Trolleybuses
the forgotten experience in electromobility

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A diesel-electric testbus from Evobus visited Szeged (en route to Bucharest) in July 2010, with a conference: "Hybrid buses in public transport."
What is electromobility?

According to the car industry (car culture…):

...instead according to sustainable future (urban culture…)

Efficient in Public Transport – Serial Hybrid Traction Systems

Electromobility
The central premise is simple:

- oil dependence problem
- CO₂ emission reduction

Source of energy
Source of energy

Who has the oil?

Diesel and gas prices are not in our control...
Rich history of trolleybus – since 1882

We are standing on solid grounds.
But who is advocating for trolleybuses?
Arguments

Energy cost / passenger / 100 km

<table>
<thead>
<tr>
<th>Mode</th>
<th>Energy Cost (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel cell</td>
<td>2.2</td>
</tr>
<tr>
<td>Fuel cell hybrid</td>
<td>0.74</td>
</tr>
<tr>
<td>Serial hybrid</td>
<td>1.21</td>
</tr>
<tr>
<td>Parallel hybrid</td>
<td>0.52</td>
</tr>
<tr>
<td>Diesel</td>
<td>0.4</td>
</tr>
<tr>
<td>Gas</td>
<td>0.44</td>
</tr>
<tr>
<td>Battery</td>
<td>0.35</td>
</tr>
<tr>
<td>Duo (Diesel)</td>
<td>0.26</td>
</tr>
<tr>
<td>Duo (Battery)</td>
<td>0.21</td>
</tr>
<tr>
<td>Trolleybus</td>
<td>0.43</td>
</tr>
</tbody>
</table>

Note: With pump station and with catenary options are indicated in the graph.

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**Fuel cell**

**Fuel cell hybrid**

**Serial hybrid**

**Parallel hybrid**

**Diesel**

**Gas**

**Battery**

**Duo (Diesel)**

**Duo (Battery)**

**Trolleybus**
Arguments

Battery replacement: every 2 years

No experience yet

Fuel cell hybrid
Serial hybrid
Parallel hybrid
Diesel
Gas
Battery
Duo (Diesel)
Duo (Battery)
Trolleybus

Year
Arguments

Capacity

<table>
<thead>
<tr>
<th>Fuel cell</th>
<th>Fuel cell hybrid</th>
<th>Serial hybrid</th>
<th>Parallel hybrid</th>
<th>Diesel</th>
<th>Gas</th>
<th>Battery</th>
<th>Duo (Diesel)</th>
<th>Duo (Battery)</th>
<th>Trolleybus</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>50</td>
<td>190</td>
<td>190</td>
<td>140</td>
<td>140</td>
<td>130</td>
<td>150</td>
<td>150</td>
<td>190</td>
</tr>
</tbody>
</table>

Without hills

High mass, low capacity
## Energy and emissions

<table>
<thead>
<tr>
<th></th>
<th>Trolley</th>
<th>DIESEL</th>
<th>CNG</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DIRECT ENERGY</strong>&lt;br&gt;(MJ/Km)</td>
<td>8,6</td>
<td>15,0</td>
<td>15,9</td>
</tr>
<tr>
<td><strong>DIRECT EMISSION CO₂</strong>&lt;br&gt;(g/Km)</td>
<td>58</td>
<td>1,092</td>
<td>1,160</td>
</tr>
<tr>
<td><strong>TOTAL ENERGY</strong>&lt;br&gt;(MJ/Km)</td>
<td>16,4</td>
<td>15,8</td>
<td>16,7</td>
</tr>
<tr>
<td><strong>TOTAL EMISSION CO₂</strong>&lt;br&gt;(g/Km)</td>
<td>1,137</td>
<td>1,146</td>
<td>1,218</td>
</tr>
</tbody>
</table>
Infrastructure, as a value

Overhead wires were controversial:

- depends on the country its evaluation
- must be viewed as an advantage! (…being connected…)

Existing trolleybus/tram catenary network is a good jumping point for advanced technologies (battery recharge possibility for hybrids)
- Case Rome: no overhead in the city center.
- Case Gdynia, Budapest, Castellón: bus route under existing wire. (Leipzig? Szeged?)
Szeged, trolleybus development

• Low-floor trolleybuses, new or converted

• New depot maintenance hall and power substations

• New routes
Thank you for the attention!