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ISGF
India Smart Grid Forum

DISTRIBUTION UTILITY MEET
DUM 2023

Session 3

Planning for Transport Electrification

Presented By

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Why Planning Transport Electrification is Required?

- **Climate Concerns**: Rising global temperatures and environmental degradation have led to a pressing need for cleaner transportation solutions.
- **Air Quality**: Poor air quality, especially in densely populated urban areas, poses serious health risks and demands cleaner transport options.
- **Energy Independence and Energy Securities**: Reducing reliance on fossil fuels and promoting electric mobility contributes to energy security and independence. Try to include the data point.
- **Technological Advancements**: Advances in battery technology and electric vehicle design have made electrification more practical and affordable.
- **Global Trends**: Many countries are prioritizing transport electrification as a means to reduce emissions and mitigate climate change.
- **Economic Opportunities**: Electric vehicle adoption presents economic growth potential, from manufacturing to charging infrastructure development.
- **Policy Initiatives**: Governments are implementing policies and incentives to accelerate the transition to electric transportation.

Initiatives of Transport Electrification at World level

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Paris Agreement

Global pact to combat climate change, reduce emissions, and limit warming.

International Colaboration

Global teamwork advancing electric vehicles for cleaner, more sustainable transportation solutions.

Electric Vehicle Initiative (EVI)

Collaborative effort promoting electric vehicle adoption and sustainable transportation solutions..

Emmision Reduction Goals of Nation

Nations unite, set targets for reducing emissions, combatting climate change impacts.

Global Awareness and Education

Promoting worldwide knowledge and understanding of electric vehicles for sustainability.

Zero Emission Mandates

Regulations requiring automakers to produce and sell low or zero-emission vehicles.

Infrastructure Developement

Expansion of worldwide electric vehicle charging network for sustainable transportation.

Global Automaker Commitments

Automakers globally pledge support for electric vehicles, accelerating sustainable transportation.

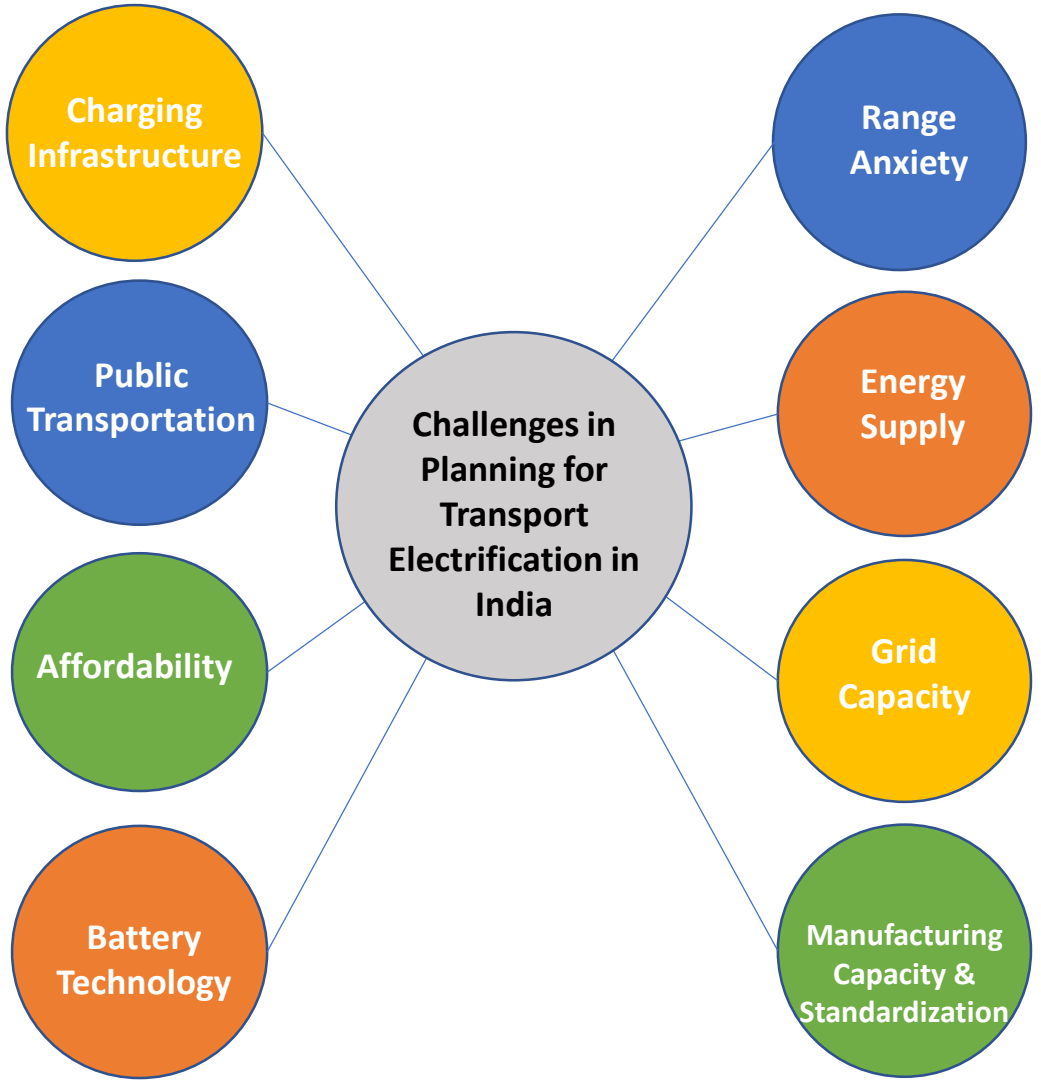
Challenges of Transport Electrification in India

Establishing an extensive and accessible charging network, particularly in rural and remote areas, is a major challenge.

Electrifying large public transportation fleets, such as buses, can be a complex and costly endeavor.

The higher upfront cost of EVs can be a barrier for many consumers, necessitating incentives and subsidies.

Developing and sourcing affordable, efficient, and environmentally sustainable batteries is crucial for EV adoption.



Concerns about the limited range of EVs and the availability of charging stations need to be addressed to build consumer confidence.

Meeting the increased electricity demand from a surge in electric vehicles (EVs) while ensuring a clean and reliable power supply can strain existing energy infrastructure.

The power grid may require substantial upgrades to handle the simultaneous charging of multiple EVs, posing a challenge for rural and peri-urban areas.

Expanding the production of EVs and components domestically is necessary to reduce dependence on imports. Not specific standard set yet for chargers.

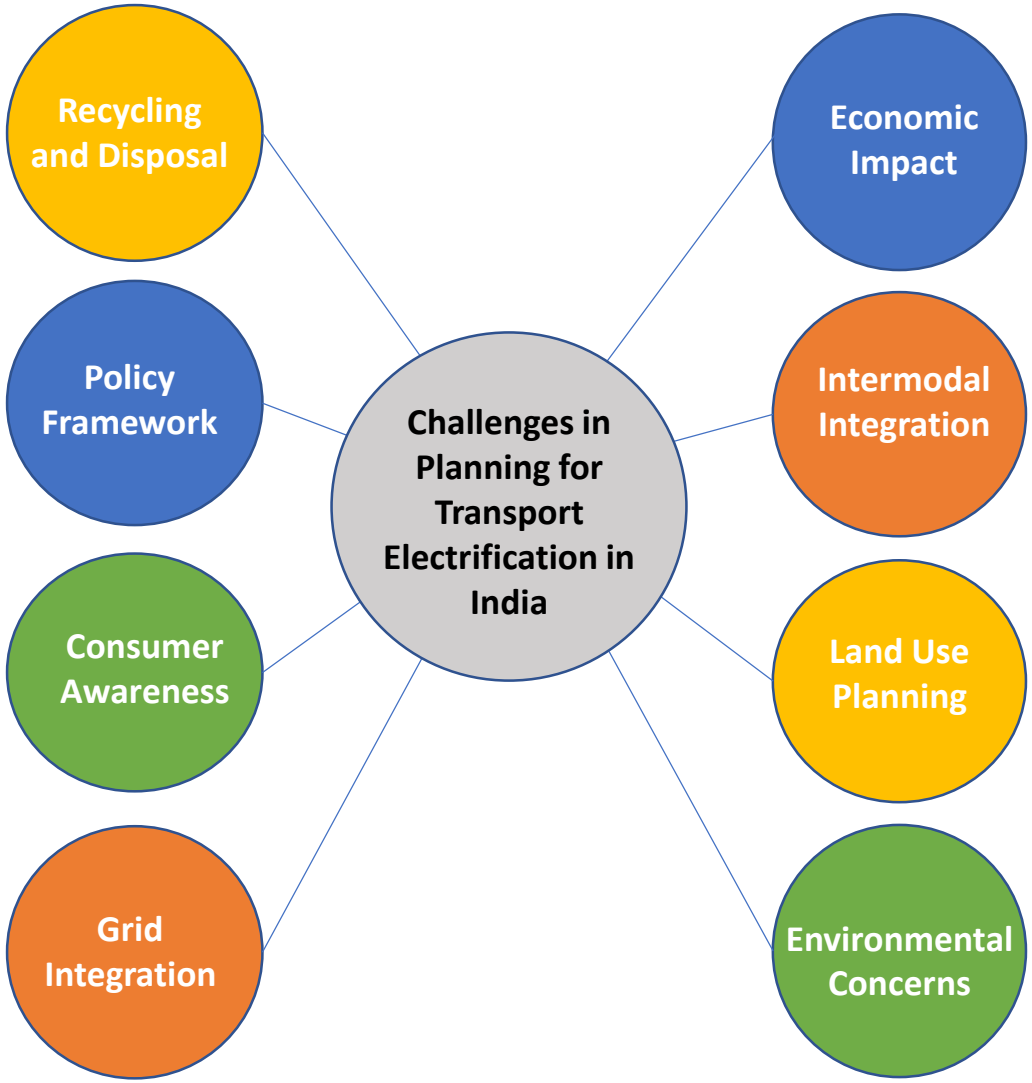
Challenges of Transport Electrification in India

Proper disposal and recycling of batteries is a concern for environmental sustainability.

Implementing and enforcing EV-friendly policies, such as emissions standards, incentives, and taxation, requires careful planning and execution.

Raising awareness about the benefits of EVs and dispelling misconceptions is essential for adoption.

Developing smart grid technology to manage charging demand and minimize grid stress is crucial.



Transitioning away from traditional vehicles may disrupt industries like oil and gas, requiring a well-managed transition for affected sectors.

Integrating various modes of transportation into a cohesive electrified transport system requires comprehensive planning.

Reconfiguring urban planning to accommodate charging stations and EV-friendly infrastructure can be challenging.

Ensuring that the production and disposal of EVs and their components are environmentally responsible is a key consideration.

Distribution Grid Planning for Transport Electrification

Grid Capacity Optimization	• Efficiently utilize existing grid capacity to meet the rising demand of electric vehicles, reducing the need for costly grid upgrades.
Load Management	• Implement smart charging strategies, including off-peak charging and load balancing, to minimize peak load on the grid. This approach reduces the requirement for capital expenditure (capex) on grid infrastructure expansion.
Cost Efficiency	• Smart charging practices contribute to cost-efficiency, making the electrification of transport more economically viable.
Address Unique Requirements	• Tailor distribution grid upgrades to cater to the distinct power supply needs of public charging stations (PCS) and bus depots. This ensures reliable and efficient power supply to these essential elements in the electric mobility ecosystem.
Dedicated Infrastructure	• Develop dedicated power lines and infrastructure to provide secure and efficient power to PCS and bus depots.
Advanced Metering	• Implement advanced metering and real-time monitoring systems for optimized power distribution to these critical EV infrastructure components.
Efficiency and Reliability	• Meticulous planning of distribution grid upgrades guarantees the efficiency and reliability of power supply to PCS and bus depots, facilitating a seamless transition to electric transportation in India and contributing to sustainability and environmental goals.

MW-scale Power for Bus Depots and Public Charging Stations

Emerging Demand

Increasing adoption of electric buses and electric vehicles necessitates MW-scale power connections in bus depots and Public Charging Stations (PCS).

Distribution Grid Planning

Comprehensive distribution grid planning is vital to ensure reliable MW-scale connections, including load assessment and grid capacity upgrades.

Municipal Challenges

Overcoming municipal challenges related to land use, permitting, and coordination with local authorities is crucial for implementing MW-scale power infrastructure.

Reliability

Addressing power quality issues, such as voltage fluctuations and harmonics, is essential to ensure the seamless and reliable operation of charging infrastructure.

Power Quality

Implementing redundant systems, backup power sources, and real-time monitoring is necessary to enhance the reliability of MW-scale power connections, minimizing disruptions and downtime.

Collaboration Amongst the Stakeholders

Importance of Collaboration

- Collaborative efforts among Distribution Companies (Discoms), transport operators, governments, and Original Equipment Manufacturers (OEMs) are essential for a successful transition to electrified transport.

Unified Strategy

- Development of a unified strategy that aligns the interests and goals of all stakeholders, ensuring a coordinated approach.

Policy Framework

- Governments can establish supportive policies and regulations, providing incentives and standards to facilitate electrification.

Infrastructure Development

- Effective collaboration fosters infrastructure development, such as charging stations and grid enhancements, critical for electric vehicle deployment.

Funding and Investment

- Cooperation can attract investment and funding opportunities for electrification projects, leveraging resources from both public and private sectors.

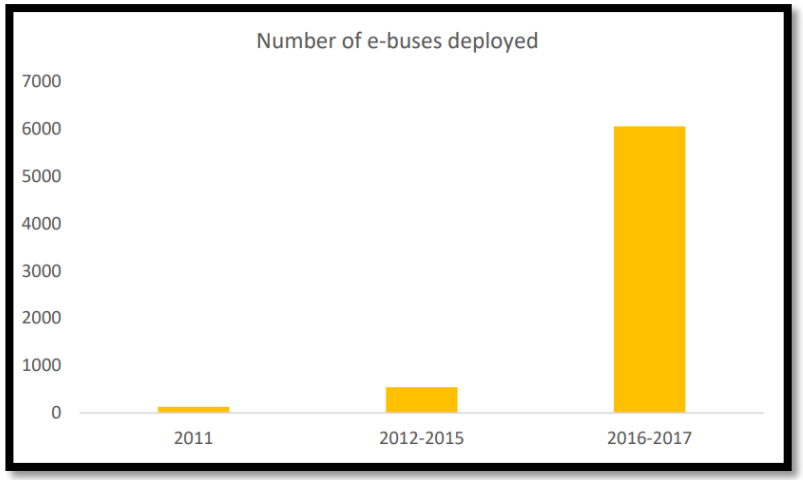
Data Sharing

- Sharing data on energy usage, charging patterns, and performance metrics enhances the overall effectiveness of electrified transport systems.

Case Study: Charging Network Planning for eBus in Shenzhen, China

Context

- In China, the big cities such as Beijing, Shanghai, Guangzhou and Shenzhen, vehicle emission is the biggest contributor among the sources of PM2.5, accounting for 45%, 29.2%, 21.7% and 52.1% respectively
- In Shenzhen, buses accounted for 0.5% of the city's vehicle fleet, but contributed 20% to the vehicle emission
- In 2017, Shenzhen made history by upgrading its entire bus fleet to battery-powered e-buses, transforming into the world's first all-electric bus city
- Most convenient arrangement has been that charging stations being simply located at the bus depot
- With the advent of all e-Bus city it would not be economic to transform every bus depot into a charging station
- Most studies on the grid impact has been qualitative and not quantitative
- Shenzhen's huge e-bus fleet of 16,359 is supported by only 26 planned and cost optimized large charging stations



Electrification of buses of Shenzhen Bus Group Co Ltd.

The design sketch of the Yueliangwan Bus Charging Station

Case Study: Charging Network Planning for eBus in Shenzhen, China

Learnings

- Government subsidy is critical to drive e-Bus adoption as Total Cost of Ownership is lower for diesel powered buses. In 2015, the subsidy in China was 500,000 RMB per bus for buses of over 10 meters
- Requirement of 1 no. high capacity charger per every 5 nos. of eBuses
- E-Buses require exclusive transformer substations, to avoid congestion with other loads in the distribution network
- E-Bus charging stations should remain exclusive and not shared with public charging stations to meet the strict operational requirements
- e-Bus Fleet companies does not own the charging infrastructure but pays charging service fee to Charging Service Provider, which has nurtured a healthy and competitive market for Charging Service Providers and Power companies
- Choosing of optimal charging station location, reduces the total cost of ownership of the eBus charger instead of going for eBus fleet operator least cost or grid augmentation least cost model

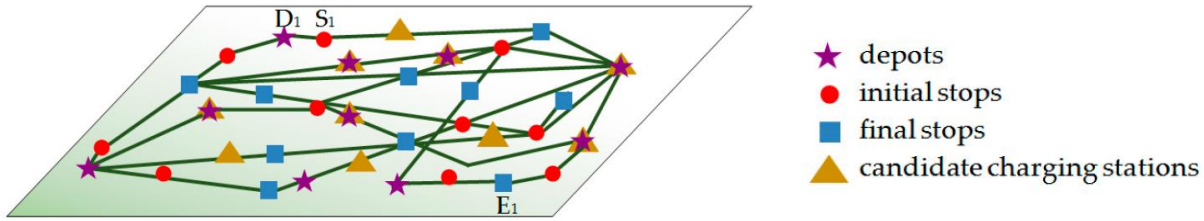
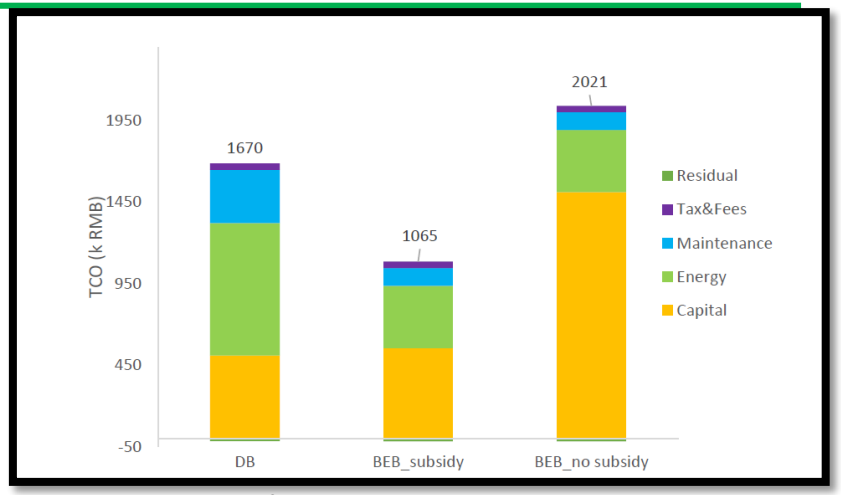


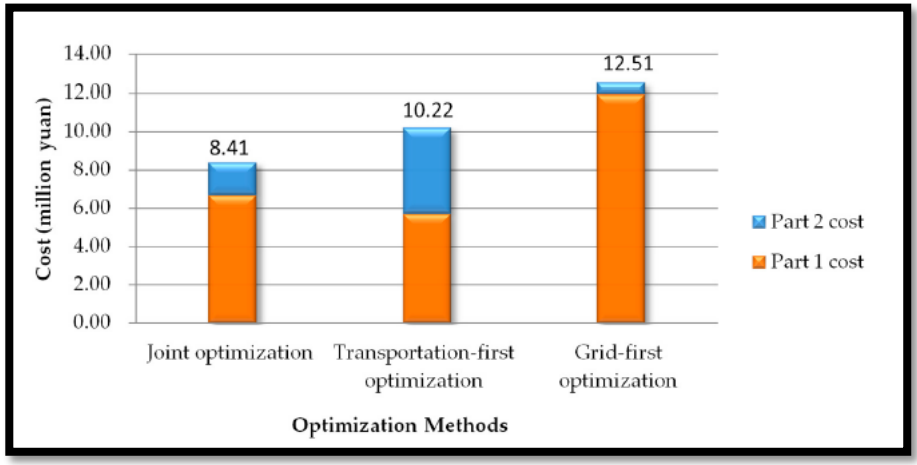
Figure 4. Transportation network.

Optimization of charging station location model



TCO result for Diesel and electric buses in a with and without subsidy scenario over the bus lifetime of 8 years

Exchange Rate as on 31-Oct-23:
1 RMB = 11.52 INR : 1 USD = 7.32 RMB : 1 USD = 83.24 INR



Total Cost for Transport (Part 1) and Grid (Part 2) for 3 models

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THANK YOU

For discussions/suggestions/queries email: ***dum@indiasmartgrid.org***

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Links/References (If any)