



Portfolio Assessment of Sustainability Interventions for Mobility using an Energetic Model of the Swiss Transportation Sector

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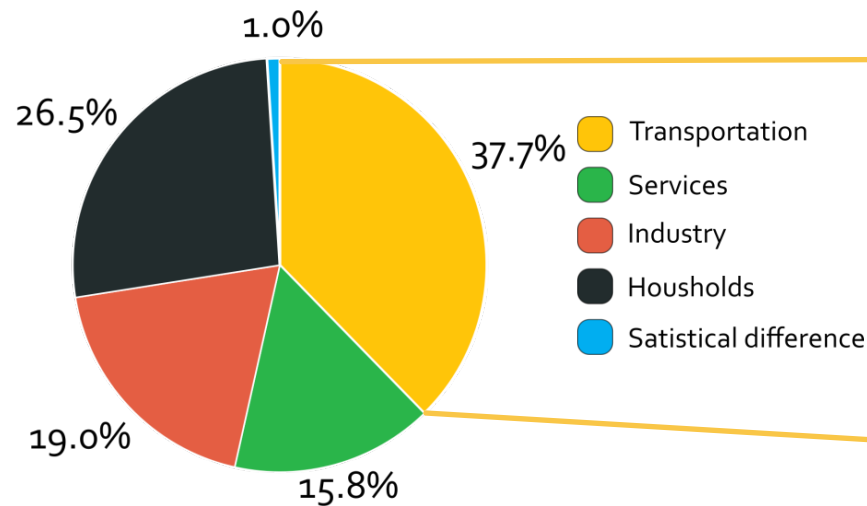
BACKGROUND

Swiss Transportation Sector

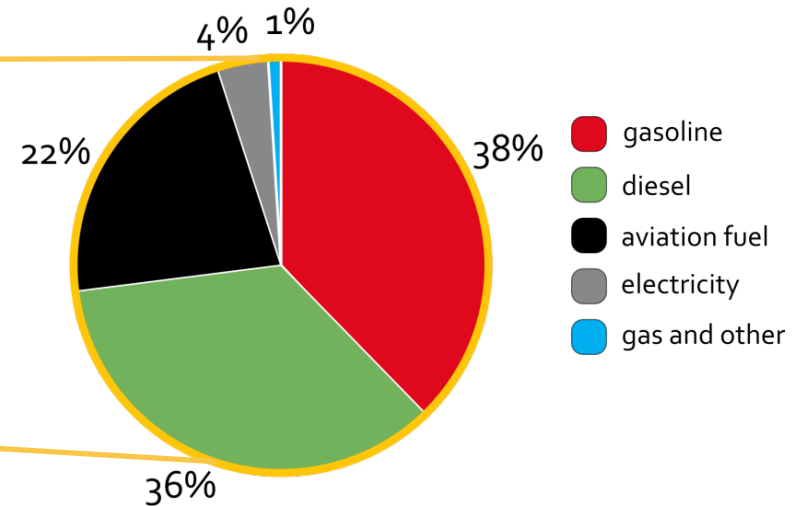
Why do we focus on it and what does it consist of?

- Political target: Reduction of energy demand + decarbonisation of society

Swiss end energy consumption



BFE: Schweizerische Gesamtenergiestatistik 2014



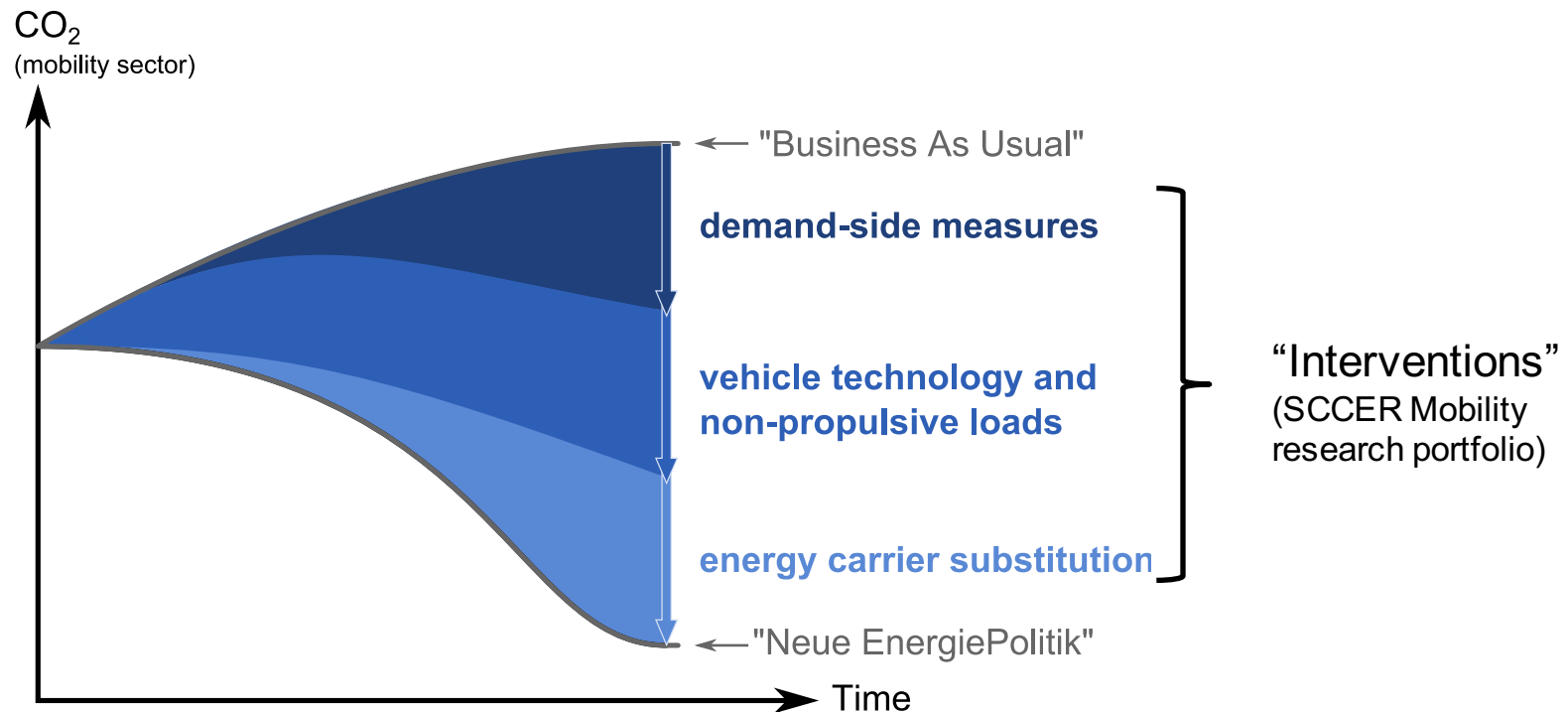
BFS: Mobilität und Verkehr - Taschenstatistik 2015

- 96% fossil carriers
- Focus on road based vehicles, private and freight transportation
- Swiss Competence Center for Energy Research – Mobility (SCCER mobility)

The core idea: intervening towards sustainability

SCCER develops means of influencing the system

- Systemic context of research projects → formulate intervention
- maximum reduction potential analysis of intervention

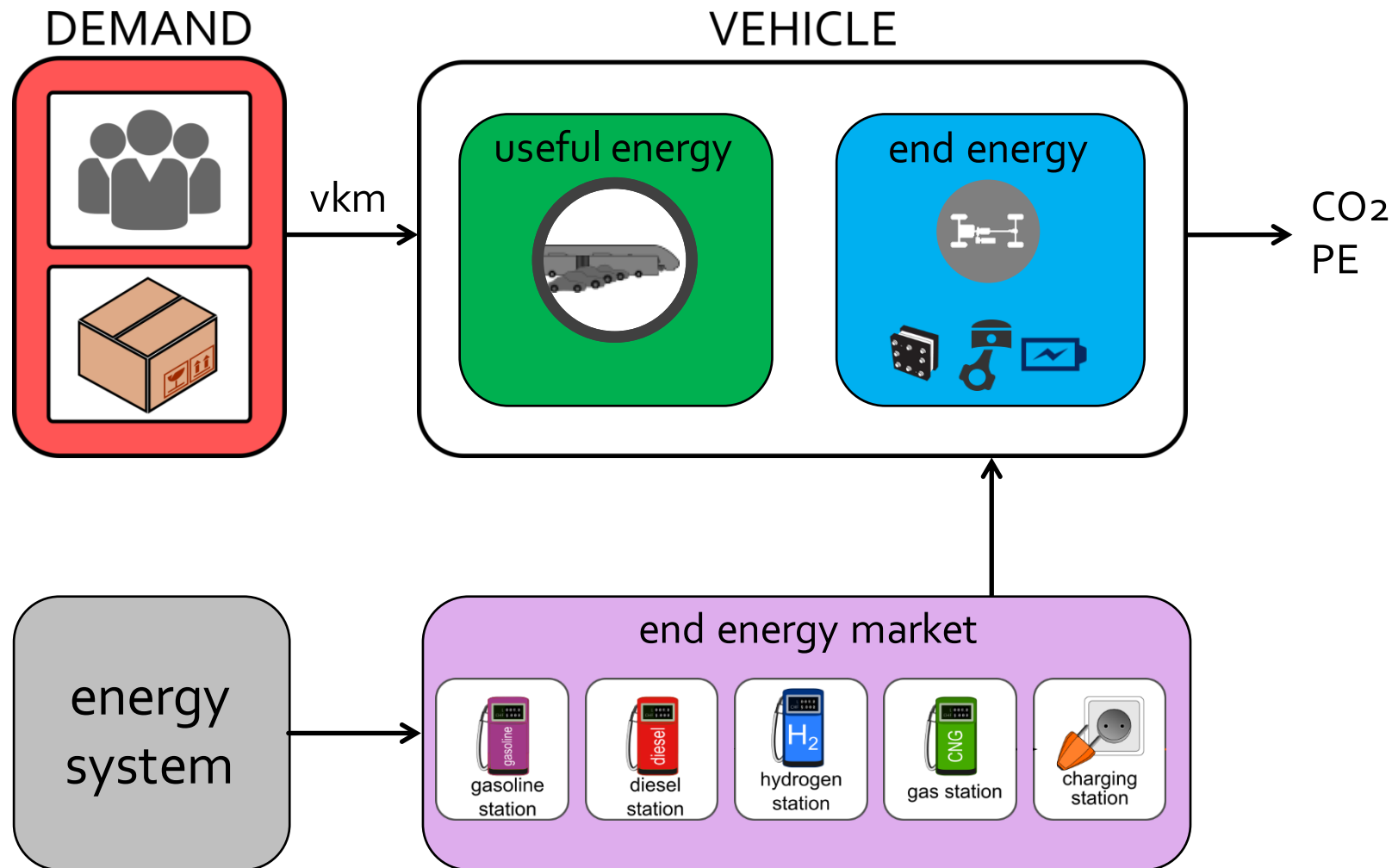


- Portfolio of intervention reveals possible pathways
- Instrument for dialogue and alignment of research

ENERGETIC MODEL

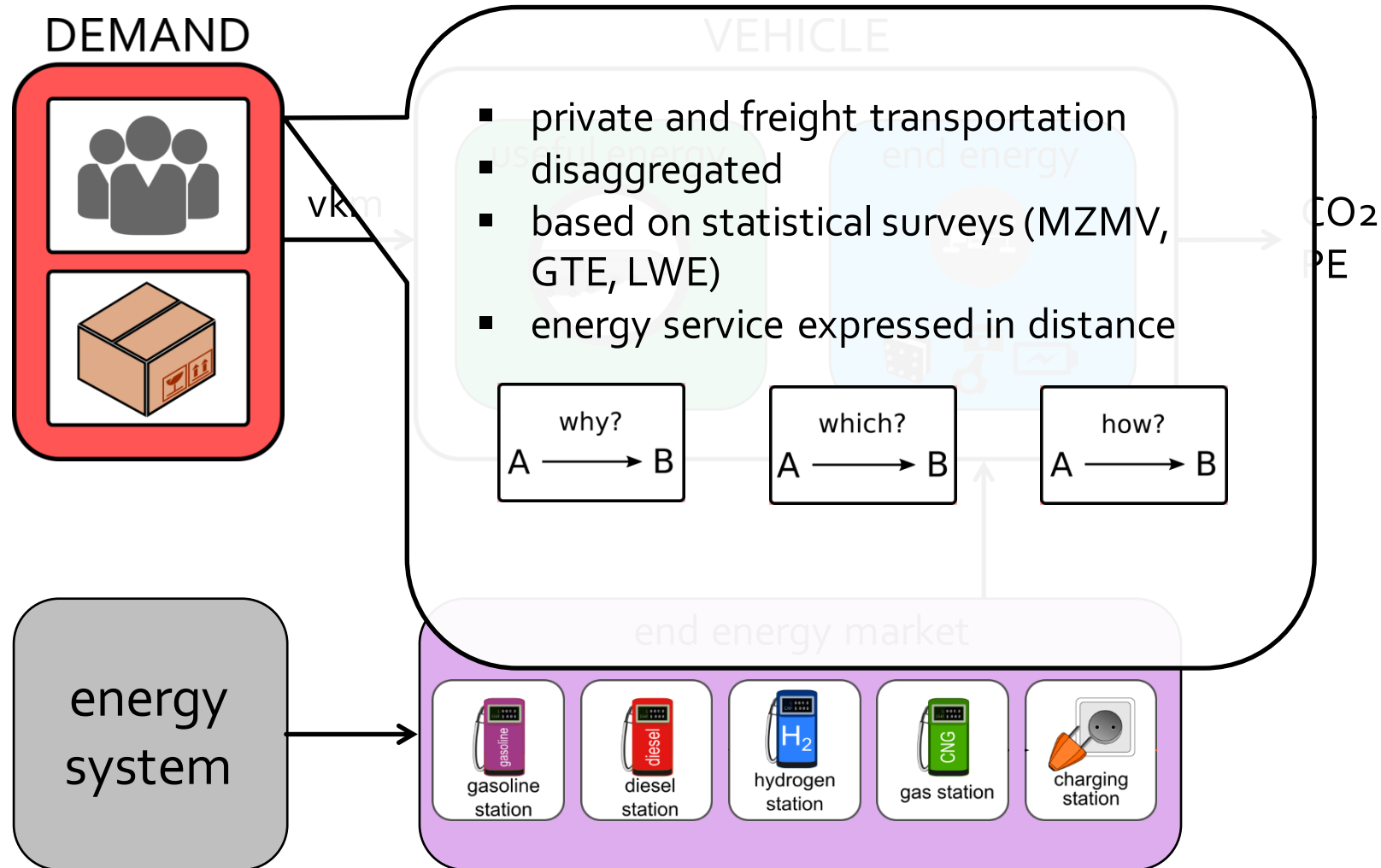
Holistic, systemic view of mobility

linking the mobility demand, vehicle technology and the energy system



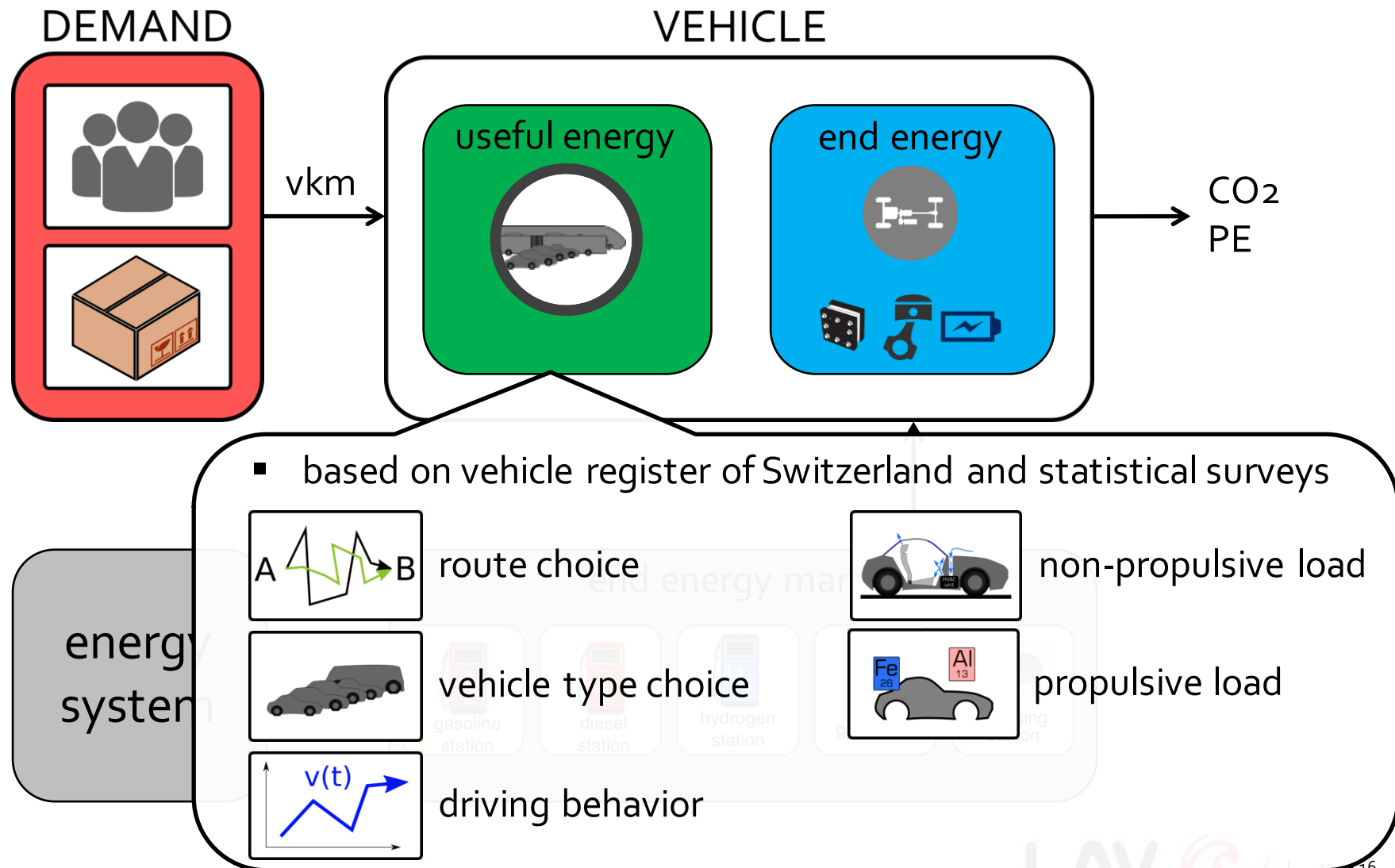
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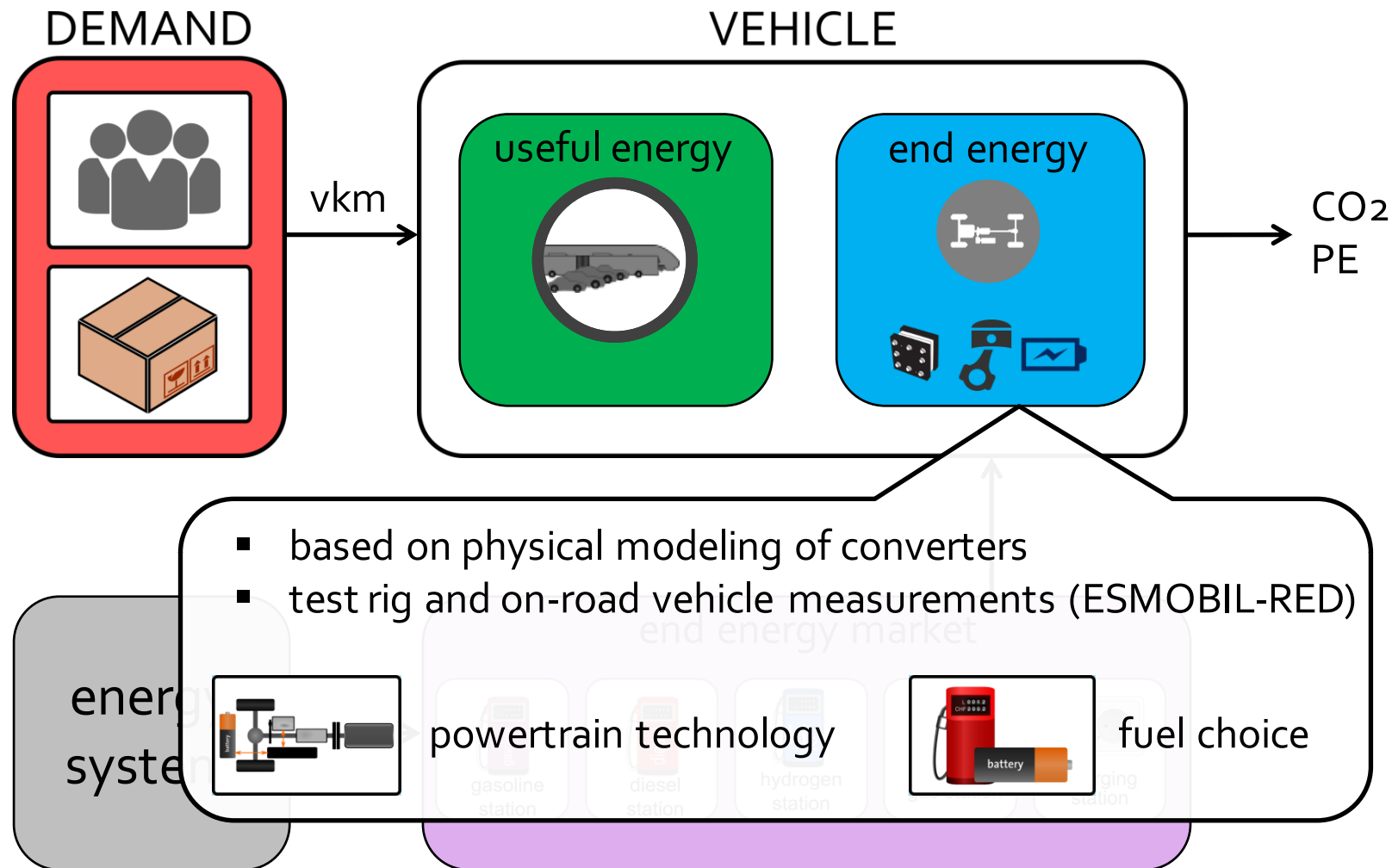
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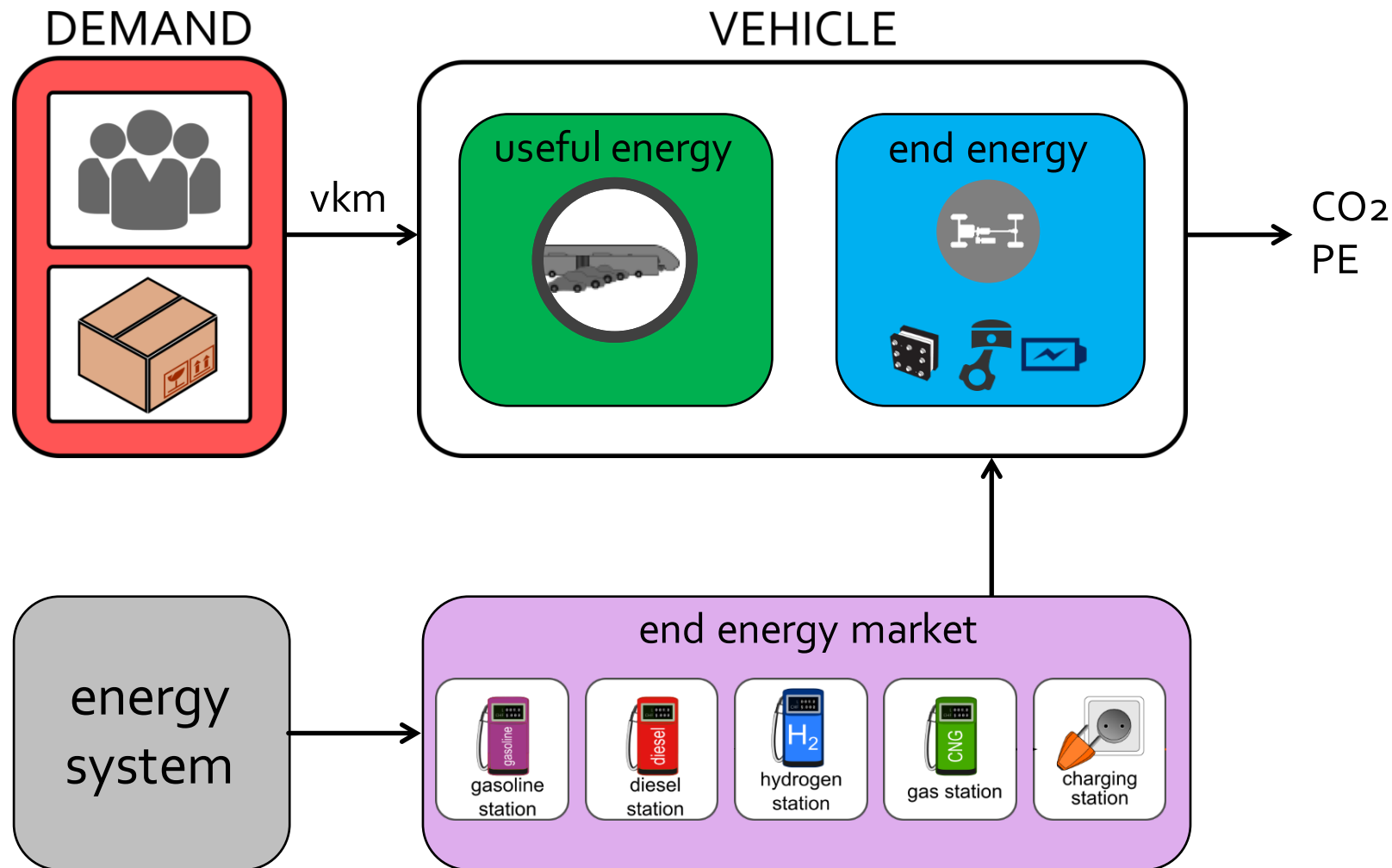
Holistic, systemic view of mobility

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Holistic, systemic view of mobility:

linking the mobility demand, vehicle technology and the energy system



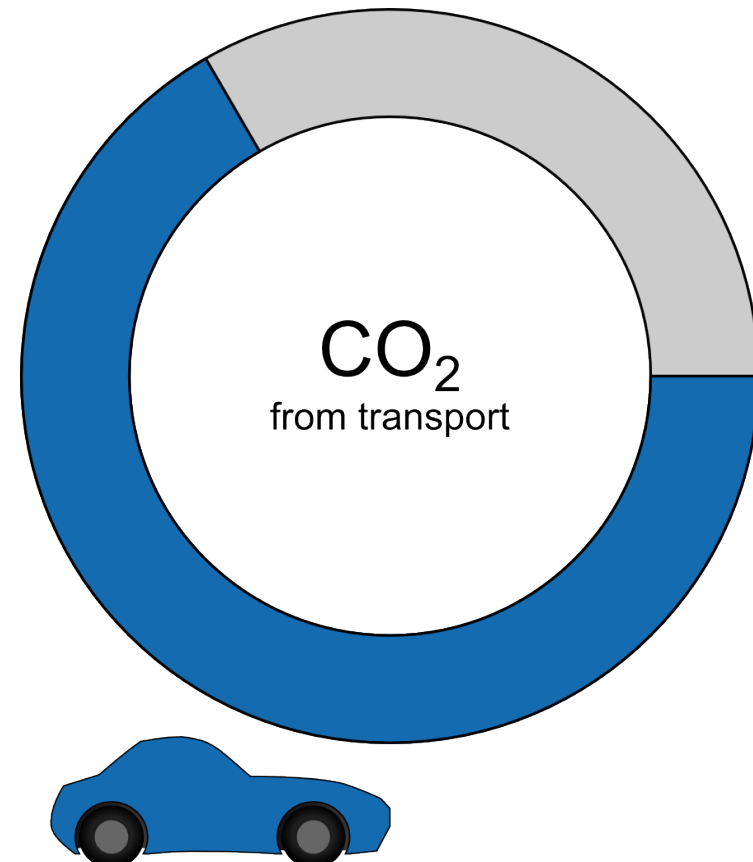
EXAMPLES

EXAMPLE: substituting car → bike

using bicycles when going less than 5 km

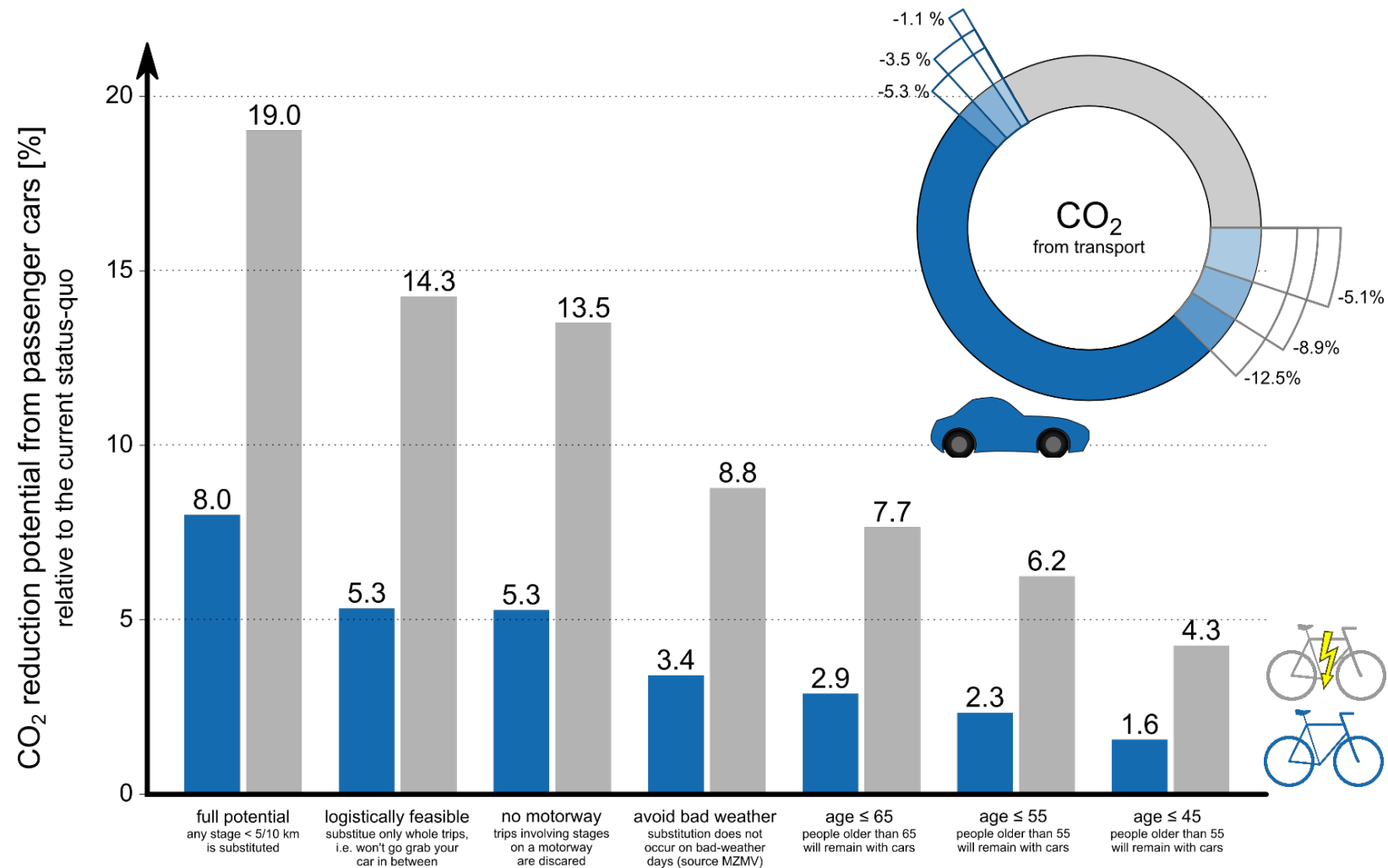


| | |
|---------------------|---|
| Origin | SCCER management |
| Other inputs | CA-A1 BFH → battery performance CA-A2 EMPA → e-bike performance MOFIS (ASTRA) → fleet specs MZMV (BfS) → vehicle movements |
| Pathway | Demand side (mobility distribution) |
| Mechanism | Substituting car-trips with bicycles → The average trip-length by car is very short → potential for subst. |
| Impediments | Comfort |



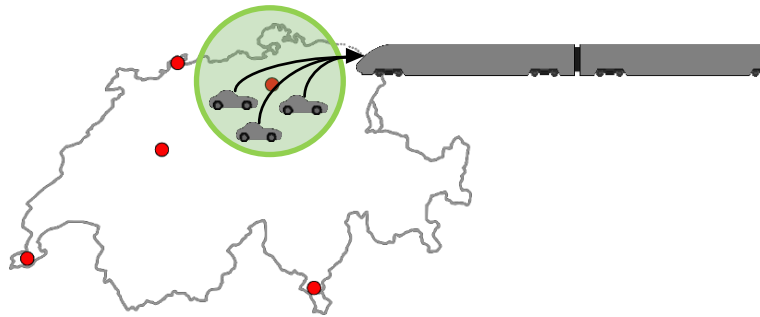
EXAMPLE: furthering non-motorized mobility

Car trips are substituted by bicycles trips → but there are impediments

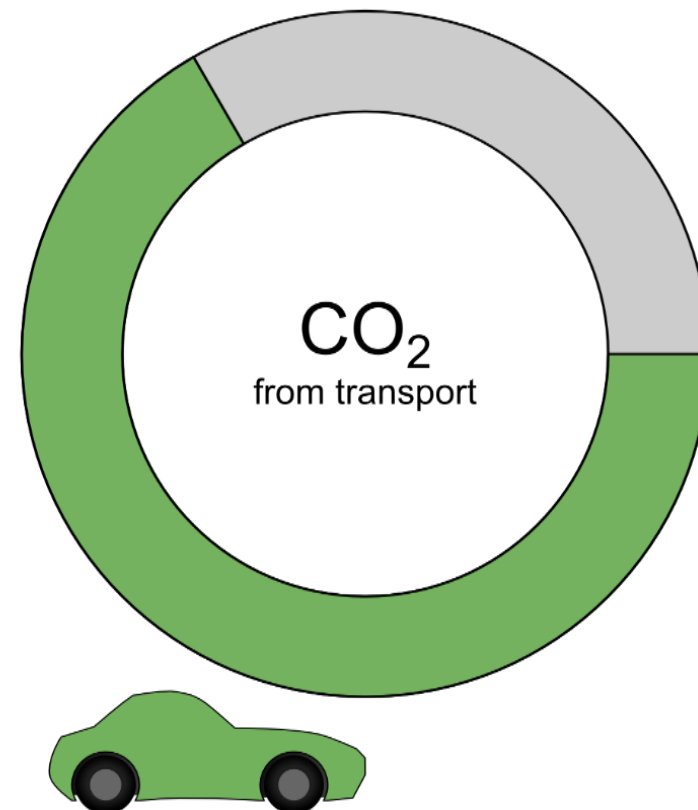


EXAMPLE: increasing the modal split: car → train

promotion of railway commuting to “core cities” (with well-developed pub. trans.)

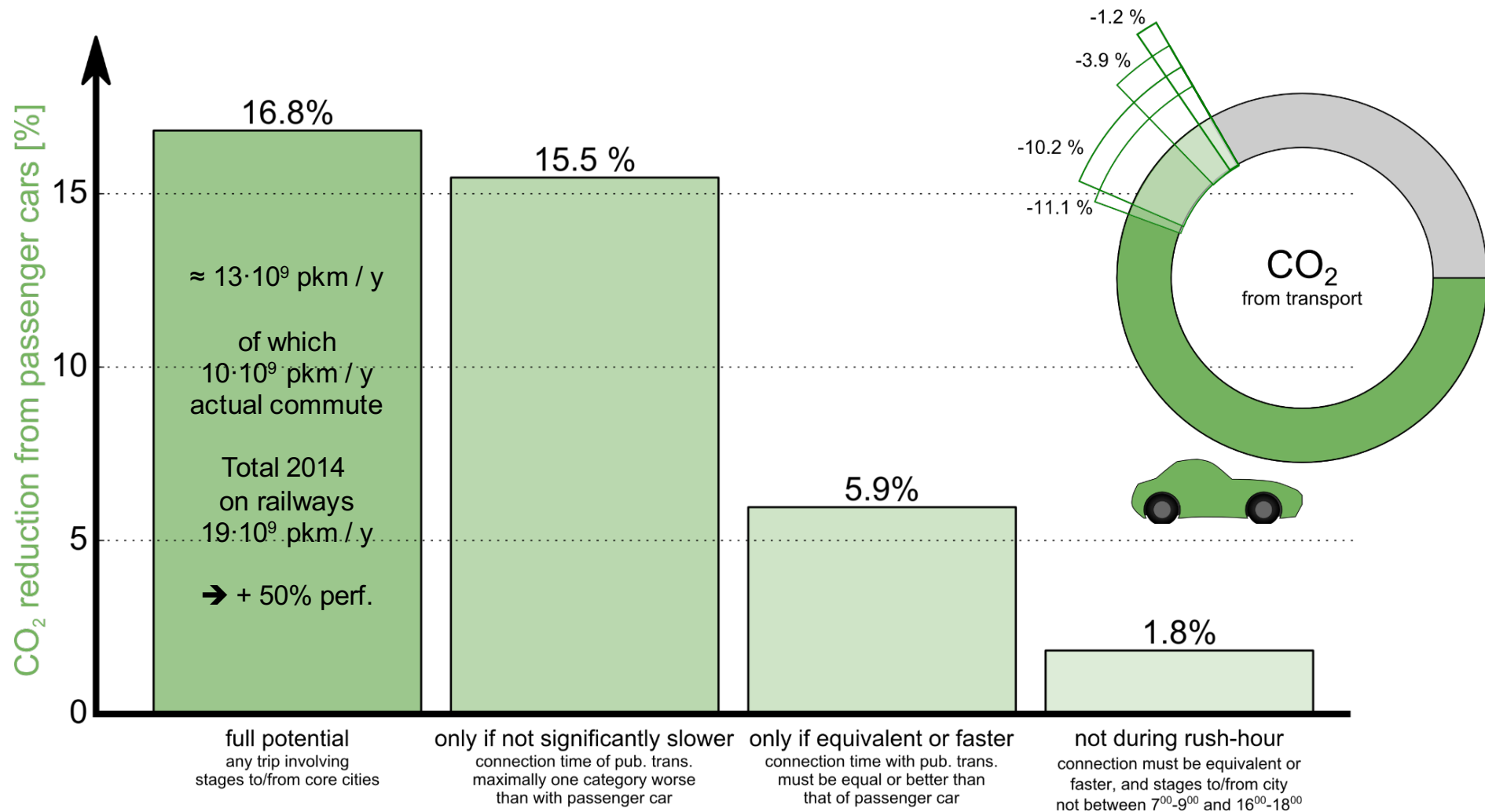


| | |
|---------------------|--|
| Origin | CA-B2, Dr. Merja Hoppe (ZHAW) |
| Other inputs | CA-A2 LAV → engine performance MOFIS (ASTRA) → fleet specs MZMV (BfS) → vehicle movements SBB → train specs and utilization |
| Pathway | Demand side (mobility distribution) |
| Mechanism | Substituting car-trips to core cities → Well-developed pub. trans. in core cities enables the substitution |
| Impediments | Comfort |



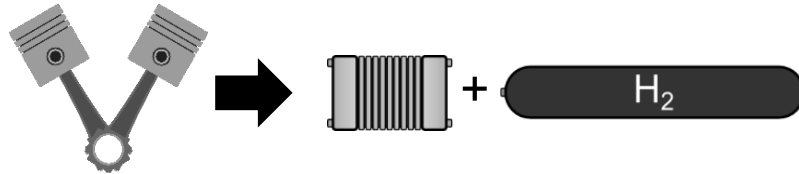
Elimination of commuting by passenger car

→ reduction of CO₂ relative to current individual mobility sector

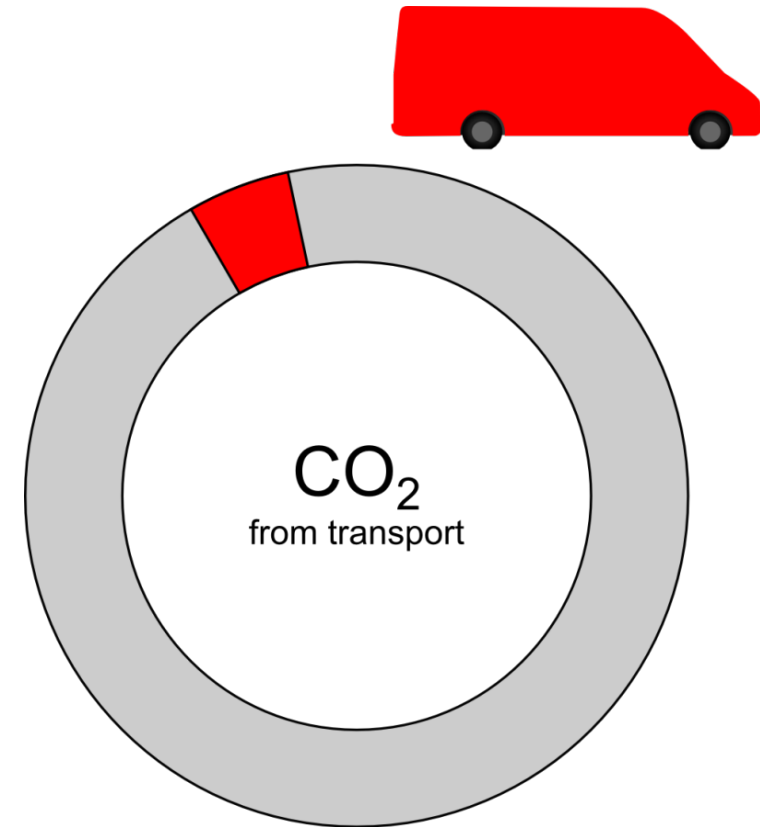


EXAMPLE: propulsion technology: ICE → fuel cell

→ electrification via fuel-cells for delivery vans

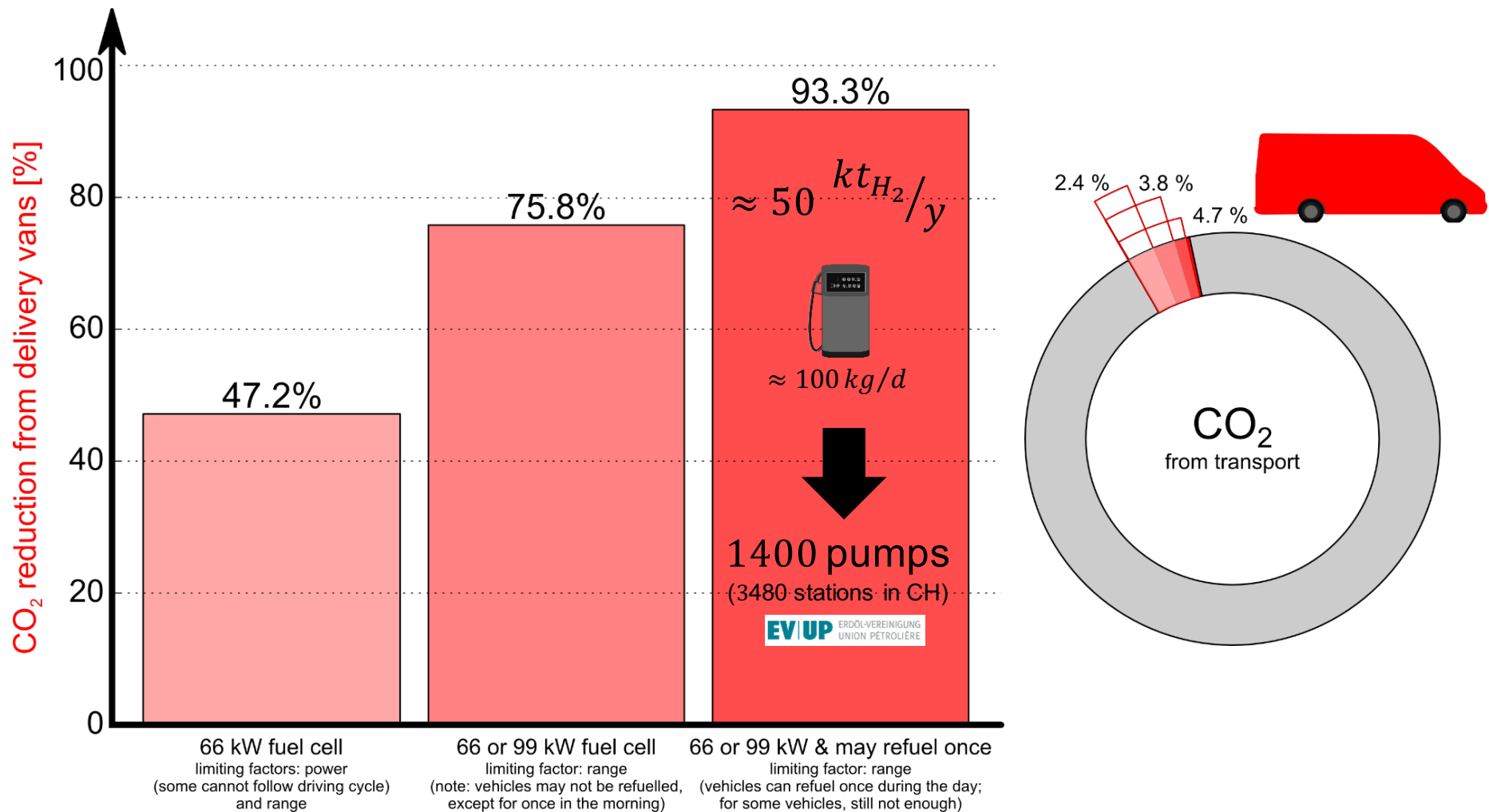


| | |
|---------------------|---|
| Origin | CA-A2, Dr. Felix Büchi (PSI) |
| Other inputs | CA-A2 PSI: fuel cell performance CA-A2 LAV: ICE performance CA-B2 PSI: LCA → hydrogen & electr. MOFIS (ASTRA) → fleet specs. LWE (BfS) → vehicle movements |
| Pathway | Energy carrier substitution |
| Mechanism | Substitution of conventional propulsion systems in vans → Commercial fleets = option to generate profits with H2 fuel station |
| Impediments | <ol style="list-style-type: none">1. Insufficient acceleration power (vehicle can't follow driving cycle)2. Insufficient range (daily mobility demand cannot be satisfied) |



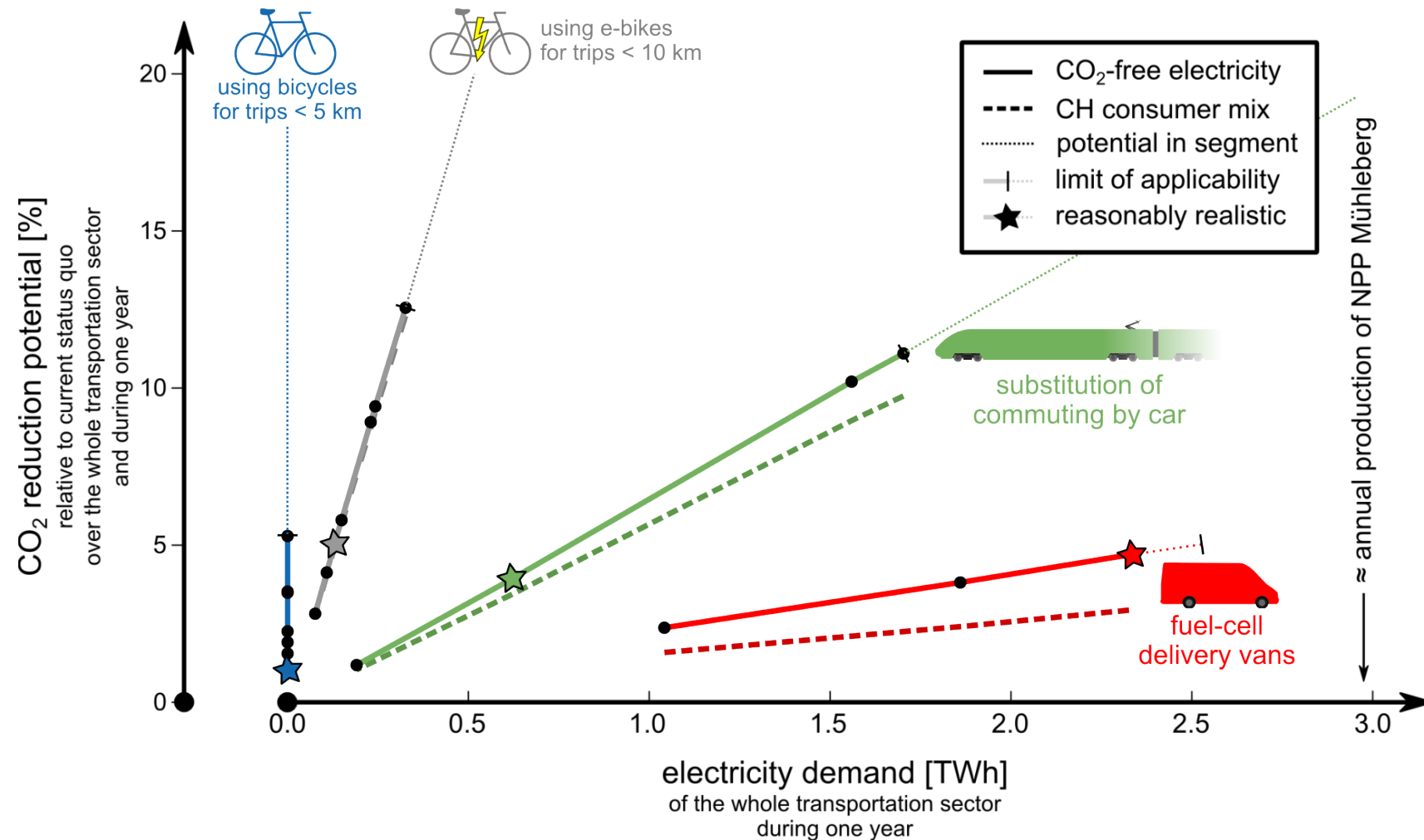
Fuel-cells → delivery vans

→ CO₂ reduction potential within segment (delivery vans)



Interventions in their systemic context

→ substitution of fossil-fuels by electricity (and possibly human muscle power)



Data: Mikrozensus Mobilität und Verkehr 2010 [ARE/BFS],
Erhebung leichte Nutzfahrzeuge 2013 [ARE/BFS]



Conclusions and Outlook

Concept demonstration

- Methodology currently in an “alpha”-stage
- Provides systemic context of “interventions” in terms of maximal CO₂ reduction potential
- Systemic inventory/cataloguing of interventions
- Rebound effects not coverable

Next steps

- improve on spatial and temporal disaggregation
- Implementing cascades / interactions → combined interventions
- Projections into the future
- Model development (Projects: ESMOBIL-RED, SCCER Strategic Guidance)

Added benefits for SCCER

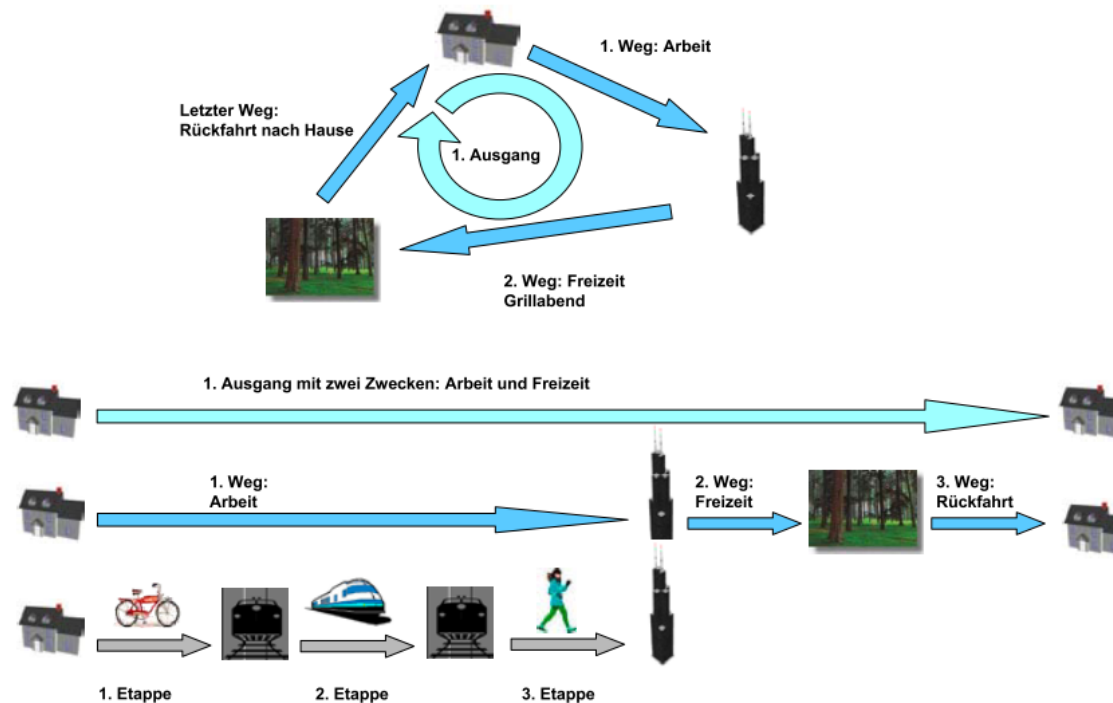
- Generate ideas for additional research / uncover gaps

Reflecting the demand side: passenger transport → microcensus

- «Mikrozensus Mobilität und Verkehr 2010» (MZMV 2010)
 - survey based on 62'868 people
 - tracing of individual people, by stages (distance travelled with one vehicle)
 - covers travelling purposes
 - vehicle ownership and usage information
 - federal dataset for calculation of transportation and kilometer performance
- latest and most detailed disaggregated representation of private transportation

Reflecting the demand side: passenger transport → microcensus

- «Mikrozensus Mobilität und Verkehr 2010» (MZMV 2010) - Method



Reflecting the demand side: freight transport → “GTE” and “LWE”

- «GTE» and «LWE»
 - kilometer performance of freight transportation on public roads
 - tracing of goods
 - information regarding vehicle emission category

→ complete, disaggregated datasets of freight transportation on road

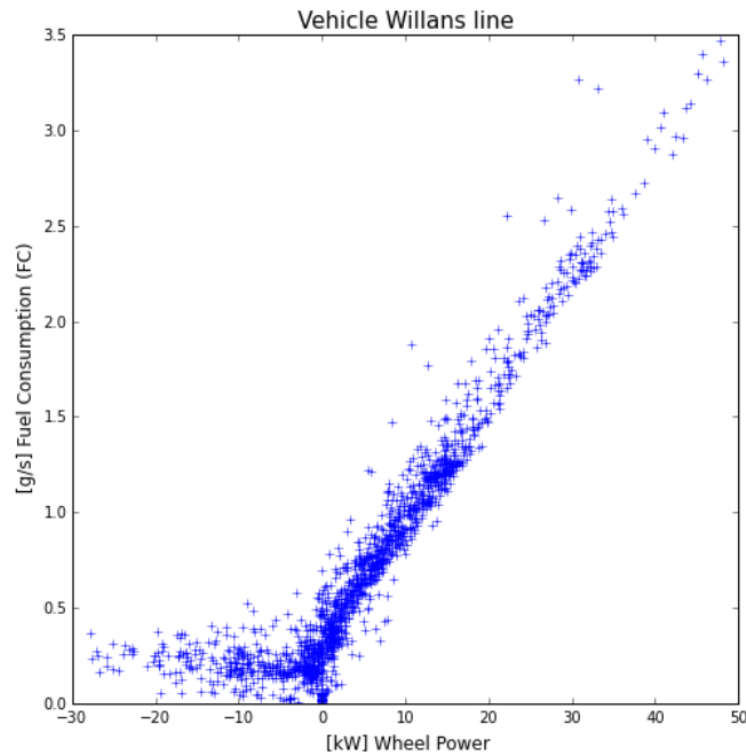
- «Automatisiertes Fahrzeug- und Fahrzeughalterregister» (MOFIS)
 - national vehicle inventory
 - technical vehicle specifications

→ dataset of all currently registered vehicles in Switzerland

Test rig data

- Skoda Octavia C 1.8 4x4 ; WLTC Messung - Fahrzeug Willans line

Test rig raw data



Vehicle: $P_{in} - P_{out}$

