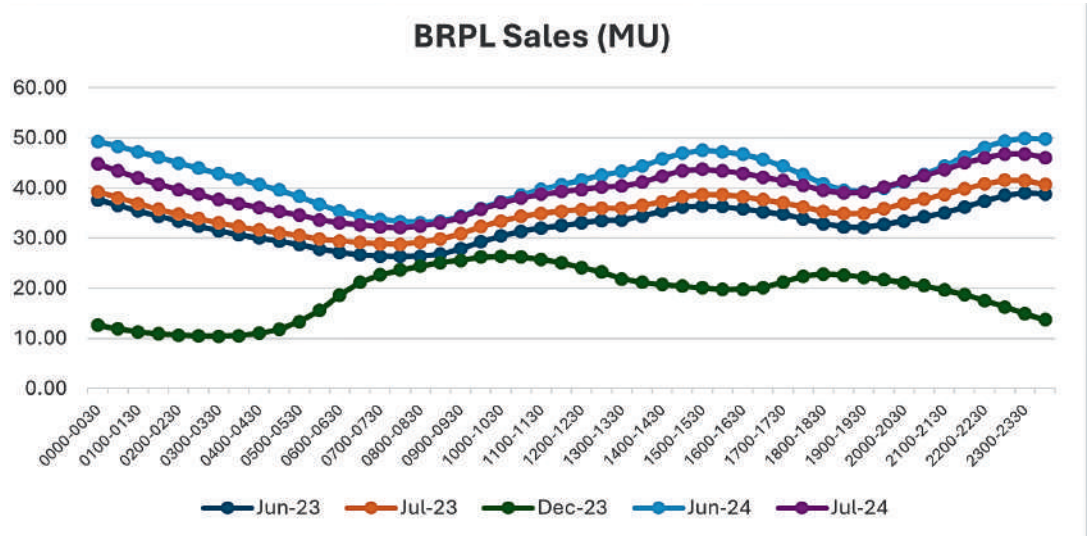


Figure 14: TPDDL Demand Curve for December 2023, June 2024 and July 2024

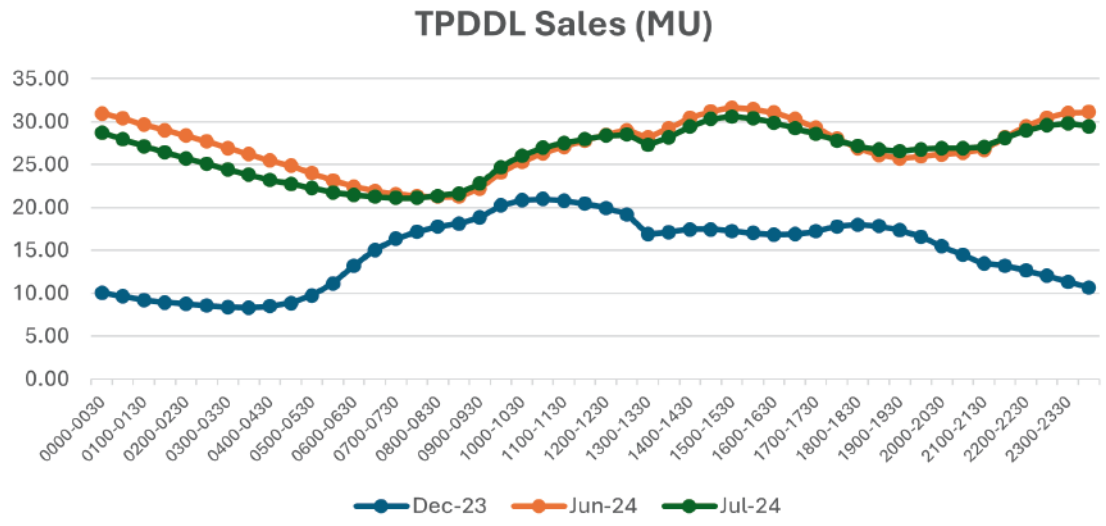
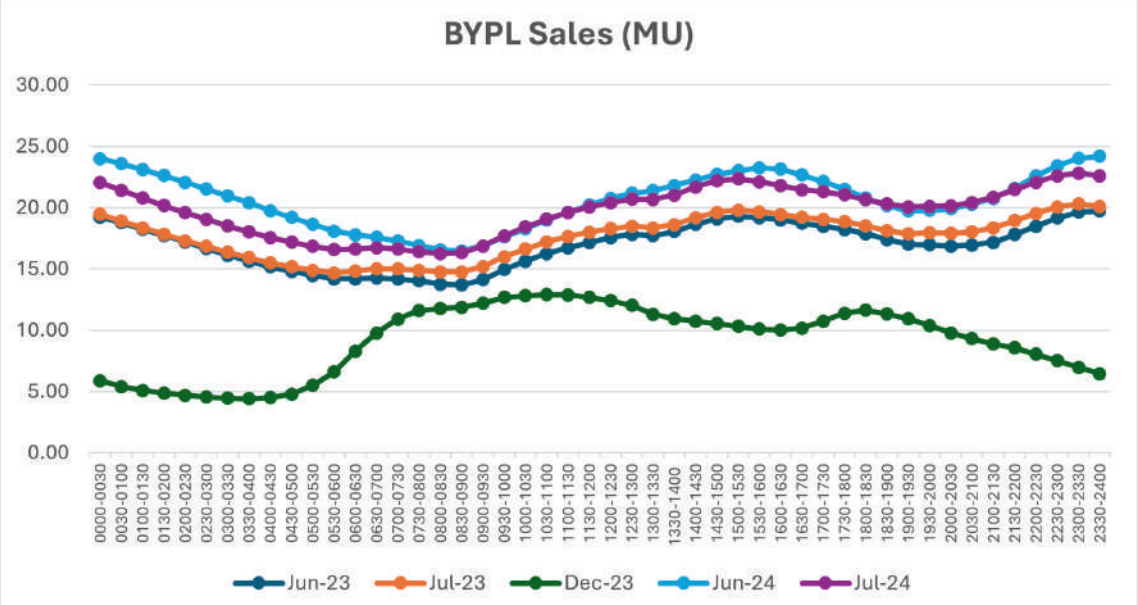


Figure 15: BYPL Demand Curve for June 2023, July 2023, December 2023, June 2024 and July 2024



From Figures 13, 14, and 15, the following can be concluded:

- In Summers, the peak occurs at Night hours (10 PM to 12 Midnight) & Afternoon (2 PM to 4 PM), and off-peak at morning hours (7 AM to 9 AM)

- In Winters, the peak occurs at morning hours (9 AM to 11 AM) and off-peak at night hours (3 AM to 5 AM).

Objectives of this study

4 Network Cost Implication

To evaluate strategies for scheduling E-bus charging in a manner that reduces reliance on costly short-term power purchases and avoids additional network costs, thereby lowering the Aggregate Revenue Requirement (ARR) of DISCOMs and minimising the burden on end consumers.

2 E-bus Working Model

To examine the functioning of E-bus charging stations and their operations, with the aim of proposing practical and feasible solutions for optimal charging.

3 Power Cost Optimisation

To analyse power procurement by DISCOMs during peak and off-peak hours across long-term, medium-term, and short-term, and identify opportunities to optimise procurement for E-bus charging through cheaper power and greater integration of renewable/solar power.

1 Peak Demand vs. E-bus Charging Pattern

To superimpose the E-bus charging profile on DISCOM peak demand during June 2024 and December 2023, and assess the extent of coincidence.

Superimposition of E-bus Charging Load and Peak Demand of DISCOMs

- **Summer Season (June 2024)**

The E-bus charging load for June 2024 has been plotted against the daily demand of the DISCOMs, along with a heat map comparing E-bus charging and the total load of all three Delhi DISCOMs. The results are presented as follows:

1. For BSES Rajdhani Power Ltd.

Figure 16 : BRPL E-bus Charging Energy Sales, block-wise (MU) in June 2024

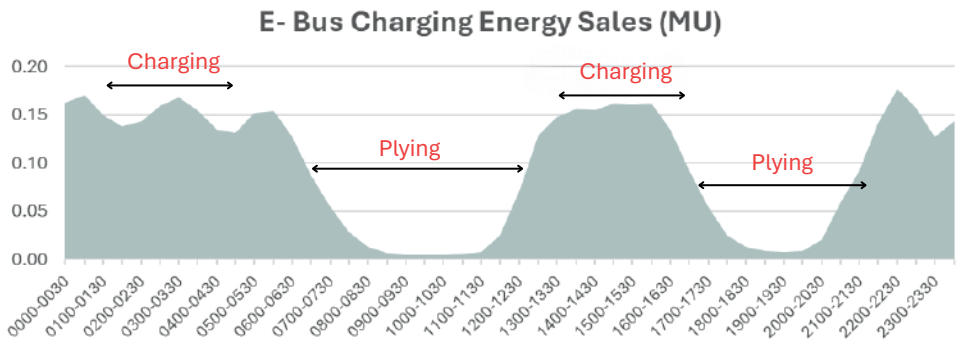
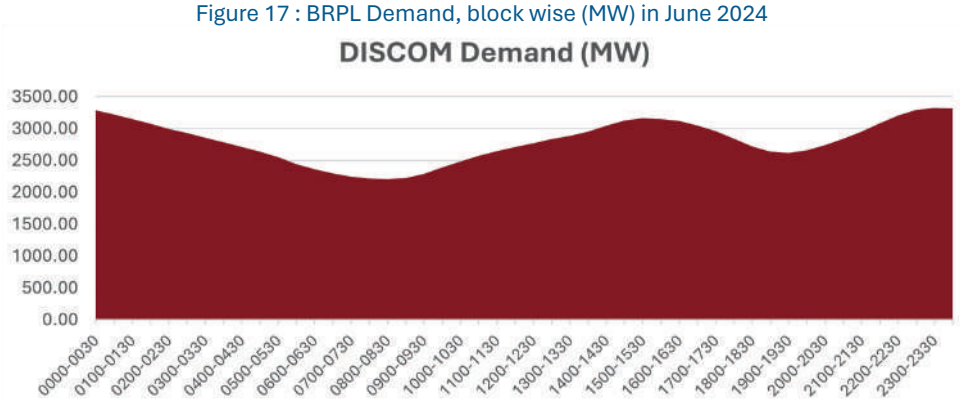


Figure 17 : BRPL Demand, block wise (MW) in June 2024



Observations

i. The charging pattern of E-buses remains largely uniform across seasons, as operating schedules and routes are consistent throughout the year.

ii. Charging demand is highest during the late-night hours (11:00 PM to 2:00 AM), when buses return to depots for overnight charging, after which the load declines as buses are deployed for morning operations.

iii. A second rise in demand is observed during midday (up to 4:00 PM), when buses return to depots for booster charging. The load then decreases again as buses resume service for evening operations.

Heat map of E-bus Charging and total load of BRPL for June 2024

Observations during Summer

i. Peak demand for both the DISCOM and E-bus charging is observed during the night hours (10:00 PM to 2:30 AM) and again in the afternoon (2:30 PM to 4:00 PM).

ii. During the morning hours (7:00 AM to 10:00 AM), neither DISCOM nor E-bus charging exhibits significant peak demand.

iii. A similar pattern is noted during the evening period (6:00 PM to 8:00 PM), when demand levels remain comparatively moderate.

Figure 18: BRPL E-bus consumption and Demand, block wise in June 2024

Time Block	Demand Met (MU)	E-Bus Consumption (MU)				Total E-Bus consumption (MU)	Demand met (%) wrt Total Demand Met	E-Bus consumption (%) wrt Total E-Bus consumption
		Mundela (4.8 MW)	Mayapuri (4 MW)	Nehru Place (5 MW)	Sukhdev Vihar (7 MW)			
0000-0030	49.28	0.047	0.031	0.026	0.059	0.163	2.44%	3.53%
0030-0100	48.33	0.050	0.032	0.035	0.053	0.171	2.39%	3.71%
0100-0130	47.22	0.036	0.035	0.032	0.047	0.150	2.34%	3.27%
0130-0200	46.17	0.025	0.033	0.023	0.057	0.138	2.29%	3.00%
0200-0230	44.97	0.031	0.027	0.029	0.057	0.144	2.23%	3.12%
0230-0300	43.95	0.043	0.030	0.036	0.051	0.159	2.18%	3.47%
0300-0330	42.86	0.047	0.035	0.025	0.061	0.168	2.12%	3.66%
0330-0400	41.81	0.039	0.036	0.023	0.058	0.155	2.07%	3.37%
0400-0430	40.69	0.030	0.032	0.028	0.045	0.135	2.01%	2.93%
0430-0500	39.64	0.032	0.031	0.026	0.043	0.132	1.96%	2.86%
0500-0530	38.31	0.041	0.034	0.019	0.057	0.152	1.90%	3.30%
0530-0600	36.71	0.043	0.034	0.016	0.061	0.154	1.82%	3.35%
0600-0630	35.43	0.039	0.030	0.011	0.047	0.127	1.75%	2.77%
0630-0700	34.44	0.029	0.024	0.005	0.030	0.087	1.71%	1.90%
0700-0730	33.75	0.017	0.016	0.002	0.019	0.054	1.67%	1.18%
0730-0800	33.30	0.009	0.010	0.001	0.009	0.029	1.65%	0.63%
0800-0830	33.12	0.005	0.005	0.000	0.004	0.014	1.64%	0.30%
0830-0900	33.38	0.003	0.002	0.000	0.003	0.007	1.65%	0.16%
0900-0930	34.34	0.001	0.001	0.000	0.003	0.005	1.70%	0.10%
0930-1000	35.90	0.001	0.000	0.001	0.002	0.004	1.78%	0.10%
1000-1030	37.32	0.001	0.000	0.002	0.002	0.005	1.85%	0.11%
1030-1100	38.60	0.001	0.000	0.003	0.002	0.006	1.91%	0.13%
1100-1130	39.71	0.001	0.000	0.005	0.002	0.008	1.97%	0.18%
1130-1200	40.65	0.007	0.001	0.016	0.002	0.026	2.01%	0.55%
1200-1230	41.56	0.029	0.011	0.018	0.013	0.071	2.06%	1.54%
1230-1300	42.59	0.040	0.026	0.018	0.044	0.128	2.11%	2.79%
1300-1330	43.27	0.051	0.029	0.024	0.043	0.147	2.14%	3.20%
1330-1400	44.36	0.054	0.031	0.023	0.048	0.156	2.20%	3.40%
1400-1430	45.75	0.051	0.030	0.025	0.049	0.155	2.27%	3.37%
1430-1500	46.96	0.055	0.029	0.028	0.049	0.162	2.33%	3.52%
1500-1530	47.52	0.053	0.029	0.029	0.050	0.160	2.35%	3.49%
1530-1600	47.22	0.056	0.029	0.027	0.049	0.162	2.34%	3.51%
1600-1630	46.76	0.053	0.022	0.021	0.039	0.135	2.32%	2.93%
1630-1700	45.74	0.043	0.016	0.012	0.022	0.093	2.26%	2.02%
1700-1730	44.37	0.026	0.008	0.009	0.011	0.054	2.20%	1.18%
1730-1800	42.66	0.010	0.004	0.005	0.006	0.026	2.11%	0.56%
1800-1830	40.83	0.004	0.002	0.003	0.004	0.013	2.02%	0.29%
1830-1900	39.57	0.003	0.001	0.002	0.003	0.010	1.96%	0.21%
1900-1930	39.23	0.002	0.001	0.003	0.002	0.008	1.94%	0.17%
1930-2000	39.93	0.002	0.001	0.004	0.002	0.010	1.98%	0.21%
2000-2030	41.14	0.002	0.007	0.010	0.002	0.021	2.04%	0.46%
2030-2100	42.71	0.013	0.023	0.022	0.002	0.059	2.11%	1.29%
2100-2130	44.36	0.029	0.031	0.026	0.006	0.092	2.20%	1.99%
2130-2200	46.27	0.050	0.028	0.024	0.040	0.141	2.29%	3.07%
2200-2230	48.08	0.052	0.026	0.026	0.072	0.177	2.38%	3.85%
2230-2300	49.41	0.036	0.028	0.031	0.063	0.157	2.45%	3.42%
2300-2330	49.91	0.022	0.034	0.031	0.040	0.127	2.47%	2.76%
2330-2400	49.79	0.031	0.035	0.026	0.051	0.143	2.47%	3.11%
Total	**2019.87**	**1.35**	**0.96**	**0.81**	**1.48**	**4.60**		

2. For TATA Power Delhi Distribution Ltd

Figure 19: TPDDL E-bus Charging Energy Sales, block wise (MU) in June 2024

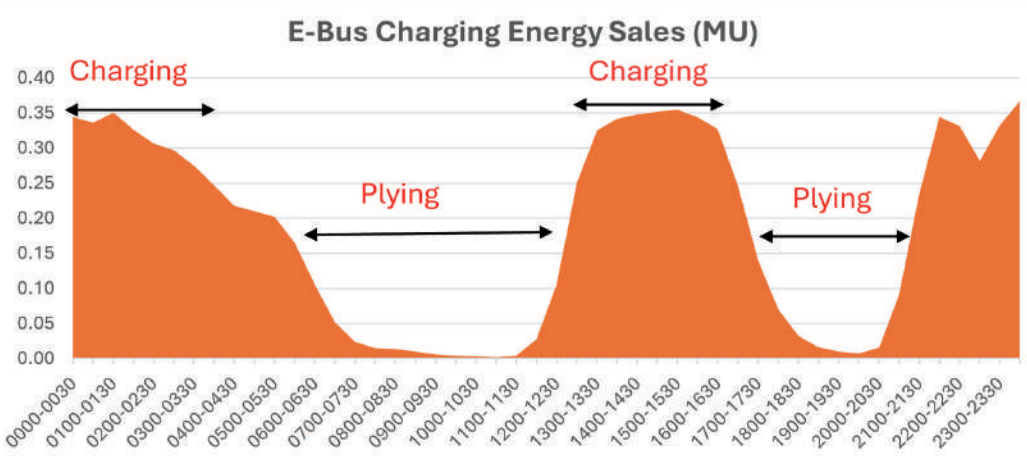
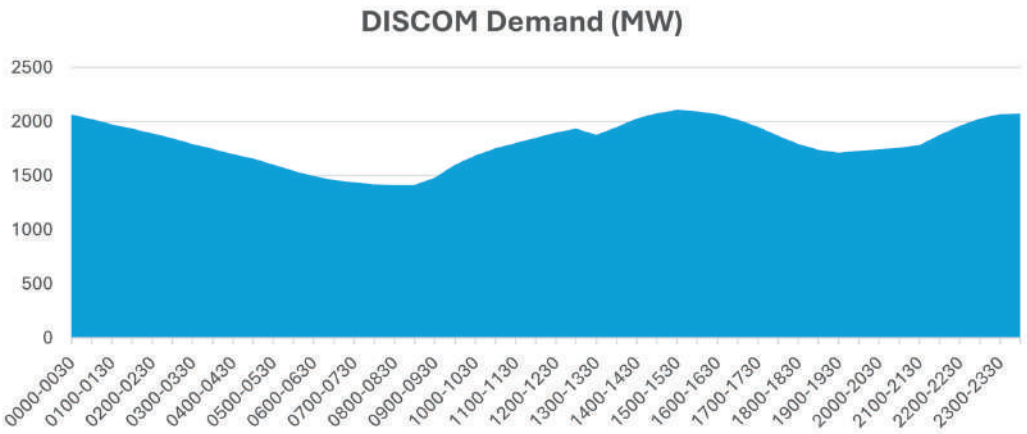


Figure 20: TPDDL Demand, block wise (MW) in June 2024



Observations:

i. The charging pattern of E-buses remains consistent throughout the year, showing no dependence on seasonal variations, as operating schedules and routes remain largely uniform.

ii. Charging demand peaks during the late-night hours (11:00 PM to 2:00 AM) when buses return to depots for overnight charging, after which the load declines as buses depart in the morning for regular operations.

iii. A second rise in demand occurs during the midday period (up to 4:00 PM), when buses return to depots for booster charging. The load then decreases once again as buses resume service for evening operations.

Heat map of E-bus Charging and total load of TPDDL for June 2024

Observations during Summer

i. Peak demand for both DISCOM and E-bus charging is recorded during the night hours (10:00 PM to 2:00 AM) and again in the afternoon (2:30 PM to 4:00 PM).

ii. During the morning hours (7:00 AM to 10:00 AM), there is no significant peak load for DISCOM, nor is there substantial demand from E-bus charging.

iii. A similar trend is observed during the evening hours (6:00 PM to 8:00 PM), when demand remains comparatively moderate.

Figure 21: TPDDL E-bus consumption and Demand, block wise in June 2024

Time Block	Demand Met (MU)	E-Bus Consumption (MU)			Total E-Bus consumption (MU)	Demand met (%) wrt Total	E-Bus consumption (%) wrt Total E-Bus Consumption
		Barwala (12 MW)	Wazirpur (6.5 MW)	Subash Palace (8 MW)			
0000-0030	30.97	0.214	0.055	0.075	0.344	2.38%	3.91%
0030-0100	30.40	0.209	0.061	0.066	0.336	2.34%	3.81%
0100-0130	29.65	0.206	0.064	0.081	0.351	2.28%	3.98%
0130-0200	29.02	0.190	0.056	0.081	0.326	2.23%	3.71%
0200-0230	28.37	0.174	0.059	0.074	0.306	2.18%	3.48%
0230-0300	27.69	0.159	0.062	0.076	0.297	2.13%	3.37%
0300-0330	26.91	0.138	0.060	0.077	0.275	2.07%	3.12%
0330-0400	26.23	0.121	0.050	0.075	0.246	2.02%	2.80%
0400-0430	25.48	0.103	0.039	0.075	0.217	1.96%	2.47%
0430-0500	24.87	0.088	0.046	0.076	0.210	1.91%	2.39%
0500-0530	24.01	0.074	0.056	0.072	0.202	1.84%	2.30%
0530-0600	23.14	0.060	0.047	0.059	0.165	1.78%	1.87%
0600-0630	22.44	0.040	0.027	0.038	0.105	1.72%	1.19%
0630-0700	21.91	0.022	0.012	0.018	0.052	1.68%	0.59%
0700-0730	21.54	0.011	0.007	0.007	0.024	1.65%	0.27%
0730-0800	21.31	0.008	0.003	0.004	0.015	1.64%	0.17%
0800-0830	21.26	0.008	0.001	0.005	0.014	1.63%	0.16%
0830-0900	21.25	0.006	0.000	0.004	0.010	1.63%	0.11%
0900-0930	22.23	0.003	0.000	0.002	0.006	1.71%	0.06%
0930-1000	24.07	0.002	0.000	0.001	0.004	1.85%	0.04%
1000-1030	25.32	0.002	0.000	0.001	0.003	1.94%	0.04%
1030-1100	26.31	0.001	0.000	0.001	0.002	2.02%	0.02%
1100-1130	27.05	0.003	0.000	0.001	0.004	2.08%	0.04%
1130-1200	27.79	0.015	0.001	0.012	0.027	2.13%	0.31%
1200-1230	28.49	0.054	0.014	0.037	0.105	2.19%	1.19%
1230-1300	29.02	0.160	0.030	0.060	0.250	2.23%	2.84%
1300-1330	28.16	0.215	0.048	0.062	0.325	2.16%	3.69%
1330-1400	29.24	0.230	0.050	0.061	0.341	2.25%	3.88%
1400-1430	30.46	0.233	0.054	0.061	0.348	2.34%	3.95%
1430-1500	31.18	0.237	0.055	0.061	0.352	2.40%	4.00%
1500-1530	31.61	0.237	0.057	0.061	0.355	2.43%	4.03%
1530-1600	31.46	0.230	0.054	0.060	0.344	2.42%	3.90%
1600-1630	31.04	0.226	0.048	0.053	0.327	2.38%	3.71%
1630-1700	30.33	0.181	0.026	0.040	0.246	2.33%	2.80%
1700-1730	29.30	0.113	0.007	0.019	0.140	2.25%	1.59%
1730-1800	28.02	0.058	0.003	0.009	0.070	2.15%	0.79%
1800-1830	26.91	0.026	0.002	0.005	0.032	2.07%	0.36%
1830-1900	26.10	0.012	0.002	0.003	0.016	2.01%	0.18%
1900-1930	25.72	0.007	0.001	0.002	0.010	1.98%	0.12%
1930-2000	25.94	0.005	0.001	0.001	0.008	1.99%	0.09%
2000-2030	26.18	0.009	0.002	0.005	0.015	2.01%	0.17%
2030-2100	26.38	0.037	0.013	0.040	0.090	2.03%	1.02%
2100-2130	26.74	0.110	0.041	0.083	0.234	2.05%	2.66%
2130-2200	28.16	0.193	0.070	0.081	0.344	2.16%	3.91%
2200-2230	29.46	0.216	0.058	0.057	0.331	2.26%	3.76%
2230-2300	30.45	0.208	0.043	0.030	0.281	2.34%	3.20%
2300-2330	31.02	0.211	0.064	0.056	0.332	2.38%	3.77%
2330-2400	31.13	0.210	0.068	0.089	0.367	2.39%	4.17%
Total	**1301.69**	**5.274**	**1.516**	**2.014**	**8.80**		

3. For BSES Yamuna Power Ltd

Figure 22: BYPL E-bus Charging Energy Sales, block wise (MU) in June 2024

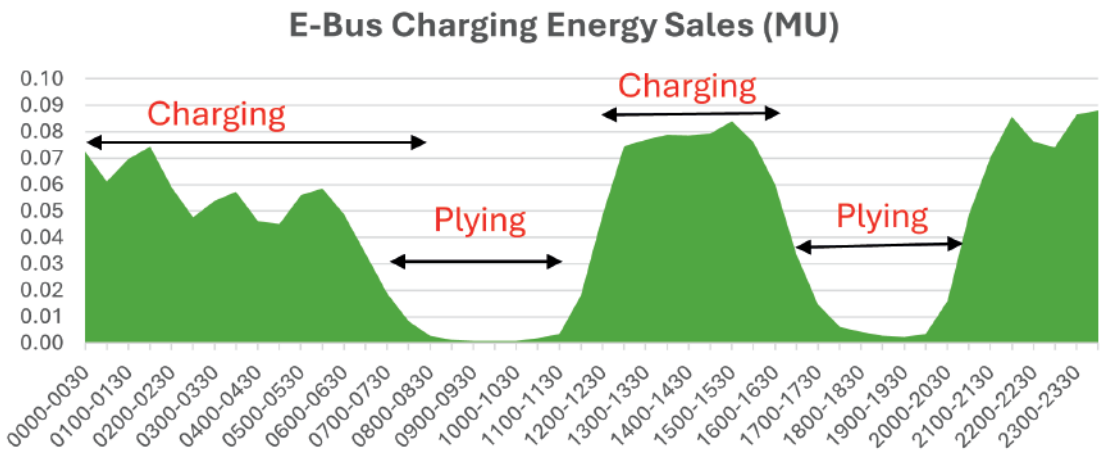
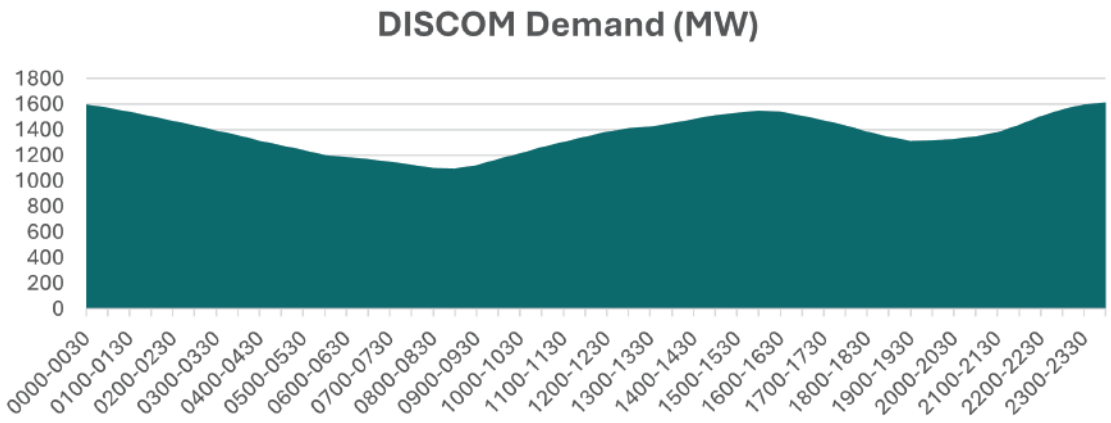


Figure 23: BYPL Demand, block wise (MW) in June 2024



Observations:

i. The charging pattern of E-buses remains consistent throughout the year, showing no dependence on seasonal variations, as plying times and routes are largely uniform.

ii. Charging demand peaks during the late-night hours (11:00 PM to 2:00 AM) when buses return to depots for overnight charging, and declines as buses depart in the morning for regular operations.

iii. A second increase in demand is observed during the midday period (up to 4:00 PM), when buses return for booster charging. The load then decreases once again as buses resume service for evening operations.

Heat map of E-bus Charging and total load of BYPL for June 2024

Observations during Summer:

i. Peak Load of DISCOM and E-bus Charging load comes during Night (10 PM to 2:30 AM) and during the afternoon (2:30 PM to 4 PM).

ii. During morning hours (7 AM to 10 AM), DISCOM doesn't have a Peak Load or a load of E-bus Charging. A similar scenario was observed during evening hours (6 PM to 8 PM).

Figure 24: BYPL E-bus consumption and Demand, block wise in June 2024

Time Block	Demand Met (MU)	E-Bus Consumption (MU)				Total E-Bus consumption (MU)	Demand met (%) wrt Total Demand Met	E-Bus consumption (%) wrt Total E-Bus
		Rajghat (4 MW)	Hasanpur-1 (8 MW)	Hasanpur-2 (8 MW)	Hasanpur-3 (8 MW)			
0000-0030	23.99	0.028	0.026	0.015	0.003	0.072	2.42%	3.44%
0030-0100	23.57	0.022	0.016	0.017	0.006	0.061	2.38%	2.90%
0100-0130	23.10	0.018	0.016	0.026	0.010	0.0700	2.33%	3.33%
0130-0200	22.61	0.016	0.026	0.025	0.008	0.075	2.28%	3.56%
0200-0230	22.07	0.013	0.026	0.016	0.004	0.059	2.23%	2.80%
0230-0300	21.51	0.009	0.017	0.016	0.006	0.048	2.17%	2.28%
0300-0330	20.95	0.004	0.015	0.025	0.010	0.054	2.11%	2.57%
0330-0400	20.40	0.002	0.024	0.024	0.008	0.058	2.06%	2.76%
0400-0430	19.74	0.002	0.025	0.016	0.004	0.047	1.99%	2.23%
0430-0500	19.21	0.006	0.017	0.016	0.005	0.044	1.94%	2.09%
0500-0530	18.63	0.006	0.015	0.025	0.009	0.055	1.88%	2.61%
0530-0600	18.08	0.002	0.025	0.024	0.008	0.059	1.83%	2.80%
0600-0630	17.78	0.001	0.026	0.017	0.005	0.049	1.79%	2.33%
0630-0700	17.58	0.000	0.017	0.013	0.004	0.034	1.77%	1.62%
0700-0730	17.28	0.000	0.007	0.008	0.003	0.018	1.74%	0.86%
0730-0800	16.91	0.000	0.002	0.004	0.002	0.008	1.71%	0.38%
0800-0830	16.55	0.000	0.001	0.001	0.000	0.002	1.67%	0.10%
0830-0900	16.46	0.000	0.000	0.000	0.000	0.000	1.66%	0.00%
0900-0930	16.85	0.000	0.000	0.000	0.000	0.000	1.70%	0.00%
0930-1000	17.62	0.000	0.000	0.000	0.000	0.000	1.78%	0.00%
1000-1030	18.28	0.000	0.000	0.000	0.000	0.000	1.84%	0.00%
1030-1100	19.00	0.002	0.000	0.000	0.000	0.002	1.92%	0.10%
1100-1130	19.62	0.003	0.000	0.000	0.000	0.003	1.98%	0.14%
1130-1200	20.21	0.005	0.009	0.004	0.000	0.018	2.04%	0.86%
1200-1230	20.76	0.017	0.020	0.008	0.003	0.048	2.10%	2.28%
1230-1300	21.17	0.037	0.013	0.018	0.007	0.075	2.14%	3.56%
1300-1330	21.38	0.035	0.018	0.017	0.007	0.077	2.16%	3.66%
1330-1400	21.82	0.036	0.020	0.017	0.005	0.078	2.20%	3.71%
1400-1430	22.25	0.036	0.017	0.019	0.007	0.079	2.25%	3.75%
1430-1500	22.70	0.037	0.019	0.018	0.005	0.079	2.29%	3.75%
1500-1530	23.00	0.037	0.020	0.020	0.007	0.084	2.32%	3.99%
1530-1600	23.24	0.036	0.016	0.018	0.006	0.076	2.35%	3.61%
1600-1630	23.14	0.032	0.011	0.013	0.004	0.060	2.34%	2.85%
1630-1700	22.67	0.020	0.007	0.005	0.002	0.034	2.29%	1.62%
1700-1730	22.14	0.010	0.002	0.002	0.001	0.015	2.23%	0.71%
1730-1800	21.50	0.004	0.001	0.001	0.000	0.006	2.17%	0.29%
1800-1830	20.78	0.002	0.000	0.002	0.000	0.004	2.10%	0.19%
1830-1900	20.17	0.001	0.000	0.001	0.000	0.002	2.04%	0.10%
1900-1930	19.72	0.001	0.000	0.001	0.000	0.002	1.99%	0.10%
1930-2000	19.77	0.001	0.000	0.002	0.000	0.003	1.99%	0.14%
2000-2030	19.89	0.006	0.000	0.007	0.003	0.016	2.01%	0.76%
2030-2100	20.28	0.023	0.000	0.016	0.009	0.048	2.05%	2.28%
2100-2130	20.76	0.023	0.016	0.023	0.009	0.071	2.09%	3.37%
2130-2200	21.59	0.031	0.030	0.020	0.005	0.086	2.18%	4.09%
2200-2230	22.56	0.036	0.025	0.013	0.002	0.076	2.28%	3.61%
2230-2300	23.43	0.035	0.011	0.020	0.008	0.074	2.36%	3.52%
2300-2330	24.02	0.036	0.014	0.026	0.010	0.086	2.42%	4.09%
2330-2400	24.19	0.031	0.028	0.023	0.007	0.089	2.44%	4.23%
Total	**990.93**	**0.702**	**0.598**	**0.602**	**0.202**	**2.105**		

Winter Season (December 2023)

E-bus Charging load vis-à-vis the daily Demand of DISCOM along with the Heat map of E- Bus Charging and total load of DISCOMs for December 2023 for all three DISCOMs in Delhi, is as follows:

1. For BSES Rajdhani Power Ltd.

Figure 25: BRPL E-bus Charging Energy Sales, block wise (MU) in Dec 2023

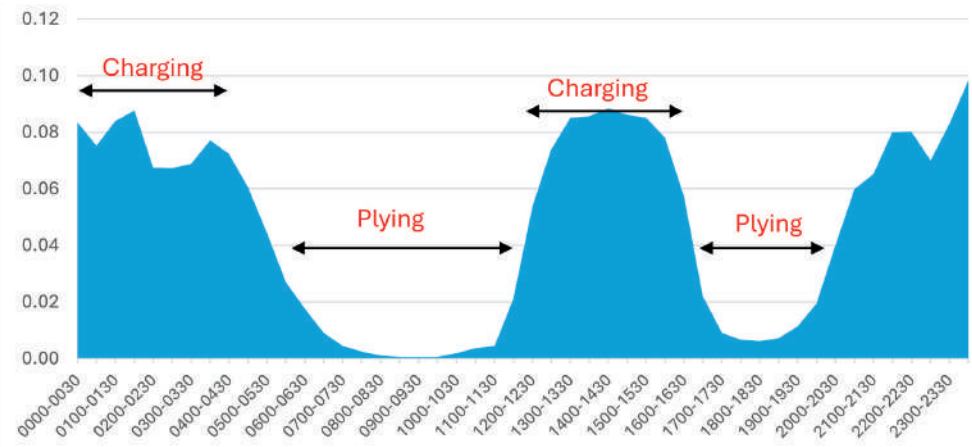
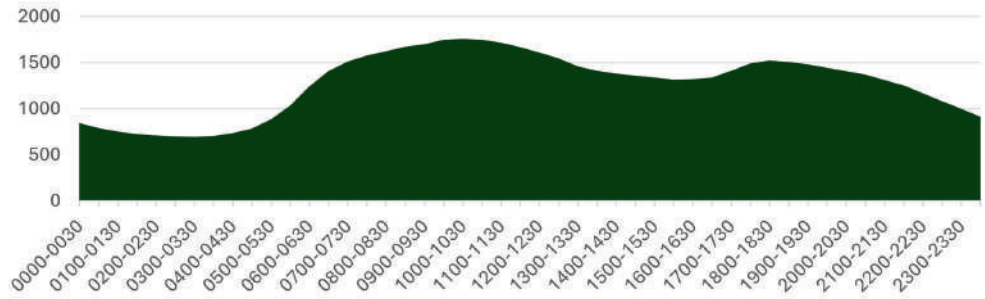


Figure 26: BRPL Demand, block wise (MW) in Dec 2023



Observations

i. The peak load of DISCOM and the charging load of E-buses do not occur simultaneously.

ii. During the night hours, when E-bus charging demand is high, DISCOM does not experience peak load.

iii. In contrast, during the morning hours (7:00 AM to 11:00 AM), when there is no significant E-bus charging, DISCOM records its peak demand.

Heat map of E-bus Charging and total load of BRPL for December 2023

Observations during Winter

i. The peak load of DISCOM and E-bus charging does not coincide during the night hours (10:00 PM to 2:30 AM) or the afternoon hours (2:30 PM to 4:00 PM).

ii. During the morning period (7:00 AM to 10:00 AM), DISCOM records its peak load, while there is no significant demand from E-bus charging.

iii. A similar pattern is observed during the evening hours (6:00 PM to 8:00 PM), when DISCOM faces peak demand without corresponding E-bus charging load.

Figure 27: BRPL E-bus consumption and Demand, block wise in Dec 2023

Time Block	Demand Met(MU)	E-Bus Consumption (MU)			Total E-Bus consumption (MU)	Demand met (%) wrt Total Demand Met	E-Bus consumption (%) wrt Total E-Bus consumption
		Mundhela (4.8 MW)	Mayapuri (4 MW)	Nehru Place (5 MW)			
0000-0030	12.61	0.04	0.02	0.02	0.08	1.37%	3.74%
0030-0100	11.86	0.03	0.02	0.02	0.08	1.29%	3.36%
0100-0130	11.30	0.03	0.03	0.02	0.08	1.23%	3.76%
0130-0200	10.92	0.04	0.02	0.03	0.09	1.19%	3.92%
0200-0230	10.63	0.04	0.01	0.02	0.07	1.16%	3.02%
0230-0300	10.46	0.02	0.03	0.01	0.07	1.14%	3.01%
0300-0330	10.44	0.02	0.03	0.02	0.07	1.14%	3.08%
0330-0400	10.56	0.04	0.02	0.02	0.08	1.15%	3.45%
0400-0430	11.03	0.04	0.02	0.01	0.07	1.20%	3.24%
0430-0500	11.78	0.03	0.02	0.01	0.06	1.28%	2.71%
0500-0530	13.32	0.01	0.02	0.01	0.04	1.45%	1.99%
0530-0600	15.54	0.01	0.02	0.01	0.03	1.69%	1.20%
0600-0630	18.65	0.00	0.01	0.00	0.02	2.03%	0.79%
0630-0700	21.15	0.00	0.01	0.00	0.01	2.30%	0.41%
0700-0730	22.67	0.00	0.00	0.00	0.00	2.47%	0.20%
0730-0800	23.67	0.00	0.00	0.00	0.00	2.58%	0.11%
0800-0830	24.39	0.00	0.00	0.00	0.00	2.66%	0.05%
0830-0900	25.10	0.00	0.00	0.00	0.00	2.74%	0.03%
0900-0930	25.52	0.00	0.00	0.00	0.00	2.78%	0.02%
0930-1000	26.21	0.00	0.00	0.00	0.00	2.86%	0.03%
1000-1030	26.36	0.00	0.00	0.00	0.00	2.87%	0.09%
1030-1100	26.22	0.00	0.00	0.00	0.00	2.86%	0.16%
1100-1130	25.73	0.00	0.00	0.00	0.00	2.80%	0.20%
1130-1200	25.02	0.01	0.00	0.01	0.02	2.73%	0.94%
1200-1230	24.11	0.03	0.01	0.02	0.05	2.63%	2.41%
1230-1300	23.21	0.03	0.02	0.02	0.07	2.53%	3.31%
1300-1330	21.87	0.03	0.02	0.03	0.09	2.38%	3.81%
1330-1400	21.17	0.04	0.02	0.03	0.09	2.31%	3.83%
1400-1430	20.72	0.04	0.02	0.03	0.09	2.26%	3.96%
1430-1500	20.39	0.04	0.02	0.03	0.09	2.22%	3.85%
1500-1530	20.06	0.04	0.02	0.03	0.09	2.19%	3.81%
1530-1600	19.77	0.03	0.02	0.03	0.08	2.15%	3.50%
1600-1630	19.79	0.02	0.01	0.02	0.06	2.16%	2.55%
1630-1700	20.07	0.01	0.00	0.01	0.02	2.19%	0.99%
1700-1730	21.21	0.00	0.00	0.01	0.01	2.31%	0.40%
1730-1800	22.39	0.00	0.00	0.00	0.01	2.44%	0.30%
1800-1830	22.82	0.00	0.00	0.00	0.01	2.49%	0.28%
1830-1900	22.61	0.00	0.00	0.00	0.01	2.46%	0.32%
1900-1930	22.19	0.01	0.00	0.00	0.01	2.42%	0.51%
1930-2000	21.68	0.01	0.01	0.01	0.02	2.36%	0.87%
2000-2030	21.09	0.01	0.01	0.01	0.04	2.30%	1.80%
2030-2100	20.54	0.02	0.02	0.02	0.06	2.24%	2.68%
2100-2130	19.65	0.03	0.02	0.01	0.07	2.14%	2.92%
2130-2200	18.75	0.04	0.02	0.02	0.08	2.04%	3.58%
2200-2230	17.54	0.04	0.02	0.02	0.08	1.91%	3.59%
2230-2300	16.24	0.03	0.02	0.02	0.07	1.77%	3.13%
2300-2330	14.92	0.04	0.03	0.02	0.08	1.63%	3.71%
2330-2400	13.70	0.04	0.03	0.03	0.10	1.49%	4.40%
Total	**917.63**	**0.97**	**0.63**	**0.64**	**2.23**		

2. For TATA Power Delhi Distribution Ltd

Figure 28: TPDDL E-bus Charging Energy Sales, block wise (MU) in Dec 2023

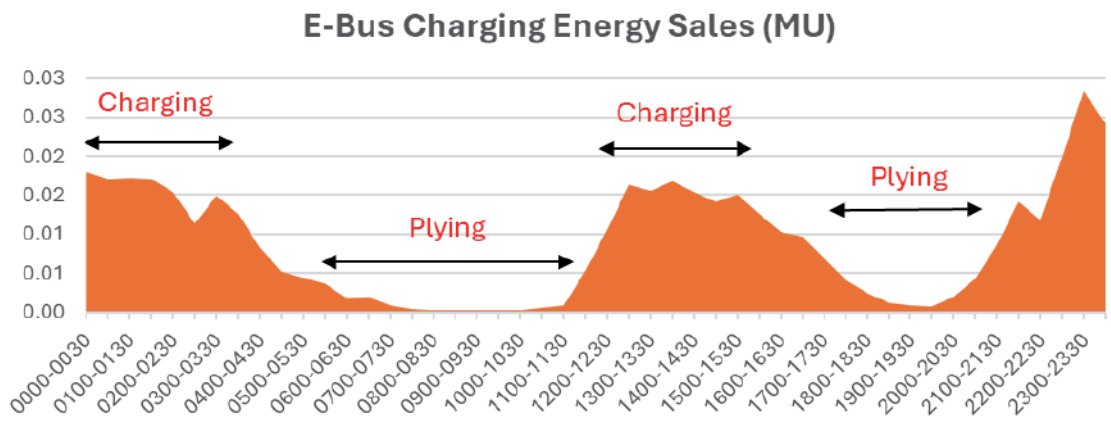
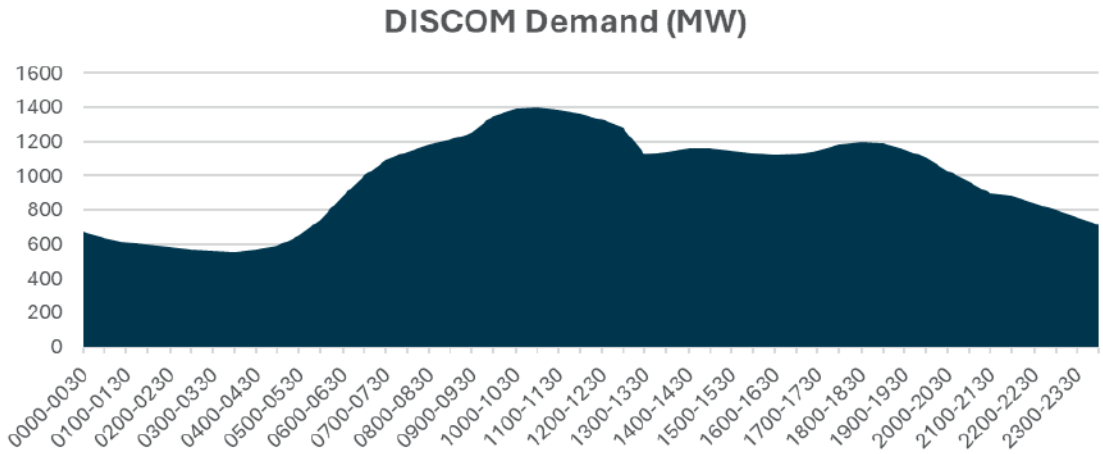


Figure 29: TPDDL Demand, block wise (MW) in Dec 2023



Observations:

i. The peak load of the DISCOM and the charging load of E-buses do not occur simultaneously.

ii. During the night hours, when E-bus charging demand is high, DISCOM does not experience peak load.

iii. In contrast, during the morning period (7:00 AM to 11:00 AM), when there is no E-bus charging, the DISCOM records peak demand.

iv. A similar pattern is observed during the afternoon and evening hours.

Heat map of E-bus Charging and total load of TPDDL for December 2023

Observations during Winter Season:

i. The peak load of DISCOM and the charging load of E-buses do not coincide during the night hours (10:00 PM to 2:30 AM) or the afternoon hours (2:30 PM to 4:00 PM).

ii. During the morning period (7:00 AM to 10:00 AM), DISCOM experiences peak demand, while there is no significant load from E-bus charging.

iii. A similar pattern is observed during the evening hours (6:00 PM to 8:00 PM), when DISCOM faces peak load without corresponding E-bus charging demand.

Figure 30: TPDDL E-bus consumption and Demand, block wise in Dec 2023

Time Block	Demand Met (MU)	E-Bus Consumption		Total E-Bus consumption (MU)	Demand Met (%) wrt Total Demand Met	E-Bus consumption (%) wrt Total E-Bus
		Depot 5 - Wazirpur	Depot-6-Subhash Place			
0000-0030	10.07	0.002	0.016	0.018	1.41%	4.23%
0030-0100	9.62	0.003	0.014	0.017	1.35%	4.01%
0100-0130	9.18	0.004	0.014	0.017	1.29%	4.07%
0130-0200	8.94	0.003	0.014	0.017	1.25%	4.04%
0200-0230	8.75	0.003	0.012	0.015	1.22%	3.63%
0230-0300	8.57	0.003	0.009	0.011	1.20%	2.67%
0300-0330	8.38	0.003	0.012	0.015	1.17%	3.50%
0330-0400	8.34	0.002	0.010	0.013	1.17%	2.96%
0400-0430	8.50	0.001	0.007	0.008	1.19%	1.97%
0430-0500	8.86	0.001	0.005	0.005	1.24%	1.23%
0500-0530	9.74	0.001	0.004	0.004	1.36%	1.04%
0530-0600	11.16	0.001	0.003	0.004	1.56%	0.88%
0600-0630	13.22	0.000	0.001	0.002	1.85%	0.41%
0630-0700	15.03	0.001	0.001	0.002	2.11%	0.46%
0700-0730	16.34	0.000	0.000	0.001	2.29%	0.21%
0730-0800	17.15	0.000	0.000	0.000	2.40%	0.12%
0800-0830	17.77	0.000	0.000	0.000	2.49%	0.07%
0830-0900	18.12	0.000	0.000	0.000	2.54%	0.07%
0900-0930	18.82	0.000	0.000	0.000	2.64%	0.06%
0930-1000	20.25	0.000	0.000	0.000	2.84%	0.06%
1000-1030	20.85	0.000	0.000	0.000	2.92%	0.06%
1030-1100	20.99	0.000	0.000	0.001	2.94%	0.13%
1100-1130	20.78	0.000	0.000	0.001	2.91%	0.19%
1130-1200	20.44	0.000	0.005	0.005	2.86%	1.28%
1200-1230	19.95	0.001	0.009	0.011	2.79%	2.50%
1230-1300	19.21	0.002	0.014	0.016	2.69%	3.85%
1300-1330	16.88	0.003	0.013	0.016	2.36%	3.67%
1330-1400	17.13	0.002	0.014	0.017	2.40%	3.94%
1400-1430	17.46	0.002	0.013	0.015	2.45%	3.64%
1430-1500	17.47	0.002	0.012	0.014	2.45%	3.34%
1500-1530	17.26	0.002	0.013	0.015	2.42%	3.54%
1530-1600	17.01	0.001	0.011	0.013	2.38%	2.98%
1600-1630	16.81	0.001	0.009	0.010	2.35%	2.41%
1630-1700	16.88	0.001	0.009	0.010	2.36%	2.26%
1700-1730	17.21	0.000	0.007	0.007	2.41%	1.63%
1730-1800	17.77	0.000	0.004	0.004	2.49%	0.96%
1800-1830	18.00	0.001	0.002	0.002	2.52%	0.56%
1830-1900	17.82	0.000	0.001	0.001	2.50%	0.27%
1900-1930	17.36	0.000	0.001	0.001	2.43%	0.19%
1930-2000	16.58	0.000	0.001	0.001	2.32%	0.18%
2000-2030	15.49	0.001	0.001	0.002	2.17%	0.48%
2030-2100	14.46	0.000	0.004	0.004	2.03%	1.02%
2100-2130	13.46	0.000	0.008	0.009	1.89%	2.03%
2130-2200	13.21	0.002	0.012	0.014	1.85%	3.35%
2200-2230	12.64	0.002	0.010	0.012	1.77%	2.79%
2230-2300	12.04	0.002	0.018	0.020	1.69%	4.69%
2300-2330	11.34	0.005	0.024	0.028	1.59%	6.68%
2330-2400	10.69	0.004	0.020	0.024	1.50%	5.71%
Total	**714.01**	**0.065**	**0.359**	**0.425**		

3. For BSES Yamuna Power Ltd

Figure 31: BYPL E-bus Charging Energy Sales, block wise (MU) in Dec 2023

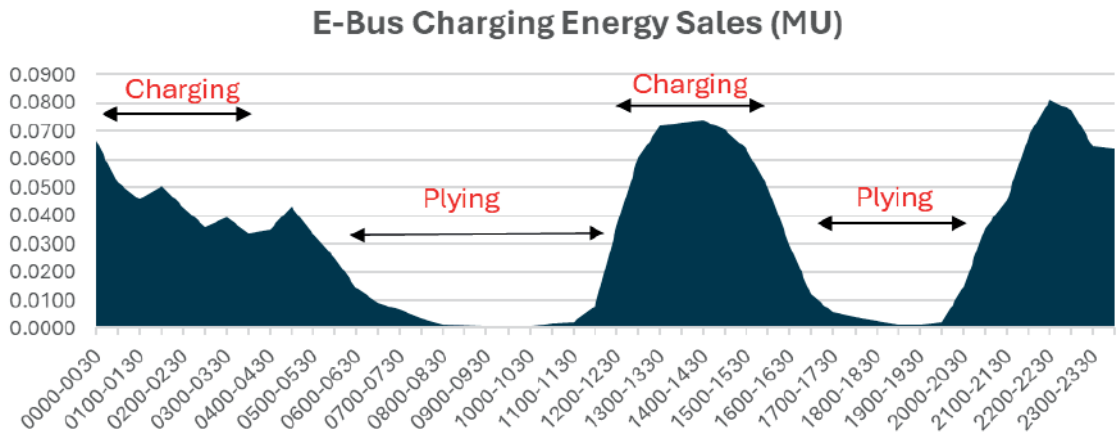
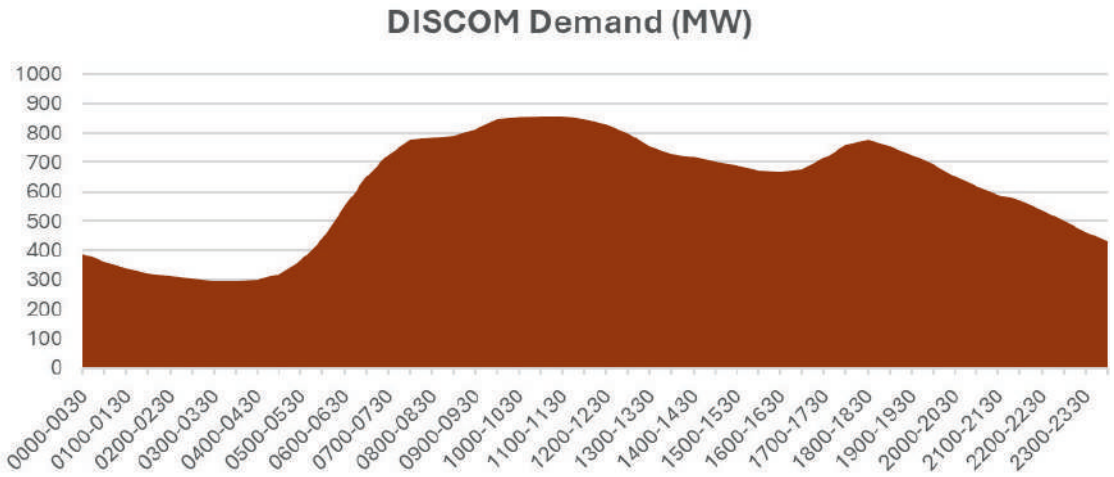


Figure 32: BYPL Demand, block wise (MW) in Dec 2023



Observations:

i. The peak load of the DISCOM and the charging load of E-buses do not occur simultaneously.

ii. During the night hours, when E-bus charging demand is high, the DISCOM does not experience peak load.

iii. In contrast, during the morning period (7:00 AM to 11:00 AM), when there is no E-bus charging, the DISCOM records its peak demand.

Heat map of E-bus Charging and total load of BYPL for December 2023

Observations during Winter

i. The peak load of the DISCOM and the charging load of E-buses do not coincide during the night hours (10:00 PM to 2:30 AM) or the afternoon hours (2:30 PM to 4:00 PM).

ii. During the morning period (7:00 AM to 10:00 AM), the DISCOM experiences peak demand, while there is no corresponding E-bus charging load.

iii. A similar trend is observed during the evening hours (6:00 PM to 8:00 PM), when the DISCOM records peak demand without significant E-bus charging.

Figure 33: BYPL E-bus consumption and Demand, block wise in Dec 2023

Time Block	Demand Met (MU)	E-Bus Consumption (MU)		Total E-Bus Consumption (MU)	Demand met (%) wrt of Total demand Met	E-Bus consumption (%) wrt Total E-bus
		Rajghat- 4 MW	Hasanpur- 8 MW			
0000-0030	5.87	0.0208	0.046	0.067	1.33%	4.26%
0030-0100	5.40	0.0147	0.037	0.052	1.22%	3.31%
0100-0130	5.08	0.0104	0.036	0.046	1.15%	2.94%
0130-0200	4.87	0.0065	0.044	0.050	1.10%	3.22%
0200-0230	4.69	0.0027	0.040	0.043	1.06%	2.73%
0230-0300	4.54	0.0010	0.035	0.036	1.03%	2.30%
0300-0330	4.45	0.0006	0.039	0.040	1.01%	2.53%
0330-0400	4.41	0.0004	0.033	0.034	1.00%	2.16%
0400-0430	4.50	0.0004	0.035	0.035	1.02%	2.26%
0430-0500	4.79	0.0004	0.043	0.043	1.09%	2.76%
0500-0530	5.50	0.0004	0.033	0.034	1.24%	2.15%
0530-0600	6.61	0.0003	0.025	0.025	1.50%	1.59%
0600-0630	8.29	0.0004	0.014	0.014	1.88%	0.90%
0630-0700	9.78	0.0003	0.009	0.009	2.21%	0.60%
0700-0730	10.91	0.0003	0.006	0.007	2.47%	0.42%
0730-0800	11.60	0.0003	0.003	0.004	2.63%	0.24%
0800-0830	11.76	0.0002	0.001	0.002	2.66%	0.10%
0830-0900	11.88	0.0002	0.001	0.001	2.69%	0.06%
0900-0930	12.20	0.0003	0.000	0.001	2.76%	0.04%
0930-1000	12.69	0.0002	0.000	0.000	2.87%	0.03%
1000-1030	12.80	0.0003	0.000	0.001	2.90%	0.05%
1030-1100	12.89	0.0016	0.000	0.002	2.92%	0.12%
1100-1130	12.88	0.0019	0.000	0.002	2.92%	0.14%
1130-1200	12.69	0.0043	0.004	0.008	2.87%	0.52%
1200-1230	12.42	0.0179	0.018	0.036	2.81%	2.32%
1230-1300	12.02	0.0358	0.025	0.061	2.72%	3.89%
1300-1330	11.31	0.0369	0.035	0.072	2.56%	4.59%
1330-1400	10.93	0.0362	0.037	0.073	2.47%	4.66%
1400-1430	10.74	0.0368	0.037	0.074	2.43%	4.74%
1430-1500	10.55	0.0345	0.036	0.070	2.39%	4.50%
1500-1530	10.32	0.0287	0.035	0.063	2.34%	4.06%
1530-1600	10.09	0.0174	0.033	0.050	2.29%	3.19%
1600-1630	10.01	0.0080	0.021	0.029	2.27%	1.88%
1630-1700	10.18	0.0033	0.009	0.012	2.31%	0.77%
1700-1730	10.73	0.0025	0.003	0.006	2.43%	0.36%
1730-1800	11.40	0.0018	0.002	0.004	2.58%	0.26%
1800-1830	11.62	0.0007	0.002	0.003	2.63%	0.18%
1830-1900	11.32	0.0005	0.001	0.002	2.56%	0.10%
1900-1930	10.92	0.0009	0.001	0.001	2.47%	0.10%
1930-2000	10.39	0.0021	0.000	0.003	2.35%	0.16%
2000-2030	9.77	0.0087	0.006	0.015	2.21%	0.95%
2030-2100	9.31	0.0104	0.025	0.036	2.11%	2.27%
2100-2130	8.88	0.0174	0.028	0.045	2.01%	2.90%
2130-2200	8.56	0.0292	0.039	0.068	1.94%	4.36%
2200-2230	8.04	0.0360	0.045	0.081	1.82%	5.18%
2230-2300	7.51	0.0380	0.039	0.077	1.70%	4.95%
2300-2330	6.96	0.0333	0.031	0.065	1.58%	4.14%
2330-2400	6.44	0.0260	0.038	0.064	1.46%	4.08%
Total	441.48	0.5317	1.0327	1.5644		

Findings Summarised

Analysis of the graphs and heat maps of demand and consumption indicates that the charging load of E-buses coincides with the peak demand of DISCOMs during the summer months (March to October), covering approximately eight months of the year. This overlap results in an additional financial burden on DISCOMs, as they are required to procure short-term power from the Power Exchange at elevated prices.

E-Bus Working Model

The Delhi Transport Corporation (DTC) had issued a Request for Proposal (RFP)[8] for the selection of bus operators (Aggregators) for the supply, operation, and maintenance of 300 air-conditioned E-buses (12 meters) under the Operating Expenditure (OPEX) model on a Public-Private-Partnership (PPP) Build-Own-Operate-Transfer (BOOT) basis.

Under this tender, the operating model adopted by DTC is the BOOT framework, wherein DTC pays monthly fixed charges to the aggregators on a per-kilometre basis under the OPEX model. At the end of the contract period, the immovable charging infrastructure created at various depots becomes the property of the DTC, while movable assets, including buses, are to be removed by the aggregator. According to the RFP, the responsibilities of differenr stakeholders are as follows:

Stakeholder Responsibilities in E-bus Operations

DISCOMs' Contribution

- Supply of electricity to E-bus charging stations at tariffs determined by the Delhi Electricity Regulatory Commission (DERC).

DTC Responsibilities

- Provision of land and conductors for bus operations.
- Payment of per-kilometre charges to operators for assured annual bus kilometres.
- Bearing the cost of electricity for charging buses on an actual basis, subject to the energy efficiency norms specified by DTC.

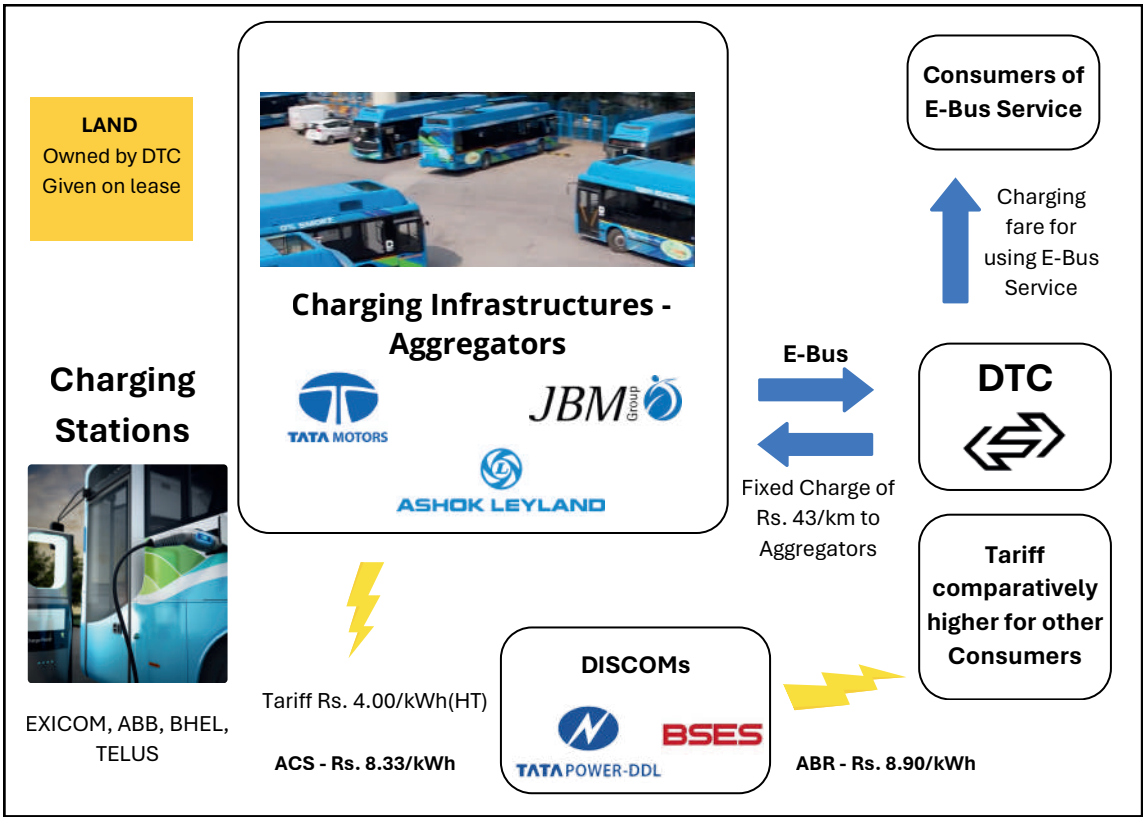
Aggregators' Role
(Tata Motors Limited, JBM Auto & Ashok Leyland)

- Procurement of buses, including preventive and breakdown maintenance, and operation of buses on DTC-specified routes.
- Development of charging and associated distribution infrastructure.
- Compliance with performance metrics and safety requirements.
- Utilisation of land provided on lease.

[8] *DTC RFP Number: DCGM/SBU/940/2020/AC*

Based on the provisions of the DTC tender, the working model of E-bus operations—covering the roles and responsibilities of DTC, aggregators, and DISCOMs—has been analysed. This model is illustrated in Figure 34.

Figure 34: Electric Bus Working Model



Other key details of E-buses:

Table 5: E-bus Tender Details

Responsibility	Details
Fleet Procurement	300 buses (AC, electric, 12m)
Battery Range	Min. 140 km (80% SOC); 120 km with AC + passengers
Operations	18 hours/day, min 200 km/day
Charging	Mix of slow and fast chargers with depot development
Maintenance	Full lifecycle (12 years or 10 lakh km)
Staff & Training	Certified drivers, mechanics, safety compliance
Compliance	CMVR, AIS-052, BIS, Bus Code, FAME-II norms

E-bus Depots:

For the purpose of this study, the actual E-bus depot load as of **November 2024**—amounting to **69 MW**—has been considered. A tentative additional load of **268 MW** is projected for **FY 2025–26.** Further details of the E-bus depot load are provided in **Annexures 1 and 2**.

Optimisation through Shifting of E-bus Charging Load

Based on the evidence-based research conducted by Power Foundation of India, it is noted that the E-bus charging load coincides with the peak demand of DISCOMs during the summer months. To meet this additional demand, DISCOMs are often required to procure costly short-term power, averaging Rs. 8.50/kWh. Optimisation can, however, be achieved by rescheduling E-bus charging slots, thereby shifting the load from peak periods to align with the availability of long-term power and reducing reliance on high-cost short-term procurement.

The charging schedule of a specific E-bus depot has been examined to assess the opportunities and scope for shifting charging load from peak to non-peak hours. The morning and evening operational schedule of E-buses is presented as follows:

Table 6: E-bus morning Schedule as per DTC

MORNING DUTY NPD					
S. No.	Route	Duty No.	Schedule O/Shedding time	Route time	Schedule I/Shedding time
1	442	1	4:40	7:20	12:00
2	442	2	5:20	7:35	12:55
3	442	3	6:00	7:35	13:35
4	442	4	6:20	7:35	13:55
5	442	5	6:40	7:35	14:15
6	442	6	7:00	7:35	14:35
7	442	7	7:20	7:35	14:55
8	442	8	7:40	7:35	15:15
9	442	9	8:00	7:35	15:35
10	442	10	8:20	7:35	15:55
11	534 A	1	4:15	7:40	11:55
12	534 A	2	4:30	7:40	12:10
13	534 A	4	5:00	7:40	12:40
14	534 A	5	5:15	7:45	13:00
15	534 A	6	5:30	7:40	13:10
16	534 A	7	5:45	7:40	13:25
17	534 A	9	6:15	7:40	13:55
18	534 A	10	6:30	7:40	14:10
19	534 A	12	7:00	7:40	14:40
20	534 A	13	7:15	7:40	14:55
21	534 A	15	7:50	7:20	15:10
22	534 A	17	8:15	7:40	15:55
23	724	23	6:10	7:30	13:40
24	724	24	7:10	7:30	14:40
25	724	25	8:10	7:30	15:40

Table 7: E-bus evening Schedule as per DTC

EVENING DUTY NPD					
S. No.	Route	Duty No.	Schedule O/Shedding time	Route time	Schedule I/Shedding time
1	442	1A	13:45	7:15	21:00
2	442	2A	14:15	7:10	21:25
3	442	3A	14:38	7:37	22:15
4	442	4A	14:58	7:37	22:35
5	442	5A	15:18	7:37	22:55
6	442	6A	15:38	7:37	23:15
7	442	7A	15:58	7:37	23:35
8	442	8A	16:18	7:37	23:55
9	442	9A	16:38	7:37	0:15
10	442	10A	16:58	7:37	0:35
11	534 A	01A	12:55	7:45	20:40
12	534 A	04A	13:40	7:45	21:25
13	534 A	06A	14:10	7:45	21:55
14	534 A	09A	14:55	7:45	22:40
15	534 A	10A	15:10	7:45	22:55
16	534 A	12A	15:40	7:45	23:25
17	534 A	15A	17:00	7:20	0:20
18	534 A	17A	16:40	7:20	0:00
19	724	1A	13:20	7:05	20:25
20	724	24A	15:42	7:33	23:15
21	724	25A	16:45	7:30	0:15

As per the above E-bus schedule (Tables 6 & 7), **Bus No. 442** departs the depot at **4:40 AM**, returns at **12:00 noon**, and remains in the depot for approximately two hours, of which **one hour is utilised for booster charging**. The E-bus then departs again at 1:45 PM, returns at 9:00 PM, and remains in the depot for about eight hours, during which two hours of charging are carried out—sufficient to fully recharge the E-bus.

This analysis highlights a **clear opportunity for shifting E-bus charging load from peak to non-peak hours**, enabling DISCOMs to meet this demand through cheaper long-term Power Purchase Agreements. To optimise charging patterns, it is assumed that **up to 50% of the E-bus charging load during peak slots can be shifted to adjacent non-peak periods.**

Based on these assumptions, **the schedule optimisation and corresponding savings in Power Purchase costs for DISCOMs in June and July 2024** are presented as follows:

Table 8: Schedule Optimization for BRPL, June 2024

Time Block	Demand Met (MU)	Total E-Bus consumption (MU)	Demand met (%) wrt Total Demand Met	E-Bus consumption (%) wrt Total E-Bus consumption	Long Term (MU)	ST-Exchange (MU) BUY	Net Power Purchase (MU)	LT Price (Rs/kWh)	ST Price (Rs/kWh) BUY	Total available Long Term Power	Scenario-1		
											Existing E-Bus Charging Pattern	Revised E-Bus Charging Pattern	Cost Savings through LT
0000-0030	49.28	0.163	2.44%	3.53%	32.42	7.44	51.50	5.07	9.88		0.16	0.16	
0030-0100	48.33	0.171	2.39%	3.71%	31.58	7.23	50.35	5.07	9.83		0.17	0.17	
0100-0130	47.22	0.150	2.34%	3.27%	30.93	6.66	49.29	5.07	9.25		0.15	0.15	
0130-0200	46.17	0.138	2.29%	3.00%	30.37	5.99	47.88	5.07	8.88		0.14	0.14	
0200-0230	44.97	0.144	2.23%	3.12%	29.65	4.96	46.44	5.07	6.96		0.14	0.14	
0230-0300	43.95	0.159	2.18%	3.47%	29.22	4.45	45.33	5.07	6.54		0.16	0.16	
0300-0330	42.86	0.168	2.12%	3.66%	28.72	4.51	44.37	5.07	6.18		0.17	0.17	
0330-0400	41.81	0.155	2.07%	3.37%	28.26	3.70	43.16	5.07	6.19		0.16	0.16	
0400-0430	40.69	0.135	2.01%	2.93%	27.93	3.10	42.06	5.07	6.45		0.13	0.13	
0430-0500	39.64	0.132	1.96%	2.86%	27.53	2.51	41.01	5.07	6.72	106.99	**0.13**	**0.07**	0.01
0500-0530	38.31	0.152	1.90%	3.30%	26.89	1.88	39.71	5.07	6.83		**0.15**	**0.08**	0.01
0530-0600	36.71	0.154	1.82%	3.35%	26.13	1.38	38.03	5.07	7.69		**0.15**	**0.08**	0.02
0600-0630	35.43	0.127	1.75%	2.77%	26.45	1.13	36.60	5.07	6.83		**0.13**	**0.06**	0.01
0630-0700	34.44	0.087	1.71%	1.90%	26.22	0.85	35.50	5.07	6.82	52.49	**0.09**	**0.23**	
0700-0730	33.75	0.054	1.67%	1.18%	26.27	0.59	34.69	5.07	5.19	**54.50**	**0.05**	**0.20**	
0730-0800	33.30	0.029	1.65%	0.63%	26.64	0.56	34.42	5.07	4.87		0.03	0.03	
0800-0830	33.12	0.014	1.64%	0.30%	27.13	0.52	34.28	5.07	4.13		0.01	0.01	
0830-0900	33.38	0.007	1.65%	0.16%	28.18	0.52	34.59	5.07	3.86		0.01	0.01	
0900-0930	34.34	0.005	1.70%	0.10%	29.25	0.57	35.42	5.07	3.89		0.00	0.00	
0930-1000	35.90	0.004	1.78%	0.10%	30.34	0.56	36.82	5.07	4.00		0.00	0.00	
1000-1030	37.32	0.005	1.85%	0.11%	31.15	0.67	38.14	5.07	3.50		0.00	0.00	
1030-1100	38.60	0.006	1.91%	0.13%	31.79	0.76	39.46	5.07	3.69		0.01	0.01	
1100-1130	39.71	0.008	1.97%	0.18%	32.09	0.79	40.60	5.07	3.55		0.01	0.01	
1130-1200	40.65	0.026	2.01%	0.55%	32.14	0.83	41.54	5.07	3.56		0.03	0.03	
1200-1230	41.56	0.071	2.06%	1.54%	32.51	0.86	42.63	5.07	3.60		0.07	0.07	
1230-1300	42.59	0.128	2.11%	2.79%	32.85	1.04	43.70	5.07	3.53		0.13	0.13	
1300-1330	43.27	0.147	2.14%	3.20%	33.31	1.04	44.39	5.07	3.41		0.15	0.15	
1330-1400	44.36	0.156	2.20%	3.40%	34.19	1.10	45.58	5.07	4.06		0.16	0.16	
1400-1430	45.75	0.155	2.27%	3.37%	35.54	2.45	47.24	5.07	4.09		0.15	0.15	
1430-1500	46.96	0.162	2.33%	3.52%	36.05	3.12	48.52	5.07	4.44		0.16	0.16	
1500-1530	47.52	0.160	2.35%	3.49%	35.77	3.98	49.20	5.07	4.32		0.16	0.16	
1530-1600	47.22	0.162	2.34%	3.51%	35.01	4.78	49.26	5.07	4.48		0.16	0.16	
1600-1630	46.76	0.135	2.32%	2.93%	34.30	4.70	48.10	5.07	4.24		0.13	0.13	
1630-1700	45.74	0.093	2.26%	2.02%	33.47	4.40	46.94	5.07	4.36		0.09	0.09	
1700-1730	44.37	0.054	2.20%	1.18%	32.14	4.09	45.30	5.07	4.51		0.05	0.05	
1730-1800	42.66	0.026	2.11%	0.56%	30.87	3.53	43.68	5.07	4.49		0.03	0.03	
1800-1830	40.83	0.013	2.02%	0.29%	29.85	2.96	41.83	5.07	5.20		0.01	0.01	
1830-1900	39.57	0.010	1.96%	0.21%	29.62	2.27	40.72	5.07	6.31		0.01	0.01	
1900-1930	39.23	0.008	1.94%	0.17%	29.71	2.34	40.56	5.07	8.94		0.01	0.01	
1930-2000	39.93	0.010	1.98%	0.21%	29.67	2.79	41.17	5.07	8.87		0.01	0.01	
2000-2030	41.14	0.021	2.04%	0.46%	29.65	4.39	42.55	5.07	9.39	68.44	0.02	0.02	
2030-2100	42.71	0.059	2.11%	1.29%	30.19	4.97	43.97	5.07	9.40	60.91	**0.06**	**0.21**	
2100-2130	44.36	0.092	2.20%	1.99%	30.72	6.23	45.82	5.07	9.67		**0.09**	**0.24**	
2130-2200	46.27	0.141	2.29%	3.07%	32.03	6.95	48.15	5.07	9.62	129.35	**0.14**	**0.07**	0.03
2200-2230	48.08	0.177	2.38%	3.85%	32.41	6.92	50.34	5.07	9.65		**0.18**	**0.09**	0.04
2230-2300	49.41	0.157	2.45%	3.42%	32.43	7.84	51.41	5.07	9.76		**0.16**	**0.08**	0.04
2300-2330	49.91	0.127	2.47%	2.76%	32.48	8.41	52.08	5.07	9.77		**0.13**	**0.06**	0.03
2330-2400	49.79	0.143	2.47%	3.11%	32.27	8.42	51.79	5.07	9.76		0.14	0.14	
Total	**2019.87**	**4.60**			**1474.32**	**161.76**	**2086.10**				**4.60**	**4.60**	**0.20**

Note: 50% demand of Time Slots in Red is displaced to Time Slots in Green

Table 9: Schedule Optimization for BRPL, July 2024

Time Block	Demand Met (MU)	Total E-Bus consumption (MU)	Demand met (%) wrt Total Demand Met	E-Bus consumption (%) wrt Total E-Bus consumption	Long Term (MU)	ST-Exchange (MU) BUY	Net Power Purchase (MU)	LT Price (Rs/kWh)	ST Price (Rs/kWh) BUY	Total available Long Term Power	Scenario-1		
											Existing E-Bus Charging Pattern	New E-Bus Charging Pattern	Cost Savings through LT
0000-0030	44.83	0.163	2.36%	3.53%	29.80	6.04	46.84	4.62	9.67		0.16	0.16	
0030-0100	43.40	0.163	2.29%	3.51%	29.60	4.93	45.33	4.62	9.43		0.16	0.16	
0100-0130	42.02	0.149	2.21%	3.23%	29.33	3.62	43.74	4.62	9.07		0.15	0.15	
0130-0200	40.76	0.139	2.15%	3.01%	28.80	3.07	42.37	4.62	9.08		0.14	0.14	
0200-0230	39.67	0.145	2.09%	3.13%	28.33	2.17	41.17	4.62	7.71		0.14	0.14	
0230-0300	38.74	0.155	2.04%	3.35%	27.86	1.48	39.96	4.62	8.09		0.15	0.15	
0300-0330	37.70	0.149	1.98%	3.23%	27.29	1.37	38.86	4.62	7.58		0.15	0.15	
0330-0400	36.85	0.142	1.94%	3.08%	26.70	1.14	37.98	4.62	7.54		0.14	0.14	
0400-0430	36.05	0.141	1.90%	3.05%	26.35	0.79	37.22	4.62	7.08		**0.14**	**0.07**	0.02
0430-0500	35.31	0.142	1.86%	3.07%	25.98	0.55	36.47	4.62	7.22		**0.14**	**0.07**	0.02
0500-0530	34.58	0.143	1.82%	3.10%	25.40	0.41	35.71	4.62	5.51		**0.14**	**0.07**	0.01
0530-0600	33.62	0.147	1.77%	3.17%	24.97	0.36	34.73	4.62	5.83	102.70	**0.15**	**0.07**	0.01
0600-0630	33.04	0.129	1.74%	2.79%	24.99	0.35	34.05	4.62	6.06		**0.13**	**0.22**	
0630-0700	32.66	0.087	1.72%	1.89%	25.38	0.24	33.79	4.62	6.68		**0.09**	**0.18**	
0700-0730	32.25	0.052	1.70%	1.13%	25.77	0.20	33.36	4.62	6.83	76.13	**0.05**	**0.15**	
0730-0800	32.07	0.024	1.69%	0.51%	26.21	0.26	33.37	4.62	6.02	**26.57**	0.02	0.02	
0800-0830	32.44	0.011	1.71%	0.24%	27.07	0.44	33.70	4.62	4.80		0.01	0.01	
0830-0900	33.06	0.006	1.74%	0.14%	28.04	0.46	34.28	4.62	4.68		0.01	0.01	
0900-0930	34.14	0.004	1.80%	0.09%	29.12	0.55	35.41	4.62	4.38		0.00	0.00	
0930-1000	35.73	0.004	1.88%	0.08%	30.03	0.76	37.00	4.62	3.82		0.00	0.00	
1000-1030	37.03	0.003	1.95%	0.07%	30.85	0.66	38.20	4.62	3.73		0.00	0.00	
1030-1100	38.00	0.005	2.00%	0.11%	31.43	0.74	39.22	4.62	3.60		0.00	0.00	
1100-1130	38.76	0.007	2.04%	0.15%	31.83	0.91	40.04	4.62	3.53		0.01	0.01	
1130-1200	39.28	0.030	2.07%	0.64%	31.79	0.88	40.64	4.62	3.72		0.03	0.03	
1200-1230	39.67	0.077	2.09%	1.66%	32.00	0.73	41.00	4.62	3.74		0.08	0.08	
1230-1300	40.21	0.126	2.12%	2.72%	32.11	0.70	41.48	4.62	3.74		0.13	0.13	
1300-1330	40.39	0.148	2.13%	3.20%	32.41	0.69	41.69	4.62	3.36		0.15	0.15	
1330-1400	41.13	0.154	2.17%	3.32%	32.74	0.91	42.65	4.62	3.52		0.15	0.15	
1400-1430	42.40	0.160	2.23%	3.46%	33.46	1.08	43.79	4.62	3.71		0.16	0.16	
1430-1500	43.47	0.170	2.29%	3.68%	33.70	1.78	44.92	4.62	3.68		0.17	0.17	
1500-1530	43.73	0.164	2.30%	3.54%	33.46	2.28	45.29	4.62	4.11		0.16	0.16	
1530-1600	43.42	0.168	2.29%	3.64%	32.72	2.54	45.07	4.62	4.18		0.17	0.17	
1600-1630	42.90	0.139	2.26%	3.01%	32.30	2.16	44.19	4.62	4.07		0.14	0.14	
1630-1700	42.17	0.090	2.22%	1.94%	31.49	2.01	43.26	4.62	4.36		0.09	0.09	
1700-1730	41.45	0.047	2.18%	1.01%	30.57	2.00	42.39	4.62	4.56		0.05	0.05	
1730-1800	40.56	0.024	2.14%	0.52%	29.73	1.81	41.40	4.62	4.46		0.02	0.02	
1800-1830	39.53	0.014	2.08%	0.30%	29.49	1.61	40.75	4.62	4.64		0.01	0.01	
1830-1900	39.03	0.010	2.05%	0.22%	29.59	1.43	40.46	4.62	5.78		0.01	0.01	
1900-1930	39.13	0.009	2.06%	0.21%	29.53	2.53	40.87	4.62	9.43		0.01	0.01	
1930-2000	40.17	0.014	2.12%	0.31%	29.71	2.99	41.69	4.62	9.51		**0.01**	**0.11**	
2000-2030	41.30	0.034	2.17%	0.74%	29.90	4.12	42.96	4.62	9.72		**0.03**	**0.13**	
2030-2100	42.47	0.076	2.24%	1.63%	30.15	4.91	44.01	4.62	9.97	89.76	**0.08**	**0.17**	
2100-2130	43.59	0.099	2.30%	2.14%	29.99	6.15	44.99	4.62	9.95		**0.10**	**0.05**	0.03
2130-2200	45.01	0.138	2.37%	2.99%	30.30	7.21	46.40	4.62	10.00		**0.14**	**0.07**	0.04
2200-2230	45.97	0.167	2.42%	3.61%	30.39	7.70	47.84	4.62	10.00		**0.17**	**0.08**	0.04
2230-2300	46.79	0.153	2.46%	3.31%	30.21	8.29	48.33	4.62	10.00	120.89	**0.15**	**0.08**	0.04
2300-2330	46.80	0.145	2.46%	3.13%	30.09	8.60	48.51	4.62	9.99	**31.13**	0.14	0.14	
2330-2400	46.03	0.157	2.42%	3.39%	30.23	8.07	48.00	4.62	9.88		0.16	0.16	
Total(MU/Cr)	**1899.35**	**4.63**			**1419.17**	**114.68**	**1965.37**				**4.63**	**4.63**	**0.20**

Note: 50% demand of Time Slots in Red is displaced to Time Slots in Green

Table 10: Schedule Optimization for TPDDL, June 2024

Time Block	Demand Met (MU)	Total E-Bus consumption (MU)	Demand met (%) wrt Total	E-Bus consumption (%) wrt Total E-Bus Consumption	Long Term (MU)	ST-Exchange (MU) BUY	Net Power Purchase (MU)	LT Price (Rs/kWh)	ST Price (Rs/kWh) BUY	Total available Long Term Power	Scenario-1		
											Existing E-Bus Charging Pattern	New E-Bus Charging Pattern	Cost Savings through LT
0000-0030	30.97	0.344	2.38%	3.91%	25.75	0.50	32.03	3.96	9.84		0.34	0.34	
0030-0100	30.40	0.336	2.34%	3.81%	25.59	0.43	31.76	3.97	9.50		0.34	0.34	
0100-0130	29.65	0.351	2.28%	3.98%	25.16	0.35	31.19	3.94	7.95		0.35	0.35	
0130-0200	29.02	0.326	2.23%	3.71%	24.77	0.20	30.52	3.91	6.84		0.33	0.33	
0200-0230	28.37	0.306	2.18%	3.48%	24.66	0.16	30.31	3.90	6.52		**0.31**	**0.08**	**0.06**
0230-0300	27.69	0.297	2.13%	3.37%	24.29	0.07	29.84	3.89	5.96		**0.30**	**0.07**	**0.05**
0300-0330	26.91	0.275	2.07%	3.12%	23.41	0.04	28.91	3.87	5.22		**0.27**	**0.07**	**0.03**
0330-0400	26.23	0.246	2.02%	2.80%	22.71	0.01	28.18	3.85	5.00	95.07	**0.25**	**0.06**	**0.02**
0400-0430	25.48	0.217	1.96%	2.47%	22.41	0.00	27.86	3.85	0.00	87.90	**0.22**	**0.43**	
0430-0500	24.87	0.210	1.91%	2.39%	22.08	0.00	27.53	3.86	0.00	7.17	**0.21**	**0.42**	
0500-0530	24.01	0.202	1.84%	2.30%	21.78	0.00	27.67	3.86	0.00		**0.20**	**0.41**	
0530-0600	23.14	0.165	1.78%	1.87%	21.64	0.00	27.51	3.85	0.00		**0.17**	**0.38**	
0600-0630	22.44	0.105	1.72%	1.19%	21.70	0.00	27.51	3.84	0.00		0.11	0.11	
0630-0700	21.91	0.052	1.68%	0.59%	21.34	0.00	27.17	3.84	0.00		0.05	0.05	
0700-0730	21.54	0.024	1.65%	0.27%	20.30	0.00	26.24	3.84	0.00		0.02	0.02	
0730-0800	21.31	0.015	1.64%	0.17%	19.62	0.00	25.56	3.87	0.00		0.01	0.01	
0800-0830	21.26	0.014	1.63%	0.16%	19.18	0.00	25.11	3.90	0.00		0.01	0.01	
0830-0900	21.25	0.010	1.63%	0.11%	19.07	0.00	25.00	3.92	0.00		0.01	0.01	
0900-0930	22.23	0.006	1.71%	0.06%	19.06	0.00	25.00	3.93	0.00		0.01	0.01	
0930-1000	24.07	0.004	1.85%	0.04%	19.17	0.00	25.12	3.93	0.00		0.00	0.00	
1000-1030	25.32	0.003	1.94%	0.04%	19.43	0.00	25.37	3.93	0.00		0.00	0.00	
1030-1100	26.31	0.002	2.02%	0.02%	19.74	0.00	25.69	3.91	0.00		0.00	0.00	
1100-1130	27.05	0.004	2.08%	0.04%	20.15	0.00	26.12	3.90	0.00		0.00	0.00	
1130-1200	27.79	0.027	2.13%	0.31%	20.48	0.02	26.49	3.89	2.83		0.03	0.03	
1200-1230	28.49	0.105	2.19%	1.19%	20.66	0.07	26.74	3.88	2.78		0.11	0.11	
1230-1300	29.02	0.250	2.23%	2.84%	20.77	0.11	26.90	3.88	3.13		0.25	0.25	
1300-1330	28.16	0.325	2.16%	3.69%	20.60	0.03	26.60	3.88	2.67		0.32	0.32	
1330-1400	29.24	0.341	2.25%	3.88%	21.10	0.27	27.33	3.86	3.28		0.34	0.34	
1400-1430	30.46	0.348	2.34%	3.95%	21.98	0.82	28.77	3.85	3.62		0.35	0.35	
1430-1500	31.18	0.352	2.40%	4.00%	22.85	1.24	30.07	3.85	3.92		0.35	0.35	
1500-1530	31.61	0.355	2.43%	4.03%	23.33	1.61	30.96	3.85	4.02		0.35	0.35	
1530-1600	31.46	0.344	2.42%	3.90%	23.47	1.52	31.02	3.86	4.19		0.34	0.34	
1600-1630	31.04	0.327	2.38%	3.71%	23.45	1.22	30.71	3.85	4.03		0.33	0.33	
1630-1700	30.33	0.246	2.33%	2.80%	23.34	0.89	30.28	3.85	4.19		0.25	0.25	
1700-1730	29.30	0.140	2.25%	1.59%	23.44	0.62	30.02	3.84	3.89		0.14	0.14	
1730-1800	28.02	0.070	2.15%	0.79%	22.98	0.35	29.32	3.82	3.62		0.07	0.07	
1800-1830	26.91	0.032	2.07%	0.36%	22.47	0.19	28.87	3.81	3.49		0.03	0.03	
1830-1900	26.10	0.016	2.01%	0.18%	23.05	0.00	29.21	3.80	0.00		0.02	0.02	
1900-1930	25.72	0.010	1.98%	0.12%	24.54	0.00	30.41	3.82	0.00		**0.01**	**0.23**	
1930-2000	25.94	0.008	1.99%	0.09%	24.98	0.00	30.80	3.85	0.00		**0.01**	**0.23**	
2000-2030	26.18	0.015	2.01%	0.17%	25.26	0.00	31.04	3.86	0.00	3.66	**0.02**	**0.24**	
2030-2100	26.38	0.090	2.03%	1.02%	25.36	0.00	31.14	3.88	0.00	100.14	**0.09**	**0.31**	
2100-2130	26.74	0.234	2.05%	2.66%	25.50	0.00	31.30	3.88	10.00	103.80	**0.23**	**0.06**	**0.11**
2130-2200	28.16	0.344	2.16%	3.91%	25.70	0.01	31.44	3.89	10.00		**0.34**	**0.09**	**0.16**
2200-2230	29.46	0.331	2.26%	3.76%	26.18	0.07	31.78	4.00	10.00		**0.33**	**0.08**	**0.15**
2230-2300	30.45	0.281	2.34%	3.20%	26.42	0.16	32.10	4.06	10.00		**0.28**	**0.07**	**0.13**
2300-2330	31.02	0.332	2.38%	3.77%	26.36	0.32	32.17	4.06	10.00		0.33	0.33	
2330-2400	31.13	0.367	2.39%	4.17%	26.34	0.43	32.26	4.07	10.00		0.37	0.37	
Total	**1301.69**	**8.80**			**1093.60**	**11.70**	**1384.88**				**8.80**	**8.80**	**0.69**

Note: 50% demand of Time Slots in Red is displaced to Time Slots in Green

Table 11: Schedule Optimization for TPDDL, July 2024

Time Block	Demand Met (MU)	Total E-Bus consumption (MU)	Demand met (%) wrt Total	E-Bus consumption (%) wrt Total E-Bus Consumption	Long Term (MU)	ST-Exchange (MU) BUY	Net Power Purchase (MU)	LT Price (Rs/kWh)	ST Price (Rs/kWh) BUY	Total available Long Term Power	Scenario-1		
											Existing E-Bus Charging Pattern	New E-Bus Charging Pattern	Cost Savings through LT
0000-0030	28.74	0.3383	2.27%	3.94%	24.31	0.26	30.33	3.65	10.00		**0.34**	**0.08**	**0.16**
0030-0100	27.96	0.3484	2.21%	4.06%	24.23	0.20	30.19	3.64	9.52		**0.35**	**0.09**	**0.15**
0100-0130	27.11	0.3401	2.14%	3.96%	23.67	0.12	29.54	3.63	7.58		**0.34**	**0.09**	**0.10**
0130-0200	26.41	0.3181	2.09%	3.70%	22.96	0.04	28.75	3.61	6.72	95.17	**0.32**	**0.08**	**0.07**
0200-0230	25.73	0.2927	2.03%	3.41%	22.41	0.00	28.17	3.60	0.00	86.82	**0.29**	**0.54**	
0230-0300	25.09	0.2765	1.98%	3.22%	21.93	0.00	27.68	3.59	0.00	8.35	**0.28**	**0.53**	
0300-0330	24.39	0.2625	1.93%	3.06%	21.37	0.00	27.12	3.58	0.00		**0.26**	**0.51**	
0330-0400	23.79	0.2214	1.88%	2.58%	21.10	0.00	26.85	3.58	0.00		**0.22**	**0.47**	
0400-0430	23.20	0.1701	1.83%	1.98%	21.17	0.00	26.90	3.58	0.00		0.17	0.17	
0430-0500	22.77	0.1594	1.80%	1.86%	21.13	0.00	26.85	3.58	0.00		0.16	0.16	
0500-0530	22.26	0.1582	1.76%	1.84%	20.01	0.00	25.74	3.56	0.00		0.16	0.16	
0530-0600	21.76	0.1239	1.72%	1.44%	20.32	0.00	26.04	3.55	0.00		0.12	0.12	
0600-0630	21.44	0.0717	1.69%	0.83%	21.61	0.00	27.30	3.56	0.00		0.07	0.07	
0630-0700	21.24	0.0367	1.68%	0.43%	21.71	0.00	27.39	3.56	0.00		0.04	0.04	
0700-0730	21.11	0.0232	1.67%	0.27%	20.55	0.00	26.25	3.55	0.00		0.02	0.02	
0730-0800	21.12	0.0156	1.67%	0.18%	19.89	0.00	25.59	3.57	0.00		0.02	0.02	
0800-0830	21.37	0.0129	1.69%	0.15%	19.37	0.00	25.09	3.58	0.00		0.01	0.01	
0830-0900	21.61	0.0102	1.71%	0.12%	19.07	0.00	24.79	3.58	0.00		0.01	0.01	
0900-0930	22.78	0.0076	1.80%	0.09%	19.09	0.00	24.83	3.58	0.00		0.01	0.01	
0930-1000	24.70	0.0050	1.95%	0.06%	18.99	0.00	24.80	3.59	0.00		0.01	0.01	
1000-1030	26.07	0.0033	2.06%	0.04%	19.35	0.00	25.19	3.59	0.00		0.00	0.00	
1030-1100	26.96	0.0032	2.13%	0.04%	19.69	0.01	25.54	3.58	2.78		0.00	0.00	
1100-1130	27.52	0.0056	2.17%	0.07%	19.98	0.04	25.80	3.58	2.90		0.01	0.01	
1130-1200	27.97	0.0276	2.21%	0.32%	20.16	0.11	26.04	3.58	2.69		0.03	0.03	
1200-1230	28.38	0.1192	2.24%	1.39%	20.31	0.18	26.23	3.58	2.38		0.12	0.12	
1230-1300	28.50	0.2569	2.25%	2.99%	20.33	0.30	26.36	3.58	2.58		0.26	0.26	
1300-1330	27.32	0.3222	2.16%	3.75%	19.70	0.16	25.59	3.59	2.41		0.32	0.32	
1330-1400	28.17	0.3547	2.22%	4.13%	20.35	0.23	26.31	3.59	2.49		0.35	0.35	
1400-1430	29.43	0.3654	2.33%	4.25%	21.39	0.50	27.63	3.59	2.80		0.37	0.37	
1430-1500	30.32	0.3699	2.40%	4.31%	21.89	0.77	28.40	3.60	3.34		0.37	0.37	
1500-1530	30.62	0.3655	2.42%	4.26%	21.85	0.96	28.58	3.60	3.67		0.37	0.37	
1530-1600	30.37	0.3514	2.40%	4.09%	21.66	0.86	28.29	3.60	4.01		0.35	0.35	
1600-1630	29.87	0.3104	2.36%	3.61%	21.24	1.32	28.31	3.59	3.34		0.31	0.31	
1630-1700	29.26	0.2371	2.31%	2.76%	21.09	1.02	27.84	3.59	3.46		0.24	0.24	
1700-1730	28.58	0.1588	2.26%	1.85%	21.21	0.64	27.59	3.58	3.38		0.16	0.16	
1730-1800	27.81	0.0955	2.20%	1.11%	21.28	0.58	27.59	3.59	3.28		0.10	0.10	
1800-1830	27.16	0.0428	2.15%	0.50%	21.79	0.14	27.68	3.58	3.10		0.04	0.04	
1830-1900	26.75	0.0182	2.11%	0.21%	22.72	0.00	28.45	3.57	0.00		0.02	0.02	
1900-1930	26.57	0.0100	2.10%	0.12%	24.16	0.00	29.85	3.61	0.00		0.01	0.01	
1930-2000	26.80	0.0078	2.12%	0.09%	24.66	0.00	30.35	3.63	0.00		**0.01**	**0.27**	
2000-2030	26.94	0.0173	2.13%	0.20%	24.59	0.00	30.29	3.65	0.00	24.38	**0.02**	**0.28**	
2030-2100	26.93	0.0897	2.13%	1.04%	24.60	0.00	30.29	3.65	0.00	73.85	**0.09**	**0.35**	
2100-2130	27.05	0.2338	2.14%	2.72%	24.48	0.01	30.18	3.66	10.00	98.23	**0.23**	**0.08**	**0.10**
2130-2200	28.12	0.3317	2.22%	3.86%	24.54	0.03	30.27	3.65	10.00		**0.33**	**0.11**	**0.14**
2200-2230	28.98	0.3115	2.29%	3.63%	24.63	0.07	30.41	3.65	10.00		**0.31**	**0.10**	**0.13**
2230-2300	29.58	0.2749	2.34%	3.20%	24.58	0.11	30.40	3.66	10.00		**0.27**	**0.09**	**0.12**
2300-2330	29.80	0.3335	2.35%	3.88%	24.51	0.14	30.36	3.67	10.00		0.33	0.33	
2330-2400	29.47	0.3771	2.33%	4.39%	24.40	0.15	30.26	3.67	10.00		0.38	0.38	
Total	**1265.87**	**8.59**			**1046.01**	**8.96**	**1330.27**				**8.59**	**8.59**	**0.98**

Note: 50% demand of Time Slots in Red is displaced to Time Slots in Green

Table 12: Schedule Optimization for BYPL, June 2024

Time Block	Demand Met (MU)	Total E-Bus consumption (MU)	Demand met (%) wrt Total Demand Met	E-Bus consumption (%) wrt Total E-Bus	Long Term (MU)	ST-Exchange (MU) BUY	Net Power Purchase (MU)	LT Price (Rs/kWh)	ST Price (Rs/kWh) BUY	Total available Long Term Power	Scenario-1			
											Existing E-Bus Charging Pattern	New E-Bus Charging Pattern	Cost Savings through LT	Cost Savings through ST
0000-0030	23.99	0.072	2.42%	3.44%	19.26	0.89	24.75	4.28	10.10		0.07	0.07		
0030-0100	23.57	0.061	2.38%	2.90%	19.25	0.81	24.32	4.28	10.15		0.06	0.06		
0100-0130	23.10	0.0700	2.33%	3.33%	18.89	0.75	23.74	4.28	10.14		0.07	0.07		
0130-0200	22.61	0.075	2.28%	3.56%	18.74	0.69	23.26	4.28	9.65		0.08	0.08		
0200-0230	22.07	0.059	2.23%	2.80%	18.61	0.50	22.70	4.28	8.73		0.06	0.06		
0230-0300	21.51	0.048	2.17%	2.28%	18.43	0.45	22.18	4.28	9.95		0.05	0.05		
0300-0330	20.95	0.054	2.11%	2.57%	18.20	0.37	21.63	4.28	8.05		0.05	0.05		
0330-0400	20.40	0.058	2.06%	2.76%	17.96	0.25	21.08	4.28	6.74		0.06	0.06		
0400-0430	19.74	0.047	1.99%	2.23%	17.89	0.19	20.50	4.28	7.09		0.05	0.05		
0430-0500	19.21	0.044	1.94%	2.09%	17.63	0.13	19.96	4.28	6.98		**0.04**	**0.01**	0.01	
0500-0530	18.63	0.055	1.88%	2.61%	17.39	0.13	19.28	4.28	9.76		**0.06**	**0.01**	0.02	
0530-0600	18.08	0.059	1.83%	2.80%	17.40	0.13	18.71	4.28	9.03		**0.06**	**0.01**	0.02	
0600-0630	17.78	0.049	1.79%	2.33%	17.48	0.17	18.41	4.28	9.01	69.90	**0.05**	**0.01**	0.02	
0630-0700	17.58	0.034	1.77%	1.62%	17.63	0.15	18.24	4.28	9.27	35.22	**0.03**	**0.11**		
0700-0730	17.28	0.018	1.74%	0.86%	17.59	0.11	17.86	4.28	6.78	34.68	**0.02**	**0.10**		
0730-0800	16.91	0.008	1.71%	0.38%	17.73	0.05	17.45	4.28	7.04		0.01	0.01		
0800-0830	16.55	0.002	1.67%	0.10%	17.79	0.04	17.20	4.28	7.46		0.00	0.00		
0830-0900	16.46	0.000	1.66%	0.00%	18.17	0.06	17.10	4.28	5.92		0.00	0.00		
0900-0930	16.85	0.000	1.70%	0.00%	18.54	0.05	17.41	4.28	6.87		0.00	0.00		
0930-1000	17.62	0.000	1.78%	0.00%	18.97	0.08	18.14	4.28	5.99		0.00	0.00		
1000-1030	18.28	0.000	1.84%	0.00%	19.28	0.10	18.79	4.28	5.53		0.00	0.00		
1030-1100	19.00	0.002	1.92%	0.10%	19.51	0.18	19.49	4.28	5.20		0.00	0.00		
1100-1130	19.62	0.003	1.98%	0.14%	19.58	0.14	20.13	4.28	5.08		0.00	0.00		
1130-1200	20.21	0.018	2.04%	0.86%	19.54	0.12	20.75	4.28	5.38		0.02	0.02		
1200-1230	20.76	0.048	2.10%	2.28%	19.70	0.07	21.28	4.28	6.22		0.05	0.05		
1230-1300	21.17	0.075	2.14%	3.56%	19.82	0.07	21.67	4.28	6.34		0.08	0.08		
1300-1330	21.38	0.077	2.16%	3.66%	19.90	0.05	21.95	4.28	6.76		0.08	0.08		
1330-1400	21.82	0.078	2.20%	3.71%	20.06	0.13	22.54	4.28	6.20		0.08	0.08		
1400-1430	22.25	0.079	2.25%	3.75%	20.45	0.15	23.29	4.28	6.39		0.08	0.08		
1430-1500	22.70	0.079	2.29%	3.75%	20.77	0.22	24.01	4.28	7.01		0.08	0.08		
1500-1530	23.00	0.084	2.32%	3.99%	20.99	0.27	24.39	4.28	6.65		0.08	0.08		
1530-1600	23.24	0.076	2.35%	3.61%	20.82	0.44	24.35	4.28	6.46		0.08	0.08		
1600-1630	23.14	0.060	2.34%	2.85%	20.38	0.43	23.87	4.28	6.80		0.06	0.06		
1630-1700	22.67	0.034	2.29%	1.62%	19.96	0.36	23.25	4.28	6.92		0.03	0.03		
1700-1730	22.14	0.015	2.23%	0.71%	19.37	0.23	22.65	4.28	7.17		0.02	0.02		
1730-1800	21.50	0.006	2.17%	0.29%	18.75	0.32	22.07	4.28	8.46		0.01	0.01		
1800-1830	20.78	0.004	2.10%	0.19%	18.59	0.16	21.40	4.28	5.84		0.00	0.00		
1830-1900	20.17	0.002	2.04%	0.10%	18.59	0.20	20.73	4.28	6.43		0.00	0.00		
1900-1930	19.72	0.002	1.99%	0.10%	18.86	0.24	20.39	4.28	7.70		0.00	0.00		
1930-2000	19.77	0.003	1.99%	0.14%	19.06	0.31	20.47	4.28	9.15		0.00	0.00		
2000-2030	19.89	0.016	2.01%	0.76%	19.35	0.41	20.63	4.28	10.90	39.48	**0.02**	**0.13**		
2030-2100	20.28	0.048	2.05%	2.28%	19.32	0.40	20.99	4.28	11.08	38.67	**0.05**	**0.16**		
2100-2130	20.76	0.071	2.09%	3.37%	19.35	0.66	21.69	4.28	11.21	78.14	**0.07**	**0.02**	0.04	
2130-2200	21.59	0.086	2.18%	4.09%	19.50	0.93	22.69	4.28	11.34		**0.09**	**0.02**	0.05	
2200-2230	22.56	0.076	2.28%	3.61%	19.65	0.89	23.52	4.28	11.32		**0.08**	**0.02**	0.04	
2230-2300	23.43	0.074	2.36%	3.52%	19.66	0.73	24.54	4.28	11.37		**0.07**	**0.02**	0.04	
2300-2330	24.02	0.086	2.42%	4.09%	19.54	0.88	24.91	4.28	11.40		0.09	0.09		
2330-2400	24.19	0.089	2.44%	4.23%	19.60	0.92	25.01	4.28	11.10		0.09	0.09		
Total	**990.93**	**2.105**			**913.47**	**16.01**	**1025.34**				**2.10**	**2.10**	**0.23**	

Note: 50% demand of Time Slots in Red is displaced to Time Slots in Green

Table 13: Schedule Optimization for BYPL, July 2024

Time Block	Demand Met (MU)	Total E-Bus consumption (MU)	Demand met (%) wrt Total Demand Met	E-Bus consumption (%) wrt Total E-Bus consumption	Long Term (MU)	ST-Exchange (MU) BUY	Net Power Purchase (MU)	LT Price (Rs/kWh)	ST Price (Rs/kWh) BUY	Total available Long Term Power	Scenario-1		
											Existing E-Bus Charging Pattern	New E-Bus Charging Pattern	Cost Savings through LT
0000-0030	22.05	0.069	2.32%	3.23%	17.60	0.33	23.09	4.09	9.58		0.07	0.07	
0030-0100	21.40	0.063	2.26%	2.93%	17.45	0.20	22.51	4.09	8.51		0.06	0.06	
0100-0130	20.78	0.066	2.19%	3.07%	17.04	0.12	21.79	4.09	8.17		0.07	0.07	
0130-0200	20.17	0.066	2.12%	3.06%	16.76	0.08	21.16	4.09	8.31		0.07	0.07	
0200-0230	19.59	0.059	2.06%	2.77%	16.55	0.07	20.62	4.09	8.74		0.06	0.06	
0230-0300	19.05	0.053	2.01%	2.48%	16.28	0.08	20.02	4.09	7.63		0.05	0.05	
0300-0330	18.50	0.046	1.95%	2.17%	15.99	0.09	19.37	4.09	6.89		0.05	0.05	
0330-0400	18.02	0.046	1.90%	2.13%	16.00	0.10	18.95	4.09	9.20		0.05	0.05	
0400-0430	17.56	0.045	1.85%	2.11%	16.05	0.10	18.45	4.09	6.45		0.05	0.05	
0430-0500	17.18	0.060	1.81%	2.79%	16.08	0.09	18.12	4.09	7.46		**0.06**	**0.01**	0.02
0500-0530	16.84	0.056	1.77%	2.61%	15.60	0.05	17.62	4.09	6.88		**0.06**	**0.01**	0.01
0530-0600	16.59	0.047	1.75%	2.21%	15.86	0.05	17.33	4.09	7.50		**0.05**	**0.01**	0.01
0600-0630	16.61	0.050	1.75%	2.32%	16.61	0.10	17.41	4.09	6.73	64.16	**0.05**	**0.01**	0.01
0630-0700	16.74	0.045	1.76%	2.09%	16.88	0.08	17.52	4.09	7.69	50.65	**0.04**	**0.10**	
0700-0730	16.62	0.025	1.75%	1.18%	16.83	0.05	17.29	4.09	8.65	13.51	**0.03**	**0.08**	
0730-0800	16.41	0.008	1.73%	0.36%	16.94	0.09	17.12	4.09	9.12		**0.01**	**0.06**	
0800-0830	16.24	0.002	1.71%	0.10%	17.08	0.06	16.90	4.09	6.04		0.00	0.00	
0830-0900	16.32	0.001	1.72%	0.06%	17.32	0.04	16.89	4.09	7.37		0.00	0.00	
0900-0930	16.86	0.001	1.78%	0.05%	17.62	0.06	17.35	4.09	6.41		0.00	0.00	
0930-1000	17.69	0.001	1.86%	0.06%	17.91	0.07	18.23	4.09	5.53		0.00	0.00	
1000-1030	18.42	0.001	1.94%	0.06%	17.98	0.09	18.93	4.09	4.82		0.00	0.00	
1030-1100	19.08	0.002	2.01%	0.11%	18.13	0.14	19.64	4.09	4.32		0.00	0.00	
1100-1130	19.61	0.004	2.07%	0.19%	18.27	0.11	20.26	4.09	4.86		0.00	0.00	
1130-1200	20.05	0.022	2.11%	1.05%	18.28	0.15	20.76	4.09	3.85		0.02	0.02	
1200-1230	20.40	0.050	2.15%	2.34%	18.29	0.17	21.05	4.09	3.50		0.05	0.05	
1230-1300	20.68	0.088	2.18%	4.10%	18.40	0.21	21.35	4.09	3.39		0.09	0.09	
1300-1330	20.67	0.082	2.18%	3.83%	18.42	0.15	21.35	4.09	3.26		0.08	0.08	
1330-1400	21.03	0.091	2.22%	4.23%	18.61	0.21	21.81	4.09	3.44		0.09	0.09	
1400-1430	21.67	0.091	2.28%	4.27%	19.03	0.17	22.43	4.09	4.44		0.09	0.09	
1430-1500	22.20	0.092	2.34%	4.28%	19.04	0.33	22.92	4.09	4.19		0.09	0.09	
1500-1530	22.35	0.093	2.36%	4.33%	18.89	0.39	22.88	4.09	4.45		0.09	0.09	
1530-1600	22.11	0.081	2.33%	3.78%	18.61	0.40	22.80	4.09	4.54		0.08	0.08	
1600-1630	21.77	0.046	2.29%	2.15%	18.41	0.30	22.52	4.09	4.79		0.05	0.05	
1630-1700	21.46	0.021	2.26%	0.98%	17.98	0.30	22.15	4.09	4.98		0.02	0.02	
1700-1730	21.30	0.009	2.24%	0.41%	17.56	0.34	21.85	4.09	5.32		0.01	0.01	
1730-1800	21.04	0.005	2.22%	0.25%	17.10	0.46	21.58	4.09	5.07		0.01	0.01	
1800-1830	20.64	0.004	2.18%	0.19%	16.90	0.28	21.27	4.09	5.59		0.00	0.00	
1830-1900	20.30	0.003	2.14%	0.13%	17.15	0.24	21.09	4.09	6.19		0.00	0.00	
1900-1930	20.05	0.002	2.11%	0.11%	17.50	0.28	20.99	4.09	8.61		0.00	0.00	
1930-2000	20.10	0.003	2.12%	0.14%	17.87	0.23	21.04	4.09	9.62		**0.00**	**0.08**	
2000-2030	20.15	0.016	2.12%	0.75%	17.97	0.23	21.08	4.09	9.65	18.50	**0.02**	**0.09**	
2030-2100	20.40	0.046	2.15%	2.12%	17.94	0.27	21.29	4.09	10.10	53.78	**0.05**	**0.12**	
2100-2130	20.84	0.068	2.20%	3.16%	18.02	0.45	21.76	4.09	11.12	72.28	**0.07**	**0.02**	0.04
2130-2200	21.47	0.091	2.26%	4.24%	18.05	0.54	22.33	4.09	11.28		**0.09**	**0.02**	0.05
2200-2230	22.08	0.080	2.33%	3.75%	18.12	0.59	22.81	4.09	10.92		**0.08**	**0.02**	0.04
2230-2300	22.58	0.075	2.38%	3.51%	18.09	0.55	23.33	4.09	10.94		**0.08**	**0.02**	0.04
2300-2330	22.81	0.083	2.40%	3.89%	18.01	0.65	23.62	4.09	10.90		0.08	0.08	
2330-2400	22.59	0.083	2.38%	3.88%	17.93	0.64	23.56	4.09	11.21		0.08	0.08	
Total	**949.08**	**2.14**			**841.02**	**10.79**	**986.21**				**2.14**	**2.14**	**0.21**

Note: 50% demand of Time Slots in Red is displaced to Time Slots in Green

It is observed from the above analysis that **shifting E-bus charging load from peak to adjacent non-peak hours can result in significant savings by reducing Power Purchase costs.** This optimisation allows greater utilisation of long-term power sources, thereby avoiding reliance on higher-cost short-term procurement. Achieving this outcome will require the **coordinated efforts of DISCOMs in Delhi, E-bus aggregators and the Delhi Transport Corporation (DTC).**

The **tentative savings estimated through this mechanism for all three Delhi DISCOMs up to FY 2029–30** are presented below.

Table 14: Optimization through shifting in E-bus Schedule for Delhi DISCOMs till FY 2029-30

	FY 2024-25	**FY 2025-26**	**FY 2026-27**	**FY 2027-28**	**FY 2028-29**	**FY 2029-30**
No. of E-buses (nos.)	2152	3035	4279	6035	8510	12000
12-m E-buses (268 kW) (MU)	505	712	1005	1417	1998	2817
9-m E-buses (200 kW) (MU)	94	133	187	264	373	526
Yearly Consumption (MU)	599	845	1192	1681	2371	3343
Summer Consumption 8 months (MU)	400	564	795	1121	1580	2229
Ratio of hourly Short Term Power Purchase (9 PM - 1 AM)	46%	46%	46%	46%	46%	46%
Consumption during (9 PM - 1 AM) (MU)	185	262	369	520	733	1034
Displaced Consumption during the Peak Slot (MU)	93	131	184	260	367	517
Short-term Rate (Rs. /kWh)	8.50	8.50	8.50	8.50	8.50	8.50
Long Term rate (Rs. /kWh)	3.70	3.89	4.08	4.28	4.50	4.72
Savings (Rs. Cr.)	45	60	82	110	147	195
Cumulative Savings (Rs. Cr.)		**105**	**186**	**296**	**443**	**638**

Assumptions for computing savings through shifting of E-bus schedule

E-bus Addition

Up to FY 2029–30, a total of 12,000 E-buses are expected to be added. A CAGR of 41% has been applied, with pro rata addition considered through FY 2029–30.

Fleet Composition

Fleet composition has been assumed at an 80:20 ratio of 12-metre E-buses (268 kW battery pack) to 9-metre E-buses (200 kW battery pack), with an average charging time of three hours.

Summer Period

Eight months have been considered as the summer period. Winter months have not been included, as E-bus charging load does not coincide with DISCOMs peak demand during this period.

STPP Ratio

A 46% ratio of hourly short-term Power Purchase (STPP) has been applied, based on STPP during the relevant slots relative to total STPP in June 2024 for BRPL

Peak Consumption

50% of consumption during peak slots has been assumed as displaceable consumption.

Short-Term Rate

An average short-term rate of Rs. 8.50/kWh has been applied.

Variable Cost

The Variable Cost (VC) of long-term Power Purchase is based on the True-Up Petition for FY 2022–23, with a 5% escalation factored in.

Optimisation through Battery Energy Storage System (BESS)

BESS provides dual benefits by enabling savings in Power Purchase costs through energy arbitrage and reducing network costs through Capital Expenditure (CAPEX) deferral. Short-duration storage devices can be effectively deployed to manage intermittent load. As indicated by load duration graphs, Delhi experiences peak demand in two distinct windows, approximately two hours in the afternoon and around five hours during the night.

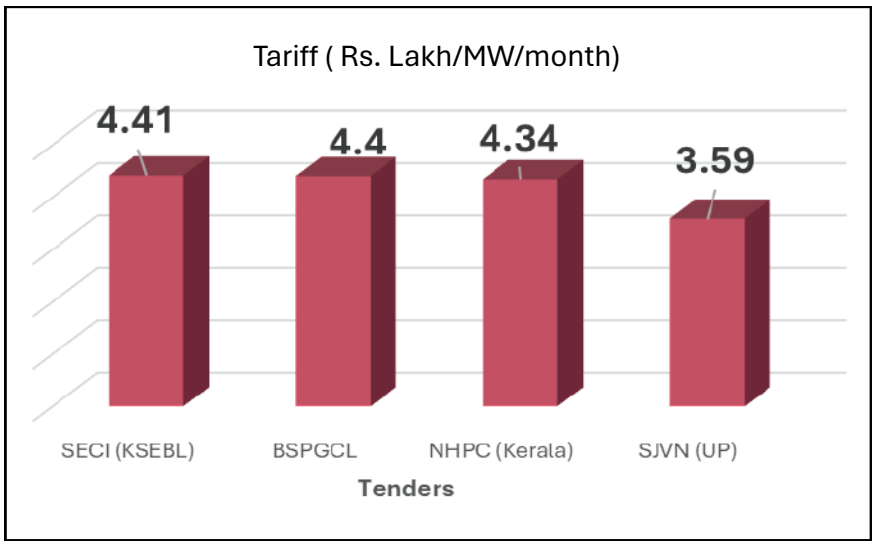
India's BESS market has witnessed rapid growth in recent years, driven by the country's ambitious renewable energy targets and the need for grid stability.

Key factors supporting this growth include:

1. A significant increase in tender awards and planned project capacity,
2. Supportive government policies such as Energy Storage Obligations (ESOs),
3. Declining battery costs, and
4. The introduction of innovative contracting models.

These developments have resulted in a sharp decline in BESS prices. Over the past three years, BESS tariffs in India have fallen from Rs. 4.41 lakh/MW/month to Rs. 3.59 lakh/MW/month. The most recent example is the SJVN BESS tender for Uttar Pradesh (July 2025), which discovered an annual fixed cost of Rs. 3.59 lakh/MW/month for a 375 MW / 1,500 MWh project with four-hour storage (one cycle), supported by 30% Viability Gap Funding (VGF).

Figure 35: BESS Tenders for 4-hr Storage, 1-cycle in India



Use - case of BESS in E-bus Charging

Depot-Level Deployment

BESS can also be installed at E-bus depots to cater to scattered charging load during the 9:00 PM to 1:00 AM window (four hours), resulting in targeted savings in Power Purchase costs.

Energy Arbitrage

BESS enables DISCOMs to optimise Power Purchase costs by storing energy during off-peak periods and discharging during peak period.

Targeted Peak Supply

A two-hour, two-cycle BESS can be deployed to supply power during peak periods—night (10:00 PM to 12:00 AM) and afternoon (2:00 PM to 4:00 PM)—leading to significant savings in both Power Purchase and network costs.

Peak Coincidence Management

Since E-bus charging often coincides with DISCOM peak demand—compelling them to procure high-cost power at approximately Rs. 8.50/kWh—BESS can be utilised to mitigate this reliance.

Network Deferral

By deploying BESS at the local network level, power can be supplied during peak hours, avoiding both high Power Purchase costs and capital expenditure for infrastructure upgrades by DISCOMs and transmission utilities.

Load Shifting

BESS can be charged during off-peak hours and discharged during peak hours to meet E-bus charging demand, thereby reducing the need for costly short-term power procurement by DISCOMs.

Cost of BESS

Based on the most recent benchmark, the annual fixed cost of BESS has been computed using the discovered tariff of Rs. 3.59 lakh/MW/month in the SJVN tender for Uttar Pradesh (July 2025). This tender covered 375 MW/1,500 MWh of capacity with four-hour storage (single cycle) and was supported by 30% Viability Gap Funding (VGF).

In addition, market prices during the period 10:00 AM to 2:00 PM over the last three months (April–June 2025) have averaged below Rs. 2/kWh. The observed prices were: Rs. 1.92/kWh at 10:00 AM, Rs. 1.97/kWh at 11:00 AM, Rs. 1.93/kWh at 12:00 PM, Rs. 1.93/kWh at 1:00 PM, and Rs. 2.70/kWh at 2:00 PM (Source: IEX, RTM). Accordingly, the input (charging) cost has been considered at Rs. 2.50/kWh.

Based on the discovered Tariff and input cost, the per unit cost of the Power from BESS is computed in Table 15.

Table 15: Cost of BESS

Particulars	UoM/ Formulae	4-hr Storage
Capacity Recovery Factor	r(1+r)^n/(1+r)^n-1	14%
Useful life (n)	Years	12
CAPEX for BESS	Rs. Cr.	3.02
O&M Expenses	Rs. Cr.	0.04
Annual Fixed Cost	Rs. Cr.	0.43
Battery Duration	Hrs	4
No. of Cycles per day	Nos.	1
Capacity	MW	1
Battery Efficiency Factor	%	85%
Fixed Cost per unit (A)	**Rs./kWh**	**3.23**
Annual Generation	MU	1.46
Annual Input Energy	MU	1.72
Cost of Input Energy	Rs./kWh	2.50
Input cost	Rs. Cr.	0.43
Cost of Charging per unit (B)	**Rs./kWh**	**2.94**
Tariff (A+B)	**Rs./kWh**	**6.17**
WACC (r)		9.42%

Assumptions

- Financial Parameters: The interest on the loan has been considered at 10.65%, the Return on Equity (RoE) at 14%, in line with the CERC (Terms and Conditions of Tariff) Regulations, 2024, and an Income Tax Rate of 30%.
- O&M Expenses: Assumed at USD 5/kW as per Lawrence Berkeley National Laboratory (LBNL), except in the National Renewable Energy Laboratory (NREL) scenario.

Based on the above, and considering a charging cost of Rs. 2.94/kWh and a fixed cost of Rs. 3.23/kWh, the tariff for a four-hour, single-cycle BESS with 30% VGF support is estimated at Rs. 6.17/kWh.

As the power sector is regulated, any CAPEX by DISCOMs requires prior regulatory approval. The proposed CAPEX for BESS deployment may therefore be funded through one of two mechanisms:

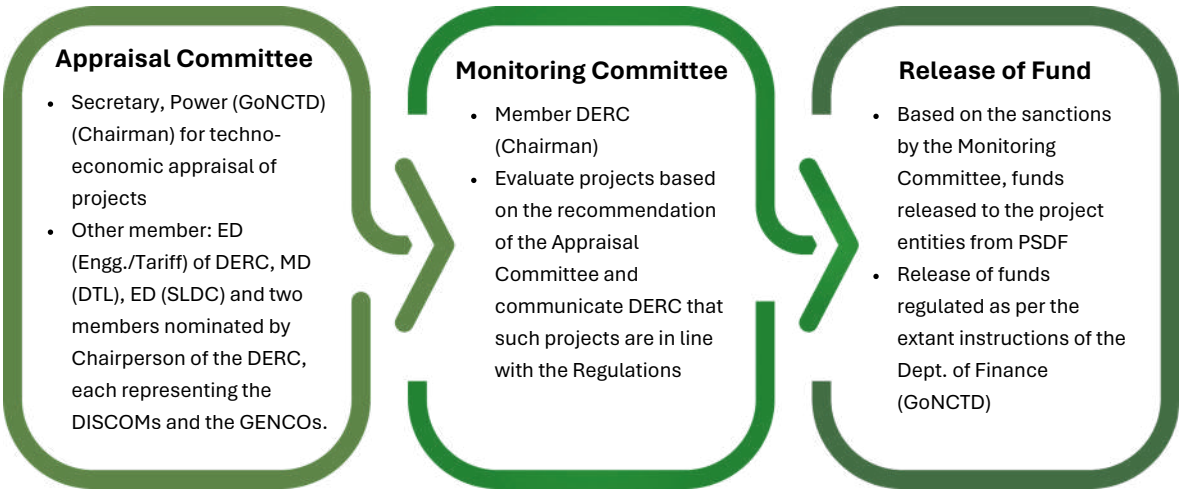
- **Inclusion in the Aggregate Revenue Requirement (ARR)** - Under this mechanism, the State Electricity Regulatory Commission (SERC) approves the CAPEX requirement for installing BESS, and the associated costs are recovered through consumer tariffs. This cost pass-through, however, results in an increased tariff burden on end consumers.

- **Support from the Power System Development Fund (PSDF)** - The DERC has issued the DERC (Power System Development Fund) Regulations, 2019[9], which allow the utilisation of PSDF for Energy Storage projects. The relevant extract is as follows:

  UTILIZATION OF PSDF
  (1) PSDF shall be utilised mainly for the following purposes:
  ...
  (e) Any other scheme/ project in furtherance of the above objectives, such as technical studies, capacity building, installation of Phasor Measurement Unit (PM U), hardware/software for upgradation of SLDC, Smart Grid initiatives, Energy Storage, Demand Side Management, etc.

The *DERC (Power System Development Fund) Regulations, 2019*, further provide the procedure for PSDF funding, which is as follows:

Figure 36: Procedure of PSDF Funding as per DERC Regulations



[9] *DERC (Power System DeveloPM ent Fund) Regulations, 2019*

Table 16: Case-I: Optimisation of Power Purchase Cost through BESS (4 Hr storage, 1 Cycle) for meeting night hours Peak Demand

Parameters	FY 2024-25	FY 2025-26	FY 2026-27	FY 2027-28	FY 2028-29	FY 2029-30
No. of E-buses (nos.)	2152	3035	4279	6035	8510	12000
12-m E-buses (268 kW) (MU)	505	712	1005	1417	1998	2817
9-m E-buses (200 kW) (MU)	94	133	187	264	373	526
Total Yearly Consumption (MU)	599	845	1192	1681	2371	3343
Summer Consumption 8 months (MU)	400	564	795	1121	1580	2229
Ratio of hourly STPP (9 PM - 1 AM)	46%	46%	46%	46%	46%	46%
Displaced Consumption (MU)	185	262	369	520	733	1034
Short-term Rate (Rs./kWh)	8.50	8.50	8.50	8.50	8.50	8.50
BESS funded through ARR + Charging Cost (Rs./kWh)- Scenario 1	6.17	6.17	6.17	6.17	6.17	6.17
BESS funded through PSDF + Charging Cost (Rs./kWh)- Scenario 2	2.94	2.94	2.94	2.94	2.94	2.94
Savings - Scenario 1 (Rs. Cr.)	43	61	86	121	171	241
Savings - Scenario 2 (Rs. Cr.)	103	145	205	289	408	575
Cumulative Savings - Scenario 1 (Rs. Cr.)	**43**	**104**	**190**	**311**	**482**	**722**
Cumulative Savings - Scenario 2 (Rs. Cr.)	**103**	**249**	**454**	**743**	**1150**	**1725**

Table 17: Case-II: Optimisation of Power Purchase Cost through BESS (2 Hr storage, 2 Cycle) for meeting day and night hours Peak Demand

Parameters	FY 2024-25	FY 2025-26	FY 2026-27	FY 2027-28	FY 2028-29	FY 2029-30
No. of E-buses (nos.)	2152	3035	4279	6035	8510	12000
12-m E-buses (268 kW) (MU)	505	712	1005	1417	1998	2817
9-m E-buses (200 kW) (MU)	94	133	187	264	373	526
Yearly Consumption (MU)	599	845	1192	1681	2371	3343
Summer Consumption 8 months (MU)	400	564	795	1121	1580	2229
Ratio of hourly STPP (10PM-12 midnight & 2PM - 4PM)	30%	30%	30%	30%	30%	30%
Displaced Consumption (MU)	121	171	241	339	479	675
Short-term Rate (Rs./kWh)	8.50	8.50	8.50	8.50	8.50	8.50
BESS funded through ARR + Charging Cost (Rs./kWh)- Scenario 1	6.17	6.17	6.17	6.17	6.17	6.17
BESS funded through PSDF + Charging Cost (Rs. /kWh) - Scenario 2	2.94	2.94	2.94	2.94	2.94	2.94
Savings - Scenario 1 (Rs. Cr.)	28	40	56	79	111	157
Savings - Scenario 2 (Rs. Cr.)	67	95	134	189	266	375
Cumulative Savings - Scenario 1 (Rs. Cr.)	**28**	**68**	**124**	**203**	**314**	**471**
Cumulative Savings - Scenario 2 (Rs. Cr.)	**67**	**162**	**296**	**485**	**751**	**1126**


FAME

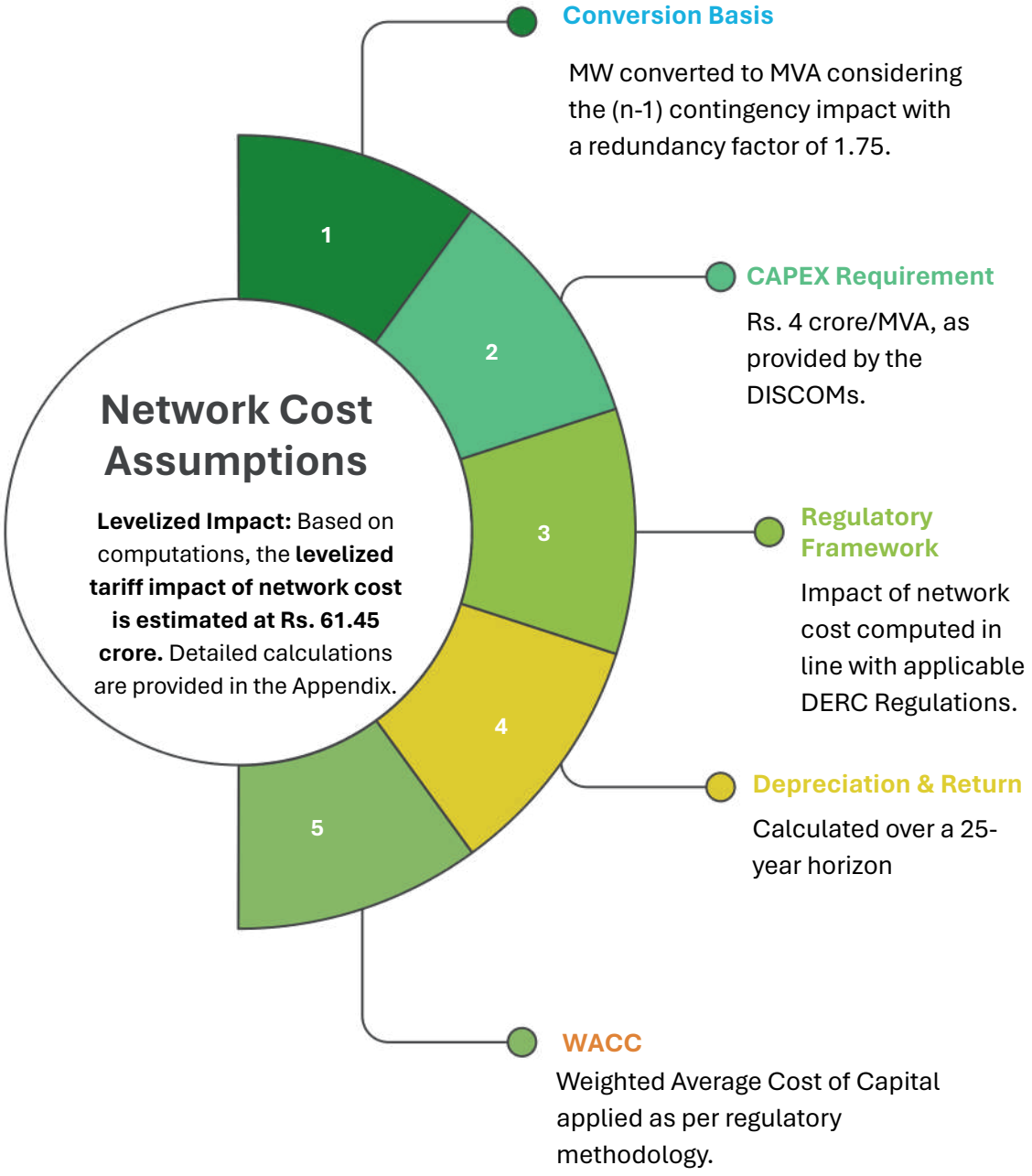
Network Cost

To meet rising demand, DISCOMs and the State Transmission Utility (Delhi Transco Ltd.) are required to upgrade their networks. With E-bus charging coinciding with peak hours, this leads to a significant increase in CAPEX requirements for strengthening both upstream and downstream infrastructure.

A key advantage of BESS is their ability to be deployed at the local network level, where they can supply power during peak hours. This reduces the need for additional network upgrades by DISCOMs and DTL, thereby avoiding incremental capital expenditure and enhancing cost efficiency.

Table 18: Assumptions for CAPEX requirement for the Network upgradation

Particulars	UoM	FY 26	FY 27	FY 28	FY 29	FY 30
E-bus Charging Capacity that can be avoided	MW	**24**	**10**	**14**	**20**	**28**
	MVA	43	18	25	35	49
Capex Requirement for the network upgradation	Rs Cr/MVA	4	4	4	4	4
	Rs Cr	171	70	99	140	197
Capex Deferral	Rs Cr	171	70	99	140	197
Debt: Equity		70:30	70:30	70:30	70:30	70:30
Debt	Rs Cr	120	49	69	98	138
Interest Rate on Debt		12%	12%	12%	12%	12%
Useful life of the network	yrs	25	25	25	25	25
Loan repayment period	yrs	12	12	12	12	12
Equity	Rs Cr	51	21	30	42	59
Rate of RoCE		14%	14%	14%	14%	14%
Salvage value of Assets		10%	10%	10%	10%	10%
Depreciation rate	1st 12 years	5.83%	5.83%	5.83%	5.83%	5.83%
	for next 13 years	1.54%	1.54%	1.54%	1.54%	1.54%
Discount rate	9.71%					



Role of BESS:

The deployment of a 4-hour, 1-cycle BESS does not save in network cost since DISCOM needs to invest in the network to meet the daytime demand of E-bus depots.

However, deployment of 2-hour, 2-cycle BESS to meet peak E-bus charging demand during both day and night hours can support demand requirements while enabling CAPEX deferral for DISCOMs. The computation of savings is placed at Table 19.

Table 19: Case-II: Optimization of Power Purchase Cost and Network Cost through BESS (2 Hr storage, 2 Cycle) for meeting day and night hours Peak Demand

Parameters	FY 2024-25	FY 2025-26	FY 2026-27	FY 2027-28	FY 2028-29	FY 2029-30
Cumulative Power Purchase Cost Savings-Scenario 1 (Rs. Cr.)	**28**	**68**	**124**	**203**	**314**	**471**
Cumulative Power Purchase Cost Savings-Scenario 2 (Rs. Cr.)	**67**	**162**	**296**	**485**	**751**	**1126**
Displaced Consumption (MU)	156	220	310	438	617	870
Displaced Consumption (MU) per month	13	18	26	36	51	73
Capacity of BESS (MW)	108	153	216	304	429	604
Cumulative Network avoided (MW)	17	24	34	49	69	97
Year wise capacity avoided (MW)	0	24	10	14	20	28
Network Cost savings (Rs. Cr.)	0	61	61	61	61	61
PPC Savings - Scenario 1 + Network Savings (Rs. Cr.)	0	101	117	140	173	219
PPC Savings - Scenario 2 + Network Savings (Rs. Cr.)	0	156	195	250	328	437
Cumulative Savings-Scenario 1 (Rs. Cr.)	**0**	**101**	**219**	**359**	**532**	**751**
Cumulative Savings-Scenario 2 (Rs. Cr.)	**0**	**156**	**352**	**602**	**929**	**1366**

Note* *Detailed computation is placed at Annexure 3.*

Assumptions

- The cumulative network capacity avoided has been considered as 16% of the installed BESS capacity.
- The impact of network cost has been computed in accordance with the applicable DERC Regulations.


TATA

Conclusion

At present, the penetration of E-buses is largely concentrated in a few metropolitan cities. However, with continued policy impetus from the Government of India, E-buses are expected to be deployed across a greater number of cities, leading to their widespread adoption nationwide. This steady increase will have a substantial financial impact on consumers at large through an increase in ACoS of DISCOMs. The analysis undertaken in this study demonstrates that E-bus charging load coincides with the peak demand of DISCOMs during the summer season.

Key observations from the report include:

1. Since E-bus charging coincides with DISCOM peak demand, the additional requirement is largely met through the procurement of short-term power at an average cost of Rs. 8.50/kWh, compared to the average long-term Power Purchase cost of Rs. 4.50–5.00/kWh.

2. The Average Billing rate (ABR) for the Electric Vehicle Charging Stations in Delhi, as per DISCOMs Petitions for FY 2024-25, is only 45% of the Average Cost of Supply (ACoS), with EV Tariffs fixed at Rs. 4.00/kVAh, whereas Clause 8.3 of Tariff Policy, 2016[10] mandates that tariff progressively reflects the cost of supply of electricity and tariffs should be brought within ±20% of the average cost of supply. The relevant extract is as follows:

> *"For achieving the objective that the tariff progressively reflects the cost of supply of electricity, the Appropriate Commission would notify a roadmap such that tariffs are brought within ±20% of the average cost of supply. The road map would also have intermediate milestones, based on the approach of a gradual reduction in cross-subsidy."*

Considering this, the Tariff for EV consumers should be ± 20% of the ACoS; however, in the present case, the Tariff of EV Consumers is -55% of the ACoS.

Further, MoP Guidelines[11] (9th September 2024) stipulates that the Tariff of EV consumers should not exceed the ACoS, and DISCOMs will charge 0.7 times the ACoS during solar hours (9:00 AM to 4:00 PM) and 1.3 times the ACoS during non-solar hours (remaining hours of the day). The relevant extract is as follows:

> *"Tariff for supply of electricity to EV charging stations*
> *(1) The tariff for the supply of electricity to EV Charging Stations shall be a single part and shall not exceed the "Average Cost of Supply" till 31st March 2028.*
> *(2) The Distribution Licensee will charge 0.7 times the Average Cost of Supply (ACoS) during solar hours (9:00 AM to 4:00 PM) and 1.3 times ACoS during non-solar hours (remaining hours of the day)."*

Thus, the tariff of Electric Vehicle Charging Stations in Delhi is not in line with the provisions of the Tariff Policy, 2016 & Guidelines issued by Ministry of Power (9th September 2024).

[10] Tariff Policy, 2016

[11] MoP Guidelines for Installation and Operation of Electric Vehicle Charging Infrastruture-2024

3. Significant cost savings can be achieved by shifting E-bus charging from peak to adjacent non-peak hours and meeting the same demand through long-term power.

4. The deployment of Battery Energy Storage Systems (BESS) at E-bus depots can further optimise costs by enabling energy arbitrage, while also supporting DISCOMs and Delhi Transco Limited (DTL) in deferring network CAPEX.

- BESS (4-hour storage, 1 cycle) can be utilised to meet night-hour E-bus charging demand.
- BESS (2-hour storage, 2 cycles) can address both day and night peak charging requirements.

5. The CAPEX for BESS deployment may be funded either through the Aggregate Revenue Requirement (ARR) or by leveraging the Power System Development Fund (PSDF).

6. Based on this analysis, the cumulative savings projected up to FY 2029–30 are as follows:

Optimization measure	Scenario	Cumulative Savings till FY 2029-30
Shifting of E-bus Charging load		Rs. 638 Crore
Installing BESS (4 Hr storage, 1 Cycle) for meeting night hours E-bus charging demand (PPC)	CAPEX funded through ARR	Rs. 722 Crore
	CAPEX funded through PSDF	Rs. 1,725 Crore
Installing BESS (2 Hr storage, 2 cycle) for meeting peak demand of E-bus charging demand at day and night hours (PPC+NC)	CAPEX funded through ARR	Rs. 751 Crore
	CAPEX funded through PSDF	Rs. 1,366 Crore

Recommendation to Stakeholders

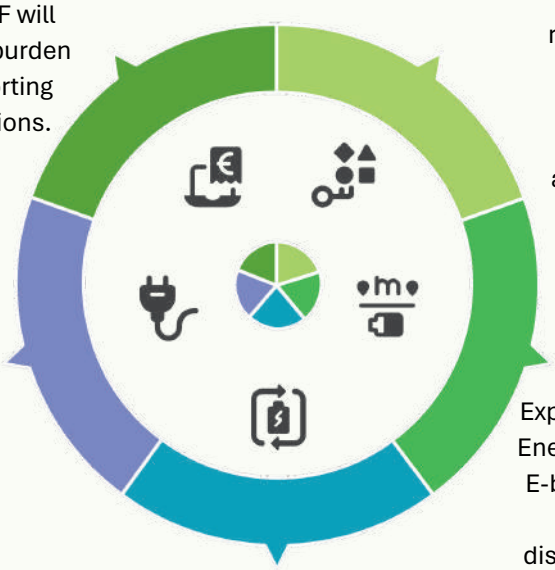
Delhi DISCOMs

Minimise financial burden

Funding BESS through PSDF will help minimise the financial burden on consumers while supporting sustainable system operations.

Resource adequacy plan

Develop a short-term resource adequacy plan to address the growing demand from E-buses, identifying energy storage as the optimal solution for managing this load.



Optimise power purchase

Leverage the PSDF pool to optimise Power Purchase costs, thereby reducing reliance on costly short-term Power procurement.

BESS installation

Explore the installation of Battery Energy Storage Systems (BESS) at E-bus depots, enabling charging during off-peak hours and discharging during peak hours to meet E-bus charging requirements.

Utilising PSDF

Consider utilising the Power System Development Fund (PSDF) to support the deployment of BESS in Delhi for managing intermittent E-bus charging loads.

Delhi Electricity Regulatory Commission (DERC)

Revise the Tariff for EV charging stations

Tariff of Electric Vehicle Charging Stations and its Time of Day should be in line with the provisions of the Tariff Policy, 2016 & Guidelines issued by Ministry of Power (9th September 2024).

Utilise the DERC PSDF Regulation

Support the installation of **Battery Energy Storage Systems (BESS)** at substations for managing intermittent E-bus charging loads. The Delhi PSDF pool currently holds approximately **Rs. 1,445 crore**, contributed by all participating entities, including Delhi DISCOMs.

Leverage PSDF Funding

To avoid loading the Aggregate Revenue Requirement (ARR) with costs of additional network infrastructure. This approach will optimise Power Purchase costs by reducing reliance on expensive short-term procurement or new Power Purchase Agreements (PPAs) to meet short-term load requirements.

Government of National Capital Territory of Delhi (GoNCTD)

Utilise DMRC facilities

Utilise Delhi Metro Rail Corporation (DMRC) parking facilities for charging E-buses during night-time hours to optimise infrastructure use and reduce network stress.

Link tariff subsidies

Link tariff subsidies to Time-of-Day (ToD) pricing for consumers where smart meters have been deployed.

Align charging schedule

DTC should align charging schedule of E-buses with revised framework. This enables optimisation of Power Purchase Costs by shifting demand away from peak hours.

Facilitate savings for DISCOMs

Facilitate savings in overall Power Purchase costs for DISCOMs, thereby lowering the Average Cost of Supply (ACoS) and ultimately reducing consumer tariffs.

Delhi Transport Corporation (DTC)

Leverage available infrastructure

Utilise shed areas and rooftops for solar generation. This will help reduce energy costs.

Adopt revised E-bus charging schedule

Adhere to the updated charging plan. Optimising charging operations is essential.

Seek Central Assistance

Obtain financial support on a per-kilometre basis for E-bus operations. This will reduce operational costs.

Secure Central Assistance

Get funding for upgrading E-bus depots. Meeting operational needs is important.

Access Central Assistance

Obtain support for behind-the-meter power infrastructure development Substations and facilities are included.

E-bus Aggregators

Shift Charging

Shift hub charging operations from peak hours to normal or off-peak hours, to the extent feasible, in order to reduce stress on the grid and optimise costs.

Advance Intimation

Provide advance intimation of all future load requirements to the respective DISCOMs, enabling effective planning for network augmentation and power procurement.

Way Forward

According to the Research & Markets Report, the number of E-buses in India is projected to reach approximately 1,50,000 by FY 2029–30[12], with electricity consumption estimated at around 42,000 MU.

Applying the results of this study for Delhi DISCOMs to the national level indicates potential savings of approximately Rs. 13,000 crore, as detailed below:

- **Optimisation through Shifting of E-bus Charging Load:** Across the country, DISCOMs face similar operational challenges in managing peak demand, often relying on load shedding or procurement of expensive short-term power during peak hours. By shifting E-bus charging load from peak to non-peak hours, as demonstrated in this report for Delhi, significant savings can be realised at the national level. The approaches outlined for Delhi DISCOMs are therefore applicable to all DISCOMs across India.

- **Optimisation through Battery Energy Storage Systems (BESS):** BESS serves as an effective tool for energy arbitrage, enabling DISCOMs to optimise Power Purchase costs. By charging batteries during off-peak hours and discharging during peak demand, DISCOMs can avoid dependence on high-cost short-term power from the market or tied-up plants with higher tariffs. As detailed earlier, deploying BESS at depots to meet E-bus peak demand can provide substantial savings and this principle is equally relevant at the national level.

[12] *Research & Markets Report on E-bus Market in India (2025-2030)*


SWITCH
DELNI

Annexure 1

Table: E-bus Depot Load (as on Nov, 2024)

E-bus DEPOT	DEPOT LOAD (as on Nov, 2024)
BSES Rajdhani Power Ltd.	
Nehru Place	5 MW
Mayapuri	4 MW
Mundela	5 MW
Sukhdev Vihar	7 MW
BSES Yamuna Power Ltd.	
Rajghat	4 MW
Hassanpur- 1	8 MW
TPDDL	
Barwala	12 MW
Wazirpur	7 MW
Subash Palace	8 MW
Rohini, Sec- 6	4 MW
Kingsway Camp	3 MW
Rohini, Sec- 16	4 MW
Total	**69 MW**

Annexure 2

Table 6: E-bus Depot tentative Load for BSES Rajdhani Power Ltd.

Location - BRPL	Load (MW)
Mundhela Kalan	5
Mayapuri	4
Nehru Place	5
Sukhdev Vihar	7
Kalkaji (T)	8
Kushak Nallah (T)	4
Dwarka Metro Station Parking (T)	3
Dwarka Sec-2 (T)	5
Keshopur (T)	5
Ambedkar Nagar (T)	7
Central workshop Okhla (T)	12
Nangloi (T)	6
Peeragarhi (T)	5
Sriniwaspuri (T)	7
Total	**83**

Table 7: E-bus Depot tentative Load for BSES Yamuna Power Ltd.

Location- BYPL	Load (MW)
DTC Depot-Rajghat-II (A)	4
DTC Depot-Hasanpur (A)	8
DTC Depot Nand Nagri (T)	6
DTC Depot East Vinod Nagar (T)	6
DTC Depot Gazipur (T)	6
Total	**30**

Table 8: E-bus Depot tentative Load for TATA Power Delhi Distribution Ltd.

Location - TPDDL	Load (MW)
Rohini-1	4
Rohini-2	4
BBM-1	3
Rohini Sec 37 (Additional load)	12.62
Netaji Subhash Place	9
Wazirpur Depot	7
Rohini Sec 37 additional load	5.6
Naraina Depot	7
Burari-II	8
Narela Sector A-2 Transport Depot	9.6
Savda Ghevra Depot	10
Bawana Depot	7
Rohini III Depot	7
Rohini IV depot	6
Narela Sector A-3 DTC Depot	6
G T Karnal Depot	6
Kanjhawala-1 Depot	6
Kanjhawala-2 Depot	7.5
BBM Central Workshop	13.1
Kirari Bus Depot	9
DMRC Parking Kohat Enclave Metro Station	2.5
DMRC Parking Rithala Metro Station	4
Sec A-09 Narela	1
Total (MW)	**154.92**

Network Cost Impact

Annexure 3

Particulars	UoM	Y-1	Y-2	Y-3	Y-4	Y-5	Y-6	Y-7	Y-8	Y-9	Y-10	Y-11	Y-12	Y-13	Y-14	Y-15	Y-16	Y-17	Y-18	Y-19	Y-20	Y-21	Y-22	Y-23	Y-24	Y-25
Depreciation	Rs Cr	5	12	17	24	34	39	39	39	39	39	39	39	10	10	10	10	10	10	10	10	10	10	10	10	9
Accumulated Dep		5	17	34	58	92	131	171	210	250	289	329	368	378	389	399	410	420	431	441	451	462	472	483	493	502
Return on Capital Employed (ROCE)	Rs Cr																									
Opening Assets		0	171	241	340	480	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677
Addition		171	70	99	140	197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Decapitalization		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	154
Closing Assets		171	241	340	480	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	523
Average Assets for FY		86	206	291	410	578	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	677	600
Regulated Rate Base		0	154	207	282	388	546	506	467	427	388	348	309	298	288	278	267	257	246	236	226	215	205	194	184	175
Investment capitalised in the year		171	70	99	140	197	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Depreciation during the year		5	12	17	24	34	39	39	39	39	39	39	39	10	10	10	10	10	10	10	10	10	10	10	10	9
Depreciation on decapitalised assets		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Net Investment capitalised		166	58	82	116	163	-39	-39	-39	-39	-39	-39	-39	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-10	-12
RRBc		166	212	289	398	551	506	467	427	388	348	309	269	288	278	267	257	246	236	226	215	205	194	184	173	163
RRBi		83	183	248	340	470	526	487	447	408	368	329	289	293	283	272	262	252	241	231	220	210	199	189	179	169
WACC		12.67%																								
ROCE		11	23	31	43	60	67	62	57	52	47	42	37	37	36	35	33	32	31	29	28	27	25	24	23	21
Deferral Cost yearly	Rs Cr	16	35	48	67	93	106	101	96	91	86	81	76	48	46	45	44	42	41	40	38	37	36	34	33	31
Discount Factor		1	0.91	0.83	0.76	0.69	0.63	0.57	0.52	0.48	0.43	0.40	0.36	0.33	0.30	0.27	0.25	0.23	0.21	0.19	0.17	0.16	0.14	0.13	0.12	0.11
Discounted Deferral Cost	Rs Cr	16	32	40	51	64	67	58	50	43	37	32	27	16	14	12	11	10	8	7	7	6	5	4	4	3
Levelized annual Deferral Cost	**Rs Cr**	**61.45**																								

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