

Electric buses
Solutions portfolio

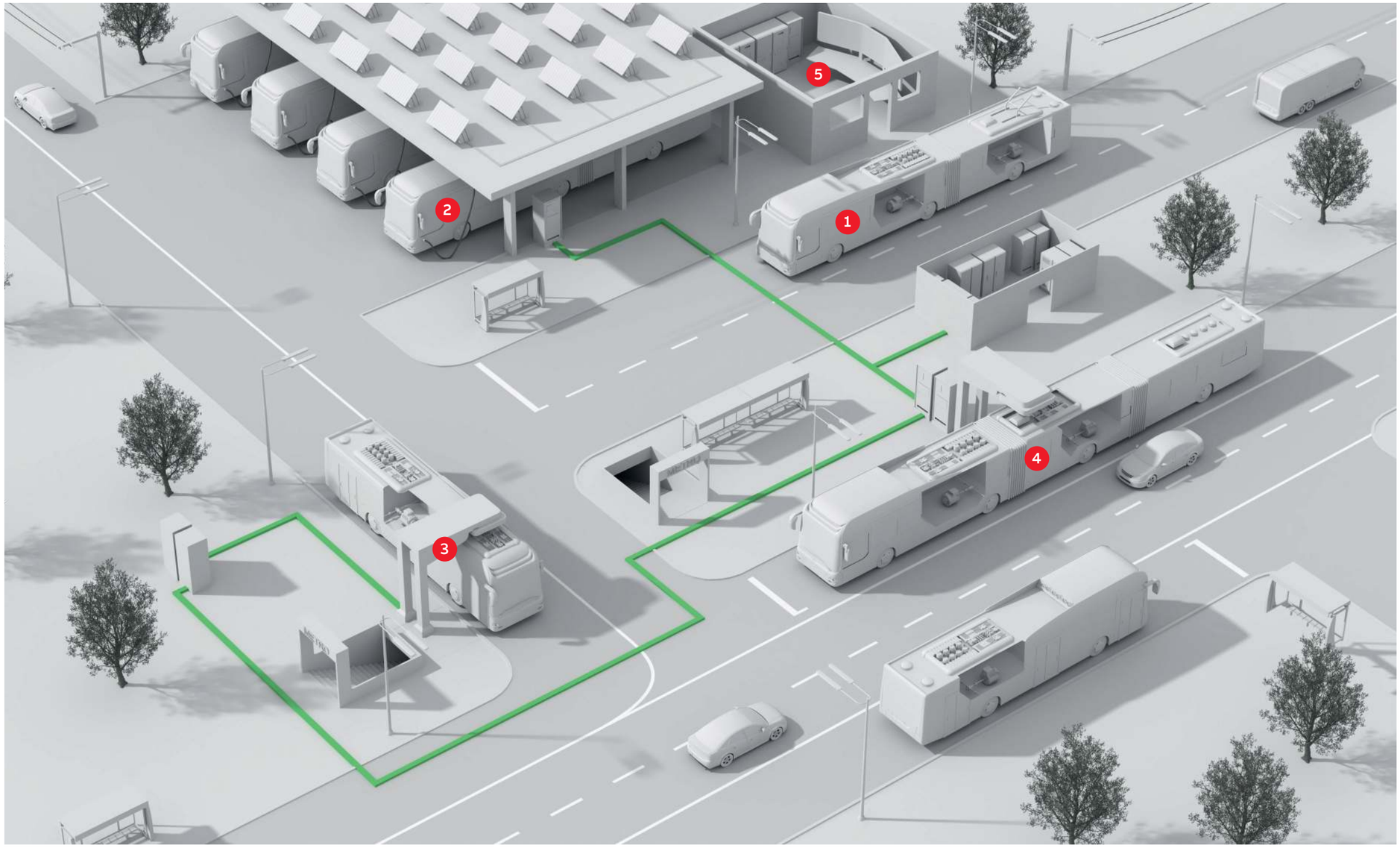
New opportunities for next generation silent, flexible and zero-emission urban mass transportation.

new.abb.com/ev-charging
new.abb.com/grid/technology/tosa

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A complete range of solutions
For your e-bus fleet



1 Catenary-free operation solution for trolley buses

- Drivetrain with batteries and DC/DC converter
- Substation

2 Overnight charging

- Drivetrain and battery pack
- Depot chargers
- Smart charging software

3 Opportunity charging

- Drivetrain and battery pack
- Opportunity charger with pantograph

4 Flash charging

- Drivetrain with battery pack and charging contact
- Depot, terminal and flash-charging infrastructure

5 Control, operation and service

- ABB Ability connected services
- Network Manager SCADA
- Enterprise Asset Management Ellipse Software
- ABB wireless solution
- Maintenance contract
- Service level agreement

From the grid to the wheel
Different solutions for different needs



Overnight charging
Overnight charging allows e-buses to be connected and charged smartly while parked at the bus depot. Chargers can be configured to offer 50 kW to 150 kW of high power fast charging. A single 150 kW charger charges up to 3 buses reducing the total charge load from 450 kW to 150 kW.

- In an overnight session (6 hours) three 300 kWh buses can be fully charged
- Very cost effective solution with the introduction of three low cost, low maintenance charge boxes
- Ability to remotely "wake up" buses for top up charging (100% SOC) and heating & air conditioning
- Supporting all open charging standards globally (CCS and OCPP compliant)
- Flexible design for roof and floor mounting
- Remote diagnostics and management tools

Opportunity charging
OppCharge is an automated fast charging system, which allows electric city buses to drive 24/7, thus enabling true zero emission public transport in cities. With its automated rooftop connection and typical charge time of 3–6 minutes the system can easily be integrated in existing bus lines by installing chargers at endpoints, terminals and/or intermediate stops.

- Charge electric buses in 3–6 minutes
- Easy integration into existing bus lines
- Automated 4-pole rooftop connection
- Based on international IEC 61851-23 standard
- Safe and reliable connection
- Remote diagnostics and management tools
- Modular system
- Power available from 150 kW to 600 kW



Flash charging
The solution called TOSA looks like a regular trolleybus, except when you look on the roof. Instead of the usual trolley poles to 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 is activated and feeds the onboard batteries to 20 seconds as passengers are getting on and off the bus. The bus wastes no time and is ready to leave. TOSA is developed for high-frequency bus routes in key urban areas that carry large numbers of passengers at peak times.

- Fully automated fast charging stations installed at some bus stops
- Catenary-free operation
- 20-second charging time
- Short-range and cost-optimal onboard batteries
- Battery capacity from 70 to 130 kWh
- Solution for 18 and 24 meters buses
- Zero-emission mass transit solution
- No communication required between infrastructures and buses
- Same time table, frequency, quantity of passengers and buses as diesel fleet
- Energy storage for peak shaving can be proposed according to local grid requirements and line operation



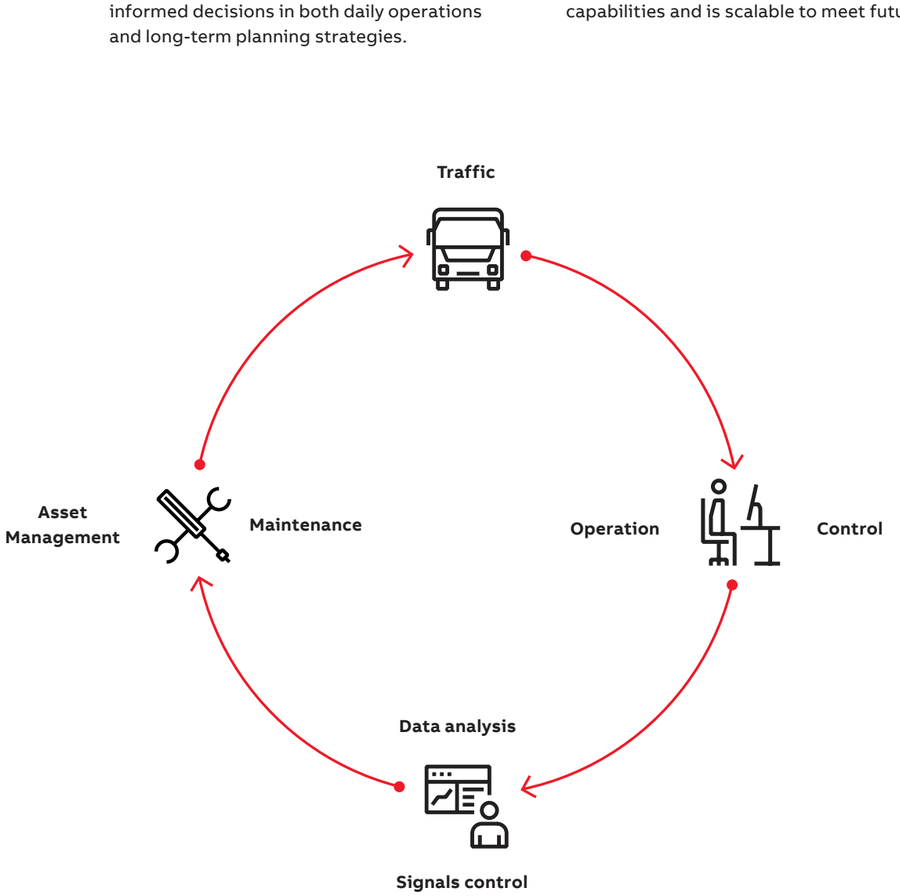
From physical to digital
Control and operation

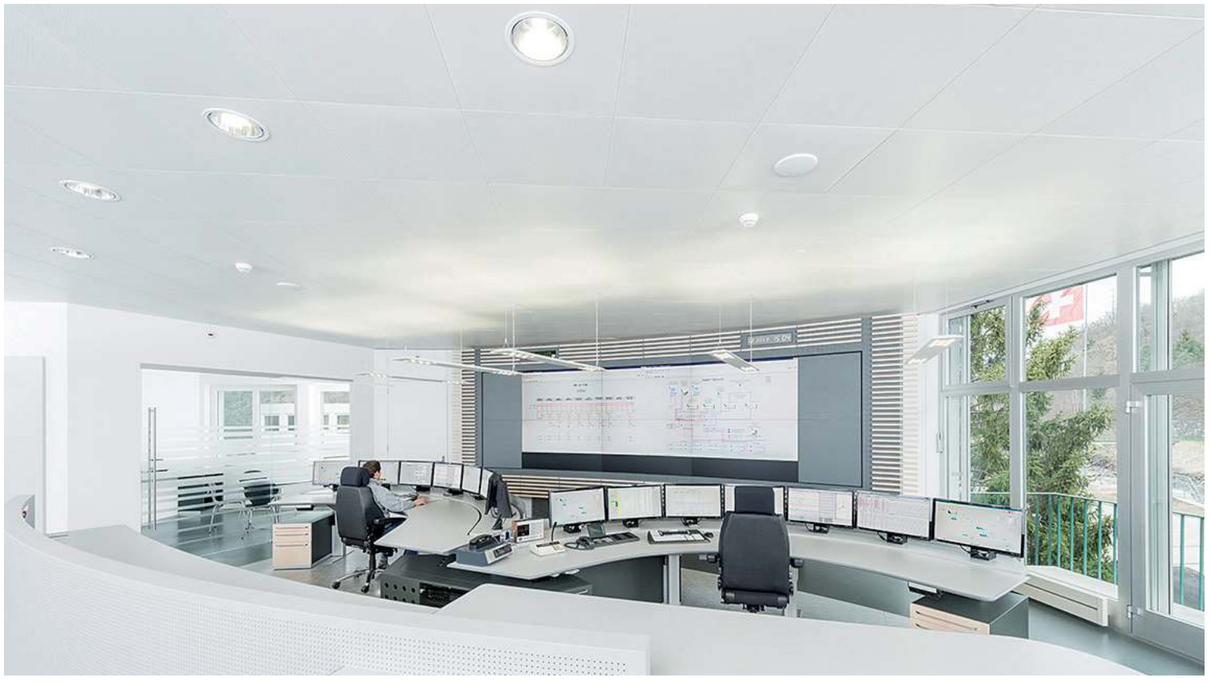
ABB Ability ™
With visibility and connectivity powered by ABB's transportation solutions, you can count on achieving the outcomes that are most vital to your business: safety, reliability, sustainability and long-term prosperity – all of which are critical to the future of our society in general.

ABB has the market's most comprehensive suite of power, prescriptive asset management and inventory solutions. Every day our solutions are enabling operators to make faster, better-informed decisions in both daily operations and long-term planning strategies.

ABB web solutions are on-line management tools providing charging infrastructure operators with real-time status information and usage statistics on their equipment. Web solutions are intended for smaller networks without a back-office and supporting APIs.

They optimize maintenance processes, enable a fast response to fault incidents and better predict maintenance needs. The overall solution is also equipped with remote access and 'cloud' capabilities and is scalable to meet future needs.





— Supporting your operation with our web monitoring platform and our SCADA solutions tailored for your e-bus fleet.

ABB Ability ™ SCADA
The ABB Ability Network Manager SCADA system allows to monitor and control the power network for the charging stations and e-buses, maximizing availability and operational efficiency.

Our ABB Ability based integrated SCADA and Enterprise Asset Management software solution provides you with actionable real-time data and valuable insights to optimize operations and enable predictive maintenance.

This innovative solution will help you to proactively manage and maintain your critical e-bus assets, enabling more timely and effective decisions. In addition to cost optimization, this technology will also result in higher availability and less service interruption for your commuters.

- Proactive monitoring and remote diagnosis
- Certified service teams
- Preventive and corrective maintenance
- Over-the-air software updates and upgrades
- Training programs
- Clear communication and overview via ABB web tools

ABB Ability ™ Ellipse
ABB Ability™ Ellipse is a purpose-built EAM and ERP solution; its detailed equipment, project and costing models create the basis for asset lifecycle management and resource planning. Assets are at the heart of Ellipse, driving data capture and analytics for dependable critical asset availability and risk-balanced outcomes.

Ellipse is a purpose-made solution built upon 35 years' global experience, with a fast path to proven value and best practices embedded online into EAM and ERP.

Ellipse is a driving force in:
- Increasing asset utilization and productivity
- Reducing operating costs
- Mitigating risk
- Meeting regulatory standards for audit compliance
- Allocating skilled resources appropriately

Drivetrain solutions

For solo, articulated and double articulated applications



Integrated drivetrain solutions
ABB provides drivetrain solutions for the buses including integrated traction and auxiliary converters, roof-mounted battery units as well as permanent magnet traction motors.

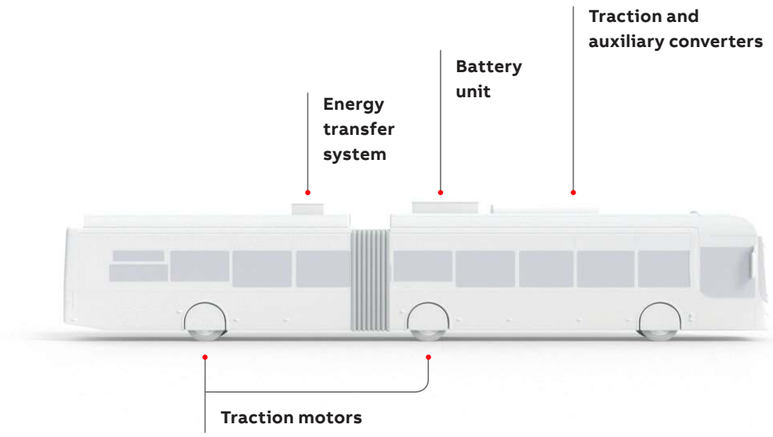
Added value of ABB's platform strategy:

- Highly integrated solution (motor converter, auxiliary converter, battery charger)
- Compact, lightweight design
- Modular platform solution (all in one box) covering all e-bus applications
- Highly energy-efficient



Traction motors
Developed from synchronous motors, ABB's low voltage permanent magnet motors combine the high speed accuracy of synchronous technology with the robust design of induction motors.

They have the capability to deliver very high torque from small motor sizes at low speed, eliminating the need for gearboxes. Additionally, use of synchronous motor technology ensures high efficiency.





OppCharge inverted pantograph
The inverted pantograph connects to a basic rail interface located on the roof of the bus: this reduces the vehicle's overall weight and cost, thereby improving its energy efficiency and increasing passenger capacity.

The fast charging system delivers 300 kW DC output power and will recharge a battery in three to six minutes. It is based on OppCharge, an open interface for DC electric bus charging using a pantograph mounted on the infrastructure for end point opportunity charging. This allows buses to be charged at the end of the line, without impacting on the normal operation of the route.

Key points:
- 3-6 minutes fast charging time
- Minimal infrastructure
- Easy to integrate in existing lines
- Future-proof – charging system based on IEC 61851-23, International standard for EV fast charging



TOSA on-board automated connection
The ETS consists in a laser-controlled moving arm that docks into the overhead receptacle of the flash-charging station in less than a second. The flash-charging technology allows the bus to take on energy in 20 seconds at selected bus stops along the route, reducing battery size and weight. The energy from the charging equipment is stored in compact roof-mounted batteries, along with the vehicle's braking energy, powering both the bus and its auxiliary services, such as interior lighting.

Key points:
- High speed and fully automatic ETS
- Fully automatic so that the driver is not distracted by the connection process and can focus on passengers, pedestrians and traffic
- Full compensation for distance to sidewalk: 0 to 70 cm
- High power: up to 600 kW
- Energy efficiency: Less than 1 percent loss
- Health and safety: Compliant with RNI norms and directives (ICNIRP)



CCS2 connector based charging
ABB offers an ideal solution to charge electric buses and trucks overnight using the CCS2 connector. It enables charging of larger fleets of electric vehicles during the night, ensuring zero emission transportation during the day.

Key points:
- Smart charging
- Small infrastructure footprint of the depot charge box
- Flexible design for roof and floor mounting
- CCS and OCPP compliant ensuring interoperability
- Remote diagnostics and management tools
- CCS2 connector is already the industry standard for DC charging of passenger cars in Europe

Flexible service solutions around the globe

More than 100 years of experience

ABB has a worldwide network of specialized centers for customer assistance and after-sales services. The broad range of services include spare parts, maintenance, upgrades and retrofit, and we offer these both on and off customer sites. ABB offers custom-made multi-year service agreements, based on a detailed study of customer operating needs.

By choosing ABB as a system provider, the customer gains a competent, reliable and committed partner for the overall electrical system and a predictable and cost-efficient solution for sustainable mobility. With a turnkey system, our project team acts as a single source of responsibility, which minimizes risk and reduces project complexity.

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