

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

SCCER Summer School, Möschberg

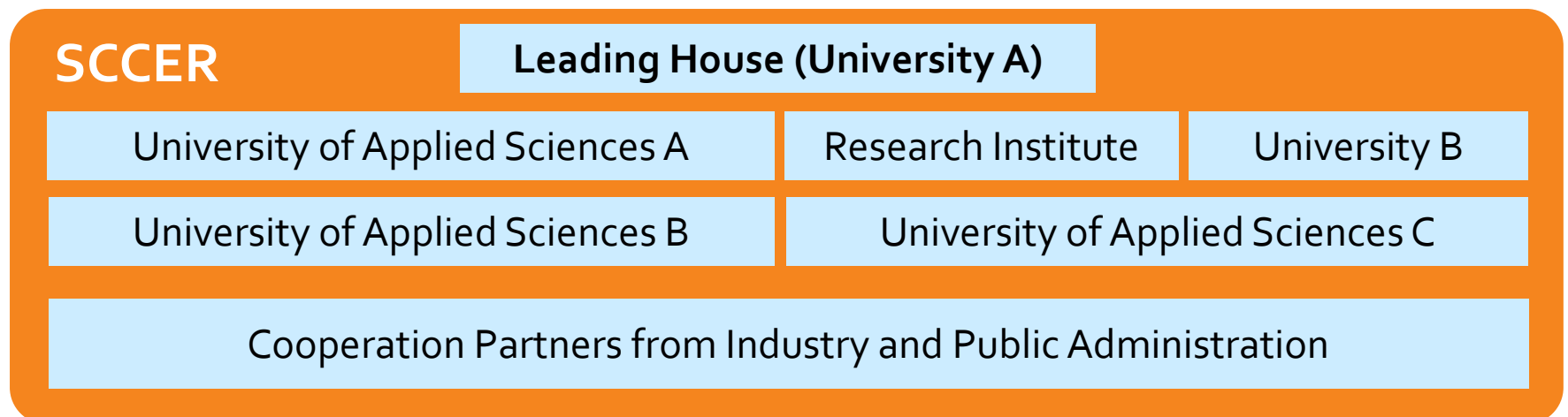
Political Background

- 2011 Swiss Federal Council and parliament:** Decision to phase out nuclear power by 2035 (legislative process ongoing)
- 2012 Swiss Federal Council:** *Energy Strategy 2050* and *Coordinated Energy Research in Switzerland Action Plan*
 - ➔ Long-term energy policy to restructure the Swiss energy system
 - ➔ Strengthen energy research in Switzerland
- 2013 Commission for Technology and Innovation (CTI):** Call for proposals for **Swiss Competence Centers for Energy Research (SCCERs)**
 - ➔ Total funding 2014-2016: 72 Mio CHF

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)



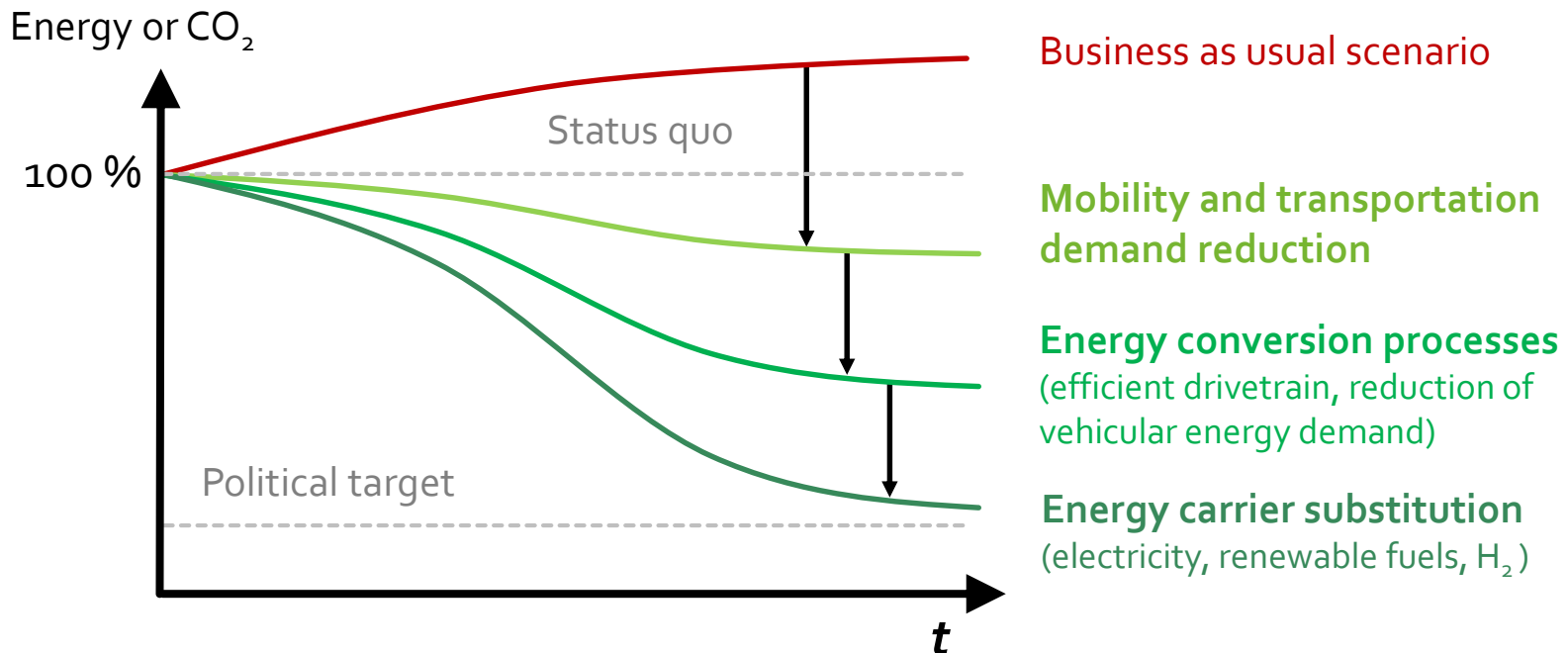
The Swiss Competence Centers for Energy Research

7 Action Areas and 8 SCCERs

- Efficiency of the **building sector** and **industrial processes**
- **Grids and their components**
- **Storage** of electrical, chemical and mechanical energy
- **Power supply** (hydropower and geothermal energy)
- **Economy, environment, law, behavior**
- Efficient concepts, processes and components in **Mobility**
- **Biomass**

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.



SCCER Mobility Objectives

- **Capacity expansion** in academia
- Encouragement and expansion of **basic and applied research** and development
- Development of **teaching and advanced training** capacities
- **Transfer of research results** to the market
- Embedding of other **energy relevant innovation** activities
- **Involve the industrial and public cooperation partners** early in the process

Members

23 Research Groups affiliated to

ETH zürich


 ÉCOLE POLYTECHNIQUE
 FÉDÉRALE DE LAUSANNE

PAUL SCHERRER INSTITUT



 Materials Science & Technology


 Berner Fachhochschule
 Haute école spécialisée bernoise

Lucerne University of
 Applied Sciences and Arts
HOCHSCHULE
LUZERN


 NTB
 INTERSTAATLICHE HOCHSCHULE
 FÜR TECHNIK BUCHS


 Fachhochschule
 Nordwestschweiz

SUPSI
 Scuola Universitaria Professionale
 della Svizzera Italiana



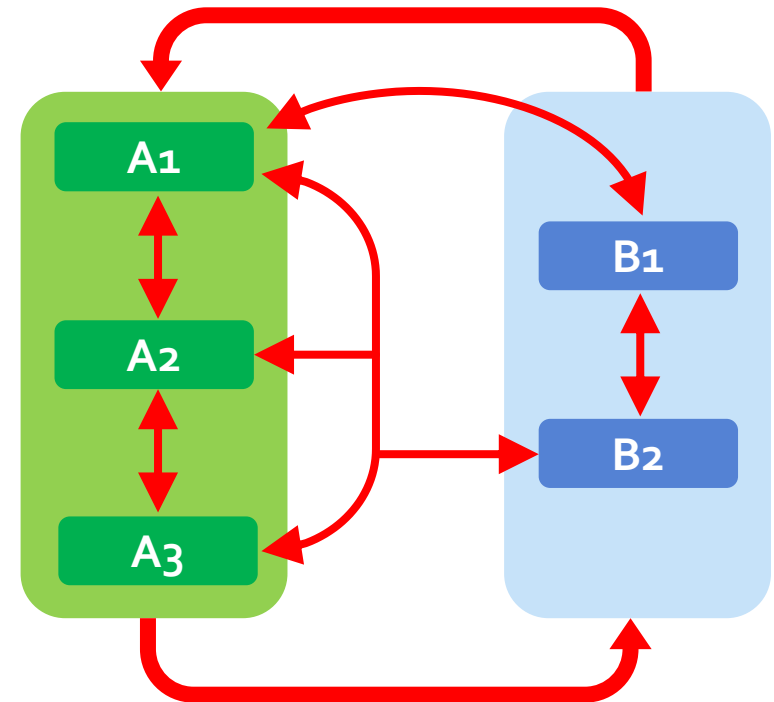
Leading House: ETH Zurich

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

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

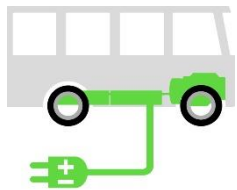


Innovation Field A
 Components and
 Technologies

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



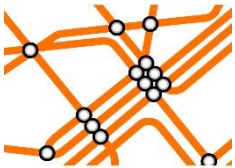
A3 Minimization of Vehicular Energy Demand



- 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

Education and Training

MAS | CAS ETH in Mobilität der Zukunft (Future Transport Systems)

- Approved by ETH Zurich (January 2016)
- Starts in January 2017 (spring term)
- Interdisciplinary MAS includes 3 CAS:
 - Systemic Aspects of Future Transport
 - Future Transport Systems: Technology Potential
 - Future Transport Systems: New Business Models

Other Activities

- **Seminar Series** (started in 2015)
- **SCCER Summer School** (started in 2016, together with SCCER HaE)
- Young Talent Development **Workshops** (started in 2015)





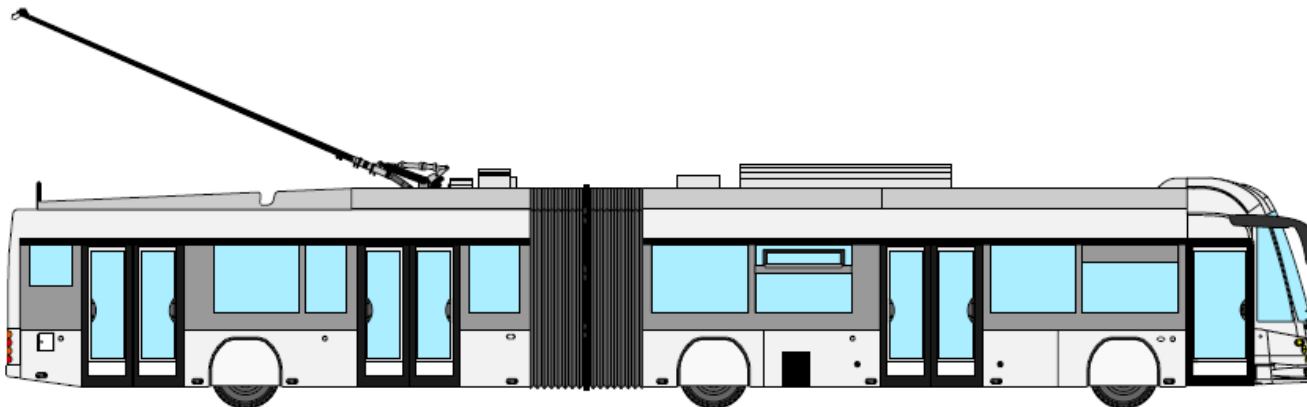
Research Projects (Examples)

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

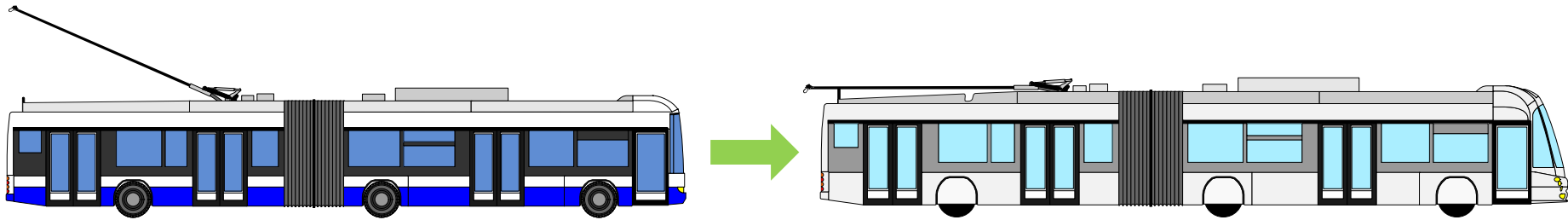
SwissTrolley+

Partners

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



Concept of SwissTrolley+

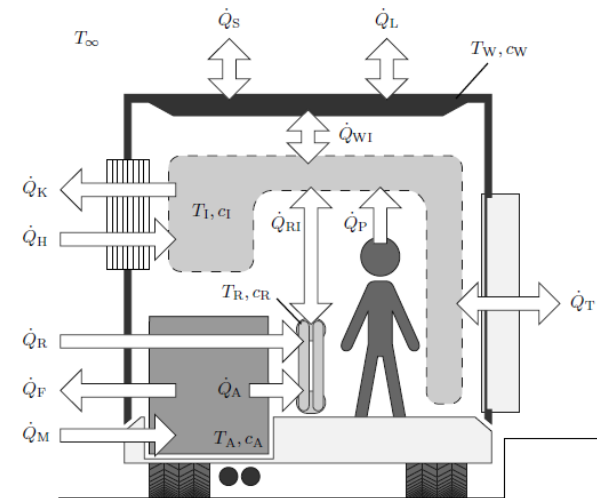
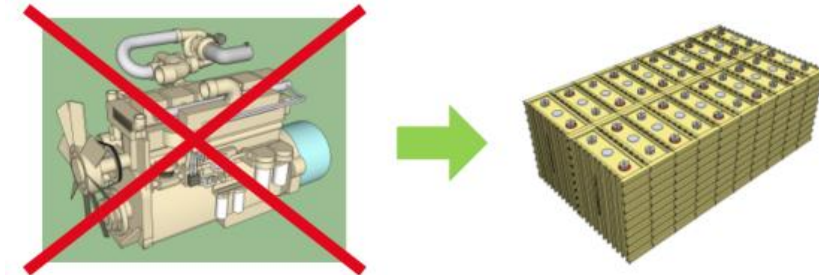


- Reduction of **noise and pollutant emissions**
- Increased **energy efficiency** by a novel **energy management system**
- **Drives without overhead wires**
- **Grid support** is now possible
- **Maintenance cost savings** by not utilizing the overhead wire network

Relevance for the Energy Transition

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

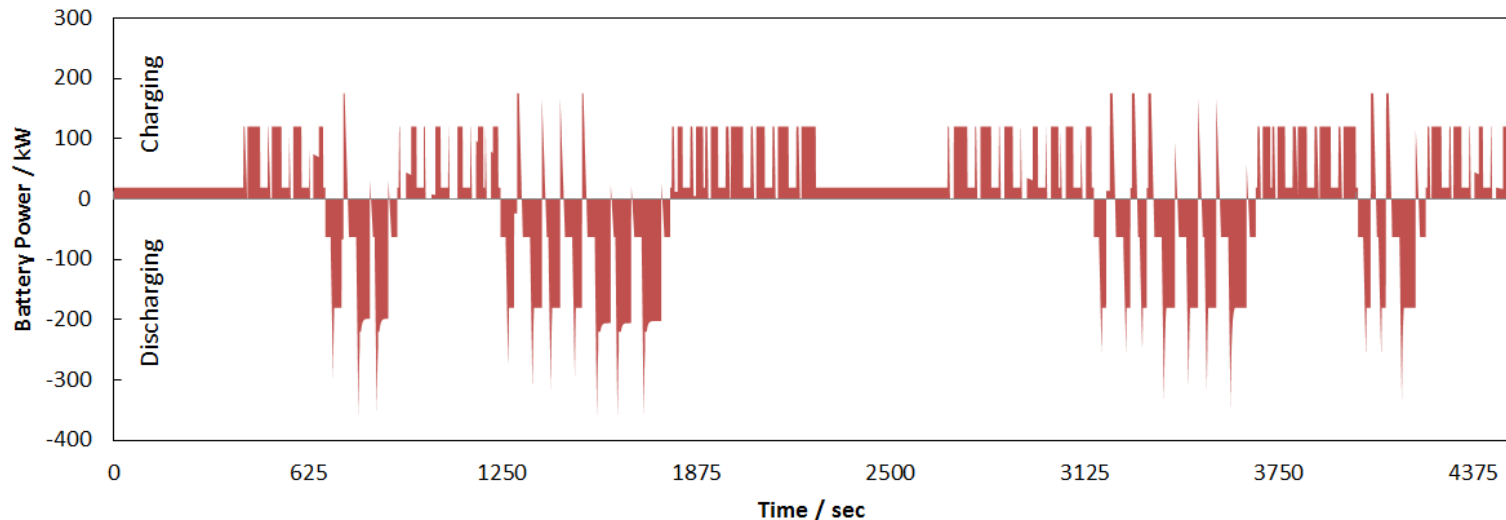
- **Optimized heating and air conditioning systems**
 - HVAC equals ca. 50% of total vehicle energy demand



Relevance for the Energy Transition

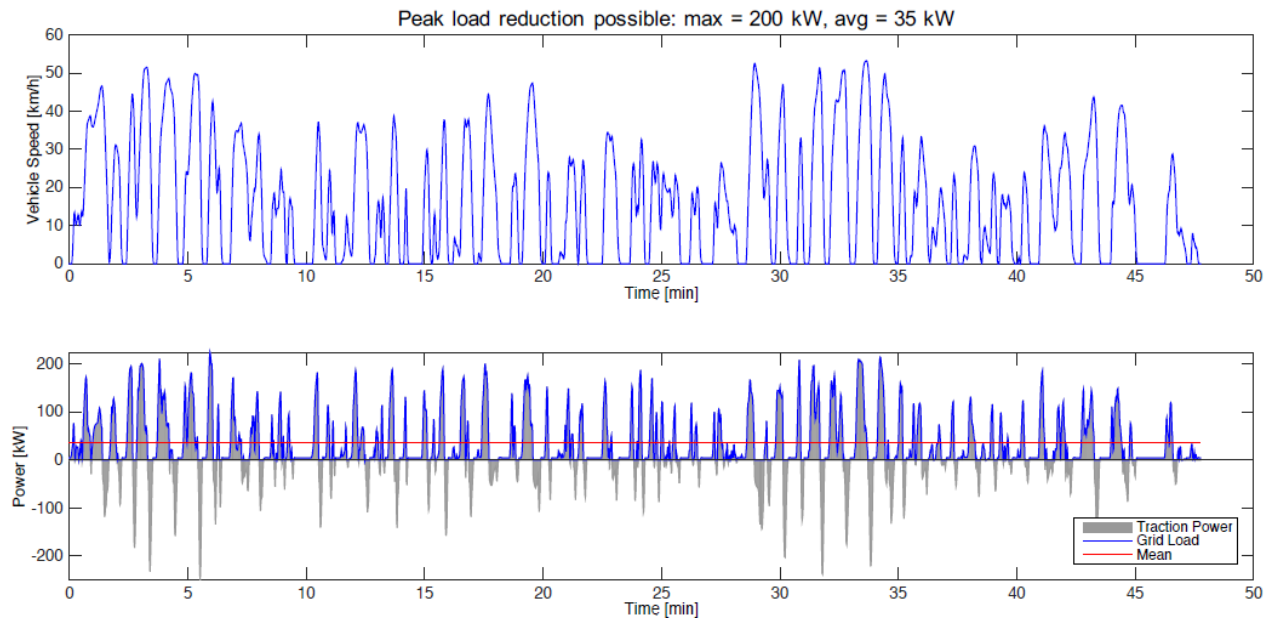
■ Battery lifetime models

- 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
- CO₂ 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)



Strategic Fit to SCCER Goals

- **Cooperation** between ETH Zurich and NTB Buchs
- Developed by 19 students within **teaching project**
- New research focus on high capacity batteries
- New business case: start up of SUNCAR HK AG at Oberbühren SG, 1.5.2015
- Knowledge for other applications with mobile high capacity batteries
- Awareness by Swiss Solar Award 2015



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 CO₂ emissions
 - Compliance with post-Euro 6 NO_x 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 CO₂ emissions than combustion of gasoline or diesel
- Allow the use of renewable fuels (bio-methane, synthetic natural gas from power-to-gas processes, CH₄ 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



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

GoEco! A Community Based Eco-Feedback Approach

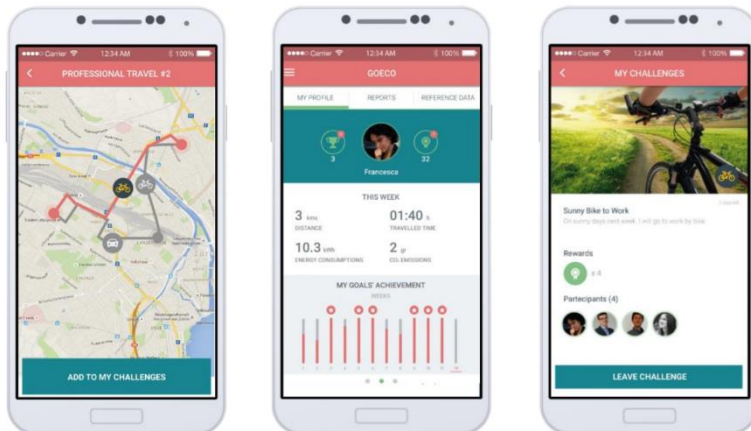
- Current mobility patterns still dominated by car use
- How to encourage people to rely on alternatives or even avoid traveling all together?
- Investigate how information feedback and social interaction effectively foster changes in personal mobility behavior



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 behavior
- Identification of main opportunities and impediments to change and policy recommendations for public authorities



SCCER Mobility Management Office Team



Prof. Dr. Konstantinos Boulouchos
Head



Prof. Dr. Andrea Vezzini
Deputy Head



Dr. Gloria Romera
Co-Managing Director



Dr. Ruth Förster
Project Manager MAS Mobility



Dr. Michael Bürgi
Co-Managing Director



Fiorella Meyer
Administrative Assistance

SCCER Mobility Contact

Further information: www.sccer-mobility.ch

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

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SCCER Mobility


The **Swiss Competence Center for Energy Research - Efficient Technologies and Systems for Mobility (SCCER Mobility)** aims at 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.

Innovation Field A deals with components and devices: Capacity Area **CA A1** aims at new battery technologies, **CA A2** at optimal use of renewable chemical energy carriers for fuel cells and combustion engines and **CA A3** at the minimization of vehicular energy demand (lightweighting and thermal management). Innovation Field B composes of **CA B1** targeting infrastructure, logistics and ICT-systems and **CA B2** covers the assessment of the transportation system.

The program aims at creating synergies at the interfaces of these five Capacity Areas serving as virtual research teams, composed of new and rededicated key research positions from ETH-Domain and the Universities of Applied Sciences. Many relevant Swiss and foreign companies are actively involved in various SCCER Mobility research projects.

In cooperation with the CTI

 **Energy funding programme**
Swiss Competence Centers for Energy Research

 Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Confederation

Commission for Technology and Innovation CTI

Events

System Models in Life Cycle Assessment

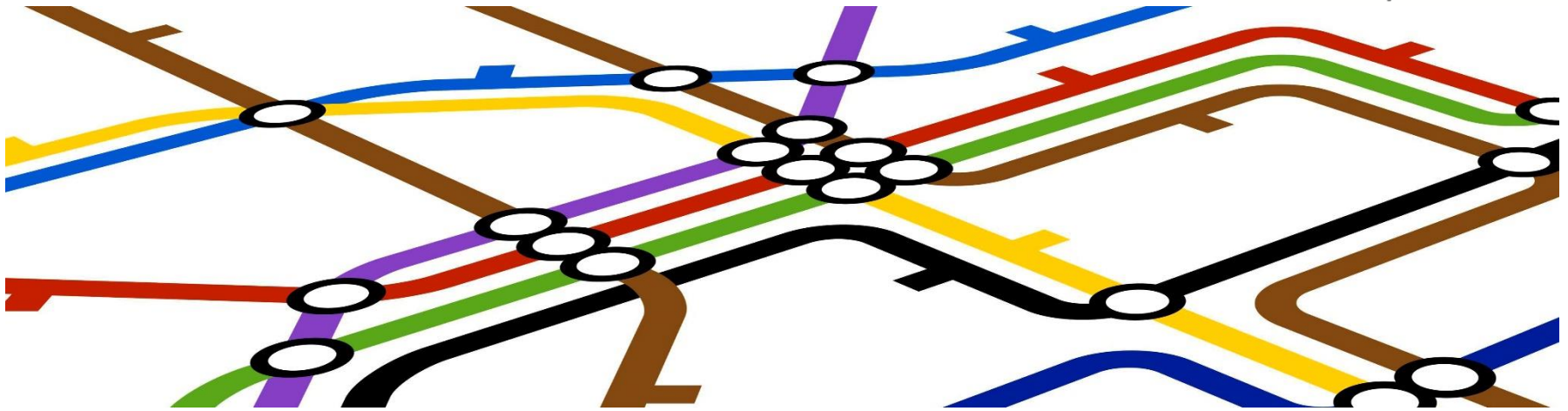
September 5, 2016

Summer school on system models in life cycle assessment, - September 5-9, ...

Energy Storage in Batteries: Materials, Systems and Manufacturing

July 11, 2016

Summer School 11-15 July 2016 in Möschi, Switzerland organized by SCCER ...



Questions?

Further Information: www.sccer-mobility.ch