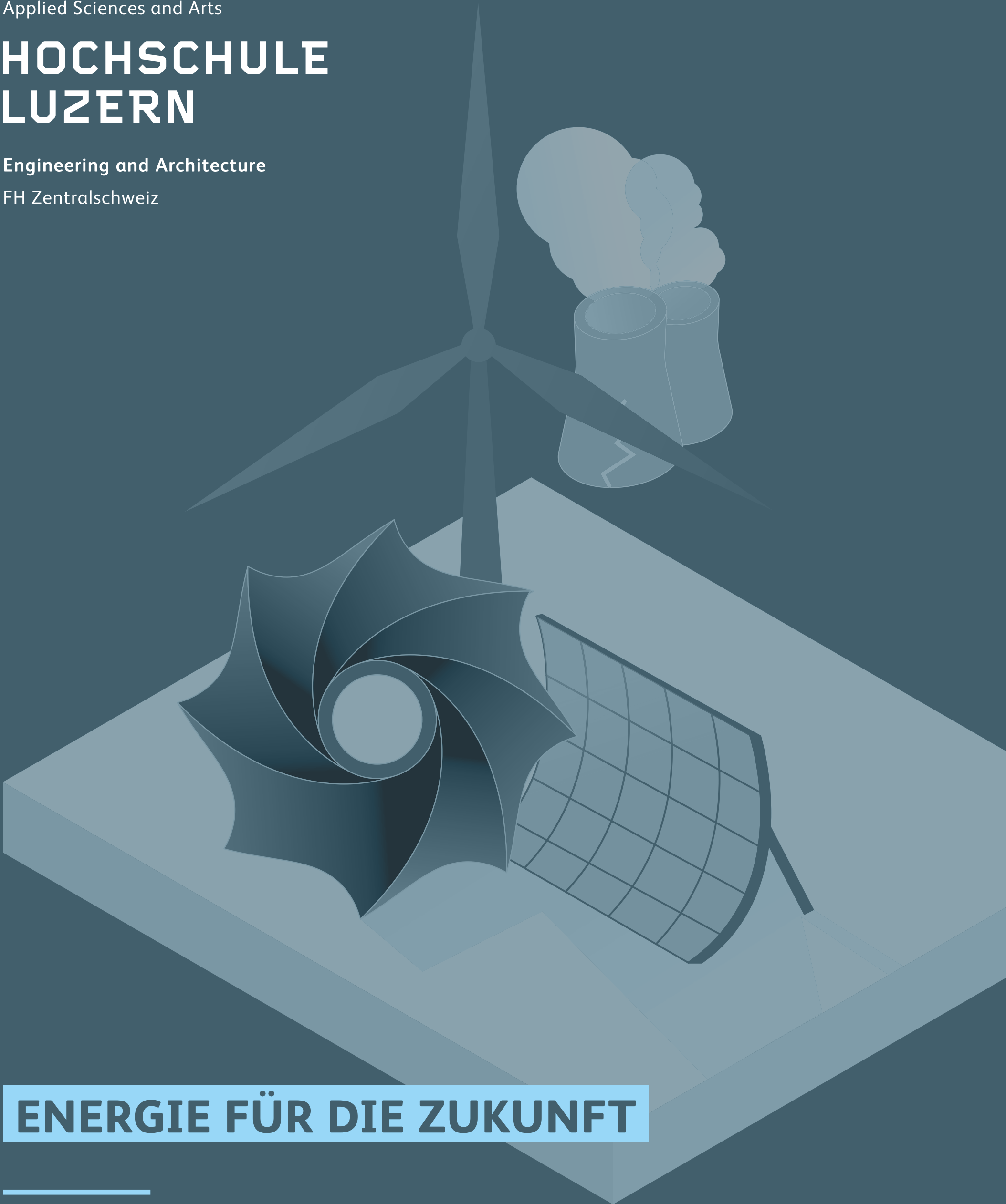
Lucerne University of
Applied Sciences and Arts

HOCHSCHULE
LUZERN

Engineering and Architecture

FH Zentralschweiz



ENERGIE FÜR DIE ZUKUNFT

Swiss Competence Centers for Energy Research (SCCER)

Review SCCER Hochschule Luzern

Management Summary

HSLU is involved in 6 of 8 SCCER and has a main focus in the three SCCER FEEB&D, SCCER EIP, and Storage. HSLU leads work packages in each of these three SCCER has the role of the deputy head in FEEB&D. In the three focused SCCER, a total capacity build-up of 14 researchers has been conducted and six research professors from HSLU in different fields are included in these research activities (ZIG, CC EASE, CC iHomeLab, CC TEVT). It was one of the strategic goals of HSLU to have a good position in the SCCER FEEB&D because of its two strategic focus topics "building as a system" and "Energy Turnaround" and its research strength in these fields. The good collaboration with EMPA could be strengthened through the close collaborative research within the SCCER FEEB&D (in particular through HSLU's deputy lead).

Overall, the evaluation of the activities in the SCCER is positive. They allow a focus on long term research topics and research activities (3-6 years), which usually is difficult with CTI/BFE projects; the capacity build-up integrated new researchers from different cultures into our University, which is very valuable and can also be challenging, because they do not know the UAS-system. The target achievement in the different SCCER is good, based on a good collaboration with ETHZ, EPFL, Universities and other UAS. Results could be achieved, which would not have been possible without the SCCER. Last but not least, the collaboration, and the joint meetings with researchers, heads, and board members have brought the different research Institutions closer together. The HSLU invested around 20% of its cantonal research budget into the SCCER research. This shows, that this interinstitutional energy research with national importance is one main strategic focus of HSLU and will continue to be so in the 2nd phase.

Table of Content

1. Introduction

Currently eight SCCER are running: SCCER FEEB&D Future Energy Efficient Buildings & Districts, SCCER EIP Efficiency of Industrial Processes, SCCER FURIES Future Swiss Electrical Infrastructure, SCCER Heat Electricity Storage, SCCER SoE Supply of Energy, SCCER CREST Competence Center for Research in Energy, Society and Transition, SCCER Mobility, SCCER BIOSWEET Biomass for Swiss Energy Future. HSLU is involved in 6 of 8 SCCER and has a main focus in the three SCCER FEEB&D, SCCER EIP, and Storage. HSLU leads work packages in each of these three SCCER has the role of the deputy head in FEEB&D. The start of the SCCER Phase 1 was in 2014. Most of the SCCER started after a positive evaluation at the beginning of 2014. The proposal for SCCER Efficiency was the only one rejected because of the large number of participating institutions. As a consequence, a new proposal was prepared and the activities were split up into two separate SCCER focusing on Efficiency in Buildings and in Industry. These two SCCER started in June 2014.

In the three focused SCCER, a total capacity build-up of 14 researchers has been conducted and six research professors from HSLU in different fields are included in these research activities (ZIG, CC EASE, CC iHomeLab, CC TEVT). It was one of the strategic goals of HSLU to have a good position in the SCCER FEEB&D because of its two strategic focus topics “building as a system” and “Energy Turnaround” and its research strength in these fields. The good collaboration with EMPA could be strengthened through the close collaborative research within the SCCER FEEB&D (in particular through HSLU’s deputy lead). A good collaboration with the University of Geneva could be established in the SCCER EIP and HAE Storage in the two workpackages led by HSLU. Further, the collaboration in SCCER EIP with ETHZ is positive, although many different professors are involved in this SCCER. The collaboration with EPFL could be improved. The good relations with the industry partners proofs to be very valuable within the SCCER, thus applied research results are achieved in short time and a useful impact for industry partners is generated.

2. SCCER Engagement UAS

Hochschule Luzern is involved in 6 of the 8 SCCER in phase 1. In phase 2 again Hochschule Luzern is involved in 6 of 8 SCCER, instead of the SCCER Mobility, the SCCER Biosweet is added.

SCCER Phase 1 at HSLU	Responsible person at HSLU	Volume Phase 1 [kCHF] 2014 - 2016	Number of employees involved
FEEB&D Future Energy Efficient Buildings and Districts	Prof. Matthias Sulzer	3.55 Mio	23
EIP Energy efficient buildings and districts	Prof. Dr. Beat Wellig	1.45 Mio	9
HaE Heat and electricity storage	Prof. Dr. Jörg Worlitschek	1.38 Mio.	6
Mobility	Prof. Vinzenz Härri	1.16 Mio.	4
FURIES Grids and their components in energy system	Prof. Dr. Ernesto Casartelli	1.00 Mio.	3
SoE Supply of Electricity	Prof. Dr. Ernesto Casartelli	0.45 Mio.	3

List of primary researchers in the SCCER.

3. SCCER Funding UAS

The funding model of SCCER requests a factor of 2 of own contribution of the institution (matching funds). FHx has the following specifications for the matching funds: factor 1 FHx research funding and factor 1 third-party funds. Funds from existing related projects can be partly taken into account.

The total **SCCER financial statement** for the period **2014-2016** is as follows:

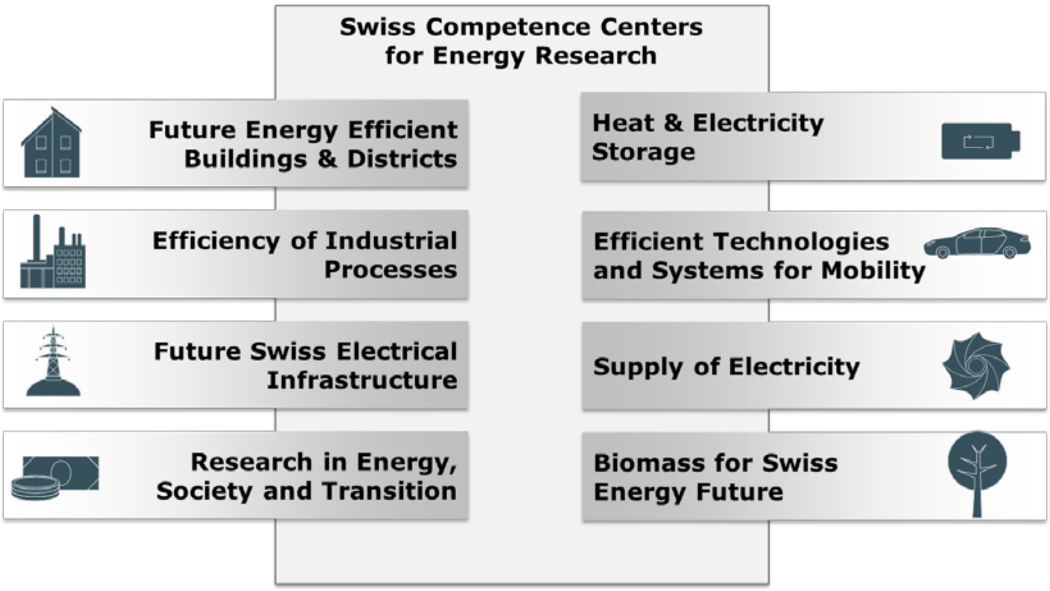
SCCER	CTI funding	HSLU funding	Third-party funding
FEEB&D	1240	1240	1100
EIP	480	480	480
Storage	680	550	680
Mobility	460	460	460
FURIES	300	300	300
SoE	250		250
Total	**3410**	**3030**	**3270**

Please give a short statement if relevant adjustments have been made since the start.
Some UAS have taken workload (and money) from ETH/Uni partners which were unable to handle their part.

The total **SCCER budget** for the period **2017-2020** is as follows:

SCCER	**SCCER funding**	**Own funding**	**Third party**
Future Energy Efficient Buildings & Districts FEEB&D	1780	1246	2315
FEEBD KTT	*150*	*150*	
FEEBD Deputy	*100*	*100*	
FEEBD Joint activity "Romande Energy demonstrator"	345	242	458
Storage of Heat and Electricity HaE	1113	532	988
Biomass	736.00	544.41	927.59
Efficiency in Industrial Processes EIP	1000	700	1300
Future Swiss Electricity Infrastructure FURIES	432	303	562
Supply of Electricity SoE	300	210	390
Total	5956	4028	6790

In thousand CHF



Note: Mark the SCCERs with your involvement

4. Review SCCER Future Energy efficient buildings & districts FEEB&D

4.1. 1st Phase 2014-2016

4.1.1. Description of the SCCER, Work Packages and Goals

Building Energy Management

Team HSLU:

- Task 2.1.1: Axel Seerig, Andrii Zakovorotnyi
- Task 2.1.3: Rainer Kyburz, Patrick Huber
- Task 2.2.2: Stephen Wittkopf, Marek Krehel

Tasks:

- Task 2.1.1: Simulation of the electricity consumption profiles of the residential and office buildings; Establishment of the procedure for the determination of the energy fingerprint of the building using measured data; Implementation of the procedure in the software toolbox
- Task 2.1.3: Perception based building control to optimize energy consumption while maintaining user comfort; Feedback system to foster energy-efficient behaviour
- Task 2.2.2: Efficient integrated day- and electric lighting modelling

Urban Decentralized Energy System

Team HSLU:

- T 3.2.2 Thomas Schluck (Project leader, contact person), Philipp Kräuchi, Nadège Vetterli
- T 3.3.1 Thomas Schluck (Project leader, contact person), Matthias Sulzer, Diego Hangartner
- T 3.3.2 Emanuele Facchinetti (Project leader, contact person), Sabine Sulzer
- T 3.3.3 Robert Spörri (Project leader), Stefan Mennel (contact person), Matthias Sulzer, Christoph Dahinden, Frank Gubser

Tasks:

- T 3.2.2 Energy Hub and Multi-Energy Grid Modelling: Contributions to holistic simulation platform (HUES) and to the realization of energy hub and multi-energy grid concepts; Support of the analysis and assessment of decentralized energy systems; Develop a modeling framework for a share-economy business model.
- T 3.3.1 Design and Planning of Energy Infrastructure: develop an early-stage decision making and planning tools for neighborhoods; assessment of 3-4 identified common model region representing different DES typologies
- T 3.3.2 Develop guidelines to create business model patterns specifically suitable for decentralized multi-energy systems
- T 3.3.3 Research Platforms and Lighthouse: Designing and building NODESlab (New Opportunities for Decentralized Energy Systrems); Establishing a life-link to FHNW (IEBau)

4.1.2. Discussion

Task 2.1.1: 5000 generated electricity consumption profiles using Monte-Carlo approach for the residential and office buildings

Achieved clustering procedure of the electricity consumption profiles for the determination of the existed behavior patterns (energy fingerprint) in building
Developed graphical user interface for the easier use of the procedure
Creation of the standalone software toolbox

Task 2.1.3: Literature Survey on User Behaviour Simulation
Sensor Fusion Platforms for user behavior awareness

Task 2.2.2: Database of high resolution BSDF data of selected Daylight Redirecting Components

Task 3.2.2: Models to simulate bidirectional, fully dynamic thermal networks were further developed and extended in functionality (multi-nodes design)

Two models for exergetic comparison of two different designs of thermal networks were developed.
A framework to simulate a share-economy business model was developed for a start-up company. The business model was assessed based on live-data and Monte-Carlo simulations, supporting the companies launch to market.

Task 3.3.1: Development of a concise method to create holistic energy concepts for locally defined regions, e.g. like a neighborhood or village, including the identification of a set of key performance indicators.

Based on computational modeling, Monte-Carlo simulations, a data-driven analysis and interviews to assess market approval the business model of an innovative start-up was pushed to market maturity

Task 3.3.2: Identification of business model ideas suitable to develop business models tailored on decentralized multi-energy systems.

Definition of a conceptual framework defining a business model solution space organizing in a structural way the identified business model ideas in business model patterns.
Definition of a set of guidelines addressing potential stakeholders of decentralized multi-energy systems towards the most suitable business model patterns.
Definition of a systematic methodology driving the business model development process for decentralized multi-energy systems.

Task 3.3.3: Putting into service NODESlab; establishing life-link to FHNW Energy Research Lab

4.1.3. Cooperation

4.1.3.1. ETHs/Universities

- Task 2.1.1: ETHZ, Automation Lab
- Task 2.2.2: EPFL
- T 3.2.2 Empa-UESL, EMPA-NEST, ETH-BP
- T 3.3.1 Empa-UESL, EMPA-NEST, ETH-BP, LBL-SRG
- T 3.3.2 HSLU-ZIG, HSLU-W, EMPA-UESL, Delft University of Technology
- T 3.3.3 EMPA-NEST, FHNW IEBau

4.1.3.2. Industry Partners

Task 2.1.1	Task 2.1.3	Task 2.2.2
• Siemens SBT, Zug • Stadt Zürich	• Frey & Cie Techinvest 22 Holding AG, Lucern	• Relux Informatik (Basel) • BASF Switzerland

		• BKW, Bern • Siemens Building Technologies, Zug • Swissgrid, Laufenburg • Landis+Gyr, Zug	(Basel) • Regent Lighting (Basel) • Heliobus (St. Gallen)	
Task 3.2.2	Task 3.3.1	Task 3.3.2	Task 3.3.3	
• Amstein+ Walthert AG • BG • ZugEstates AG • InSitu Energie AG	• BKW Energie AG • Gemeinde Wohlen (BE) • ZugEstates AG • InSitu Energie AG	• BKW Energie AG • Gemeinde Wohlen (BE) • InSitu Energie AG • MISURIO	• BG • Hälg • Inretis • Brugg Pipesystem s • ewz • Debrunner Acifer • Siemens	• Hauser Automatic • Hilti • HS Energietechnik • Danfos • Belimo • Grundfos • HakaGerodur

4.2. 2nd Phase 2017-2020

4.2.1. Description of the SCCER, Work Packages, Goals and Cooperation

The main goal of SCCER FEEB&D is to reduce CO2-emissions of buildings and districts significantly. This challenge is approached by four activities. Work package 1 concentrates on reducing the energy intensity of buildings (lower energy input per square meter). Work package 2 focuses on the carbon intensity of energy supply (CO2 per kWh) and delivers answers on how to integrate more renewables into supply systems of districts such as low temperature networks thus transferring districts to energy hubs. Work package 3 delivers an overview on where Switzerland as country is standing. Work package 4 concentrates on socio-economic aspects to significantly reduce time-to-market of energy hub and multi energy grid technologies. Lucerne UAS works in WP1, WP2, and WP4 cooperating strongly with Empa, ETHZ, FHNW and EPFL.

Contact person: Nadege Vetterli
Academic partners: EPFL, EMPA, ETH, ZHAW, FHNW, LBL (USA)
Industry partners: Schenker Storen, Siemens BT, Regent Lighting, Misurio, BKW, Gemeinde Wohlen, Romande Energie, Stadt Luzern, Belimo, A+W, CREM, ZugEstates AG, BG, Insitu Energie AG, Stadt Zürich

4.2.2. Main Activities/Focus

In WP1 the development of data driven mathematical models (via machine learning) in combination with physical models allows model predictive control to cut energy intensity of buildings.
In WP2 a complementary lab network is going to be established linking NEST with NODES and ERL and thus providing a test bench for rapid prototyping of energy hub and multi energy grid technologies. (NEST representing the energy hub, NODES the low temperature network and ERL the hardware in the loop infrastructure to integrate building components and thus serve as the on-site supplier.) Simulation models will be developed, on-site demonstration and validation is conducted and technical guidelines on planning low temperature networks will be written.

In WP4 the analysis of energy hubs using a systemic approach to identify crucial key success factors will accelerate the emergence and foster dissemination. Parallel guidelines on business-models will be published.

- Automated 'Eyesight' Venetian Blinds, Glazing with dynamic solar heat gains
- User Behaviour Recognition, Automatic Generation of Building Models
- Methodologies & Guidelines to support stakeholders in developing business models
- Strategies & components to ensure robust operation of Low Temperature Networks (LTN)
- Simulation infrastructure for MEG/EH systems
- Identification of buildings / building clusters with high thermal renovation potential

5. Review SCCER Energy efficient industrial processes EIP

5.1. 1st Phase 2014-2016

5.1.1. Description of the SCCER, Work Packages and Goals

Monitoring and Implementation (WP1) / Plant-wide integration (WP4)
Team HSLU:
Beat Wellig (Project leader work-package leader WP1, contact person), Sabine Sulzer, Donald Olsen, Yasmina Abdelouadoud, Marina Santoro, Rishabh Saxena
Tasks:

- WP1: Identification, characterization and validation of available data on energy efficiency measures; extended E-modules; identification and characterization of investment decision processes; identification of success factors.
- WP4: Process integration and heat recovery in batch processes

5.1.2. Discussion

Results concerning WP1: Monitoring and implementation

- Observatory of industrial energy utilization (macro-data) and management.
- New E-Modules and additional fluid library extension completed
- Improved understanding of investment decision processes in Swiss industry sectors.

Results concerning WP4: Process integration

- Practical features and graphical tools for the direct heat recovery optimization in batch process using pinch analysis
- Case study of process efficiency and excess heat recovery in a rock wool production facilit y
- Study of efficient heat integration of a temperature swing adsorption process for CO2 capture
- Software, workflow and decision –making support for conceptual thermal energy storage integration in batch processes
- Methodology and case study for the integration of a solar thermal system in a medium-sized brewery using pinch analysis

General impressions/experiences from the period 2014-2016 can be included.

5.1.3. Cooperation

5.1.3.1. ETHs/Universities

- Uni-GE

- EPFL

5.1.3.2. Industry Partners

EnAW, Flumroc AG, Ricella AG, Migros

5.2. 2nd Phase 2017-2020

5.2.1. Description of the SCCER, Work Packages, Goals and Cooperation

Contact person: Prof. Dr. Beat Wellig
Academic Partners: EPFL, Uni-GE
Industry Partners: EnAW, SwissMEM, Flumroc, LONZA

5.2.2. Main Activities/Focus

- Energy modeling for PinCH Analysis
- Ex-post characterization and categorization of multiple benefits
- Cross-companies “best practices” to prioritize and rank energy efficiency measures

6. Review SCCER Heat and Electricity Storage HaE

6.1. 1st Phase 2014-2016

6.1.1. Description of the SCCER, Work Packages and Goals

Team HSLU:
Anastasia Stamatiou (Project leader, contact person), Andreas Ammann, Andreas Abdon, Simon Maranda, Felix Eckl, Damian Gwerder, Ludger Fischer, Jörg Worlitschek (work package leader)
Tasks:

Integrated assessment of storage technologies

- Development of a uniform techno-economic, environmental and social assessment method for electrical and thermal storage
- Use of this method for the assessment of different energy storage technologies and applications.

Storages for flexibility of power and heat

- In depth evaluation of critical parameters of existing ABB concept on Electrothermal Energy Storage. Evaluation and comparison of alternative concepts.
- Investigation of interactions of heat and electricity conversion and storage and corresponding control strategies
- Design of an energy unit for conversion and storage of power and heat and set up of a functional model

The engagement of Lucerne University of Applied Sciences & Arts (HSLU) is twofold in this SCCER. On the one hand HSLU is leading the Workpackage 5 ‘Assessment of Energy Storage’, on the other hand HSLU has two tasks within the workpackage 1 ‘Storage of Heat’. The main goal of HSLU within WP 5 is the technoeconomic and lifecycle assessment of thermal energy storage systems at the technology level as well as assessing the requirements for Energy Storage at the Swiss energy system level. A continuation of the close collaboration with PSI and University of Geneva during Phase I is foreseen. The goals of HSLU in the field of WP1 ‘Storage of Heat’ are the development of seasonal heat storages based on combined sensible and latent technologies and latent heat storages with high thermal power to capacity ratios. A special focus is on the development of water vapour dense insulation materials together with the company Swisspor for seasonal storages. There is close cooperation with EPFL (Prof. Haussener) on modelling of solidification and melting processes, with ETH (Prof. Steinfeld) on combining sensible and latent storage components as well with the international research partners TU Vienna, TU Eindhoven, Dalahousie University Halifax and University of Edinburgh.

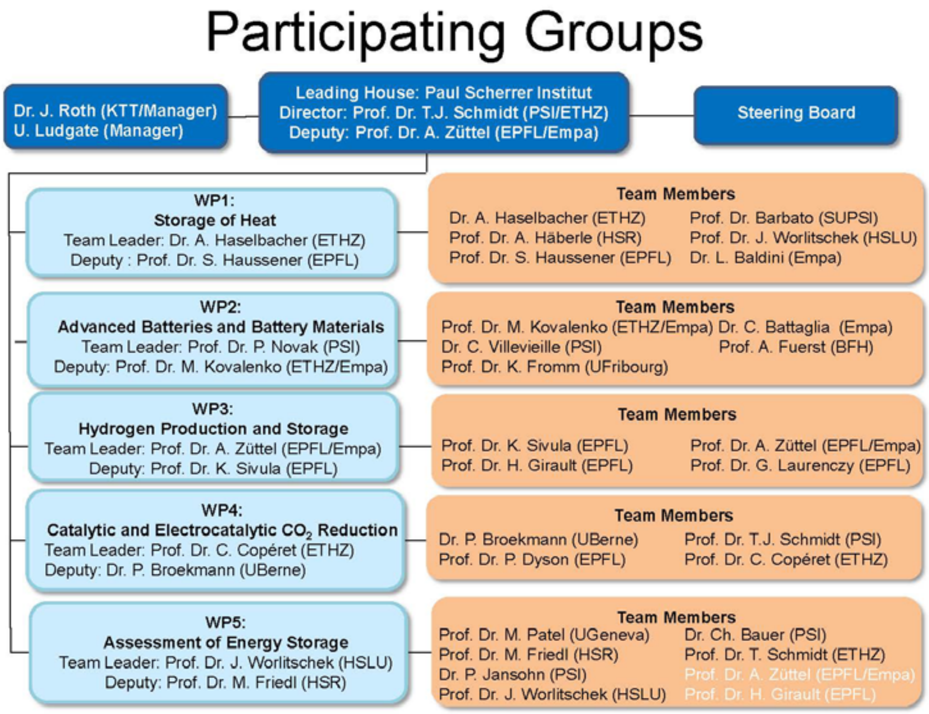


Figure 1: Structure of SCCER Storage with HSLU involvement in the Leadership of WP 5 ‘Assessment of Energy Storage’ and within the participation in WP1: ‘Storage of Heat’.

6.1.2. Discussion

Results related to integrated assessment of storage technologies

- Assessment of energy storage technologies for three different time scales (minute, hour and season)
- Integrated techno-economic and environmental assessment of power-to-gas systems
- Interdisciplinary review of energy storage for communities including challenges and perspectives
- Techno-economic analysis of battery storage and curtailment in a distribution grid with high PV Penetration

Results related to storages for flexibility of power and heat

- In depth evaluation of ETES concept proposed by ABB was finalized
- Alternative concepts of Dual Energy Storage and converter based on isobutene and ammonia developed and analyzed
- Development of simulations on the following topics:
  - high temperature NH_3 heat-pump for industrial applications
  - latent heat storage systems comprising tube bundle heat exchangers
  - latent heat storage systems comprising finned tube heat exchangers
  - assessing the economic potential of an electro-thermal storage when performing arbitrage

    - assessing the economic and energetic performance of combining heat pumps and thermal storages to provide domestic hot water and heating in residential building
- Business cases were recognized both in the industrial and in the building sectors
- Latent heat storage was developed with a phase change temperature of 12 °C – pilot plant to be installed within 2017
- Latent heat storage prototype for storage of process heat at 93°C was installed
- Industrial consortium to support developments within DESC was pursued

The most important results HSLU plans to achieve within Phase II of SCCER Heat and Electricity Storage is on the one hand a methodology to assess and compare thermal energy storages 2 at technology level and at energy system level. On the other hand, a demonstration plant of a seasonal thermal energy storage combining new latent/sensible technology concepts and new insulation materials should be achieved together with the 'SENSAI' industry consortium. In the field of high power latent heat storages the concept of direct contact heat exchange should lead to economically attractive thermal energy storages e.g. for the application in process heat storage.

6.1.3. Cooperation
6.1.3.1. ETHs/Universities
- Laboratory for Energy Systems Analysis, Paul Scherrer Institut
- Energy efficiency laboratory, University of Geneva
- TU Wien
- Centre for Research & Technology Hellas

6.1.3.2. Industry Partners
Mayekawa, Fafco AG, Sunamp, Migros, Moettler Toledo

6.1.3.3. 2nd Phase 2017-2020

6.1.4. Description of the SCCER, Work Packages, Goals and Cooperation
Contact person: Prof. Dr. Jörg Worlitschek

Academic Partners: PSI, Uni-GE, Solites (DE), University of Edinburgh (UK), Dalhousie University Halifax (CA), Politecnico Milano (IT)

Industry Partners: Swissgrid, BKW, Haka Gerodur, Strabag, Heag, Schenk, Cupasol, Sunamp Limited, Sauter, Fafco

6.1.5. Main Activities/Focus
- Sensible seasonal heat storage, Low-temperature (<150°C) high-power heat storage
- Assessment of energy storage at technology and energy system level

7. Review SCCER Concepts, Processes & Components in Mobility

7.1. 1st Phase 2014-2016

7.1.1. Description of the SCCER, Work Packages and Goals
Team HSLU:

V. Härri (Project leader, contact person), O. Duvanel and P. Habermacher

Tasks:
- A1: Integration of SCAPs in e-vehicles
- B1.1: Interaction between grid and charging infrastructure

7.1.2. Discussion

- Module "Storage" and "E-Mobility" accomplished
- New prototype (motor) for e-bike realized
- Measurement's system for e-vehicle
- First steps of survey and recommendations for vbl/VVL
- Energy's measurement on a small bus
- Energy's measurement on a double-articulated trolleybus

7.1.3. Cooperation

Evaluation of the cooperation with other UAS, ETH, Uni and industry partners.

7.1.3.1. Universities of Applied Sciences

7.1.3.2. ETHs/Universities

7.1.3.3. Industry Partners

- Stromer, new e-bike motor (Paper EPDC Stromer)
- VVL, catenary free operation (Paper EPDC Hess)
- vbl, energy's measurement DGT
- Magic-Bike
- Bomatec (Permanent Magnet)
- Stercom, SCAPs
- Mobimo (mobility and energy supply concepts)
- AFE Werner Meier (Mättivor)

7.2. 2nd Phase 2017-2020

No participation in Phase 2.

8. Review SCCER Supply of Electricity SoE

8.1. 1st Phase 2014-2016

8.1.1. Description of the SCCER, Work Packages and Goals

Team HSLU:
Ernesto Casartelli (Project leader, contact person), David Roos, Oliver Ryan
Tasks:

- Heat Transfer Modeling in Pumps
- Erosion Modeling in Pumps

8.1.2. Discussion

- Conjugate Heat Transfer Modeling with wall resolution independency
- LES modeling for thermal boundary layer
- Erosion modeling including geometry modification due to erosion

8.2. 2nd Phase 2017-2020

8.2.1. Description of the SCCER, Work Packages, Goals and Cooperation

Contact person: Prof. Dr. Ernesto Casartelli
Academic Partners: EPFL, HES-SO
Industry Partners: Andritz Hydro, Sulzer Pumps

8.2.2. Main Activities/Focus
- Transient modeling of hydraulic machines
- Cavitation/Erosion modeling

9. Review SCCER Grids and their components in energy system FURIES

9.1. 1st Phase 2014-2016

9.1.1. Description of the SCCER, Work Packages and Goals
Team HSLU:
Ernesto Casartelli (Project leader, contact person), Manuel Tiefenthaler, Oliver Ryan, Angelika Schmid, Armando der Rio, Benno Fleischli
Tasks:
- Characterization of pump-turbine instabilities (experimental)
- Modeling of pump-turbine instabilities (CFD)

9.1.2. Discussion
- Experimental characterization of pump turbine instabilities
- Development of efficient computational techniques for transient and moving mesh computations
- Systematic computation of instabilities in different pump-turbines

9.1.3. Cooperation
Evaluation of the cooperation with other UAS, ETH, Uni and industry partners.
9.1.3.1. Universities of Applied Sciences
9.1.3.2. ETHs/Universities
9.1.3.3. Industry Partners
Andritz Hydro

9.2. 2nd Phase 2017-2020

9.2.1. Description of the SCCER, Work Packages, Goals and Cooperation
Contact person: Prof. Dr. Ernesto Casartelli
Academic Partners: HSR

9.2.2. Main Activities/Focus
- Multiphysics modeling of hydraulic and electric machines

10. Review SCCER Biomass for Swiss Energy Future Biosweet
New participation in Phase 2.

10.1. 2nd Phase 2017-2020

10.1.1. Description of the SCCER, Work Packages, Goals and Cooperation
Contact person: Prof. Dr. Thomas Nussbaumer

Academic Partners: FHNW, HES-SO, PSI, WSL
Industry Partners: Schmid AG, COOP

10.1.2. Main Activities/Focus

- Optimized screw burner combustor, grate combustor for dusty biomass fuel
- District heating concepts to increase efficiency using flue gas condensation

11. Review NFP 70

11.1. Description of the NFP, Work Packages, Budget and Goals

HSLU leads on of five projects under the umbrella project „ACTIVE INTERFACES – Holistic operational strategies crossing over obstacles for large-scale advanced PV integration into urban renewal processes. HSLU's role is develop strategies to simplfy standards, assessments and certifications for building integrated photovoltaics (http://p3.snf.ch/project-153849). The project runs until November 2018 and has a budget of 420'000 from SNF. Projects partners take care of different work-packages, SUPSI for standards and certification, ETH for LCA and econcept for policies, where HSLU takes care of pilot- and demonstration projects of coloured photovoltaics for knowledge and technology transfer.

11.2. Discussion

One team member successfully completed her PhD study at EPFL in the area of visual assessments, including several publications such peer-reviewed and conference paper. Further knowledge and technology transfer includes pilot- and demonstration projects with industry and technology transfer partner in the area of colored photovoltaic facades such as HSLU's contribution to the Swiss Energy Challenge featured on the NFP news website http://www.nfp70.ch/de/News/Seiten/04072016_news_nfp70_energy-challenge.aspx. Further outputs as of today comprise publications on policies and standards, as well as a patent filing with industry. Further pilot- and demonstration projects with implementing industries or clients will follow to continuously increase public acceptance/demand of/for building integrated photovoltaics.

12. Review UAS Overall

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In the three focused SCCER, a total capacity build-up of 14 researchers has been conducted and six research professors from HSLU in different fields are included in these research activities (ZIG, CC

EASE, CC iHomeLab, CC TEVT). It was one of the strategic goals of HSLU to have a good position in the SCCER FEEB&D because of its two strategic focus topics "building as a system" and "Energy Turnaround" and its research strength in these fields. The good collaboration with EMPA could be strengthened through the close collaborative research within the SCCER FEEB&D (in particular through HSLU's deputy lead). A good collaboration with the University of Geneva could be established in the SCCER EIP and HAE Storage in the two workpackages led by HSLU. Further, the collaboration in SCCER EIP with ETHZ is positive, although many different professors are involved in this SCCER. The collaboration with EPFL could be improved. The good relations with the industry partners proofs to be very valuable within the SCCER, thus applied research results are achieved in short time and a useful impact for industry partners is generated.

Overall, the evaluation of the activities in the SCCER is positive. They allow a focus on long term research topics and research activities (3-6 years), which usually is difficult with CTI/BFE projects; the capacity build-up integrated new researchers from different cultures into our University, which is very valuable and can also be challenging, because they do not know the UAS-system. The target achievement in the different SCCER is good, based on a good collaboration with ETHZ, EPFL, Universities and other UAS. Results could be achieved, which would not have been possible without the SCCER. Last but not least, the collaboration, and the joint meetings with researchers, heads, and board members have brought the different research Institutions closer together. The HSLU invested around 20% of its cantonal research budget into the SCCER research. This shows, that this interinstitutional energy research with national importance is one main strategic focus of HSLU and will continue to be so in the 2nd phase.

12.1. Description and Goals

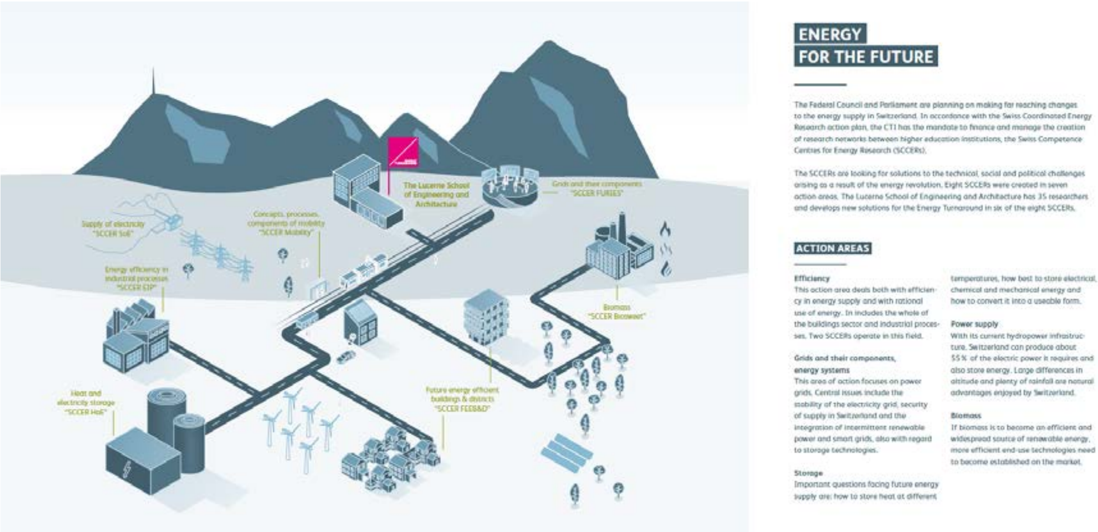
The research group LUCCERNE was founded at HSLU to foster the internal collaboration as well as the collaboration between the SCCER. LUCCERNE achieved to bring together the researchers and build-up own research topics, which are closely integrated into the SCCER activities. They focus on techno-economic evaluation, business model innovation and technology transfer.
Fokus on three strategic SCCER: FEEB&D, EIP and HaE. Build-up of capacity, strong KTT and sustainable development of University collaboration for the period after SCCER-funding.

12.2. Adjustments for the Period 2017-2020

The research group LUCCERNE was founded at HSLU to foster the internal collaboration as well as the collaboration between the SCCER. LUCCERNE achieved to bring together the researchers and build-up own research topics, which are closely integrated into the SCCER activities. They focus on techno-economic evaluation, business model innovation and technology transfer.

13. The role of the UAS beyond 2020 (optional)

Build-up of longterm netword with the University and industry partners beyond SCCER leading to more joint projects and even joint research institutes, which will carry on the successful work of the SCCER.



Flyer KTT Energy for the future, Hochschule Luzern

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