

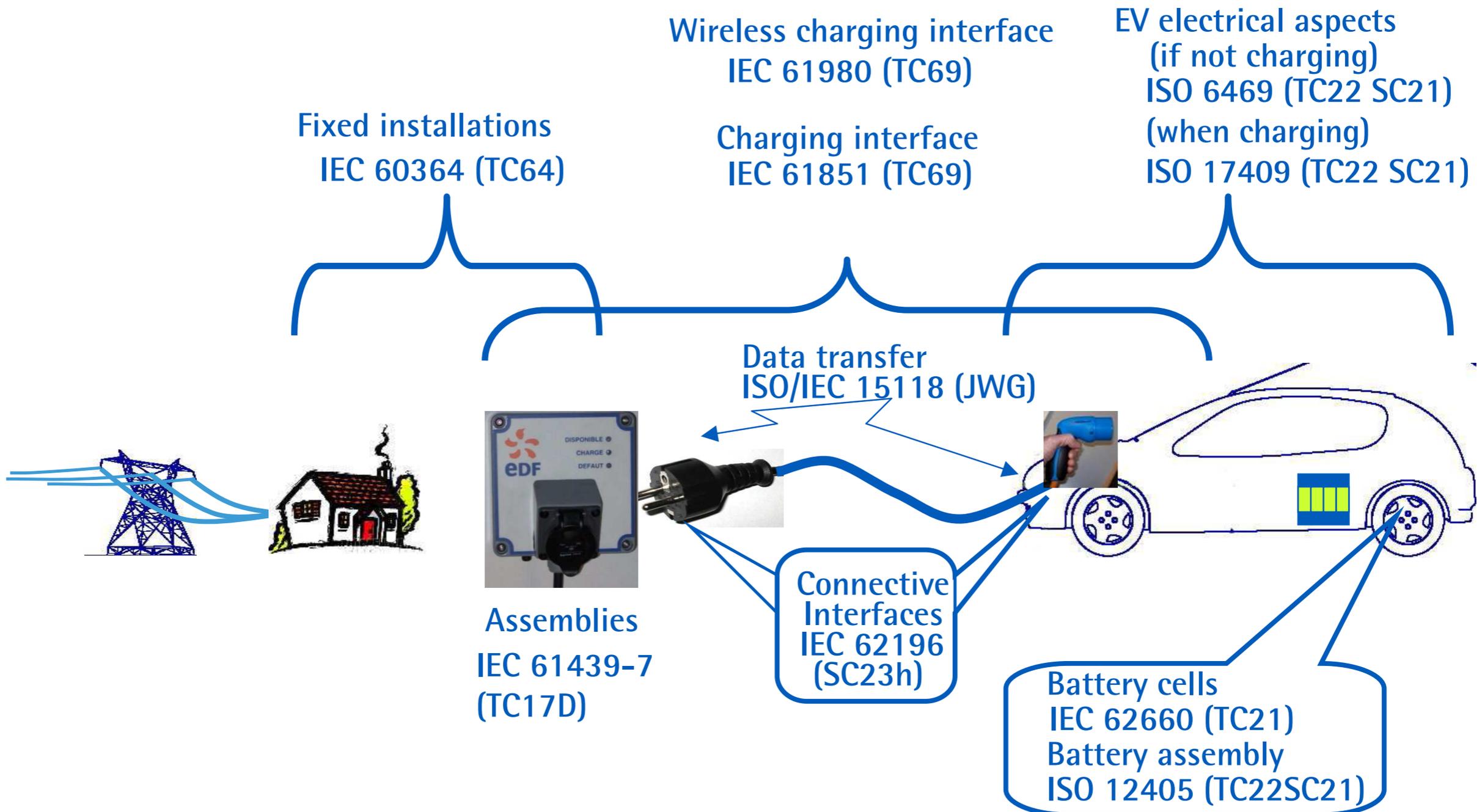


Standardization and testing of powertrain components

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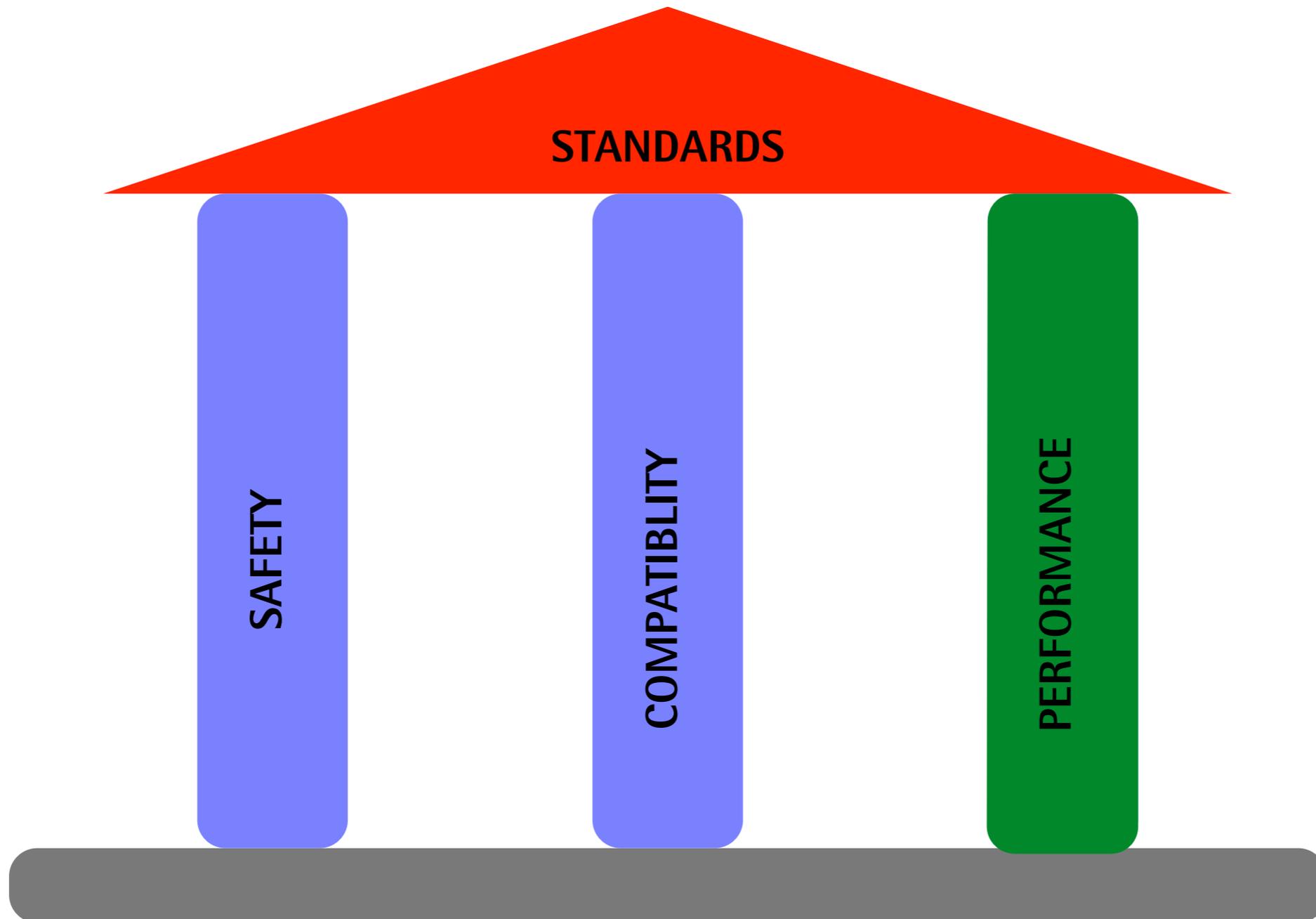


EV Standardization Landscape





The House of Standardization





ISO versus IEC

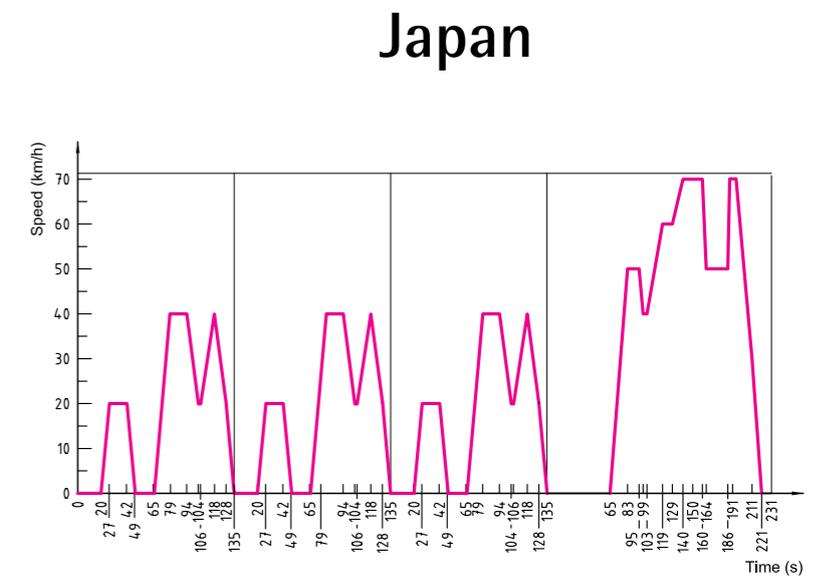
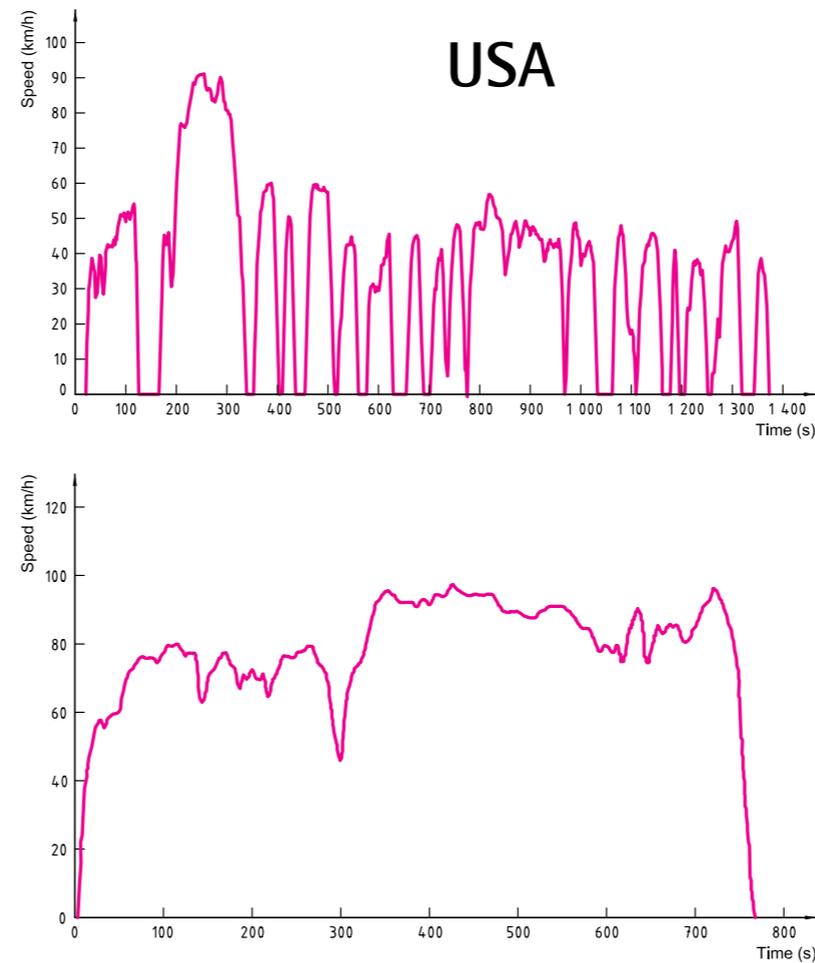
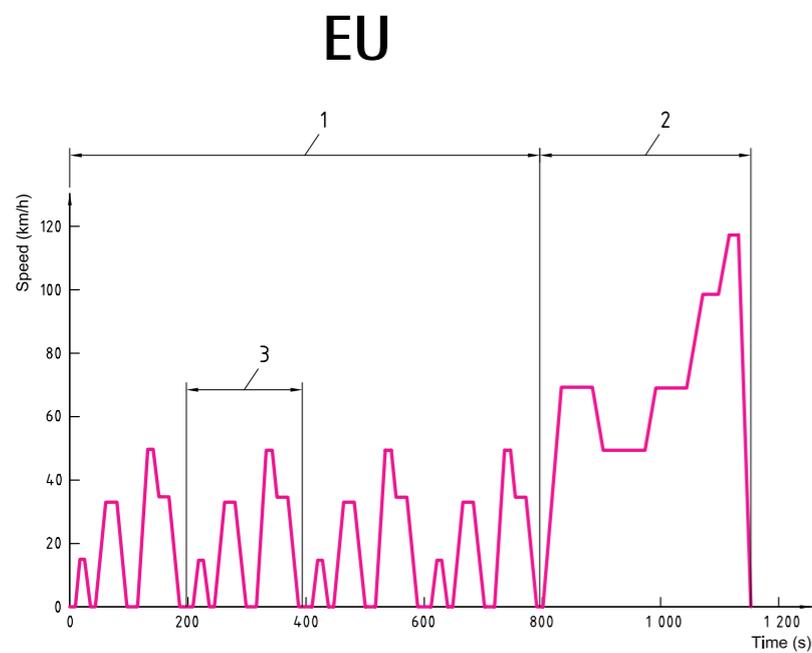
- Cultural differences
 - Automotive sector
 - Electrotechnical sector
- Division of labour

ISO TC22 SC21	IEC TC69
Aspects related to the electric vehicle as a whole	Aspects related to electrical components and electric supply infrastructure



Vehicle performance standards

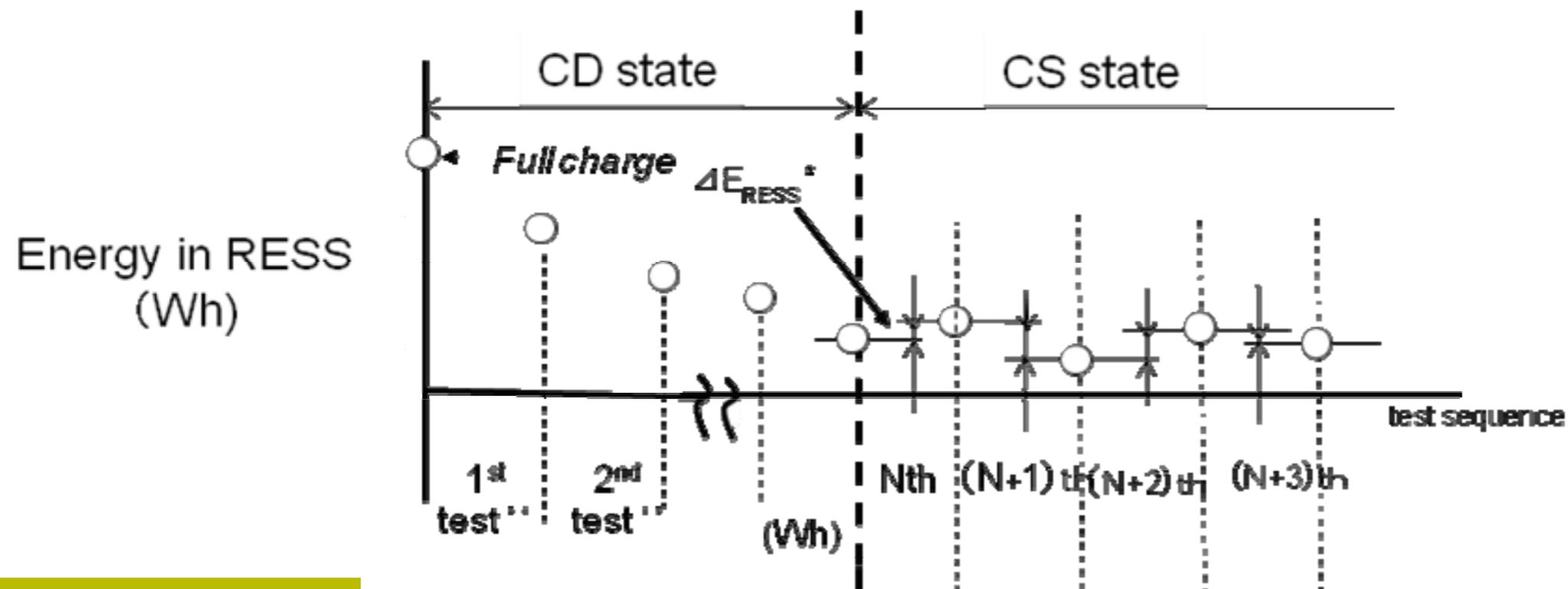
- ISO 8714:2002 Energy consumption and range for battery-electric vehicles
 - Based on regional test cycles





Vehicle performance standards

- ISO 23274 Hybrid-electric road vehicles - Exhaust emissions and fuel consumption measurements
 - Part 1 Non externally chargeable vehicles (2013 Ed.2)
 - Part 2 External chargeable vehicles (2012 Ed.1)





Drivetrain Component Standards

- Extensive standardization for industrial traction motors (IEC 60349)
- No demand from automotive industry !
- No tradition in automotor standardization
- IEC TC69 WG2 disbanded

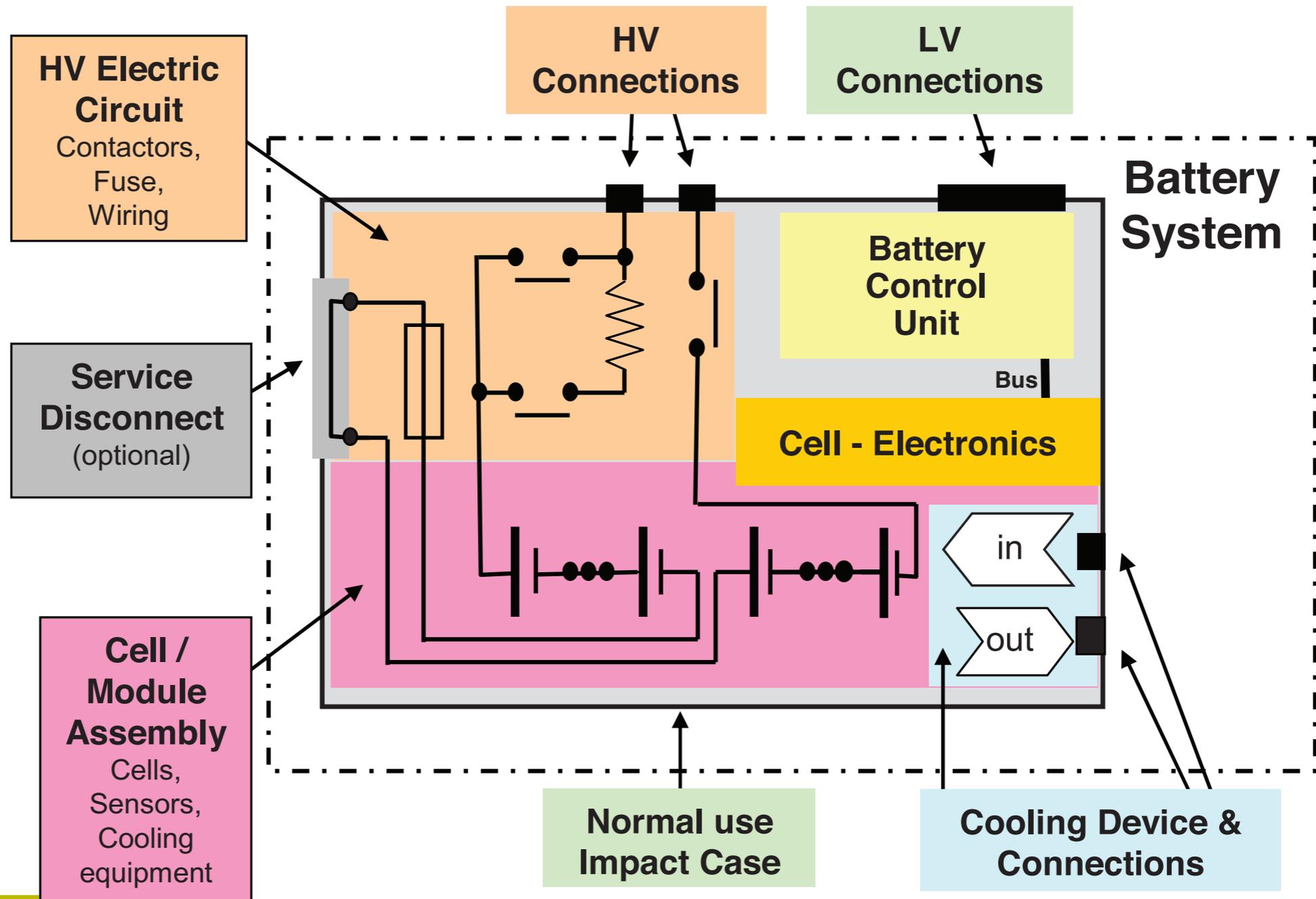


RESS standards

- ISO: Vehicle-centric
 - Battery system
 - ISO 12405 family
- IEC: Battery-centric
 - Battery cells
 - IEC 62660 family
 - IEC 61982



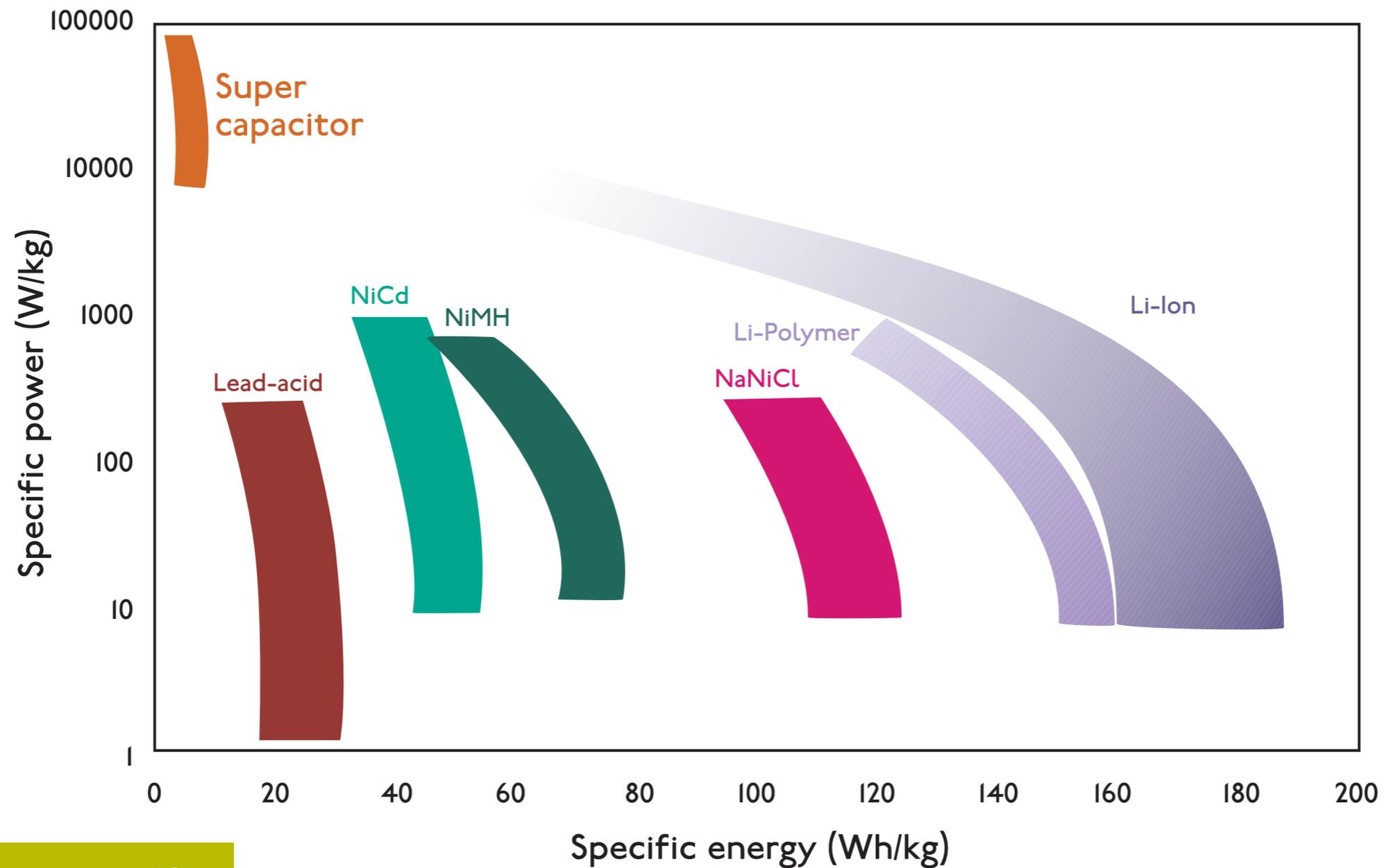
Battery system





Battery technologies

Ragone chart (cell level)





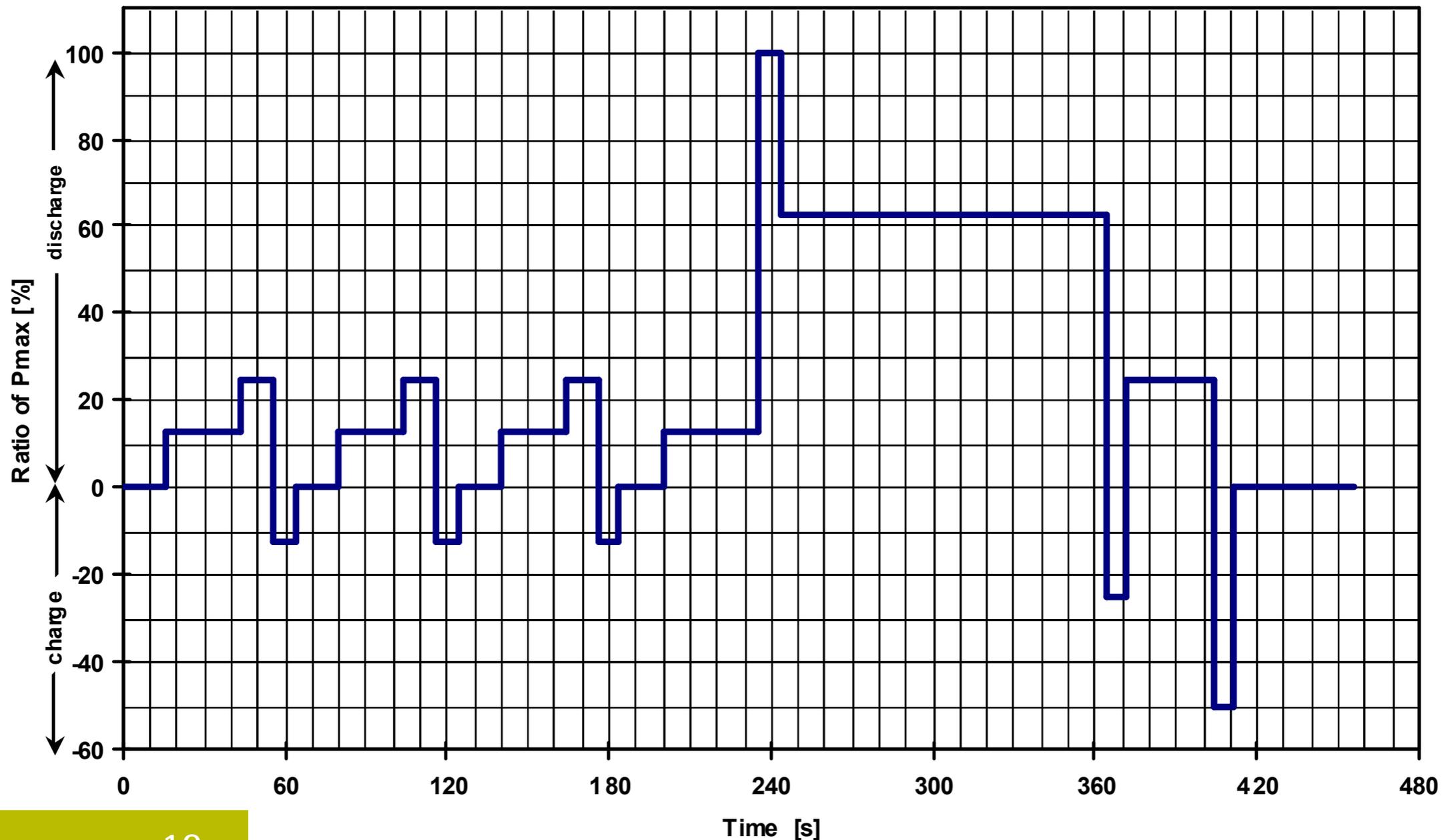
Battery performance

- Energy performance (Wh)
 - Capacity test
 - Test cycle reflecting actual use
 - Battery-electric versus hybrid
- Power performance (W)
 - Peak power
 - Internal resistance



Battery-electric capacity

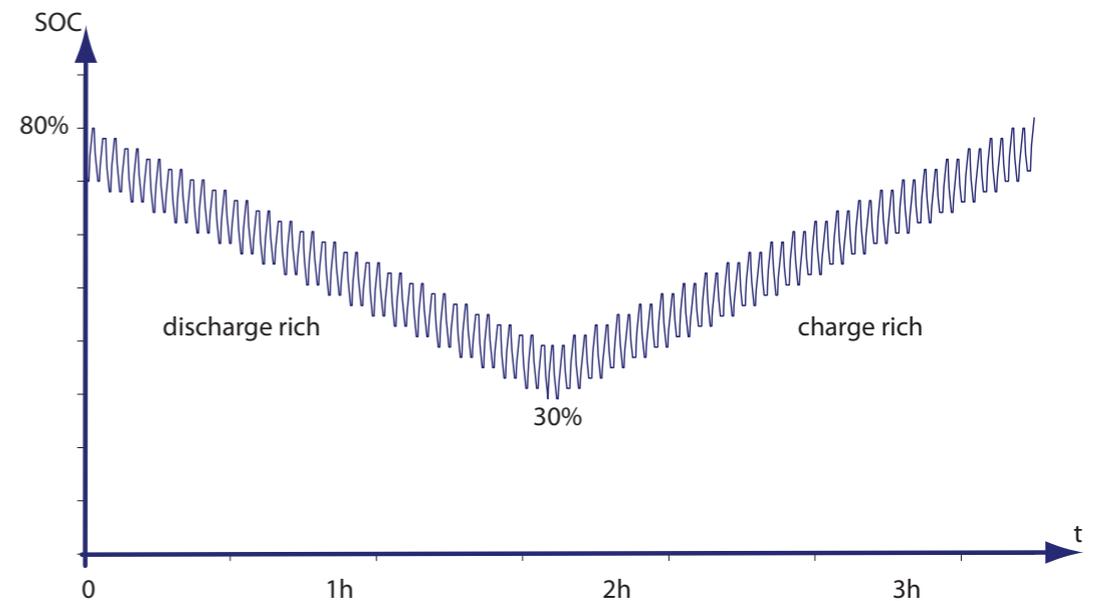
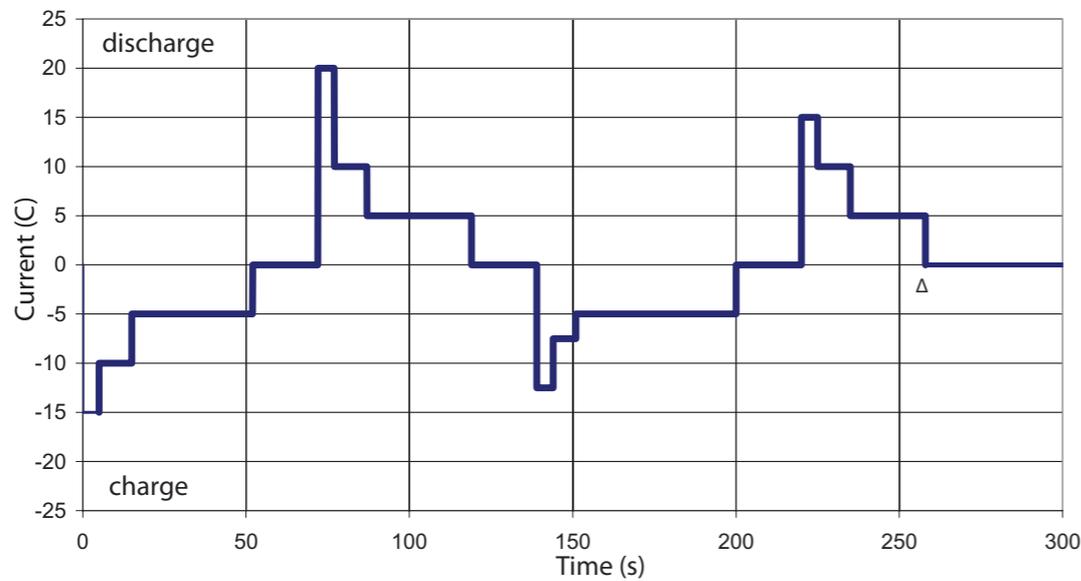
- IEC 62660-1 and ISO 12405-2





Hybrid capacity

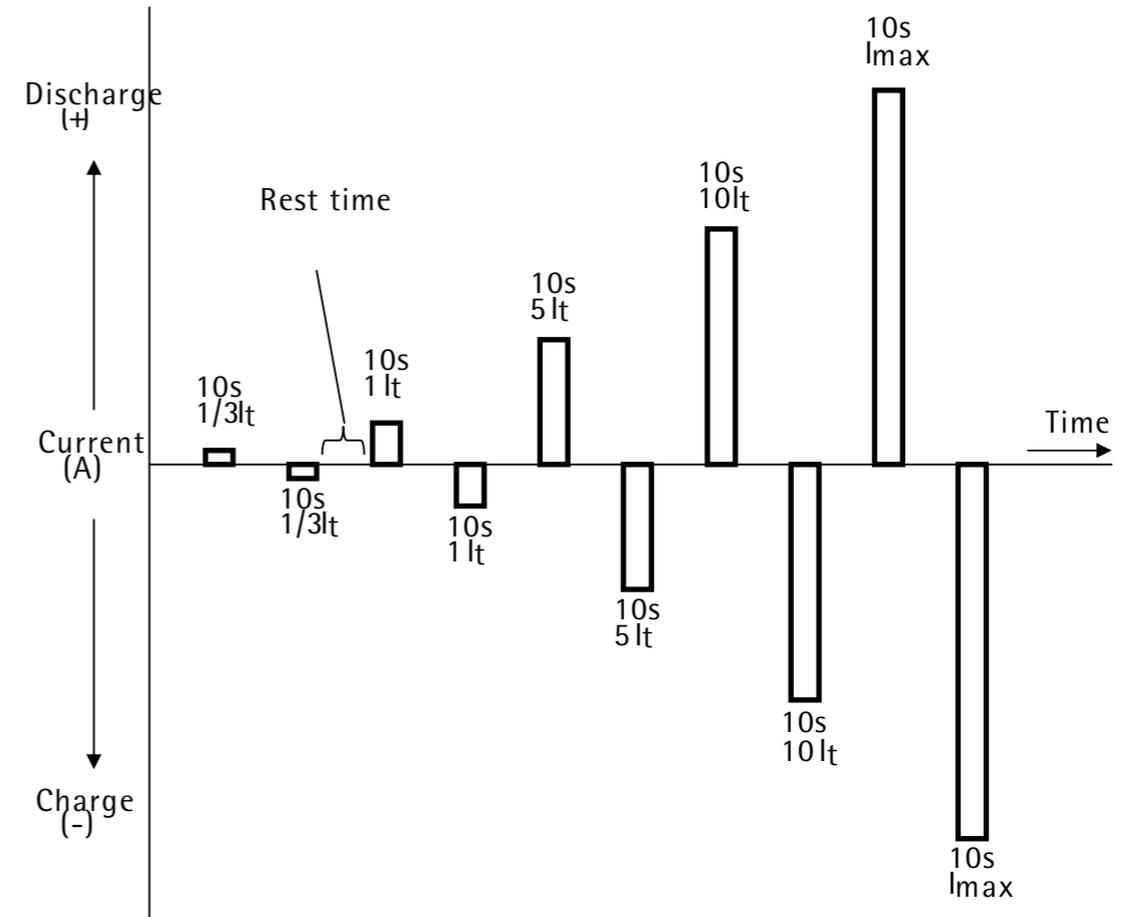
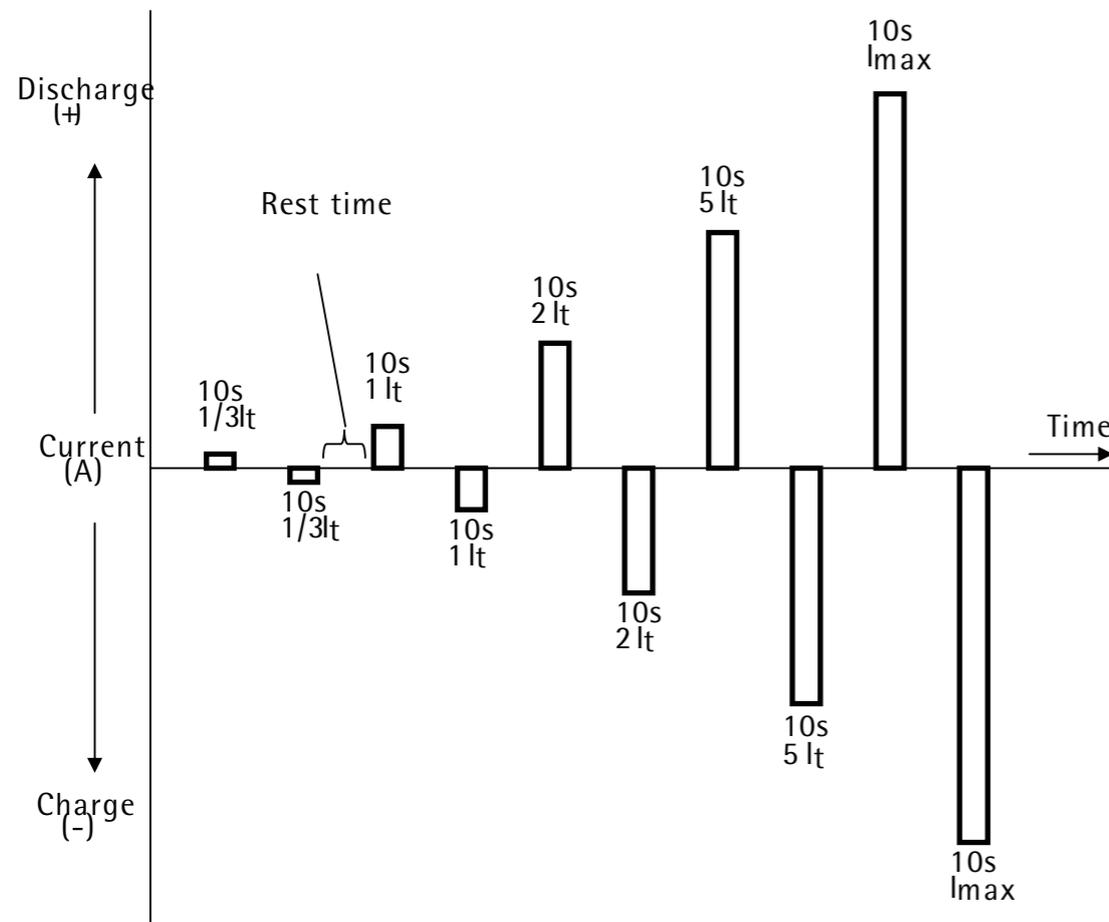
- IEC 62660-1 and ISO 12405-1
- Charge-rich or discharge-rich microcycles
- State of charge evolution





Power test

- For BEV and HEV applications





Other RESS

- Electric double-layer capacitors: IEC 62576
- New components: hybrid capacitors
 - New standards needed?
- New applications: second-life
 - Test cycles for stationary applications
 - State of health determination



Conclusions

- Performance test standards essential for assessment of vehicles and components
- Need for accurate test cycles
- Response to new developments



Thank you!

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