



EV Charging Infrastructure and Standards in China

By Yaming Zhang

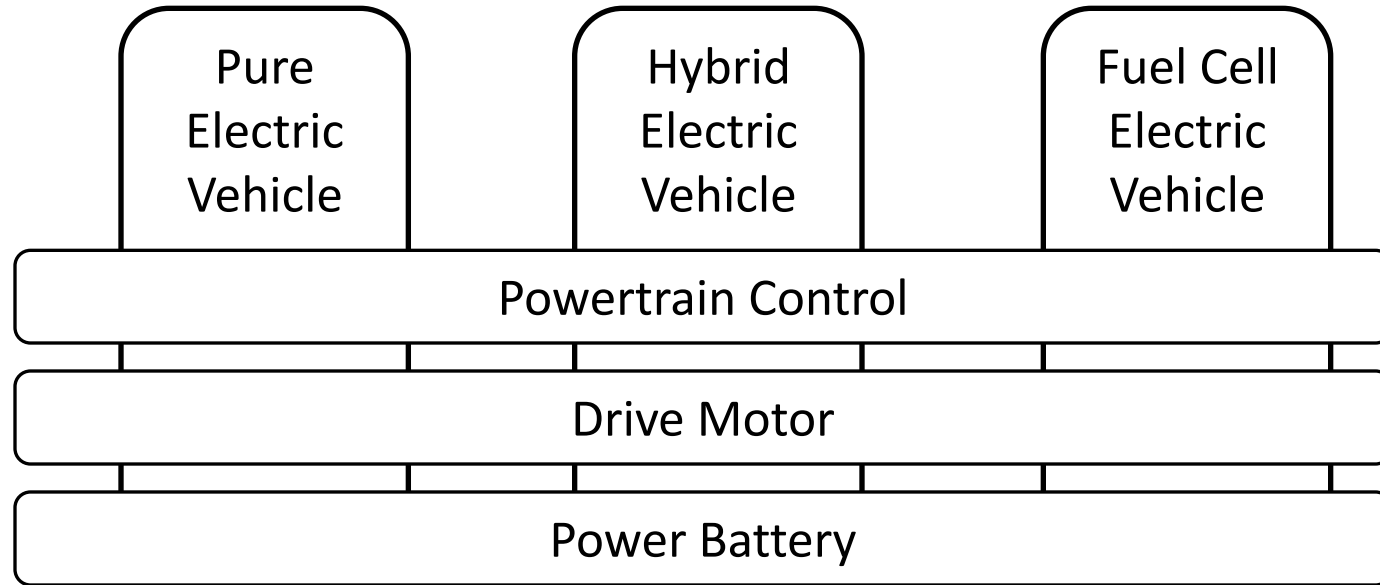


Agenda

- EV Development and Demonstration in China
- EV Charging infrastructure in China
- EV charging Safety Technology
- EV charging standards in China
- Summary



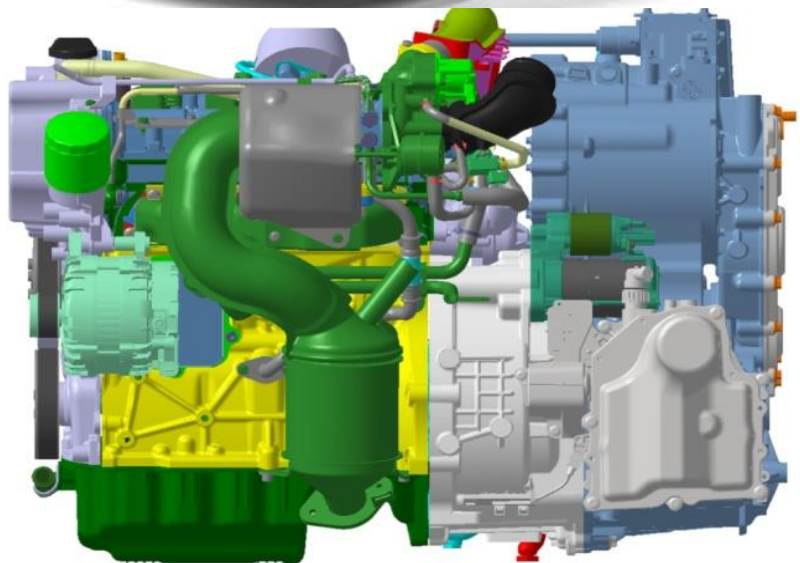
EV Development and Demonstration



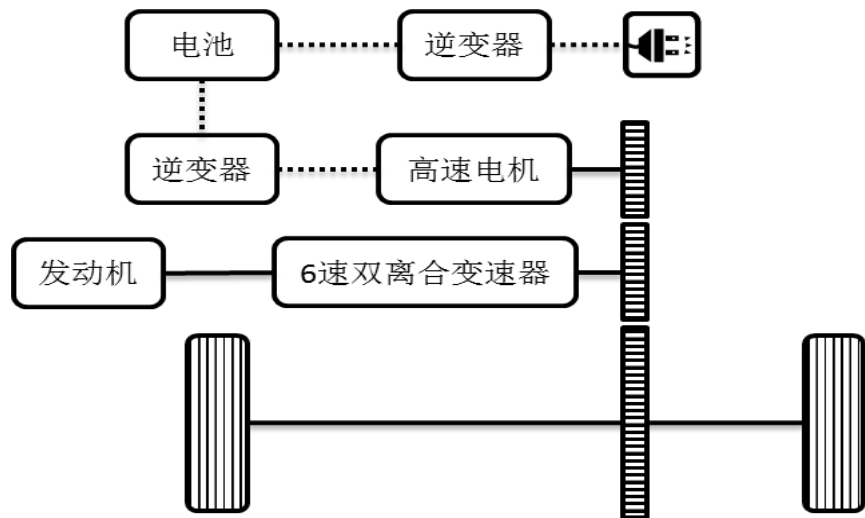
- China included EV and other new energy vehicles in the 863 Program (National High Technology Research and Development Program) in the past decades, and a comprehensive R&D framework is in place, focusing on the powertrain control, drive motor, power battery for PEV, HEV and FCEV.



EV Development and Demonstration

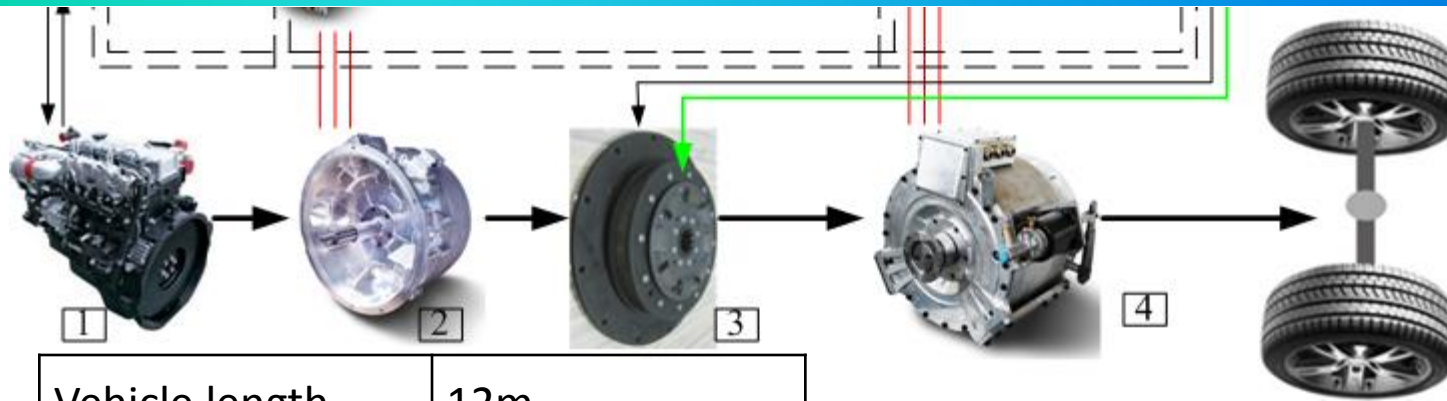


No Load Mass	1720kg
Gasoline Engine	113kW/240Nm
Electric Motor	110kW/ 250Nm
Fuel Consumption	1.6L/100km
Battery	13kWh
Electric Range	70km





EV Development and Demonstration



Vehicle length	12m
Full Load Mass	17,500kg
Engine	CNG Engine 140kW
ISG Electric Motor	850Nm/ 135kW
Electric Motor	2100Nm /150kW
Battery	560V 15kWh
Electric Range	≥30km
Fuel Saving	≥40%



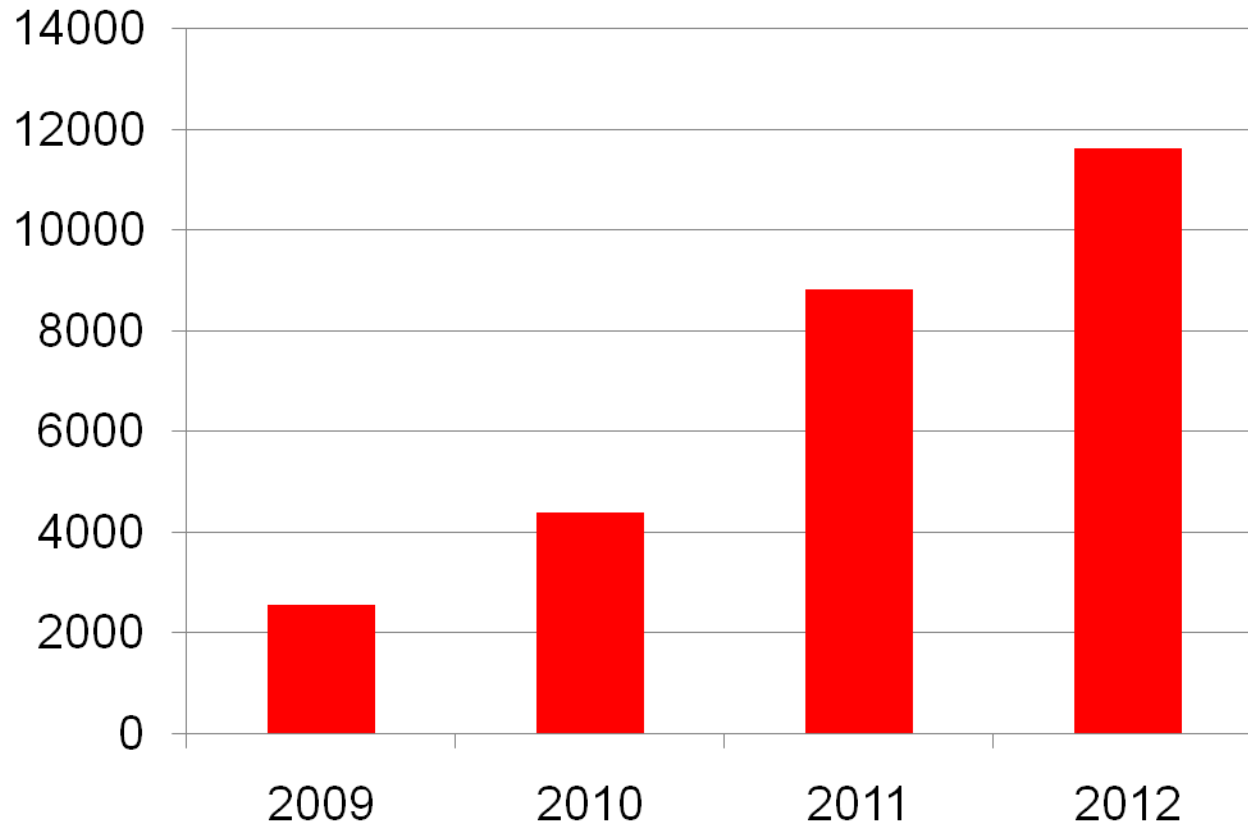


EV Development and Demonstration

	2009-2012 Subsidy (RMB per vehicle)	2013-2015 Subsidy (RMB per vehicle)	Comparison
Electric Passenger Car	60,000	60,000	0%
Hybrid Electric Passenger Car	32,000	0	100%
Plug-in Hybrid Electric Passenger Car	50,000	35,000	30%
Electric Bus (length≥10m)	500,000	500,000	0%
Hybrid Electric Bus (length≥10m)	420,000	0	100%
Plug-in Hybrid electric bus (length≥10m)	420,000	250,000	40%



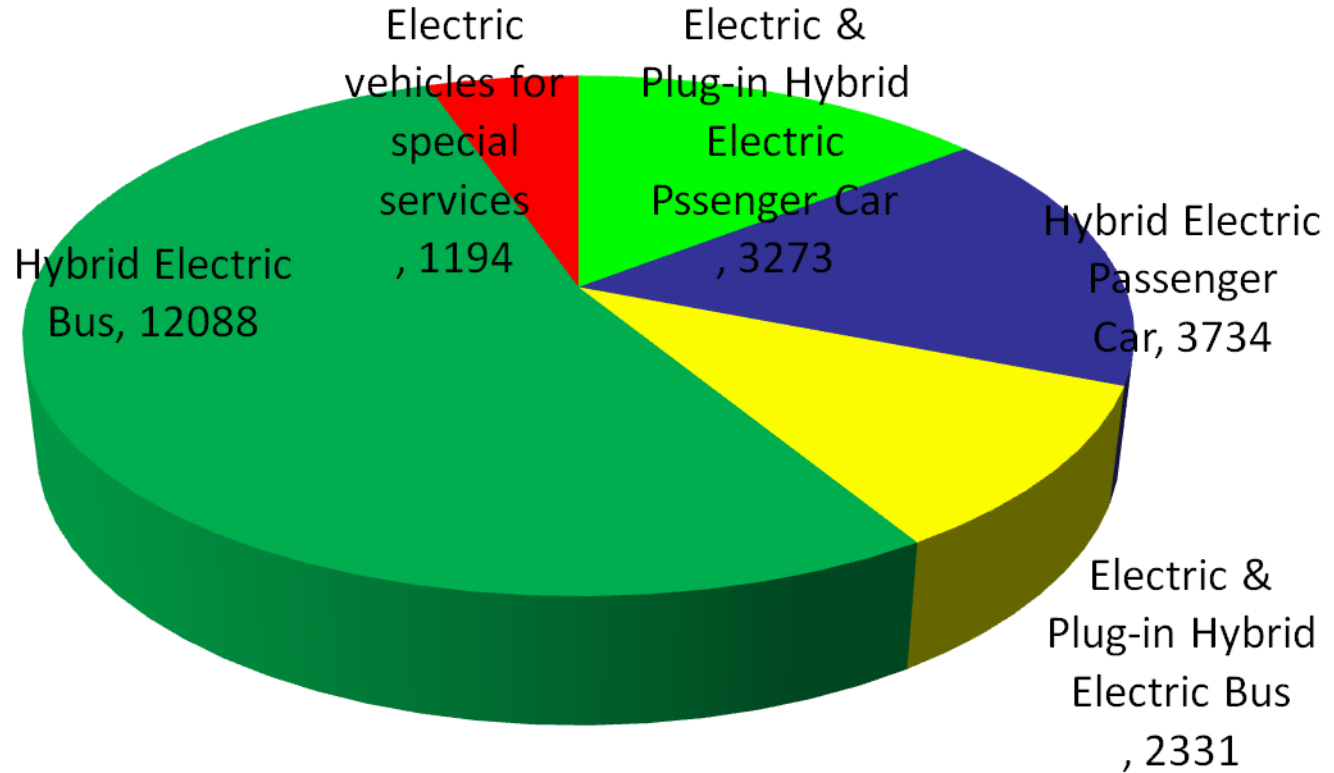
EV Development and Demonstration



- Nearly 28,000 Electric & Hybrid Electric Vehicles demonstrated



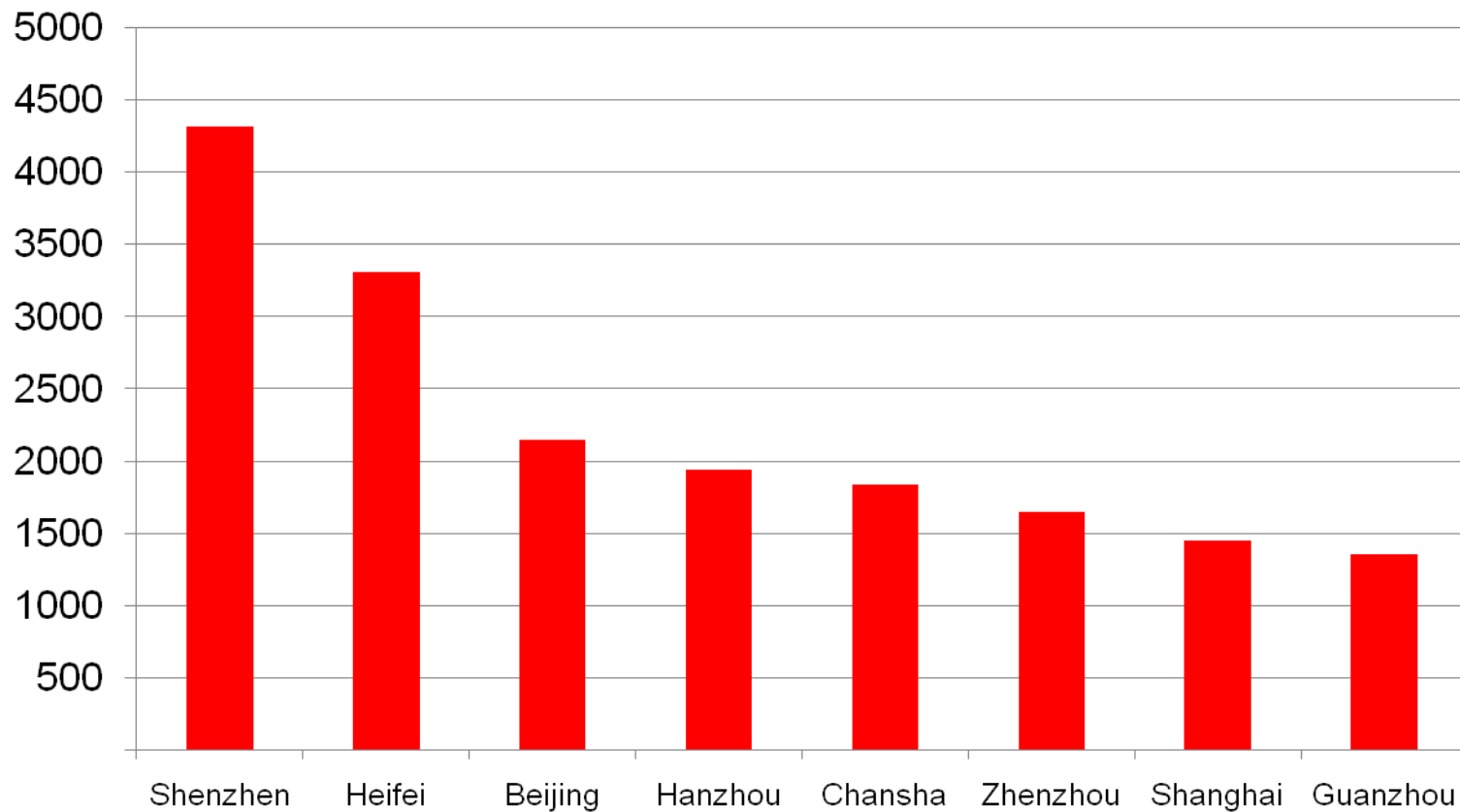
EV Development and Demonstration



- Different kinds of vehicles



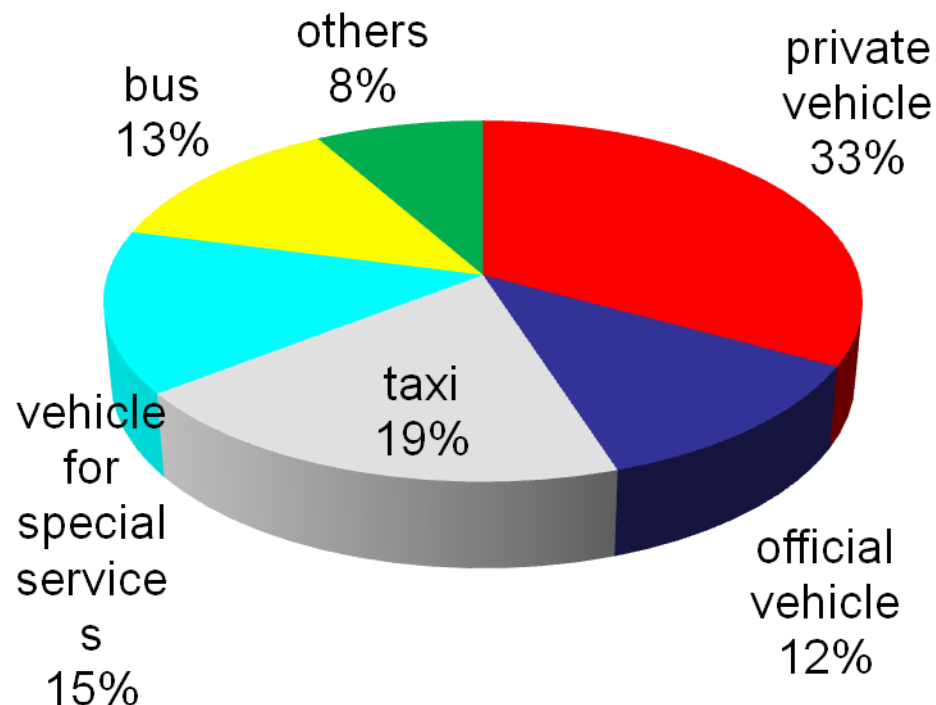
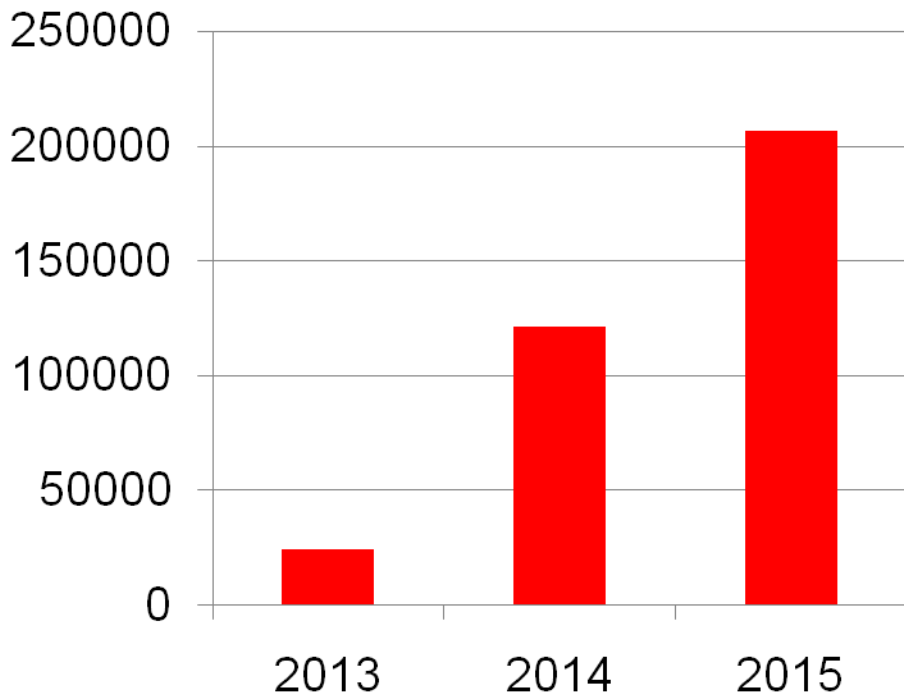
EV Development and Demonstration



- Top ten cities data



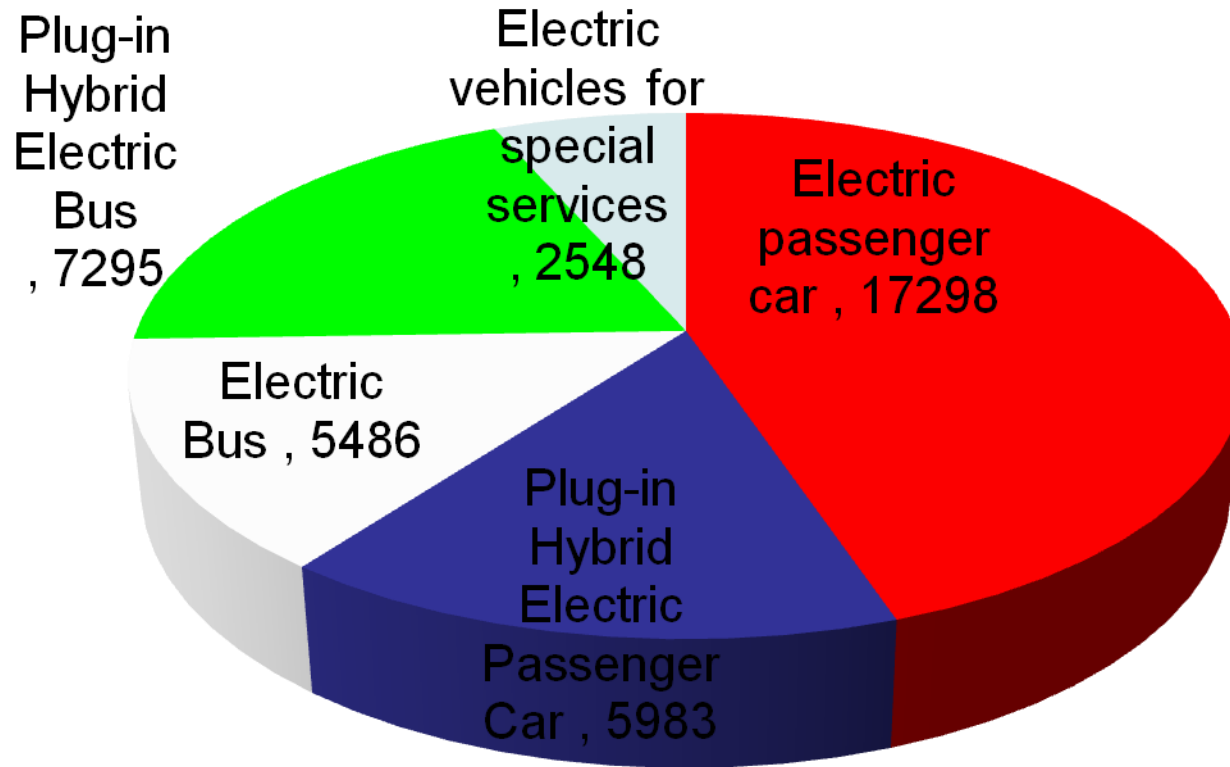
EV Development and Demonstration



- About 330,000 vehicles will be demonstrated in 40 cities, 2013-2015



EV Development and Demonstration



- By Sept., 38, 616 vehicles demonstrated



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EV Charging infrastructure in China

- AC charging point
- DC charging point
- Battering Charging station
- Battery swapping station
- On board charger



EV Charging infrastructure in China



- The charging point mainly applies slow charging mode with low current, concerning to the safety and battery life cycle.
- Charging point covers less areas, approximately $1 m^2$, and costs less as well.
- However, long time of charging could not meet the instant use requirement.



EV Charging infrastructure in China



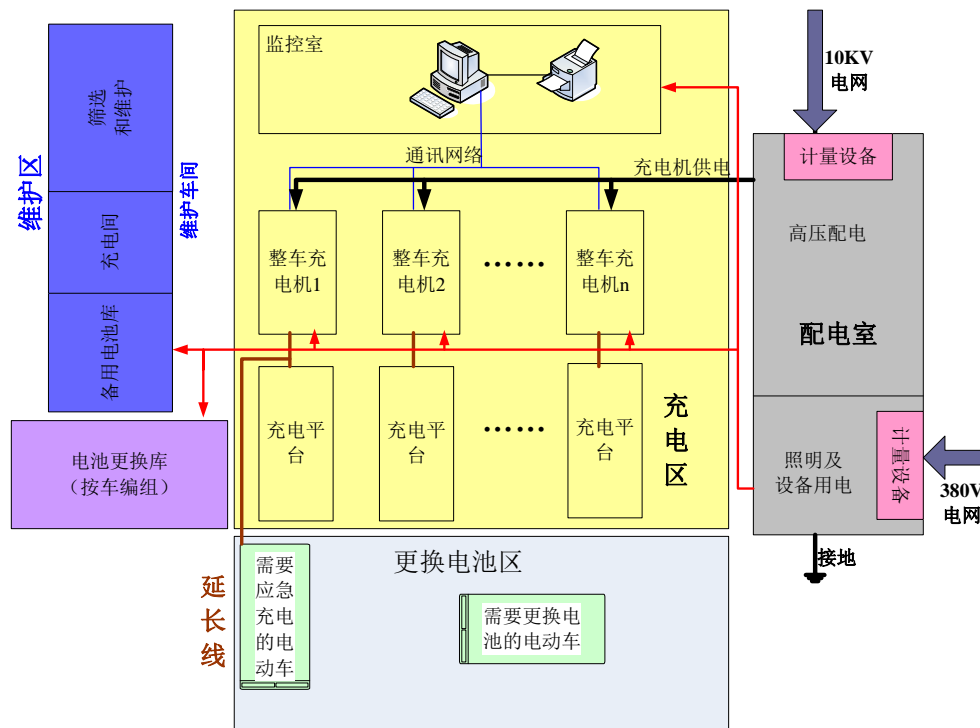
- The charging station with fast charging mode is more efficient and time-saving in charging. It would charge 50%-80% of electricity in 10-30 minutes.
- Whereas, the construction and management of charging station are relatively higher,
- Present battery technology is not fully developed, thus the fast charging mode has great potential hazard on battery.



EV Charging infrastructure in China

• In general, a full function charging station is consist of

- Electricity Distribution Area
- Monitoring Area
- Charging Area
- Battery Swapping Area
- Battery Maintenance Area





EV Charging infrastructure in China

- Due to the electricity would be supplied by charging and battery swapping, hence the construction of charging station have much more flexibility than conventional gasoline station.
- by construction and structure, the charging station could be divided into:
 1. Integrated Battery Swapping Station
 2. Master-servant Battery Swapping Station
 3. Parking Vehicle Charging Station

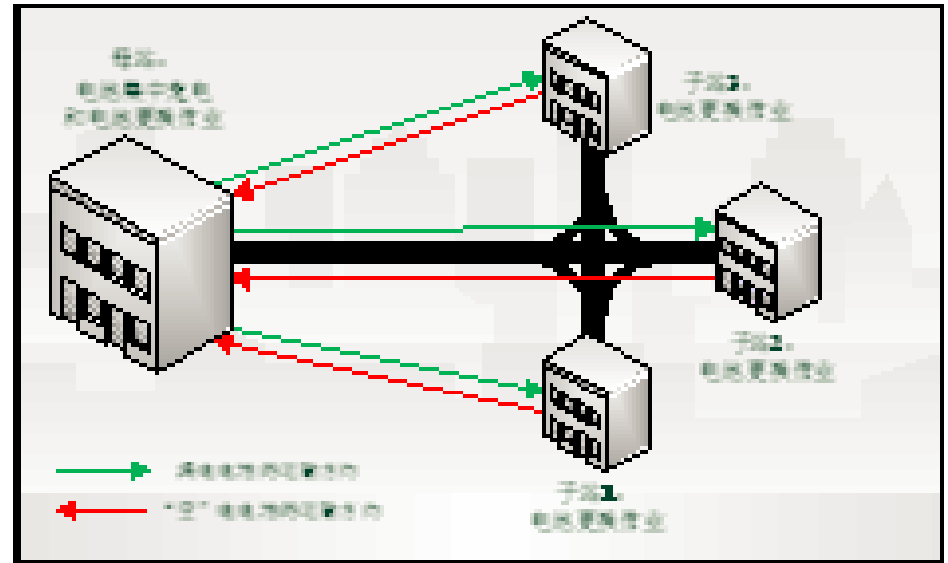


EV Charging infrastructure in China

-Master-servant Battery Swapping Station

-Low-electricity battery are gathered to charge all together in the master work station, while battery swapping is executed servant work station.

-The distribution system transfers fully charged battery to servant work station and returns low-electricity battery to master work station. It could also provide emergency charging service.

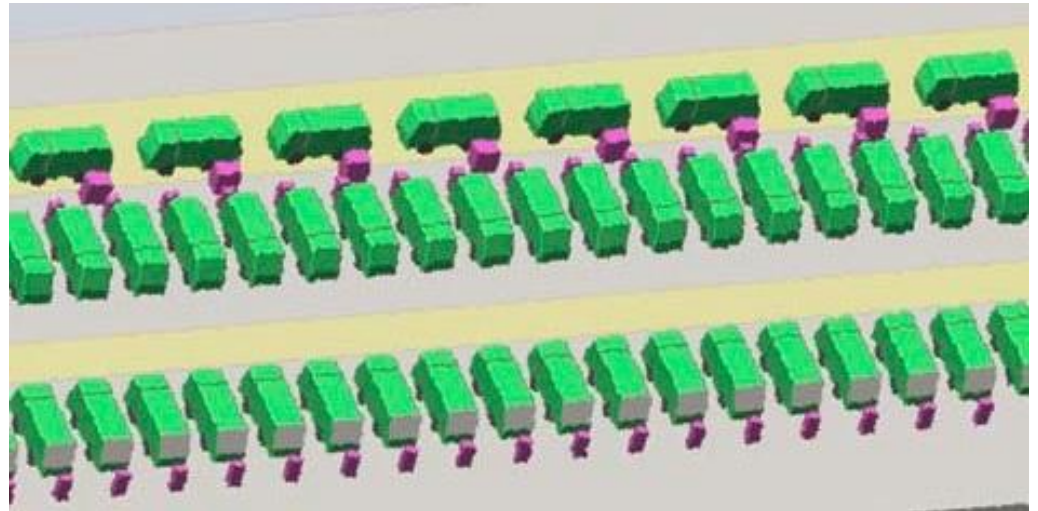




EV Charging infrastructure in China

-Parking Vehicle Charging Station

It refers to a charging station which provide regular charging or emergency fast charging service. It could be considered as a parking field with a plenty of chargers.





EV Charging infrastructure in China

- Charging station in Beijing



- DC charging points



- Charging station in Shanghai





EV Charging infrastructure in China

- Swapping station in Hanzhou
- DC charger
- Battery swapping robot



- Swapping station in Beijing Olympic Games



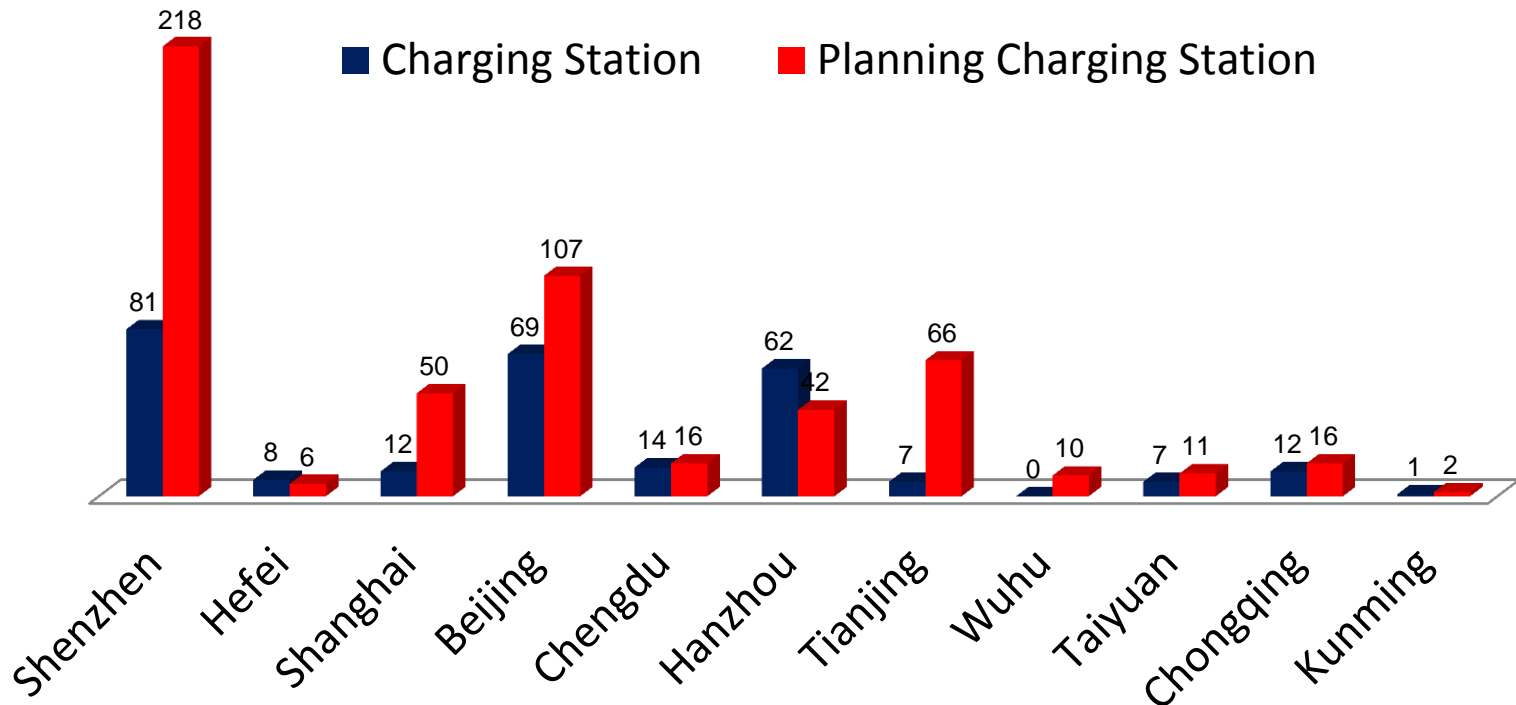
- Monitoring room





EV Charging infrastructure in China

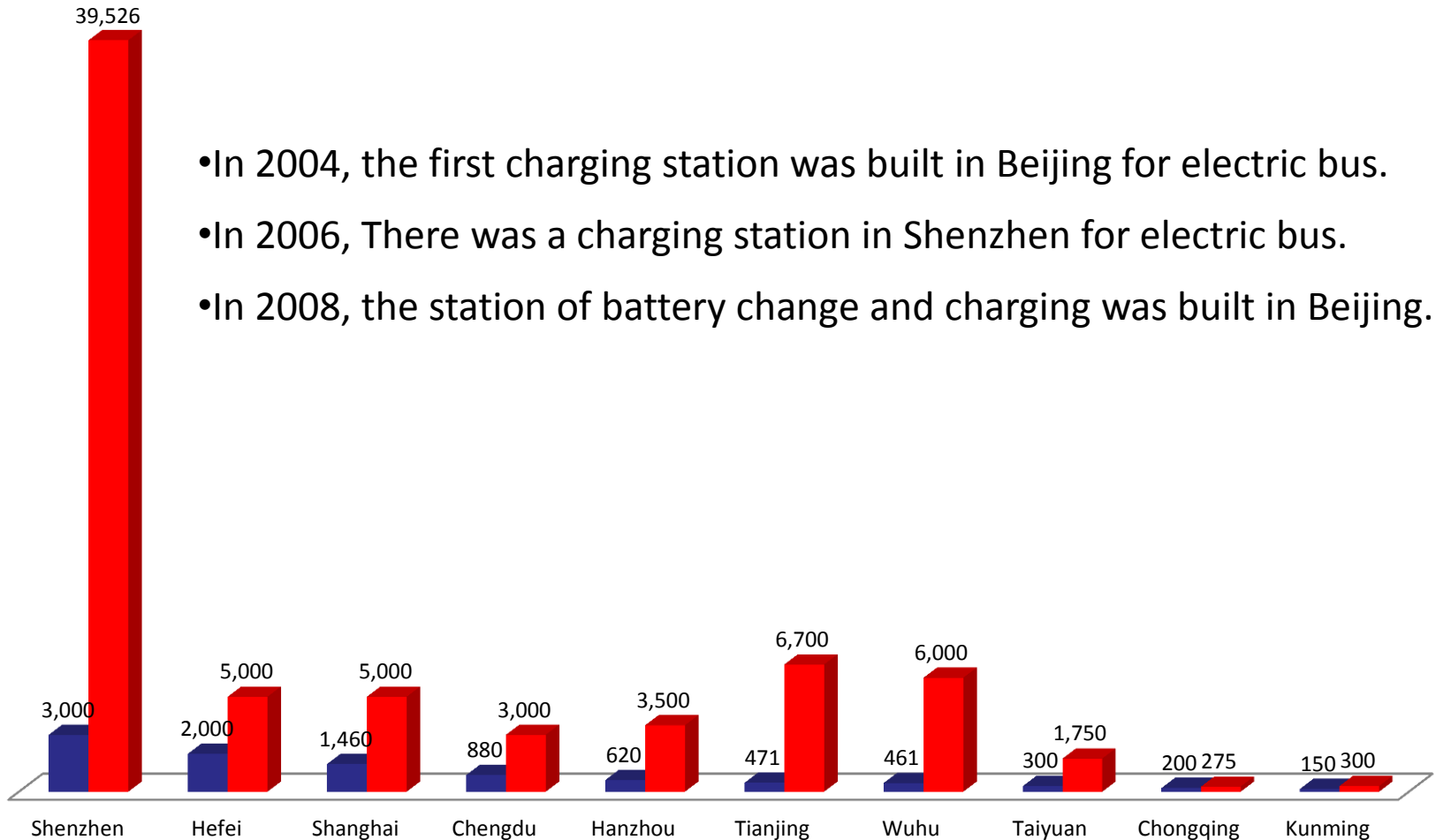
- Until Sept. 2014
 - 217 charging station has been built, 939 for DC fast charge and 221 for AC fast charge
 - 13,754 AC slow charging points has been built





EV Charging infrastructure in China

■ Charing Point Number ■ Planning Charing Point Number



- In 2004, the first charging station was built in Beijing for electric bus.
- In 2006, There was a charging station in Shenzhen for electric bus.
- In 2008, the station of battery change and charging was built in Beijing.



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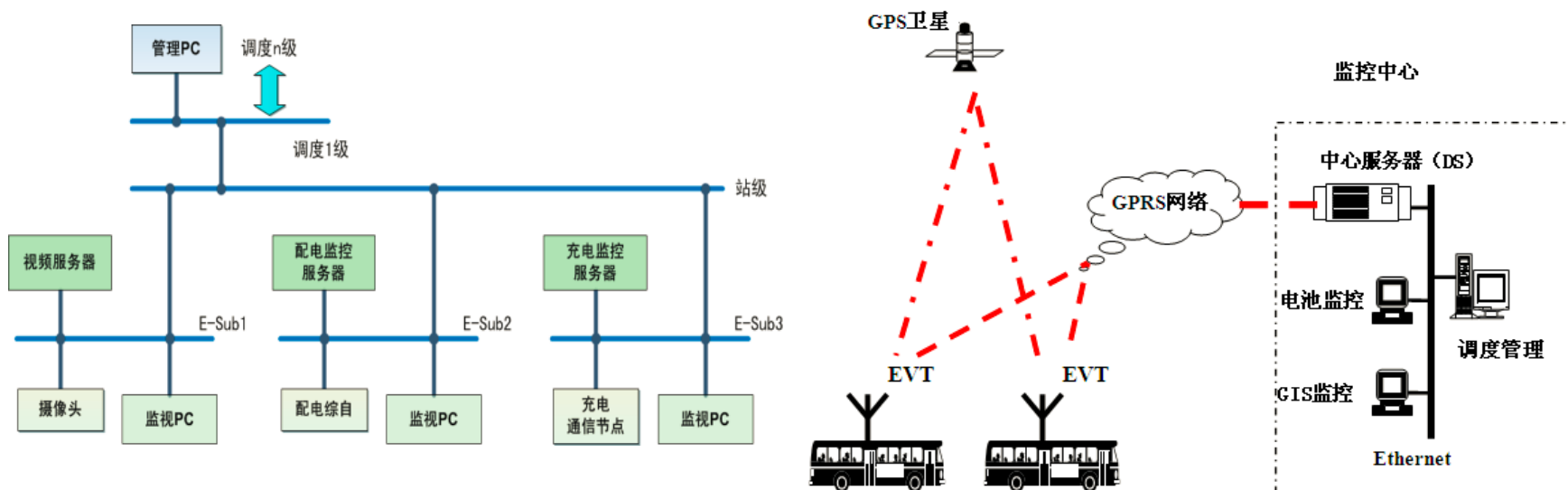
Charging safety technology

- Monitoring technology
- Charging technology
- Battery pack safety technology



Charging safety technology

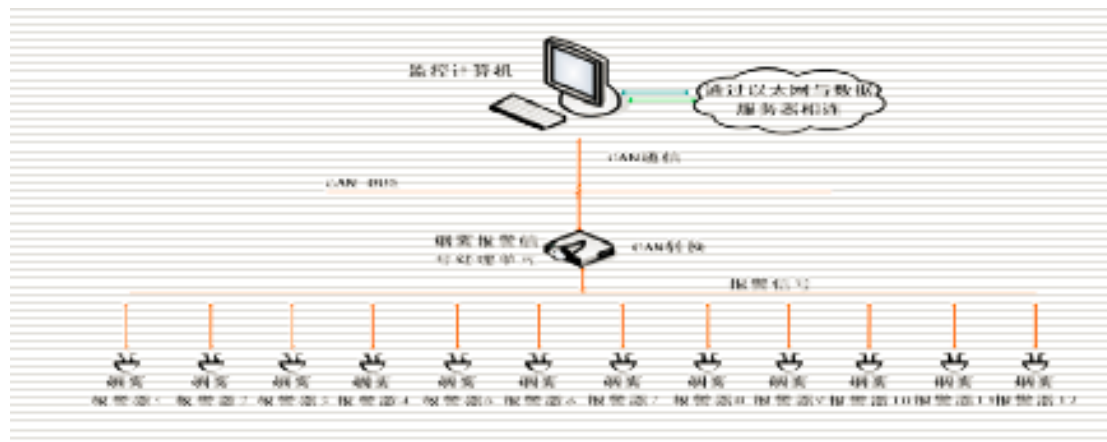
- Charging monitoring: real-time monitoring of the battery, charger and electricity supply system.
- Electric vehicle status monitoring: the inspection and the scheduling system for remote monitoring of electric vehicles and batteries.
- Smoke detection and monitoring system in the charging station





Charging safety technology

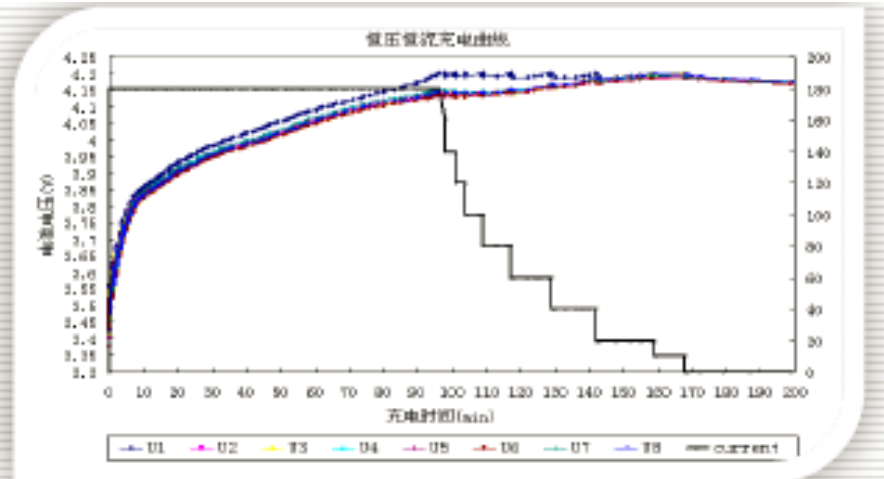
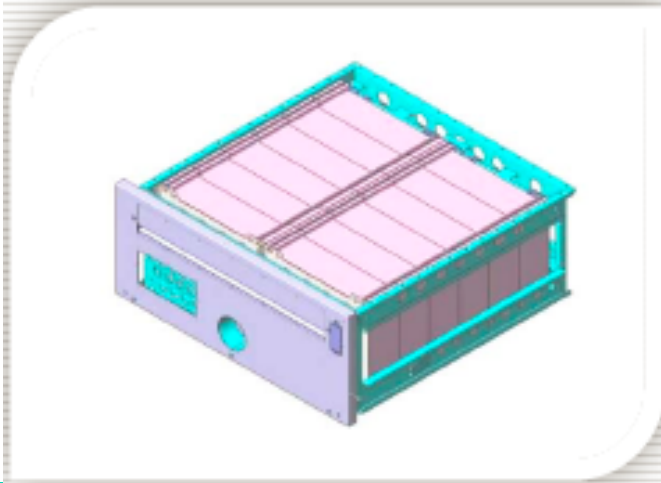
- Closed loop control for charging management, to prevent the potential damage of single cell.
- Battery pack resistance detection : real-time test after the pack assembled in the vehicle





Charging safety technology

- Structure safety technology of power battery pack
 - Double layer plate structure, isolation between electric parts and battery;
 - Inner insulation layer, insulating material roller, insulation fixed etc.
 - Inner pack with security architecture
- Multilevel insulating with car body and the battery holder.





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EV Charging Standards in China

- China has published 19 related standards , including 7 national standards , 10 enterprise standard of National Grid(6 enterprise standard have been released) and 2 military standards.



EV Charging Standards in China

- GB/T 18487.1-2001 Electric vehicle conductive charging system Part 1:General requirement
- GB/T 18487.2-2001 Electric vehicle conductive charging system Part 2:Electric vehicles requirements for conductive connection to an AC/DC supply
- GB/T 18487.3-2001 Electric vehicle conductive charging system Part 3:AC/DC Electric vehicle charging station

These standards equivalent to IEC 61851, they are the first electric vehicles charging station standards have been formulated of china . At that time the electric vehicles industry has not been developed , so there are some provisions of the standards are fuzzy or unsuitable , most of the provisions are aimed at electric vehicles and charger , the requirement of charging stations is little.



EV Charging Standards in China

- **Q/GDW 235-2009 Electric vehicle off-board charger Communication protocol**

Standard specifies the communication protocol of off-board charger , including the communication frame format , data encoding and transmission rules of charger and BMS, charger and charging monitoring system.

- **Q/GDW 236-2009 Electric vehicle charging station General technical requirements**

Standard specifies the functional requirement, technical requirements, safety requirements, marks and logos of the electric vehicle charging station.

- **Q/GDW 237-2009 Electric vehicle charging station Guide of layout design**

Standard specifies the location principle and inside layout requirements of electric vehicle charging



EV Charging Standards in China

- **Q/GDW 238-2009 Electric vehicle charging station Power supply system specification**

Standard specifies the requirements of technical ,safety, environment of electric vehicle charging stations dedicated power supply system.

- **Electric vehicle charging station Charging monitoring system**

Standard specifies the basic composition, function requirements and technical requirements of charging monitoring system.

- **Electric vehicle off-board charger Metering requirement**

Standard specifies the technical requirements of off-board charger DC energy metering section.

- **Electric vehicle on-board charger Meter requirement**

Standards specifies the energy metering function and related technical requirements of electricity power facilities for on-board charger (AC input : 220V, $\leq 30A$) .



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Summary

- China highly emphasize the EV research development and demonstration.
- Different charging modes are applied in China.
- Charging infrastructure is to be built soon to fit for the electric vehicle development.



Thanks for your attention !

