E-mobility of 2 and 3 wheelers: Copenhagen, Paris & Delhi

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Introduction

- How do 2/3 E-Mobility deployments compare across cities in developed and emerging markets?
- What are the lessons learned for each city?
- How can we scale such project globally?

Approach

Electric 2/3 Wheelers

Developed Markets

Emerging Markets

Bycyklen Pedelec Sharing System

Velib Pedelec Sharing System

Private Taxi E-Rickshaw System

Systems

Scale, Economics & Regulation

<table>
<thead>
<tr>
<th></th>
<th>Copenhagen</th>
<th>Paris</th>
<th>Delhi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of e-vehicles</td>
<td>1860 / 105</td>
<td>5460 / 1229</td>
<td>500</td>
</tr>
<tr>
<td>Vehicles / Stations</td>
<td></td>
<td></td>
<td>/ free floating</td>
</tr>
<tr>
<td>Usage</td>
<td>~1 mil rents in 2016</td>
<td>~20 mil rents in 2017</td>
<td>500 mil rents in 2017</td>
</tr>
<tr>
<td>Passengers/users per day per vehicle</td>
<td>1.4</td>
<td>10-15</td>
<td>18</td>
</tr>
<tr>
<td>Vehicle capital cost (Euro)</td>
<td>~2.300</td>
<td>~2800</td>
<td>~1000-1500</td>
</tr>
<tr>
<td>Price per km or per hour per passenger (E)</td>
<td>4</td>
<td>1</td>
<td>0.20</td>
</tr>
<tr>
<td>Hourly price over hourly GDP per capita</td>
<td>17 %</td>
<td>6 %</td>
<td>25 %</td>
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Regulation / licensing

- License until 2021 by City administration
- City government awarded the concession
- Mildly regulated from 2014 - low compliances

Capacities & Technology

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<tbody>
<tr>
<td>Road space consumption (w.r.t. car)</td>
<td>9 %</td>
<td>9%</td>
<td>80 %</td>
</tr>
<tr>
<td>Transport capacity - people</td>
<td>1</td>
<td>1</td>
<td>4-5</td>
</tr>
<tr>
<td>Transport capacity - goods - Kg</td>
<td>15</td>
<td>15</td>
<td>25</td>
</tr>
<tr>
<td>Integration with public transport</td>
<td>Free Transport &amp; Travel planner App</td>
<td>no</td>
<td>Serves as feeder for metro (S-bahn)</td>
</tr>
<tr>
<td>Electric Motor type - in Watts</td>
<td>250</td>
<td>250</td>
<td>650-1400 DC</td>
</tr>
<tr>
<td>Battery type</td>
<td>37V 10 Ah Li-ON</td>
<td>36V 8.8 Ah Li-ON</td>
<td>12V 100Ah VRLA</td>
</tr>
<tr>
<td>Range km</td>
<td>25</td>
<td>50</td>
<td>90-100</td>
</tr>
<tr>
<td>Speed boost (km/hr)</td>
<td>+22</td>
<td>+25</td>
<td>25</td>
</tr>
<tr>
<td>Vehicle weight kg</td>
<td>30</td>
<td>25</td>
<td>300</td>
</tr>
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Lessons Learned per E-Mobility System

- Price
  - Promote the low costs in comparison to MIT
  - Integration in PT supports Bike & PT
  - Subsidies
  - Integration of smartphones required rather than usage of an integrated tablet
  - Subsidies can only be justified by reduction of MIT –accompanying research about effects on MIT required
  - Network Density
    - Network density needs to be higher to increase rentals

- Network Density
  - Critical mass of stations and pedelecs enables high adoption
  - Integration into Urban Identity
    - Design elements and visibility on streets makes Velib part of daily life
  - Smartphone integration
    - Users can charge their smart devices on the move

- Safety & Security
  - Safety accessories (Helmet, knee pad…) required
  - User-friendliness
    - Descriptive subscription scheme required

- Bottom up innovation
  - Grass-root innovation can solve large scale problems
  - Low policy interference
  - Job creation
    - New technologies can lead to increase in employment and social empowerment

- Importance of training
  - Lack of institutional mechanisms for training can compromise safety
  - E.g. education instead of penalties

- Infrastructure development
  - New means of transport require supporting infrastructure (like lanes, parking spots) otherwise they may lead to chaos

Best Practices for Global Scalability & Discussion

- High population density and low private vehicle ownership support adoption.
- Electric mobility is viable and scalable for both high and low per capita income economies, if adapted to local conditions.
- Infrastructure development and integration of the system in city scale promotes acceptance and usage.
- Such systems can be implemented with a sustainable business model through corporations or individual entrepreneurs.

References

1. The article of The Indian Express 'E-rickshaws: Pedelec System: A Case Study' http://www.thehindu.com/reprint/telugu/1000925/article6488517.ece

TU Campus EUREF Student Poster

www.mobility2grid.de