Uttar Pradesh
Power Corporation Limited

UPREV
U.P. Renewable and EV Infrastructure Ltd

EV CHARGING INFRA

Distribution Utility Meet | 14 - 15 November 2024

DISTRIBUTION UTILITY MEET DUM2024

UPREV OBJECTIVES

Formation of UPREV

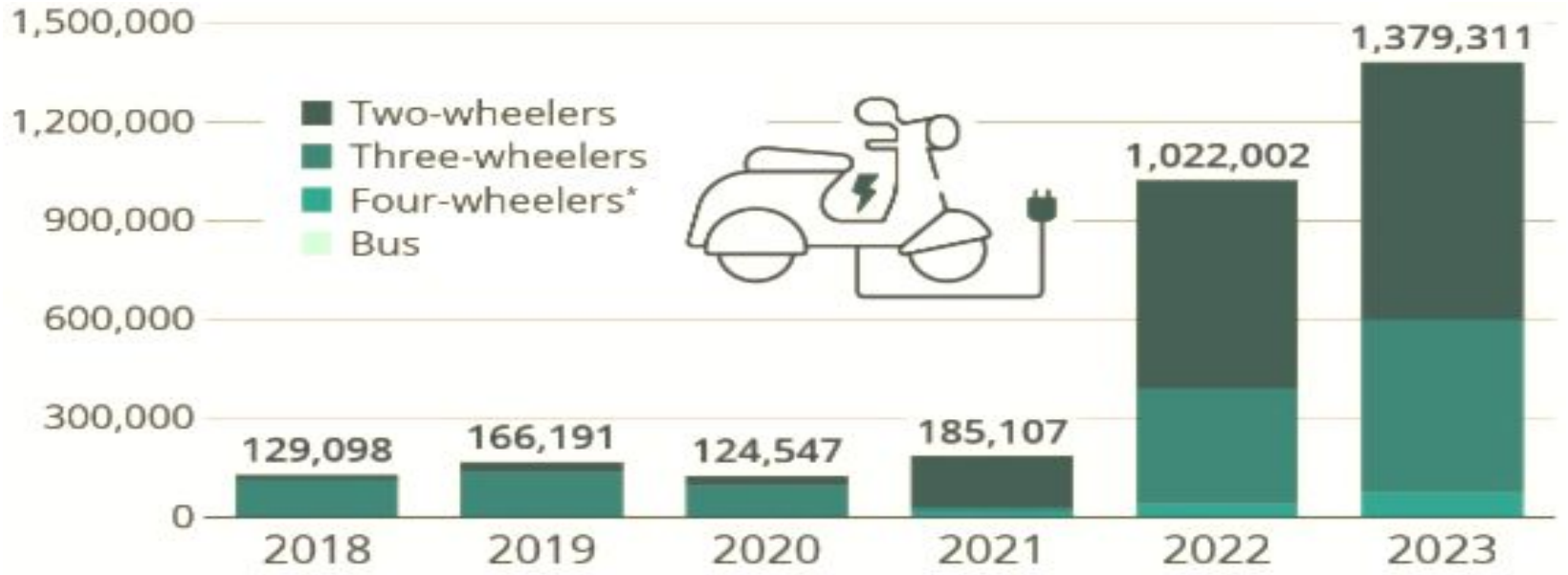
UP Renewable & EV Infrastructure Limited (UPREV) is **wholly owned subsidiary of UPPCL** created for promotion of EV Infrastructure in the state.

Key Goals of UPREV :

- Develop EV charging Infrastructure and to provide EV charging services.
- Develop and maintain EV charging infrastructure on land banks on state highways, national highways, cities and other places.
- Work on PPP mode related to EV charging infrastructure.
- Operating all type of EV vehicles on ownership, lease, rental or any other business models.
- Act as bulk consumer of UP DISCOMs in respect of its EV charging business.
- Leverage renewable energy sources to power EV charging stations, reducing carbon footprint and promoting sustainable practices in the EV sector.

Electric Vehicle propagation & Infrastructure

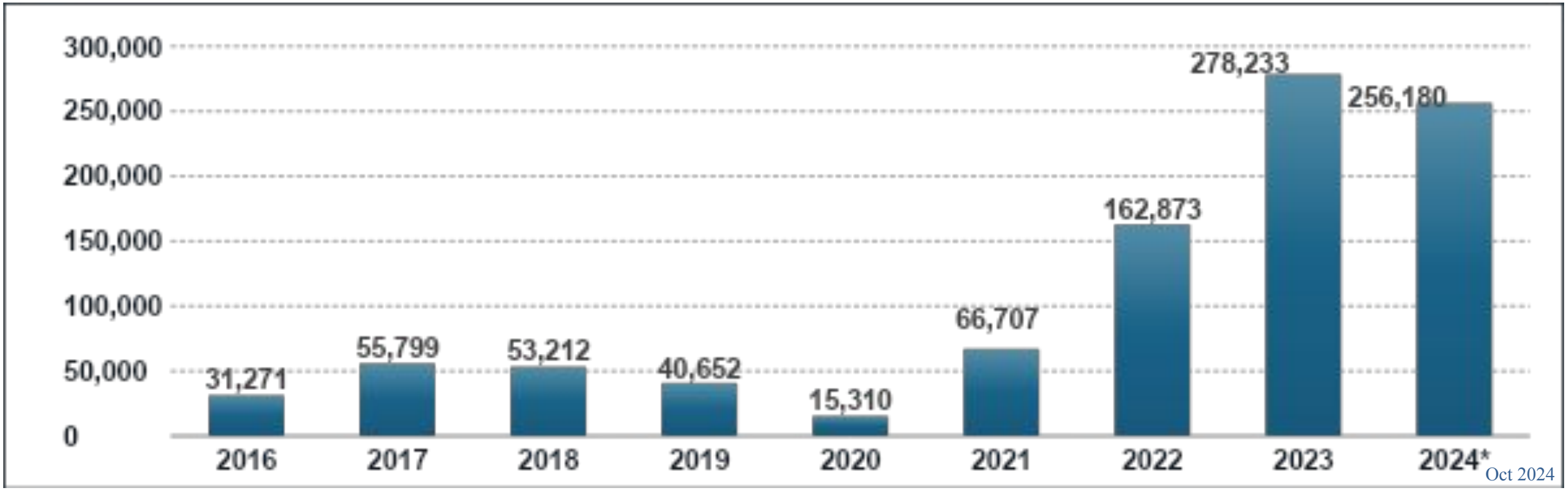
EVs Registered Pan India (2018-2023)



- By 2030, Bain & Co. projects electric two-wheelers will represent **40-45% of EV sales** in India, and passenger EVs **15-20**%.
- As per a Niti Aayog report EV adoption targets of 80% for two-wheelers, 70% for commercial vehicles, 40% for buses, and 30% for private cars by 2030
  - Presently **25,202** nos. of public EV Charging Stations have been installed in India for ~ **30 Lakh** Vehicles on Road.
    - At current**, 1,951** nos. of Charging Stations are installed in Uttar Pradesh.
    - Estimated **45-50 million EVs are expected to be on road on road by 2030.**

Growth of Electric Vehicles in Uttar Pradesh

EVs Registered in UP State (2016-2024)



- The state comprises of **20.12%** of the national EV stock. In FY 2022-23, UP's EV adoption rate was **71%** as compared to FY 2021-22.
- Major nos. out of registered vehicles are 3 wheelers followed by 2 Wheelers, followed by 4 Wheelers.
- With approximately **10 lakh EVs on the road and only 1,951 charging stations available** across Uttar Pradesh, Shows a substantial gap in infrastructure, underscoring the need for rapid expansion to support the growing demand and reliable access to charging for all EV users.

Factors affecting EV Adaptation Rate

Range Anxiety :

- Range anxiety is a significant **barrier** to electric vehicle (EV) adoption, particularly for long-distance travel.
- EV ranges (200–500 km) can be insufficient for long-distance travel. For instance, the Tata Nexon EV offers ~312 km, and the MG ZS EV ~419 km per charge.

Charging Infrastructure Accessibility:

- Limited availability of charging stations, especially in rural and remote areas, hinders EV adoption.
- In U.P. at present there is ~1 charging station per 500 EVs is present

Charging Speed and Time:

- Slow charging speeds compared to refueling conventional vehicles .
- Charging times range from 30 minutes to 12 hours. Fast chargers (50 kW DC) charge a Tata Nexon EV to 80% in ~60 minutes, while home chargers take 8–12 hours.

Investment in Upstream Infra :

- **Charging Station Costs:** Low EV adoption leads to underutilized stations, prolonging ROI.
- **Grid Upgrades:** EV adoption demands grid improvements.
- **Extended Payback Periods:** With low charging fees and few EVs, ROI often exceeds 10 years, deterring investments in an evolving market.
- **Risk of Obsolescence:** Rapid tech advances may outdate infrastructure before ROI, increasing investment risks.
- **Reliance on Subsidies and Government Support**

Battery Technology and Lifespan:

- Uncertainty about battery Performance .
- EV batteries last 5–10 years with a warranty of 8 years or 160,000 km. Battery degradation can reduce range by 10–20%.

Initiatives by the Central Government

Latest Initiatives of Ministry of Power

- **Delicensed Activity:** EV charging station installation is now delicensed, simplifying entry for businesses.
- **Single Part Tariff:** Introduces reduced rates during solar hours (9 AM 4 PM) with capped service charges based on charging type and time of day.
- **Coverage Goals:** By 2030, mandates one station per 1 km² in urban areas and every 20 km on highways.
- **Land & Financial Incentives:** Allows subsidized public land access with revenue sharing models to reduce costs.
- **PM EDRIVE Initiative:** From Oct 2024 to Mar 2026, aims to install 74,300 chargers for cars, buses, two wheelers, and three wheelers.
- **FAME II Allocation:** INR 800 crore allocated to OMCs for 7,432 fast charging stations across India.

Applicable Electric Vehicle Charging Tariff in U.P.

LMV-11: Electric Vehicle Charging Tariff

- **Applicability:**
  1. **Existing Consumers** (LMV-1, LMV-2, LMV-4, LMV-6, LMV-9, HV-1, HV-2, HV-3): Allowed to use their existing electricity connections for EV charging.
  2. **Increased Load:** Consumers may request an increased sanctioned load if EV charging requires more power than their current connection allows.

- **Multi-Storey Buildings:**
  1. **LMV-1b:** Energy charge - **₹6.20/kWh.**
  2. **HV-1b:** Energy charge - **₹5.90/kWh.**

- **Public Charging Stations:**
  1. **Low Tension (LT) Charging Stations:** Energy charge - **₹7.70/kWh.**
  2. **High Tension (HT) Charging Stations:** Energy charge - **₹7.30/kWh.**

- **Penalty for Exceeding Contracted Demand:**
  1. **LT Demand:** ₹150/kVA/month.
  2. **HT Demand:** ₹250/kVA/month (only applied to excess demand)

- **TOD has been eliminated by UPERC**

Initiatives by the U.P. State government

Charging & Swapping Stations

- **Capital Subsidy:**
  - Charging: 20% subsidy (up to ₹10 lakh) for investments over ₹25 lakh; 1st 2000 stations.
  - Swapping: 20% subsidy (up to ₹5 lakh) for investments over ₹15 lakh; 1st 1000 stations.
- **Govt Land:** Available on revenue-sharing (₹1/kWh) for 10 years.

Manufacturing Support

- **Capital Subsidy (10-30% on investment based on project size/type):**
  - Integrated EV, Mega, Ultra-Mega Battery, and MSME projects eligible.
- **Stamp Duty & Fee Reimbursements:**
  - Stamp duty: 100% for certain projects and regions.
  - Quality Certifications: 50% cost (up to ₹10 lakh) & patent reimbursements for Large/MSME.
- **Skill Development:** Stipend of ₹5,000/employee for up to 50 employees.

EV Adoption Incentives

- **Registration & Road Tax Waivers:**
  - 100% exemption on EVs registered in UP (first 3 years), and UP-manufactured EVs in years 4-5.
- **Purchase Subsidies (1 year):**
  - 2-Wheelers: 15% (up to ₹5000), cap of ₹100 Cr for 2 lakh EVs.
  - 3-Wheelers: 15% (up to ₹12,000), cap of ₹60 Cr for 50,000 EVs.
  - 4-Wheelers: 15% (up to ₹1 lakh), cap of ₹250 Cr for 25,000 EVs.
  - E-Buses & E-Goods Carriers: Up to ₹20 lakh and ₹1 lakh per vehicle respectively.

- **The operational subsidy should continue to cover underutilization costs until break-even is reached ensuring viability.**
- **It ensures continuous growth and financial sustainability as asset utilization rises.**

Government Initiatives & Action Plan of UPREV

Government Initiatives

PM E-Drive Grants :Ministry of Heavy Industries **provides Rs. 2,000 Cr. for EV charging station establishment**

Comprehensive Project Reportfor EV infrastructure in major Uttar Pradesh cities, highways, and transport agencies.

Maintain land banks for EV charging by securing land on a right-to-use basis from land-owning departments.

collaborate with Charge Point Operators (CPOs) to deploy infrastructure via a PPP model

Partner with government agencies to develop upstream infrastructure for EV charging stations

Action Plan of UPREV

- **Land Use in Energy Sector:** Approved right-to-use policy (Rs. 1/kWh) for EV stations on land owned by Discoms, UPPTCL, and UPRVUNL.
- **Expansion to Government Land:** Proposal to extend right-to-use (Rs. 1/kWh) for EV charging on other lands owned by other Government dept.
- **Mandatory EV Charging in New Projects:** Coordination with Housing Department to require EV charging stations in new development approvals.
- **Charging Spaces in Public Areas:** Proposal to allocate EV charging spaces in schools, malls, parking areas, and housing societies.
- **Revenue Models & Partnerships:** Developing BOO/BOOT/BOM models with Charge Point Operators and collaborating with NITI Aayog, WRI India, ISGF, and Grand Thornton for guidance

Estimation of Charging Stations Required for Cities in U.P.

As per new Ministry of Power guidelines,

One charging station should be installed every- 1 km x 1 km in cities.

A total of **6,462 charging stations** are required across **62 cities** of Uttar Pradesh.

20 km on both sides of highways

Given the length of National Highways (NH) in U.P. is ~ **12,270[1] kms**, total of **613 charging stations (approx.)** are required .

Additionally, with the length of State Highways (SH) being ~**8,432[2] km**, a total of **421 charging stations (approx.)** are required.

Charging stations along major expressways

- Agra-Lucknow – **12 charging stations** (approx.)
- Bundelkhand Expressway – **12 charging stations** (approx.)
- Purvanchal Expressway - **14 charging stations** (approx.)

On each side of the highway

Charging stations Required in major cities of U.P.

Cities	Charging station required
Lucknow	631
Banda	443
Meerut	405
Kanpur	403
Greater Noida	380
Prayagraj	365
Gorakhpur	226
Ghaziabad	210
Muzaffar Nagar	204
Noida	203
Varanasi	164
Jhansi	160
Hathras	142
Bareilly	123
Agra	121

The estimation of slow & Fast chargers needs to be done based on CAPEX & Financial Viability

INDUSTRY CONCERNS

Infrastructure and Power Supply

❑ Power Connection & Reliability

Current 49kW LT connection threshold limits CPOs. Higher thresholds for HT connections requested to support high-demand sites.

❑ Priority Locations

High-power chargers on highways (in partnership with UPSRTC) and urban locations for fleets near high-traffic areas.

❑ Single Window Clearance

Improved interdepartmental coordination for approvals to streamline processes and reduce delays.

Strategic Location & Consumer Needs

❑ Segmented Tenders

Separate tenders for 2/3-wheelers, 4-wheelers, and buses/trucks to better match segment needs.

❑ Stakeholder Collaboration

Incentives for malls and offices (e.g., minus metering) encourage hosting chargers and drive utilization.

❑ Consumer-Centric Enhancements

Prioritize convenience and app-based support for users, especially for fleet and e-bus operations.

Grid Impacts and Management in EV Infrastructure

Grid Impact

- **Increased Demand and Peak Load :** EV charging surges are expected to add stress to grid infrastructure, requiring upgrades to maintain stability and avoid congestion**.**
- **Peak Load Stress :**High, concentrated charging during peak hours can strain grid capacity, potentially causing overloads, outages, and increased need for peak power resources. Devising load-shifting strategies and offering incentives for off-peak charging, utilities can ease peak demand, improve grid stability, and optimize resource use.
- **Voltage Stability and Power Quality Issues :** Rapid charging, especially with DC fast chargers, can cause fluctuations in voltage and frequency, potentially leading to grid instability and affecting power quality for other consumers.

Grid Management

Vehicle-Grid Integration (VGI) Strategies

V1G & V2G: Uni- and bi-directional charging to manage demand and supply.
Virtual Power Plant (VPP): Aggregates EVs to stabilize the grid.
Battery Swapping: Rapid, peak-reducing solution for fleets.

Load Forecasting & Modeling

Forecasting : Project regional charging demands, enabling optimized infrastructure planning.

Grid Impact Simulations: Forecast EV impacts on distribution feeders to guide cost-effective upgrades.

Demand Management Techniques

Non-Wire Solutions: Reduce grid investment needs through distributed energy and demand-shifting.

Energy storage : Stores energy during off-peak periods and uses it during peak times can help balance electricity supply and demand, improve power quality.

Revenue Sharing Models for Charging Infrastructure

Revenue Sharing *(Base Model)*

(Based on Case Studies: Ahmedabad Municipal Corporation, BEST Undertaking, Delhi Transco Ltd., and WBSEDCL)

Land Rent

- **Base Rent:** A set rate per kWh or sq. meter, adjusted annually for inflation, ideally between 5-10% escalation every 3 years.
- **Term Flexibility:** Allow customized terms based on urban vs. highway locations, with urban areas typically requiring higher base rent due to higher land costs.

CPO Revenue

- **Primary Revenue:** Charging fees, minus shared revenue and land rent.
- **Additional Revenue Streams:** CPOs can retain income from ancillary services on-site, potentially attracting more traffic to charging locations.

Revenue Sharing

- **Fixed or Variable Rate:** Rs. X per kWh or a set percentage of revenue. This can vary based on urban or highway usage rate
- **Periodic Review:** Rates should be reviewed and potentially adjusted every 3-5 years to reflect market conditions.
- Considering rental and TfL-based models, zoning cities with 5-6 CPOs per zone for competition.
- Progressive battery cost declines could allow subsidies to shift toward infrastructure, easing financial strain. A temporary fee moratorium until 10% utilization further supports viability during the ramp-up phase.

Terms of Concession

- **Base Term:** 10 years for initial infrastructure setup, with potential extensions based on mutually agreed conditions.
- **Review for Renewal:** Extensions contingent upon meeting performance standards, such as station uptime and user satisfaction metrics

Land Rental Revenue Comparison – Case Study – (1/2)

- **Govt. Land will be provided at Nominal Cost**
- **Private Land will be availed at Lease Amount as per mutual agreement:** Revenue remains constant regardless of usage or Capacity Utilization Factor (CUF)

Considerations

Item	Description
Land Lease Rate/Year	2.5%
Circle Rate/Sqm	50,000
Land Required for EV Sqm	50
Total Value (₹)	25,00,000
Lease Value (₹/Year)	62,500

Considerations

Item	Description (Assumptions)
Capacity of AC Charging station	10 kW
Capacity of DC Charging station	60 kW
Availability Factor	85%
Units Consumed with 100% CUF (AC)/Year	74,460
Unit consumed with 100% CUF(DC)/Year	4,46,760
Total Units Consumed with 100% CUF/Year	**5,21,220**

Capacity Utilisation Factor (CUF)	Rental Value on the Basis of Unit Consumption @Rs 1/kWh	Lease Amount (Rs)	Per unit Rate (Rs./kWh)
5%	26,061	62,500	2.40
12%	**62,500**	**62,500**	**1**
25%	1,30,305	62,500	0.48
50%	2,60,610	62,500	0.24
75%	3,90,915	62,500	0.16

Land Rental Revenue Comparison – Case Study – (2/2)

Key Takeaways

- To cover the **Weighted Average Cost of Capital (WACC) of 12.4%** (considering 10% as a cost of Debt and 18% cost of Equity) the charging station would need a **CUF of approximately 59.5%,** on the Basis of Unit Consumption @Rs 1/kWh for investment assumption of Rs. 25 Lakhs**.**
- **To achieve the expected return**, a Capacity Utilization Factor **(CUF) of 59.5%** will be required, compared to the current CUF of 5% .**Targeted subsidies (e.g., capital subsidies, interest rate reductions) can bridge revenue gaps** and reduce investment risks. **This support will sustain early-stage infrastructure until EV adoption increases and CUF naturally rises.**
- **Housing companies should integrate EV charging infrastructure to help socialize initial costs during the ramp-up phase.**
- **Low-utilization stations can benefit from consumption-based rent, while high-utilization stations thrive with fixed leases.**

Estimation of revenue at average service tariff

Capacity Utilisation Factor (CUF)	Total Revenue for each CUF level at an average service tariff of ₹8 per kWh
5%	41,697
25%	83,395
50%	2,08,488
75%	4,58,673

Asset Utilization & Viability

Asset Utilization & Return Potential in EV

Infrastructure

❑ **Asset "Sweating" Reality**

Presently, EV charging infrastructure assets are **only utilized at 4-6%** of capacity, a common trend in early-stage, capital-intensive sectors.

❑ **Techno-Financial Perspective**

Low utilization impacts initial Return on Investment (ROI), with revenues currently limited due to low demand density and uneven adoption rates across regions.

❑ The operational subsidy should continue to promote infrastructure growth, aid capital recovery, and ensure financial sustainability as asset utilization increases.

Long-Term Financial Viability

❑ **Asset Repurposing & Dynamic Load Balancing**

Adaptive infrastructure, capable of supporting both charging and discharging (V2G), maximizes asset usage and reduces idle time.

❑ **Financial Stability through Flexible Business Models**

With PPPs, leasing options, and tiered pricing models, even low-usage assets can contribute to overall profitability, making the EV sector an evolving yet high potential investment landscape

Operational Efficiency and Future Readiness

Technological and Regulatory Adaptability

❑ Future-Proofing Contracts

Drafting contracts with flexible terms to accommodate future tech upgrades, protecting investments and ensuring infrastructure stays competitive as the EV sector evolves.

❑ Solar Integration & Banking

Solar power with banking (quarterly) for highways and urban centers enhances sustainability.

❑ Battery Swapping

Integrate battery swapping infrastructure to support quicker turnaround times, especially for high-usage vehicles like taxis and delivery fleets.

CPO Performance and Evaluation

❑ CPO Selection Criteria

Metrics like TAT and uptime to ensure reliability; enforce maximum bid participation for consistency.

❑ Consumer-Centric Enhancements

App support for all segments of EVs and improved services for e-bus users to enhance experience and convenience.

Thank you