Realize your vision with Bombardier TALENT 3 BEMU

The Battery Electric Multiple Unit Train

APTA 2019 Rail Conference
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Chief Engineer
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For non-electrified regional lines of up to 100 km, Bombardier’s TALENT 3 battery electric multiple unit (BEMU) offers the best solution in terms of total cost of ownership with significant emission reduction.
## The Bombardier TALENT 3 battery electric multiple unit (BEMU)

The ideal solution for non-electrified lines up to 100 km

<table>
<thead>
<tr>
<th>1. Reduced costs</th>
<th>2. Reduced emissions</th>
<th>3. Reduced noise and vibrations</th>
</tr>
</thead>
<tbody>
<tr>
<td>The TCO of the battery powered</td>
<td>Lowest CO₂ emissions, compared to diesel and fuel cell trains, as well as NOx and particle emissions.</td>
<td>Vibrations and noise emission are reduced by up to 7 decibels, providing passengers with a comfortable ride.</td>
</tr>
<tr>
<td>TALENT 3 train is more than 50% lower than fuel cell Trains and 10% lower than conventional diesel trains</td>
<td></td>
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</tbody>
</table>

### Modular batteries

<table>
<thead>
<tr>
<th>4. Improved operability</th>
<th>5. Avoidance of infrastructure costs</th>
<th>6. Increased passenger comfort</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improved operability due to fleet standardization, new connections and fast recharging.</td>
<td>In comparison to fuel cell trains, infrastructure costs are eliminated or reduced thanks to 100% electrical battery train operation.</td>
<td>Direct connections and the reduction of travel time leads to increased ridership.</td>
</tr>
</tbody>
</table>

For non-electrified lines of up to 100 km, the TALENT 3 BEMU is the best alternative to diesel driven and fuel cell trains, providing unmatchable benefits for both operators and passengers.
1. Reduced costs
Significant lower total cost of ownership over the complete asset lifecycle

Best total cost of ownership and 50% lower than fuel cell trains

<table>
<thead>
<tr>
<th></th>
<th>DMU</th>
<th>Fuel Cell</th>
<th>BEMU</th>
<th>EMU</th>
</tr>
</thead>
<tbody>
<tr>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0%</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

Low cost and fast implementation time

35% lower energy cost* compared to diesel and fuel cell

The TCO of the battery powered TALENT 3 train is best in class and more than 50% lower than a fuel cell train

*Based on Germany’s current energy mix
## 2. Reduced emissions

### Significant reduction of harmful emissions

<table>
<thead>
<tr>
<th>Up to 15% reduced emissions*</th>
<th>Zero emissions with renewable energy</th>
<th>Helping countries reach environmental targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>By using electricity from the catenary, and Bombardier’s MITRAC traction batteries, emissions are significantly reduced in comparison to a standard diesel train.</td>
<td>With 100% green energy coming from water, wind and solar energy, the battery train can operate 100% emission-free.</td>
<td>The TALENT 3 battery train is an excellent alternative to DMUs for non-electrified and partial-electrified networks, helping transit authorities keep environmental commitments and reduce emissions.</td>
</tr>
</tbody>
</table>

### Lowest CO₂ emissions and reduction of NOx and particle emissions.

*Based on Germany’s current energy mix

- DMU = 0.021 kgCO₂ eq/km/seat
- BEMU = 0.018 kgCO₂ eq/km/seat
- Fuel Cell = 0.06 kgCO₂ eq/km/seat
- BEMU = 0.018 kgCO₂ eq/km/seat

- **Zero emissions with renewable energy**
  - With 100% green energy coming from water, wind and solar energy, the battery train can operate 100% emission-free.

- **Helping countries reach environmental targets**
  - The TALENT 3 battery train is an excellent alternative to DMUs for non-electrified and partial-electrified networks, helping transit authorities keep environmental commitments and reduce emissions.

*Based on Germany’s current energy mix
3. Reduced noise and vibrations
Low noise and vibrations increase comfort for travellers and residents

- Additional capsulation of components and systems can be offered as an option to further reduce noise.
- Absence of a diesel engine enables quieter operation with fewer vibrations, increasing passenger comfort.
- Low noise level provides a quiet living environment for people residing near the railway.

Vibrations and noise emission are **reduced by up to 7 decibels**, providing passengers with a comfortable ride.
4. Improved operability
Homogenous fleets and combined networks for more efficient transportation

- Battery trains are able to run on electrified and non-electrified lines. This leads to homogenous fleets with significant advantages in terms of maintenance and driver training.

- Battery trains open new opportunities for traffic planners and operators by combining electrified networks with non-electrified lines, connecting cities and rural areas with the same fleet.

- Batteries are recharged in as little as 7 to 10 minutes, ensuring short stand time and increasing the operational flexibility and efficiency.

Improved operability due to fleet standardization, new connections and fast recharging.
5. Avoidance of infrastructure costs
Battery trains are an excellent alternative to costly electrification

- The battery train connects electrified lines with non-electrified lines, omitting the need for costly electrification infrastructure or additional fuel cell infrastructure.

- Electrification costs heavily rely on the current infrastructure, if terminal stations are electrified, no additional investment for electrification is required for the BEMU to operate.

- The German railway network is up to 60% electrified. The majority (86%) of the remaining 40% of the lines are shorter than 100 km.

Infrastructure costs are eliminated or reduced thanks to 100% electrical battery train operation.
6. Increased passenger comfort
High comfort and direct connections for an enjoyable and convenient journey

- By using the same train on different lines within the network, passengers can benefit from more direct connections.

- Direct connections without longer stops on crossing stations for passenger exchange reduces the travel time significantly and increases the passenger satisfaction level.

- The reduced noise level, passenger info and entertainment systems as well as comfortable interior arrangements ensure a pleasant and relaxing journey for all passengers.

Direct connections and the reduction of travel times leads to increased ridership.
Awarded innovative technology – Bombardier’s battery train
Bombardier wins Brandenburg innovation award in November 2018

This award is a great testament to Bombardier’s accomplishments and commitment to deliver innovative and high-performing products that solve today’s environmental and mobility challenges.
A recent study by TU Dresden proved the TALENT 3 battery train is the most cost-effective and CO₂-free alternative to diesel and fuel cell trains in terms of total cost of ownership over the entire 30-year service life.
Facts and figures
Did you know?

The TALENT 3 battery-train is the first of its kind to enter passenger service in Europe in over 60 years.

Over 960 trains from the TALENT product family have been sold around the world over the last 20 years.

Noise reduction by up to 7 dB compared to conventional DMUs.

With 100% green energy, the battery train is 100% emission-free.
## TALENT 3 battery train

### Germany

### Vehicle data

<table>
<thead>
<tr>
<th><strong>Vehicle type</strong></th>
<th>Battery Electrical Multiple Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Configuration</strong></td>
<td>3-car unit</td>
</tr>
<tr>
<td><strong>Power supply</strong></td>
<td>15 kV AC and MITRAC batteries</td>
</tr>
<tr>
<td><strong>Train length</strong></td>
<td>56,200 mm</td>
</tr>
<tr>
<td><strong>Seats</strong></td>
<td>169</td>
</tr>
<tr>
<td><strong>Bogie</strong></td>
<td>FLEXX Compact</td>
</tr>
<tr>
<td><strong>Battery charging time</strong></td>
<td>7-10 minutes</td>
</tr>
<tr>
<td><strong>Speed</strong></td>
<td>140 km/h</td>
</tr>
<tr>
<td><strong>Max acceleration</strong></td>
<td>1.1 m/s²</td>
</tr>
</tbody>
</table>

### Project history

<table>
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<tr>
<th><strong>Fleet</strong></th>
<th>1 demonstrator train</th>
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<tr>
<td><strong>Status</strong></td>
<td>In testing and homologation phase. By the end of 2019 the commercial test-run operation will begin with Deustche Bahn in the Baden-Wuerteeberg region of Germany.</td>
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</table>
Questions & answers
Thank you very much!

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