

# Phase II: The Challenges Ahead

Prof. Konstantinos Boulouchos, Head SCCER Mobility

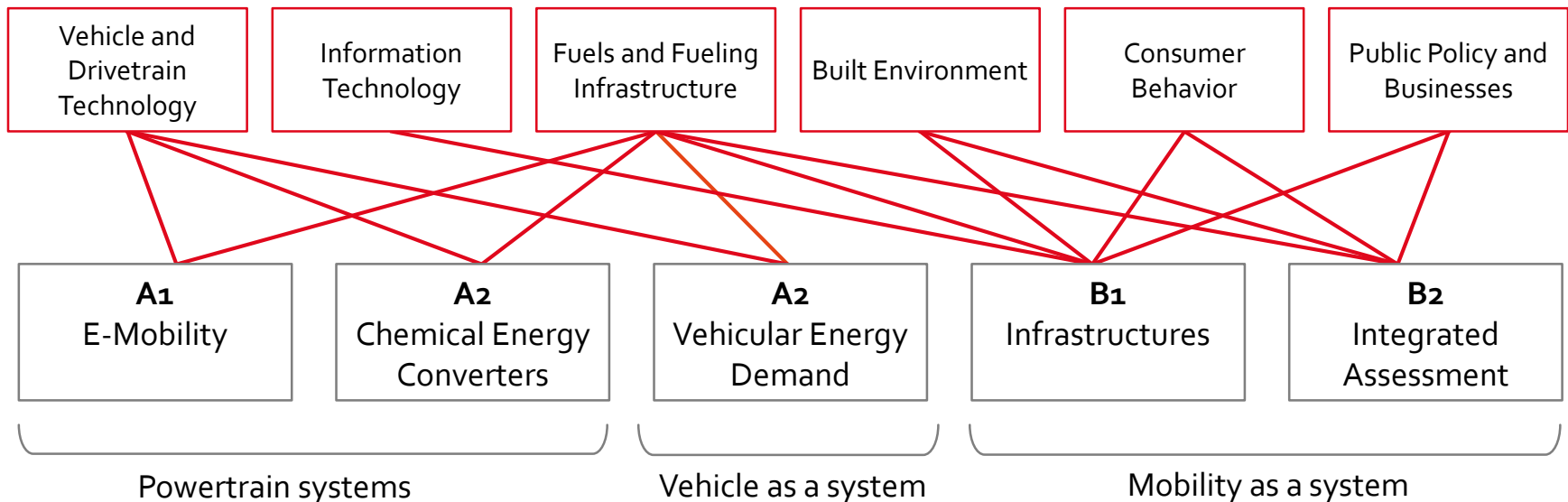
# Phase II: strong focus on Interdisciplinary and Integrated Approach to Mobility

- Further exploiting synergies within SCCER Mobility
- Join Activities (JA): Toward the integration of Mobility with the overall Energy System
- Vision Development:
  - Complement “bottom-up” with “top-down” approaches towards a coherent research strategy
  - Integration instrument among research groups and Capacity Areas

# Interdisciplinary and Integrated Approach to Mobility

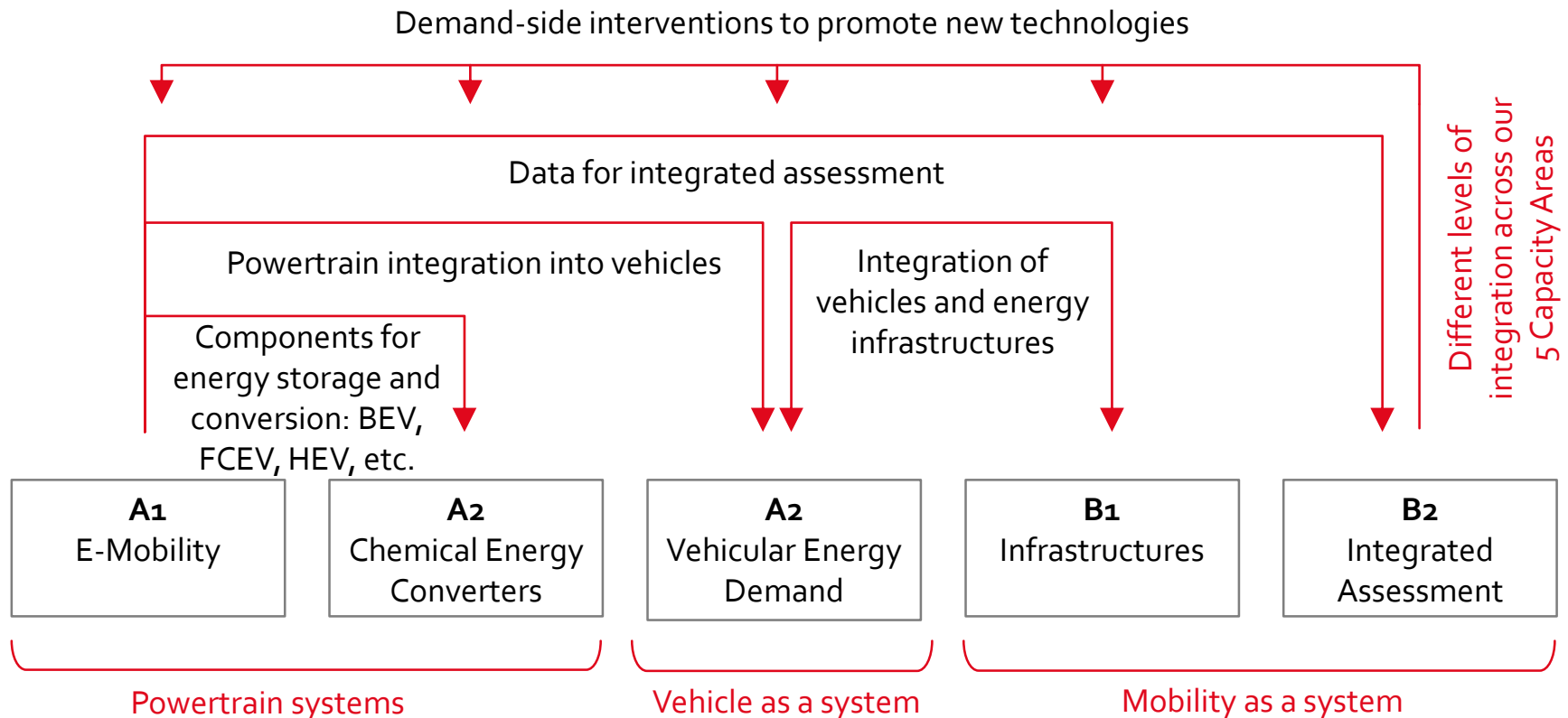
Future mobility and transportation depend on **complex and inter-related technological, social, economic and political developments.**

To cope with this complexity, **SCCER Mobility's approach is highly interdisciplinary and ...**



# Interdisciplinary and Integrated Approach to Mobility

... increasingly integrated in phase II (2017-2020), ...



# Interdisciplinary and Integrated Approach to Mobility

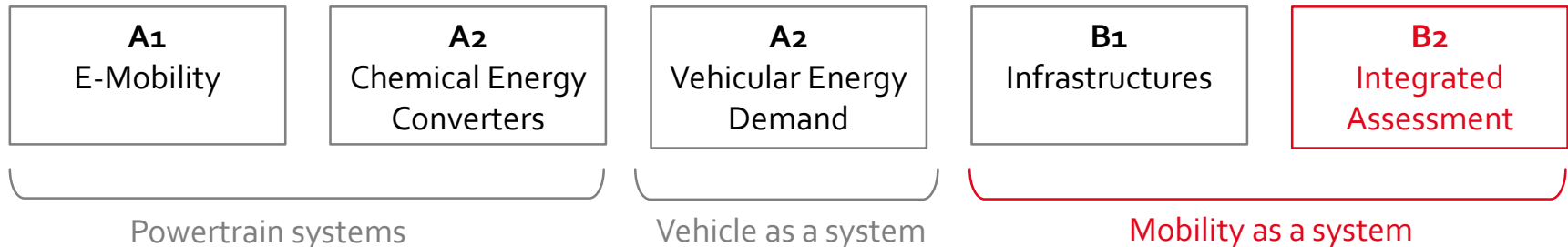
... with new **cross-cutting and extended socio-economic research activities.**

MAS | CAS ETH Future Transportation Systems → **Interdisciplinary, advanced training**

Learning Lab Future Transport Systems → **Development paths for Swiss mobility**

SCCER Mobility White Papers → **Communicating research to external stakeholders**

New Joint SCCER Activities → **Integration of energy research in Switzerland**



# Learning Lab Future Transport Systems (L<sup>2</sup>-FTS)

**Extension of the Strategic Guidance Project** (whose potential was limited to first order interventions) to account for subsequent effects on energy demand and GHG emissions or feedback loops of transport related interventions

Framework for

- **Integration of SCCER Mobility research** into future path of the Swiss transport system
- **Definition of important research questions**
- Exploratory tool in the new MAS | CAS ETH in Mobilität der Zukunft (Future Transport Systems) to **facilitate interaction between researchers and external partners**
- **Outreach** to opinion leaders and the interested public

Hosted at ETH Zurich, LAV

# SCCER Mobility White Papers

- **Phase II: Series of SCCER Mobility White Papers to communicate research findings in specific fields of general relevance for politics, public administration or industry**



# Joint Activities

## Toward the integration of Mobility with the overall Energy System

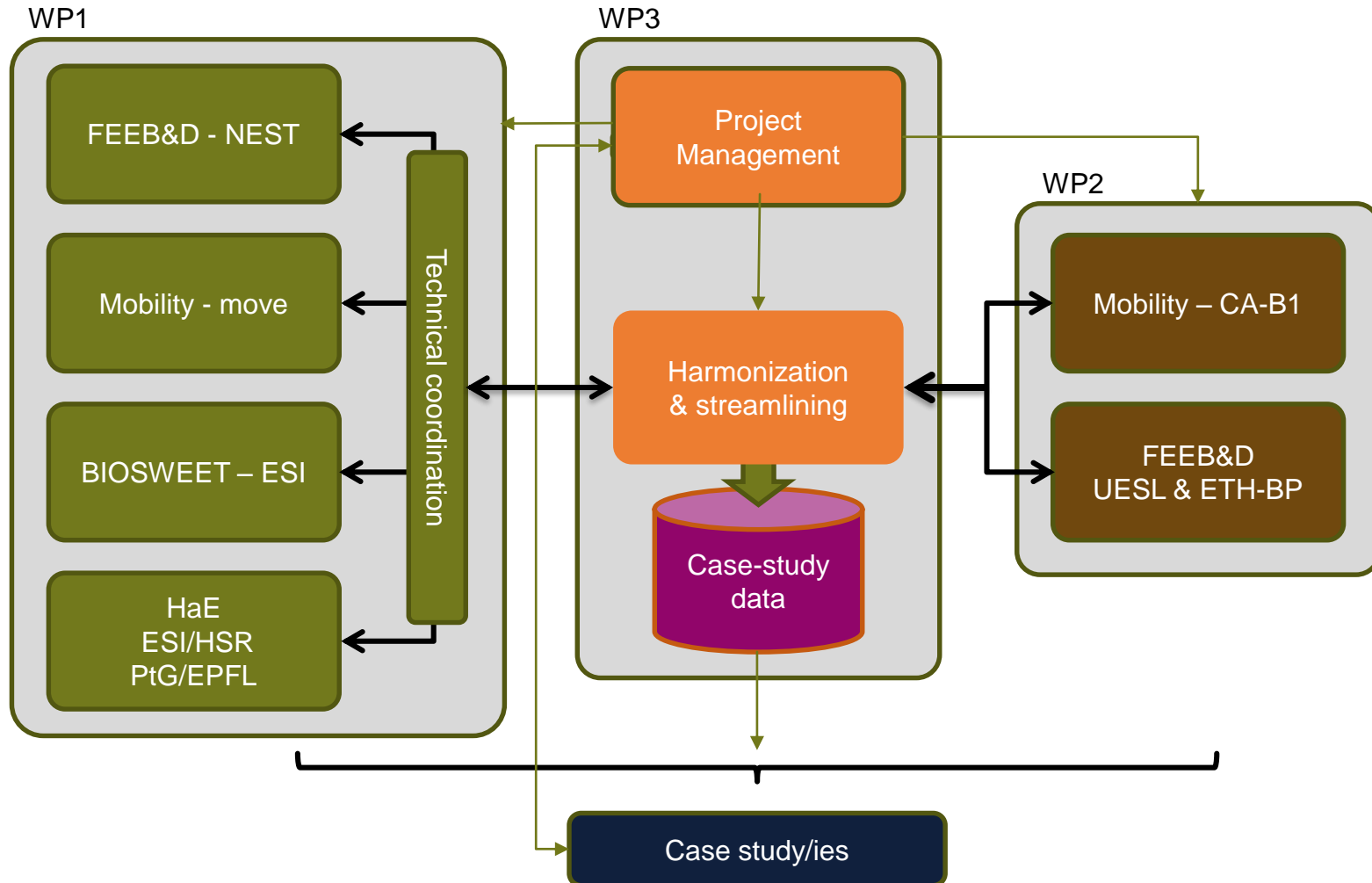
- CEDA: Common Energy Demonstrator Access (Lead Mobility)
- CREST-Mobility (Lead CREST)
- Simulation and Modeling (Lead SoE)
- White Paper on P2X (Lead HaE)



# Joint Activity CEDA- Coherent Energy Demonstrator Assessment

- **The aim of CEDA**
  - is to **provide a common basis for the energy-systemic view** of the different storage and conversion technologies investigated in the demonstrators, interfacing these with the mobility and building demand patterns.
  - To guide the process the team will address the specific needs of a set of **dedicated case-study** projects (in preparation with external stakeholders).
  - Anchoring Capacity Areas A3, B1
- **Participating SCCERs: HaE, FEED&D, BIOSWEET and Mobility,**

# CEDA – Coherent Energy Demonstrator Assessment



# Joint Activity with SCCER CREST

- **Additional funding** for joint research activities to ...
  - ... analyze legal, economic and social determinants of mobility demand and investments in new mobility infrastructure
  - ... estimate energy impact of mobility scenarios 2050
- **Approaches** (still in discussion)
  1. Detailed modeling of demand for mobility (incl. rebound effects) and identification of parameters influencing demand
  2. (Loose) coupling of behavioral, economic and environmental modelling tools
  3. Field experiments
- **SCCER Mobility Research Groups involved**

ETHZ IVT (K. Axhausen), PSI LEA (S. Hirschberg), ZHAW INE (M. Hoppe)

  - Anchoring Capacity Areas B1 and B2

# Joint activity: Scenario and Modelling initiative

- To **combine the modelling capabilities** of the different SCCERs and to develop coherent and robust scenarios
- **Participating SCCERs:** CREST, SoE, Mobility, FURIES, HaE, EIP, FEEB&D, and BIOSWEET
- Anchoring Capacity Areas B2 and Learning Lab

## Joint activity: White Paper on P2X

- Assess the **technological and economic potential of P2X\*** to address the challenges of temporal and spatial grid balancing
  - \* Energy conversion technologies that produce synthetic gases, fuels or energy feedstock products using an electro-chemical conversion process.
- **Participating SCCERs:** SCCERS HaE, FURIES, Biosweet and CREST

## Vision Development: The purpose

- To **integrate perspectives** about the ideal future mobility system in Switzerland and about the impact of the SCCER activities, from the demand/supply res. Socioeconomic/ Technology side.
- To identify missing competencies and important interfaces for cooperation with other SCCERs
- To **expand the common ground** between researchers from the different disciplines in SCCER
  - To this end: The Vision Development report should help our members and interested reader to **keep in mind the big picture**
- Work currently in progress, final version due December 2016

# Vision Development: Targeting the Driving Factors

**Driving factors** for the evolution of **energy demand and CO<sub>2</sub>-emissions** in the transportation sector:

$$m_{CO_2|a} = \underbrace{(popul)}_{(A)} \cdot \underbrace{\frac{GDP}{popul}}_{(B)} \cdot \underbrace{\frac{pkm}{GDP}}_{(C)} \cdot \underbrace{\frac{vkm}{pkm}}_{(D)} \cdot \underbrace{\frac{E_N}{vkm}}_{(E)} \cdot \underbrace{\frac{E_{end}}{E_N}}_{(F)} \cdot \underbrace{\left[ \frac{E_{prim}}{E_{end}} \cdot \frac{m_{CO_2}}{E_{prim}} + \frac{E_{invest}}{n \cdot E_{end}} \cdot \frac{m_{CO_2}}{E_{invest}} \right]}_{(G)} \quad \underbrace{(H)} \quad \underbrace{(I)} \quad \underbrace{(J)} \quad \underbrace{(K)}$$

n= life-time of Hardware / infrastructure

(B), (C): exogenous drivers

(D), (E): demography, urban planning, and pricing policies

(F): vehicle technology, legislation

(G): powertrain technology, legislation

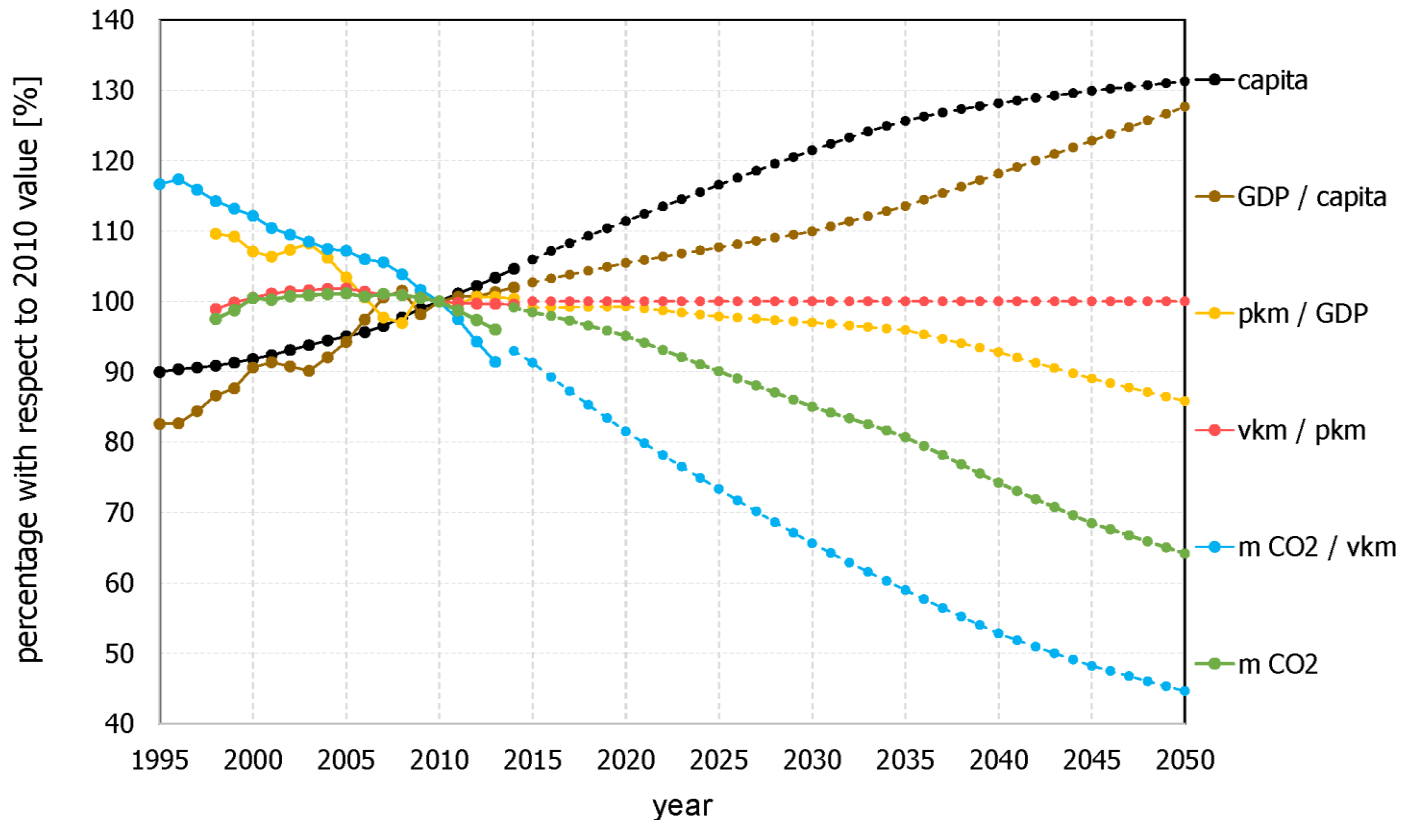
(H), (I): energy / electricity infrastructure, technology innovation, policy

(J), (K): technology innovation, policy / legislation.

# Vision Development: Targeting the Driving Factors

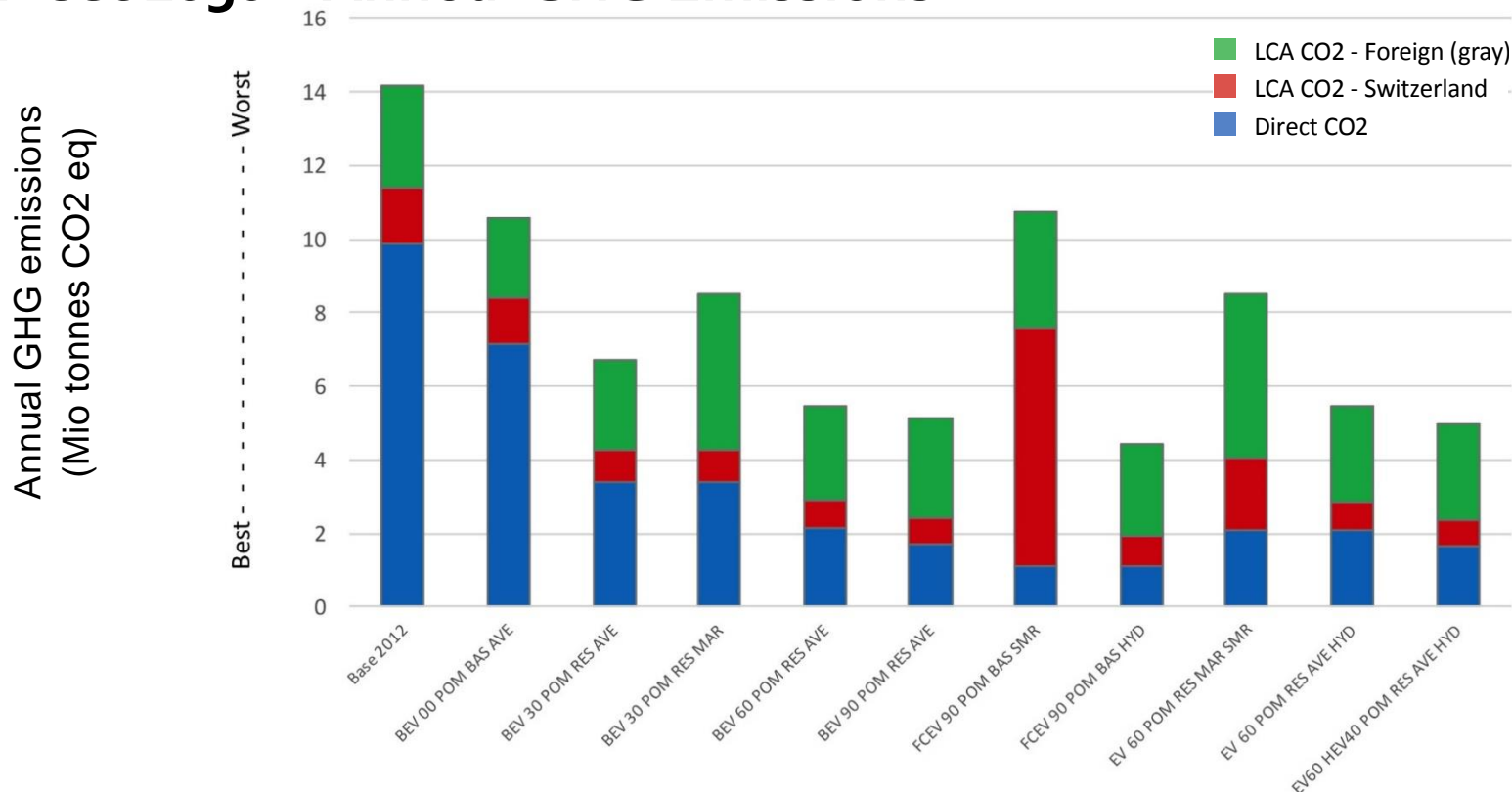
$$m_{CO_2} = (cap) * (GDP/cap) * (pkm/GDP) * (vkm/pkm) * (m_{CO_2}/vkm)$$

Kaya decomposition of road based passenger transportation on Swiss territory, backcasting and future trend





# Integrated Assessment Example: Fleet 2050 – Annual GHG Emissions



## Drivetrains

BEV - Battery Electric Vehicles  
FCEV - Fuel Cell Electric Vehicles  
EV - ½ BEV, ½ FCEV  
HEV - Hybrid Electric Vehicles

Numbers are % fleet sales penetration in 2050.  
Balance of fleet is internal combustion vehicles.

## Electricity

POM - Demand is BFE "Political Measures"  
BAS - Supply is gas-dependent strategy  
RES - Supply is renewables strategy  
AVE - Charging is average generation mix  
MAR - Charging is marginal generation mix

## Hydrogen

SMR - Steam Methane Reforming  
HYD - Electrolysis using Swiss Hydropower

Source: PSI-LEA, 2016

# Vision Development: The transformation path from a systemic perspective

- The transformation path is necessary to bridge the gap between the envisioned sustainable mobility system and the evolution based on current trends
  
- Interventions to realize this transformation path can be structured according to the following levels:
  - Micro-Level (individual mobility behavior)
  - Meso-Level (role of organizations)
  - Macro-Level (society / policy)

## Vision Development: next steps & phase II

- A first complete draft version will be ready within the next weeks the, the final version until end of 2016.
- Valuable experience and lessons learned from this project will flow into phase II
  - to provide strategic guidance on our research portfolio
  - and to support the development and assessment of future mobility scenarios.

Thanks for your attention