SUSTAINABLE DEVELOPMENT STRATEGY FOR EV BATTERY

TOM ZHAO
Managing Director
What are WE facing today?
What can BYD do?
What can WE do more?
WHAT ARE WE FACING TODAY?

LFP & NMC is the mainstream of the market
BYD ED Roadmap
Rapid Growth of Lithium-ion Battery
Cobalt price increased by leaps and bounds
LFP & NMC is the mainstream of the market

Source: Bloomberg New Energy Finance
LFP & NMC is the mainstream of the market

Source: Bloomberg New Energy Finance
LFP vs NMC

Source: Bloomberg New Energy Finance
Rapid Growth of Lithium-ion Battery

Source: Bloomberg New Energy Finance. Note: Assumes 100% of stationary is lithium-ion.
Cobalt would meet shortage sometime later

Source: Bloomberg New Energy Finance, press releases, Avicenne, USGS, IDTechEX, Wealthdaily

Note: CE refers to consumer electronics, E-bus refers to electric buses
Cobalt Price increased more than 3 times in one year

Source: cbcle.com
Cobalt is the most fluctuations factor for NMC battery

Percentage change in commodity price (%)

Source: Bloomberg New Energy Finance. Note: NMC chemistry modelled here is NMC (111). NMC battery pack cost is $223/kWh.
WHAT CAN BYD DO?
BYD Strategy

- Technology
- Upgrading on NMC
- Repurpose & Recycling
- Strong Tech. Backup-LFP
Technology
Upgrading on NMC

Repurpose & Recycling

Strong Tech. Backup-LFP
Forecast mass of used batteries coming out of electric vehicles

- Notes: ONLY EV
- Source: Bloomberg New Energy Finance

Battery Data

| Mass of a 24kWh battery pack | 0.29 tonnes |
| Energy content of a tonne of batteries | 83 kWh |

Unit: tonne

311,000 tonne = 25GWH
Battery Repurpose & Recycling

- Disassembly & Refine
- Cell Material
- Other Uses
- Assembly
- Module
- +Retired
- xEV Battery System
- Integrate
Baolong, Shenzhen
Capacity: 15MW/30MWH
Area: 1800 m²
Working Condition: 3 cycle/day 0.5C
Operating time: 1700+cycles
SOC range: 10%-100%

Changsha Plant
Capacity: 10MW/22.6MWH
Area: 2500 m²
Working Condition: 2 cycle/day 0.3C
Under Construction
Repurpose - Communication Base Station

Capacity: 48V/150Ah,  Load: 70A

Capacity: 48V/600Ah  Load: 60A
Repurpose - AGV

AGV (Automatic Guided Vehicle)
Capacity: 12V/150Ah; 24V/150Ah
Raw Material Recycling

Battery disassembling take 3 steps

1. Disassembling
   - Battery disassembling automatically
   - Separation of battery components
   - Positive & negative plate drying & deodorization.

2. Material Recycling
   - Graphite elution, copper foil recycling
   - The positive material desorption, aluminum foil recycling

3. Regeneration
   - Graphite removing impurity, cladding, regeneration and activation
   - Lithium iron phosphate regeneration: lithium extraction, precursor preparation
   - NMC elements extraction and regeneration
Table 3: Metal content of a 24kWh NMC battery

<table>
<thead>
<tr>
<th>Metal</th>
<th>Kg per battery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper</td>
<td>31</td>
</tr>
<tr>
<td>Aluminium</td>
<td>21</td>
</tr>
<tr>
<td>Cobalt</td>
<td>10</td>
</tr>
<tr>
<td>Nickel</td>
<td>10</td>
</tr>
<tr>
<td>Manganese</td>
<td>9</td>
</tr>
<tr>
<td>Lithium</td>
<td>4</td>
</tr>
</tbody>
</table>

Source: Bloomberg New Energy Finance
Gap in the Future

Notes:
1. Supposed battery recycling volume equal battery used volume that year
2. Supposed 24 kWh battery contains 10 kg cobalt
3. Supposed 24 kWh battery contains 0.29 tonnes
4. Supposed cobalt recycling rate is 95%
Technology
Upgrading on NMC

Repurpose & Recycling

Strong Tech. Backup - LFP
## Chinese Government Subsidy Policy

<table>
<thead>
<tr>
<th>Item</th>
<th>2017 China national subsidy standards</th>
<th>2018 China national subsidy standards</th>
<th>Change</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recharge Mileage</td>
<td>100≤R&lt;150</td>
<td>20</td>
<td>/</td>
<td>Cancel subsidies</td>
</tr>
<tr>
<td></td>
<td>150≤R&lt;250</td>
<td>36</td>
<td>15</td>
<td>-58.3%</td>
</tr>
<tr>
<td></td>
<td>200≤R&lt;250</td>
<td></td>
<td>24</td>
<td>-33.3%</td>
</tr>
<tr>
<td></td>
<td>250≤R&lt;300</td>
<td></td>
<td>34</td>
<td>-22.7%</td>
</tr>
<tr>
<td></td>
<td>300≤R&lt;400</td>
<td></td>
<td>45</td>
<td>2.2%</td>
</tr>
<tr>
<td></td>
<td>R≥400</td>
<td></td>
<td>50</td>
<td>13.6%</td>
</tr>
<tr>
<td>R≥250</td>
<td>150≤R&lt;200</td>
<td></td>
<td></td>
<td>1. More detailed grading, from three Levels to five Levels.</td>
</tr>
<tr>
<td></td>
<td>200≤R&lt;250</td>
<td></td>
<td></td>
<td>2. The threshold of recharge mileage increased to 150 km.</td>
</tr>
</tbody>
</table>

Source: VehicleTrend
Driving Demand

80km /day * 5 days = 400 km is enough for daily driving

One Week Drive without Additional Charge

Zero Range Anxiety for **400KM**
BYD EV Recharge Mileage

- Environmentally-Friendly Battery
- 140 kph
- 400 km

- Zero Emission
- 500 km Range
- 1 Hour Rapid Charging
- It's Not Only What You Drive, It's The Way You Live
- Fire Safe
WHAT CAN WE DO MORE ON LFP?
BYD Commercial Vehicle
THANK YOU