TOSA flash-charging e-bus
Enabling emission-free public transport in Geneva

Catenary-free operation and 20-second charging at selected bus stops offers opportunities for the next generation of e-buses which are silent, flexible and emission free.

ABB will provide the core technology including the on-board traction equipment and the fully automatic flash-charging system for an e-bus line in Geneva, Switzerland.

TOSA
The electric bus, named TOSA, looks like a regular trolleybus, except when you look on the roof. Instead of the usual trolley poles which connect overhead lines, this e-bus has a controlled moving arm that connects, in less than a second, to an overhead receptacle integrated into the bus shelter. The high-power flash-charging technology feeds the on-board batteries for 20 seconds, the time it takes for passengers to get on and off the bus. So passengers never have to wait for the bus to charge.

From concept validation to the deployment of the line 23
The first articulated bus (18.75 m length) for 133 passengers ran under real-life operating conditions from May 26, 2013 to end 2014 on a route from Geneva’s airport (terminus) to the nearby Palexpo exhibition centre (flash-charging station). Based on the results, a decision was taken to deploy TOSA on the full line 23 (12 kilometers, 12 buses) in 2018.

Urban mass transportation
Thanks to re-charging along the route, the battery size and weight have been reduced, resulting in increases in both space for passengers and energy efficiency.

High capacity without overhead lines
Depending on the bus route, a flash-charging station is installed at every fourth or fifth stop. This technology eliminates the visual impact of the overhead lines associated with trolleys and reduces noise emissions of diesel buses. By not being bound to the overhead lines the system also offers greater route flexibility. This makes TOSA an ideal solution for urban mass transport.

Comfort, safety and public health
The energy transfer system is designed to ensure passenger comfort as well as health and safety. The direct-contact technology prevents electromagnetic field emissions associated with induction loop charging technologies.
Operating and investments costs
TOSA can be used like trolley- or diesel buses – ie, frequency and stopping times remain unchanged. This is especially important during peak hours and directly impacts costs. Timetables can be maintained without the need for extra operating hours or additional buses.

Four partners, four competencies to achieve sustainable mobility
ABB launched the new electric bus charging system TOSA together with Geneva canton’s public transport operator TPG, the Office for Promotion of Industries and Technologies OPI and the Geneva power utility SIG. TPG operates and maintains a fleet of hundreds of trolleybuses, buses and trams. For the TOSA e-bus, they defined the operating conditions as 20 seconds charging time at stops, automation and high passenger capacity. SIG provided their power grid experience. OPI led the project management in line with the innovation and partners’ roles. ABB developed the concept, the on-board traction equipment and the new type of fully automatic and flash-charging system.

### TOSA demonstrator
- **Operator**: TPG
- **Bus manufacturer**: HESS
- **Bus**: Electric articulated bus
- **Length of the bus**: 18.75 m
- **Passenger capacity**: 133
- **Route**: Geneva’s airport (terminus) to the nearby Palexpo exhibition center (flash-charging station)
- **Timing**: May 26, 2013 - End 2014
- **Kilometers driven**: ~ 11,500 kms
- **Connections**: More than 5,000

- **ABB scope of supply for infrastructure**
  - 13 Flash-charging stations 20 s, 600 kW, 600 VDC
  - 3 Terminus feeding stations 4-5 min, 400 kW, 600 VDC
  - 4 Depot feeding stations 30 min, 45 kW, 500 VDC

- **ABB scope of supply for the buses**: 12 drivetrain solutions, each comprising
  - Automatic energy transfer system (ETS)
  - Battery unit
  - Traction converter with integrated auxiliary converter
  - Two permanent magnet tractions motors

<table>
<thead>
<tr>
<th>TOSA Line 23 order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operator</td>
</tr>
<tr>
<td>Bus manufacturer</td>
</tr>
<tr>
<td>Bus</td>
</tr>
<tr>
<td>Length of the bus</td>
</tr>
<tr>
<td>Passenger capacity</td>
</tr>
<tr>
<td>Route</td>
</tr>
<tr>
<td>Length of the route</td>
</tr>
<tr>
<td>Kilometers driven per year</td>
</tr>
<tr>
<td>Start of operation</td>
</tr>
</tbody>
</table>