

## Training module on Electric Vehicles (EVs)

**Programme Title:** Electric Vehicles, Batteries and Charging Stations

**Course duration:** 5 days

**Venue:** NSB, Noida

Session title	Time (IST)	Broad areas to be covered
<b>Day-1 (day name)</b>		
Welcoming remarks and inaugural address	10.00 – 10.10 (10 minutes)	NSB
Interaction with the participants	10.10 – 10.20 (10 minutes)	Participants introduction
Basics of Electric Vehicles	10.20 – 11.30 (60 mins presentation + 10 minutes Q/A)	History of EVs, Working of EVs and its main components, Types of EVs Basics of electric vehicles (EVs), plug-in electric vehicles (PEVs), plug-in hybrid electric vehicles (PHEVs), and hydrogen electric vehicles, their advantages and disadvantages, comparison of conventional versus electric vehicles in terms of maintenance and infrastructure, etc.
Tea break	11.30 – 11.40 (15 minutes)	
Electric Vehicles trends	11.45 – 13.05 (60 minutes presentation + 10 minutes Q/A)	EV adoption trends, government's outlook and policies for EVs, EV industry and its Manufactures, cost and current market of electric vehicles, etc.
Lunch Break	13.05 – 14.00 (55 minutes)	
Vehicle dynamics (part-I)	14.00 – 15.30 (75 minutes presentation + 15 minutes Q/A)	Introduction to vehicle dynamics, aspects of vehicle dynamics; tools and techniques to assess the vehicle dynamics, etc.
Tea break	15.30 – 15.45 (15 minutes)	
Vehicle dynamic (part-II)	15.45 – 17.15 (75 minutes presentation + 15 minutes Q/A)	Challenges and problems associated with vehicle dynamics, suspension technologies, design and development processes, examples of vehicle dynamics, etc.
<b>Day-2 (day name)</b>		
Fleet electrification plans and EV acquisition (part-I)	10.00 – 11.30 (75 minutes presentation + 15 Q/A)	Public transport electrification measures, opportunities and challenges, Indian and global aspects, etc.
Tea break	11.30 – 11.45 (15 minutes)	
Fleet electrification plans and EV acquisition (part-II)	11.45 – 13.15 (75 minutes presentation + 15 minutes)	Cases and/or examples
Lunch Break	13.15 – 14.00 (45 minutes)	
EV ecosystem (part-I)	14.00 – 15.30 (75 minutes + 15 minutes Q/A)	Charging infrastructure and types, Indian and global scenario, key players, etc.
Tea break	15.30 – 15.45 (15 minutes)	
EV ecosystem (part-II)	15.45 – 17.15	Concepts of AC and DC charging;

	(75 minutes presentation + 15 minutes Q/A)	Prospects and reality of EVs Global and climate impact, etc.
<b>Day-3 (day name)</b>		
Electric vehicle batteries	10.00 – 11.30 (75 minutes presentation + 15 Q/A)	EV battery, requirement of an EV battery, battery history, types of EV batteries, charging process and requirement, swapping, examples of EVs using different batteries, future batteries, roadmap etc.
Tea break	11.30 – 11.45 (15 minutes)	
Battery management system	11.45 – 13.15 (75 minutes presentation + 15 minutes)	BMS and its need, general function of BMS and its architecture, various battery packs like voltage sensing, current sensing, temperature sensing, etc., HV contractor control, State of Charge (SOC) and methods to find SOC, cell balancing, applications of BMS, etc.
Lunch break	13.15 – 14.00 (45 minutes)	
Applications of EVs and hybrid vehicles	14.00 – 15.30 (75 minutes + 15 minutes Q/A)	Application range of EVs and hybrid vehicles, Market scenario of EVs and hybrid vehicles in India and other countries, Future trend and challenges, etc.
Tea break	15.30 – 15.45 (15 minutes)	
Smart applications & grid support by EVs	15.45 – 17.15 (75 minutes presentation + 15 minutes Q/A)	Vehicle-to-grid (V2G) and Grid-to-vehicle (G2V) systems, V2G and G2V systems requirements and power flow, applications of V2G system like peak load levelling, peak power, spinning reserves, etc.; Applications of G2V system; Global V2G and G2V infrastructure; Social and environmental impact of V2G and G2V systems, challenges to V2G and G2V concepts and way forward; etc.
<b>Day-4 (day name)</b>		
Field visit to NTPC facilities	10.00 – 13.00 (180 minutes)	
Lunch break	13.00 – 14.00 (60 minutes)	
Visit to battery vendor facilities, charging stations	14.00 – 17.00 (180 minutes)	
<b>Day-5 (day name)</b>		
Felicitations of participants & closing remarks	10.00 – 13.00 (180 minutes)	

### Pedagogical Tools

The pedagogical tools for the course shall comprise of the lectures by subject experts & AV modules, interactive sessions/group activities, experience sharing, and case study analysis. All participants will be provided copies of the presentations and selected publications and AV modules as reading materials. All the course modules and materials will be in English.

**Takeaways from the course**

- Practical understanding of Electric vehicle and battery technologies.
- Practical understanding of the charging infrastructures.
- Understanding of vehicle dynamics and fleet electrification.
- Understanding of various challenges and key issues associated with the EVs and batteries.
- Understanding about the way forward for EVs, batteries and charging infrastructure.