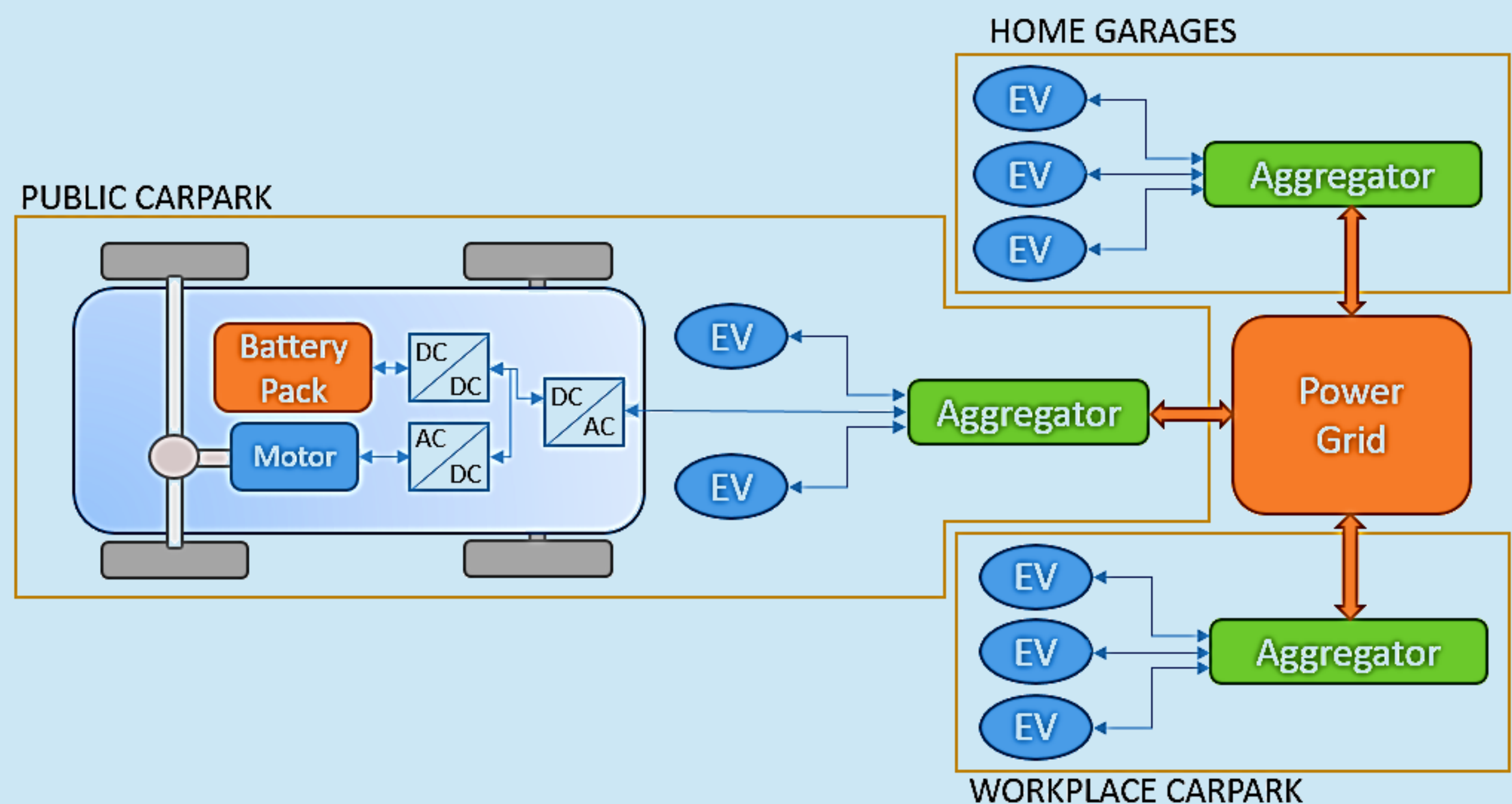


Vehicle-to-Grid (V2G) Communications and Controls

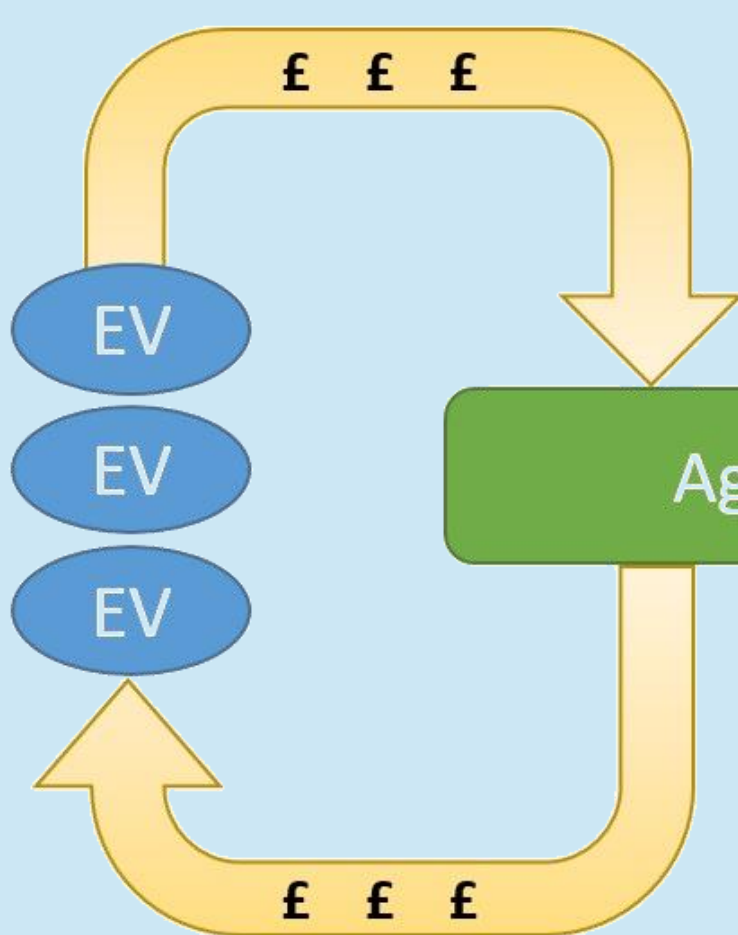
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What is V2G?

V2G uses the batteries of parked electric vehicles (EVs) for grid-based energy storage, providing services such as frequency regulation or backup power. V2G could be implemented wherever a number of EVs is being parked for a period of time. The charging/discharging of several EV batteries is managed through so-called aggregators. A typical arrangement might be the usage of one aggregator per car park.

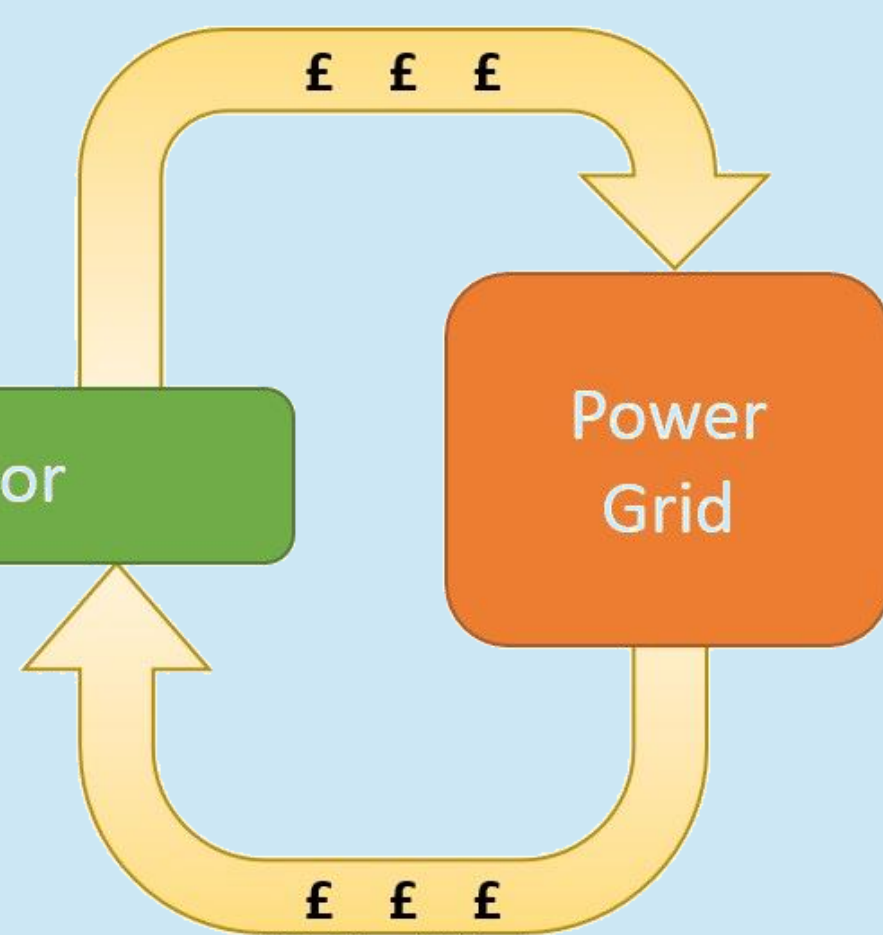


[1] Fees for battery charging



[4] Compensation for grid services

[2] Fees for electricity consumption



[3] Compensation for aggregator service

Types of communications

The implementation of V2G requires continuous communication between all parts of the network to assess the available battery capacity connected and to track any electricity flow allowing payments to be made for electricity usage as well as for providing grid services.

One can generally differentiate between Grid-operator/Aggregator communications (What grid services are needed? How much battery capacity is available?), Aggregator/EV communications (What is the battery state-of-charge? Is charging required or is discharging possible?) and EV/Driver communications (When does the EV battery need to be charged up?).

Challenges of communications and controls

The concept of V2G is still in its infancy and several issues still need to be addressed. There is no current market for aggregators and the amount of EVs is not yet sufficient to create one. Further, the ability to participate in V2G needs to be included in future EV designs.

With regards to communications and controls, most issues are of technical nature (industry standards, wired or wireless communication, encryption, etc.) but some are social (driver convenience and control over charging behaviour) or even legal issues (accountability, protection of private information about driver's behaviour).

