



# ZERO-CO<sub>2</sub> PUBLIC TRANSPORT: FROM VEHICLE TO SYSTEM OPTIMIZATION

Three research institutions from Bern University of Applied Sciences BFH and ETH Zürich worked on the new «SwissTrolley plus» bus of the Hess AG in the framework of SCCER Mobility, Innosuisse and BFE projects.

## Decarbonization and Zero-CO<sub>2</sub>

New public transport bus fleets – as the «SwissTrolley plus» – help to pursue Swiss energy strategy 2050 by decarbonizing road transportation.

## Energy, Battery and Bus-Route

«Swiss Trolley plus» is a new “in-motion-charging” trolleybus resulting from the combination of three research axes. The development of a self-learning predictive energy management system (team C. Onder ETHZ), a battery State of Health (SoH) model for tailor-made battery pack degradation reduction (team A. Vezzini, BFH) a planning tool to optimize and extend «Swiss Trolley plus» bus routes (team J. Huber BFH). The overall outcome is a reduction in CO<sub>2</sub> emissions and an increase in the quality of life along the bus route in the neighborhoods.

## Interdisciplinary Consortium

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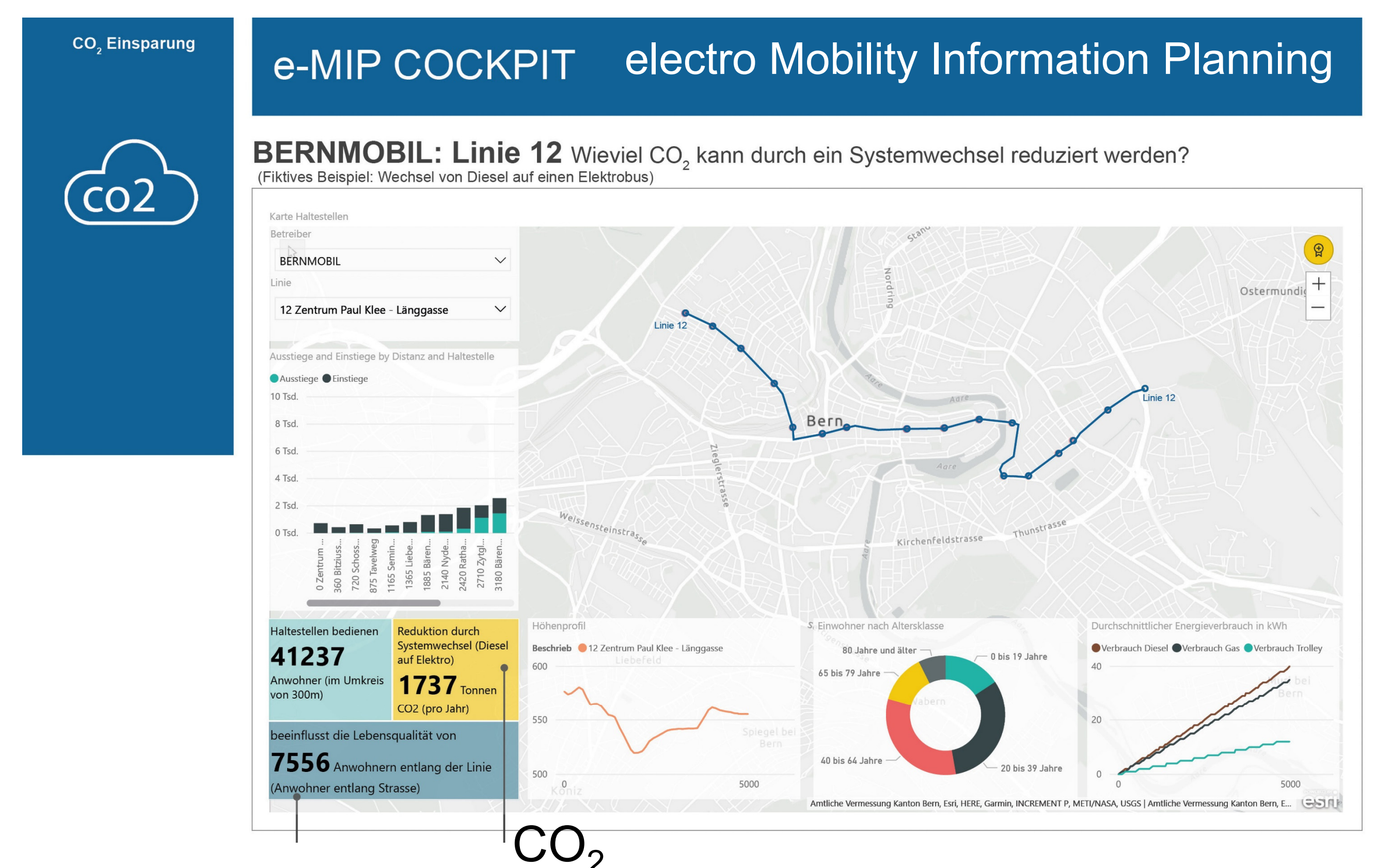
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## (Big) Data Management

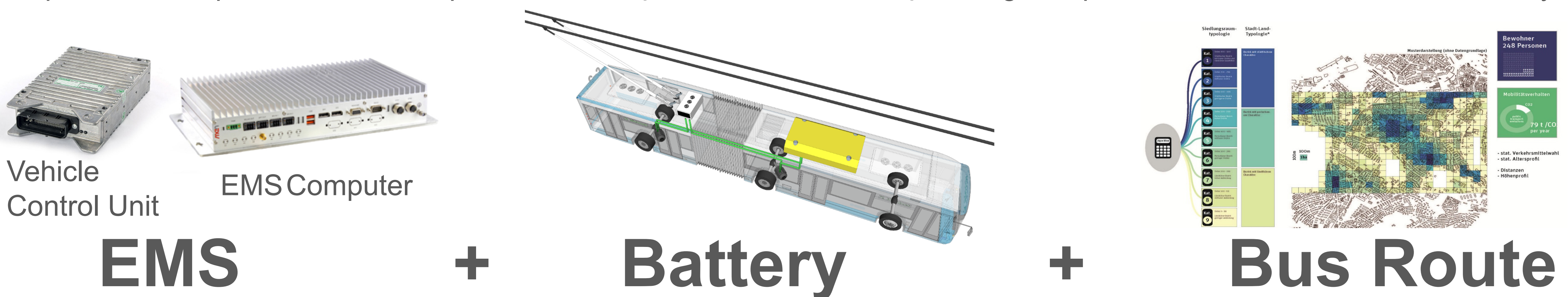
Energy-, battery- management and urban contextual analysis today means (Big) Data research. The projects culminated in:

- **15% reduction in energy consumption** through the new energy management system (EMS), compared to state-of-the-art trolley buses, demonstrated in a field study.
- An **increase of the battery lifetime by 25%** with only a slight increase in energy demand of 3%, obtained by integrating the SoH model in the EMS.
- The ability for **line extensions** that were planned (VBZ, Bernmobil, VBB), simulated (Dencity BFH) and tested (VBZ, Bernmobil). The bus route extensions were evaluated by a complex index (Dencity BFH) of urban densification statistics in relation to route maps of the public transport providers and are summarized in a decision-making-cockpit.



## Learning Trolley System - Energy, Battery, Bus Route-Cockpit

An enhanced predictive learning energy management system in combination with battery's operation strategies that minimize degradation result in optimized and extended grid free bus routes that are spatially visualized in a decision-supporting cockpit for the procurement process. The cockpit shows the optimized bus routes, passenger capacities, utilization and urban density.



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