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EV CHARGING INFRASTRUCTURE: IMPACTS, CHALLENGES AND SOLUTIONS

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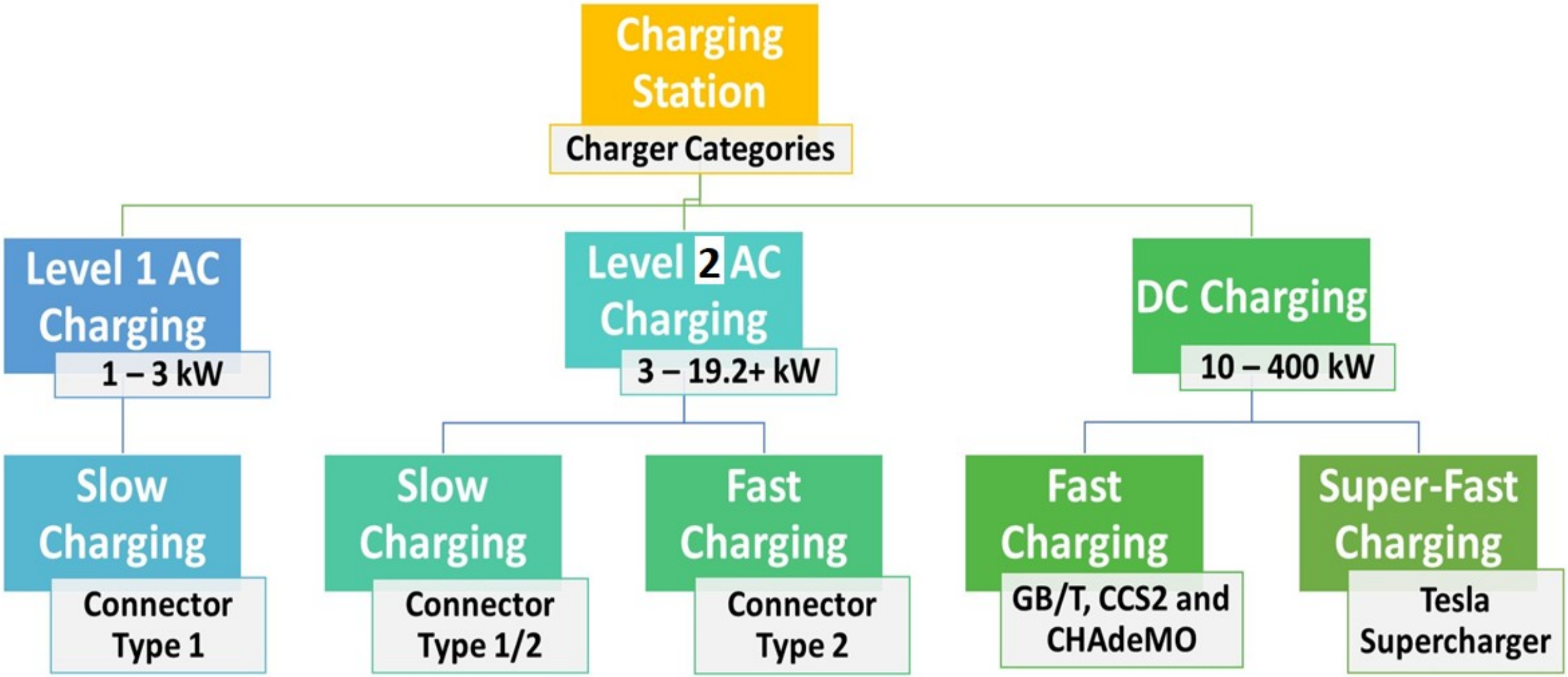
INTRODUCTION

- Net Zero Emission Target by 2070
- 30% EV market share by 2030
- 35,52,804 EV's sold as of January 2024
- 12,146 public EV charging stations as on 02.02.2024
- **Roadblocks for the EV industry**
  - ➢Range anxiety
  - ➢Lack of public charging infrastructure

Types of EV CHARGING



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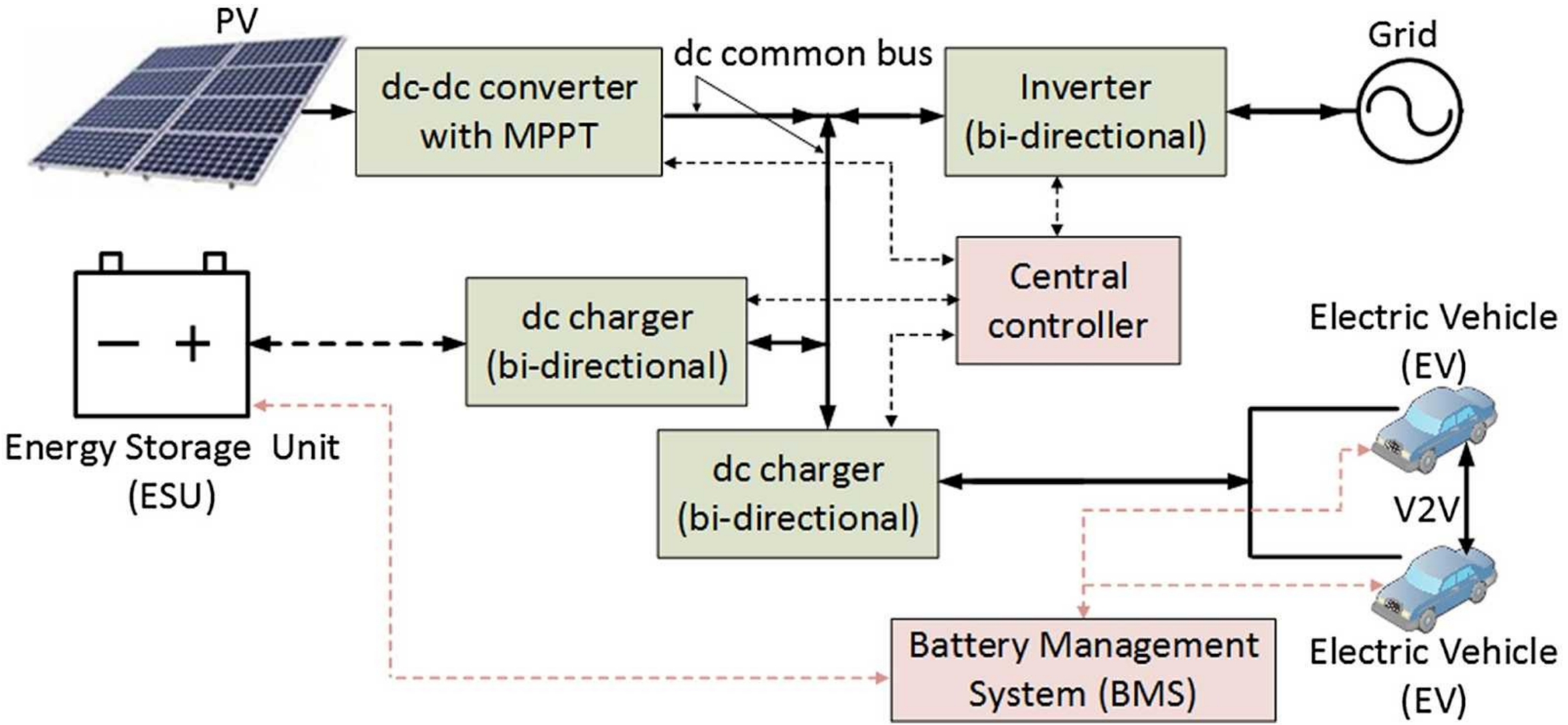
EV CHARGING INFRASTRUCTURE



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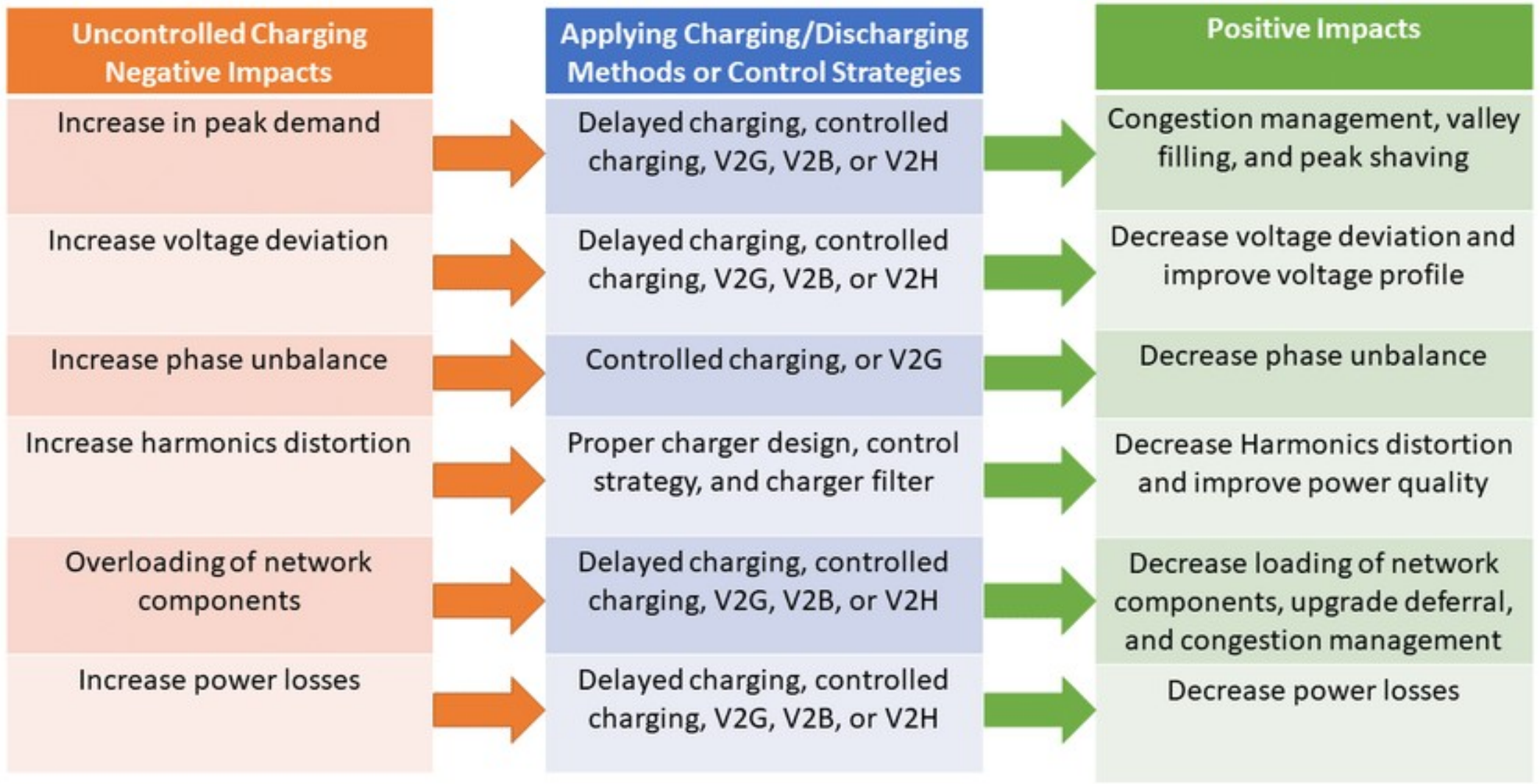
Roadblocks for Charging Infrastructure

- Parking space availability
- High capital and installation cost
- Lack of sufficient incentives
- Upgradation of existing power grid components
- Uncertainty of EV charging demand
- Availability of different standards for charging connectors
- Incompatibility between various models and chargers

Impact of EV Charging on Power Distribution Network



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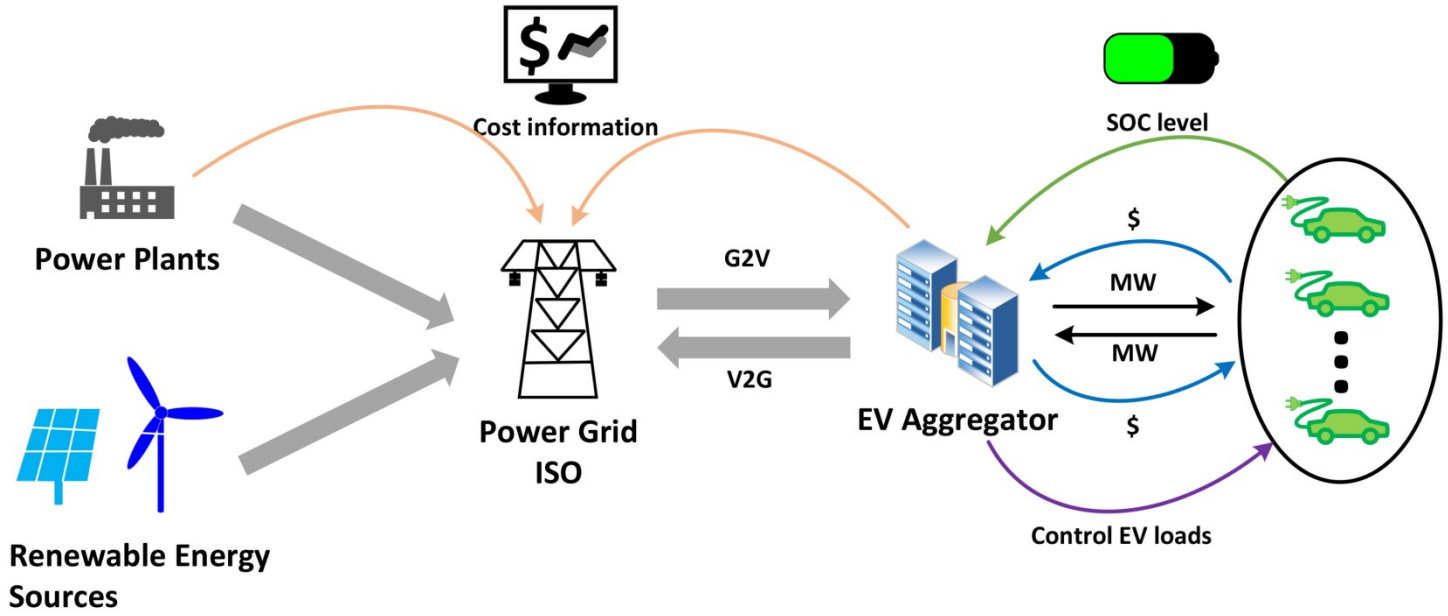
Grid Integration of EVs

- Acts as an energy storage system
- Earn incentives
- Bidirectional meters
- **Ancillary services to grid**
  - Reactive power support
  - Voltage and frequency balance
  - Dealing of uncertainties in renewable power
  - Valley filling
  - Peak shaving

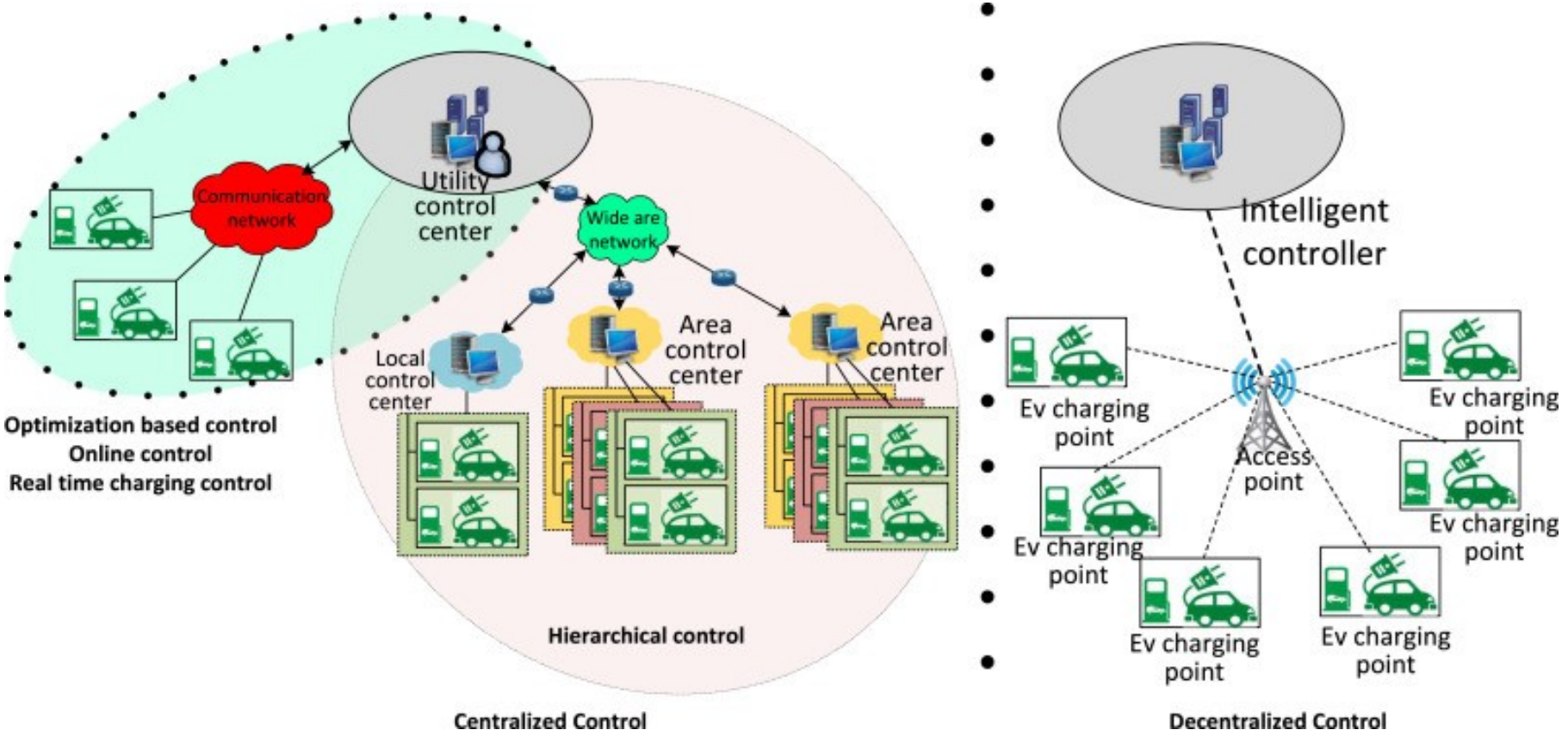


Courtesy : Reference 7

Control architecture in EV Charging

- **Centralized Control**
  - Master control engine - decision making
  - Optimization problem size is large

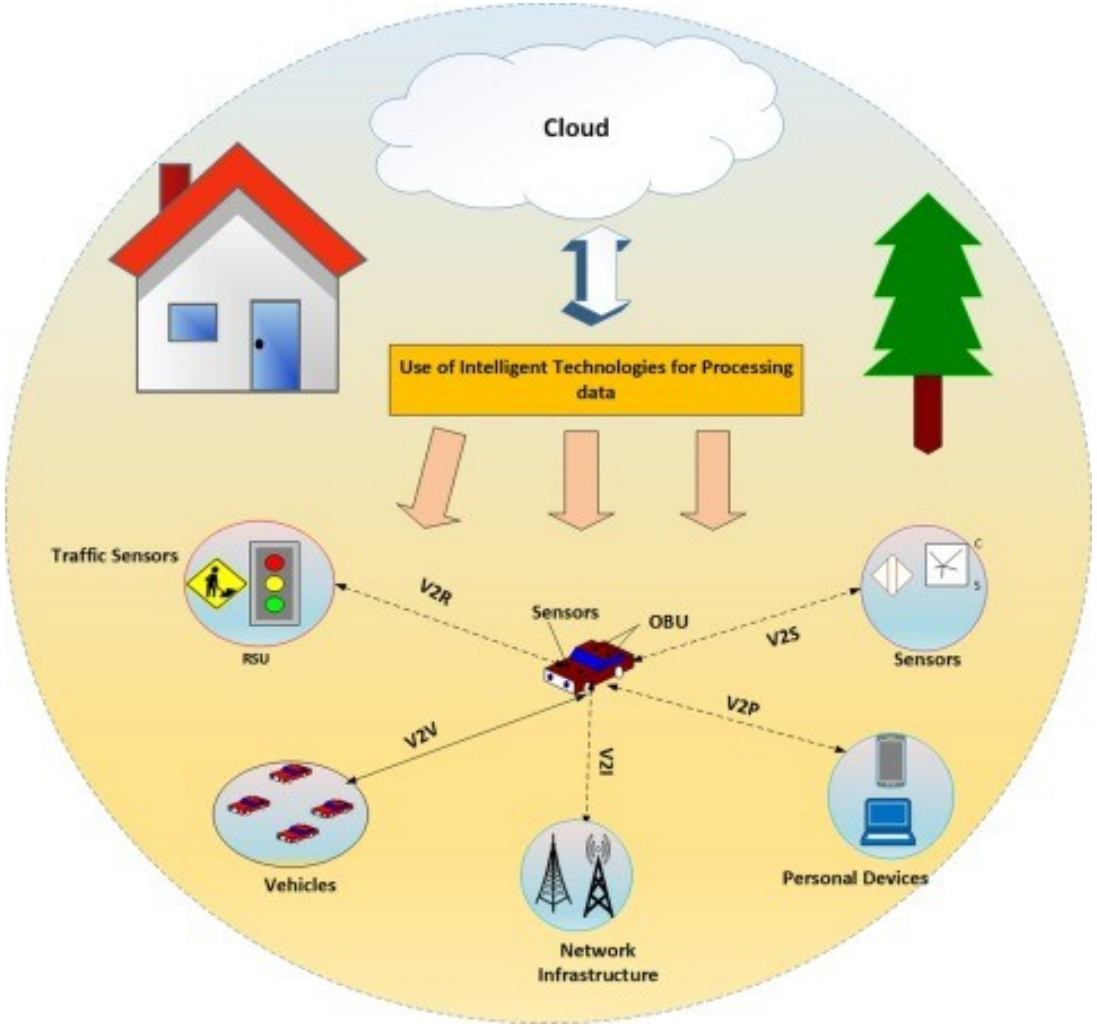
- **Decentralized/Distributed Control**
  - EV users directly choose their charging schedules
  - No guarantee to reach the global optimal solution



Courtesy : Reference 8

Connected Mobility- VANET and IoV

- VANETs enable sharing messages among vehicles
  - Alleviates traffic congestion
  - Reduce accident rates, enhance safety, optimize routing etc.
- IoV - IOT & V2X communication capabilities
- IoV enables various services and applications
- Real-time data exchange between vehicles, infrastructure, and the grid
- Facilitates smart charging, allowing EVs to identify optimal charging times
- Optimal pricing and routing mechanisms in public charging stations



Courtesy : Reference 9

Challenges and possible solutions

Challenges	Possible Solutions
Range anxiety Dependence on imported batteries	Increase the number of fast charging stations, mobile charging stations, increase battery capacity
	Research on battery materials, more manufacturing units for batteries.
Unstable operation Waiting time for EV users Meet load generation balance Overloading of grid Uncertainty in EV charging demand	Optimize location of charging stations, and number of EV chargers
	Accurate forecasting of demand due to EV charging
	Implement Time of Use (ToU) tariffs, real time pricing etc.
	Charging during availability of solar and wind power
	Advanced energy management system
Power quality issues Harmonics Voltage and frequency regulation	PWM based switching methods for converters
	Coordinated charging
	Renewable energy based EVCS can be integrated with smart inverters
Space constraints Land constraints	Locate charging posts in the middle rather than at the edges EV charging set up in existing petrol/diesel pumps, parking lots etc.

THANK YOU

For discussions/suggestions/queries email: ***isuw@isuw.in***

visit: www.isuw.in

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