EV infrastructure and standardization in China

State Grid Corporation of China
Otc.2013
1 Overview of EV infrastructure construction
2 Standardization of EV infrastructure in China
3 Comparison of EV infrastructure Standards
Overview - types of infrastructure

EV infrastructure

Charging
- On-board charging
  - AC Charging spot
  - Private car
- Off-board charging
  - DC charger
  - Private car Public bus

Battery swap
- Commercial vehicle
  - Side-swapping
  - Public bus Sanitation vehicle
- Passenger car
  - Rear-swapping
  - Bottom-swapping
  - Private car Taxi
### Overview-AC charging spot

#### AC Charging Spot

<table>
<thead>
<tr>
<th>Item</th>
<th>Spec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupler</td>
<td>GB</td>
</tr>
<tr>
<td>UI</td>
<td>LCD / LED / VFD Keyboard</td>
</tr>
<tr>
<td>Billing</td>
<td>RFID / IC card</td>
</tr>
<tr>
<td>Power</td>
<td>AC 220V (380V) 50Hz ± 1Hz</td>
</tr>
<tr>
<td>Output-U</td>
<td>single-phase ,220V ± 10%</td>
</tr>
<tr>
<td>Output-I</td>
<td>≤ 32A</td>
</tr>
<tr>
<td>IP</td>
<td>IP55</td>
</tr>
<tr>
<td>Communication interface</td>
<td>RS485 / 2G / 3G</td>
</tr>
<tr>
<td>Installation</td>
<td>Pillar/Wallbox</td>
</tr>
</tbody>
</table>
### Overview - DC Charger

#### DC Charger

<table>
<thead>
<tr>
<th>Item</th>
<th>Spec.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupler</td>
<td>GB</td>
</tr>
<tr>
<td>UI</td>
<td>LCD / LED / VFD Keyboard</td>
</tr>
<tr>
<td>Billing</td>
<td>RFID / IC card</td>
</tr>
<tr>
<td>Power</td>
<td>AC 380V ± 10%, 50Hz - 60Hz</td>
</tr>
<tr>
<td>Output</td>
<td>DC 200-500V, 0-100A DC 300-700V, 0-250(600)A</td>
</tr>
<tr>
<td>Efficiency (50%-100% load)</td>
<td>≥92%</td>
</tr>
<tr>
<td>IP</td>
<td>IP55</td>
</tr>
</tbody>
</table>
Overview - battery swap station

【Battery swap station】

Side-swapping: applicable to commercial electric vehicles such as buses and sanitation trucks which have battery packs installed in both sides of the vehicle body.

Rear-swapping: applicable to electric passenger vehicles such as private cars and taxis, with battery packs installed in the trunk of the vehicle body.

Bottom-swapping: applicable to electric passenger vehicles such as private cars and taxis, with battery packs installed in the chassis of the vehicle body.
Up to Jun. 2013, **SGCC** has built **383** charging stations/battery swap stations and **15,333** AC charging spots.
Overview - main supplier

Up to the end of 2012, **CSG** has built **18** charging stations/battery swap stations and **3,229** AC charging spots.
Up to the end of 2012, Potevio has built 74 charging stations.
Overview—summary of NEV

Application of new energy vehicles in China

- **pilot city**
- **nationwide**

<table>
<thead>
<tr>
<th>Year</th>
<th>Pilot City</th>
<th>Nationwide</th>
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</thead>
<tbody>
<tr>
<td>2012.12</td>
<td>27,400</td>
<td></td>
</tr>
<tr>
<td>2013.03</td>
<td>39,800</td>
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</tr>
<tr>
<td>2013.07</td>
<td>49,700</td>
<td>60,000</td>
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</tbody>
</table>
Comparison of the standard structure between ISO/IEC and China
# Standardization

## Corresponding of the standard

<table>
<thead>
<tr>
<th>ISO/IEC</th>
<th>China</th>
</tr>
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<tbody>
<tr>
<td><strong>System</strong></td>
<td></td>
</tr>
<tr>
<td>IEC 61851</td>
<td>GB/T 18487-2001</td>
</tr>
<tr>
<td></td>
<td>GB/T 27930-2011</td>
</tr>
<tr>
<td><strong>Interface</strong></td>
<td></td>
</tr>
<tr>
<td>IEC 62196</td>
<td>GB/T 20234-2011</td>
</tr>
<tr>
<td><strong>Communication</strong></td>
<td></td>
</tr>
<tr>
<td>ISO 15118</td>
<td>GB/T 27930-2011</td>
</tr>
<tr>
<td></td>
<td>Q/GDW 397-2009</td>
</tr>
<tr>
<td></td>
<td>Q/GDW 398-2009</td>
</tr>
<tr>
<td></td>
<td>Q/GDW 399-2009</td>
</tr>
<tr>
<td><strong>Battery swap</strong></td>
<td></td>
</tr>
<tr>
<td>IEC 62840</td>
<td>GB/T 29317</td>
</tr>
<tr>
<td></td>
<td>Q/GDW 486-2010</td>
</tr>
<tr>
<td></td>
<td>Q/GDW 487-2010</td>
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<tr>
<td></td>
<td>Q/GDW 488-2010</td>
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<td>Q/GDW 685-2011</td>
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<tr>
<td></td>
<td>Q/GDW 686-2011</td>
</tr>
<tr>
<td>No</td>
<td>Publish No</td>
</tr>
<tr>
<td>----</td>
<td>--------------</td>
</tr>
<tr>
<td>1</td>
<td>GB/T 20234.1-2011</td>
</tr>
<tr>
<td>2</td>
<td>GB/T 20234.2-2011</td>
</tr>
<tr>
<td>3</td>
<td>GB/T 20234.3-2011</td>
</tr>
<tr>
<td>4</td>
<td>GB/T 27930-2011</td>
</tr>
<tr>
<td>5</td>
<td>GB/T 28569-2012</td>
</tr>
<tr>
<td>6</td>
<td>GB/T 29317-2012</td>
</tr>
<tr>
<td>7</td>
<td>GB/T 29318-2012</td>
</tr>
</tbody>
</table>

(18 Industry Standards and 37 Enterprise Standards are published or being prepared.)

Maintenance of **GB18487.1 Electric vehicle conductive charging system Part1: General requirement** *(kick-off meeting 2013.09.02)*

Milestone: 2013.12 1st WD, 2014.03 2nd WD, 2014.05 CD, 2014.09 FDIS
AC charging coupler

- **Mode 1** connection: normal socket-outlet charging
- **Mode 2** connection: normal socket-outlet with in cable control box
- **Mode 3** connection: dedicated AC charging spot

China: Mode 2 and Mode 3 connection with single-phase (32A) power supply are recommended, three-phase is under consideration.
# Comparison - AC charging coupler

<table>
<thead>
<tr>
<th></th>
<th>IEC 62196-2:2010</th>
<th>GB 20234.2-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type1-U.S</strong></td>
<td></td>
<td>China</td>
</tr>
<tr>
<td><strong>Type 2-Germany</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type 3-Italy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Phase</strong></td>
<td>Single phase</td>
<td>Single phase</td>
</tr>
<tr>
<td><strong>Current</strong></td>
<td>32A (80A U.S)</td>
<td>70A/63A</td>
</tr>
<tr>
<td><strong>Voltage</strong></td>
<td>250V</td>
<td>480V</td>
</tr>
<tr>
<td><strong>Pin &amp; interlock</strong></td>
<td>5-pin, mechanical lock</td>
<td>7-pin, electronic lock</td>
</tr>
<tr>
<td><strong>Control pilot pin</strong></td>
<td>Two short pins</td>
<td>One short pin, one long pin</td>
</tr>
<tr>
<td><strong>Male &amp; female pin</strong></td>
<td>Plug: male</td>
<td>Plug: male</td>
</tr>
<tr>
<td><strong>Vehicle connector</strong>: female</td>
<td>Vehicle connector: female</td>
<td>Vehicle connector: male</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
</tbody>
</table>
Comparison-DC charging coupler

Japan proposal → CHAdeMO

China proposal → GB/T 20234 Connection set for conductive charging of electric vehicles

Germany proposal → AC & DC Combo coupler

Japan

China

Europe/US
## Communication Protocol

<table>
<thead>
<tr>
<th>Physical layer</th>
<th>Link/Network layer</th>
<th>International:</th>
<th>China:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>PLC</td>
<td>CAN BUS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>IP Based</td>
<td>CAN</td>
</tr>
</tbody>
</table>

## PWM pilot control

<table>
<thead>
<tr>
<th>EVSE side</th>
<th>Voltage detection</th>
<th>International:</th>
<th>China:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Voltage detection</td>
<td>Current detection</td>
</tr>
</tbody>
</table>
Thank you for your attention!