

Your benefits with PSITraffic/DMS

- ✓ **INCREASE** of
 - Vehicle availability
 - Work to capacity at the garage
 - Transparency for all users
- ✓ **REDUCTION** of
 - Fuel processes
 - Vehicle reserve
 - Cancelled tours
- ✓ **OPTIMISATION** of
 - Vehicle maintenance
 - Vehicle parking
 - Vehicle disposition

Your benefits

- + Data available in real-time
- + Efficient operations
- + Open interfaces
- + Mapping your company processes
- + Hardware independence





**100%
READY**

PSItraffic – The DMS for electric buses

Depot and charging management for the public transport 4.0

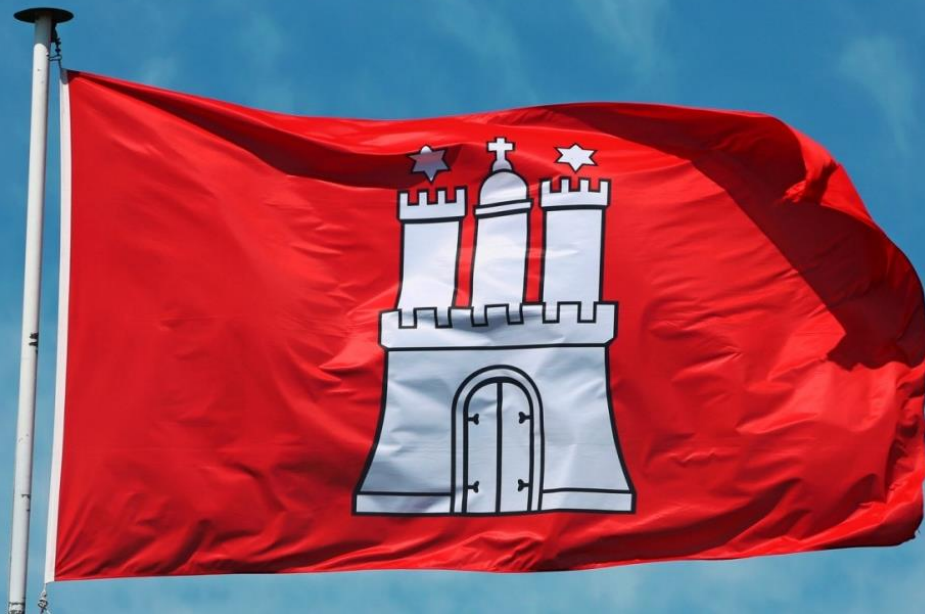
PSIebus – Depot and charging management for your E-Bus fleet

- Seamless integration of emission-free buses in planning, dispatching and controlling
- PSI combines depot and charging management in ONE solution



Starting Point: A clear Political Decision

„As of 2020, Hamburg will procure only emission-free busses.“



Major of Hamburg,
April 2015

Project Progress

- ▶ From 60 e-busses to >500 in 5 yrs.
- ▶ 76 charging stations are active.
- ▶ 2 depots are equipped.



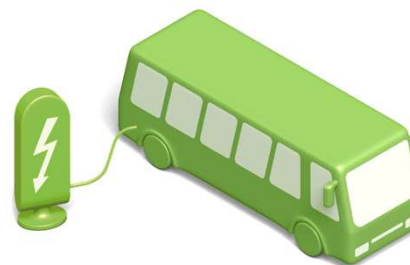
Challenges during Transition from Diesel to Electricity

Diesel bus



- Fuel capacity: ~ 2.100 kWh
- Combustion engine used for climatization
- Re-fuelling within several minutes

Electro-bus



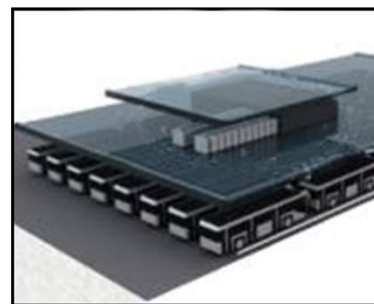
- Battery capacity: ~ 150 – 300 kWh
- Climatization by traction battery
- Charging takes several hours

Diesel bus depot



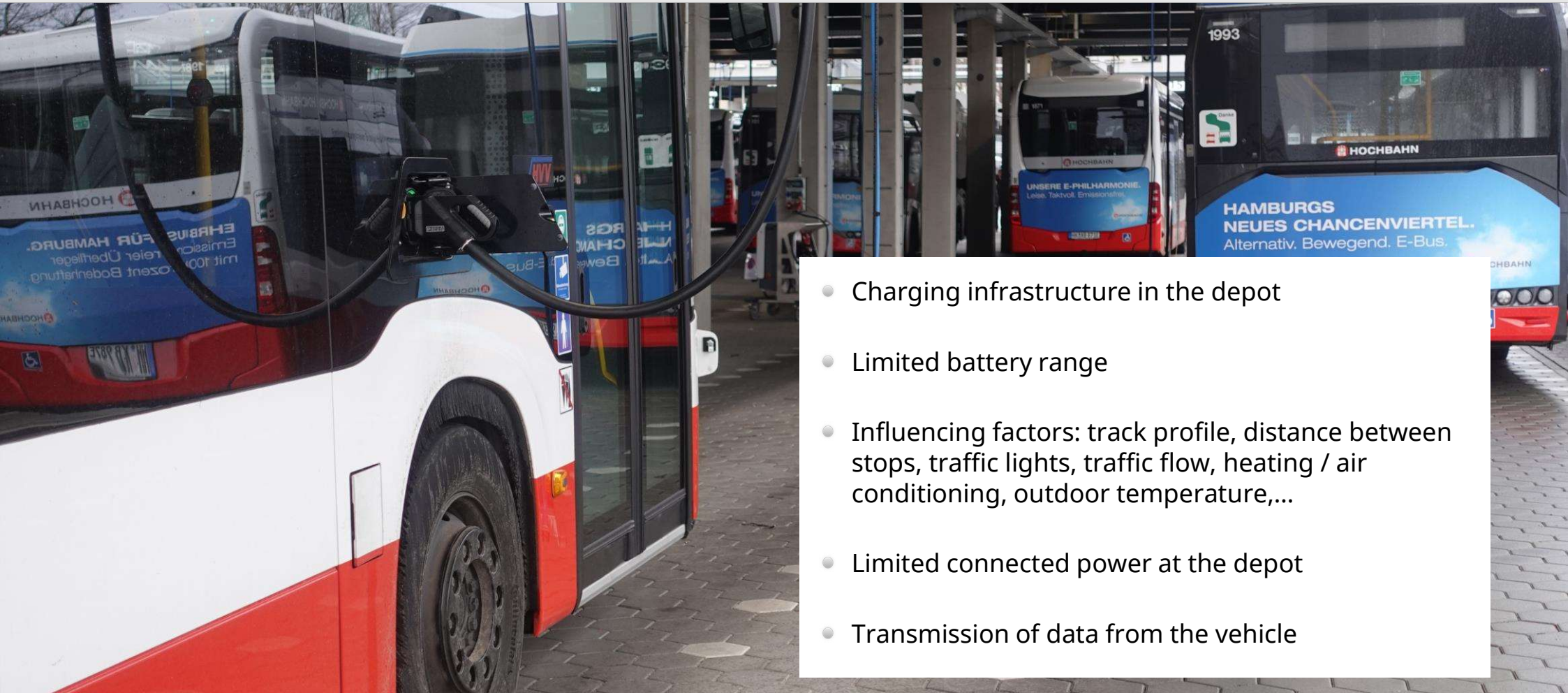
- Refuelling is separated from parking
- Only a few fuel pumps

Elektro-bus depot



- Charging and parking at one place
- Electrical area grid needs supervision
- Power peak shaving saves costs
- Intelligent planning of (charging) operation

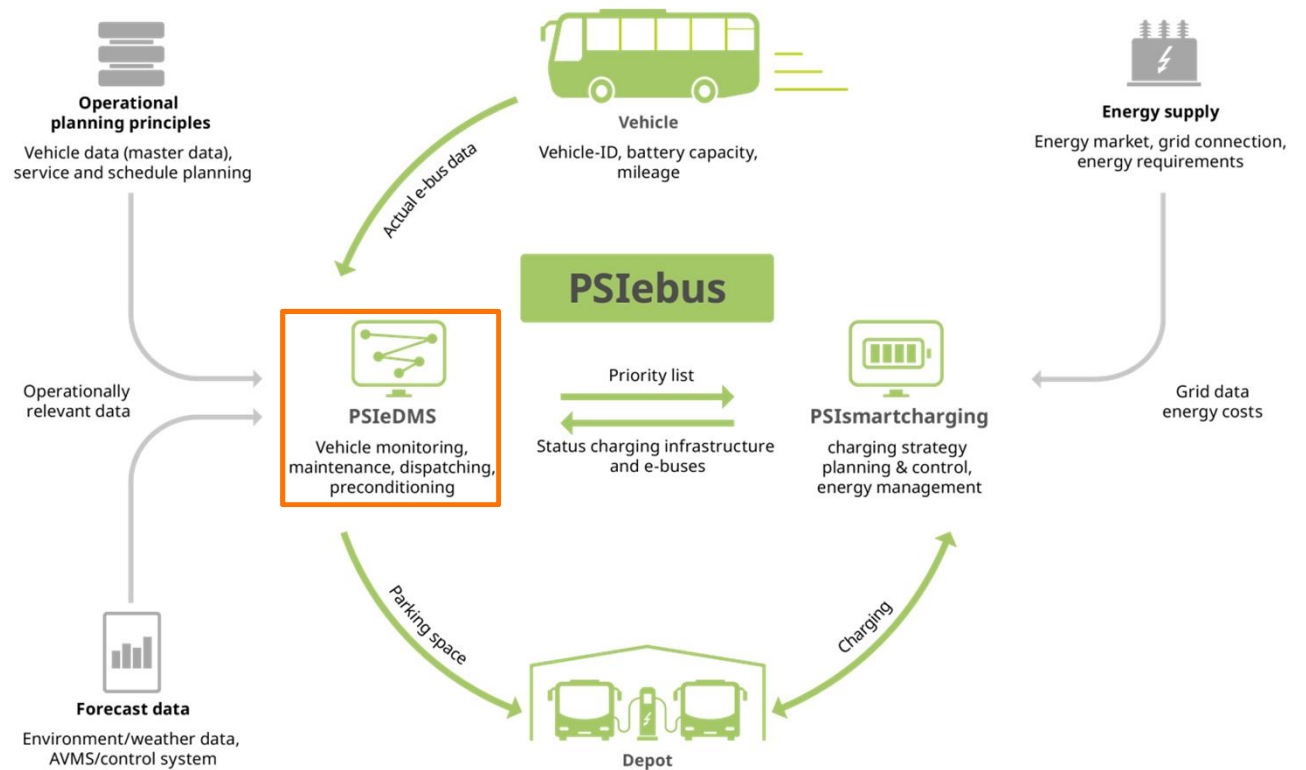
New challenges due to the use of electric buses



- Charging infrastructure in the depot
- Limited battery range
- Influencing factors: track profile, distance between stops, traffic lights, traffic flow, heating / air conditioning, outdoor temperature,...
- Limited connected power at the depot
- Transmission of data from the vehicle

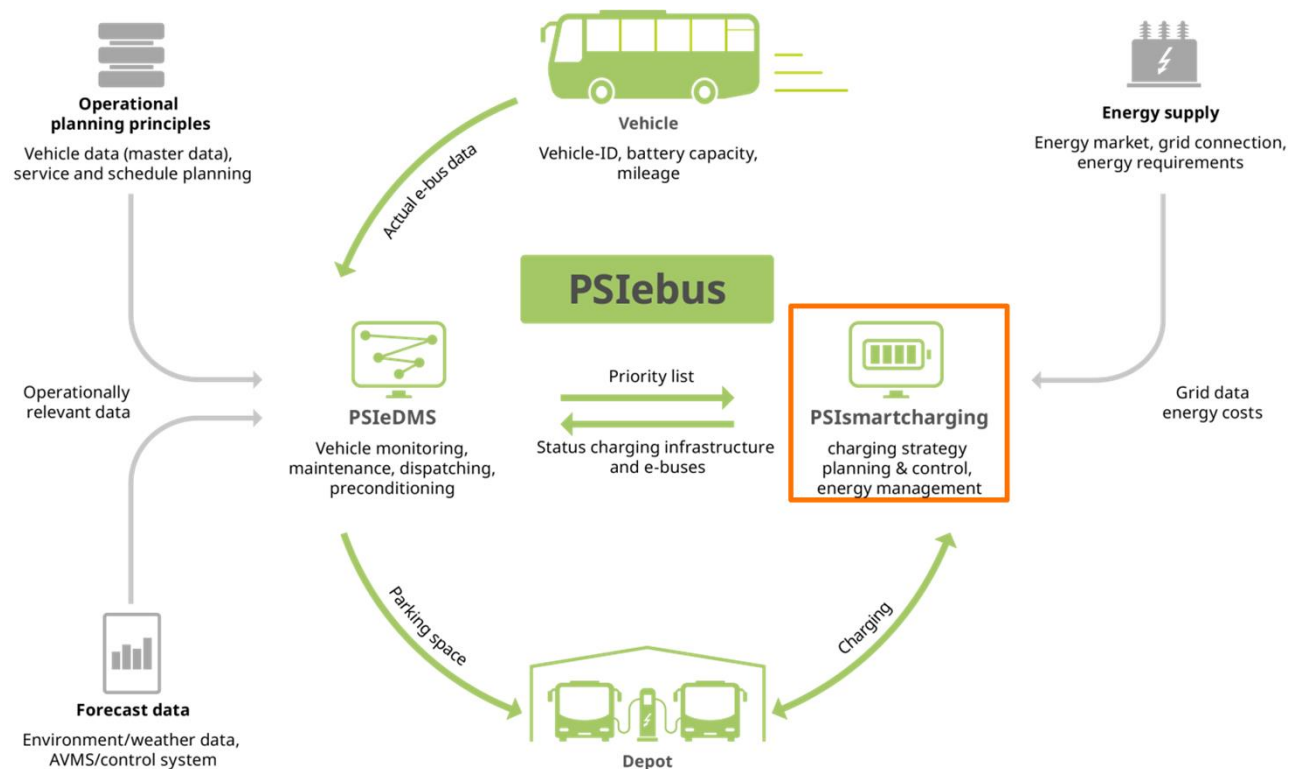
PSIeDMS – Vehicle monitoring and control

- Continuous check of battery capacity
- Consideration in block planning
- Optimal placement of vehicles in the depot (SOC-dependent) – adapted to the existing charging infrastructure and the planned trips
- Best possible use of available charging station
- Minimal preconditioning before or after the start of blocks (just-in-time)



PSIsmartcharging – Dynamic load and charging management

- Forecast of total daily energy requirement
- Consideration of vehicle data and outside temperatures
- Comparison with existing energy supply
- Inclusion of supply, company buildings and workshops
- Development of a charging infrastructure strategy
- Electricity supply taking into account the currently available power grid capacities and the conditions of the energy market



Data analysis/ Prognosis of circulation energy consumption for electric vehicles



Vehicle data on the track

- State of Charge %
- Vehicle-ID
- Mileage status
- FMS data
- Timestamps

KI based evaluation

- **Survey data:** Observed energy consumption of electric vehicles
- **Data collection:** Saving and managing observations
- **Empirics:** Determination of guidelines for the forecast
- **Forecast:** Calculation of predicted energy consumptions

