LARGE SCALE CHARGING OF ELECTRIC VEHICLES

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The mega cities in China

- There are 19 million people living in Beijing
- There are over 5 million cars
“Diseases triggered by indoor and outdoor air pollution kill 656,000 Chinese citizens each year”

World Health Organization
1,000,000 EVs on the road by 2015!

**BYD e6**

From Wikipedia, the free encyclopedia

**BYD e6** is an all-electric crossover car manufactured by BYD Auto with a range of 300 km (186 mi) according to the Carmaker.[1] Field testing began in China in May 2010 with 40 units operating as taxis in the city of Shenzhen.[2] Sales to the general public began in Shenzhen on October 26, 2011, after over two years behind schedule (the original release date was in 2009).[3][4]

BYD plans to sell the e6 model in the U.S. for US$35,000 before any government incentives.[5] After re-scheduling the U.S. launch several times, in October 2011 BYD announced that sales to retail customers will be delayed at least for 18 months due to the lack of charging infrastructure.[6]
China has offered several incentives to boost the development of electric and hybrid cars, including subsidies of 120,000 yuan on the purchase of the battery-powered e6 MPV produced by Shenzhen-based BYD.
The need of large scale charging
Charging with renewable energy
## Type of chargers

<table>
<thead>
<tr>
<th>Power supply</th>
<th>Voltage</th>
<th>Max current</th>
<th>Charging time</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 phase 3kW</td>
<td>230 VAC</td>
<td>16A</td>
<td>6-8 hours</td>
</tr>
<tr>
<td>1 phase 7kW</td>
<td>230 VAC</td>
<td>32A</td>
<td>3-4 hours</td>
</tr>
<tr>
<td>3 phase 10kW</td>
<td>400 VAC</td>
<td>16A</td>
<td>2-3 hours</td>
</tr>
<tr>
<td>3 phase 24kW</td>
<td>400 VAC</td>
<td>32A</td>
<td>1-2 hours</td>
</tr>
<tr>
<td>3 phase 43kW</td>
<td>400 VAC</td>
<td>63A</td>
<td>20-30 min</td>
</tr>
<tr>
<td>DC 50kW</td>
<td>400-500 VDC</td>
<td>100-125A</td>
<td>20-30 min</td>
</tr>
</tbody>
</table>
EMS architecture for large scale charging

Network switched charging

Unmanaged charging
Results and activities

- Patent (provisional): EMS architecture, scheduling algorithms, and pricing mechanisms
- Funding (NSF-CREATIV)
- Industrial interests
Summary of features

- Network switched charging
- Deadline differentiated service and pricing
- Optimal online scheduling
- Optimized pricing and admission control
Profit vs. price at different traffic levels