sccer mobility

Swiss Competence Center for Energy Research
Efficient Technologies and Systems for Mobility

In Zusammenarbeit mit der KTI

Energie
Swiss Competence Centers for Energy Research

Schweizerische Eidgenossenschaft
Confédération suisse
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Kommission für Technologie und Innovation KTI

Swiss Competence Center for Efficient Technologies and Systems for Mobility (SCCER Mobility)

Swiss Mobility Days

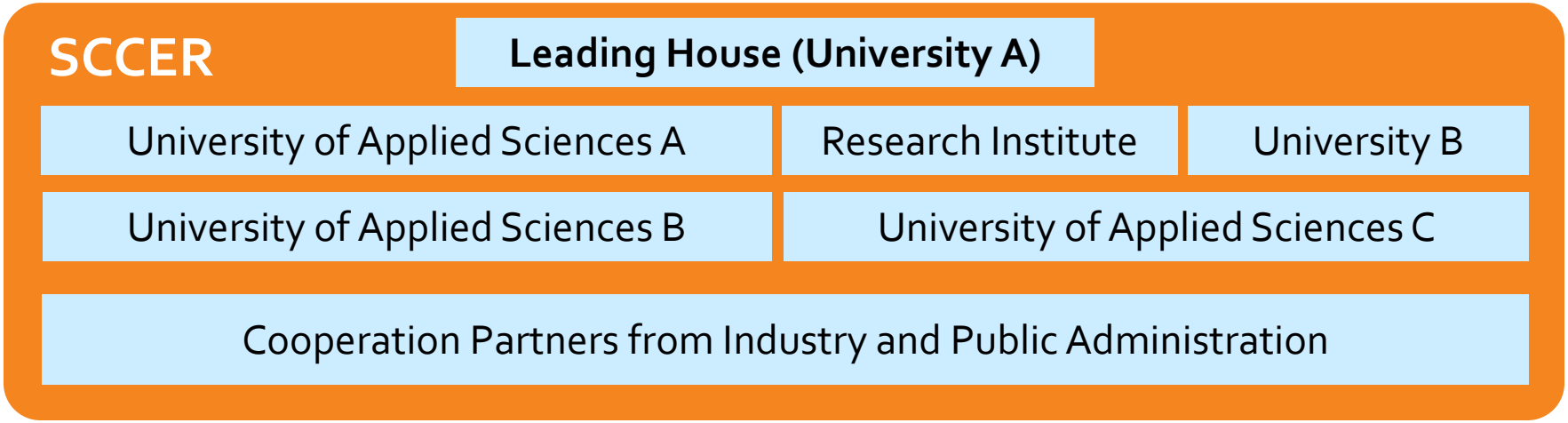
Prof. Dr. Andrea Vezzini

7 April 2016, CERM Martigny

The Swiss Competence Centers for Energy Research

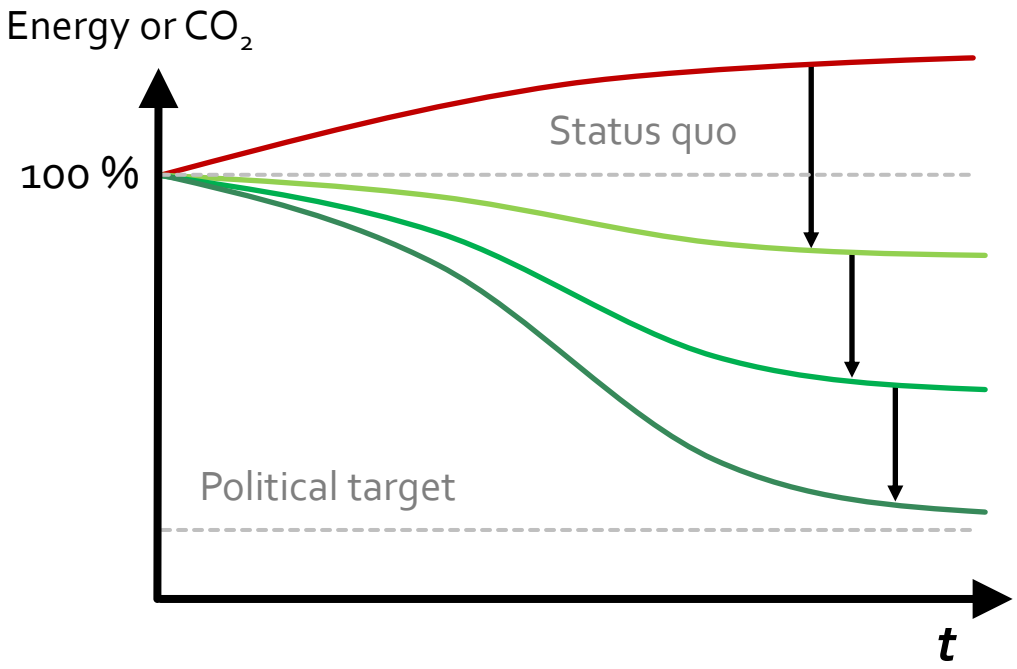
Purpose and Institutional Structure

- **Promote innovation** required to implement the Energy Strategy 2050
- **Develop solutions** for technical, social and political problems
- **Bundle the energy research activities** of Swiss universities and **work closely with industry** (virtual consortia)



SCCER Mobility Mission

Developing the knowledge and technologies essential for the **transition of the current fossil fuel based transportation system to a sustainable one**, featuring minimal CO2-output and primary energy demand as well as virtually zero-pollutant emissions.



Business as usual scenario

Mobility and transportation demand reduction

Energy conversion processes
(efficient drivetrain, reduction of vehicular energy demand)

Energy carrier substitution
(electricity, renewable fuels, H_2)

Members

23 Research Groups affiliated to

ETH zürich

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

PAUL SCHERRER INSTITUT PSI

EMPA Materials Science & Technology

Berner Fachhochschule
Haute école spécialisée bernoise

Lucerne University of Applied Sciences and Arts
HOCHSCHULE LUZERN

NTB INTERSTAATLICHE HOCHSCHULE FÜR TECHNIK BUCHS

n|w Fachhochschule Nordwestschweiz

SUPSI
Scuola Universitaria Professionale della Svizzera Italiana

zh aw

Leading House: ETH Zurich

Partners from Industry and Public Administration

ABB Turbosystems AG • Bcomp Ltd. • Bombardier • BRUSA Elektronik AG • Bucher-Schörling AG • Carrosserie HESS AG • CTI National Network Carbon Composites Schweiz • Designwerk GmbH • ESRI Schweiz AG • FPT Motorenforschung AG • FVV Forschungsvereinigung Verbrennungskraft-maschinen • Kistler Instrumente AG • Kummler & Matter AG • LEM SA • Liebherr Machines SA • myStromer AG • Protoscar SA • SBB AG • St. Gallisch-Appenzellische Kraftwerke AG • Swiss Center for Electronic and Microtechnic • Volkswagen AG • Verkehrsverbund Luzern VVL

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Capacity Areas

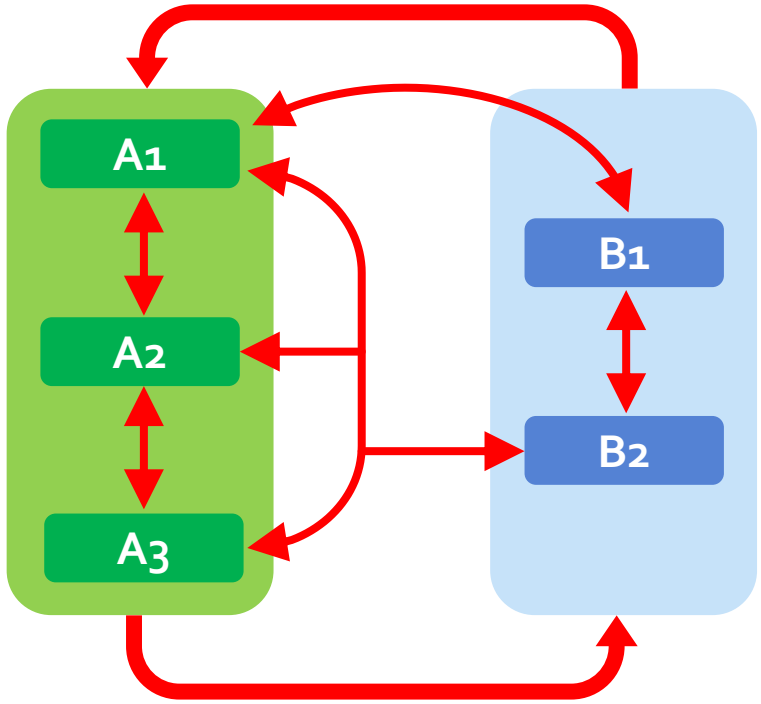
A1 **Systems and Components for E-Mobility**

A2 **Chemical Energy Converters**

A3 **Minimization of Vehicular Energy Demand**

B1 **Integration, Operation and Optimization of Mobility Systems**

B2 **Integrated Assessment of Mobility Systems**

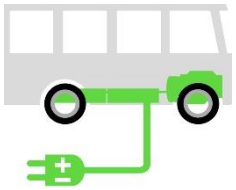


Innovation Field A
Components and Technologies

Innovation Field B
Mobility Systems

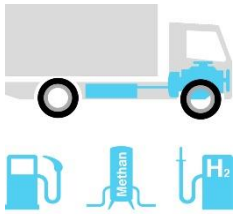
Capacity Areas

Innovation Field A: Components, Devices and Processes



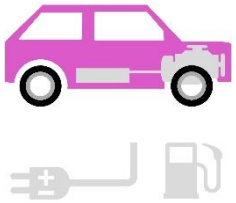
A1 Swiss Battery Research Platform (E-Mobility)

- Battery systems for rail, bus, construction, agricultural and utility vehicles



A2 Chemical Energy Converters

- Cost reduction for fuel cell systems
- Internal combustion engines: renewable fuels, efficiency increase, zero pollutants

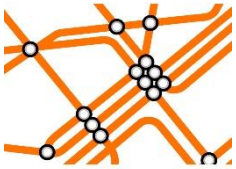


A3 Minimization of Vehicular Energy Demand

- High volume lightweight thermoplastics and bioinspired composites
- Thermal management

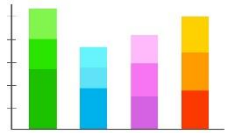
Capacity Areas

Innovation Field B: System Aspects of Mobility



B1 Integration, Operation and Optimization of Mobility Systems

- Infrastructure and new urban transport
- Urban planning and environmental impact
- Spatio-temporal data Acquisition and analysis, monitoring devices and user communication



B2 Integrated Assessment of Mobility Systems

- Technology assessment and energy economics
- Socio-economic aspects of mobility

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CA A1: Battery Technology for Battery Systems for Rail, Bus, Construction, Agricultural and Utility Vehicles

- Electrification of drive train and auxiliaries in mobile markets with low production numbers but specific requirements demand customized electrochemical storage systems
- SCCER Capacity Area includes ETH, PSI, EMPA, BFH, FHO and HSLU

- Create a research and technology platform for mobile battery systems providing cell, module and system know-how for Rail, Bus, Construction, Agricultural and Utility Vehicles industry partners
- Establish cross-industry research activities to allow low production volume markets to develop customized battery system solutions

Research Projects (Examples)

- SwissTrolley+
- SUNCAR Solarbagger
- Horizon 2020 Project GasOn
- GoEco!

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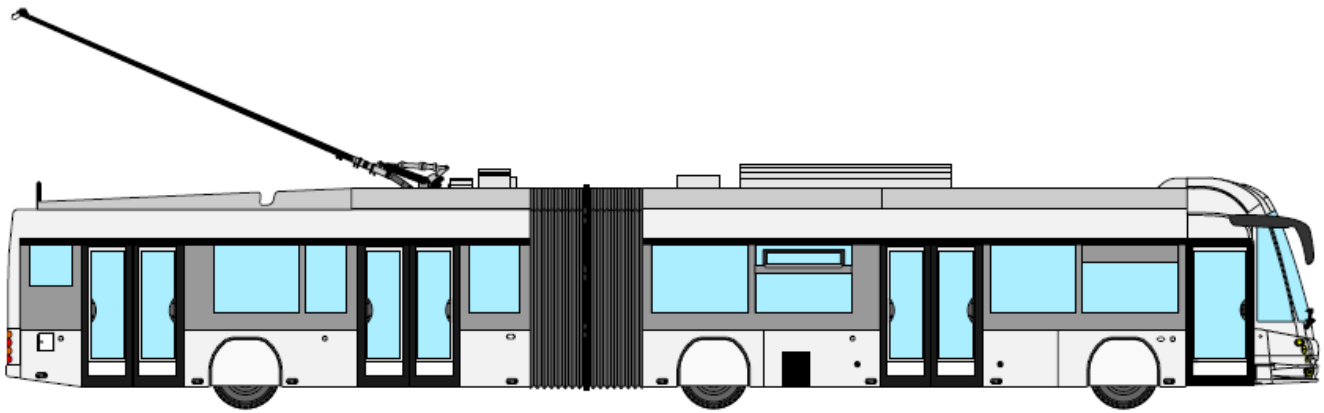
SwissTrolley+

Partners

- Carrosserie HESS AG
- Verkehrsbetriebe Zürich (VBZ)
- Institute for Dynamic Systems and Control, ETHZ
- BFH-CSEM Energy Storage Research Center
- Bundesamt für Energie BFE



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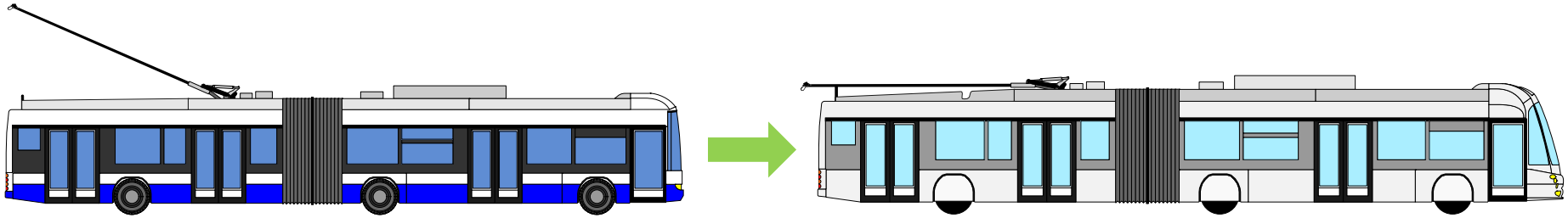
Concept of SwissTrolley+



- Reduction of **noise and pollutant emissions**
- Increased **energy efficiency** by a novel **energy management system**
- **Drives without overhead wires**
- **Grid support** is now possible
- **Maintenance cost savings** by not utilizing the overhead wire network

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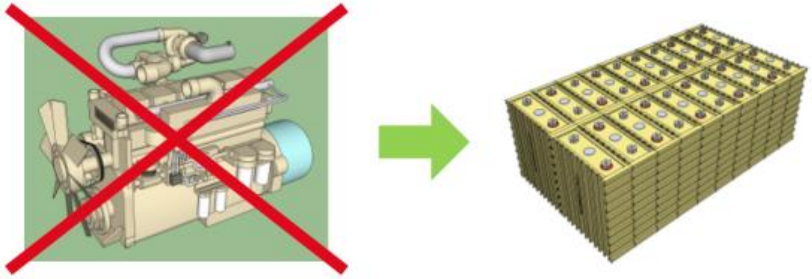
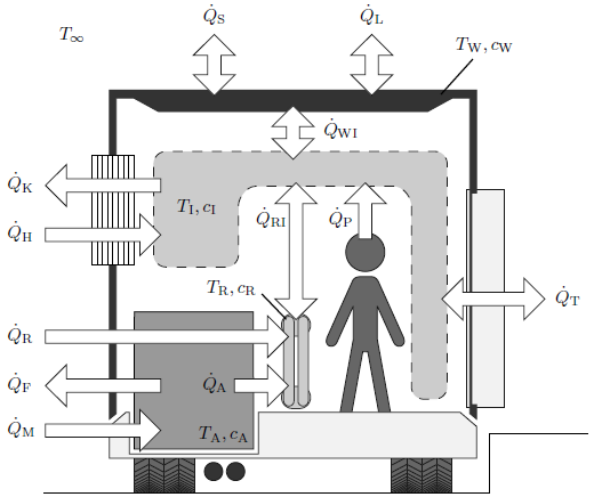
Relevance for the Energy Transition

- **15% reduced energy demand**
  - Regenerative braking always possible
  - Predictive optimal energy management strategy

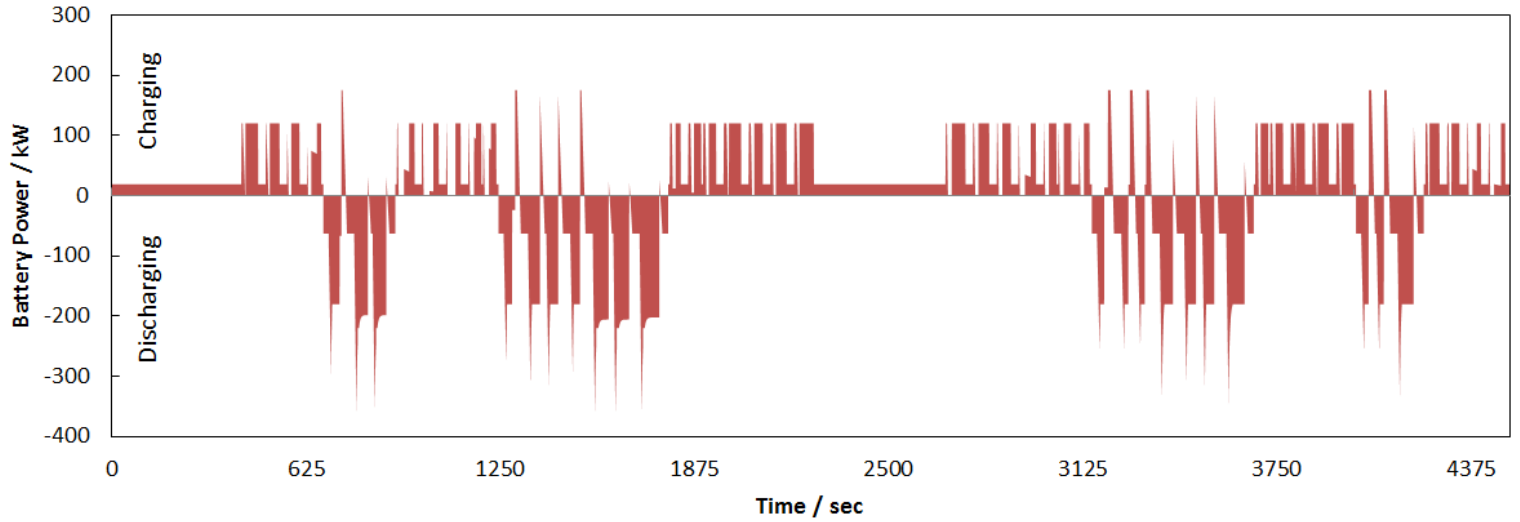


- **Optimized heating and air conditioning systems**
  - HVAC equals ca. 50% of total vehicle energy demand



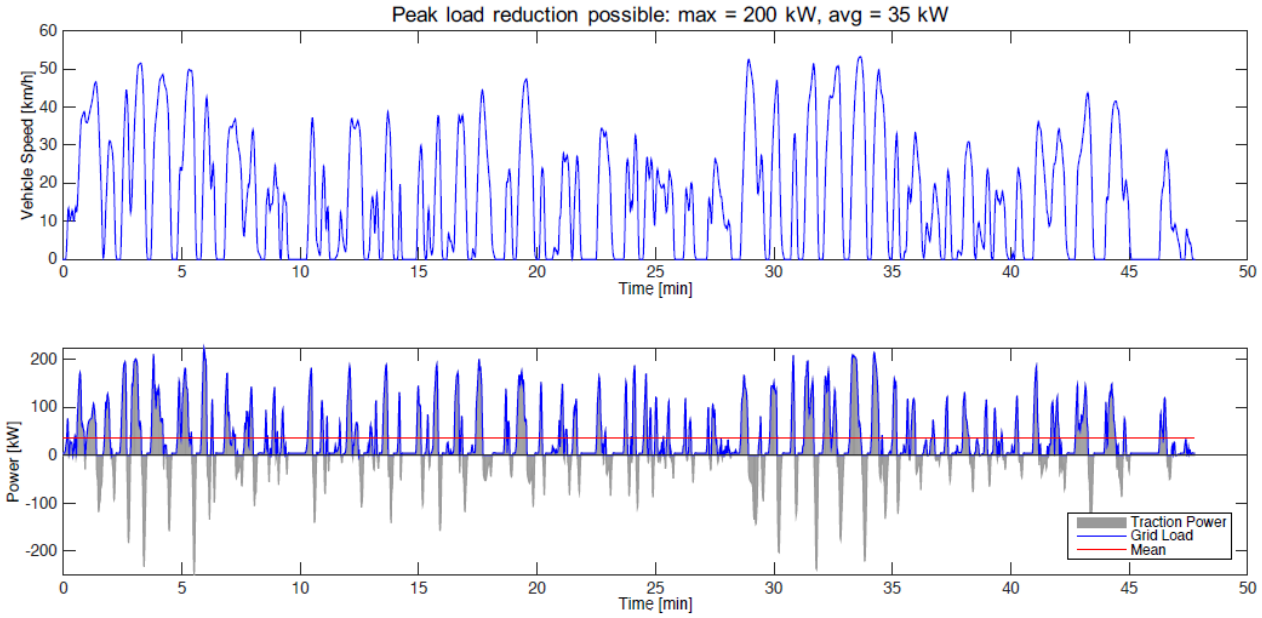
Relevance for the Energy Transition

- **Battery lifetime models**
  - Incentive for novel business models by engineers and decision makers
  - Proper management of the battery for higher energy savings and return on investment



Relevance for the Energy Transition

- **Reduced peak loads on electric grid**
  - Less grid stabilization energy is required
  - Peak load is a main driver of electricity pricing



SUNCAR Solarbagger

Partners

- Institut für Werkzeugmaschinen und Fertigung, ETHZ
- Institut für Entwicklung Mechatronischer Systeme, NTB

SUNCAR Solarbagger

- Fully autonomous E-excavator (16 t, 9 h/d)
- Li-Battery 190 kWh
- Power of diesel engine 70 kW
- Power of E-motor 75 – 167 kW
- Less fuel costs - 21 kCHF/a
- Pay back time 8.5 years

Relevance for Energy Transition

- Reduction of energy consumption by factor 5
- CO_2 reduction 40 t/a; significant noise reduction
- 3.7 % power consumption of the shown PV (Affentranger Bau AG)
- E- mobility technology is suitable for heavy duty applications
- Profitability is given within 8-9 years (bisection by reduction of battery costs within the next few years)

GasOn Project (Horizon 2020)

Partners

- Institute for Dynamic Systems and Control, ETHZ
- Aerothermochemistry and Combustion Systems Laboratory, ETHZ
- Automotive Powertrain Technologies, Empa
- VW, Ricardo, Continental

Gas – Only Internal Combustion Engines

GasOn Project (Horizon 2020)

- **Development of CNG-only high efficiency engines**
  - Improvement in efficiency and range compared to existing systems
  - Use of low-carbon fuels, reduction of CO_2 emissions
  - Compliance with post-Euro 6 NOx emissions regulations
- **Focus at ETHZ and Empa (SCCER Members)**
  - Ignition and combustion fundamentals as well as on engine prototyping

Relevance to the Energy Transition: Why CNG?

- **Use of low-carbon fuels**: Methane combustion produces 25% less CO_2 emissions than combustion of gasoline or diesel
- Allow the use of renewable fuels (bio-methane, synthetic natural gas from power-to-gas processes, CH_4 or hydrogen mixtures, etc.) **without change in the technology or infrastructure**
- **SCCER Mobility Contribution**
  - **State of the art for passenger cars** with methane combusted in gasoline-like engines and gasoline-like efficiencies are achieved
  - **20% fuel consumption reduction** compared with today's technology, **600 km driving range**
  - Improvement of fundamental understanding of ignition and combustion in gas engines for future developments

GoEco!

Partners

- Institute for Applied Sustainability to the Built Environment, SUPSI
- Institut für Kartographie und Geoinformation, ETHZ

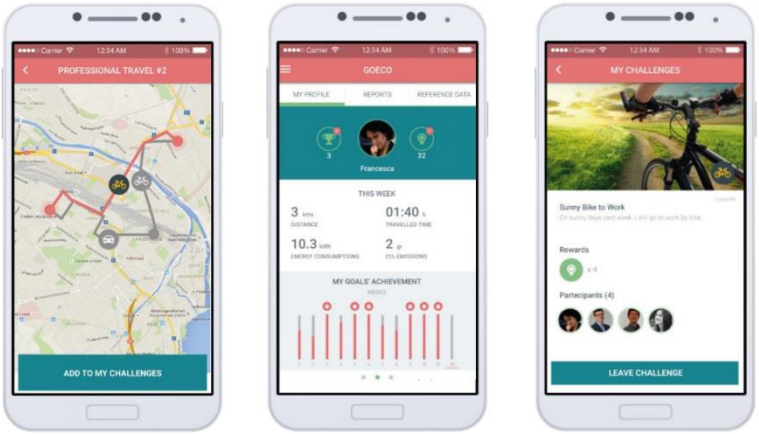
GoEco! A Community Based Eco-Feedback Approach

- Current mobility patterns still dominated by car use
- How to encourage people to rely on alternatives or even avoid traveling all together?
- Investigate how information feedback and social interaction effectively foster changes in personal mobility behavior

GoEco!
EIN COMMUNITY-BASIERTER ECO-FEEDBACK-ANSATZ UM NACHHALTIGES PERSÖNLICHES MOBILITÄTSVERHALTEN ZU FÖRDERN

Living Lab and GoEco! Mobile Application

- Living lab experiment involving real-life users in real-world settings
- In 2016, 800 users in Zurich and Ticino test a smartphone application tracking their trips and using game elements to challenge them to modify their mobility behavio
- Identification of main opportunities and impediments to change and policy recommendations for public authorities



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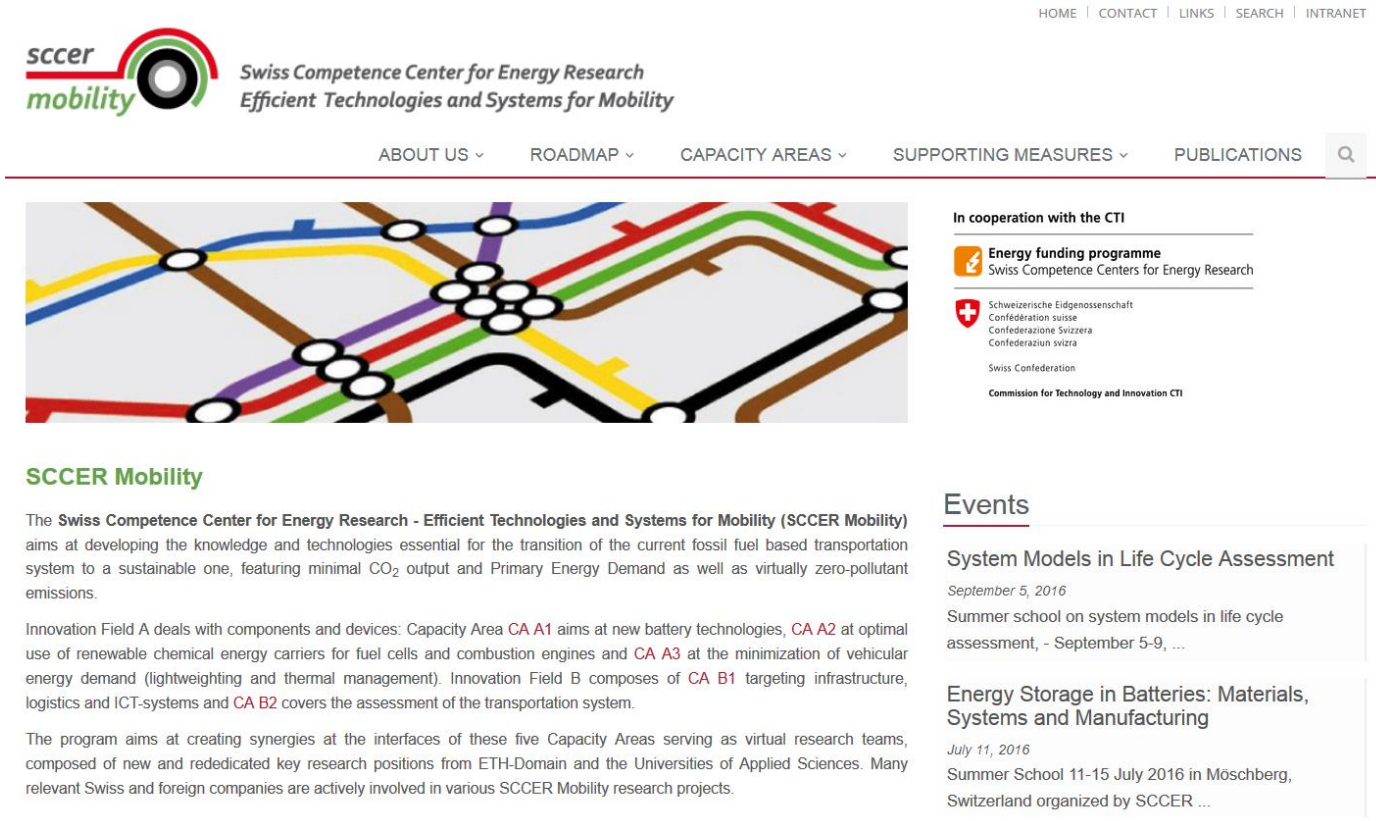
SCCER Mobility Contact

Further information: **www.sccer-mobility.ch**



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