Presentation on
Electric Vehicles - Impact on Utility and Regulatory Interventions

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Agenda

- **Why EVs ???**
- **Pointers from International Best Practices**
- **Penetration of EVs**
  - **Technical Impact**
  - **Legal Aspects**
  - **Possible Business Models**
  - **Tariff Impact**
  - **Suggestions for Tariff**
  - **Suggestions for Regulatory Interventions**

Why EVs ???

- **1/3rd of crude imports in India attributed to transportation; 80% in the road transportation**
- **National Electric Mobility Mission Plan 2020, notified by Department of Heavy Industries puts emphasis on EVs as a key mitigation strategy**
- **Co-benefits of EVs include curbing air-pollution; substantive benefits ambient air quality in the urban centers**
- **Recently published reports by NITI Aayog argues in favor of EVs; utilities can use EVs as mobile assets**
- **The Forum of Regulators commissioned a study to assess**
  - **International best practices within the EV space**
  - **Role of regulators and distribution licensees**
  - **Impact of EVs on the distribution networks**
  - **Business models within the purview of existing current legislations**
  - **Tariff impact**

Penetration of EVs – Base Numbers

- NEMMP vehicle stock numbers
  - Low Growth scenario (2.2 lacs vehicles excluding 2-wheelers)
  - High Growth scenario (4 lacs vehicles excluding 2-wheelers)
- NEMMP+ vehicle stock numbers
  - Low Growth scenario (4.95 lacs vehicles excluding 2-wheelers)
  - High Growth scenario (8.4 lacs vehicles excluding 2-wheelers)
- Investments in the charging infrastructure
  - NEMMP scenario
    - Low growth (2,873 MUs and INR 603 Crores investment) – 547 MW additional load
    - High growth (5,322 MUs and INR 834 Crores investment) – 1013 MW additional load
  - NEMMP+ scenario
    - Low growth (7,993 MUs and INR 1,142Crores investment) – 1,521 MW additional load
    - High growth (25,218 MUs and INR 3,372 Crores investment) – 4,798 MW additional load

Pointers from International Best Practices

- **Regulators in California and Vermont have approved the capital expenditure towards EV Supply Equipment (EVSE) installations as a part of rate base.**

- **Electricity distribution companies have offered attractive time-of-day tariffs to promote off-peak charging.**

- **They have also played a key role in the development of public charging infrastructure.**

- **US, Japan and China experimenting utilization of EVs as grid assets, - demand response resource or ancillary services through Vehicle-to-Grid technologies.**

- **Governments have offered substantial direct and indirect incentives to EVs. Direct incentives include purchase subsidy for EVs and subsidy for installation of chargers while indirect benefits range from tax breaks to access to reserved lanes and parking spots,**

- **France offers an CO_2 emission based "feebate" system, which subsidizes electric vehicle purchase while penalizing higher-emission vehicles**

Penetration of EVs – Technical Impact

- **Impact of slow and fast charging on the voltage levels simulated in MATLAB on residential and commercial distribution transformers**

- **Impacts need to assessed at macro (national grid) and local distribution**
  - **No impact on the entire grid with 5000 MW of peak loads**

- **Simulation results show no adverse impact on the voltage levels**
  - **The transformer can be safely loaded with a split of 60%-40% for residential loads and electric vehicle load respectively.**
  - **a baseline 50% loaded commercial feeder can safely absorb up to 20% of additional EV load from fast charging, similarly the residential feeder, can safely handle a ratio of 60%:40% from Residential load and EV load**

- **The peak co-incident charging scenario showed that a loading of around 20% from fast chargers should be the threshold**

- **Limitations – impact on each grid points – distribution networks – need to develop specific expansion plans**

Penetration of EVs – Legal Aspects

- **Legal questions**
  - **Would setting up of public charging stations fall under the jurisdiction of distribution systems?**
  - **Does it entail supply of electricity to public at large?**
  - **Who can invest in Public charging infrastructure?**

- **Evaluation of above questions suggests the following:**
  - **EV charging service would fall within the ambit of electricity distribution (a licensed activity)**
  - **EV charging service to EV users/drivers entails supply of electricity, thus needs to be regulated**
  - **Tariff charged to the consumers needs to be regulated and determined by respective Commissions**

Penetration of EVs – Possible Business Models

- **Distribution Licensee owned EV charging infrastructure**
  - **Supply of electricity to EVs**
  - **Tariff as determined by the SERC**
- **Distribution Licensee franchised EV charging infrastructure**
  - **Franchisee to install / operate charging stations. Franchisee can also be under PPP Model**
  - **Franchisee receives electricity at single point as bulk supply**
  - **Tariff (incl. tariff cap, if any) as determined by the SERC**
  - **Can also be allowed to buy power through Open Access without application of Cross Subsidy Surcharge**
- **Privately Owned Battery Swapping Stations**
  - **Aggregation of demand for batteries and setting up of battery swapping stations by the utility / distribution licensee / franchisee**
  - **Sale of Battery is not sale of electricity. Third parties can set up stations to avail special category tariff as determined by the SERC**
  - **Can also be allowed to buy power through Open Access**

Penetration of EVs – Tariff Impact

- **Two scenarios**
  - **NEMMP targets and corresponding EV charging infrastructure requirements and**
  - **An aggressive target termed the NEMMP+[1]**

- **Both NEMMP and NEMMP+ scenarios use Low Growth and High Growth options**
- **Tariff impact assessment was carried out in two formats –**
  - **Entire investment socialized to all the consumers of the licensee and**
  - **Investments charged only to the EV category**

Scenario	Business models	Growth options	Tariff Impact (Rs./kWh)
NEMMP	**Scenario 1A:** Investments socialized to all the consumers	Low Growth	**0.0007**
		High Growth	**0.0010**
	Scenario 1B: Investments charged only to EV category sales	Low Growth	**0.2810**
		High Growth	**0.2097**
NEMMP+	**Scenario 2A:** Investments socialized to all the consumers	Low Growth	**0.0013**
		High Growth	**0.0040**
	Scenario 2B: Investments charged only to EV category sales	Low Growth	**0.1912**
		High Growth	**0.1790**

Penetration of EVs – Suggestions for Regulatory Interventions

- **Regulators to allow pass through of investments made in EV charging infrastructure by the Distribution Licensees in tariffs**
- **Create simplified framework for franchisee agreements between the DLs and private sector/interested Public Sector Undertakings/associations to set-up charging infrastructure**
- **Appoint multiple and non-exclusive franchisees within its area of supply for setting up public charging infrastructure**
- **Create new tariff category for EVs by allowing recovery of incremental cost of infrastructure through wheeling charges over and above the average cost of service**
- **Allow special ToD structure for EV charging infrastructure accounting for use of backed-down assets in the night time**
- **Allow Open Access to EVs charging infrastructure aggregators without cross subsidy surcharge. Also allow banking of RE generation to promote reduced tariffs**

Penetration of EVs – Enabling Framework for Roll-out

Roles and Functions of various agencies

- **CERC / FoR – Regulatory framework including legal aspects, licensing requirements, tariff etc.**
- **Amendment to the Electricity Act, 2003 if licensing requirement for charging infrastructure / charging business is to be dispensed with.**

Standardization – Connectivity, Safety and Product

- ***Connectivity with the Grid* – CEA to specify standardization of connectivity parameters i.e. power factor, load factors, harmonics, voltage etc.**
- ***Equipment / Products* – BIS to specify standards for equipment / products / components**

Roll-out Plan

- **Should provide for "Electric Charging" as well as "Swapping Aggregator" models**
- **In the long-run volumetric increase in Evs may result in reduction of cost gap between these models**

Thank you

Penetration of EVs – Charging Infrastructure as per NEMMP

Category	Low Growth		High growth		Sources
	Level 2	Fast DC	Level 2	Fast DC	
4 Wheelers	35,000	17,000	45,000	23,000	Exhibit # 42 to # 49 at page 112 to 115 of NEMMP 2020 document
2 Wheelers	-	-	-	-	
Buses	60	30	100	50	
3 Wheelers	2,000	1,000	4,000	2,000	
Light Commercial Vehicles	4,000	2,000	5,000	3,000	
Sub Total	**41,060**	**20,030**	**54,100**	**28,050**	
Cost per charging installation, INR (all types except buses)	36,000	2,25,000	36,000	2,25,000	Footnotes at the above referred exhibits
Cost per charging installation, INR (buses)	4,50,000	10,00,000	4,50,000	10,00,000	
Total Cost, INR Crores	**150**	**453**	**199**	**635**	
Grand total (INR Crore)	**603**		**834**		