

Policy Brief 1: Insights from Stakeholder Mapping & Interviews to Support EV Road mapping

Target Audience: Government Nodal Agencies, Urban Planners, and Policy Makers.

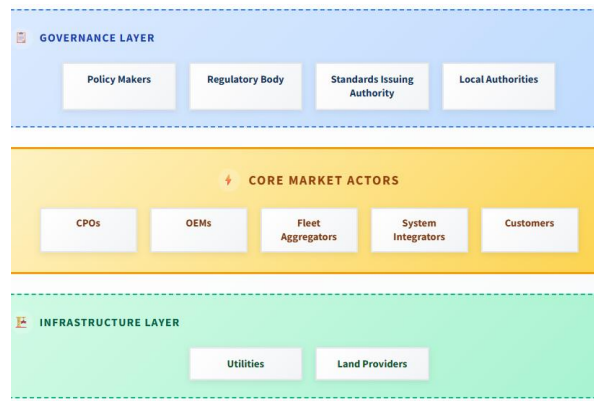
- The Challenge:** The transition to electric mobility is currently hindered by a complex web of interdependencies. Conflicting priorities between government agencies focusing on targets, utilities on grid stability, and private players on profit cause significant scaling barriers.
- Key Evidence:**
 - Market Intelligence Gaps:** The lack of real-time data on charging behaviour and infrastructure performance weakens the development of a coherent roadmap.
 - Usage Patterns:** While 70% of riders rely on night charging, public "top-up" infrastructure is critical for daytime commercial fleet viability, especially between 1 PM and 4 PM.
 - Efficiency Gaps:** 2Ws require 30–40 minutes for a fast charge, whereas 3Ws can take up to 2.5 hours.
 - Fragmented User Experience:** Overlapping roles and inconsistent charging standards between Charge Point Operators (CPOs) and Original Equipment Manufacturers (OEMs) create a fragmented ecosystem that hinders adoption.
- Strategic Recommendations:**
 - Mandate Standards:** Enforce universal standards like LECCS or CCS2 to move beyond proprietary barriers.
 - Data Sharing:** Implement an open-API platform for real-time monitoring of charger availability.
 - PPP for Land:** Pool underutilized land parcels and offer them at concessional rates (50% reduction) to improve operator viability.

Stakeholder Interaction Matrix

From	To	Relationship Type
Policy Makers	Regulatory Body	Policy direction, incentives
Regulatory Body	Utilities	Tariffs, compliance
Regulatory Body	CPOs	Tariff compliance, licensing
Standards Authority	OEMs	Technical standards
Standards Authority	CPOs	Interoperability standards
Utilities	CPOs	Electricity connection
Land Providers	CPOs	Lease, land allocation
System Integrators	CPOs	Hardware/software deployment
OEMs	CPOs	↔ Compatibility + partnerships
Fleet Aggregators	CPOs	Captive charging demand
Customers	OEMs	Vehicle purchase
Customers	CPOs	Charging demand
Local Authorities	CPOs	Land use, zoning approvals

Key Relationships

- Policy direction & incentives
- Grid & infrastructure support
- Technical standards
- Bidirectional partnership
- Demand & market signals
- Land & resource allocation

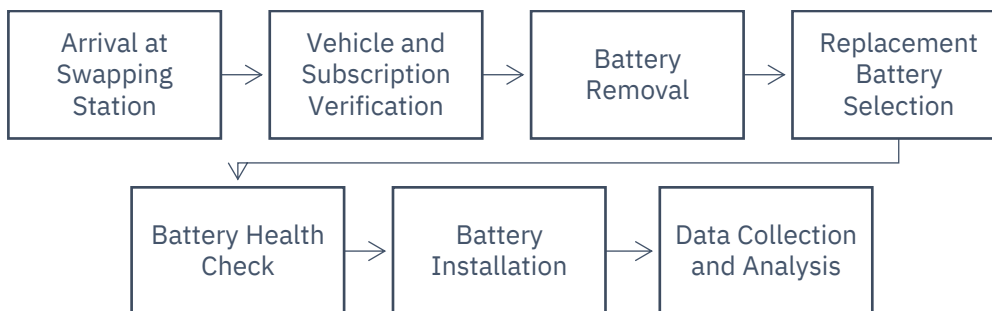


Interaction Matrix & Governance Flow

Policy Brief 2: Tools Supporting "Battery-as-a-Service" (BaaS) Model for EV Infrastructure

Target Audience: Fleet Operators, Battery Manufacturers, and CPOs.

- **Overview:** The battery is the most expensive EV component. BaaS decouples this cost, allowing users to rent batteries and pay only for energy consumed.
- **Operational Mechanics:**
 - **Battery Float:** Networks require 1.2 batteries for every 2W and 3.6 batteries for every 3W on the road.
 - **Energy Intensity:** A 15-slot swap station consumes ~280 kWh/day to support ~200 swaps.
 - **Thermal Management:** Stations utilize cooling systems during high-speed charging to extend battery life to 3,000 cycles.
- **The B2B Anchor Strategy:**
 - B2B partnerships (logistics/delivery) provide the consistent demand needed for long-term viability.
 - Offering 35% discounts to B2B clients reduces early-stage volatility and shortens the payback period.
- **Policy Recommendations:**
 - **Standardize Designs:** Establish universal battery dimensions and communication protocols.
 - **Open Access:** Allow operators to procure renewable energy directly through PPAs, reducing electricity costs by 33%.



Workflow of Battery Swapping Station

Aspect	Charging Stations	Battery Swapping
Technology	Charges the EV's battery directly through a charging port.	Replaces the depleted battery with a fully charged one.
Time Efficiency	Typically takes longer to charge (30 minutes to several hours depending on the charging level).	Takes a few minutes to swap batteries, resulting in minimal downtime.
Infrastructure	Requires installation of charging points at various locations.	Requires battery swapping stations equipped with automated systems to store and manage batteries.
Cost	Lower upfront costs for installation, but operational costs for electricity and maintenance can be higher.	Higher initial investment in battery swapping infrastructure and battery stock, but no direct increased energy consumption costs.
Battery Ownership	Users own the battery; can charge anywhere with access to charging stations.	Battery is owned by the service provider; users pay for each swap.
Energy Supply	Depends on local electricity grid; slow or fast charging based on infrastructure.	Requires large battery inventory and continuous recharging of batteries at stations.

A Comparison of Charging Stations and Battery Swapping

2. Workflow: "

Policy Brief 3: Guidelines for User-Centric EV Charging Infrastructure Design through a GESI Lens

Target Audience: Infrastructure Developers and Social Inclusion Officers.

- **The Challenge:** Current stations often suffer from broken equipment and deserted locations. 85% of Chennai's existing stations are rated poor or very poor by users.
- **GESI Design Standards:**
 - **Visibility:** Stations must have a clear line of sight from 5–10 meters and signage visible from 50 meters.
 - **Safety:** Prioritize active areas near metro stations or retail zones; maintain a 50m distance from standalone liquor stores.
 - **Lighting:** Mandate 30 lux for surface stations and 40 lux for basement units.
 - **Ergonomics:** Connectors should be at a 1.2m height to ensure accessibility and protection from waterlogging.
- **Institutionalizing Inclusion:**
 - **Reintroduce Mandates:** Reserve 10% of parking in commercial buildings for EV charging.
 - **Disaggregated Data:** Require CPOs to track gender-disaggregated usage to identify accessibility gaps.



Ease of finding a charging station



Safety and security



Charging infrastructure & network connectivity



Amenities

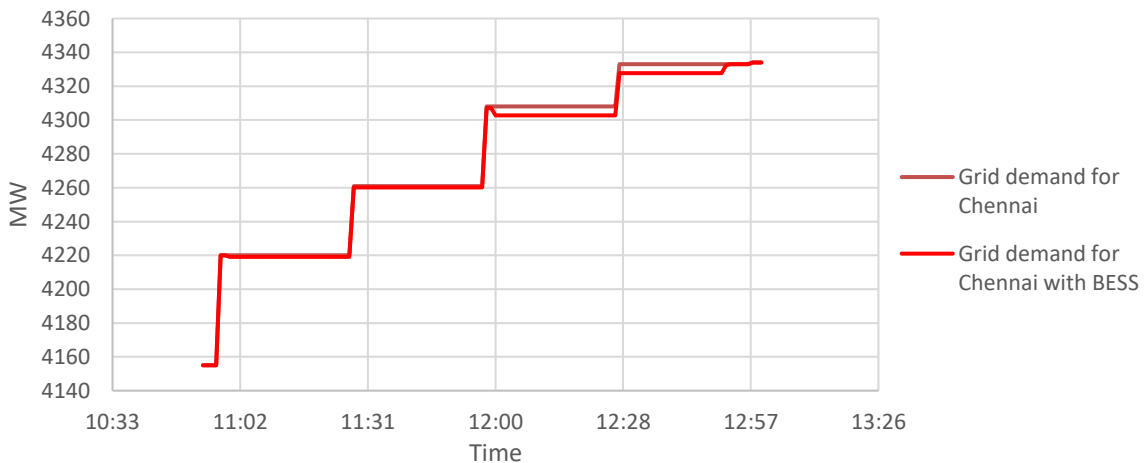
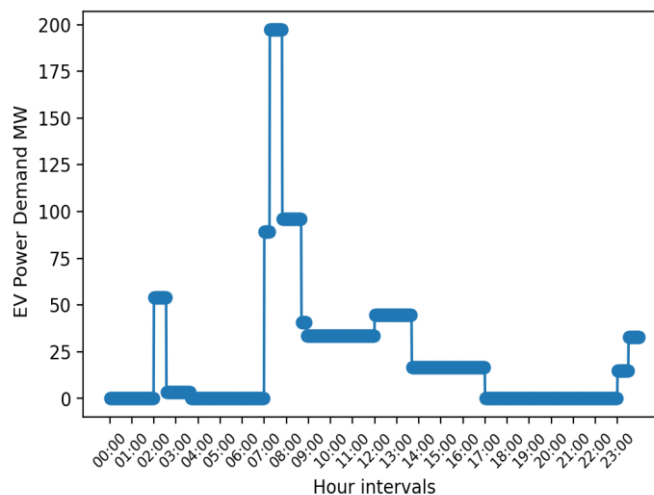
Sno.	Focus Area	Parameter	Upgradable?
1	Ease of Finding the Charging Station	Location, Details, and Availability	Yes
		Signage	Yes
		Visibility	No
2	Safety and Security	Active Area	No
		Standalone Liquor Store Distance	No
		Lighting	Yes
		CCTV Camera	Yes
		Height of Charging Point	No
		Fire Safety	Yes
		Helpline Number	Yes
		Ease of Access and Egress	No
4	Charging Infrastructure and Network Connectivity	Detailed User Instructions	Yes
		Interoperability Information	Yes
5	Amenities	Dedicated Space for Charging	Yes
		Shaded Areas for Rest	No
		Additional Amenities (Toilets, Drinking Water)	No

Focus Area of GESI & Parameter Checklist

Tools for EV/Energy Scenario Development and Demand Forecasting

Target Audience: Utility Companies (DISCOMs) and Municipal Planners.

- **Overview:** Projections over a 30-year period (2023–2053) are essential to align urban growth with grid asset lifecycles.
- **Forecasting Chennai's Future:**
 - **BAU Case:** Energy demand for EV charging is projected to grow **90 times** by 2053.
 - **Peak Load:** Maximum demand occurs between 7 AM and 8 AM, risking localized grid stress.
- **Integration of Renewables:**
 - **Solar Offsetting:** To reach "Moderate" adoption targets in 2043, Chennai requires ~584.5 MW of solar capacity for EVs.
 - **BESS Optimization:** Battery Energy Storage Systems charge during off-peak (5 AM) and discharge during peak (11 AM–4 PM) to stabilize the grid.
- **Policy Recommendations:**
 - **Dynamic Planning:** Replace static targets with scenario-based frameworks (BAU/Moderate/Accelerated).
 - **Incentivize Storage:** Provide subsidies for charging stations that include Solar PV and BESS.

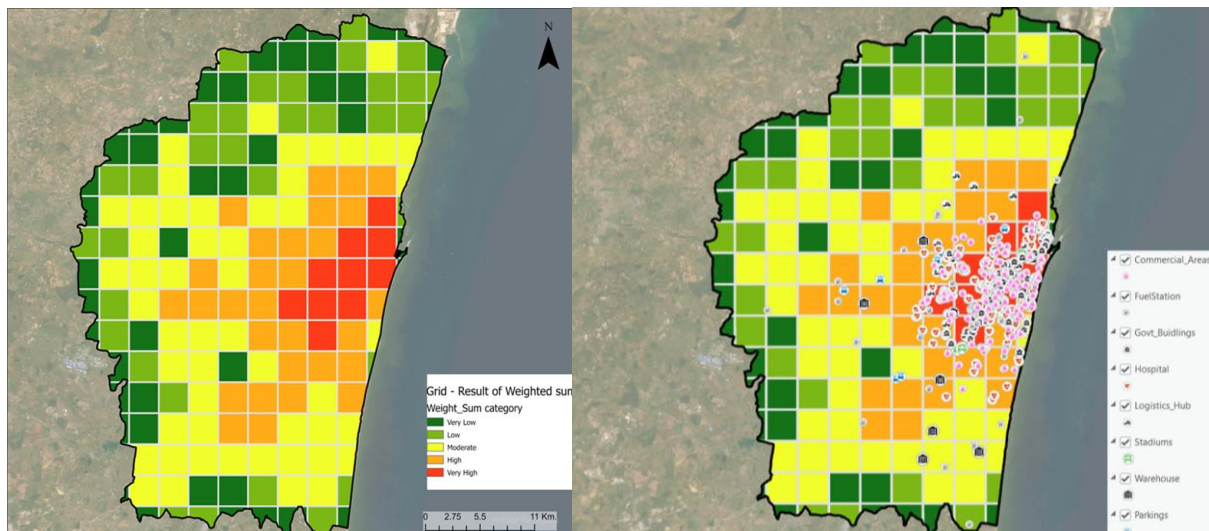


Daily 24 hours EV charging load curve and BESS discharging during peak demand time

Policy Brief 5: Geospatial Analysis and EV Charging Station Cluster Identification Tool

Target Audience: Private Investors, CPOs, and Zoning Authorities.

- **Precision Siting:** Haphazard deployment leads to underutilized hardware. GIS analysis ensures stations are placed where demand is highest.
- **Siting Methodology:**
 - **City-Level Screening:** Weighting factors include road proximity (Weight 3), commercial land use (25%), and population density (20%).
 - **Site-Level Validation:** Filtering for environmental constraints like restricted wetlands and proximity to substations.
- **Strategic Typologies:**
 - **Logistics Hubs:** Dedicated units for delivery fleets.
 - **Transport Hubs:** Multimodal integration at Metro/Railway stations.
 - **Commercial Zones:** Malls and markets with robust power infrastructure.
 - **Fuel Stations:** Leveraging existing energy infrastructure for convenient access.
 - **Recreational Spaces:** Capture footfall at parks and botanical gardens.
- **Policy Recommendations:**
 - **Mandate Grid Analysis:** Use a 3 km x 3 km grid for all urban infrastructure planning.
 - **Digital Verification:** Use tools like Google Street View for virtual space assessments before ground deployment.
 - **Standardize Weighted Criteria:** Local authorities should establish a standard set of weighted criteria—prioritizing accessibility and commercial activity.



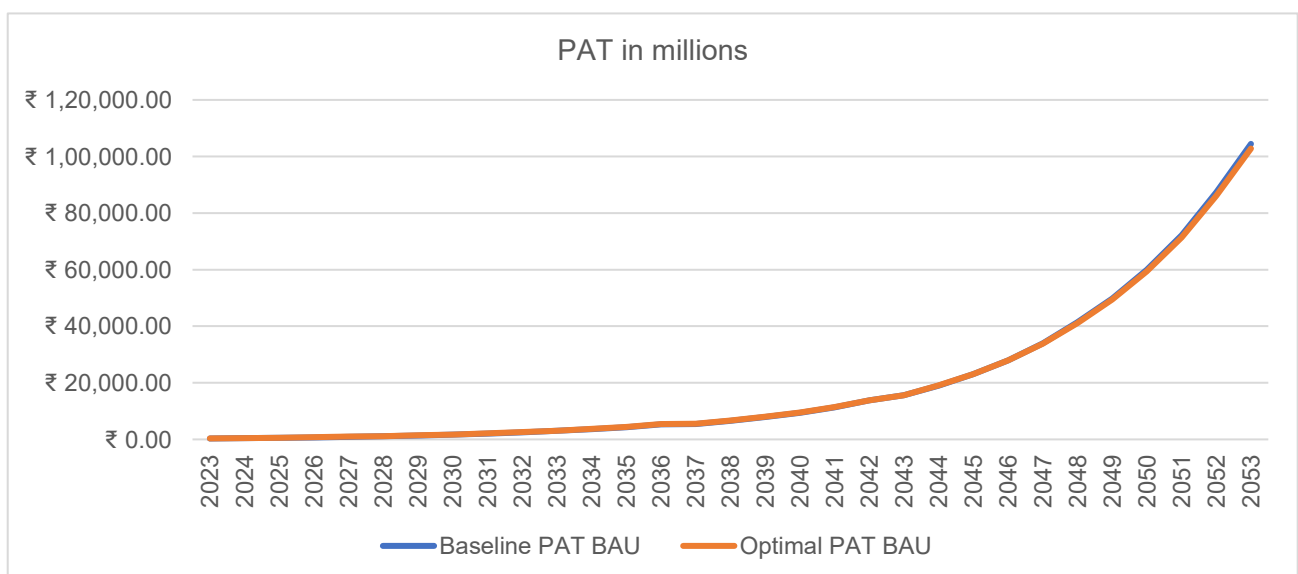
Optimal location clusters for EV charging infrastructure and High Potential Grid

Policy Brief 6: Financial Model for Developing Battery Swapping Stations

Target Audience: Financial Institutions, Investors, and CPOs.

- **Transition to Profitability:** While baseline models may show initial strain, an optimal strategy ensures long-term viability.
- **Cost & Revenue Structure:**
 - **CAPEX:** Includes cabinets (~₹5 lakh), mounting (15% of total), and battery float.
 - **OPEX:** Dominated by electricity (40–53%) and labour (up to 50% by 2053).
 - **Non-Charging Revenue:** Advertising and retail partnerships can generate ₹15,000–₹20,000 extra per station monthly.
- **Strategic Optimizations:**
 - **PPP Savings:** Using government land at concessional rates reduces lease costs by 50%.
 - **PPA Savings:** Direct procurement reduces energy costs by one-third.
- **Key Findings:** The "Optimal Model" (PPP + PPA + B2B contracts) shows profitability and sustained growth, whereas the BAU model faces continuous losses.

Year	Revenue	Total Operational Expenses	EBITDA	Depreciation	Amortisation	EBIT	Interest	EBT	PAT
2023	967.06	267.32	699.74	192.53	2.48	504.73	55.07	449.67	350.74
2028	2,469.94	663.41	1,806.53	220.02	19.62	1,566.89	94.09	1,472.80	1,148.78
2033	6,278.01	1,674.00	4,604.01	401.34	68.68	4,133.99	175.99	3,957.99	3,087.23
2038	13,264.99	3,579.87	9,685.12	643.51	216.06	8,825.55	302.76	8,522.78	6,647.77
2043	33,843.42	9,428.48	24,414.9	2,308.85	696.06	21,410.03	1,366.90	20,043.1	15,633.65
2048	86,588.67	25,368.03	61,220.6	4,149.75	1,506.48	55,564.41	2,863.6	52,700.8	41,106.64
2053	220,566.7	69,535.02	151,031	9,838.13	2,714.09	138,479	6,683.4	131,796	102,800.9



Profit and Loss Statement and Profit After Tax (in millions) for Battery Swapping Stations