Smart charging and V2G

Prof. Dr. Pavol Bauer, Delft University of Technology

TU Delft dutch-incert

Learning Objectives

- What is smart charging and vehicle-to-grid (V2G)?
- Why do we need smart charging?
- What are the advantages and disadvantages of V2G?
- In which cases can smart charging can be applied?

Definition

Smart charging is a series of intelligent functionalities to control the EV charging power in order to create a flexible, sustainable, low cost and efficient charging environment.

Benefits of smart charging

- Increase the flexibility of charging
- Higher utilization rates of fixed assets
- Efficient utilization of energy in distribution network
- Make electric vehicles more sustainable
- Provide new revenue streams to EV owners

V2X

V2G

- Using the electric vehicle battery to feed power back to the grid using a bidirectional EV charger

- V2G = Vehicle to Grid
- V2H = Vehicle to Home
- V2B = Vehicle to Building
- V2L = Vehicle to Load
- .....

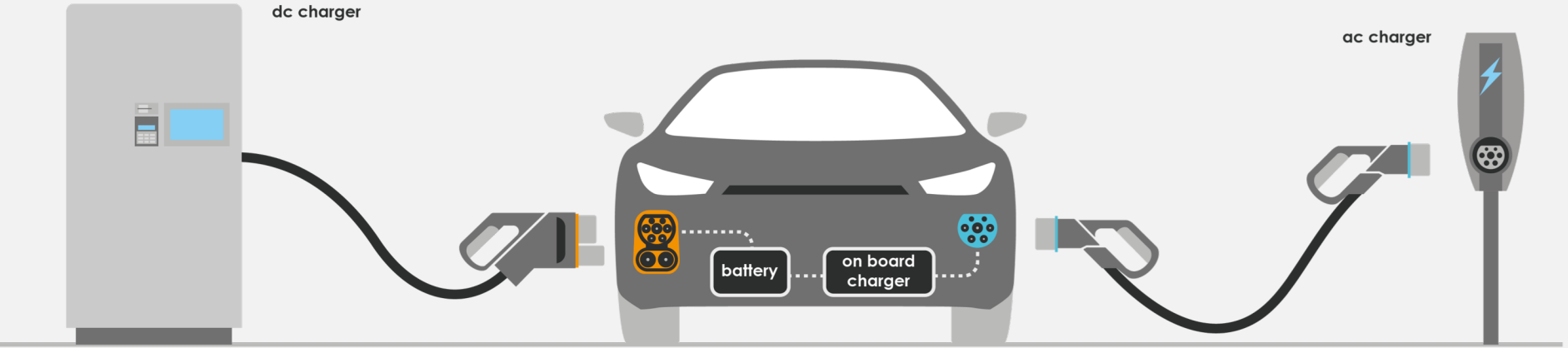
V2x advantages and challenges

- ☺ Storage for renewables
- ☺ Reduce peak demand
- ☺ Emergency power
- ☺ Ancillary services

- 😐 Bidirectional charger
- 😐 Battery degradation
- 😐 ICT infrastructure
- 😐 Standardization and regulatory framework
- 😐 Lack of incentives for user

V2X

- AC charging: Bidirectional on-board EV charger
- DC charging: Bidirectional off-board EV charger



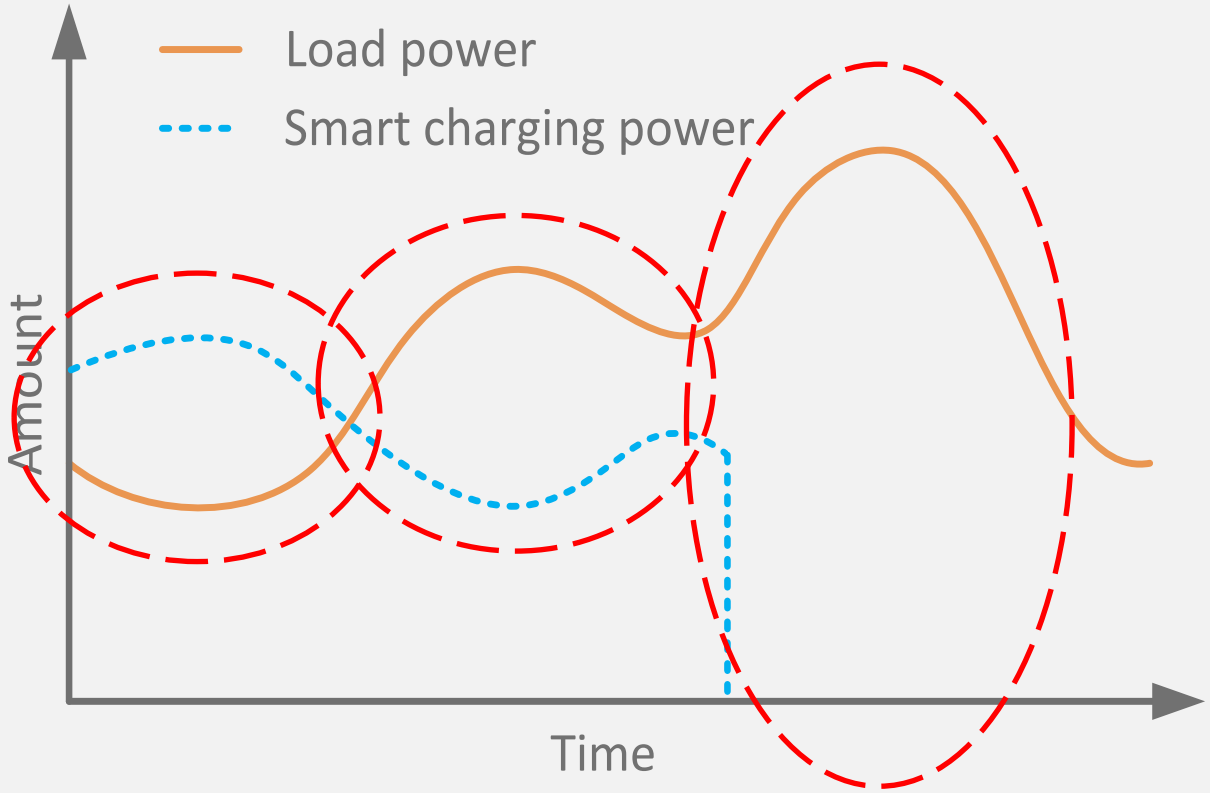
Applications of Smart charging

Example applications of smart charging

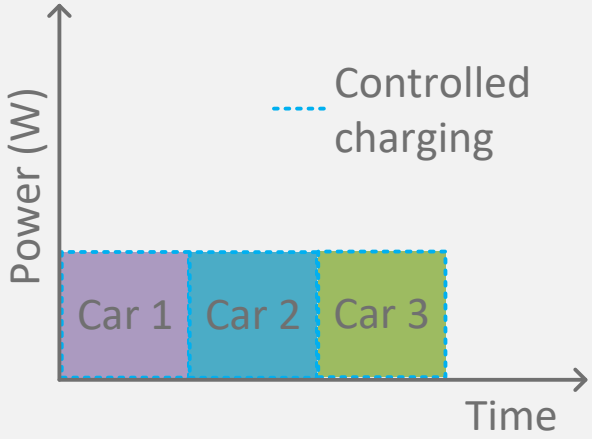
- Local load balancing
    - Adjust charging time/power according to load
    - Balance multiple charge points with priority
- Renewable energy utilization
- Price based charging
- Peak shaving
- Grid back up

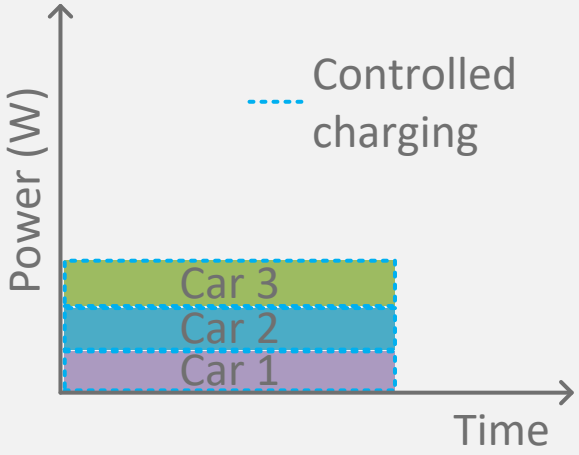
} V2G

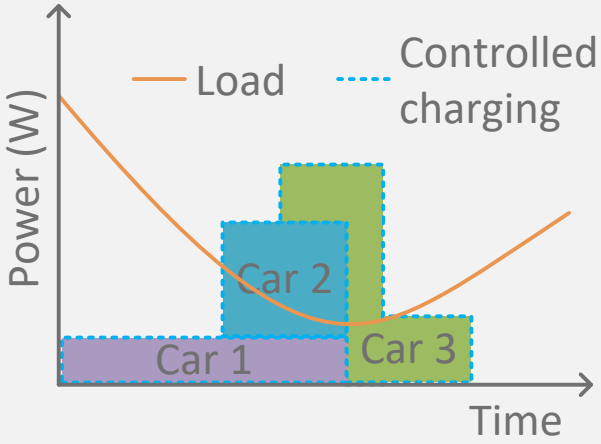
Load balancing



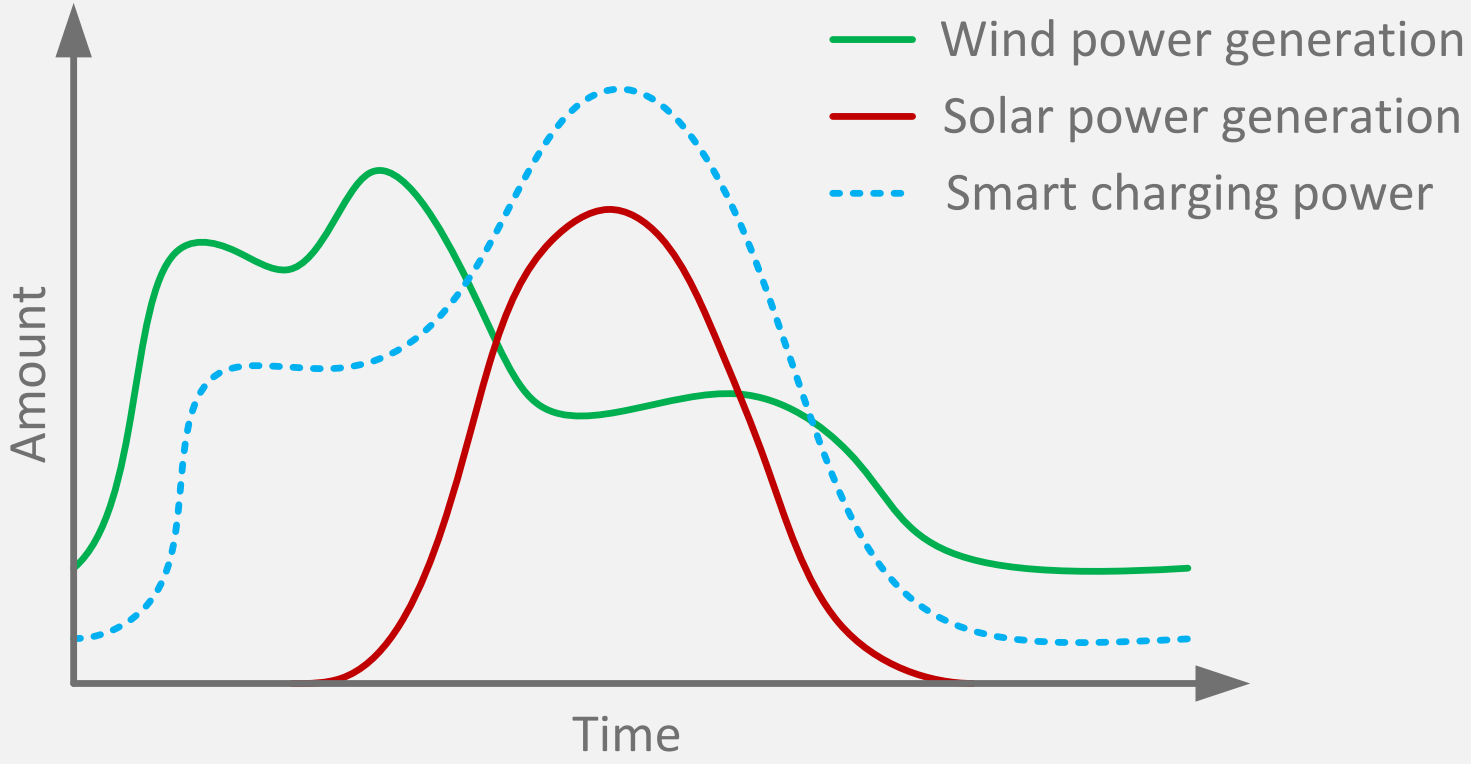
Load balancing



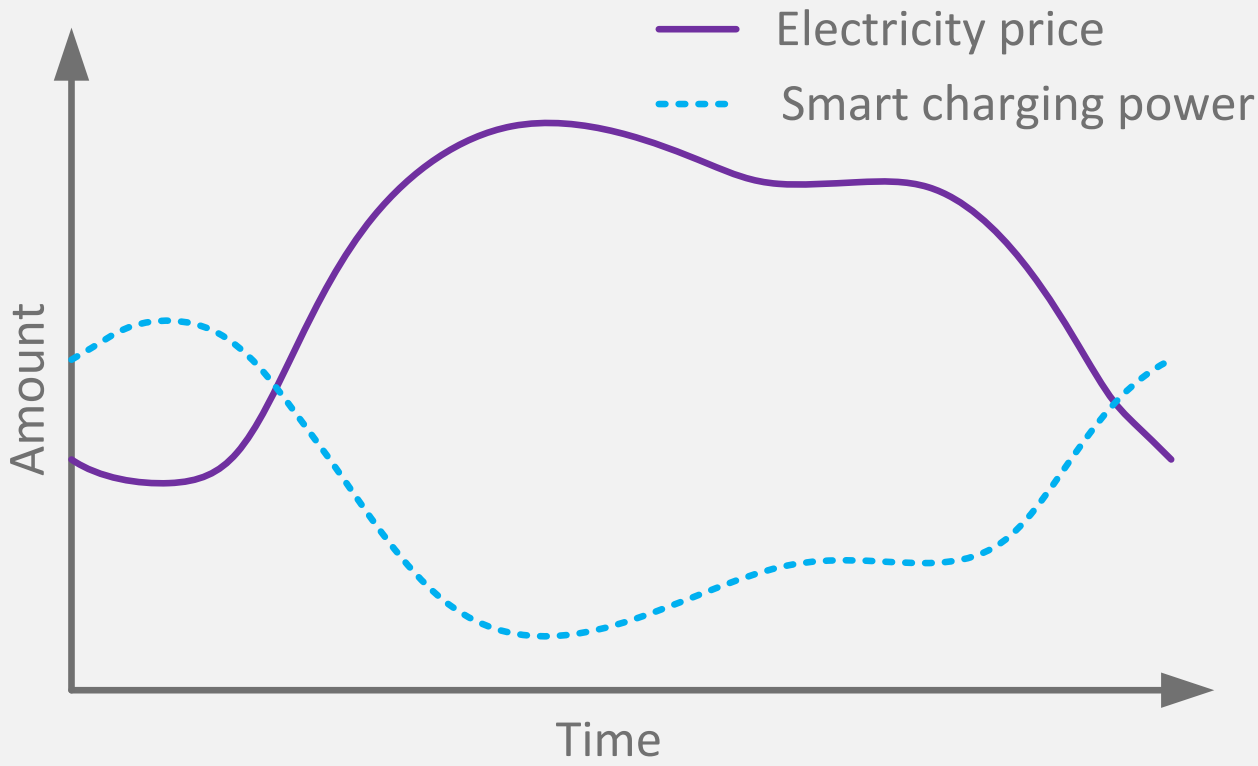




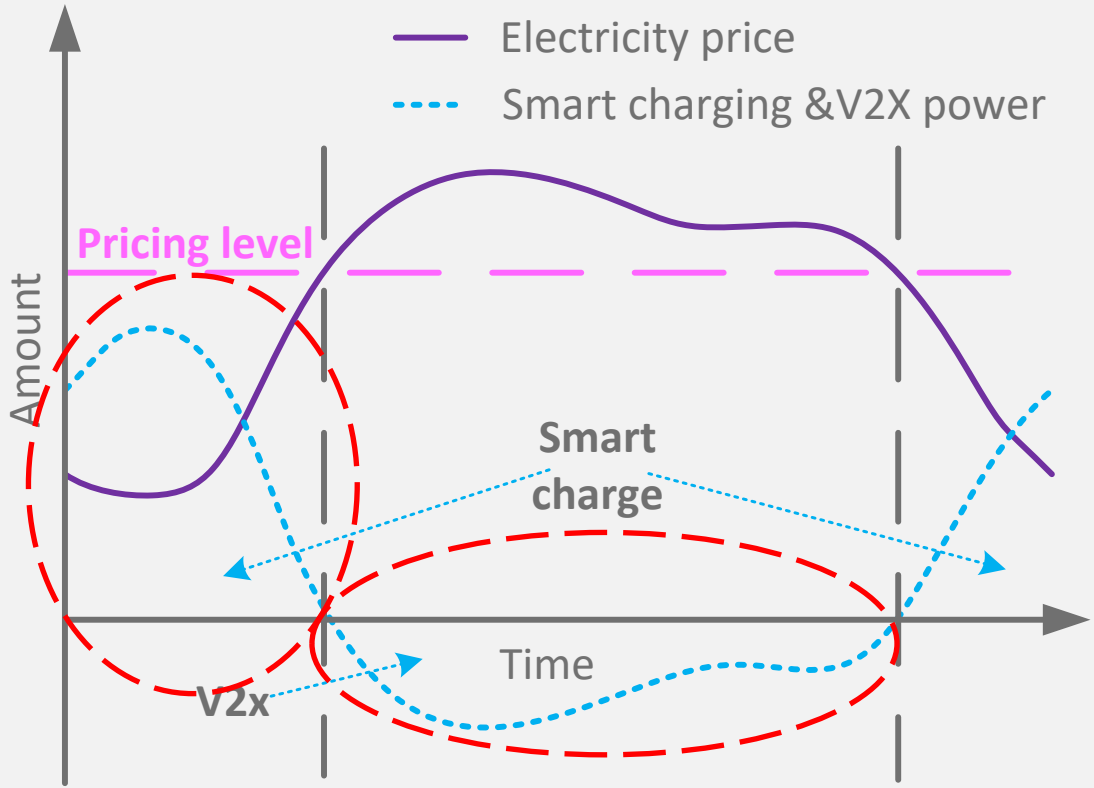
Renewable energy availability



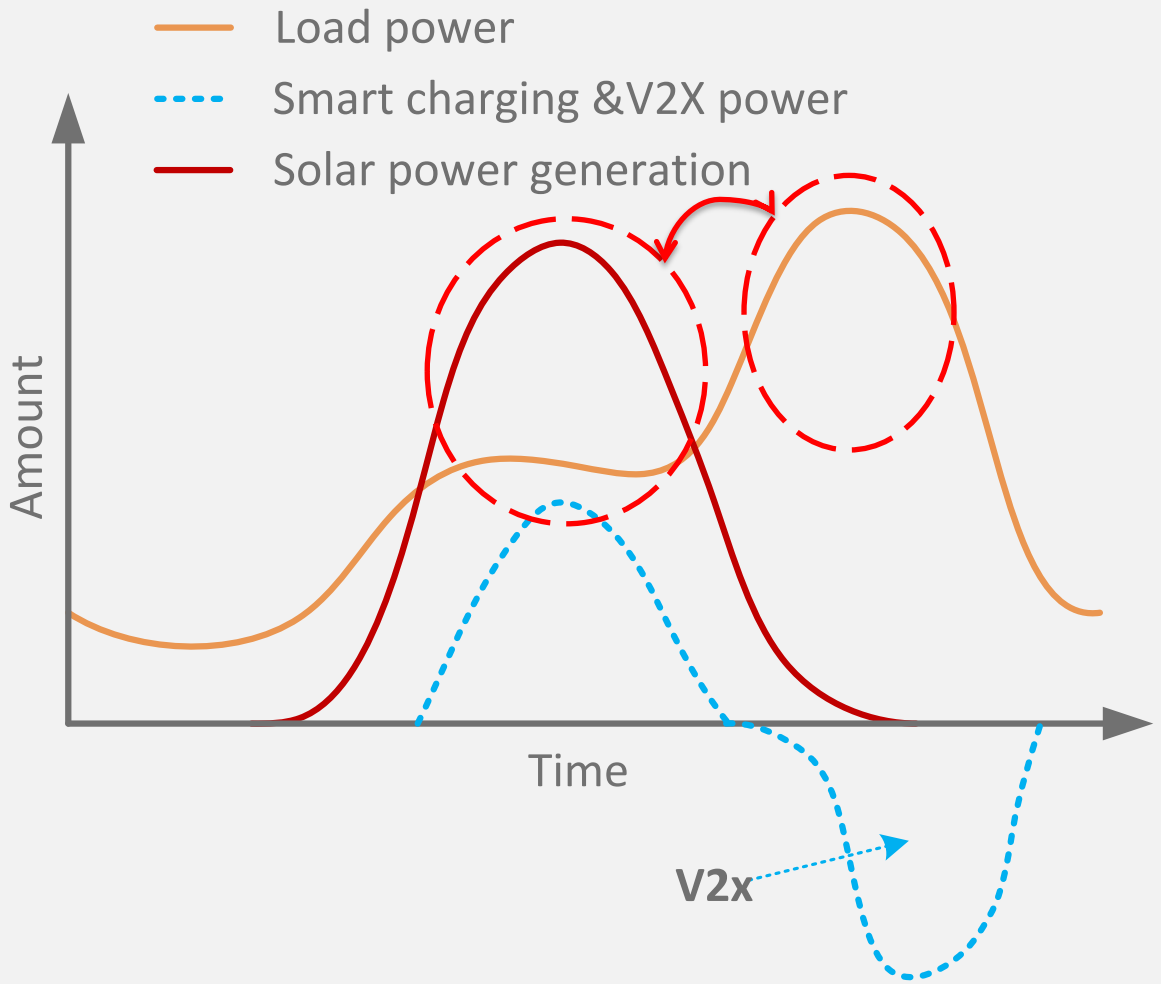
Price based charging



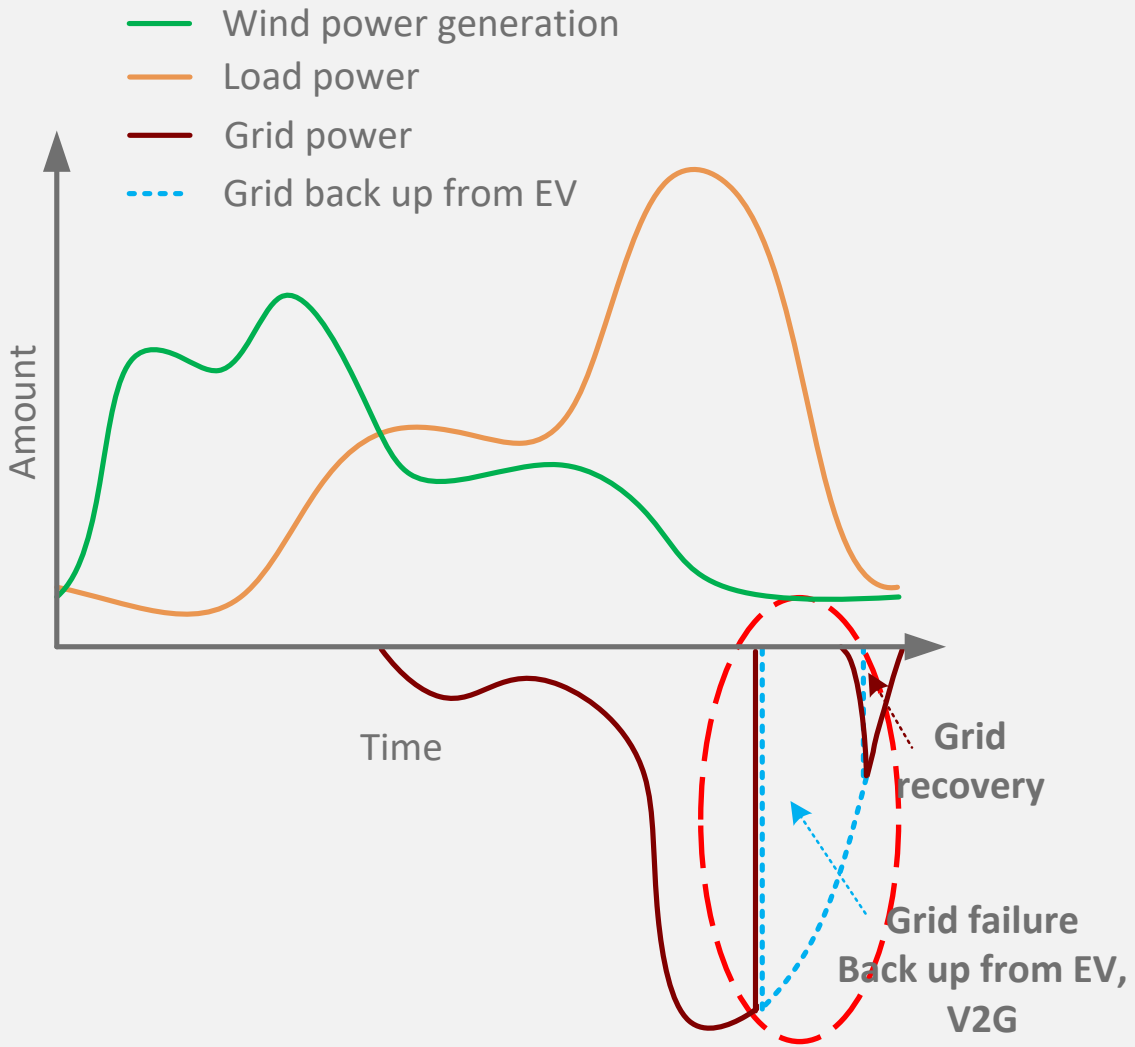
Price based charging



Peak shaving



Grid backup


Wind power generation
Load power
Grid power
Grid back up from EV
Amount
Time
Grid recovery
Grid failure
Back up from EV, V2G

Smart charging

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