Project BOB

An integrated approach to a smart-trolley-systems

Workshop 5 November 2021

Adrian Dogge

Gefördert durch:
Bundesministerium für Verkehr und digitale Infrastruktur

Koordiniert durch:
NOW Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie
PtJ Projektträger Jülich Forschungszentrum Jülich

Situation today

- Pressure to change the way the mobility sector works

Situation today

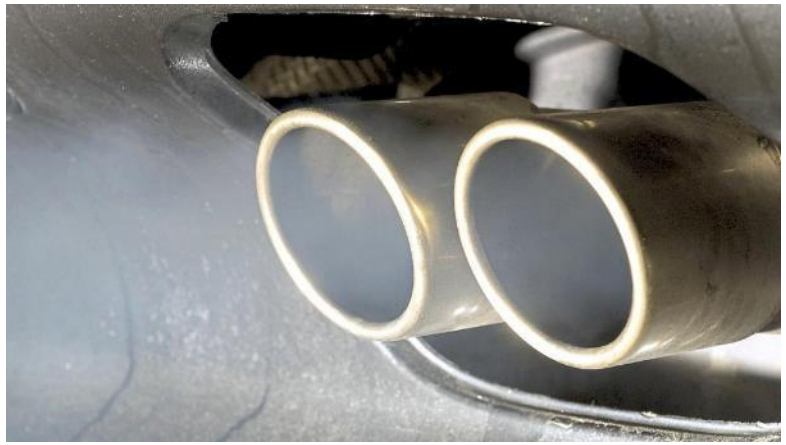

Foto: dpa

Foto: adobe photo stock | lovelyday12

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L 188/116 DE Amtsblatt der Europäischen Union 12.7.2019

RICHTLINIE (EU) 2019/1161 DES EUROPÄISCHEN PARLAMENTS UND DES RATES

vom 20. Juni 2019

zur Änderung der Richtlinie 2009/33/EG über die Förderung sauberer und energieeffizienter Straßenfahrzeuge

(Text von Bedeutung für den EWR)

Situation today

- Pressure to change the way the mobility sector works
  - Climate change
  - Local emissions
  - Traffic
- Stronger support for public transport and sharing services
- Electrification of traffic through battery electric and fuel cell technologies

How to get 100% emission-free public transport in Solingen

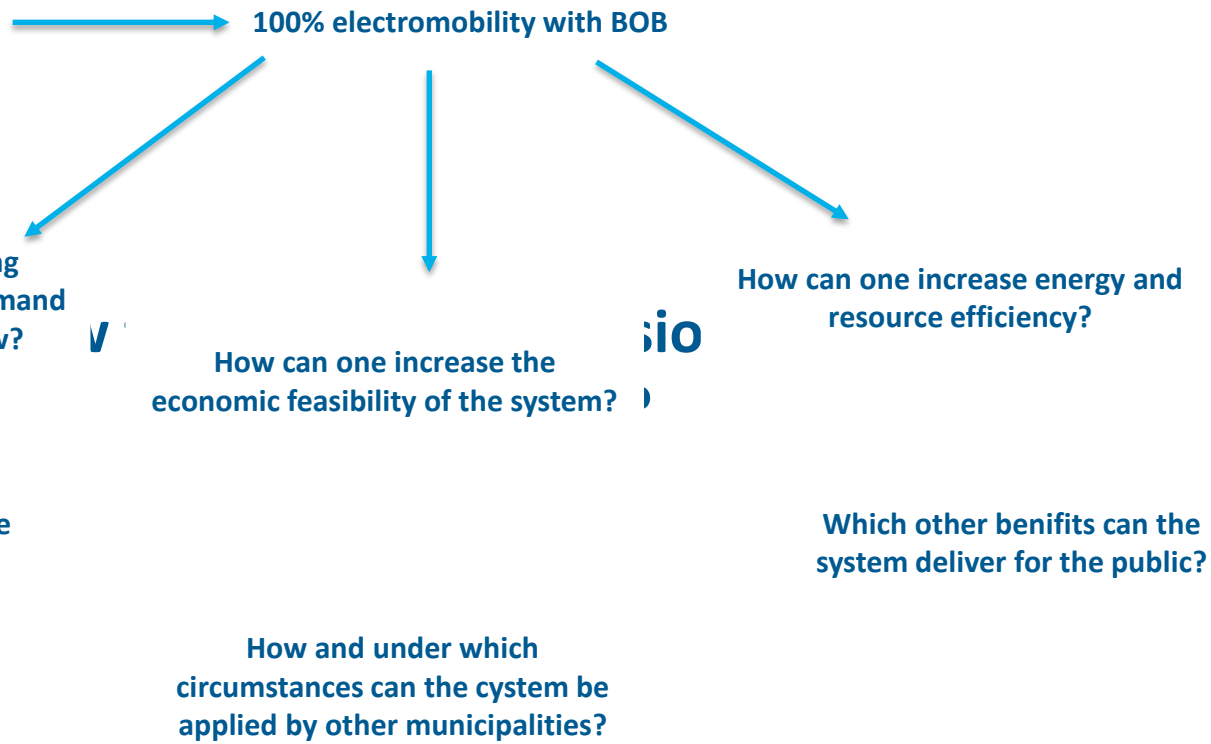
- 50 dieselbusses
- electromobility since 1952
- 50 trolleybusses
- > 100 km catenary grid
- 65 % passengers transported electrically

➢ 100 % emission-free public transport using trolleybus technology

➢ BOB

Source: Stadtwerke Solingen GmbH

How to get 100% emission-free public transport in Solingen



BOB Solingen

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Solingen

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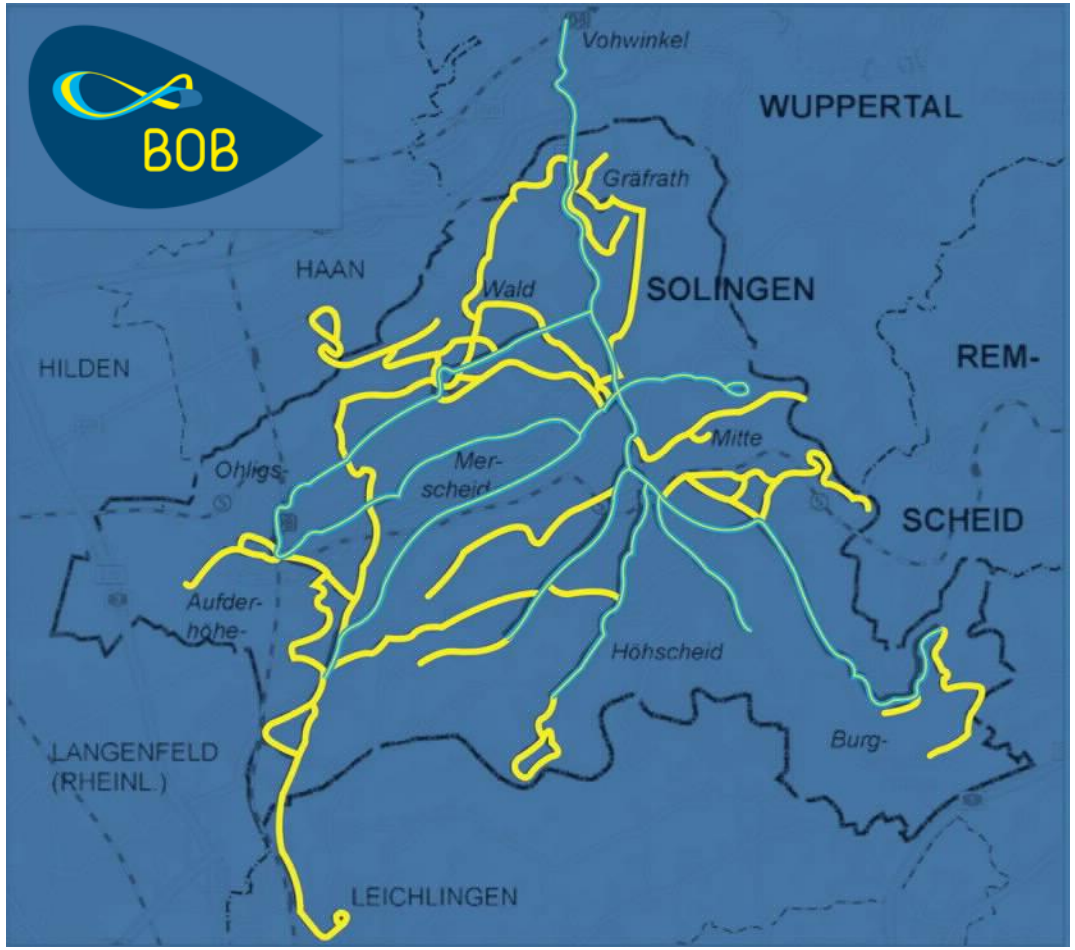
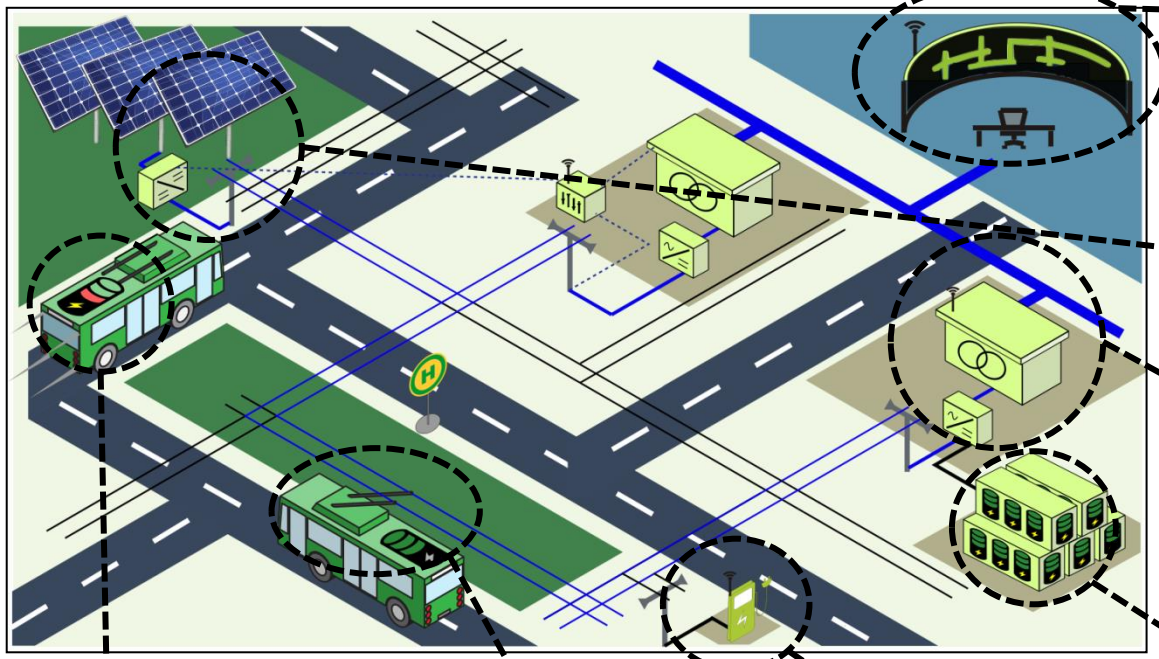
How to get 100% emission-free public transport in Solingen



- Current public transport network
- Diesel only
- Catenary for trolleybusses
- First battery trolleybus line
- Potential future network

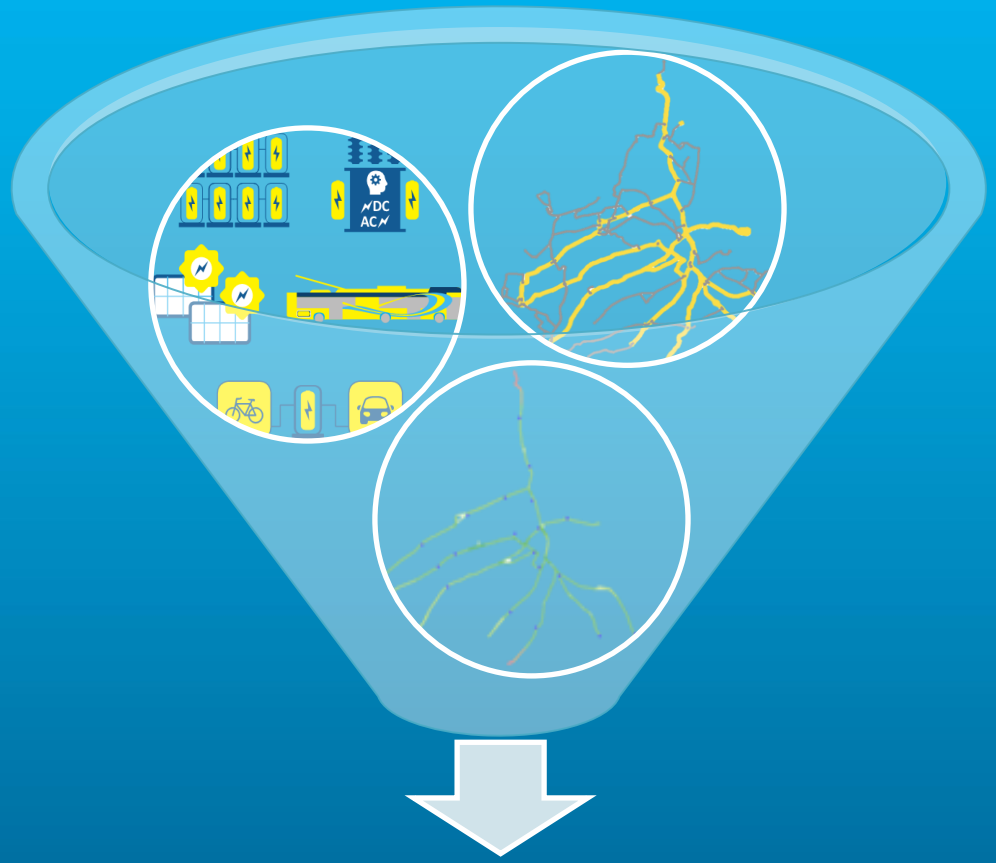
Smart-Trolleybus-System (STS)

How it works



Source: Lehrstuhl für Elektrische Energieversorgungstechnik, Bergische Universität Wuppertal

- Automated monitoring and control
- PV systems integration
- Substation (bidirectional)
- Stationary Battery storage
- Battery trolleybus – discharging
- Battery trolleybus – charging
- Charging stations for EVs and pedelecs



BOB
BatterieOberleitungsBus

Das Smart-Trolley-System (STS)

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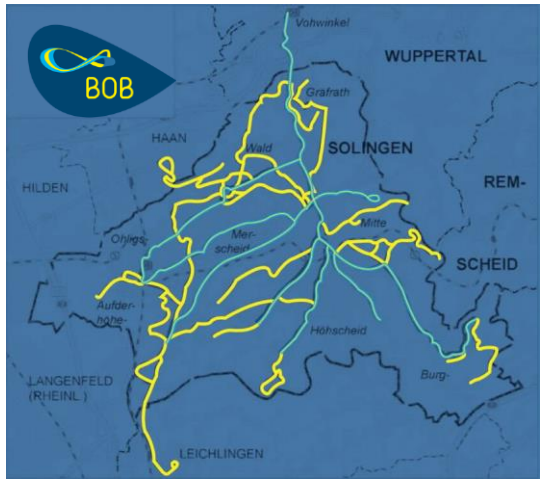
Simulation of Solingen‘s catenary

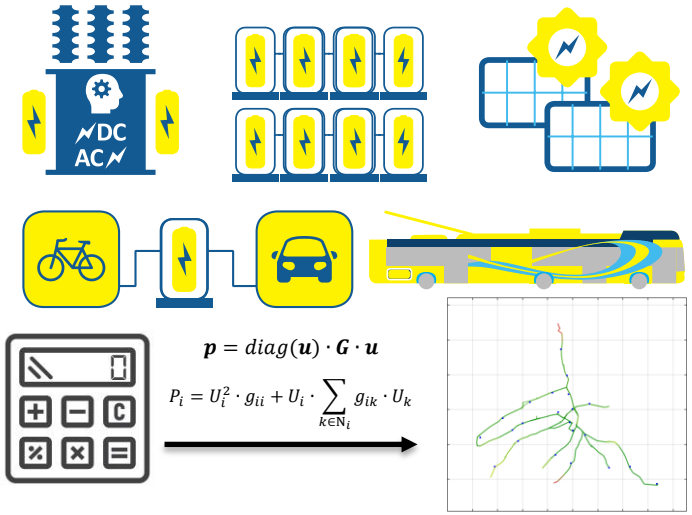
Creating the simulation

- Grid data
  - Electrical grid
    - 660 V DC catenary
    - 10 kV AC distribution grid
  - Traffic network
    - streets (incl. topography)
    - traffic lights, bus stops, etc.
- bus timetables

- Modelling and implementation of all components

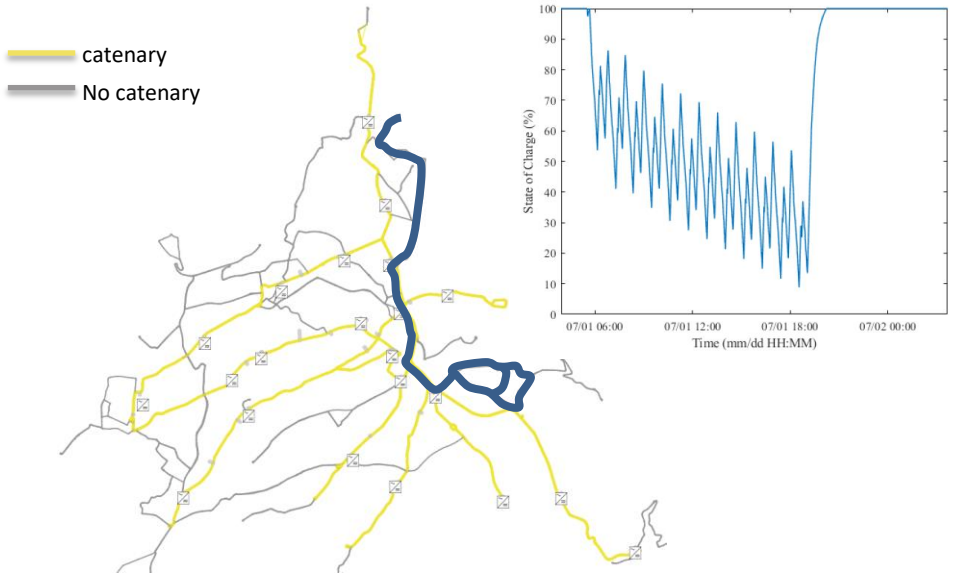
- Identification of grid status via power-flow calculation



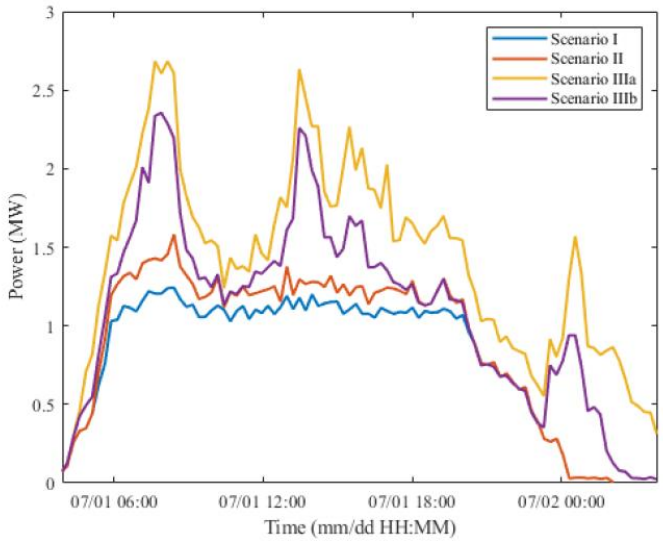


Simulation of Solingen‘s catenary

Use cases of the simulation



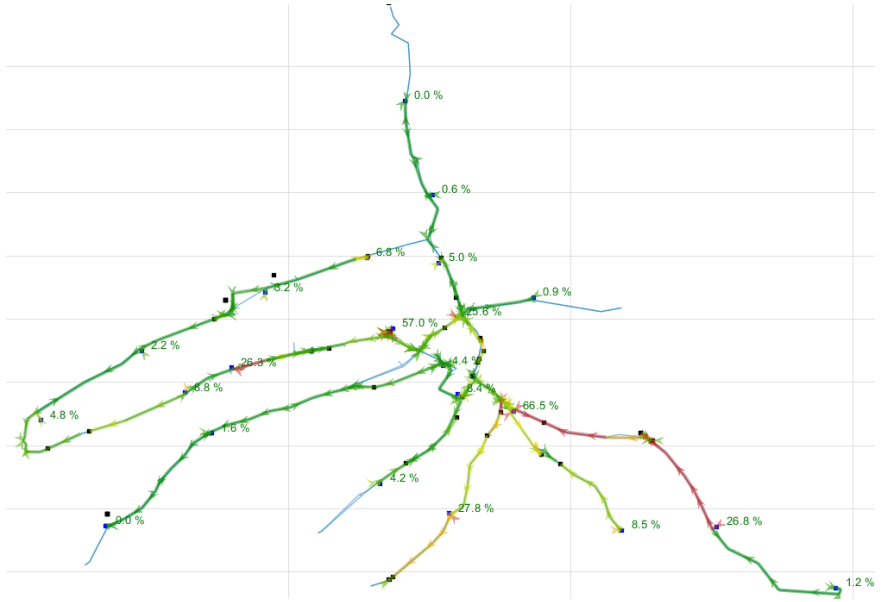
Assessment of bus routes to switch from diesel to battery trolley buses – taking battery capacity into consideration



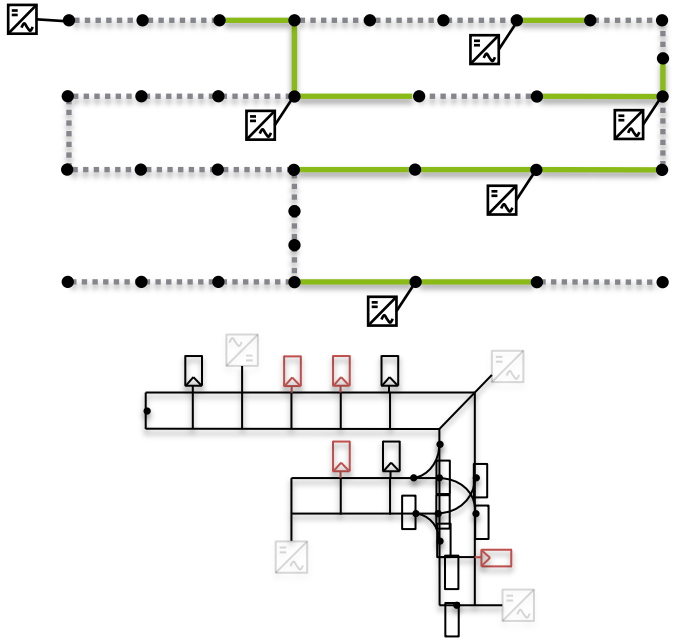
Scenario analysis over the whole grid

Simulation of Solingen‘s catenary

Use cases of the simulation



Grid simulation – predicting excess of grid limits for a defined timeframe



planning: designing new or expansion of trolleybus systems

(also optimal positioning and dimensioning of pv plants or EV charging stations)

Potential for photovoltaics

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Potential for photovoltaics

Installations	parallel	mounted
Possible module area	151.054 m²	96.176 m²
No. of modules	92.849	59.102
Power	25.113 kWp	15.998 kWp
Yield per year	18,8 Mio. kWh/a	13,1 Mio. kWh/a
Yearly electricity usage for trolley busses		7,9 Mio. kWh/a

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Koordiniert durch: NOW, PtJ
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Does this system increase user numbers?

We don‘t know.

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Does this system increase user numbers?

Increase

- Visibility for public transport as being innovative and sustainable
- Photovoltaics and charging stations: participatory approach possible (even though legally dificult)
- Modern busses with digital backbone can be used for further ameneties
  - Live data
  - USB charging ports
  - Passenger counting system
  - …

No increase / decrease

- Battery capacity and distance to infrastructure pose new restrictions for route planning
- Catenary may be seen as visually unattractive
- Electromobility is (currently) more expensive at first and might lead to higher fare prices

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