Success of 2- & 3-wheelers in Asia

- >550 million two- and three-wheelers in Asia by 2035
- Growth rates in India and China: ~11% p.a.

Photo credits: Benoit Colin, EMBARQ

Bangalore, India
E-Bikes Sales in China

1998: 40,000

2005: 10 million
Convenient, Independent and Fast

- Less labor-intensive than cycling or walking
- Door-to-door mobility
- Independent from schedules and routes
- Flexible in congested roads
- Faster than alternatives
- Less space requirements for parking than four-wheelers
Poor Public Transport

- Rapid population growth
- Congestion in mixed traffic
- Loss of productive time
Poor Public Transport

- Long walking distances to stations
- High fares
- Long waiting time in crowded station
- Overcrowded vehicles
Efficient and Cost-effective

Middle-income households

Trips under 10km

Photo credits: Zhou Jia, EMBARQ

Hangzhou, China
## Cost-effectiveness

<table>
<thead>
<tr>
<th></th>
<th>Unit Cost</th>
<th>Rate of Impact</th>
<th>Cost per 100 pax-km (in US$)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>E-Bike</td>
</tr>
<tr>
<td><strong>Purchase price</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Battery Costs</td>
<td>0.34</td>
<td>0.34</td>
<td>0.50</td>
</tr>
<tr>
<td>Electricity (use phase only)</td>
<td>0.10</td>
<td>0.10</td>
<td>0.56</td>
</tr>
<tr>
<td>Gasoline (use phase only)</td>
<td>4.42</td>
<td>4.42</td>
<td>0.56</td>
</tr>
<tr>
<td>Fare</td>
<td>6.50</td>
<td>6.50</td>
<td>0.19</td>
</tr>
<tr>
<td><strong>Total cost per 100 passenger kilometer traveled</strong></td>
<td>30.40</td>
<td>27.53</td>
<td>12.42</td>
</tr>
</tbody>
</table>

Source: changed according to Cherry, 2007
China: government ban for gasoline-powered two-wheelers
No tailpipe emissions from e-bikes
Source of emissions is outside city
## Emissions

<table>
<thead>
<tr>
<th></th>
<th>Energy Use (kWh/100 pax-km)</th>
<th>CO₂ (g/pax-km)</th>
<th>SO₂ (g/pax-km)</th>
<th>PM (g/pax-km)</th>
<th>NOₓ (g/pax-km)</th>
<th>Lead (g/pax-km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>140</td>
<td>306</td>
<td>0.689</td>
<td>0.277</td>
<td>1.32</td>
<td>0.299</td>
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<tr>
<td>Bus</td>
<td>13.06</td>
<td>48.4</td>
<td>0.022</td>
<td>0.065</td>
<td>0.270</td>
<td>0.005</td>
</tr>
<tr>
<td>BSEB*</td>
<td>6.12</td>
<td>22.08</td>
<td>0.123</td>
<td>0.125</td>
<td>0.027</td>
<td>0.710</td>
</tr>
<tr>
<td>SSEB**</td>
<td>8.42</td>
<td>30.44</td>
<td>0.164</td>
<td>0.175</td>
<td>0.020</td>
<td>1.013</td>
</tr>
</tbody>
</table>

*BSEB = bicycle-style electric bike
**SSEB = scooter-style electric bike

Source: changed according to Cherry, 2007
No distinction between different types of e-bikes

Road Transportation Safety Law classifies e-bikes as non-motorized vehicles

Lack of safety regulations (e.g. helmet enforcement, licensing, speed limits...)

Shanghai, China
E-bike drivers with a history of at-fault accident during the previous year in Beijing and Hangzhou (2011)

Source: changed according to Yao and Wu, 2011
Increase of e-bike related fatalities by almost six times between 2004 and 2008
What do we need?

- Definitions and Data for different types of e-bikes
- Safety regulations
- More renewable energies for power generation
- Regulations and incentives for battery disposal/recycling
- Improvements in PT and NMT that address mobility needs (reliability, affordability, connectivity, efficiency, safety)
Contact

Katrin Eisenbeiß

k.eisenbeiss@gmx.de

@KEisenbei

katrin.eisenbeiss