

Project BOB

battery trolleybuses in smart energy grid systems



Adrian Dogge

Gefördert durch:



Koordiniert durch:



Situation today

Severe changes in mobility sector

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

Gefördert durch:



Koordiniert durch:



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



Source: Stadtwerke Solingen GmbH

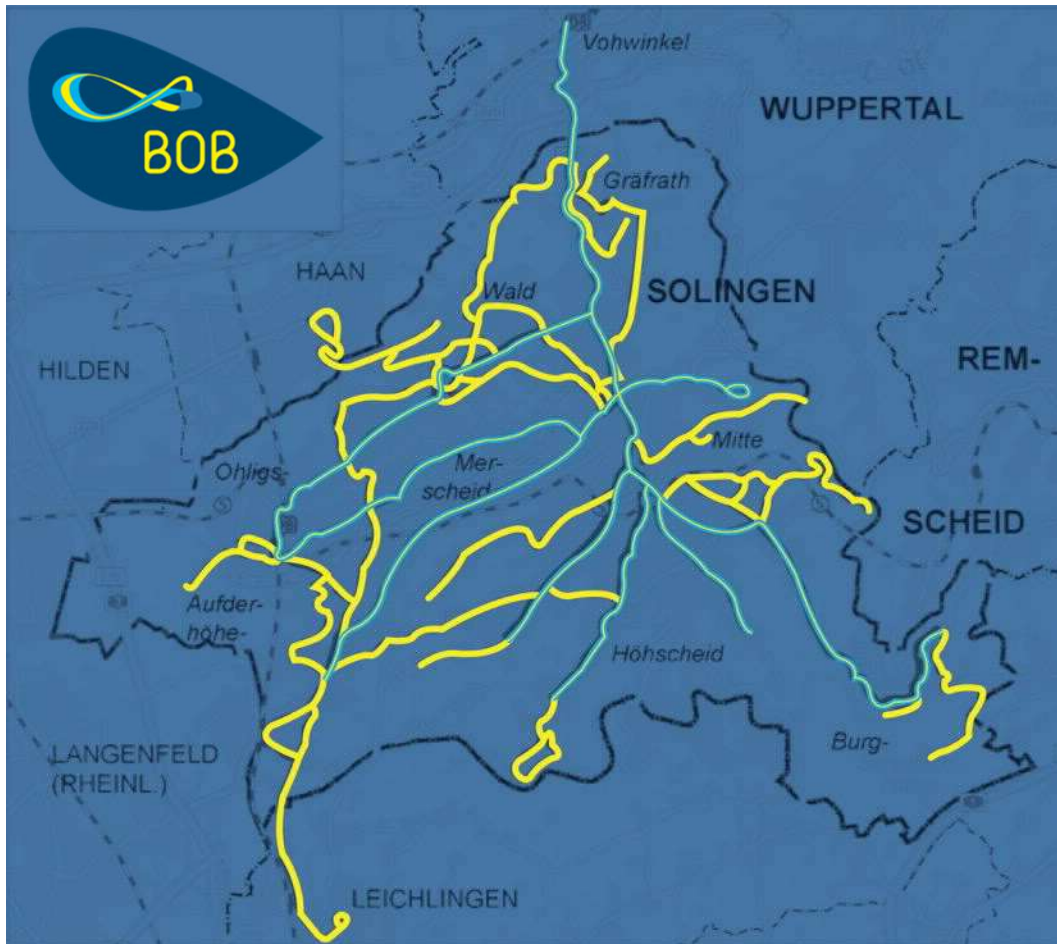
Gefördert durch:



Koordiniert durch:



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



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

Gefördert durch:

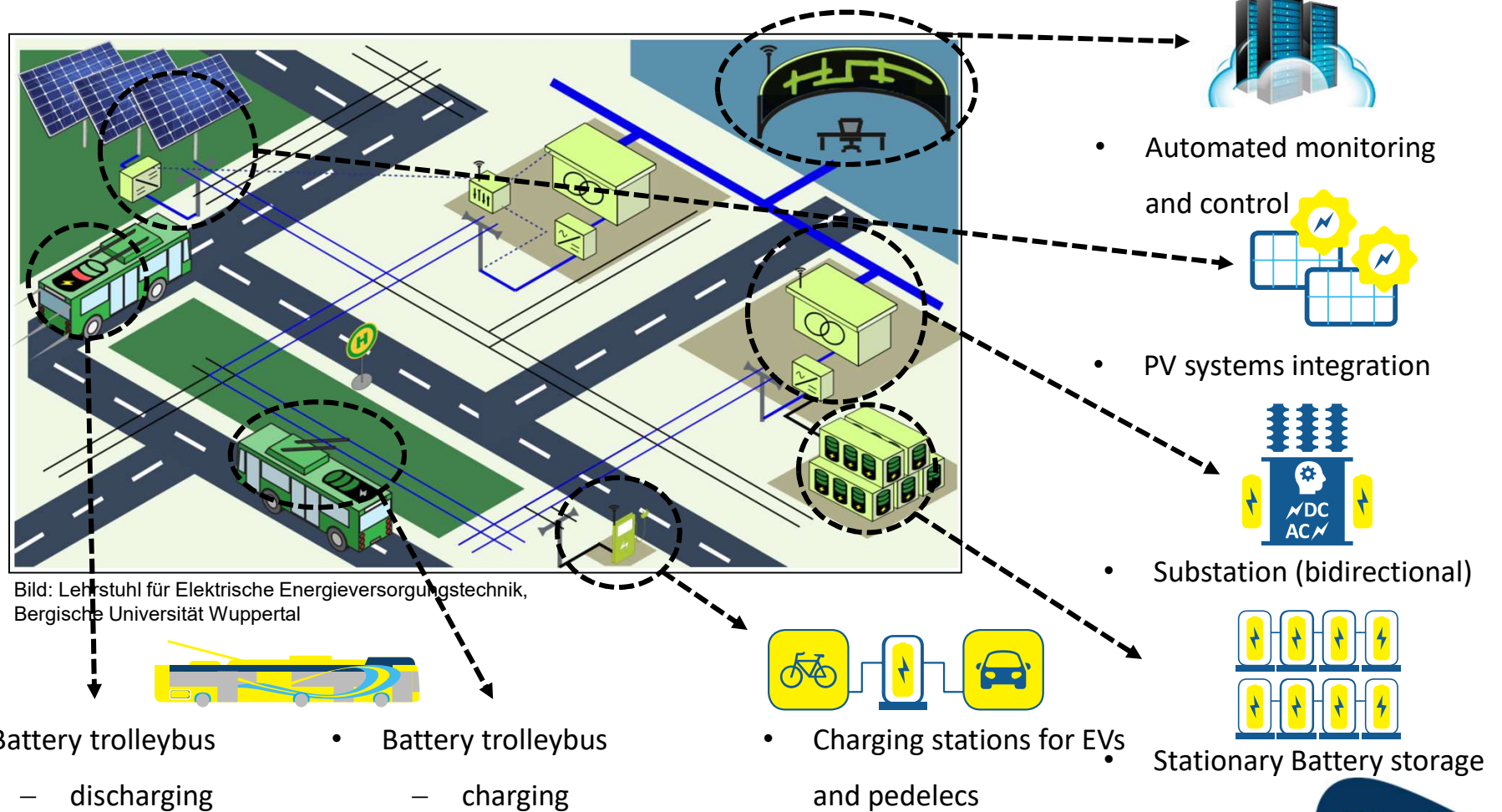


Koordiniert durch:



Smart-Trolleybus-System (STS)

How it works



Gefördert durch:



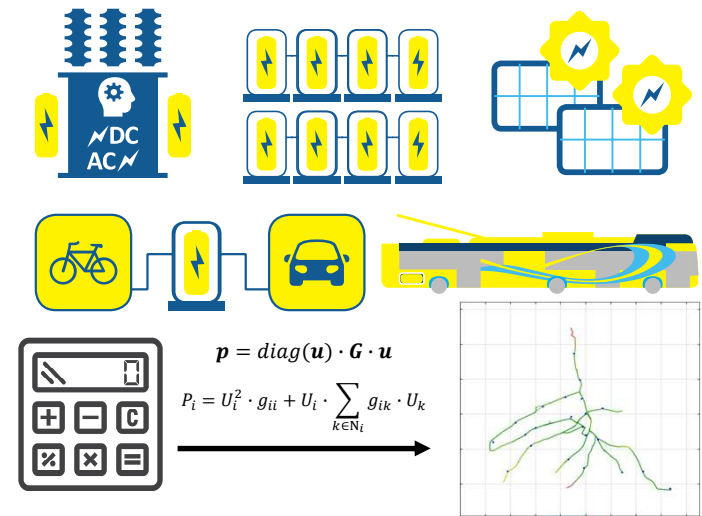
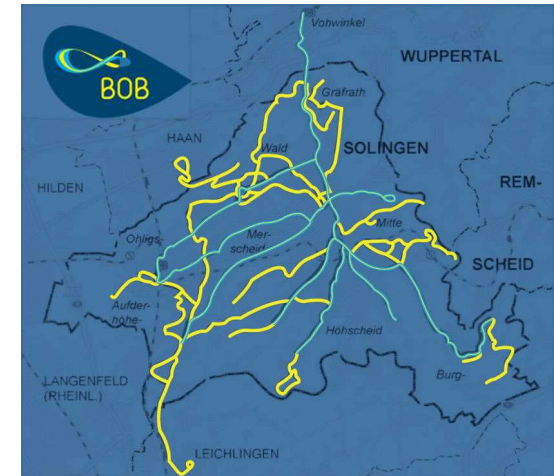
Koordiniert durch:



Simulation of Solingen's catenary

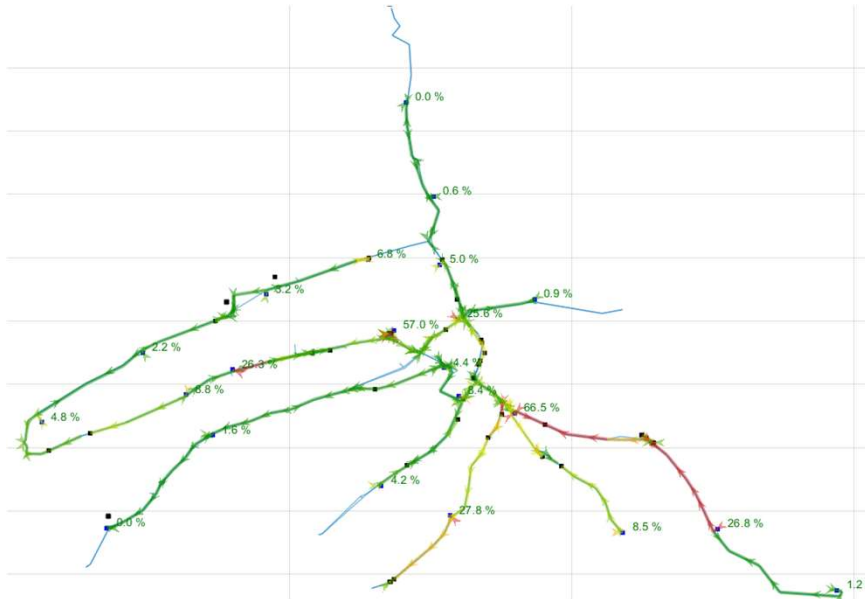
Creating the simulation

- 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

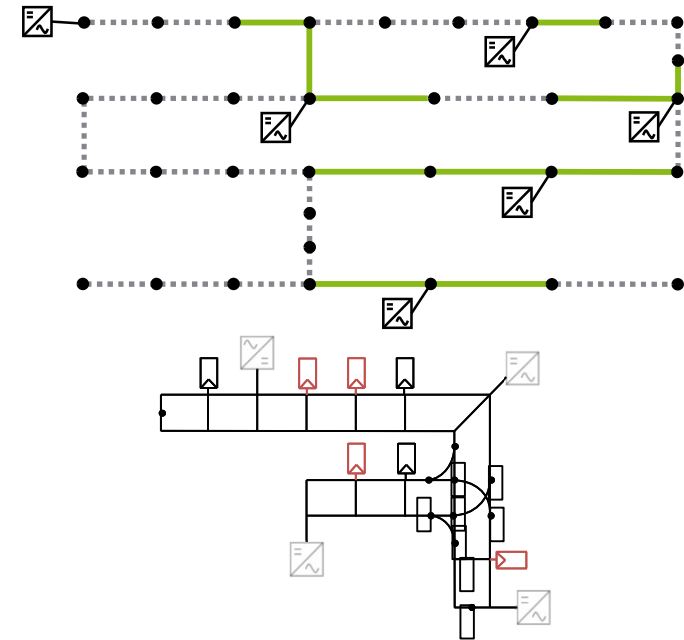


Simulation of Solingen's catenary

Use cases of the simulation



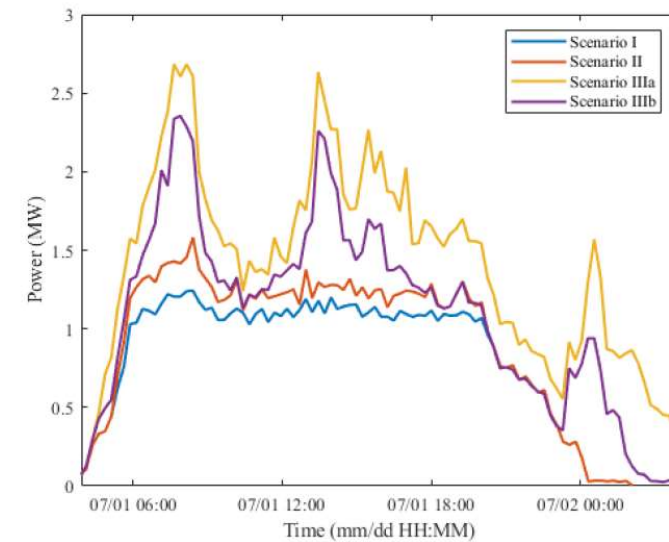
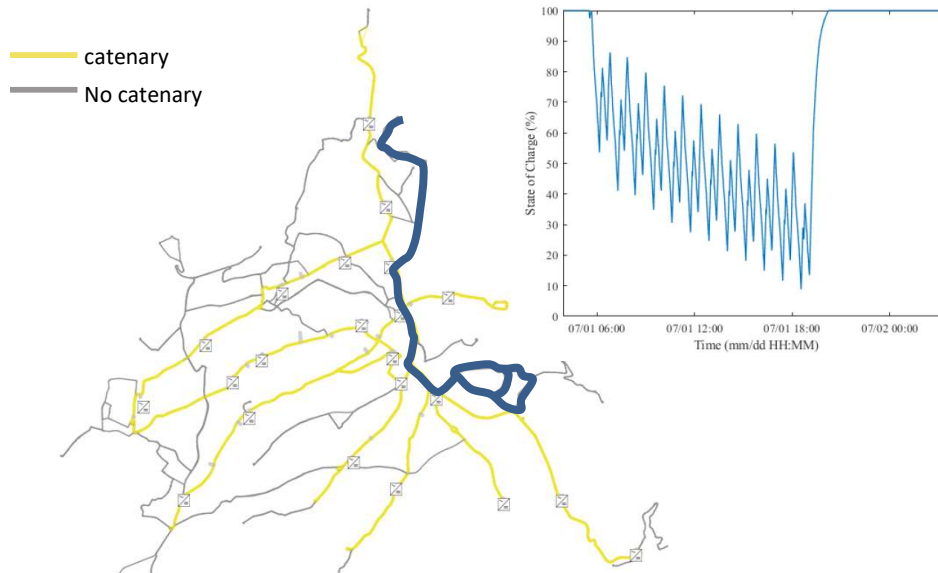
Grid simulation – predicting excess of grid limits for a defined timeframe



planning: designing new or expansion
of trolleybus systems
(also optimal positioning and
dimensioning of pv plants or EV
charging stations)

Simulation of Solingen's catenary

Use cases of the simulation



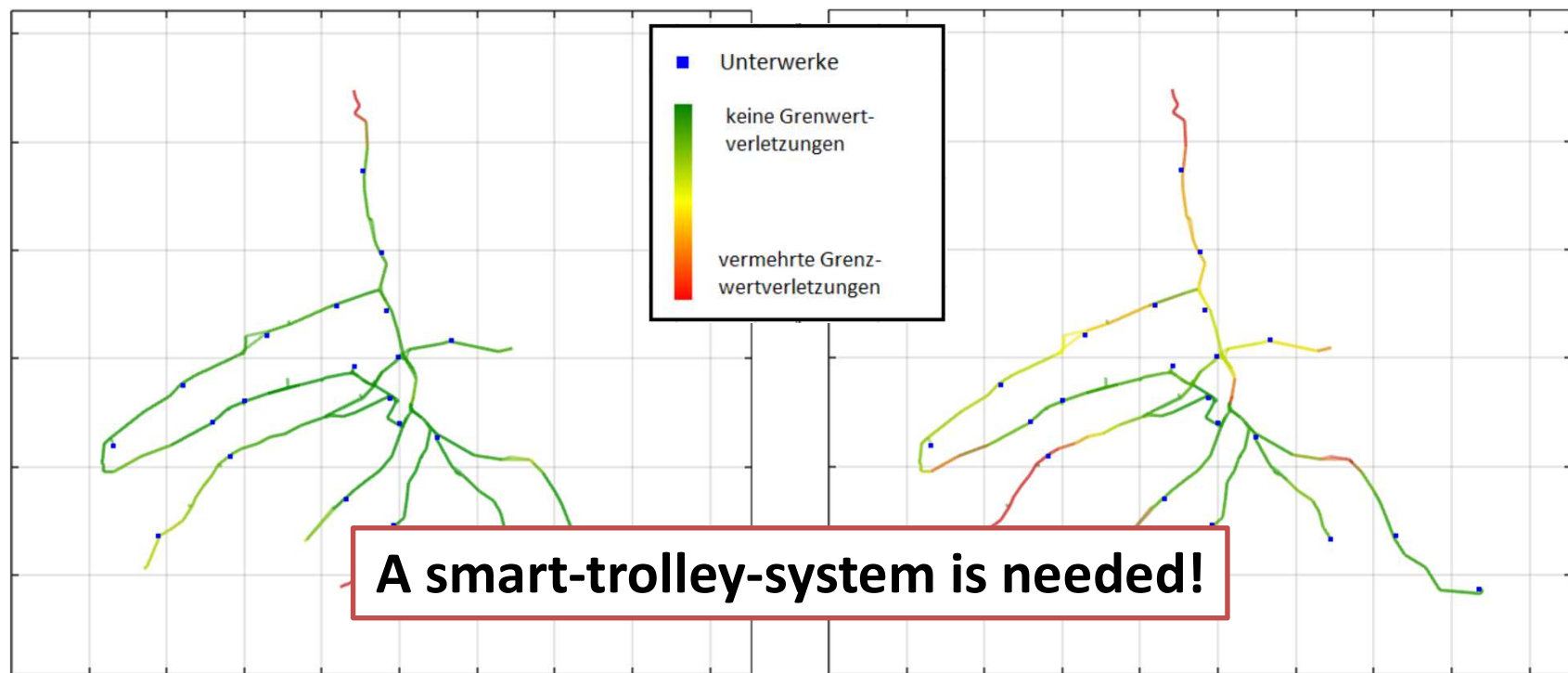
Assessment of bus routes to switch from diesel to battery trolley buses – taking battery capacity into consideration

Scenario analysis over the whole grid

Load on the catenary

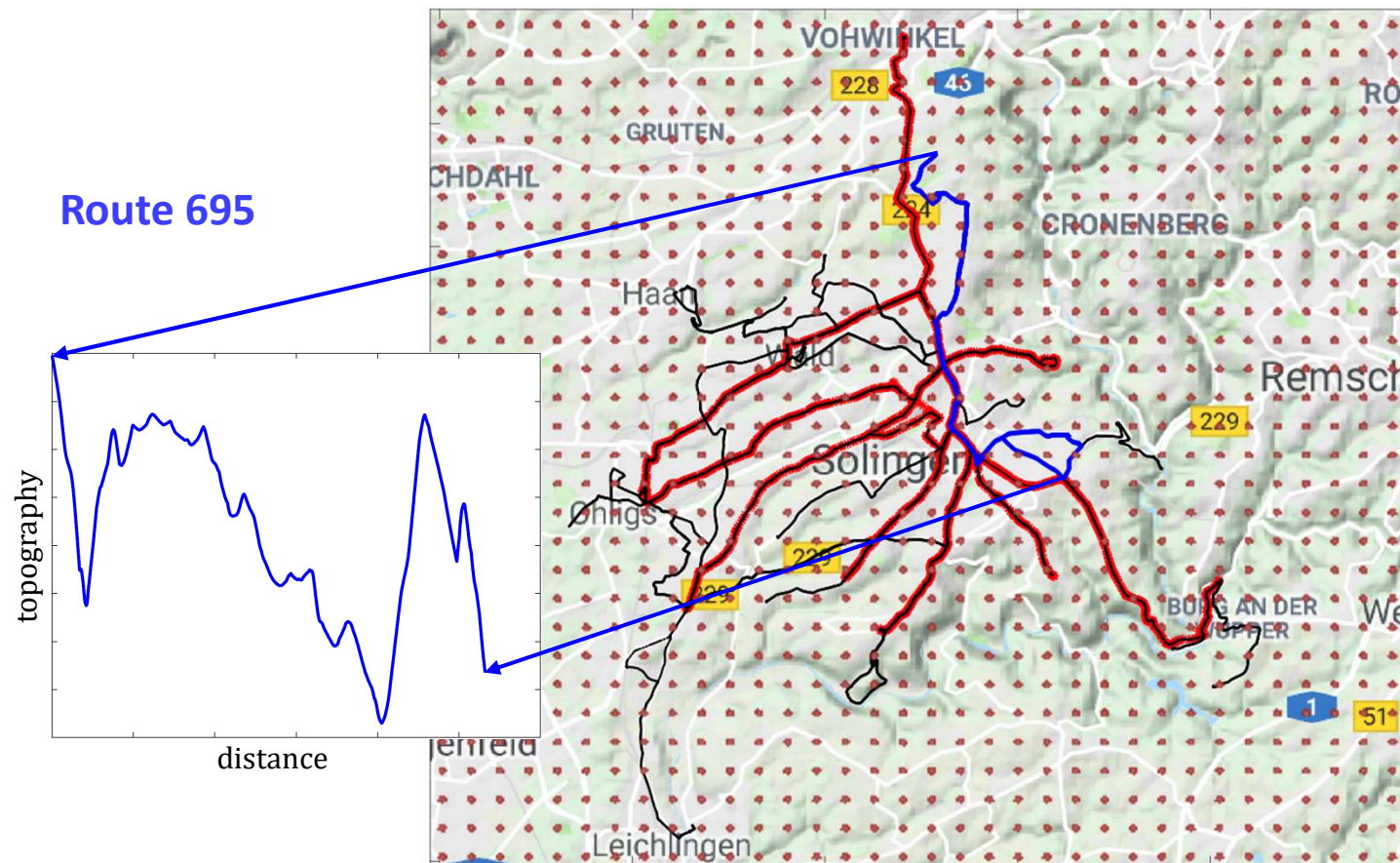
Scenario analysis with the simulation

- Simulation scenario I:
 - 50 trolley buses
 - 50 diesel buses
- Simulation scenario IIIa:
 - 100 battery trolley buses
 - No conventional trolleys or diesel buses



BOB – battery trolleybus in the smart-trolley-system

Topography data for energy demand prognosis

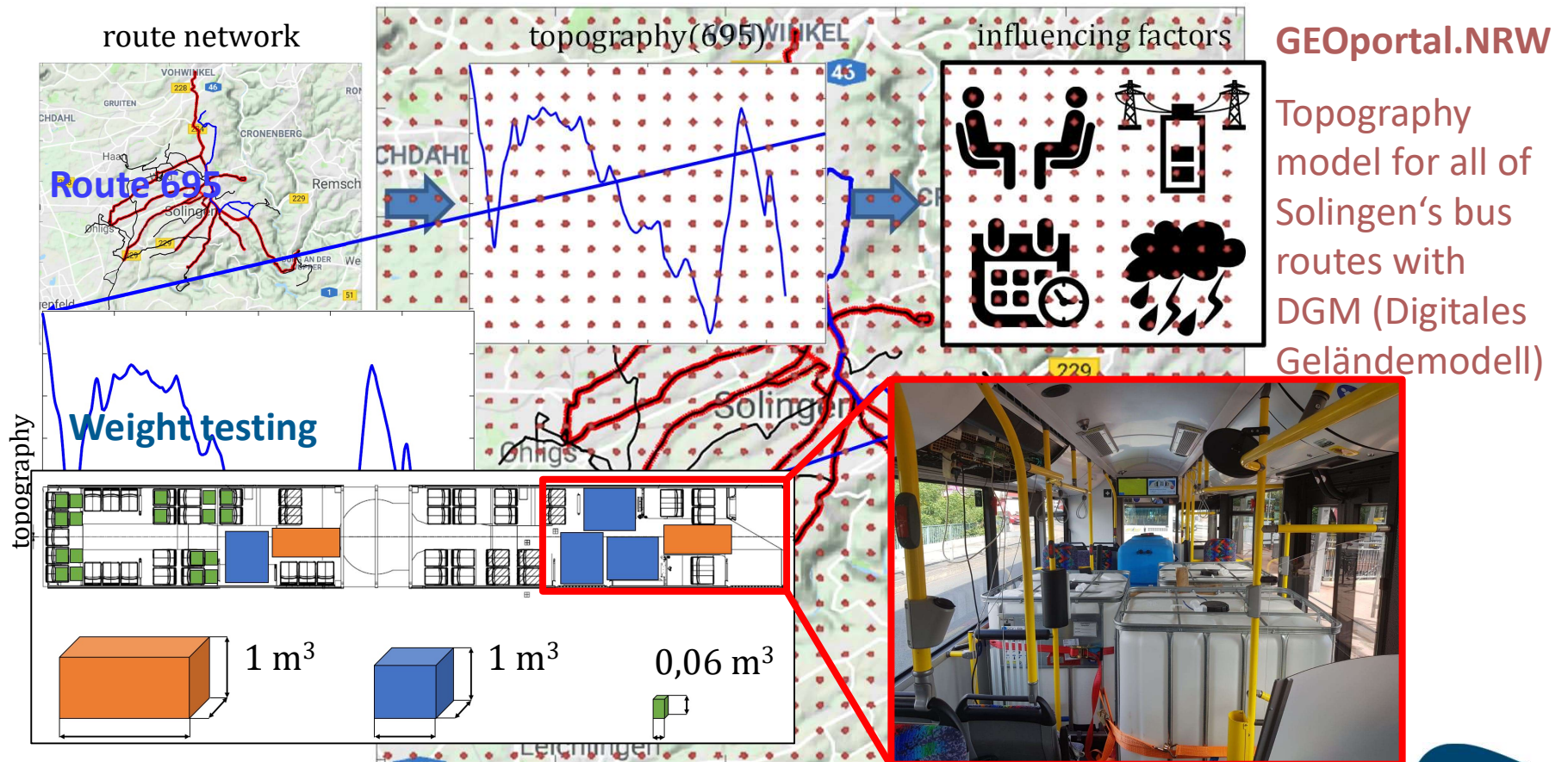


GEOportal.NRW

Topography
model for all of
Solingen's bus
routes with
DGM (Digitales
Geländemodell)

BOB – battery trolleybus in the smart-trolley-system

Energy demand analysis

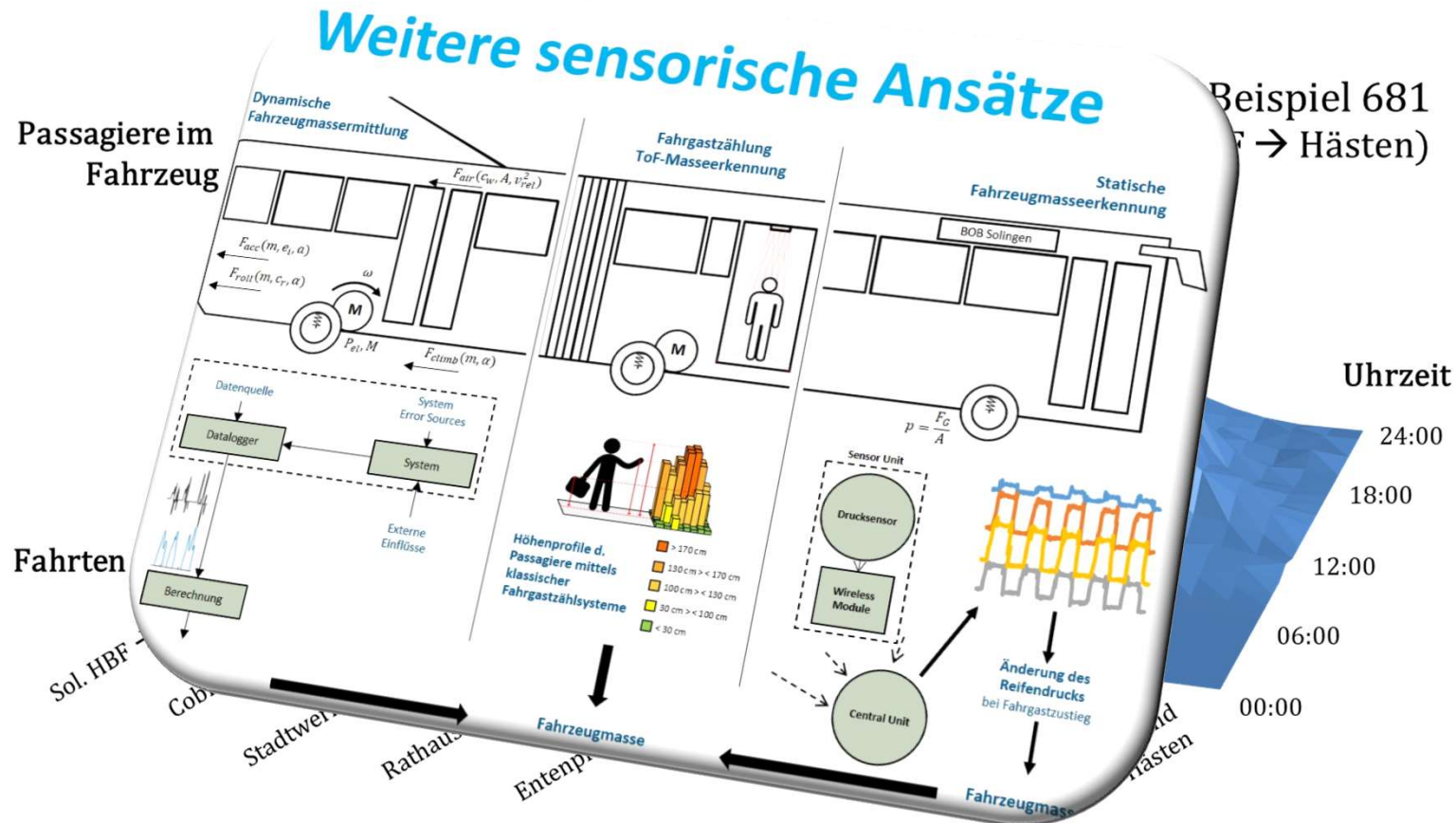


GEOportal.NRW

Topography model for all of Solingen's bus routes with DGM (Digitales Geländemodell)

BOB – battery trolleybus in the smart-trolley-system

Vehicle weight and passenger count

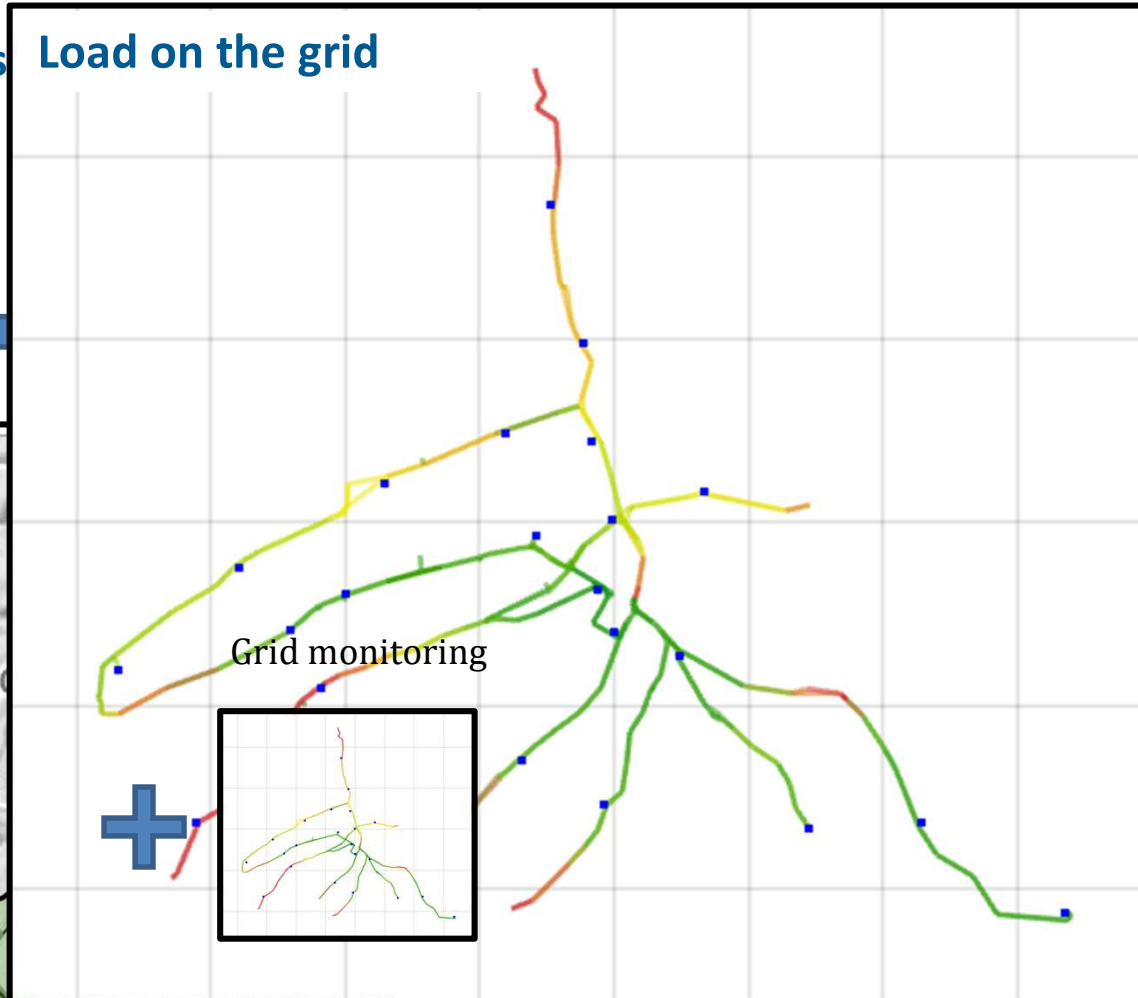
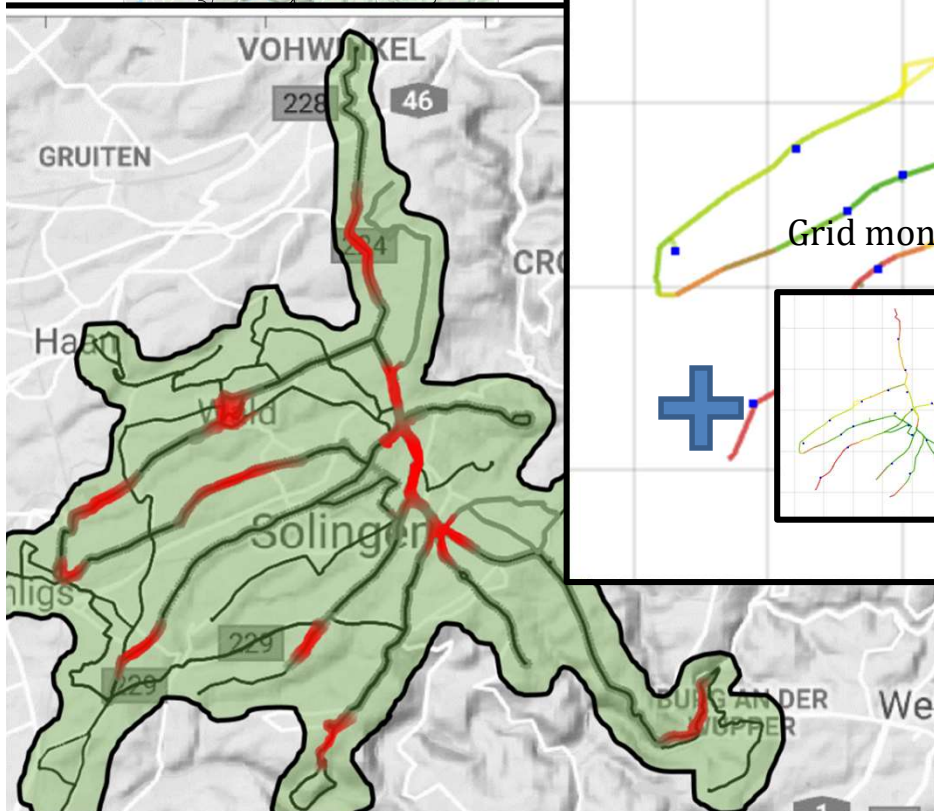


BOB – battery trolleybus in the smart-trolley-system

analysis of flexibility

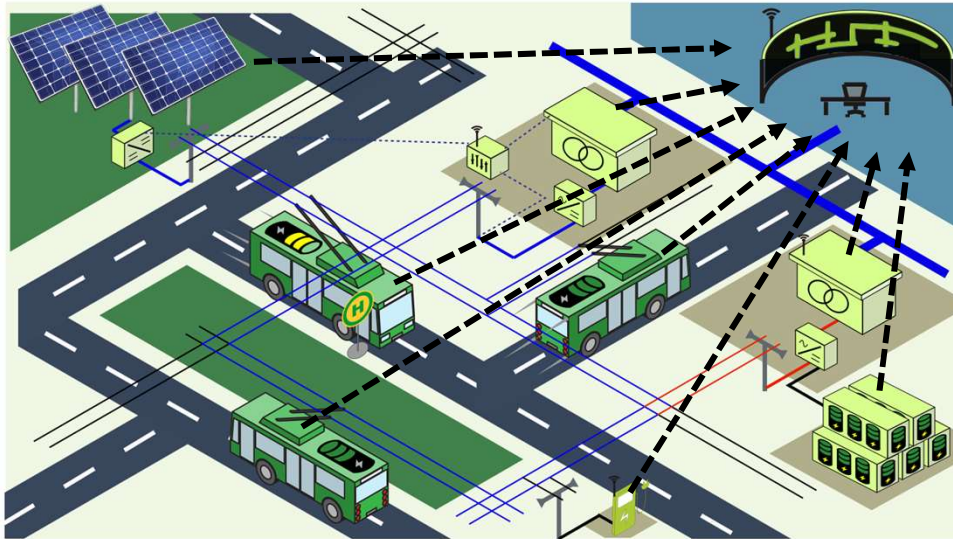
Energy demand analysis Load on the grid

Route network



Smart-Trolleybus-System

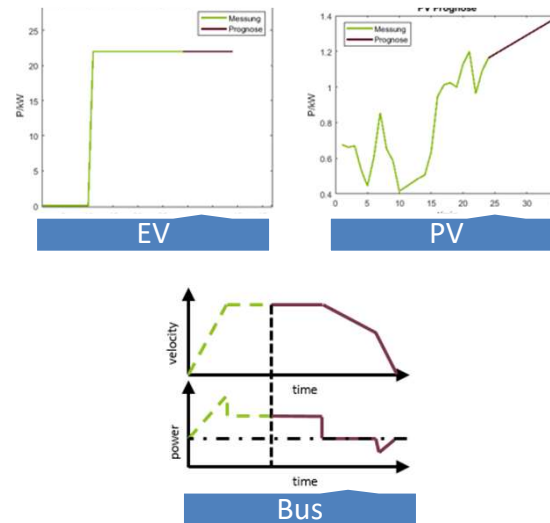
monitoring



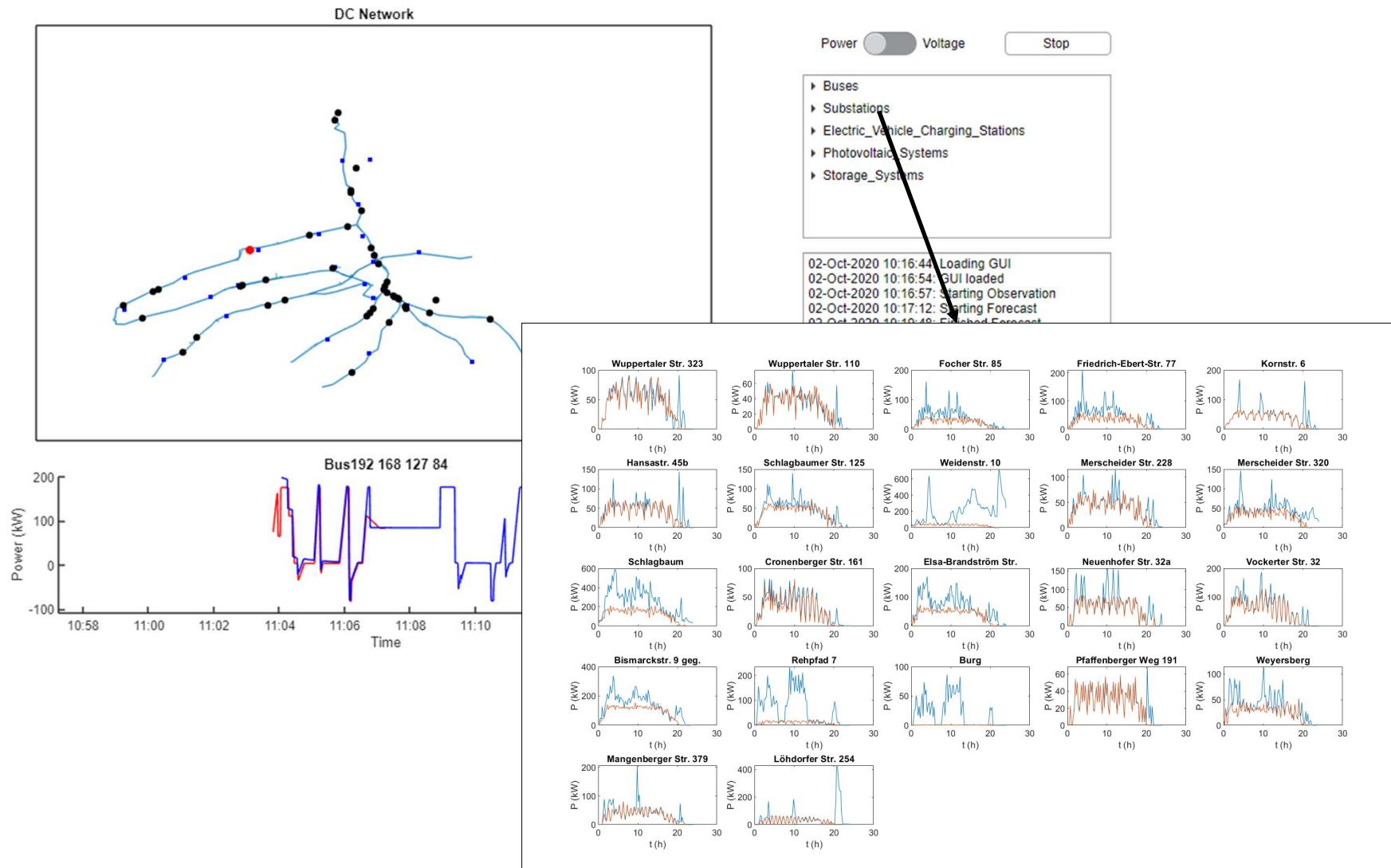
continuously gathering
live data of all
implemented
components



simulative prediction
of each individual
system component



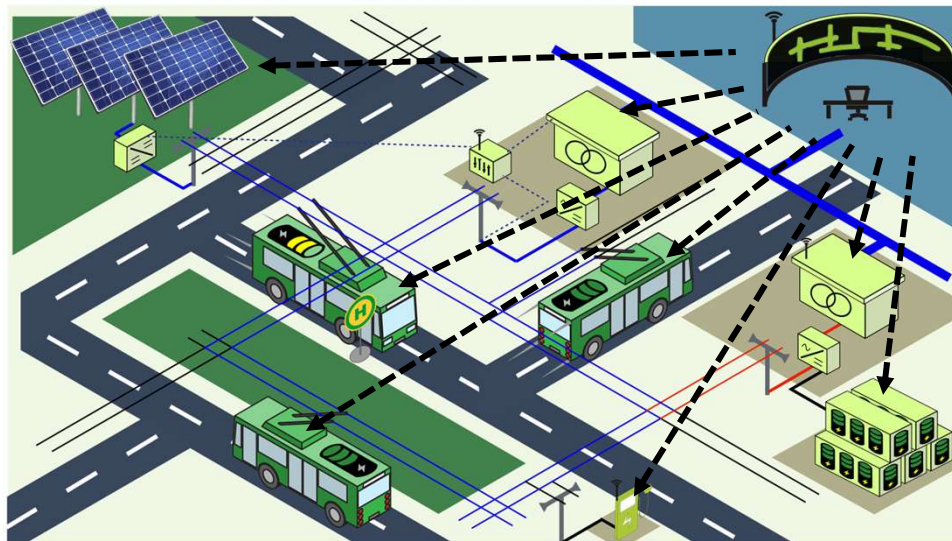
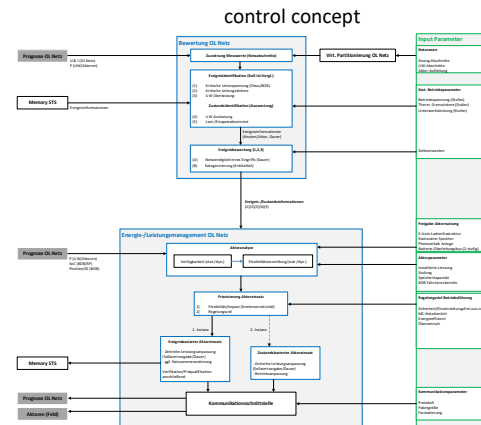
prediction of
grid state



control



running control algorithms



sending control orders
to each system
component

BOB – an integrated energy system

- 100% emission-free public transport
- High efficiency as electricity is directly used
- Through smart energy management systems stability can be maintained and new business models can be realised
- Uncertain legal framework

Gefördert durch:



Koordiniert durch:



Thank you!

Get the latest project news at
www.bob-solingen.de (German only)

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