Transport and Climate Change Week

#TransportWeek21

EV integration and gap analysis in Indian EV ecosystem

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giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
On behalf of: Federal Ministry for the Environment, Nature Conservation and Nuclear Safety of the Federal Republic of Germany

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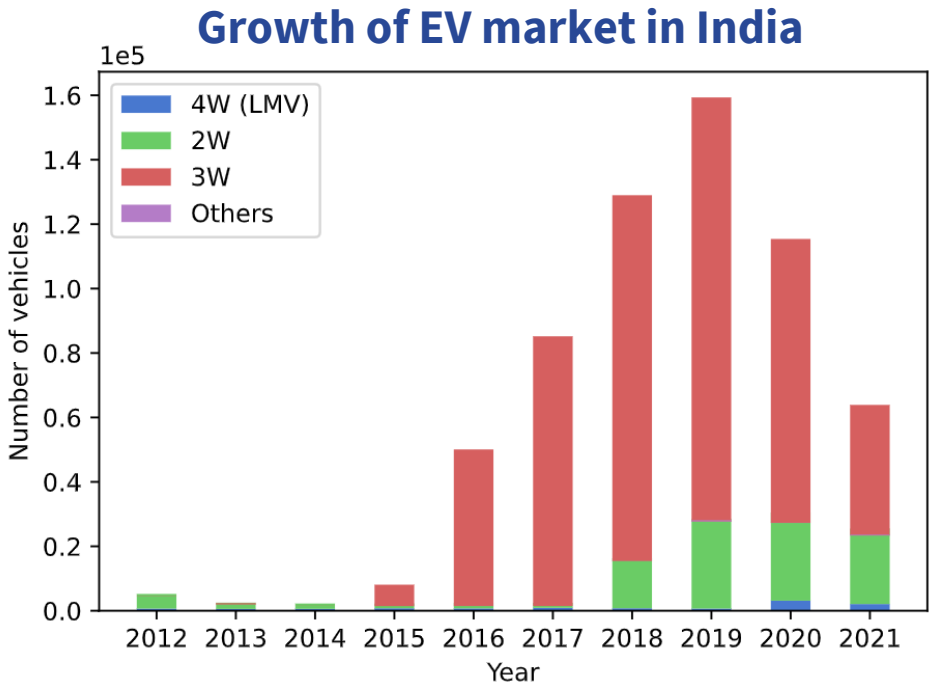
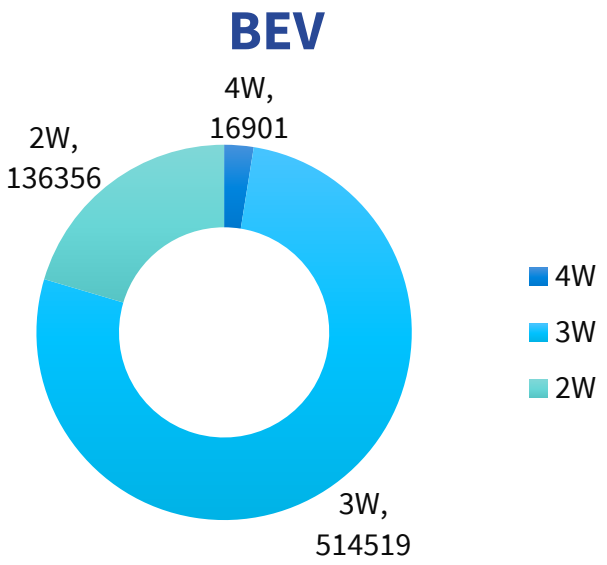
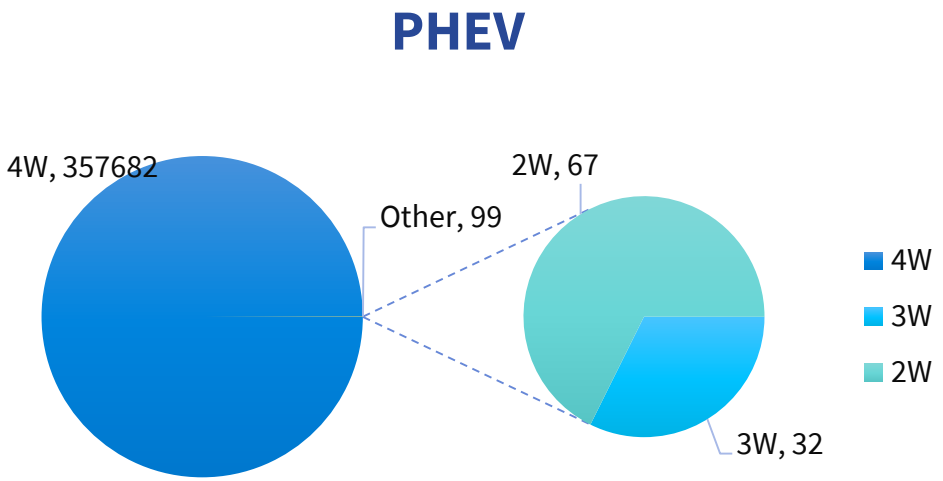
Indian EV Market

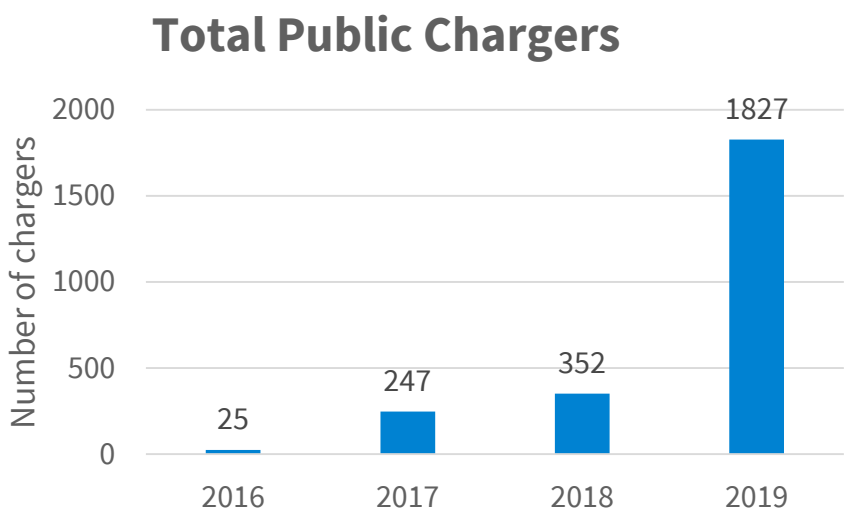
- **6,67,776 BEVs** and **3,57,781 PHEVs** are registered in India up to April 2021.
- Majority of vehicles are 2W or 3W

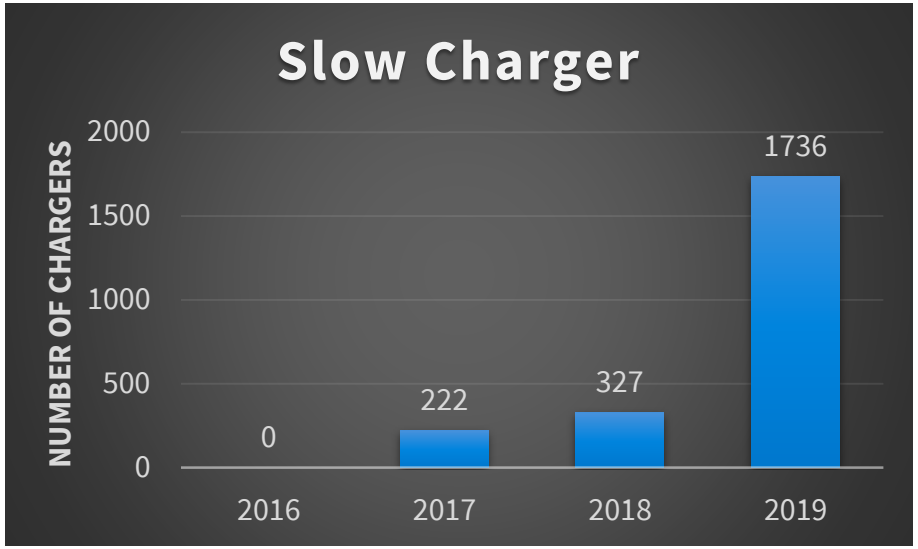


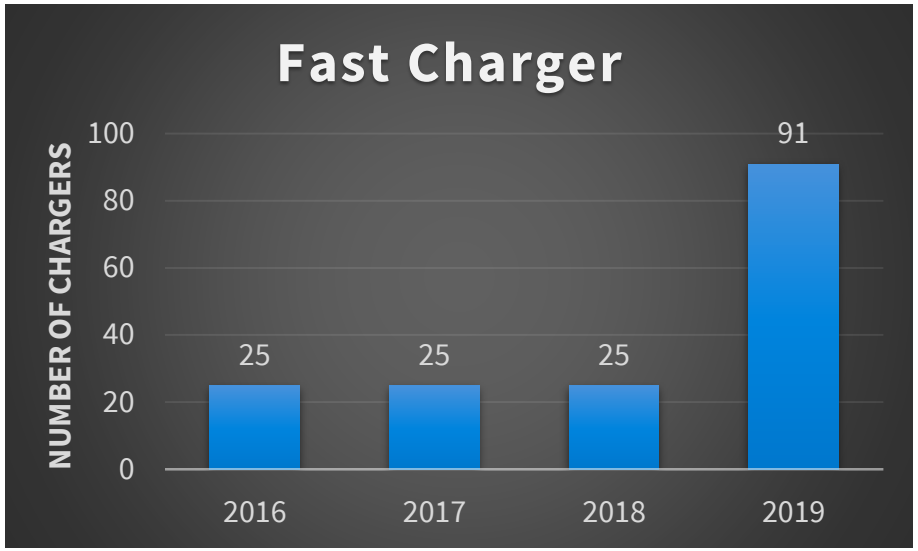




Public EV charging Infrastructure in India





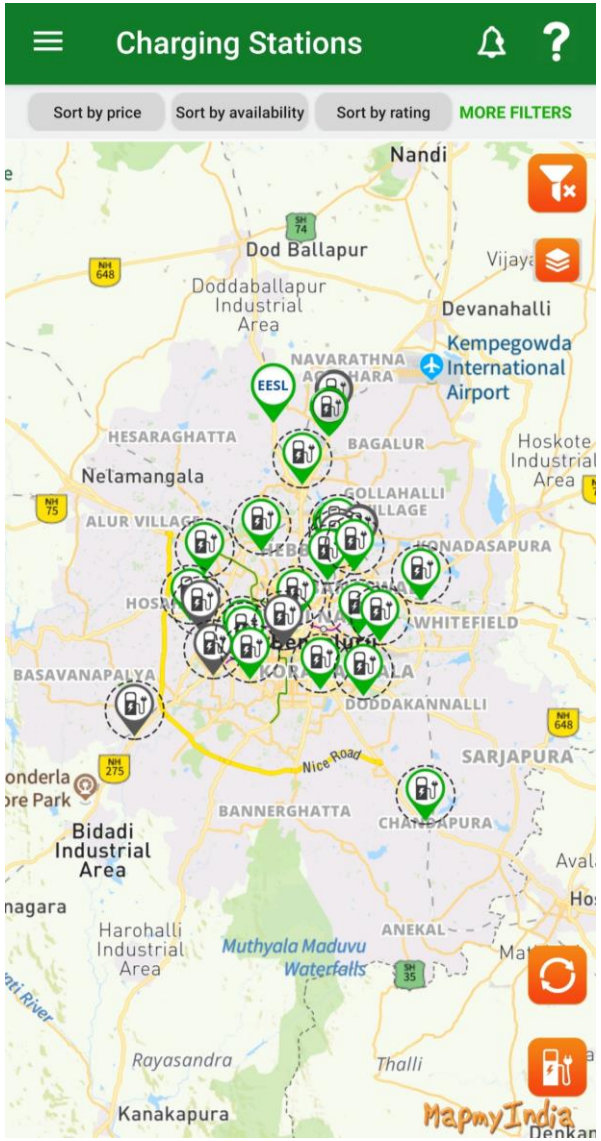


- Slow Charger < 22 kW
  Fast Charger > 22 kW
- Till March, 2021, approximately 1800 public chargers have been installed in India. (Source: SMEV)
- Considering the number of public EV chargers in India is around 1800, there are 9.39 EVs (4W) per charger in India.

Source: IEA, Global EV Outlook 2020

Indian EV charging Infrastructure

- The charging infrastructure is still in its infancy.
- Under the FAME II scheme DHI has sanctioned 2636 chargers in 62 cities pan India. Further 241 charging stations have been later added.
- Different Govt. agencies and PSUs were awarded the tender to install chargers under the FAME II scheme.
- Expression of Interest also sent for installation of 1544 chargers on expressways and highways pan India.
- Different DISCOMs have also rolled out Charging Management platforms accessible to the public, to remotely monitor and reserve charging stations under its jurisdiction. Eg, BESCOM
- Few private parties also have started in the PCS business. Eg, Fortum, Magenta Power, PlugNGo



ElectreeFi mobile app

Gaps-EV charging infrastructure

- Lack of adequate support to private sector companies for charging infrastructure development
- Allocation of PCS not concentrated on high EV growth cities.
- Misalignment between subsidy in charging infrastructure and vehicle subsidy
- Lack of alignment between charging demand and allocation of charging infrastructure
- No subsidy for battery swapping
- Lack of support for grid infrastructure development to cater to EV load.

Challenges in Development of Charging Infrastructure in India (1/2)

- In India, the initial push towards public charging is seen to be primarily towards AC001 and DC001.
- Most 2W, 3W and 4W models (excepting Mahindra EVs) do not use AC001 (without adapters) and DC001
- Slow chargers would also need more time for charging, so not favorable as public chargers
- Unorganized charging infrastructure (for 3W).

Source: BSES

Challenges in Development of Charging Infrastructure in India (2/2)

- The Indian EV market has not reached a critical mass for private player participation in EV charging infrastructure domain.
  - High cost of EV
  - High interest rate
  - High insurance cost
- Separate power infrastructure would be needed for fast charging stations and e-bus charging stations- a discouraging factor due to high investment
- Land availability for EV charging infrastructure
- Lack of instruments to lease land owned by Govt. offices/agencies to set up PCS
- Standardization of charging infrastructure for 2W and 3W

TERI, Electric Vehicles: Perspective Of DISCOMs And Stakeholders 2020

Challenges in Indian Distribution Network

- Highly loaded distribution feeders would warrant grid upgradation requirement to cater to EV charging needs, both private and public.
- The weak financial condition of state run DISCOMs may make it difficult for distribution system upgradation required for EV charging.
- The recovery of costs incurred for grid upgradation can be challenging
- Need for transparency in EV tariffs
- Need for time-based EV tariffs
- Lack of adequate regulations in EV charging integration to grid.
- Lack of smart grid infrastructure including smart meter penetration

Challenges for Battery Swapping in India

To increase uptake of e-2W and e-3W and push battery swapping Govt. of India has permitted the sale of Evs without batteries.

- Purchasing a battery separately may increase the cost, as the GST applicable for battery is higher at 18% compared to the EV's 5%
- The FAME II subsidies are based on battery size, so claiming subsidies for EVs without batteries would warrant clarification.
- In order to increase compatibility, the batteries would be needed to be standardized which would slow down innovation.
- There would need to be understanding among the different EV OEMs to have the same battery specifications for easy swapping.
- Ownership issues would also need to be regulated, on who owns the EV battery after being swapped at a swapping station.
- Accountability issues, as the safety of the EV would come into question if subpar batteries are used by the EV user.
- Warranty claims would be difficult.

Bidirectional Power Flow: Opportunities & Challenges

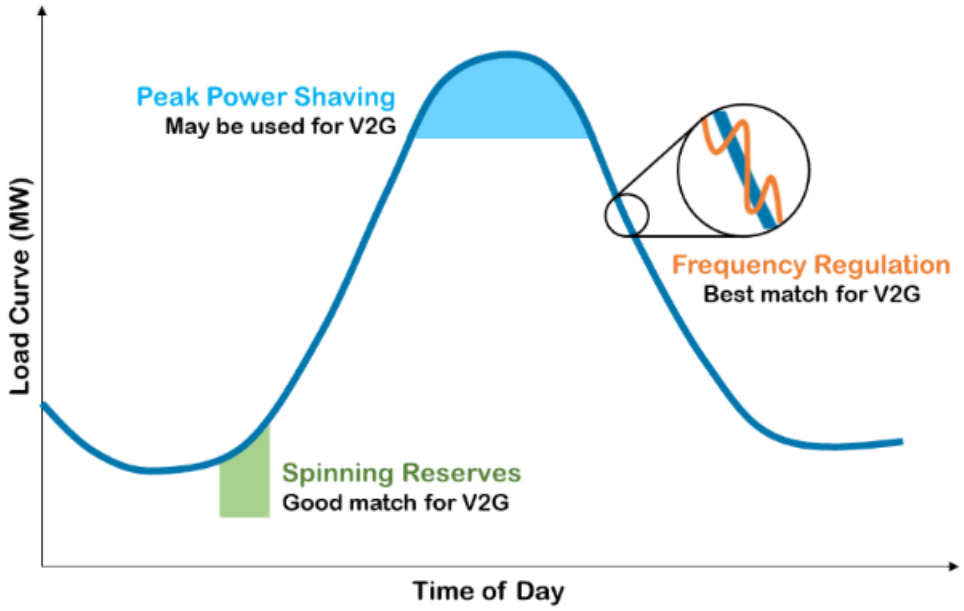
Services to TSO (V2G)
- Frequency Regulation
- Peak Power Shaving
- Spinning Reserves

Services to DSO (V2G)
- Congestion management
- Voltage support

Behind-the-Meter Optimization (V2B)
- Can be utilized by private residences for load shifting
- Increasing self RE utilization

Back-up Power Supply (V2H & V2L)
- Emergency power to residence
- Emergency power to equipments

Grid support from EV

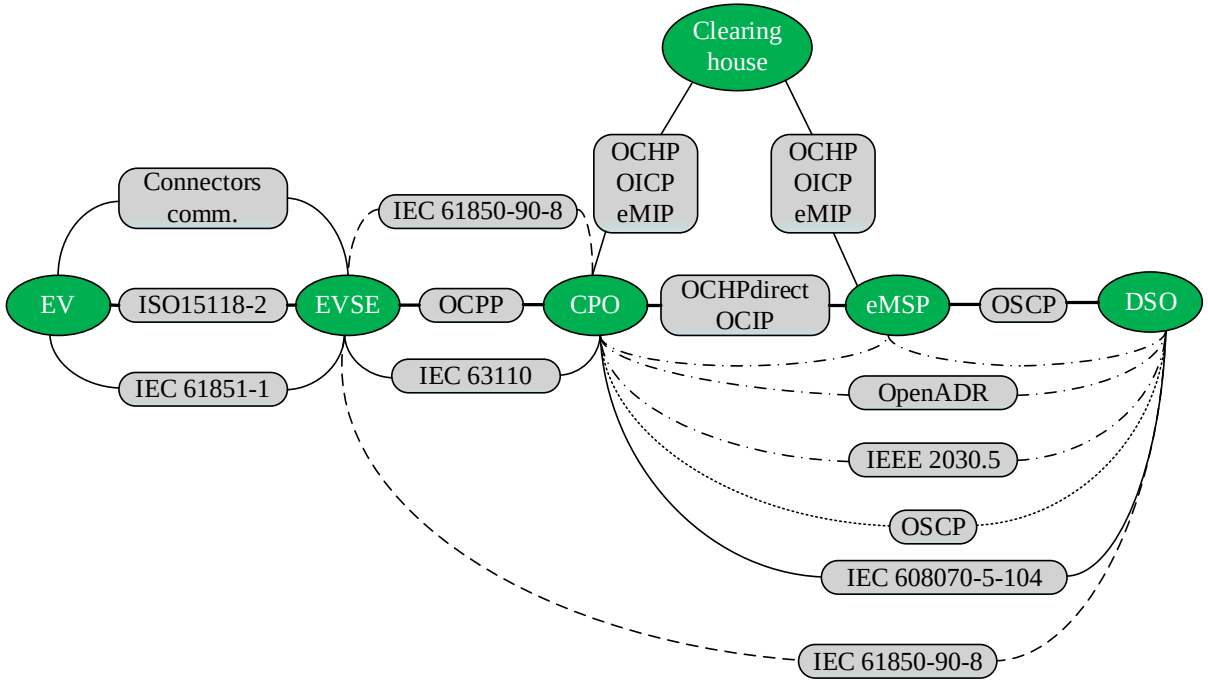


Currently in India there is a lack of
- EVs compatible with bidirectional charging
- EV chargers with bidirectional charging ability
- Adequate regulations
- Infrastructure including ITC to support V2X.
- Energy market products for EV participation

Standards and Protocols for Communication: Challenges

- OCPP has been mandated for communication between EVSE and CPO in India.
- No mention of communication between other entities.
- The lack of recommendation of communication would restrict availability of Smart Charging and e-roaming.
- Communication between CPO, eMSP and DSO required to enable Smart Charging and Demand Response
- Inclusion of clearing house would be required for e-roaming

Communication standards between different stakeholders in EV ecosystem



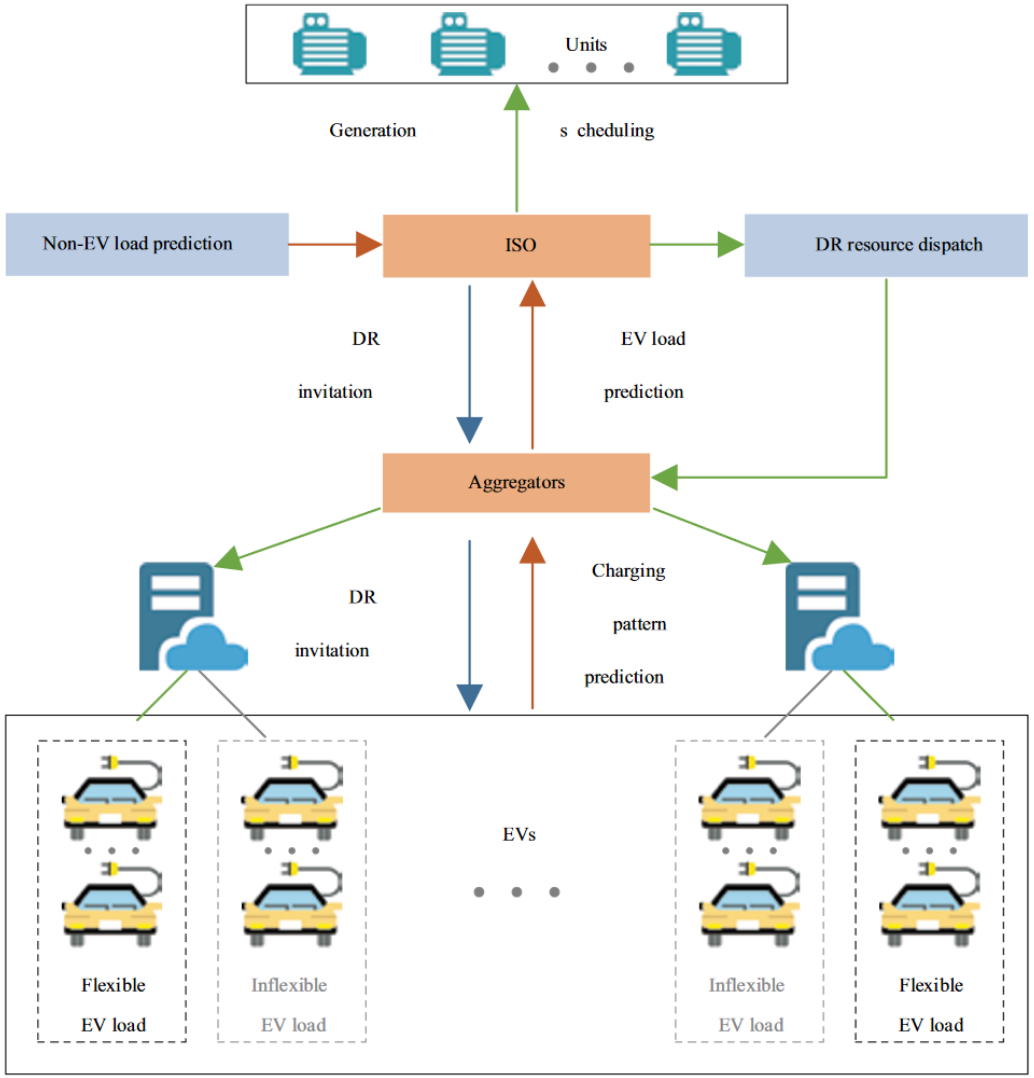
Source: Elaand.Nl

Enablers for Ancillary Service and Demand Response from EVs

Enablers for Ancillary Service and Demand Response

- Regulations
- Aggregation of EVs
- Smart metering
- State-of-art forecasting
- Controllability and Observability

Time-based EV tariffs can act as passive demand response

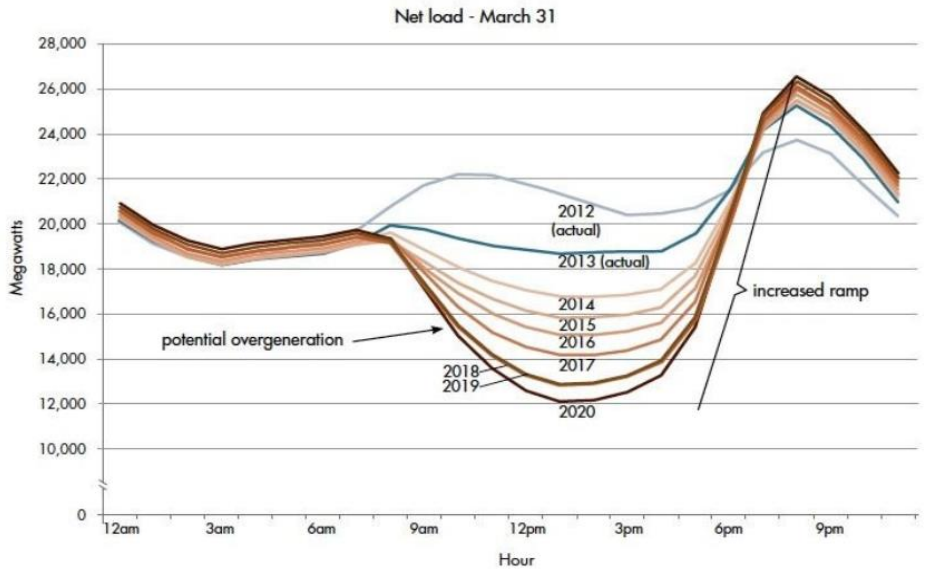


Chen Fang, *et al.* Aggregator-based demand response mechanism for electric vehicles participating in peak regulation in valley time of receiving-end power grid, *Global Energy Interconnection*, Volume 3, Issue 5, 2020, Pages 453-463, ISSN 2096-5117,

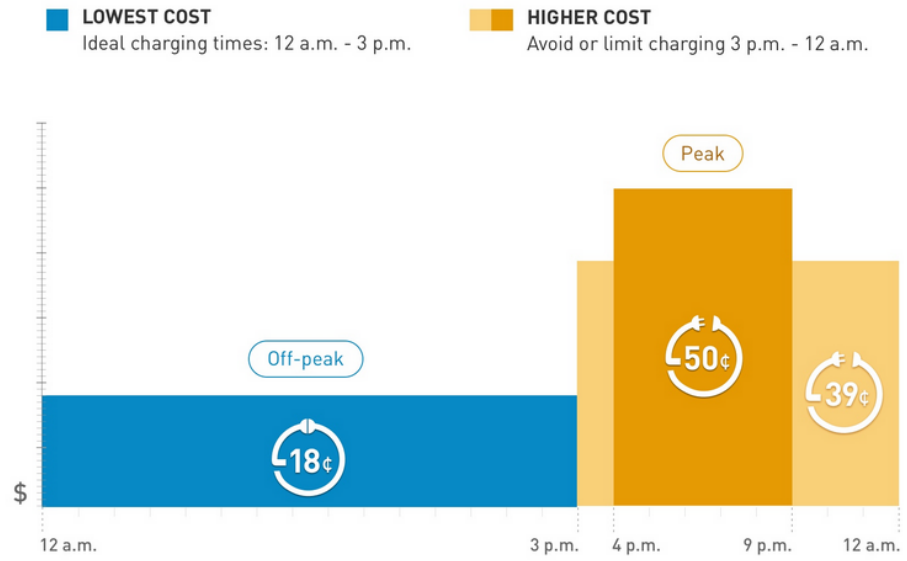
Renewable Energy Integration for EV Charging: Opportunities

- In California to rectify for the duck curve, early noon periods have been demarcated as off-peak periods.
- In Netherlands, the balancing market is used to control charging based on RE generation.

Daily Load Curve of California



PG&E EV tariff



- *RE generation can be considered while designing time-based EV tariffs.*
- *Virtual net metering to integrate local PV generation with local community EV charging needs can be designed.*
- *Charging stations with integrated PV system has also been utilized to reduce the amount of electricity that needs to be purchased. BESCOM has designed a case study on this aspect.*

PG&E EV Tariffs, https://www.pge.com/en_US/residential/rate-plans/rate-plan-options/electric-vehicle-base-plan/electric-vehicle-base-plan.page

Study Outcome – On the Way

July 2021	• **Fundamentals of Electric Vehicle Charging Technology and its Grid Integration**
July 2021	• **Global review of Electric Vehicle Charging Infrastructure and its Grid Integration**
August 2021	• **Status Quo of Electric Vehicle Charging Infrastructure and Grid Integration in India**
August 2021	• **Gap analysis and Recommendations for EV integration in India**

Conclusion

- Need for more focus on policy and regulatory enablers for charging infrastructure in the overall EV ecosystem
- While there is relatively more focus on 2/3 W charging infrastructure, there is a need for adequate focus on 4W segment
- While battery swapping can be a supplementary station, the industry standards need to be harmonized and regulated in a balanced manner
- Public charging stations are currently predominantly slow chargers (>95%). Public charging need to be predominantly fast charging based.
- Need to address the issue of grid infrastructure upgradation through a sustainable financial model for accommodating fast charging/large slow charging hubs
- Smart charging needs to be planned in Indian grid. It will not only unlock numerous benefits from the underlying grid scale storage in EVs, but it will also avoid/minimize/defer grid upgradation and enable higher RE integration