Decarbonization of the BVG bus fleet: from ramp-up phase to an E-Bus system

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We move people forward - we are the heartbeat of Berlin

1,066 m
passengers

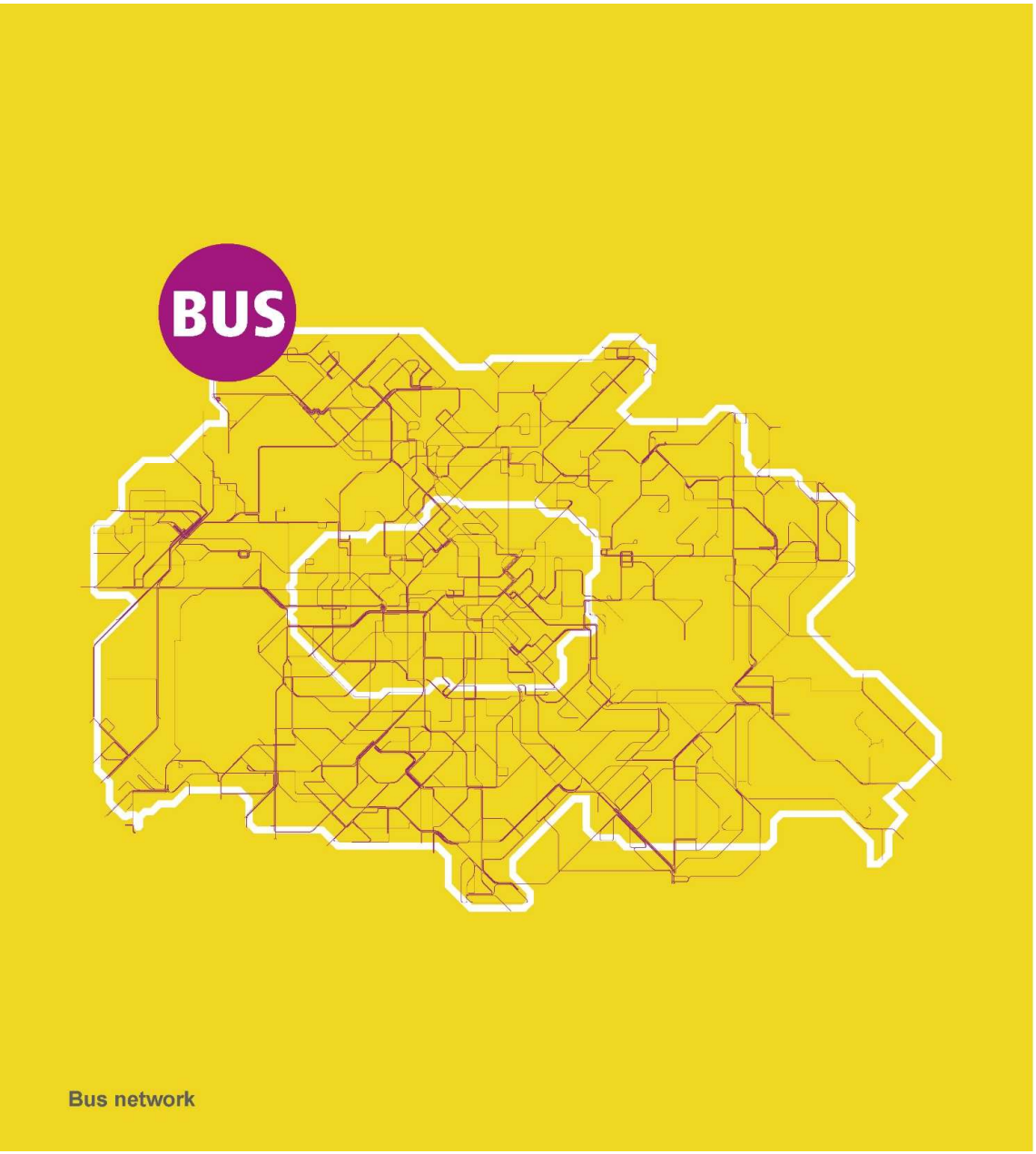
3,262
vehicles

7,770
stops/stations

184
lines

16,087
employees

BVG in 2023



Bus network

6,770 stops -

the bus network is

the biggest in the country

- 460.6 m passenger journeys
- 1,631 buses
- 6,770 stops
- 153 lines
- 1,802 km of line network

BVG

320 km make

Berlin‘s tram network

the world‘s third biggest

- 200.6 m passenger journeys
- 381 trams
- 825 stops
- 22 lines
- 320 km of line network

155 km long -

Berlin‘s metro network

is one of Europe‘s top 5

- 529.8 m passenger journeys
- 1,250 metro cars
- 175 stations
- 9 lines
- 155 km of line network

The BVG is transforming its entire bus fleet

in order to meet local and global emission targets

Global climate protection

Local air pollution prevention

100% local emission free by 2030

Various technologies are available

E-Bus (Depot-charge)

E-Bus (Terminus Charge)

Battery-O-Bus (Trolley Bus)

H_2-Fuel Cell (-Hybrid)

The e-bus transformation started with research projects

working closely with research facilities and universities

Forschungscampus Mobility 2 Grid EUREF

REINER LEMOINE INSTITUT

TECHNISCHE UNIVERSITÄT BERLIN

Initial research projects

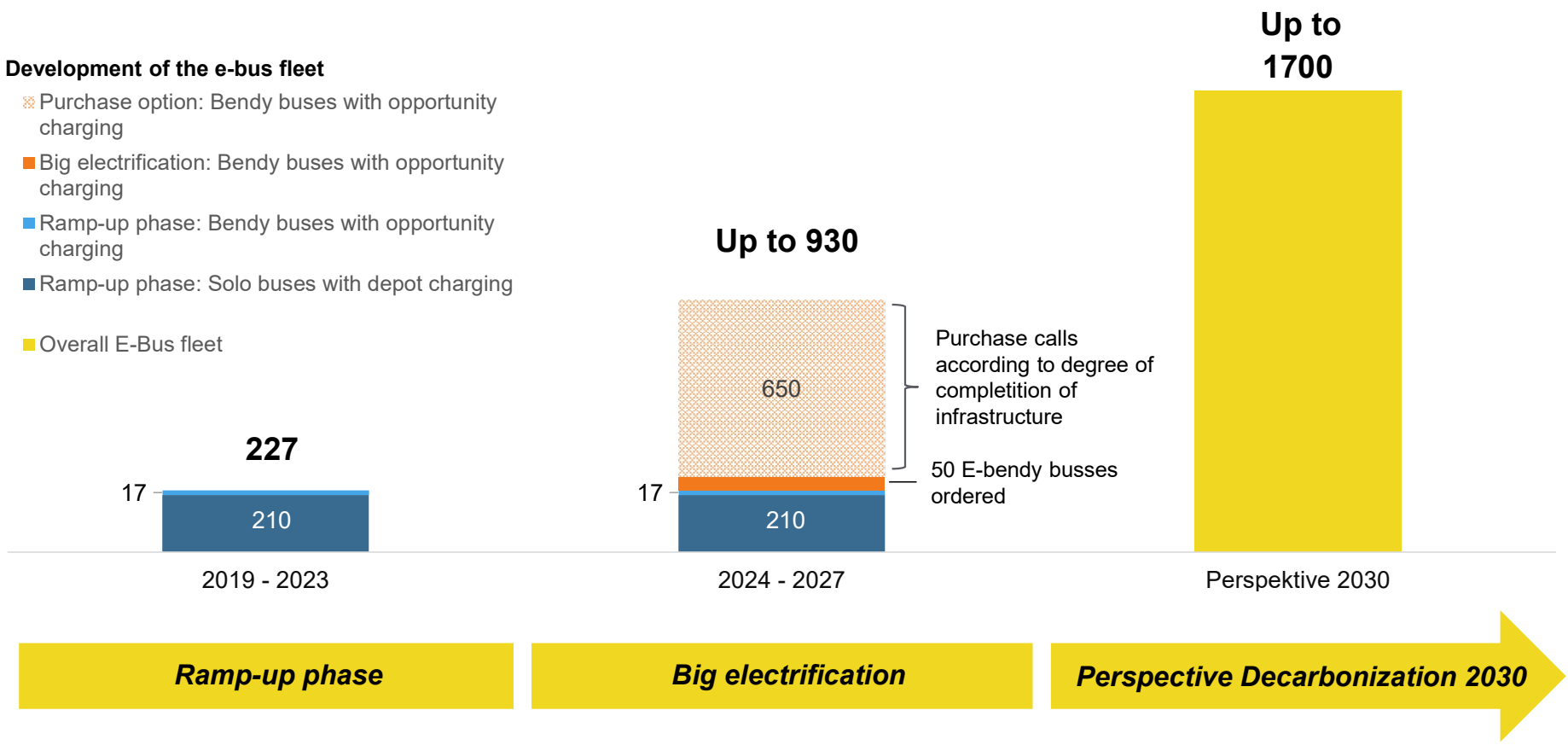
- *Hydrogen bus project (2010-2015)* Hydrogen combustion buses
- *E-Bus Berlin project (2015-2017):* opportunity charging using induction
- *Mobility2grid* (phase 1, 2016-2020): integration of battery-electric vehicles into decentralized energy grid

Ramp-up phase

- *Purchase of 210 solo buses* as depot-chargers (Evobus, Solaris and Ebusco)
- *E-Metrobus project* for the trial of opportunity charging with high-power-chargers at end of line stops

15% of BVG‘s bus fleet is already electric -

with the next big electrification step starting in 2024



The foundation for successful electrification is a

closely interlocked e-bus system

Charging infrastructure in depots

Charging infrastructure in the city (End of line)

IT-systems and digitalization

- Pre-conditioning
- Disposition
- Battery monitoring
- Load management
- Depot management system

Through a combination of technology and infrastructure

in depots and in the city we achieve high operational flexibility

Depot charging

Opportunity charging

Flex charging (from 2024)

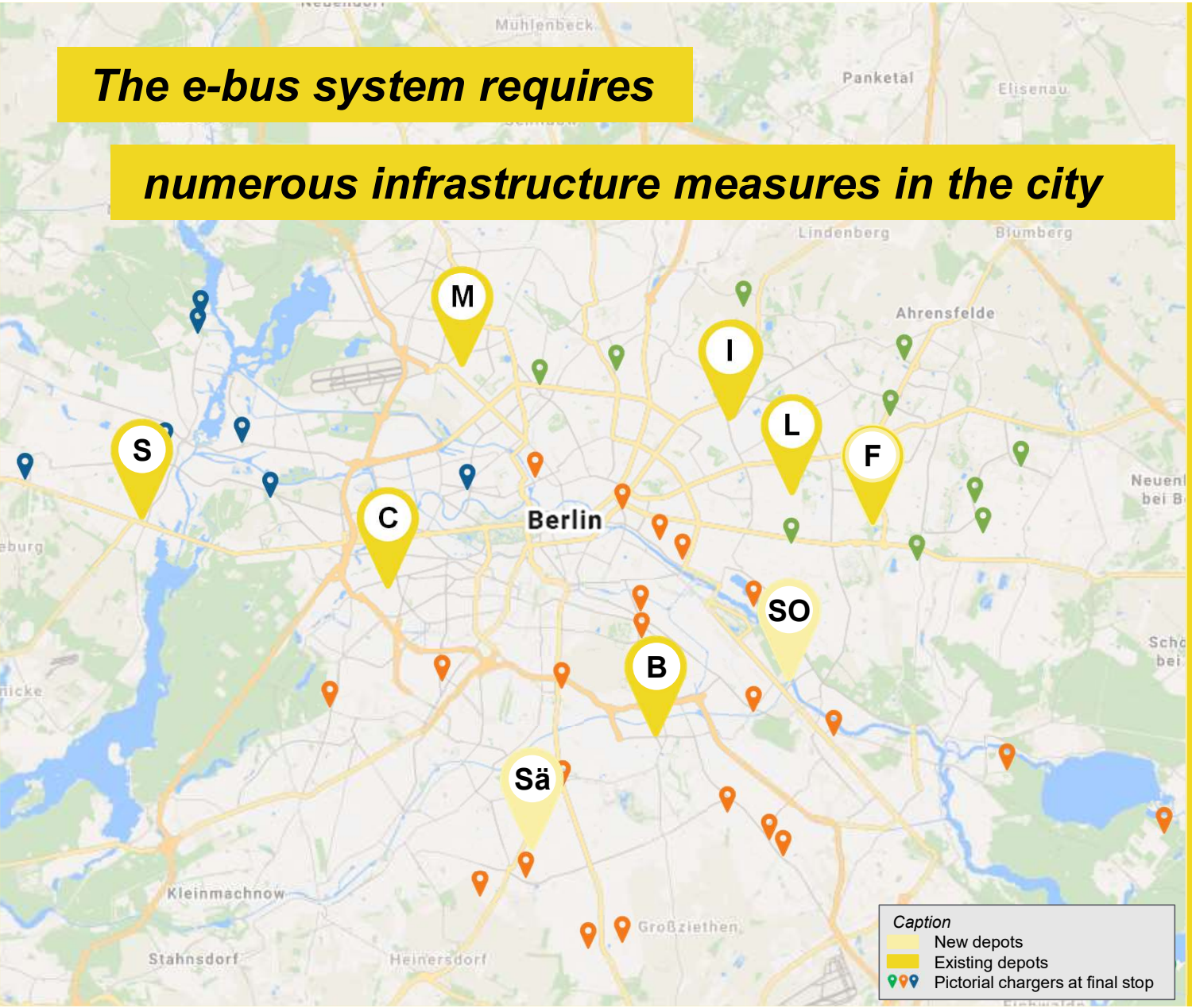
Flexible operation:
- Fast charging
- Big batteries
- Bottom-up Pantographs

Adoption to
- high ranges of depot chargers (previously not available)
- heterogeneous bus network with some long lines
- operation areas far away from depots

Reduction of additional vehicle/personnel requirements through circulation optimization and IT systems

The e-bus system requires

numerous infrastructure measures in the city



BVG

Depots

- **I** Depot Indira-Gandhi-Str.
- **S** Depot Spandau
- **SO** New Depot Betriebshofverbund Süd-Ost
- **F** Depot Alt-Friedrichsfelde
- **Sä** New Depot Säntisstr.
- **B** Depot Britz
- **C** Depot Cicerostr.
- **L** Depot Lichtenberg
- **M** Depot Müllerstr.

Fast charging at final stops

Up to 110 high power chargers at 40 final stops in the first expansion stages

Throughout the ramp-up we experienced many challenges

- **Official requirements** (fire protection, rainwater, etc.) must be taken into account at an early stage when planning infrastructure and depots

- **Interaction between charging station and e-bus** and between the components of the buses (battery, heat pump, etc.) is crucial

- The large number of **vehicle and charging infrastructure interfaces** must already be taken into account when awarding the contract

- BVG is a large and complex transport company; there is **no such thing as an off-the-peg system**

For operational processes IT-solutions

are becoming ever more important

SERVICE

- Asset-status *(State of charge; Workshop, Service)*
- Automatic allocation of parking spaces
- Dynamic power and load management

DISPOSITION

- Automatic (re-)disposition
- Automatic pre-conditioning
- Driver registration

Bus depot

Line

LINE

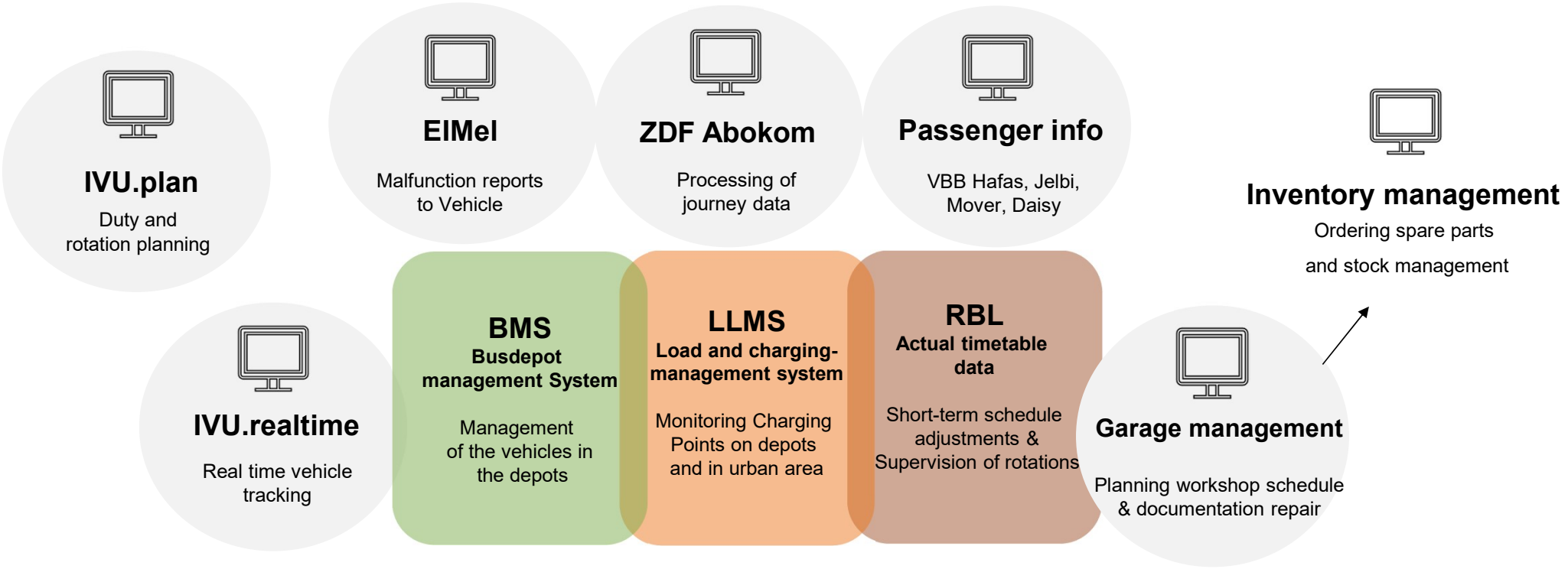
- Asset-status
- Diagnostic tool for dynamic power & load management

DISRUPTIONS

- Disruption-management
- Staff planning
- Digital workshop processes

Growing complexity can only be encountered

through clear focus on harmonised IT-systems




Thank you for
your attention!
BVG
JEDES MAL, WENN DU EINSTEIGST,
SIND WIR GELADEN.
Projekt E-MetroBus