



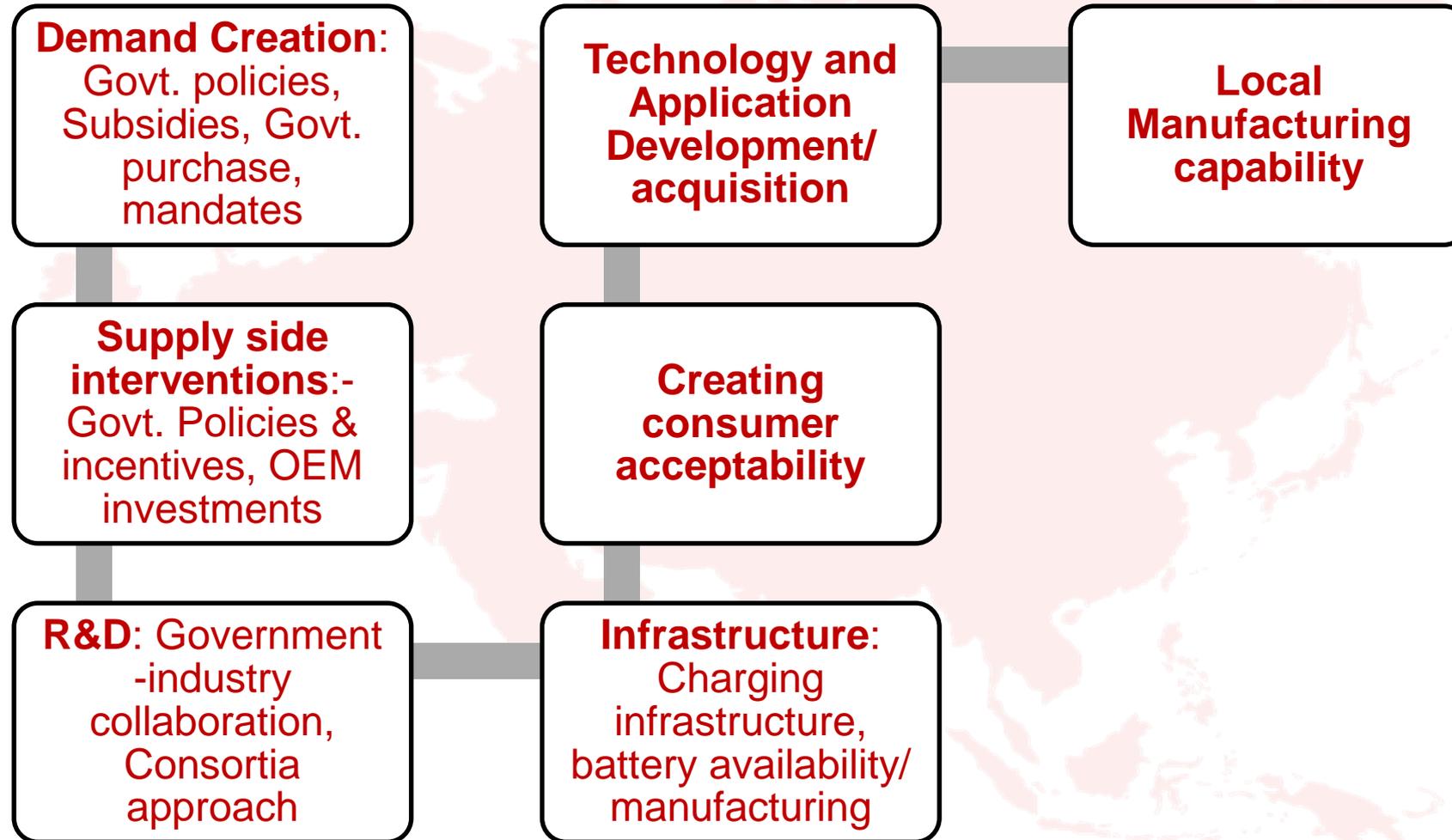
India's E-Mobility Ambitions – Can PQ issues lead to a flat Tyre?

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Central Electricity Authority

The potential roadmap for E-Mobility



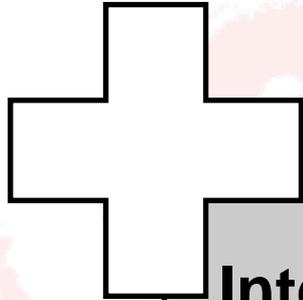
E-Mobility Roadmap Drivers

- Establishments of EV Charging Infrastructure (EVCI) on wide scale
- Creating business models for EVCI owners
- Making the prices of EV affordable.
- Economic disposal of existing automobile, if one opts for new EV
- Indigenisation in the EV sector
- Reduce dependency on imported components and batteries
- Development and adoption of suitable Standards

Some Latest Developments....

- NTPC is offering complete E-bus solution to State Transport Undertakings (STUs) and through its wholly owned subsidiary, NVVN Ltd., has concluded the tender for 450 Nos. E-buses for meeting the requirement of various State/City STUs.
- An agreement has been signed on 4th Mar'20, with Department of Transport, A&N islands for deploying E-bus solution.
- Similar E-bus solutions for J&K, Tirumala Tirupati Dept. (TTD) and Arunachal Pradesh are in various stages of discussion.

EV - a new class of consumer loads in the distribution grid



Integration of EVs in grid management can:

- Improve grid power quality
- Form distributed storage
- Support renewable energy sources

Uncontrolled charging can lead to

- Increasing peak loads
- Overload of grid structure
- Decreasing grid power quality

Charging Infrastructure for EVs – Guidelines and Standards

Phase-I (1-3 Years)

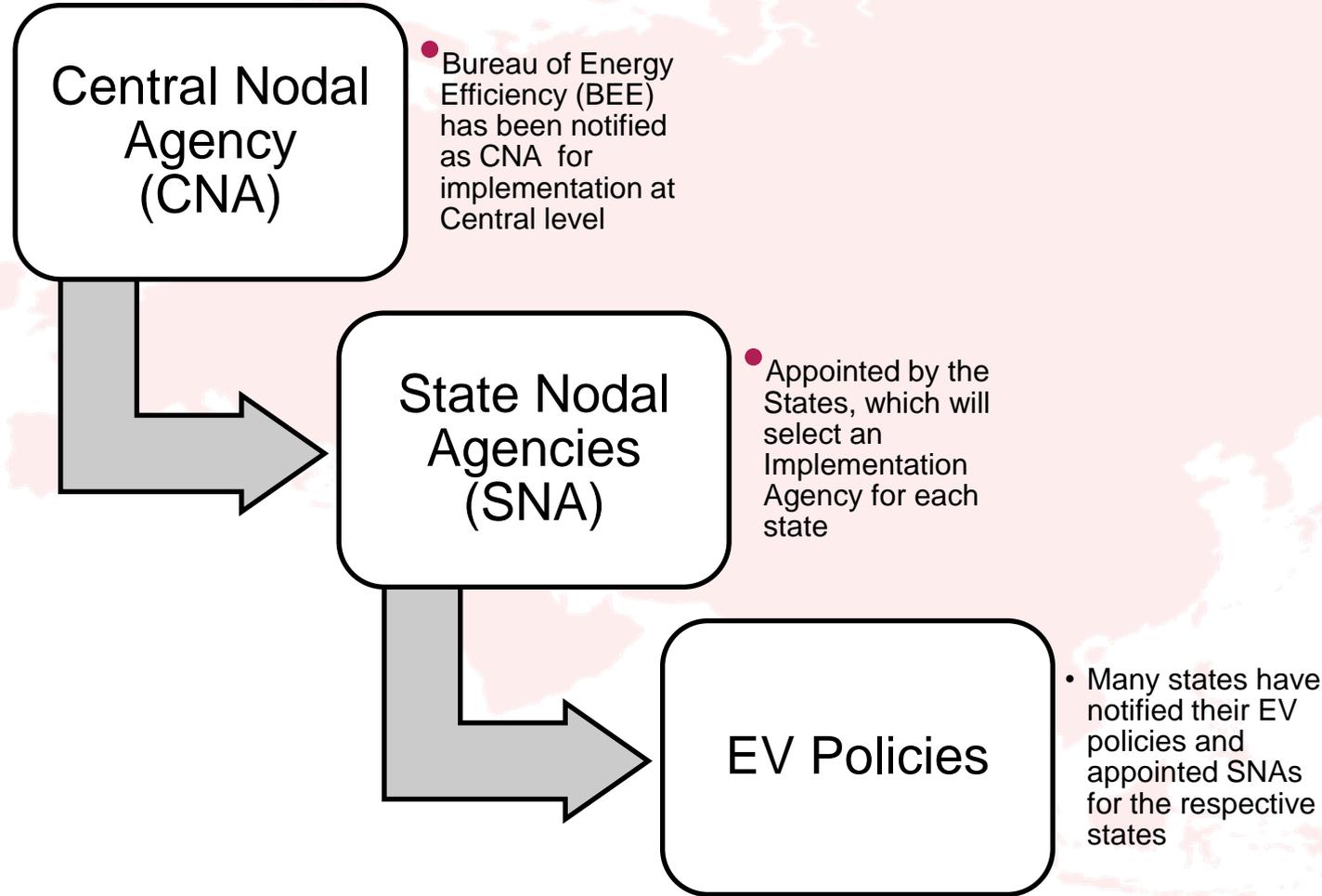
All Mega Cities with population of 4 Million plus as per census 2011, all existing expressways connected to these Mega Cities & Important Highways connected with each of these Mega Cities may be taken up for coverage.

Phase-II (3-5 Years):

Big cities like State Capitals, UT headquarters may also be covered for distributed and demonstrative effect. Further, important Highways connected with each of these Mega Cities shall be taken up for coverage.

- At least one charging station should be available in a grid of 3 km X 3 km.
- One Charging Station be setup at every 25 km on both sides of highways / roads.
- For long range EVs and heavy duty EVs should be at least one charging station at every 100 kms.

EV Charging Infra Policy and Implementation



Charging Infrastructure – Private and Public

Private charging at residences / offices shall be permitted. DISCOMs may facilitate the same.

No minimum infrastructure requirements apply to Private Charging Points meant for self-use of individual EV owners (non-commercial basis).

Setting up of **Public Charging Stations (PCS)** shall be a de-licensed activity- to comply to applicable safety standards etc.

- Any person seeking to set up a Public Charging Station may apply for connectivity and he shall be provided connectivity on priority by the Distribution Company licensee to supply power in the area.
- Any Charging Station/ Chain of Charging Stations may also obtain electricity from any generation company through open access.

Public Charging Infrastructure – Min Reqt

- An **exclusive transformer** with all related substation equipment including safety appliances, if required.
- **33/11 kV line/cables** with associated equipment including as needed for line termination/metering etc.
- **Adequate space for Charging and entry/exit** of vehicles.
- **Current international standards** that are prevalent and used by most vehicle manufacturers internationally such as CCS and CHadeMO.
- **The kiosk/board** may have options for installation of additional chargers if required.
- The Public Charging Station Providers are free to create Charging Hubs and to **install additional number of Kiosk/Chargers** in addition to the minimum number of chargers prescribed.
- **Tie up with at least one online Network Service Providers (NSPs)** to enable advance remote/online booking of charging slots by EV owners. Such online information to EV owners should also include information regarding location, types and numbers of chargers installed/available etc.

Public Charging Infrastructure – Min Reqt

Fast charging facility

- **Appropriate Liquid Cooled cables** if High Speed Charging Facility for on board charging of Fluid Cooled Batteries (FCBs) is also planned.
- **Appropriate Climate Control Equipment** for Fast Charging of Batteries to be used for swapping (i.e. not on board)
- **Inspection and clearance** as communicated by a suitable clearance certificate, by the concerned electrical inspectors/technical personnel designated specifically by the respective DISCOM for this purpose.
- DISCOMs may also empanel **one or more third party authorized technical agencies** for inspection and clearance

Public charging Infrastructure (PCI) for long distance EVs and/or heavy duty EVs

- **At least two chargers of minimum 100 kW (with 200-1000 V) each of different specifications (CCS & Chademo)** and with single connector gun each in addition to the minimum charging infrastructure requirements as mandated for Public Charging Stations.
- **Appropriate Liquid Cooled Cables for high speed charging facility** for on-board charging of Fluid Cooled Batteries (currently available in some long range EVs).
- It is notable that Fluid Cooled Batteries (FCBs) are generally necessary for Fast Charging / Long Distance use of EVs and/or for Heavy Duty Vehicles like buses/trucks etc.
- Fast Charging Stations (FCS) which are meant only for 100% **in-house/ captive utilisation, for example buses of a company, would be free to decide the charging specifications** as per requirement for its in-house company EVs.

Public Charging Infra – Expected Locations and Players

- **Priority to existing retail outlets (ROs) of Oil Marketing Companies (OMCs)** for installation of Public EV Charging Stations (in compliance with safety norms including ‘firewalls’ etc.)
- **Company Owned and Company Operated (COCO) ROs** may be given higher preference. For establishing the PCS at Fuel Stations the clearance from Petroleum and Explosives Safety Organisation (PESO) is a must.

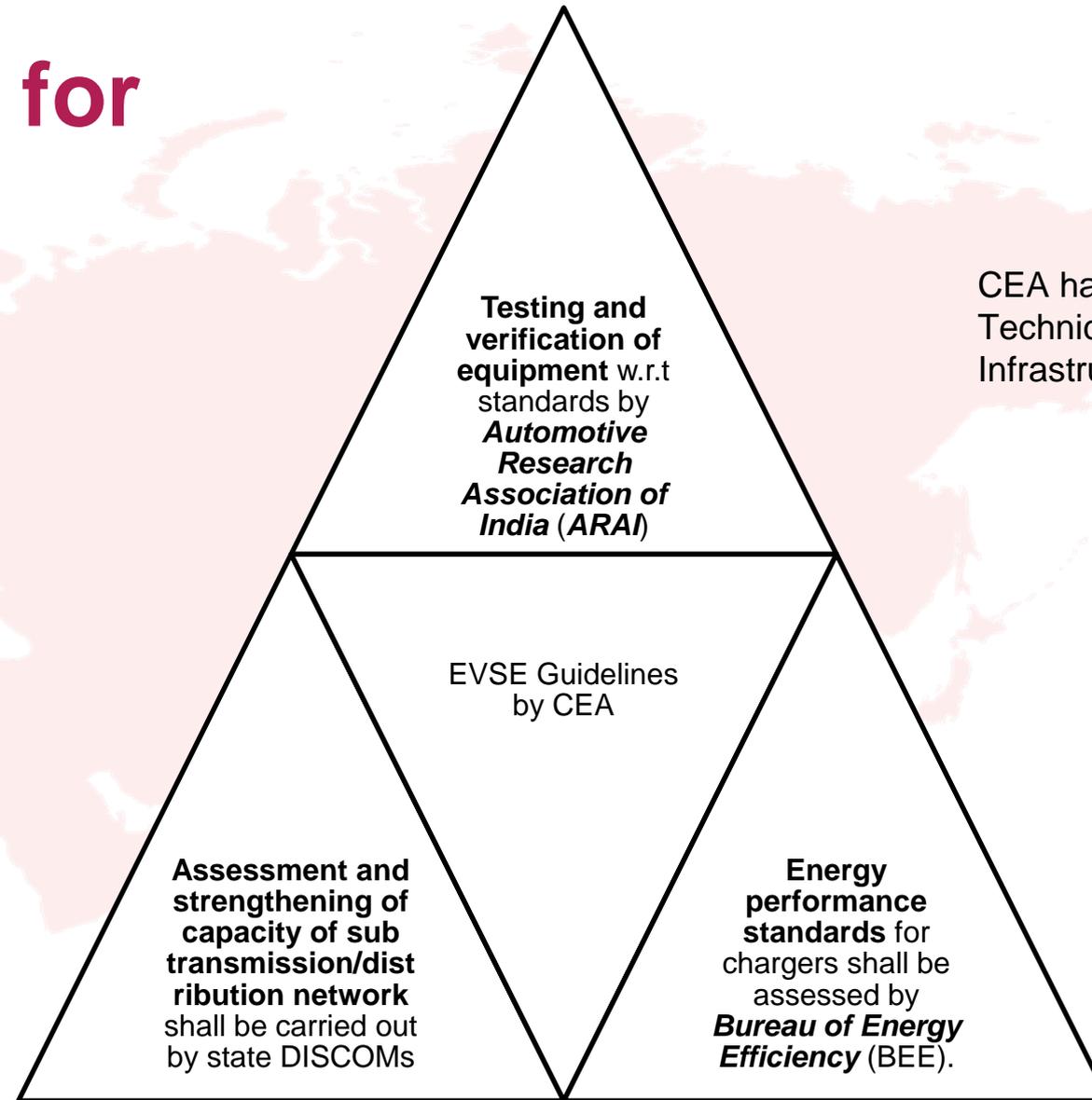
Latest Development

Department of Heavy Industries (DHI) in their EOI dated 12th October 2020 has been issued for inviting proposals from any Govt.

Organization/Public Sector Undertaking (PSU) (State/Central)/Govt DISCOM/ Oil Public Sector Undertaking and similar other Public/Private entities to build and operate Public EV charging infrastructure on major Highways/Expressways.

Central Electricity Authority (CEA) shall create and maintain a national online database of all the Public Charging Stations through DISCOMs.

CEA Guideline for EV Supply Equipment (EVSE)



CEA has prepared a report on Technical Aspects of Charging Infrastructure for Electric Vehicles

CEA (Technical Standards for Connectivity to the Grid) (Amendment) Regulations

Voltage and Current Harmonics

The limits of voltage harmonics by the distribution licensee in its electricity system, the limits of injection of current harmonics by bulk consumers, point of harmonic measurement, i.e., point of common coupling, method of harmonic measurement and other related matters, shall be in accordance with the **IEEE 519-2014 standards**, as amended from time to time;

Measuring and metering of harmonics

Continuous process with meters complying with provisions of IEC 61000-4-30 Class A

The data measured and metered with regard to the harmonics, shall be available with distribution licensee and it shall also be shared with the consumer periodically.

The bulk consumer shall install power quality meter and share the recorded data thereof with the distribution licensee as specified by the SERC

CEA (Technical Standards for Connectivity to the Grid) (Amendment) Regulations

Periodic measurement of other power quality parameters

Voltage sag, swell, flicker, disruptions shall be measured as per relevant IEC Standards by the distribution licensee and the reports thereof shall be shared with the consumer.

The distribution licensee shall install power quality meters in a phased manner within three years from the date of commencement of the Central Electricity Authority (Technical Standards for Connectivity to the Grid) (Amendment) Regulations, 2018 covering at least 33% of the 33 kV substations each year.

PQ Standards for charging station, prosumer, or a person connected or seeking connectivity to the electricity system

1. Reliable protection system to detect various faults and abnormal conditions and provide an appropriate means to isolate the faulty equipment or system automatically.
2. The applicant shall ensure that fault of his equipment or system does not affect the grid adversely.
3. The appropriate licensee shall carry out adequacy and stability study of the network before permitting connection
4. The limits of injection of current harmonics at the point of common coupling by the user, method of harmonic measurement and other such matters, shall be in accordance with the IEEE 519-2014 standards, as amended, from time to time.
5. The measuring and metering of harmonics shall be a continuous process with power quality meters complying with the provisions of IEC 61000-4-30 Class A.
6. The data measured and metered as mentioned in sub-regulation shall be available with the distribution licensee and be shared with the consumer periodically.
7. The applicant seeking connectivity at 11 kV or above shall install power quality meters and share the recorded data
8. In addition to harmonics, periodic measurement of other power quality parameters such as voltage sag, swell, flicker, disruptions shall be done by the distribution licensee as per relevant IEC standard and the reports thereof shall be shared with the consumer”.

Compliance

Compliance of regulations

(1) It shall be the responsibility of concerned licensee to ensure that before connectivity to the grid, all the provisions with regard to the connectivity stipulated in these regulations are complied with by the applicant.

(2) The user may be disconnected from the grid by the licensee for non-compliance of any provision of these regulations, under report by the licensee to the appropriate Electricity Regulatory Commission.”.

Charging Infrastructure Safety and PQ

- Protection against the overload of input supply and output supply fittings
- The electric vehicle charging station shall be equipped with a protective device against the uncontrolled reverse power flow from vehicle
- Direct Current (D.C.) electric vehicle charging point shall disconnect supply of electricity to prevent overvoltage at the battery if output voltage exceeds maximum voltage limit sent by the vehicle
- The electric vehicle charging points shall not energize the charging cable when the vehicle connector is unlocked and the voltage at which the vehicle connector unlocks shall be lower than 60V

Earth Protection Systems for better PQ

- Earthing of all electric vehicle charging stations shall be as per IS 732
- Residual operating current of not greater than 30 mA; interrupt all live conductors, including the neutral; and have a performance at least equal to Type A and be in conformity with IS 732-2018.
- Earth-connected metal shielding and the cable insulation shall be wear resistant and maintain flexibility over the full temperature range
- Connection between the earth terminal of the supply and the conductive parts of the vehicle which shall be of sufficient rating to satisfy the requirements of IEC 60364-5-54
- Power supply cables used in charging station or charging points shall conform to IEC 62893-1 and its relevant parts

List of Important Standards for EVs

- i. Automotive Industry Standard AIS-138 (Part-1), February, 2017 and Automotive Industry Standard AIS-138 (Part-2), January, 2018 have been brought up by Ministry of Road Transport and Highway for Electric Vehicle conductive AC and DC charging system respectively.
- ii. CEA (Measures Relating to Safety and Electric Supply) (Amendment) Regulations, 2019, published on 28.6.2019 which incorporated safety provisions for charging stations for EVs.
- iii. Technical Standards IS 17017 Part-1: 2018 – EV Conductive Charging System- General Requirement published by Bureau of Indian Standards (BIS).
- iv. For high level communication between Electric Vehicle (EV) and Electric Vehicle Supply Equipment (EVSE): IS/ISO 15118 (Part-1 to 5 and Part-8) have been published by BIS. This is basically for high voltage DC fast charging.
- v. For low voltage charging and AC charging, basic communication is provisioned in standards AIS-Part 1.
- vi. CEA technical report has recommended Open Charge Point Protocol (OCPP) for communication between Electric Vehicle Supply Equipment (EVSE) and Central Monitoring System (CMS).
- vii. For fast charging, connectors of Combined Charging System (CCS), and CHAdeMO have been recommended.
- viii. DC Bharat Charger 001 and AC Bharat Charger 001 are being used for low power applications.
- ix. CEA has developed the format and circulated to the Discoms for information for creating and maintaining the database of charging activities.

Joining hands for better PQ, faster and smoother transition to EVs

Let us acknowledge...

We are learning too....

Gathering field know-how from all stakeholders is key to improving PQ

High standards will set a strong foundation for PQ

PQ is critical to ensure reliability of electrical networks and avoid unforeseen challenges

To ensure good PQ ...we must join hands together!



Thank You