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Commission for Technology and Innovation (CTI)

SCCER Accompanying Research– Module 1: Thematic, Institutional and Knowledge Value Chain Related Shortcomings

Final Report
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Summary

Introduction and objectives of module 1

In 2012, the Federal Council's Action Plan regarding Coordinated Energy Research in Switzerland[1] requested an intensification of energy research. Consequently, the Swiss Confederation allocated 72 million Swiss Francs in funding for the formation of eight Swiss Competence Centers for Energy Research (SCCERs)[2] for energy research. This funding also covers the operational costs of the SCCERs during the period 2013-2016. Moreover, competitively selected energy research projects have received additional earmarked funding of a total of 46 million Swiss Francs (additional CTI funds).

In addition to monitoring by the SCCERs and the work of the SCCER evaluation panel, accompanying research analysed selected aspects of the SCCERs more thoroughly. Based on this research, which is structured in five modules, recommendations regarding possible amendments for the second stage of the action plan (2017-2020) were compiled.

Module 1 of the accompanying research analyses whether there are thematic, institutional or knowledge value chain related shortcomings in the SCCERs.

Conclusions and SCCER-overarching recommendations

Many of the thematic and institutional shortcomings are related to funding constraints. In the bidding process, the SCCERs were required to prioritise with respect to the research topics and the integrated institutions to ensure efficient research and a minimal research volume for sustainable research capacities. Hence, the identification of shortcomings is relative and lies in the field of tension between the funding available, the topics relevant for the Energy Strategy 2050 and the requirements for efficiency and minimal research volume.

Somehow ambiguous expectations from SCCERs

The requirements and expectations of the SCCERs are somehow ambiguous. On the one hand, the SCCERs are encouraged to deliver swift and tangible contributions to E2050 targets by moving in the direction of applied research and away from basic research. On the other hand, new and innovative solutions are required. Such research, typically on a lower TRL, needs time to be made ready for application and the market. According to the Coordinated Energy Research Action Plan[1)], «the overall expectation is innovation in the

1 Federal Council dispatch on the Coordinated Energy Research in Switzerland Action Plan – measures for 2013–2016. BBl 2012 9017, Status: October 17, 2012.

2 SCCERs: Swiss Competence Centers for Energy research: Future Energy Efficient Buildings & Districts (FEEB&D); Efficiency of Industrial Processes (EIP); Future Swiss Electrical Infrastructure (FURIES); Heat and Electricity Storage (HaE); Supply of Electricity (SoE); Efficient Technologies and Systems for Mobility (MOBILITY); Biomass for Swiss Energy Future (BIOSWEET), Energy, Society and Transition (CREST).

respective domain, over many years to come. Mostly everything else is means to the end and is left to the SCCER. Special actions/participations/cooperations are not objectives and will not be specified or required in particular. […] The work of the SCCER includes activities with short term impact, mostly based on work of ongoing forces and activities with longer term impact, based on new approaches, which are partly initiated by new forces» (KTI, 2016).

Recommendation: Since it is up to the SCCERs to decide within their research road maps on the research strategy and the corresponding topics and resources allocated to the different topics, the Evaluation Panel should verify within the verification of the research road maps and the annual SCCER evaluations if the research topics and the share of topics with low and with high TRL are adequate and promise to optimally contribute to the goals of E2050.

Difficult tendering conditions for universities and universities of applied science

The UASs and universities found the very short bidding period of seven weeks challenging. The less favourable funding conditions requiring higher self-funding or in-kind contributions were also an obstacle.

Recommendation: after having clarified the targets and research priorities of the SCCERs the question as to whether the composition of the SCCERs corresponds to the modified targets should be reconsidered. Giving more weight to research with a high TRL, which has a higher potential for generating contributions to the implementation of E2050 in the short and medium term, could require greater participation by those selected UASs positioned closer to the market.

Neglect/exclusion of existing know-how

Funding modalities such as substantial self-funding resources and in-kind contributions are less attractive for UASs and universities. Non-academic private energy research institutions do not receive funding and are de facto excluded from direct participation. Therefore, not all of the corresponding know-how, especially with respect to socio-economic, policy and implementation research in the area of energy and building research, is integrated.

Recommendation: if research topics with a high potential of generating contributions to the implementation of E2050 in the short and medium term are prioritised, the funding conditions for UASs, universities and private research institutions should be reconsidered and modified to enhance their participation.

Summary of shortcomings and recommendations

Considering the thematic goals of the bid and available funding, the priority setting and thematic coverage of research by the SCCERs was deemed to be adequate. However, based on the data collected and the expert interviews, the following shortcomings were

identified as significant. Recommended actions are also outlined for each of the main shortcomings.

Organisation of applied research in photovoltaic and solar thermal energy research is not clear

PV has been intentionally excluded from the SCCER-bid since there is a particular CSEM-PV-network, which is funded separately. Even if there are some PV-research activities in FEEB&D and FURIES, PV is not fully integrated into the SCCER-networks and the degree of collaboration with the CSEM network is not clear.

Recommendation: reconsider the relationship between the SCCER networks and the CSEM-PV[3] network for funding phase 2. Push system approach to exploit solar, and combine this with storage and smart control technologies.

Use of electricity and its efficiency potential is not addressed

Efficiency in electricity applications is a significant research topic and should be dealt with in SCCER EIP.

Recommendation: implement the research topic in the second phase, taking into account available funding and the need to prioritize. Check cooperation with CREST in order to overcome the main barriers to implementing known technologies.

Inadequate socio-economic research in the SCCERs

In the current setting of the SCCERs there is an explicit focus on socio-economic research in CREST. There is little or no socio-economic research by the technical SCCERs in their particular thematic field. CREST is basically doing research along its own research themes and priorities according to its roadmap. Direct collaboration between the technical SCCERs and CREST for SCCER-specific socio-economic research topics has to be developed first or further, particularly as the relevance of socio-economic topics will tend to increase the longer the SCCERs are in operation and the higher the technology readiness level (TRL) of their research is.

Recommendation: foster socio-economic research within the technical SCCERs and foster joint projects between CREST and technical SCCERs in funding phase 2, at least within those SCCERs which have not yet conducted adequate socio-economic research (namely EIP, HaE, MOBILITY and BIOSWEET).

Lack of research on mid-sized small hydropower in SCCER SoE [2)]

Mid-sized small hydropower plants have a relatively high relevance in the implementation of E2050 (1-2 TWh/a) and it has to be cleared if SoE shall strengthen its efforts in this area albeit the topic has not first priority.

Recommendation: investigate whether integration of the research topic in the second phase is recommended given not only the existing research priorities and financial re-

[3] CSEM-PV network: Besides the 8 SCCERs there is a separately funded network for Swiss PV research, managed by CSEM Neuchâtel (CSEM (centre Suisse d'électronique et de microtechnique) is a private, non-profit Swiss company for applied research).

sources but also the possible non-SCCER research funding in this research area which is already available. In the investigation, the newest results of the legislative process of the E2050 have to be considered[4].

No hydro-geothermal energy (HGTE) research in SCCER SoE *2)*

HGTE is regarded as a significant research topic but it is not clear if the limited research funds shall be shared between petro-thermal and hydro-thermal geothermal energy research, particularly as upcoming petro-thermal research results serve very much also hydro-geothermal energy.

Recommendation: the high cost of geothermal research justifies a focus on petro-thermal geothermal electricity and combined heat production. Hydrothermal geothermal energy might benefit from the possible synergies of this research.

No wood combustion research in SCCER BIOSWEET *2)*

Current appraisals of the relevance of wood combustion differ widely. If the SCCERs strives for highest possible mid- to long-term contributions to E2050, allocation of currently available SCCER research funds should remain as it is, especially if research on wood combustion is already financed by non-SCCER research funds.

Recommendation: examine the exclusion of wood combustion with regards to strategies other than the Swiss energy strategy 2050 (E2050), namely the biomass strategy of the Swiss Federal Office of Energy and the current energy policy instruments. Considering the limited research funds and the need for thematic focus it seems justifiable to waive wood combustion research within the SCCERs as long as there are other (non-SCCER) wood combustion research funds.

Sufficiency topic not adequately addressed

Besides CREST at least MOBILITY and FEEB&D are supposed to address the sufficiency issue, since it might play a role which is expected to become even more relevant in the future.

Recommendation: even if the “readiness level” of the topic is still very low, in funding phase 2 it is important to ensure that sufficiency is addressed in the research agendas and road maps of SCCER MOBILITY and SCCER FEEB&D and sufficiency research in CREST is extended in funding phase 2 as indicated by CREST.

Insufficient support for pilot and demonstration projects

Pilots and demonstrators are often expensive. Some SCCERs argue that industry is not willing to participate with relevant resources because the economic but also the legal framework conditions are not appropriate. But it seems questionable, if it is adequate to reallocate substantial funds away from SCCER research, application and implementation towards single pilots. If framework conditions are not clear yet, they have to be clarified first.

4 March 2, 2016: National Council excluded small hydropower smaller than 1 MW from the feed-in tariff.

Recommendation: check prior to funding phase 2 whether selected pilot and demonstration projects truly need and deserve additional funding. Pooling resources with other European countries could be of help. Further, access to the EU research program Horizon 2020 is crucial.

Insufficient integration of universities of applied sciences (UAS) and universities

Several research institutions and related researchers from UAS have been excluded during the SCCER tendering process due to unavoidable priority setting. Based on our accompanying research we suggest reconsidering the integration of research from some selected UAS, if they can deliver added value to specific SCCERs.

Recommendation: reconsider the feasibility and expedience of the integration of researchers from ZHAW (e.g. for the facility management research topic), HES-SO, SUPSI and FHNW, especially given the tendency towards increases in the technology readiness level (TRL) in the future. Reconsider the adequacy of the current funding rules for UASs (universities of applied sciences) and universities (higher requirements regarding self-funding and in-kind contributions) since this resulted in the withdrawal of several UASs during the application process and a loss of interest from some universities.

Lacking integration of private research organisations

Existing know-how from established private research organisations, especially in the fields of socio-economic research as well as implementation, policy design and assessment research, is de facto excluded, mainly because of the funding rules for private researchers.

Recommendation: enable participation of private research institutions by amending the funding modalities in funding phase 2 or by increasing existing research funding budgets where private research institutions are eligible to facilitate collaboration of private research institutions with SCCERs.

Insufficient involvement of industry, SME and practice partners and of policy makers

In funding phase 2 cooperation and collaboration with industry and practice partners are getting more important albeit easier because of often rising TRL.

Recommendation: ensure that these involvements are of sufficient relevance in the call for funding phase 2 and in the subsequent evaluation of applications.

Knowledge and technology transfer (KTT) is still insufficient and not yet established in all of the technology oriented SCCERs

As the share of research activities in the SCCERs on higher TRL will increase the longer the SCCERs are active, KTT and the development of market solutions/implementation will gain in importance

Recommendation: ensure further development of KTT activities and dedicated personnel in funding phase 2.

Zusammenfassung

Ausgangslage der Begleitforschung SCCER und Ziele des Modul 1

2012 forderte der Bundesrat mit der Botschaft zum Aktionsplan «Koordinierte Energieforschung Schweiz» eine Verstärkung der Energieforschung. In der Folge sprach der Bund 72 Mio. Fr. für den Aufbau und Betrieb von acht Energieforschungskompetenzzentren (Swiss Competence Centers for Energy Research SCCERs[5]) für den Zeitraum 2013-2016. Zusätzlich wurden 46 Mio. Fr. für kompetitiv vergebene Energieforschungsprojekte gesprochen (zusätzliche Gelder für KTI-Projekte).

Die Arbeit der SCCERs wird begleitet durch das Evaluationspanel SCCER sowie durch ein Monitoring. Ergänzend untersuchte die Begleitforschung SCCER ausgewählte Aspekte im Detail. Die Begleitforschung ist in fünf Module aufgeteilt. Basierend auf den Resultaten wurden mögliche Verbesserungen für die zweite Phase des Aktionsplans (2017-2020) formuliert.

Im Modul 1 der Begleitforschung wurden thematische und institutionelle Lücken sowie Lücken in der Wertschöpfungskette (knowledge production chain) identifiziert.

Folgerungen und SCCER-übergreifende Empfehlungen

Viele der thematischen und institutionellen Lücken sind auf die finanziellen Rahmenbedingungen zurückzuführen. Im Ausschreibungsprozess wurden die SCCERs aufgefordert, sich bezüglich Forschungsthemen und beteiligten Akteuren weiter zu fokussieren. Zweck der Fokussierung ist eine effiziente Forschung mit einem kritischen Volumen pro Forschungsgebiet. In Folge dessen ist die Identifikation von Lücken relativ und liegt im Spannungsfeld zwischen den verfügbaren Mitteln, den relevanten Themen für die Energiestrategie 2050 und der Sicherstellung eines kritischen Volumens je Forschungsgebiet.

Etwas unklare Erwartungen an die SCCERs

Die Anforderungen und Erwartungen an die SCCERs sind zwiespältig, resp. mehrdeutig. Auf der einen Seite werden die SCCERs aufgefordert, durch einen Fokus auf angewandte Forschung schnelle und handfeste Beiträge zu den E2050-Zielen zu liefern. Auf der anderen Seite werden neue und innovative Lösungen gefordert. Gemäss dem Aktionsplan «Koordinierte Energieforschung Schweiz» wird von den SCCERs grundsätzlich erwartet, dass in den einzelnen Forschungsbereichen in den kommenden Jahren Innovationen generiert werden. Dabei ist es den SCCERs überlassen, wie diese Innovationen erzeugt werden, spezielle Vorgaben werden nicht gemacht. Die SCCER-Forschung umfasst dabei Aktivitäten, die schon bald zu Innovationen führen werden und die an allen-

[5] SCCERs: Swiss Competence Centers for Energy research: Future Energy Efficient Buildings & Districts (FEEB&D); Efficiency of Industrial Processes (EIP); Future Swiss Electrical Infrastructure (FURIES); Heat and Electricity Storage (HaE); Supply of Electricity (SoE); Efficient Technologies and Systems for Mobility (MOBILITY); Biomass for Swiss Energy Future (BIOSWEET), Energy, Society and Transition (CREST).

falls schon bestehende Forschung anknüpfen, wie auch Aktivitäten, die neue Themen aufgreifen und erst längerfristig zu Innovationen führen können (KTI, 2016).

Empfehlung: Da die SCCERs im Rahmen ihrer Strategie- und Road Map-Entwicklung die Forschungsthemen und die entsprechende Mittelzuteilung bestimmen, sollte das Evaluationspanel im Rahmen der Überprüfung der SCCER Road Maps und der jährlichen SCCER-Evaluationen prüfen, ob die Wahl der Forschungsthemen sowie der Anteil von Themen mit hoher und tiefer TRL aus der Sicht der Strategie E2050 zweckmässig sind.

Schwierige Ausschreibungsbedingungen für Universitäten und FHs

Die sehr kurze Bewerbungsfrist war eine grosse Herausforderung für die FHs und Universitäten. Die weniger vorteilhaften Fördermodalitäten infolge von höheren geforderten Eigenleistungen waren ebenfalls ein Hindernis.

Empfehlung: Nach der Klärung der Ziele und der Forschungsprioritäten der SCCERs (siehe vorheriger Abschnitt) ist zu prüfen, ob die institutionellen Zusammensetzung der SCCERs den angepassten Zielen entspricht. Ein verstärkter Fokus auf Forschungsthemen mit einem hohen TRL und entsprechend hohen Potenzial für einen kurz- und mittelfristigen Beitrag zur E2050, kann eine verstärkte Beteiligung von FHs bedingen, welche nahe am Markt positioniert sind.

Vernachlässigung/Ausschluss von bestehendem Wissen

Die Fördermodalitäten bezüglich der geforderten Eigenleistungen sind für FHs und Universitäten weniger attraktiv. Nicht-akademische private Energieforschungsinstitutionen erhalten keine Fördermittel und sind somit de facto von einer direkten Beteiligung ausgeschlossen. Folglich wird relevantes Wissen nicht in die SCCERs einbezogen. Dies betrifft insbesondere die sozio-ökonomische und energiepolitische Forschung, so z.B. im Gebäudebereich.

Empfehlung: Werden Forschungsthemen mit einem kurz- und mittelfristig hohen Potenzial für einen Beitrag zur E2050 priorisiert, sind die Fördermodalitäten für FHs, Universitäten und private Energieforschungsinstitutionen für deren verstärkten Einbezug anzupassen.

Zusammenfassung der Lücken und Empfehlungen

Unter Berücksichtigung der thematischen Ziele der Ausschreibung und den verfügbaren Mitteln werden die Prioritätensetzung und die thematische Abdeckung der SCCERs als adäquat beurteilt. Gleichwohl konnten, basierend auf den verfügbaren Daten und Berichte sowie Experteninterviews, folgende Lücken als relevant identifiziert und entsprechende Handlungsempfehlungen formuliert werden.

Unklare Organisation der angewandten Photovoltaik- und Solarthermie-Forschung

Weil schon ein separat finanziertes PV-Forschungsnetzwerk des CSEM bestand, wurde die PV-Forschung in der SCCER-Ausschreibung ausgeschlossen. Obwohl in FEEB&D

und FURIES trotzdem gewisse PV-Forschungsaktivitäten laufen, konnte die PV-Forschung bisher zu wenig in die SCCER-Netzwerke integriert werden und die Art sowie das Ausmass der Zusammenarbeit zwischen dem CSEM-Netzwerk und den SCCERs sind unklar.

Empfehlung: Überprüfung der Beziehung der SCCER-Netzwerke mit dem CSEM-PV-Netzwerk für die zweite Förderphase. Stärkung des Systemansatzes, um das Potenzial der Solarenergie bestmöglich auszuschöpfen, inkl. Kombination mit Speicher- und intelligenten Steuerungstechnologien.

Effizienzpotenziale von Elektrizitätsanwendungen werden nicht behandelt

Das Forschungsthema Effizienz im Strombereich ist relevant und fehlt bisher.

Empfehlung: Aufnahme des Forschungsthemas in der zweiten Phase in SCCER EIP, unter Berücksichtigung der verfügbaren Ressourcen und der Notwendigkeit zur Priorisierung. Prüfung einer Kooperation mit CREST, um die wichtigsten Hemmnisse bei der Anwendung bekannter Technologien zu überwinden.

Inadäquate sozio-ökonomische Forschung in den SCCERs

Aktuell macht vor allem CREST sozio-ökonomische Forschung, in den technischen SCCERs fehlt die sozio-ökonomische Forschung weitgehend. Bisher verfolgt CREST primär die eigene Forschungsagenda, direkte Zusammenarbeit mit technischen SCCER ist selten. Je länger die SCCER bestehen, umso wichtiger werden aber sozio-ökonomische (Umsetzungs-) Themen.

Empfehlung: Stärkung der sozio-ökonomischen Forschung innerhalb der technischen SCCERs und Stärkung der Joint Projects zwischen den technischen SCCERs und CREST in der zweiten Phase. Dies betrifft insbesondere jene SCCERs, welche bis jetzt keine adäquate sozio-ökonomische Forschung betreiben. Namentlich sind dies EIP, HaE, MOBILITY and BIOSWEET.

Fehlende Forschung zur mittelgrossen Kleinwasserkraft im SCCER SoE [4)]

Mittelgrosse Kleinwasserkraftwerke haben eine gewisse Bedeutung für E2050, die Relevanz bzw. die Priorität für dieser Forschung ist jedoch unklar.

Empfehlung: Überprüfung einer Aufnahme des Forschungsthemas in der zweiten Phase unter Berücksichtigung der bestehenden Forschungsprioritäten und den finanziellen Mitteln sowie den bereits bestehenden Forschungsmitteln, welche für diesen Bereich zur Verfügung stehen. In der Überprüfung ist der aktuellste Stand zum parlamentarischen Gesetzgebungsprozess im Rahmen der E2050 zu berücksichtigen[6].

Fehlende Forschung zur hydrothermalen Tiefengeothermie (HGTE) im SCCER SoE [4)]

Grundsätzlich hat HGTE ein Potenzial und eine gewisse Relevanz. Es ist jedoch fraglich, ob es zweckmässig ist, die knappen verfügbaren Forschungsmittel beim sehr hohen Mittelbedarf in der Geothermieforschung auf petro- und hydrothermale Forschung aufzutei-

6 2. März 2016: Der Nationalrat schliesst Kleinwasserkraftwerke kleiner 1 MW von der KEV aus.

len, dies umso mehr, als die Ergebnisse der Petrothermieforschung auch der HGTE-Forschung dienen.

Empfehlung: Die hohen Kosten der Geothermieforschung rechtfertigen eine Konzentration auf die petro-thermale Elektrizitäts- und Wärmeproduktion. Die hydrothermale Tiefengeothermie kann von möglichen Synergien profitieren.

Fehlende Forschung zur Holzverbrennung in BIOSWEET [4)]

Die momentanen Einschätzungen der Holz-Verbrennungsforschung für die E2050 gehen auseinander. Falls die mittel- bis langfristigen Beiträge der Forschung zu E2050 im Vordergrund stehen, hat die Holz-Verbrennungsforschung weniger Priorität als die anderen Forschungsthemen von BIOSWEET.

Empfehlung: Überprüfung des Ausschlusses des Themas vor dem Hintergrund weiterer Strategien neben der Energiestrategie 2050 (E2050), insbesondere der Biomassenstrategie des Bundesamts für Energie BFE und den aktuellen energiepolitischen Instrumenten. Unter Berücksichtigung der limitierten finanziellen Mittel und dem notwendigen thematischen Fokus scheint der Ausschluss des Themas innerhalb der SCCERs gerechtfertigt zu sein, solange andere Forschungsgelder für das Thema zur Verfügung stehen.

Inadäquate Abdeckung des Forschungsthemas der Suffizienz

Die Suffizienzthematik ist vor allem in CREST, aber auch in FEEB&D und in MOBILITY von Bedeutung und sollte dort aufgegriffen werden. Die Bedeutung der Suffizienzforschung wird in Zukunft zunehmen.

Empfehlung: Aufnahme des Themas in SCCER MOBILITY und SCCER FEEB&D und Erweiterung der Suffizienzforschung in SCCER CREST in der zweiten Beitragsphase wie von CREST angegeben.

Nicht ausreichende Unterstützung von Pilot- und Demonstrationsprojekten

Pilot- und Demonstrationsprojekte sind teuer. Einige SCCER beklage mangelnde Motivation bzw. Beteiligung der Wirtschaft an P+D-Projekten, oftmals weil die Rahmenbedingungen unklar sind oder noch nicht geklärt wurden. Es stellt sich daher die Frage, ob es zweckmässig ist, zusätzliche P+D-Mittel zu sprechen, oder ob nicht zuerst die Rahmenbedingungen angepasst werden müssten. Dies umso mehr als spezielle Gefässe für P+D-Projekte bestehen.

Empfehlung: Überprüfung im Vorgang zur zweiten Phase, ob für Pilot- und Demonstrationsprojekte tatsächlich zusätzliche Fördermittel benötigt werden oder bestehende Fördergelder besser ausgeschöpft werden können. Ressourcenbündelung mit anderen europäischen Ländern und der Zugang zum Forschungsprogramm Horizon 2020 sind essenziell.

Nicht ausreichende Integration der Fachhochschulen (FH) und Universitäten

Diverse Fachhochschul- und Universitätsinstitute wurden in der Bewerbungsphase für SCCER nicht in die sich bildenden SCCER-Netzwerke aufgenommen. Die Ursachen lagen zum Teil bei der unumgänglichen Prioritätensetzung durch die SCCER, zum Teil

aber auch bei den Beitragsmodalitäten und beim sehr kurzen Ausschreibungsverfahren für SCCER.

Empfehlung: Überprüfung der Machbarkeit und Zweckmässigkeit eines verstärkten Einbezugs von Institutionen der ZHAW (z.B. für das Forschungsthemen Facility Management), HES-SO, SUPSI und FHNW vor dem Hintergrund der stetigen Erhöhung des «Technology Readiness Level TRL» der Forschungsthemen in der Zukunft. Überprüfung der Angemessenheit der aktuellen Fördermodalitäten für FHs und Universitäten (höhere Anforderungen an Eigenleistungen), welche zum Rückzug einzelner FHs und dem Interessensverlust einzelner Universitäten während des Ausschreibungsprozesses führten.

Fehlende Integration von privaten Forschungsinstitutionen

Private Forschungsinstitutionen (vor allem bei der sozio-ökonomischen Energieforschung, Policy Design- und Implementationsforschung) werden durch die aktuell gültigen Beitragsmodalitäten de facto mehr oder weniger ausgeschlossen.

Empfehlung: Ermöglichung der Teilnahme von privaten Forschungsinstitutionen durch eine Anpassung der Fördermodalitäten für die zweite Phase.

Nicht ausreichender Einbezug von Industrie, KMU und Praxispartnern sowie politischen Entscheidungsträgern

Je länger die SCCERs operativ tätig sind, umso wichtiger wird der Einbezug der Stakeholder der Forschung werden (Industrie-, KMU- und Praxispartner, politische Entscheidungsträger).

Empfehlung: Bei der Beurteilung der Wiederbewerbungen für die zweite Phase dem Einbezug der Industrie, KMU und Praxispartnern sowie politischen Entscheidungsträgern in die SCCERs eine genügend hohe Relevanz beimessen.

Nicht ausreichender Wissens- und Technologietransfer (WTT)

Mit steigender Laufzeit der SCCERs wird in vielen Forschungsbereichen die TRL steigen, so dass WTT zunehmend bedeutsamer werden wird. Zum Teil fehlt WTT zurzeit noch bzw. ist noch zu wenig ausgebaut.

Empfehlung: Sicherstellung der weiteren Entwicklung der WTT-Aktivitäten und dezidierter WTT-Manager-Positionen in der zweiten Phase.

Résumé

Introduction et objectifs du module 1

En 2012, le plan d'action du Conseil fédéral sur la Recherche énergétique suisse coordonnée[7] demandait que soit renforcée la recherche énergétique suisse. Par conséquent, la Confédération suisse a financé la création et l'exploitation de huit pôles de compétence suisses (Swiss Competence Centers for Energy Research SCCER)[8] dans le domaine de la recherche énergétique, à hauteur de 72 millions de francs, pour la période de 2013 à 2016. De plus, des projets de recherche énergétique sélectionnés par voie de concours bénéficient de fonds supplémentaires à but spécifique pour un total de 46 millions de francs (fonds supplémentaires de la CTI).

En plus du monitoring par les SCCERs et du travail du panel d'évaluation SCCERs, une recherche d'accompagnement a analysé plus en détail certains aspects sélectionnés des SCCERs. Cette recherche d'accompagnement se compose de cinq modules. Elle a servi de base à l'élaboration de recommandations concernant d'éventuelles modifications pour la seconde période du plan d'action (2017-2020).

Le module 1 de la recherche d'accompagnement analyse si les SCCERs présentent des lacunes en ce qui concerne les instituts de recherche importants, les sujets de recherche et la couverture de la chaîne de production du savoir (knowledge value chain).

Conclusions et recommandations générales pour les SCCERs

Un grand nombre de lacunes thématiques et institutionnelles ont trait au financement limité. Lors de la procédure d'appels d'offres, il a été demandé aux SCCERs de se concentrer de plus sur les sujets de recherche et les institutions intégrées de sorte à garantir l'efficacité de la recherche avec une masse critique par sujets de recherche. Par conséquent, l'identification de lacunes est relative et réside dans le champ de tension qui existe entre le financement disponible, les sujets importants pour la stratégie énergétique 2050 et les exigences d'efficacité et de masse critique de recherche.

Attentes quelque peu ambiguës de la part des SCCERs

Les exigences et attentes des SCCERs étaient quelque peu ambiguës. D'un côté, on encourage les SCCERs à apporter une contribution rapide et concrète aux objectifs de la stratégie énergétique 2050, en s'orientant pour cela vers la recherche appliquée au détriment de la recherche fondamentale. Mais d'un autre côté, de nouvelles solutions inno-

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7 Message du Conseil fédéral relatif au plan d'action sur la Recherche énergétique suisse coordonnée – mesures pour 2013–2016. FF 2012 9017, Statut: octobre 17, 2012.

8 Swiss Competence Centers for Energy research SCCER: Future Energy Efficient Buildings & Districts (FEEB&D); Efficiency of Industrial Processes (EIP); Future Swiss Electrical Infrastructure (FURIES); Heat and Electricity Storage (HaE); Supply of Electricity (SoE); Efficient Technologies and Systems for Mobility (MOBILITY); Biomass for Swiss Energy Future (BIOSWEET), Energy, Society and Transition (CREST).

vantes sont demandées. Cette recherche, généralement à un faible niveau de maturité technologique (TRL), nécessite du temps avant d'être prête pour l'application et le marché.

D'après le plan d'action sur la Recherche énergétique suisse coordonnée[1)], «l'attente principale est l'innovation dans le domaine respectif pendant de nombreuses années. Pratiquement tout le reste est un moyen de parvenir à l'objectif et est laissé à l'appréciation du SCCER. Les actions/participations/coopérations spéciales ne constituent pas des objectifs et ne seront pas spécifiées ni requises. […] Le travail du SCCER inclut des activités ayant un impact à court terme, essentiellement fondées sur le travail de forces et d'activités en cours ayant un impact à long terme, basé sur de nouvelles approches qui sont en partie initiées par de nouvelles forces» (CTI, 2016).

Recommandation: il incombe aux SCCERs de décider dans leurs feuilles de route de la stratégie de recherche, des sujets correspondants et des ressources allouées à ces différents sujets. Par conséquent, le panel d'évaluation devrait contrôler dans le cadre de sa vérification des feuilles de route de recherche et des évaluations annuelles des SCCERs si les sujets de recherche et le partage des objectifs à faible et à haut niveaux de maturité technologique (TRL) sont adéquats et contribueront de manière optimale à atteindre les objectifs d'E2050.

Conditions de soumission difficiles pour les universités et les universités de sciences appliquées

Les universités de sciences appliquées (HES) et les universités ont rencontré des difficultés du fait du très court délai de sept semaines pour l'appel d'offres et des conditions de financement moins favorables (autofinancement imposé ou contributions en nature plus étendues).

Recommandation: après avoir clarifié les objectifs et priorités de recherche des SCCERs, il conviendrait de réévaluer si leur composition correspond aux objectifs modifiés. Si l'on donne plus de poids aux TRL élevés qui ont tendance à déboucher sur des contributions importantes pour l'E2050 à court et moyen termes, une participation accrue d'HES sélectionnées plus proches du marché pourrait s'avérer nécessaire.

Exclusion du savoir-faire existant

Pour les HES et les universités, les modalités de financement telles que d'importants fonds propres et les contributions en nature sont moins attrayantes. Les instituts de recherche énergétique privés non universitaires ne reçoivent pas de financement et sont, de fait, exclus d'une participation directe. Par conséquent, le savoir-faire correspondant, notamment celui qui concerne la recherche socio-économique, politique et de mise en œuvre dans le domaine de la recherche énergétique et du bâtiment n'est pas intégré.

Recommandation: si l'objectif est d'obtenir des contributions majeures pour la stratégie énergétique 2050 à court et moyen termes, les conditions de financement des HES, universités et instituts de recherche privés devraient être réexaminées et modifiées en vue d'accroître leur participation et de créer des conditions plus équitables pour la recherche des SCCERs.

Synthèse des principales lacunes et recommandations

Eu égard aux objectifs thématiques de l'offre et au financement disponible, l'établissement des priorités et la couverture thématique de la recherche des SCCERs sont considérés comme adéquats. Néanmoins, les informations de base recueillies et les entretiens menés avec des experts ont permis d'identifier les principales lacunes suivantes qui ont trait à la couverture thématique, à l'intégration des instituts de recherche et à la couverture de la chaîne de production du savoir. Des recommandations d'action sont formulées pour chacune de ces principales lacunes.

L'organisation de la recherche appliquée en photovoltaïque (PV) et thermie solaire pas claire

Le PV a été exclu intentionnellement de l'appel d'offres SCCER puisqu'il existe un réseau CSEM-PV particulier qui est financé séparément. Même si certaines activités de recherche en PV figurent dans FEEB&D et FURIES, le PV n'est pas intégré entièrement dans les réseaux SCCER et le degré de collaboration avec le réseau CSEM n'est pas clair.

Recommandation: reconsidérer la relation entre les réseaux SCCER et le réseau CSEM-PV pour la deuxième phase de financement. Promouvoir l'approche systémique visant à exploiter l'énergie solaire combinée aux technologies de stockage et de contrôle intelligentes.

Utilisation de l'électricité et de son potentiel d'efficacité manquent dans le pôle EIP [6)]

L'efficacité dans les applications électriques constitue un sujet de recherche important qui devrait être traité dans le pôle EIP.

Recommandation: mettre en œuvre ce sujet au cours de la seconde phase. Examiner la collaboration avec le pôle CREST afin de surmonter les principaux obstacles à la mise en œuvre des technologies connues.

Recherche socio-économique inadéquate au sein des SCCERs

Dans l'actuelle organisation des SCCERs, l'accent est mis explicitement sur la recherche socio-économique dans le pôle CREST. Les SCCERs techniques effectuent peu voire aucune recherche socio-économique dans leur champ thématique. La recherche du pôle CREST s'articule autour de ses propres sujets et priorités de recherche, conformément à sa feuille de route. Il importe de développer la collaboration directe entre les SCCERs techniques et le pôle CREST pour les sujets de recherche socio-économique spécifiques aux SCCERs, car ces sujets gagneront en importance au fur et à mesure que le travail des SCCERs s'inscrira dans la durée et plus le niveau de maturité technologique (TRL) de ses recherches augmentera.

Recommandation: promouvoir la recherche socio-économique au sein des SCCERs techniques ainsi que les projets conjoints du pôle CREST et des SCCERs techniques au cours de la deuxième phase de financement. Ce, du moins dans les SCCERs qui n'ont

pas encore développé suffisamment la recherche socio-économique, notamment les pôles EIP, HaE, MOBILITY et BIOSWEET.

Centrales hydroélectriques petites et moyennes manquent dans le pôle SoE [6)]

Les centrales hydroélectriques petites et moyennes jouent un rôle relativement important dans la mise en œuvre d'E2050 (1-2 TWh/an). Il faut donc clarifier si le pôle SoE doit renforcer ses efforts dans ce domaine bien que ce sujet ne représente pas une priorité.

Recommandation: vérifier s'il est conseillé d'intégrer le sujet de recherche dans la deuxième phase compte tenu des priorités de recherche, des ressources financières existantes et des fonds de recherche hors SCCERs qui existent déjà dans ce domaine de recherche. Cette vérification doit tenir compte des derniers résultats du processus législatif de l'E2050.9

Géothermie profonde hydrothermique manque dans le pôle SoE [6)]

La géothermie profonde hydrothermique est considérée comme un sujet de recherche significatif. Cependant, il n'est pas établi clairement si les fonds de recherche doivent être partagés entre la recherche énergétique sur la géothermie pétrothermique et hydrothermique, compte tenu notamment du fait que les futurs résultats de la recherche pétrothermique pourront également servir en grande partie à l'énergie hydro-géothermique.

Recommandation: la recherche géothermique étant très coûteuse, il est judicieux de se focaliser sur la géothermie profonde pétrothermique. La géothermie profonde hydrothermique peut profiter des éventuelles synergies résultant de cette recherche.

Combustion du bois manque dans le pôle BIOSWEET [6)]

Les évaluations actuelles sur l'importance de la combustion du bois divergent considérablement. Si l'objectif des SCCERs est d'apporter des contributions optimales à moyen et long termes à l'E2050, l'allocation des fonds de recherche SCCER actuellement disponibles devrait rester inchangée, surtout si la recherche sur la combustion du bois est déjà financée par des fonds de recherche hors SCCER.

Recommandation: examiner l'exclusion de la combustion du bois dans les stratégies autres que l'E2050, notamment la stratégie sur la biomasse de l'OFEN et les instruments actuels de politique énergétique. Compte tenu des fonds de recherche limités et de la nécessité de se focaliser sur certains thèmes, il semble justifié de renoncer à la recherche sur la combustion du bois dans les SCCERs du moment que d'autres fonds de recherche (hors SCCERs) existent pour ce sujet.

Sujet de la suffisance pas traité de manière adéquate

En plus du pôle CREST, les pôles MOBILITY et FEEB&D sont censés traiter du sujet de la suffisance puisqu'il pourrait jouer un rôle de plus en plus important à l'avenir.

9 Le 2 mars 2016, le Conseil national a exclu les centrales hydroélectriques qui produisent moins de 1 MW de la rétribution à prix coûtant.

Recommandation: même si le «niveau de maturité» de ce sujet reste très peu élevé, il est recommandé de s'assurer que la suffisance figure dans les programmes de recherche et les feuilles de route du SCCER MOBILITY et du SCCER FEEB&D et que la recherche sur la suffisance dans CREST sera étendue pendant la deuxième phase de financement, comme indiqué par le pôle CREST.

Soutien pour les projets pilotes et de démonstration insuffisant

Les projets pilotes et de démonstration sont bien souvent coûteux. Certains SCCERs avancent que l'industrie ne souhaite pas participer en investissant les ressources appropriées car les cadres économiques mais aussi juridiques ne sont pas adaptés. On peut toutefois se demander s'il est adapté de redistribuer des fonds importants pris à la recherche, l'application et la mise en œuvre de SCCERs à des projets pilotes. Si les conditions cadres ne sont pas encore claires, elles doivent d'abord être clarifiées.

Recommandation: étudier pour la deuxième phase de financement si des projets pilotes et de démonstration sélectionnés ont véritablement besoin des fonds supplémentaires. Il pourrait s'avérer utile de mutualiser des ressources avec d'autres pays européens. En outre, l'accès à l'Horizon 2020 est essentiel.

Intégration sélective d'autres universités de sciences appliquées (HES) et universités insuffisant

Plusieurs institutions de recherche et chercheurs d'HES ont été exclus pendant la procédure d'appels d'offres des SCCERs en raison des priorités imposées. Sur la base de notre recherche d'accompagnement, nous suggérons de reconsidérer l'intégration de la recherche de certaines HES sélectionnées, si elle peut apporter de la valeur ajoutée à des SCCERs spécifiques.

Recommandation: réexaminer la faisabilité et l'opportunité d'intégrer des institutions de la ZHAW (p. ex. pour le sujet de recherche de facility management), l'HES-SO, la SUPSI et la FHNW, en tenant compte du fait que les niveaux de maturité technologique (technology readiness level TRL) tendront à augmenter à l'avenir. Réévaluer l'adéquation des règles actuelles de financement pour les HES et les universités, puisque ces règles (autofinancement imposé ou contributions en nature plus étendues) ont été une raison du départ de plusieurs HES durant le processus d'application et du désintérêt de certains instituts universitaires.

Manque d'intégration des organisations de recherche privées

Le savoir-faire d'organisations de recherche privées établies, notamment dans les domaines de la recherche socio-économique et de la recherche de la mise en œuvre, de la conception de politiques et d'évaluation est, de fait, exclu, principalement en raison des règles de financement pour les chercheurs privés.

Recommandation: permettre la participation d'instituts de recherche privés en modifiant les modalités de financement pendant la deuxième phase de financement.

Participation de l'industrie, des PME, de partenaires ainsi que des décideurs politiques insuffisants

Pendant la deuxième phase de financement, la collaboration avec l'industrie et les partenaires de terrain devient plus importante quoique plus simple du fait de TRL souvent plus élevé.

Recommandation: s'assurer de la pertinence de cette exigence pendant l'appel pour la deuxième phase de financement et l'évaluation ultérieure des applications.

Le transfert du savoir et de la technologie (TST) doit être établi dans chaque SCCER axé sur la technologie.

Plus l'activité des SCCERs s'inscrira dans la durée, plus la part des activités de recherche sur des sujets à TRL élevé augmentera. Par conséquent, le TST et le développement de solutions de marché/de la mise en œuvre gagneront en importance.

Recommandation: garantir le développement ultérieur des activités de TST et du personnel dédié au cours de la deuxième phase de financement.

1 Background

1.1 Applied energy research in contribution to the federal «Energy Strategy 2050»

In view of promoting a sustainable and efficient energy use in Switzerland as well as the gradual nuclear phase-out, the Promotion of Education, Research and Innovation for 2013-2016 has been reinforced (SERI statement - measures for 2013-2016[10]). Additional measures are necessary to reach the goals set by the «Energy Strategy 2050». In addition to these measures defined by SERI, the Federal Council's Action Plan on the Coordinated Energy Research in Switzerland[11] specifically targets applied energy research. Moreover the Federal Department of the Environment, Transport, Energy and Communications (DETEC) has increased its support of pilot and demonstration (P+D) projects.

The creation and funding for 2013-2016 by the Swiss Confederation, the cantons and to some extent by private companies in the context of research projects of interuniversity «Swiss Competence Centers for Energy Research» (SCCERs) is the main instrument for implementing the «Coordinated Energy Research in Switzerland». With regard to the second period of funding (2017-2020) of the SCCER, the organisation and past activities of the SCCERs are currently being evaluated.

1.2 The SCCERs in the Action Plan «Coordinated Energy Research in Switzerland»

An important basis for the implementation of the Energy Strategy 2050 is provided by the increased promotion of education, research and innovation (SERI statement 2013-2016) stipulating institutional funding measures (especially in the ETH domain) as well as competitive project funding ranging from basic research to product-related development of pilot schemes. The Action Plan «Coordinated Energy Research in Switzerland» 2013-2016 is supposed to give applied energy research new impulses (except for P+D with increased funding outside of the Action Plan).

Based on the Action Plan the technology fields and the corresponding areas of action as well as main research areas with the biggest potential with regard to the Energy Strategy 2050 were identified. In the context of the Action Plan the creation and operation of originally seven Swiss Competence Centers for Energy Research[12] (SCCERs)[13] are funded

[10] Statement of the State Secretariat for Education, Research and Innovation SERI - measures for 2013-2016 , issued on February 22, 2012

[11] Dispatch of the Federal Council on the Coordinated Energy Research in Switzerland Action Plan – measures for 2013–2016. BBl 2012 9017, Status: October 17, 2012.

[12] Other than initially provided in the tender phase, eight SCCER were created as there are two SCCER (FEEB&D and EIP) in the area of energy efficiency

[13] SCCER: Swiss Competence Centers for Energy research: Future Energy Efficient Buildings & Districts (FEEB&D); Efficiency of Industrial Processes (EIP); Future Swiss Electrical Infrastructure (FURIES); Heat and Electricity Storage (HaE);

by the Swiss Confederation with 72 million Swiss Francs for the period 2013-2016. Moreover, competitively selected energy research projects receive additional earmarked funding of overall 46 million Swiss Francs (additional CTI funds). The action plan aims at increasing innovative activities and furthering innovation in the fundamental action and technology fields of the energy strategy.

The emerging eight thematically focussed SCCERs are national networks of research institutes of the ETH domain, Universities, Universities of Applied Science and of partners in the private economy which can contribute to projects according to the CTI guidelines of project funding. Thereby the different elements of the knowledge production chain are to be strengthened all the while keeping the focus on applied research. Every SCCER has a leading house with an associated coordinator that is responsible for reporting and coordination within the SCCER.

The funding of the SCCERs - initially set for a period of four years, with a second period planned for 2017-2020 - covers the basic funding of the operation of the SCCERs including capacity building as well as the funding of innovation projects in the research areas of the SCCERs.

The basic funding by the Swiss Confederation of the SCCERs activities in building research capacities on the one hand (60 million Swiss Francs) and in operating and coordinating the research network on the other (12 million Swiss Francs) are complemented by contributions of the involved Universities and Universities of Applied Science. Additional funds are competitively awarded by the CTI to specific projects in the area of applied energy research (46 million Swiss Francs, 2013-2016). The funds meant for capacity building are tied to the condition that the affected research institutes invest at least the same amount of money they receive from CTI (in kind or in cash) into capacity building measures thereby proving a long-term commitment to the research project. The conditions regarding the investments necessary to obtain the capacity building funds by the CTI are more challenging for Universities and Universities of Applied Science.

Innovation projects are evaluated and supported based on the established criteria of the CTI namely market relevance, degree of novelty, implementation potential in the associated action field as well as solid partnerships with relevant private or public companies in the area of energy.

1.3 Accompanying research on the implementation of the action plan «Coordinated Energy Policy Switzerland» by 8 SCCERs

In addition to the self-monitoring of the activities and target achievement by the SCCERs, an accompanying research is to analyse selected aspects of the SCCERs more thoroughly. The accompanying research is structured in five modules:

Supply of Electricity (SoE); Efficient Technologies and Systems for Mobility (MOBILITY); Biomass for Swiss Energy Future (BIOSWEET), Energy, Society and Transition (CREST).

Module 1: Thematic, institutional and knowledge value chain related shortcomings

Module 2: Interdisciplinary collaboration

Module 3: Contacts with enterprises

Module 4: International positioning

Module 5: Coordination and synthesis

Based on the accompanying research, recommendations regarding possible amendments for the second stage of the action plan (2017-2020) will be compiled.

1.4 Objectives and tasks of module 1

Module 1 of the accompanying research analyses whether all relevant actors in the research areas and action fields of the eight SCCERs are represented and clarifies the reasons of non-integration in case a relevant research actor is not part of the SCCER research network.

Another objective of module 1 is to assess whether the entire knowledge production chain in the respective research areas and action fields is sufficiently and adequately covered. It is important to note that the SCCERs are deliberately focussed on applied research and implementation of innovations.

That leads to the following questions:

1 What relevant institutions and actors of Swiss energy research, which are active in one of the main research areas as stipulated by the Federal Council's dispatch, are not involved in the SCCERs?

2 Are there any relevant thematic shortcomings in the coverage of the designated research areas by the SCCERs? Are there any important shortcomings in the value chain?

3 For what reasons do certain relevant research actors not participate in the SCCERs? What are the reasons certain topics and elements of the knowledge are not sufficiently covered?

4 Recommendations as to how to respond to the identified deficits and the need for improvement in certain aspects with regard to the second period of funding of the SCCERs in 2017-2020.

2 Procedure and methodology

2.1 Procedure for module 1

In phase I, available data and information from the SCCERs call for bids and the reports from the first evaluation on the constitution, strategy and first activities of the SCCERs by the evaluation panel were collected. In addition, econcept screened available research databases for their informative value regarding participating research institutions and research areas covered by the latter. Here it became evident that the initial approach had to be revised and further detailed in order to deduct a definite course of action (procedure for module 1: detailed concept, cf. Figure 1).

The main outcome of phase I of the accompanying research was the decision to stronger focus on gathering information on SFOE research area managers, SCCER heads, CTI experts and members of the SCCER evaluation panel. Figure 1 illustrates the resulting procedure with its different work steps.

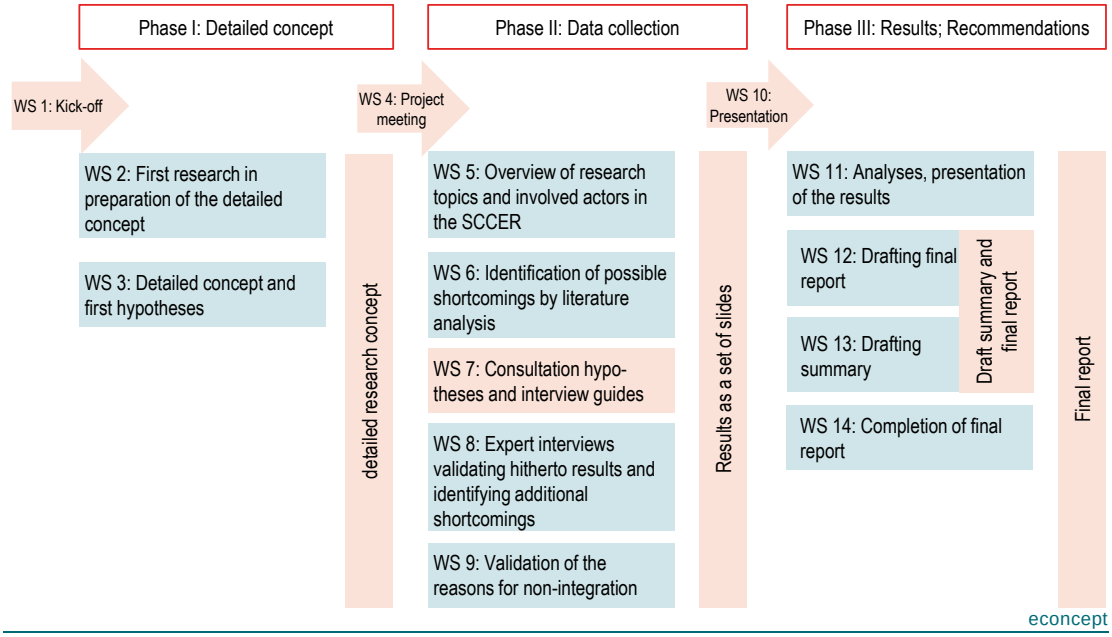


Figure 1: Procedure for module 1 of the accompanying research of SCCERs (WS: Work Step)

Based on the analysis of the available information on the SCCERs (web pages, applications, call for bids and evaluation) econcept compiled an overview of the research areas covered by the SCCERs and participating research institutions. The overview provides first indications about possible shortcomings in the coverage of the designated research areas and the participation of relevant research institutions in the SCCERs as well as possible reasons for these shortcomings.

At the centre of the data collection in phase II were guideline-based expert interviews (work step 8). In addition to the more generic information obtained by screening the available research databases, the expert interviews served to obtain specific information

corroborated by personal experiences about perceived shortcomings, their relevance and possible reasons. The interviewed experts are specified in Table 58, the average interview lasted 60 minutes.

The findings of these interviews were then validated by three phone interviews with previously identified research institutions not involved in the SCCER, thereby deepening the cause analysis of the shortcomings (work step 9).

A summary of the most important findings was finally given to the SCCER heads for consultation and presented at the SCCER Steering Committee Meeting on January 18th, 2016 (work step 11). The feedback of the SCCER heads and Steering Committee is included in this final report.

The information and data sources employed for the accompanying research are detailed in the next chapter.

2.2 Information and data sources

The exploration and identification of the topics covered by the SCCERs as well as of the necessity for thematic and institutional amendments (topics not covered and relevant research actors not represented) is based on document analysis and expert interviews.

In the following table, the used documents are listed, including details on their content and the exploitation for the report.

Source	Content / Exploitation
Dispatch on the Coordinated Energy Research in Switzerland Action Plan – measures for 2013–2016 (Federal Council, 2012)	Information on – the origination process of the SCCERs – the thematic subdivisions of the seven action areas
Call for bids – Swiss Competence Centers for Energy Research SCCER (CTI, 2013a)	Information on – the origination process of the SCCER – the description of the main themes and issues in the action areas. «The description provides a binding initial reference description and as such form part of the performance agreement with the steering committee» (CTI, 2013a).
Call for bids in action area 1 on 'Efficiency' – Swiss Competence Centers for Energy Research SCCER (CTI, 2013b)	Information on – the origination process of the SCCER – the description of the main themes and issues in the action area 'Efficiency'. «The description provides a binding initial reference description and as such form part of the performance agreement with the steering committee» (CTI, 2013a).
Applications of the SCCER (final)	Information on – Definition of the thematic field the SCCER has offered to do research on and the steering committee has agreed on. This is relevant for thematic shortcomings in level 3 (see chapter 2.4); – involved institutions
Roadmaps and Document of Work (if available) of the SCCER	Information on – latest thematic focus of the SCCER (in particular of the work packages), relevant for thematic shortcomings in level 3 (see chapter 2.4)

Source	Content / Exploitation
Homepages of the SCCER	Information on – thematic focus of the SCCER – involved institutions
Global SCCER Evaluation Report 2014 (CTI 2014a)	Information on – Feedback from the SCCER evaluation panel (EP) on the thematic focus and involved institutions of the SCCER Remark: The first evaluation (2014) of the SCCER took place only few months after its launch. Accordingly the results of the evaluation are limited.
Consolidated Evaluation Reports 2015 (CTI 2015)	Information on – Feedback from the SCCER evaluation panel (EP) on the thematic focus and involved institutions of the SCCER Remark: For lack of time the results of the second evaluation published by the end of 2015 could only be partly considered for this report.
Feedback of the SCCER heads regarding the Consolidated Evaluation Reports 2014 (SCCER 2015)	Information on – Viewpoint of the SCCER on thematic focus and involved institutions
Financial Monitoring - State September 2015, Forecast December 2015	Information on – involved institutions, researchers and their research topics
Statistics on energy research of the years 2010, 2011, 2012 and 2013 (SFOE, 2012/2013/2014/2015)	Information on – research facilities active in the seven action areas
Survey of the Rectors' Conference of Swiss Universities (CRUS, 2013)	Information on – interested institutions (institutions which were interested in the participation in an SCCER in advance to the proposal)
Survey of the Rectors' Conference of the Swiss Universities of Applied Sciences (KFH, 2012)	Information on – interested institutions (institutions which were interested initially in the participation in an SCCER)

Table 1: Used documents

Note on existing research databases

None of the analysed databases[14] provides information about the research activities of each research institute. Even the most high-quality database – the one the federal energy research statistics is based on – indicates the name of the institute only for 15% of the projects. Therefore, no existing research databases were used for this report.

Phone interviews were held with experts within and outside the SCCERs in order to achieve a precise and yet independent picture. The SCCER interviews were held with seven SCCER heads and one SCCER program manager. The Non-SCCER interviews were done with all eight research area managers of the federal office of energy and with two members of the core group of the SCCER evaluation panel (see Appendix A-4 Table 58 for the list of the experts who were interviewed).

2.3 Definition of notions and concepts

For Module 1 of the accompanying research we assume the following definitions and *concepts:*

[14] a) Database on which the federal energy research statistics is based; b) Aramis database; c) Energy research database of the Swiss Federal Office of Energy (SFOE).

— **Main research areas** based on the Federal Council Dispatch (SFOE 2012): Research topics which are to be investigated by the SCCERs with priority and which are determined for the measures in the period of 2013-2016 by the dispatch to Coordinated Energy Research Action Plan.

— **Research areas according to the SFOE:** Research topics based on the structure applied by the Federal Office of Energy, e.g. for the statistical database on energy research

— **Areas of action** based on the dispatch: Research fields determined in the dispatch to the Coordinated Energy Research Action Plan which ought to be covered by one or two SCCERs

— **Knowledge production chain**: Knowledge production and innovation process, comprising basic research, the development of implementation models and prototypes up to demonstration installations and implementation on the market or in policy making processes (see chapter 2.6 Figure 4).

Research actors and corresponding research institutions

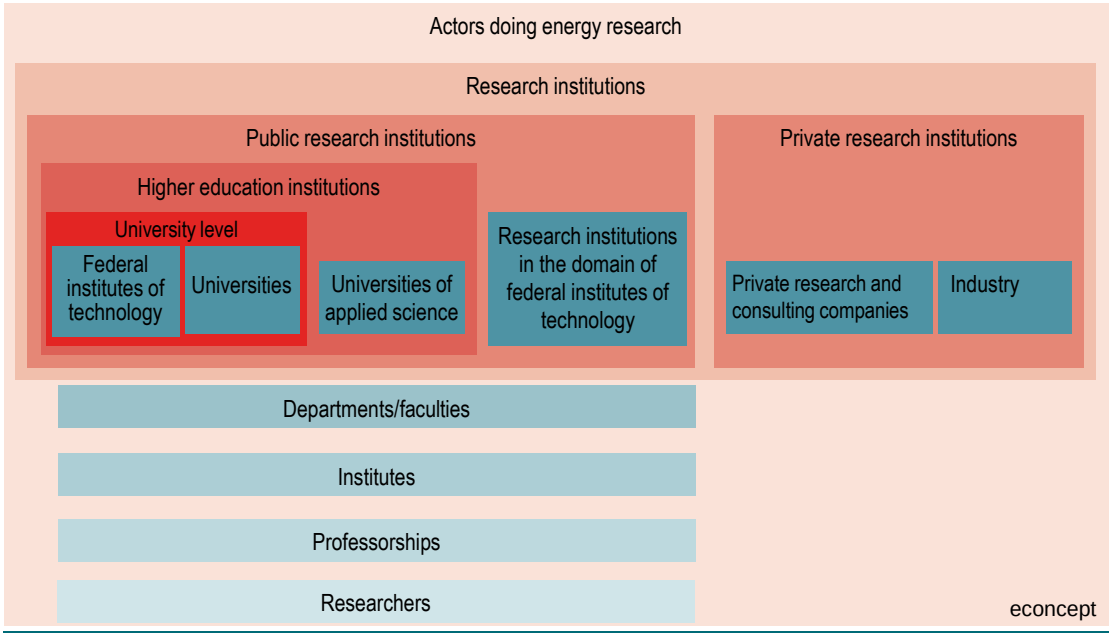


Figure 2 Definitions: The notion «energy research actor» comprises all institutions and actors doing energy research in the research fields of the Coordinated Energy Research Action Plan

2.4 Research topics in the main research areas of the Coordinated Energy Research Action Plan not covered by the SCCERs – thematic shortcomings

To identify possible thematic research shortcomings of current SCCER research, it is necessary to define the meaning of «thematic research shortcomings» in this context.

Thematically the research fields for the SCCERs comprise the seven prescribed areas of action according to the call for bids for the establishment of SCCERs (CTI, 2013a). This

call indicated for the seven areas of action the main research areas (see CTI, 2013a, p. 6-8) which have to be covered according to the Dispatch to the Coordinated Energy Action Plan (federal council, 2012).

In the first round of the tender procedure the evaluation panel (EP) assessed the SCCER bids submitted and defined for each SCCER application the needs for amendments and supplements required. In the area of action «economy, environment, law, behaviour» this led to the merge of two applications from the first round to the SCCER CREST. Furthermore, the area of action of «efficiency» was split into the two SCCER FEEB&D and EIP, resulting finally in 8 SCCERs launched in late 2013 to early 2014, after the second round of the tender procedure.

In the assessment of the applications the EP emphasized

- the need to strive for innovations, supporting the energy strategy 2050 (E2050) by pushing fast market and policy implementation. Thereby, it is expected that the SCCER research does not only continue existing research but generates additional innovation and contributions to E2050 and
- that the applications prioritize possible activities and concentrate on topics within the particular area of action with the highest future potential for E2050. Furthermore, several SCCERs applications were requested to reduce the number of participating research institutions and partners such that the particular research units achieve a critical volume per research unit which is considered indispensable for innovative and sustaining research activities in the area of action.

These requirements are not fully unambiguous which illustrates that the identification of possible thematic shortcomings will also be a result of appraising the weight put on the requests from the EP listed above.

Based on the thematic indications for the seven areas of action (dispatch on coordinated energy action plan, 2013), the tender and evaluation process and the emerging 8 SCCERs, there are three levels of thematic research fields and corresponding possible thematic shortcomings which can be distinguished:

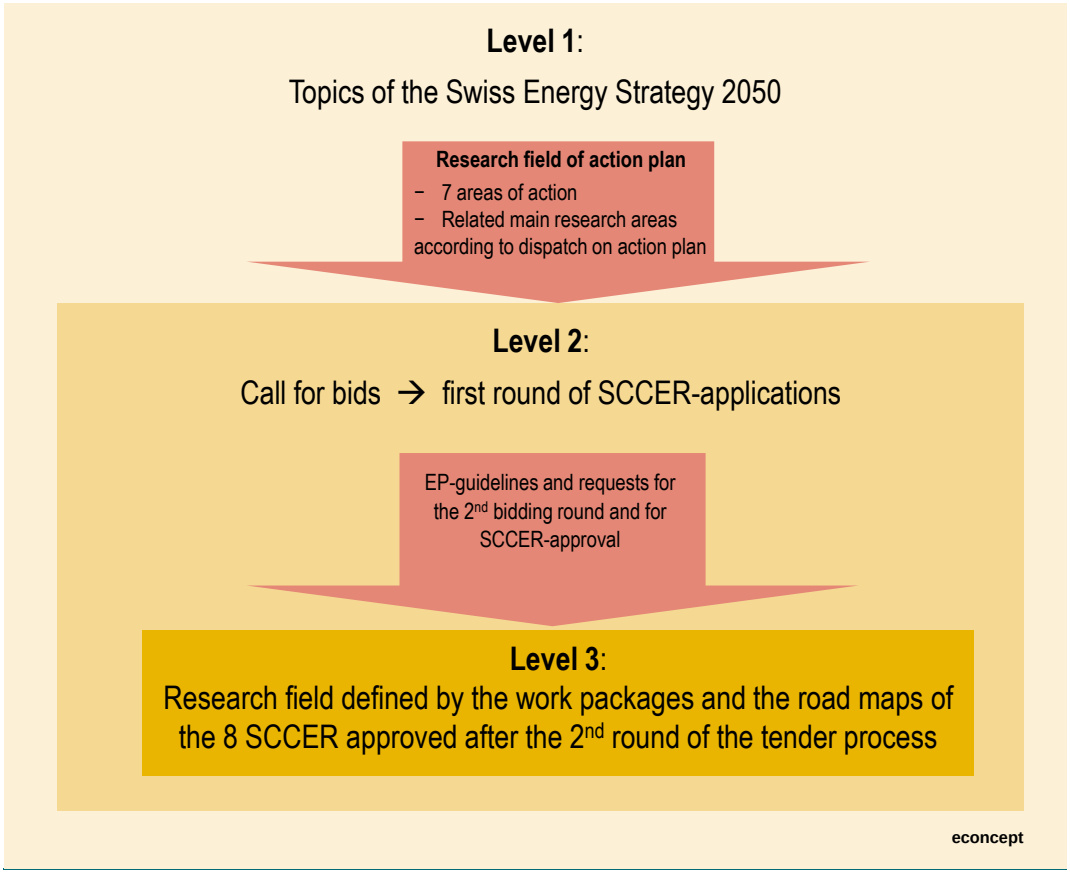


Figure 3 Different possible levels for the thematic research field to be covered by the research of the 8 SCCERs

Level 1: Level 1 comprises all possible research topics in the realm of the Swiss energy strategy 2050 (E2050) and establishes the gross thematic range for determining possible thematic shortcomings.

Level 2: The thematic field of level 2 is confined by the prioritizations of the coordinated energy action plan: Prioritization on 7 areas of action. For each area of action the action plan mentions specific main research areas. Level 2 excludes e.g. nuclear energy and photovoltaics (PV). Even though PV has high priority in E2050 it is not listed as priority subject. The reason is the existing PV program and the corresponding PV network of CSEM[15] with is funded and supported separately. Nevertheless, the absence of PV in the SCCER was questioned by several experts interviewed. Level 2 corresponds to the thematic field which was addressed by the SCCER call for bids.

Level 3: Level 3 is the level from which to start with identifying subsequently possible thematic shortcomings. The frame of reference for the identification of thematic shortcomings is basically level 2. The thematic range of level 3 comprises the research topics which have been adopted by the SCCER in their work packages and road maps. It corresponds to the range of themes taken up by the

[15] CSEM: Centre suisse d'électronique et de microtechnique) is a private, non-profit Swiss company for applied research.

SCCER in their first round application minus the topics which had to be eliminated to take into account the feedbacks and requests of the Evaluation Panel (EP) assessing the first round SCCER-applications. General tendency of the first assessment of the SCCER-applications was to concentrate on the most promising topics related to the targets of E2050 and to reduce the range of research topics to the most innovative ones and to the topics with the highest potential to contribute to E2050, thereby assuring a critical extent of resources available per topic. This resulted in the abandonment of less relevant topics and research actors during the application process. It has to be acknowledged that the resources available for the SCCER are an important underlying framework condition for this evaluation and concentration process (more resources would have allowed for a broader range of research topics which can be dealt with efficiently).

The identification of thematic shortcomings focusses first on shortcomings with respect to the research topics of the approved final application. Second, it is explored if there remain shortcomings with respect to the thematic field of level 2 which corresponds to the thematic field of the SCCER call. The search for shortcomings will not be extended to further possible shortcomings if the whole thematic range of E2050 (level 1) is considered, going beyond the prioritization on the 7 areas of action of the action plan.

The shortcomings are determined by literature analysis (see chapter 2.2) and expert interviews.

2.5 Integration of Swiss research actors doing energy research in the field of the SCCERs – integration shortcomings

Usually researchers represent also a research topic or area. Identified thematic shortcomings indicate possible integration shortcomings, since the researchers or research institutions of topics not covered will usually not participate in the corresponding SCCER (even if the expert interviews show that besides direct and funded collaboration there are sometimes also other more informal ways of cooperation or at least of information).

On the other hand, there may be similar research at different research institutions. In such cases it is difficult to assess if this constitutes a deficit in integration of Swiss researchers or research institutions. It was requested by the call and it is confirmed by the EP in the assessment of the SCCER applications that research resources are to be allocated efficiently. This requires usually the concentration on only one and thereby on the most promising research partner per topic. Duplication without added value has to be avoided and doing so is not an integration shortcoming.

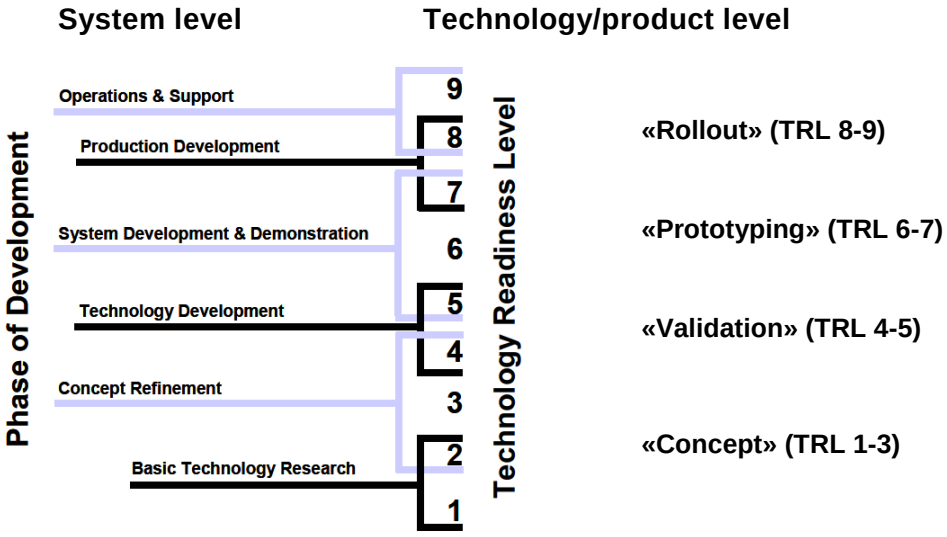
Not integrated research institutions and researchers doing research in the area of the SCCERs are also determined by expert interviews, simultaneously with the exploration of thematic shortcomings and the same interview partners (see above). The interviews aim at identifying relevant researchers or institutions doing energy research in the field of

SCCERs which are not participating. Relevant means that their research has a high innovation and implementation potential in a topic dealt with by the SCCERs and that they are leading in research and development or implementation, respectively. Here again, identified integration shortcomings depend on the resources available for the SCCERs (see above). The relevance of the research institutions and researchers for the research in the particular SCCER is assessed by the experts interviewed who are doing research in the SCCER (close to the topics investigated), from the Federal Office of Energy (close to the topic but neutral with respect to the SCCER) and by selected further experts from the EP and from the research community not participating in SCCERs (external views).

2.6 Shortcomings in covering the knowledge production chain – shortcomings in the knowledge production chain[16]

The knowledge production chain is defined by the following elements:
Basic research → development of implementation models and prototypes → demonstration of installations → implementation on the market (CTI, 2013a, p. 5)

Sauser et al. (2006) assign technology readiness levels (TRL 1 – 9) to the knowledge production chain (see Figure 4).



Sauser et al. 2006, supplemented by econcept

Figure 4 Different descriptions of the knowledge production chain

Whilst providing support for basic research, the SCCER call and the energy research action plan indicate that the main focus of the support measures is supposed to be on applied research and applying the findings to promote innovation (CTI, May 2013, p.4): «The main aim of research promotion is to find solutions to problems which will arise as the result of the energy revolution (phasing out nuclear energy while keeping to CO_2

[16] Knowledge production chain: CTI (May 2013) defines the following elements of the knowledge production chain: From basic research → development of implementation models and prototypes → demonstration of installations → implementation on the market.

goals). At the same time, consideration must be given to the entire knowledge production chain and the benefits it can deliver, from basic research through the development of implementation models and prototypes to demonstration installations and implementation on the market». These messages are somewhat ambiguous in that on the one hand the entire knowledge production chain has to be considered while on the other hand the main support has to focus on applied research and applying findings for the targets of E2050.

Therefore, the assessment of the coverage of the knowledge production chain and the identification of possible shortcomings shall be mainly based on valuations and appraisals of experts involved and being able to assess the relevance of certain elements of the knowledge production chain for particular research topics as well as the adequacy of specific research activities at certain positions on the knowledge production chain.

Again this information is collected by expert interviews. Questions with respect to possible shortcomings in covering the knowledge production chain adequately are integrated in the interview questions which explore thematic shortcomings and shortcomings in the integration of research institutions and researchers.

3 Results: Relevant shortcomings with recommended action

Based on the collected basic information and the expert interviews, we identified various thematic and institutional shortcomings as well as shortcomings in the knowledge production chain within the eight different SCCERs. The tables below illustrate these shortcomings by explaining the reasons for the shortcomings, assessing their relevance and formulating recommendations. Hereby only shortcomings with recommendations are specified. Appendix A-3 contains a complementary list with an overall assessment by the SCCER heads and shortcomings without recommended action for each SCCER. Furthermore Appendix A-2 gives a brief summary on each of the eight SCCERs regarding the research topics and the participating institutes.

3.1 Future Energy Efficient Buildings & Districts (FEEB&D)

SCCER FEEB&D – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Thematic shortcomings		
Assignment of PV research between the CSEM-PV-Network and the SCCERs is not clear. PV research in FEEB&D tends to be suboptimal and fragmented	PV has been intentionally excluded from the SCCER bid since there is the CSEM-PV network doing PV research. Within the SCCER the PV topic is not dealt with comprehensively in an integrated way. FEEB&D deals only with integration of PV in the building envelope. Further, the other solar research topics like solar thermal, the reloading of ground storage capacities; hybrid solar concepts, heat storage and smart control issues are somewhat disconnected from the SCCERs and FEEB&D. The linking of the CSEM-network to FEEB&D and the SCCERs in terms of grid, seasonal storage and PV in buildings is not optimal. The lack of wind energy is justified by the need to concentrate on the research areas with the highest potential for contributing to the targets of E2050 and makes sense.	Check the practicality of the separate CSEM PV network and the possibility of integrating the PV network into the SCCERs in funding phase 2.
Sub-critical volume of solar thermal research in FEEB&D, no system approach regarding exploitation of solar energy in buildings.	Reasons: Disconnection of PV, and the requirement to focus thematically and with respect to the partners involved on research topics with a high potential for generating **additional** contributions to the implementation of E2050. System approach for optimally exploiting solar potentials in the buildings area, including storage options, grid interaction and smart control, is lacking. Within the system approach solar thermal has a relevant role (especially for hot water production). To what extent solar thermal, storage issues and smart control have to be integrated in FEEB&D depends on the allotment of the topic to FEEB&D, FURIES, SoE and possibly HaE as well as on the extent these topics get already non-SCCER research funding.	Ensure system approach to solar energy exploitation in buildings in funding phase 2 (with FEEB&D, FURIES, HaE and SoE). Check need to take up solar thermal in phase 2, especially for grid, storage and hybrid solar issues. More solar thermal research requires more funding.
Too narrow focus on aerogel research and on dynamic glazing research	Both topics are considered as very relevant for a high performance building envelope, even if dynamic glazing is still on a lower technology readiness level (TRL). Upcoming materials research is targeting cheaper aerogels for cheaper products and a wider application of these aerogels. The narrow focus is justified by the request of the EP for critical volume as well as by the fact that the choice of focus on the material level has also been qualified as a strength of FEEB&D.Experts' appraisals regarding the breadth of research on the building and building envelope are ambiguous. Some doubts regarding	Reassess the appropriateness of the concentration on aerogel and dynamic glazing for phase 2.

SCCER FEEB&D – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
	the thematic coverage remain.	
Lack of life cycle analyses	So far it has not been possible to discern a consistent life cycle approach. Important LCA-researchers are not partners of FEEB&D (e.g. Stefanie Hellweg ETHZ).	Require consequent application of life cycle approach in phase 2
Institutional shortcomings		
UAS-partners abandoned in the 2nd application	Reasons: Lack of funding. The number of the UAS abandoned depends on the funding available. The UAS partners were supposed to participate expediently in FEEB&D in order to ensure a critical research volume.	If funding in phase 2 will be increased, check if then the integration of selected additional UAS will bring added value (especially ZHAW, HES-SO and possibly FHNW).
Lack of established private energy research institutions	Non-academic private energy research institutions do not receive funding. De facto they are excluded from direct participation. Given the previous importance of well-established non-academic private research institutions, especially with respect to socio-economic policy and implementation research in the area of energy and building research, this is a relevant shortcoming.	Check the adequacy of the current funding model for private energy research institutions and ways of integrating this existing know-how into SCCER research: Either by establishing the necessary prerequisites in funding modalities or by increasing existing research funds where private research institutions are eligible.
Shortcomings in the knowledge value chain		
Decentralized energy systems: deficits in the evaluation of impacts and in implementation.	WP3 "Decentralized urban energy systems" is considered rather academic in the evaluation of 2014. NEST (EMPA) is also a long way from implementation. Bridging the shortcoming to practical implementation is needed. Integration of current practice into FEEB&D research has to be improved.	Enhance integration of practical implementation into research in funding phase 2 by thematic obligation or involvement of practice partners.

Table 2: SCCER FEEB&D – Shortcomings identified by experts and recommended action.

3.2 Efficiency of Industrial Processes (EIP)

SCCER EIP – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Thematic shortcomings		
Use of electricity and its efficiency potential is not addressed.	Reasons: there should be a stronger emphasis on research in the field of electricity use and efficiency of electricity use in EIP but it has the smallest budget of all SCCER projects. Because of budget constraints, EIP set clear priorities and focuses on heat, which is the most relevant form of useful energy. Heating efficiency improvements are easier to achieve than efficiency improvements to electricity applications, which are generally more complex. Information: SOE is already financing research in this area. Relevance: The topic is highly relevant for achieving the targets of E2050, where power efficiency is of great importance. CREST could support EIP with regards to overcoming the main barriers in the implementation of known technologies.	Address the issue of efficiency of electricity use in EIP. Check if this requires more funding to the EIP in phase 2. Check cooperation with CREST in order to overcome the main barriers to implementing known technologies.

SCCER EIP – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Non-technical aspects of efficiency of industrial processes are barely addressed.	Reasons: among all the SCCER projects which require a strong focus, EIP has the smallest budget. EIP cooperates in these areas with the existing research – namely the National Research Program NRP 70/71 and the SCCER CREST – instead of conducting its own research. Relevance: Energy intensive companies are cost-sensitive. Nevertheless, research on non-technical and non-economic aspects of high efficiency can help to overcome existing barriers.	Check if the cooperation with NRP 70/71 and CREST is adequate and expedient.
Aspects of districts (e.g. in the form of industrial symbiosis) are not addressed strong enough.	Relevance: widening the perspective allows more possibilities for heat recycling (part of WP4).	If funding can be increased in phase 2, check supplementation of research in phase 2.
Institutional shortcomings		
Not involved: ETHZ, Institute for Environmental Engineering	Life cycle-analyses can help in identifying optimal solutions and should be a basic approach in the assessment of EIP solutions.	Ensure deployment of the LCA approach in EIP in phase 2. Check possibility to increase funding and/or strengthen cooperation.
Shortcomings in the knowledge production chain		
Collaboration with industry is only partially developed.	Collaboration with industry is crucial for the implementation of the findings. Pilots and demonstration projects are important to gain industry confidence in new solutions.	Require to strengthen collaboration with industry.
No knowledge and technology transfer-position (KTT) within EIP	Reasons: EIP has the smallest budget among all SCCERs Relevance: KTT is crucial for building up new cooperation with industry. One promising way is to create a dedicated KTT position. This person identifies the areas of interest of companies on-site and checks which research topics could be worked on within the EIP. This could also lower access threshold of small and medium-sized businesses for innovative new technologies.	Require elaboration of a KTT concept and establishment of a dedicated KTT position.
No basic research	Reasons: EIP has the smallest budget among all SCCERs. Relevance: Basic research is considered important to fill the pipeline with new ideas for long-term research and for mid-term innovations. However, the focus of SCCER research is supposed to be on applied research which makes a tangible contribution to the targets of E2050. There are other funds for basic research and the anyway limited research resources should rather not be allocated to basic research in EIP.	Check if there is a need for more basic research in EIP that can contribute to E2050 in funding phase 2.

Table 3: SCCER EIP – Shortcomings identified by experts and recommended action.

3.3 Future Swiss Electrical Infrastructure (FURIES)

SCCER FURIES – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Thematic shortcomings		
Unclear if distribution grids have been adequately addressed.	Focus of FURIES is on bulk grid. But WP1 addresses planning, monitoring and control of distribution grids in collaboration with 5 more SCCERs) which will be and important issue in the light of a more decentralized and more fluctuating energy generation in the future.	Check the focus on grid research for funding phase 2.

SCCER FURIES – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Research on hydropower and battery storage issues in FURIES is not optimal	The hydropower and the battery storage research topics are rather marginal for FURIES. It enlarges the range of research actors, which is already broad. These topics should be moved preferably to HaE and/or SoE with which FURIES has collaborations (SoE and HaE work on technology development and FURIES on grid integration of the technologies).	Check if reallocation of these topics to the collaborating SCCERs SoE and HaE is necessary and makes sense
Institutional shortcomings		
Lack of international industrial partners from the grid for inter-national bulk grid topics and lack of cooperation with IEA and international standards organizations.	Including international industrial partners from the grid area would be very beneficial since the subject of bulk grids cannot be considered on a national level alone. WP 2 needs a clearer focus on the European aspects of bulk transmission networks.	Involve international industrial partners in the bulk grid topics.
Unclear role of associated partners.	Not only is the role of associated partners unclear but their role should also be questioned since they do not really deliver results. Further, they sometimes do not tend to fit well thematically. Instead more cooperation with other SCCERs is encouraged.	Check the number of funded partners and the activation of these partners as well as the possibility of strengthening the cooperation with other SCCERs.
Shortcomings in the knowledge production chain		
Future research affected by P&D projects	There is a concern that the planned focus on pilot and demonstration projects could negatively impact desirable future research (this concern could be questioned: the SCCERs are intended to strive for tangible contributions to E2050 targets and not to enforce basic research; on the other hand there is still funding in existing P&D programs available which is not exploited).	Phase 2: Check future allocation of resources on research, testing and demonstration, encourage use of existing funds for P&D
Unclear benefits of the cooperation with partners and know-how transfer	As of today, the benefits of cooperation with partners remain vague (EP). This might be due to the short period that FURIES has been active. The EP and the program manager appraise the situation quite different.	Not clear. Observe the future development of cooperation.

Table 4: SCCER FURIES – Shortcomings identified by experts and recommended action.

3.4 Heat and Electricity Storage (HaE)

SCCER HaE – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Thematic shortcomings		
No research regarding water-based heat storage technologies in HaE	Water-based heat storage technologies promise early results. They have a considerable potential which is close to being market ready (high TRL), and this potential is easy to tap (it is more the system integration and management of these potentials than the technology which has to be developed). By contrast, the costs of the many storage technologies investigated in HaE are still a long way from being market-ready (low TRL).	Water-based heat storage technologies should be taken up by HaE, even before funding period 2.
Research on how HaE research and the technologies involved meet society's needs and gain its acceptance is not sufficient.	With the numerous plans for cross-work package prototypes and applications, a focus on how society's needs are met and how acceptance is gained seems to be necessary.	Check if this thematic recommendation of the EP is implemented.

SCCER HaE – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Institutional shortcomings		
Institutional coverage is ok, no clear shortcomings.	HaE sought to ensure that the key players were involved. None of the remaining researchers are considered to be a must for integration into HaE.	
Shortcomings in the knowledge production chain		
SME are hardly involved.	Involvement of large companies in the field is good, but SME are missing.	Check how to better involve SME.
Lack of industry participation	Industry participation is difficult and hesitant because of unclear political and economic framework conditions which hinder industry involvement.	Increase industry involvement in implementation and on higher TRL.
Long-term link to E2050: Many HaE research topics are far from implementation and the product/market level.	Many research topics in HaE are still a long way from implementation in E2050 and far from the product/market implementation level. This reflects the current TRL of the technologies which are developed. But they are expected to contribute substantially to E2050 in the long run (>2025)	Check focus and priorities in HaE for funding phase 2, especially is water based heat storage with high TRL should be taken up to also contribute in the short run to E2050.

Table 5: SCCER HaE – Shortcomings identified by experts and recommended action.

3.5 Supply of Electricity (SoE)

SCCER SoE – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Thematic shortcomings		
Hydro-geothermal energy is not covered	The E2050 focuses mainly on electricity whereas hydro-geothermal energy (HGTE) produces mainly heat. HGTE has lower priority given the goals of the E2050. HGTE is a complex technology and it is expected that only a few suitable sites with enough water will be found in Switzerland. HGTE is regarded a significant research topic and one which basically would be expected to be included in SoE. The researchers within SoE already have most of the required competences. But it is not clear if the limited research funds should be shared between petro-thermal and hydro-thermal geothermal energy research. We would rather recommend keeping the current focus on petro-thermal acknowledging that upcoming research results could serve very much also hydro-geothermal energy.	Since geothermal research is very expensive, it makes sense to focus on petro-thermal geothermal electricity and combined heat production. Hydrothermal geothermal energy might profit from possible synergies of petro-geothermal research.
Importance of mid-sized small hydropower plants in natural rivers is underemphasized.	Experts state that mid-sized small hydropower plants are relevant to the E2050 goals and SoE should therefore strengthen its efforts in this area and not focus only on small-sized small hydro. The head of SoE questions whether the relevance attributed to small hydropower plants in natural rivers in E2050 is adequate. A further explanation for the currently minor role played by mid-sized small hydropower plants in SoE could be that research is done by UAS, which have more challenging funding conditions. Furthermore the TRL of the technology is already very high. HES-SO Wallis is part of the SoE and is already carrying out non-SCCER research independent of SoE on hydropower micro-turbines.	Check if integration in the second phase is recommendable given the existing research priorities and financial resources as well as possibly already existing non-SCCER research funding in this research area. If integration of the topic is considered, it could be addressed by HES-SO Wallis, which is already part of SoE.

SCCER SoE – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Dam safety is poorly addressed.	PSI's Technology Assessment (TA) group is actively involved in "risk, safety and societal acceptance" and "the comparative assessment of accident risks". In order to assess dam safety, it is highly recommended that the SFOE research area "Talsperren" and the SoE researchers share information. This would mean an improved structured approach and a deeper understanding of the topic. The SFOE commissioned the development of a concept on dam safety about four years ago. This study would be a good starting point if the topic is to be studied in more depth. It was pointed out that if safety studies would also be for all other technologies in the SCCERs	Cooperate with the SFOE research area "Talsperren" and consider taking up dam safety in phase 2. CTI: Check whether safety issues should be addressed for all relevant technologies in the SCCERs.
No research on PV and wind energy in SoE	Economic nearly viable potential of PV and to a lesser extent of wind energy in Switzerland is high, higher than the potentials for additional hydro or geothermal electricity at the time being. SoE should address these technologies and coordinate with the CSEM Network, FURIES and HaE with respect to PV.	Ensure in phase 2 adequate technology portfolio in SoE taking into account risks regarding future economic potential of SoE technologies
Institutional shortcomings		
Lack of participation of Département des géosciences UNIFR	UNIFR did not participate despite his interest in SoE. Reason: no matching funds could be ensured within three months. He is now an associated partner of the SoE. Some of Prof. Mosar's students are working in the SoE.	Consider involving UNIFR in phase 2. Check with UNIFR whether matching funds can be ensured for the second phase.
No participation of HSR (FHO)	The HSR is conducting research in the field of drilling technologies but is not part of the SoE. It is not necessary to integrate the institute in the SoE, but cooperation could be a good idea.	Ensure exchange/cooperation with HSR.
Shortcomings in the knowledge production chain		
Lack of pilot- and demonstration facilities for all SoE topics	In order to develop and test innovative technologies, a need for major pilot- and demonstration facilities in all three fields (hydropower, deep geothermal energy and, by inference CO2 storage) was identified. One reason for insufficient funding of such facilities is the present difficult economic situation of Swiss utilities. But there are public P&D programs which are currently not fully exploited and which possibly could finance this research	Investigate ways of ensuring appropriate funding for pilot- and demonstration facilities, starting with better exploiting existing P&D programs. Cooperation with other European countries could be of help. Further, access to Horizon 2020 is crucial.

Table 6: SCCER SoE – Shortcomings identified by experts and recommended action.

3.6 Energy, Society and Transition (CREST)

SCCER CREST – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Thematic shortcomings		
Mobility research topics, especially socio-economic mobility research are not addressed.	Although some research deals with mobility oriented topics, this is only to a limited extent. Designated mobility and energy research is lacking. Claims that mobility research in Switzerland is limited and mobility researchers in Switzerland are in short supply have to be questioned. If this is found to be the case then it will be rather on the academic level. Quite some research is carried out by mobility researchers in private companies.	Integrate socio-economic mobility topics to a greater extent (possibly even in advance of funding phase 2). Check whether it is necessary to establish addi-

SCCER CREST – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
		tional mobility professorships in phase 2.
Existing field studies and lighthouse pilot projects need to be extended.	Some field studies with practice partners have started, but it is too early for large-scale field studies since practice partners (mostly utilities) are not yet ready for it. Field studies are costly and exceed the budgets of practice partners. The planned new household survey is considered relevant.	Ensure conduct of selected field studies in phase 2 (increase funding for this if necessary).
Policy design, acceptance and policy implementation research need to be extended.	So far there has been a lot of research into individual behavior but little research into policy design, policy acceptance, policy implementation and evaluation at the macro level (for policy makers). Such activities are said to have been started in the meantime (e.g. Grimsel seminar). CREST plans "white papers" in order to provide research findings and recommendations to practice partners and policy makers. One expert expects that research on policy and policy instruments will be launched in 2016. This will be funded mainly by universities.	Claim the "white papers" in phase 2 and check provision of research results to practice and policy partners.
Sufficiency topic is not adequately addressed.	CREST's sufficiency research is very much at the household level. The impact of more sufficiency on the markets and at the macro level growth, distribution, sectoral effects, etc.) is not addressed.	Check explicit extension of sufficiency research on the macro/market level in phase 2.
Institutional shortcomings		
Limited know-how in psychology, sociology and political science in CREST research	Psychological research has in the meantime been supplemented (by UNIGE). According to CREST, it is not realistic to have more researchers in psychology.	Check supplementation of research in phase 2.
Non-participation of established private research institutions active in socio-economic energy research	There is no funding for private socio-economic energy research by CREST. Partners willing to collaborate experience difficulties raising the necessary funds. So far public bids by academic and private partners have not been successful. The differing funding models including the twofold funding by CREST for academic partners, and by other research funds for private partners, were a relevant barrier. Furthermore, there was relatively little government funded socio-economic research which could have funded private partners (probably at least partly as a consequence of the allocation of public funds to the SCCERs and CREST).	Reconsider the funding model which excludes private researchers from SCCER collaboration.
Shortcomings in the knowledge production chain		
Few contributions by policy design and implementation research to E2050 goals	It might be too early to assess the respective contributions of CREST. Early exchange of information/knowledge is important (→ Grimsel seminar). For recommendations it is necessary that research is at an advanced stage.	Ensure elaboration of results and recommendations which are relevant and can be used by actors and policy makers.

Table 7: SCCER CREST – Shortcomings identified by experts and recommended action.

3.7 Efficient Technologies and Systems for Mobility (MOBILITY)

SCCER MOBILITY – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Thematic shortcomings		
Socio-economic issues are not	Research into economic and systemic issues in the areas of mobility, policies and policy instruments should be intensified. So far so-	Ensure and enhance energy-related socio-economic

SCCER MOBILITY – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
adequately addressed.	cio-economic research into MOBILITY has been limited to areas of mobility demand and behavior. MOBILITY claims that more is not possible with the resources currently available. A clear division of work with CREST and joint projects are needed.	mobility research by additional funding or reallocation of funds in phase 2. Clarify division of research activities between MOBILITY and CREST and ensure carrying out of joint projects.
Mobility pricing is not addressed.	Currently MOBILITY does no adequate research on this topic.	MOBILITY should address this research topic.
Mobility behavior is not satisfactorily addressed.	Research on energy-related individual mobility behavior is selective, which is sufficient neither in MOBILITY nor in CREST.	Enhance research and coordinate it with similar research activities by CREST.
Freight transport is not satisfactorily addressed.	MOBILITY sees the need for intensifying research in this topic, which will become increasingly relevant in the future. It has already 3 active cooperation partners but lacks funding	Ensure funding of freight traffic research and enhance freight traffic research in funding phase 2.
Rebound effects are not addressed.	This topic is more or less neglected (e.g. in scenarios with self-driving autonomous cars).	Engage in rebound research in phase 2.
Institutional shortcomings		
Newly established research capacities are not involved yet.	ETHZ employed 1 professor and 2 assistant professors in computer vision and control and in the risk center are newly. They have the potential to become a competence cluster. Although the EP requested not to fund related technology development, MOBILITY seeks to find an appropriate way to include the knowledge of these persons	Consider integration of these professors at the beginning of the second funding period or before.
Researchers who are competent in the area of socio-economics, particularly at the system level, are not involved to a sufficient extent.	Integrate partners engaged in socio-economic mobility and energy research at the system level. Behavioral issues are investigated mainly by CREST, but these are not mobility related. MOBILITY is supposed to get more involved in behavioral research in the mobility sector to give the topic adequate attention. MOBILITY points out that socio-economic mobility research is to be extended but for that MOBILITY does not have the resources now to achieve critical mass and needs badly joint projects with CREST	Check additional funding and/or ensure joint projects with CREST to achieve critical mass of socio-economic research in SCCER MOBILITY.
IRE Institute of Economic Research, USI is not involved.	IRE is very involved in the Alptransit issue and regional/local mobility research topics. IRE (Prof. Maggi) could possibly supplement work in CA B1 in phase 2, and strengthen MOBILITY's economic research capacities, which would be desirable.	Investigate involvement of IRE into CA B1 in phase 2.
Shortcomings in the knowledge production chain		
Industry cooperation has yet to be substantiated.	The EP evaluation report of 2015 indicates that co-operation with industry is progressing. Thereby, system integration of projects, services and products from industry partners has to be ensured while at the same time further developing MOBILITY activities	Ensure continuing efforts to involve industry partners (collaboration and cooperation).

Table 8: SCCER MOBILITY – Shortcomings identified by experts and recommended action.

3.8 Biomass for Swiss Energy Future (BIOSWEET)

SCCER BIOSWEET – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Thematic shortcomings		
Exclusion of wood combustion	(Direct) wood combustion was included in the first application, but was then dismissed in the second application and is therefore not part of BIOSWEET. Reasons that wood combustion is not part of BIOSWEET: – BIOSWEET provided an extensive study on this topic and discussed the exclusion several times with the EP and CTI. The EP supported the exclusion. – Limited funding resources for SCCER research. – In the call for bids, direct wood combustion is not explicitly mentioned. – Direct wood combustion has a high TRL and will play a decreasing role in E2050 until 2050 (reduction by 50% from today in absolute values in scenario "Neue Energiepolitik NEP"). Reasons for inclusion of wood combustion in BIOSWEET: – System integration and air pollution control are still relevant research topics for the promotion of wood energy which has a strong market potential. Existing industry in Switzerland can put the results into practice. – Wood combustion has its place in the biomass strategy of the SFOE and receives funding from the departmental research program of the SFOE. Wood combustion plays an important role in current energy policy and is supported by specific federal and cantonal policy instruments (cantonal building program, climate compensation projects (KliK), etc.) Conclusion: The appraisal of the relevance of wood combustion for E2050 differs at the time being. Considered limited funds for the SCCER and the fact that there is also established non-SCCER funding for energy research, it might be appropriate that wood combustion research has to live because of priority reasons with non-SCCER research funding only.	Based on the funding resources in the second funding phase, verify appropriateness of the exclusion of wood combustion again. If wood combustion will still not be integrated in BIOSWEET, investigate possible cooperation of BIOSWEET with external partners.
Extraction and pretreatment of biomass not addressed	The extraction of biomass is not addressed, and the pretreatment of biomass and recycling of nutrients are only incidentally dealt with by BIOSWEET. All three topics are regarded as complementary research topics. Remark: the topic "availability and use of biomass" in the bid was perceived as rather unclear. Reasons: 1. the evaluation committee requested that the scope of BIOSWEET is reduced, and 2. limited funding resources. Relevance: in order to obtain electricity from biomass, all elements of the production chain – including the extraction and pretreatment – are relevant.	Investigate possible cooperation of BIOSWEET with external partners, especially in the form of concrete projects. Clarify the desired content of the topic "availability and use of biomass".
Institutional shortcomings		
Dismissal of Prof. Nussbaumer (HSLU)	Prof. Nussbaumer was part of BIOSWEET in the first application, but then was excluded in the final application. His research focuses on heat and power from wood, mainly by direct combustion what is not considered a priority research topic.	If wood combustion would be taken up in funding phase 2: Check involvement of Prof. Nussbaumer in BIOSWEET.
Non-involvement of Prof. Patel,	Prof. Patel could bring in aspects of technology assessment and LCA. In order to ensure Prof. Patel's participation, more funding would be	Verify appropriateness of non-inclusion of Prof.

SCCER BIOSWEET – Shortcomings identified by experts and recommended action		
Shortcomings	Reasons for and relevance of the shortcomings	Recommended action
Chair for Energy Efficiency, UNIGE	needed. The integration of the Chair for Energy Efficiency is planned in FEEB&D for the second phase.	Patel in funding phase 2, taking into account available funding resources.
Non-involvement of HEIG-VD	HEIG-VD (Prof. Röthlisberger) could bring in his expertise in small scale wood combustion (wood-pellet stoves) if wood combustion is going to be integrated in BIOSWEET. His institute colleague Prof. Michel is part of BIOSWEET.	If wood combustion would be taken up in funding phase 2: Check involvement of HEIG-VD
Dismissal of BFH	BFH was part of BIOSWEET in the first application, but was then excluded in the final application. The research areas are, among others, harvesting technologies and surveys on the potential of agricultural residues.	Consider possible cooperation with BFH, especially in form of joint projects.
Shortcomings in the knowledge production chain		
Pilots and prototypes for thermochemical processes are not being considered.	Large pilots and prototypes (1 – 10 MW) can make a considerable contribution to bioenergy. If the funding of large scale facilities cannot be provided, small facilities can help to further develop the technology. If they are successful, they can be scaled up in 10 – 20 years. Funding problems for pilots might suggest deficits with integrating industry/utility and community partner. Furthermore, there are P&D supporting programs not fully exploited yet.	Check financing options for pilots and prototypes in funding phase 2, taking into account P&D funding programs not exploited yet.
The lack of cooperation with large utilities and communities	The cooperation with large utilities and possibly with communities: 1. they are the ones who will finally apply the technologies and 2. they are important for financing big scale pilots and prototypes. However, energy from biomass is often not in their focus yet. Cooperation is possible with SME, but the impact is limited.	Ensure intensified efforts to foster considerable cooperation with utilities and communities.

Table 9: SCCER BIOSWEET – Shortcomings identified by experts and recommended action.

4 Conclusions main shortcomings and recommendations

4.1 Context for interpreting the shortcomings identified

Early assessment of integration and knowledge production chain shortcomings

Present accompanying research has been carried out at a moment in time where the SCCER-development was still in an early stage. We could draw only partly from the evaluation reports of the second round of SCCER evaluations carried out by the evaluation panel this fall. In any case especially the assessment of possible shortcomings regarding the coverage of the knowledge production chain is rather too early.

Bidding process: Requirement to focus with respect to the research topics and the research institutions integrated

For the first SCCER application more or less all of the SCCERs covered a broad thematic range and tried to integrate as much of the Swiss research community as possible within the research area in which they planned to be active. The evaluations of the first SCCER-applications by the evaluation panel (EP) caused the SCCER-networks applying in the first round to focus thematically and to reduce the staff of researchers integrated in the particular SCCER to be more in line with the available funds for building up the SCCERs and doing research. The aim of the EP was to ensure innovative and efficient research with high added value for the E2050 which needs supposedly a critical volume of research reslources per topic and researcher to pursue these targets.

Identification of shortcomings is relative

In the light of this assessment process the reply to the research questions of Module 1 and the valuation of the findings, identifying possible shortcomings in the thematic coverage of the research fields defined by the call as well as in the integration of Swiss research institutions and researchers in the SCCERs, are sometimes ambiguous. As mentioned above, all of the networks applying in the first bidding round had to reduce their staff as well as the research topics and activities to bring into line available funds with research activities and staff. Many shortcomings identified are relative, depending on the resources available as well as on the targets the research is pursuing (here given by the targets of E2050). Hence, the evaluation of the integration of research institutions, thematic coverage and coverage of the knowledge production chain has to focus on «relevant shortcomings», i.e. shortcomings which should be overcome within the framework conditions and the restrictions of the SCCER program. Relevant shortcomings would call for action, meaning for taking up a research topic and/or institution, extending a research topic or integrating implementing partners by the setting of amended priorities with corresponding reallocation of resources or extension of resources (in funding phase 2), respectively.

4.2 SCCER-overarching conclusions and recommendations

In general adequate priority setting by the SCCERs

Available funding made priority setting regarding the research topics and the research staff indispensable. In general, the priorities set in the SCCERs are deemed to be adequate if the thematic goals of the call and available funding are considered and we didn't identify basic thematic and institutional or knowledge production chain related shortcomings except the integration of PV and solar energy in general, socio-economic research and knowledge and technology transfer (KTT).

It will be the task of the tender process for phase 2 to provide either more funding to extend coverage of research topics and corresponding research institutions or to require the reallocation of funds.

Ambiguous requirements and expectations

Regarding the coverage of the knowledge production chain by the particular SCCER activities, it has to be acknowledged, that the SCCERs are not yet active for a long time (many of the documents available for our assessment stem from late 2014 to early 2015, the newest evaluations could only partly be exploited for the evaluation presented here). Hence, the assessment of the activities along the knowledge production chain after two years of research activity is rather too early to deliver appropriate and reliable conclusions regarding the coverage of the knowledge production chain. Here too, we find ambiguous expectations to be met by the SCCERs:

1. On the one hand, the SCCERs should deliver fast and tangible results and contributions to E2050. They are encouraged to go rather more towards applied research than basic research, strengthen actor and industry involvement and active participation/collaboration, to enhance implementation, especially policy implementation. They are also required to not just continue and increase already existing research. But the latter could often most likely contribute fast to E2050. On the other hand the SCCERs are requested to invest into innovative technologies and solutions. But such solutions, typically on a lower TRL, not directly starting from existing research, need time to be ready for application and the market and for contributing to E2050. Hence, the time range of SCCER funding is short, at least if only the first funding period is considered. Many researchers and institutions considering active commitment in a SCCER based their decision processes on this time range. The fact that they did not have planning security for further periods of time increased in some cases the tendency to continue with existing research and was in some other cases the reason for not participating in the SCCER bid.

2. On the other hand there is the requirement (by the call as well as by the EP) to focus, to ensure a critical volume for the sake of efficiency and sustainability of the research done and the capacities built up. Consequently, part of the thematic and institutional shortcomings identified comprises research topics and research institutions abandoned due to focussing during the application process. This fact required identifying so called «relevant shortcomings», considered the funds available. The relevance of

the shortcomings identified was assessed by the expert interviews, i.e. by the SCCER heads as well as by the programme managers of the SFOE, members of the evaluation panel, not participating researchers and documents analysed.

According to the Coordinated Energy Research Action Plan (Federal Council, 2012) «the overall expectation is innovation in the respective domain, over many years to come. Mostly everything else is means to the end and is left to the SCCER. Special actions/participations/cooperations are not objectives and will not be specified or required in particular. … The work of the SCCER includes activities with short term impact, mostly based on work of ongoing forces and activities with longer term impact, based on new approaches, which are partly initiated by new forces» (CTI, 2016).

Recommendation: Since it is up to the SCCERs to decide within their research road maps on the research strategy and the corresponding topics and resources allocated to the different topics, the Evaluation Panel should verify within the verification of the research road maps and the annual SCCER evaluations if the research topics and the share of topics with low and with high TRL is adequate and promises to optimally contribute to the goals of E2050.

UAS and universities unprepared for the SCCER call

Many of the UAS and universities doing research in the research fields of the SCCER-call were somewhat unprepared for the call for bidding. The preparation of the call emerged from ETHZ/PSI and was based to a significant extent on the institutional conditions of the ETH-domain and the kind of research the ETH-domain is doing. Since the ETH-domain has already undergone internal coordination within competence centers they were better prepared to building up networks in SCCERs. Furthermore, they have better opportunities to organize research funds fast.

The UAS and universities were challenged by the very short bidding period of 7 weeks. Due to the more complicated funding conditions in the corresponding Cantons, several institutes of UAS and also of some universities gave up (see also next paragraph). Several of them not due to thematic reasons but either due to lack of time or due to the impossibility to provide own funding or in kind contributions within the deadline of the call. This led the heads of the SCCERs (all but one from the ETH-domain) focus on partners from key UAS who were able to react within the restrictions of the call.

Recommendation: After having clarified the targets and priorities of the research of the SCCERs it should be reconsidered if the composition of the SCCERs corresponds with the modified targets. More weight on research on a high TRL, tending to yield high contributions to E2050 in the short and medium term, could require higher participation of those UAS which are closer to the market.

Neglect of existing know-how and direct or partial exclusion of research know-how and competitors by the funding rules

The funding modalities like the short funding period for this kind of research as well as required own funding resources and in kind contributions are less attractive for UAS and

universities and hit them partly unprepared. Some universities withdrew because of the funding scheme, which they considered not favourable for universities coupled with a relatively short funding period which makes reallocation of own funding resources unattractive and risky (lack of funding security after 4 years). For the UAS, lacking time resources during the bidding process, especially considering the necessity to organize own funding during the short bidding period drove several UAS out of the process.

Non-academic private energy research institutions do not get funding and are actually excluded from direct participation. Therefore, the corresponding know-how, especially with respect to socio-economic, policy and implementation research in the area of energy and building's research, is not integrated and will probably be less developed by these actors in the future.

Recommendation: Funding conditions for UAS and universities but also for private non-academic research institutions complicate participation of UAS and universities or might even de facto exclude private research institutions. If high contributions to E2050 in the short and medium run are strived for, the funding conditions for UAS, universities and private research institutions shall be reconsidered and modified to enhance their participation and to get closer to a level playing field for SCCER research.

4.3 Main shortcomings and recommendations

The evaluation disclosed the following main shortcomings which should be considered for the tendering and commissioning of the phase 2 of SCCER funding.

Organisation of applied PV and solar energy research is not clear

PV has been intentionally excluded from the SCCER-bid (there is a particular CSEM-PV-network, which is funded separately). Even if there are some PV-research activities in FEEB&D (building integrated PV) and FURIES (forecasting, planning, control, grid interaction of PV), PV seems to be not fully integrated into the SCCER-networks and the degree of collaboration with the CSEM network is not clear. For the SCCERs mentioned it is just inconsistent not to integrate these subjects in their roadmap and activities as well.

As a consequence of current priority setting, the other solar research areas (solar thermal, reloading of ground storage capacities, hybrid solar concepts, heat storage, smart control and exploitation) are somewhat disconnected from the SCCERs. A system approach, taking into account all solar technologies, storage (reloading) technologies and smart control for optimal exploiting the potentials, is lacking.

Recommendation: Reconsider the relationship between the SCCER networks and the PV network for funding phase 2. Solar energy in general (including solar thermal) should get more attention and a system approach to exploit solar energy combined with storage and smart control technologies should be pushed.

Use of electricity and its efficiency potential is not addressed

Efficiency in electricity applications is regarded a significant research topic, and one which should be dealt with in EIP.

Recommendation: implement the topic in the second phase, taking into account available funding and the need to prioritize. Check cooperation with CREST in order to overcome the main barriers to implementing known technologies.

Lack of research on mid-sized small hydropower in SCCER SoE

Mid-sized small hydropower plants have a relatively high relevance in the implementation of E2050 (1-2 TWh/a) and it has to be cleared if SoE shall strengthen its efforts in this area albeit the topic has not first priority (nice to have or need to have?).

Recommendation: Check if integration of the research topic in the second phase is recommendable given the existing research priorities and financial resources as well as possibly already existing non-SCCER research funding in this research area. If integration of the topic is considered, it could be addressed e.g. by HES-SO Wallis, which is already part of SoE.

No hydro-geothermal energy (HGTE) research in SCCER SoE

HGTE is regarded a significant research topic and one which basically would be expected to be included in SoE. The players within SoE already have most of the required competences. All that would remain is to redefine the focus and allocate resources. But it is not clear if the limited research funds should be shared between petro-thermal and hydrothermal geothermal energy research. We would rather recommend keeping the current focus on petro-thermal acknowledging that upcoming research results serve very much also hydro-geothermal energy.

Recommendation: Since geothermal research is very expensive, it makes sense to focus on petro-thermal geothermal electricity and combined heat production. Hydrothermal geothermal energy might profit from possible synergies of this research.

No wood combustion research in SCCER BIOSWEET

Viewed within the context of the targets of the E2050 together with the call for bids on the one hand, and the biomass strategy of the SFOE together with current energy policy instruments on the other, the appraisal of the relevance of wood combustion differs widely. If the SCCERs strives for highest possible mid- to long-term contributions to E2050, allocation of currently available SCCER research funds should remain as it is, especially if research on wood combustion is already financed by non-SCCER research funds.

Recommendation: Verify the exclusion of wood combustion with regards to strategies other than the E2050, namely the biomass strategy of the SFOE and the current energy policy instruments. Considered the limited research funds and the need to focus thematically it seems justifiable to waive wood combustion research within the SCCERs as long as there are other (non-SCCER) wood combustion research funds.

Inadequate socio-economic research in the SCCERs

In the current setting of the SCCERs there is an explicit focus on socio-economic research in CREST («energy, society and transition). From the other SCCERs only few do sufficient socio-economic research in the thematic field of the particular SCCER. CREST is basically doing research along its research themes and priorities according to its roadmap and assumes thereby a somewhat overarching perspective for the socio-economic issues selected. Since CREST has its own agenda and direct collaboration between the SCCERs and CREST for SCCER-specific research topics has to be developed first, the other SCCERs should carry out for themselves an adequate analysis of specific socio-economic research questions which arise in each respective SCCER. The relevance of socio-economic topics will tend to increase the longer the SCCERs are in operation and the higher the technology readiness level (TRL) of their research.

Recommendation: Foster socio-economic research within the technical SCCERs and foster joint projects of CREST with technical SCCERs in funding phase 2. This at least in/with those SCCERs which have not yet developed enough adequate socio-economic research, namely EIP, HaE, MOBILITY and BIOSWEET.

Sufficiency topic not adequately addressed

The sufficiency issue is not addressed in current SCCER research road maps except in SCCER CREST. At least in SCCER MOBILITY and in SCCER FEEB&D the sufficiency issue might play a role which is expected to become even more relevant in the future. SCCER CREST indicates to consider extending research on sufficiency subjects in funding phase 2, although CREST questions the priority of the topic at the same time.

Recommendation: Even if the “readiness level” of the topic is still very low, it is recommended to make sure that the sufficiency subject is taken up into the research agendas and road maps from at least MOBILITY and FEEB&D and that CREST is extending sufficiency research as indicated in funding phase 2.

Insufficient support of pilot and demonstration projects

Several SCCERs claim that they do not get enough funding for pilots and demonstrators, which are typically expensive (more expensive than research). Some argue that industry is not willing to participate with relevant resources because the framework conditions (economic but also legal framework conditions) are not appropriate. Basically this problem rather indicates that implementation and industry cooperation is not yet developed enough and it is questionable, if it is adequate to reallocate substantial funds away from SCCER research, application and implementation towards single pilots. If framework conditions are not clear yet, it has to be decided if these will become clearer soon and if it is worthwhile to dedicate additional funds to specific pilots.

Recommendation: Check if pilots and demonstrators truly need and deserve additional funding. Bundling resources with other European countries could be of help. Further, access to Horizon 2020 is crucial.

Insufficient integration of UAS and universities

Several research institutions and related researchers from UAS have been excluded during the SCCER tendering process. This was partly a result of unavoidable priority setting which makes sense. Based on our accompanying research we suggest reconsidering the integration of research from some selected UAS, which could deliver added value to specific SCCERs.

Recommendation: Reconsider feasibility and expedience of integration of researchers from ZHAW (e.g. for the facility management topic), HES-SO, SUPSI and FHNW, especially in the light of TRL tending to increase in the future.

Lacking integration of private research organisations

To make use of existing know-how from established private research organisations, especially in the fields of socio-economic research as well as implementation, policy design and assessment research, the funding rules for private researchers would have to be changed to have a level playing field. With rising TRL of technological research, the integration of private socio-economic research can be of increasing relevance to E2050.

Recommendation: Enable and foster participation of private research institutions by either amending the funding modalities in funding phase 2 or by correspondingly enhancing existing research funds where these private research institutions are eligible and get a chance to participate and collaborate with SCCER researchers in SCCER research projects, funded by these existing research funds.

Insufficient involvement of industry, SME and practice partners and of policy makers

For funding phase 2 existing cooperation and collaboration with industry and practice partners should be established or extended. With rising TRL this is getting more important albeit easier.

Recommendation: Ensure adequate relevance of this requirement in the call for funding phase 2 and the subsequent evaluation of the applications.

***Knowledge and technology transfer (KTT)* is still insufficient and not yet established in all of the technology oriented SCCERs**

As the share of research activities in the SCCERs on higher TRL will increase the longer the SCCERs are active, KTT, the development of market solutions/implementation will gain in importance. Part of the SCCERs does not yet have effective KTT concepts and staff.

Recommendation: Ensure further development of KTT activities and dedicated staff in funding phase 2.

Check reallocation of selected research topics within the 8 SCCERs

The allocation of the topics hydropower and battery storages to FURIES is questioned. They are playing there quite a marginal role.

Recommendation: Check for funding phase 2, if FURIES is supposed to deal with these two topics or if these two topics shall be reallocated to SoE and HaE.

Appendices

A-1 References

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SCCER CREST, 2013: Swiss Competence Center for Energy Research – Competence Center for Research in Energy, Society and Transition – SCCER Funding Application. SCCER CREST, July 9 2013.

SCCER MOBILITY, 2015: Swiss Competence Center for Energy Research – Efficient Technologies and Systems for Mobility – SCCER Funding Application. SCCER MOBILITY, July 9 2013.

SCCER BIOSWEET, 2015: Swiss Competence Center for Energy Research – BIOmass for SWiss EnErgy fuTure – SCCER Funding Application. SCCER BIOSWEET, July 9 2013.

SCCER, 2015: Reply to the Consolidated Evaluation Report 2014 by the SCCER-Heads (collected letters). SCCER, January 2015.

SFOE, 2012/2013/2014/2015: Statistics on energy research of the years 2010, 2011, 2012 and 2013. Swiss Federal Office of Energy SFOE.

A-2 Overview on the eight SCCERs

In the following section, an overview on each of the eight SCCERs is given. This comprises following elements:

- brief summary of the origination process of the SCCERs;
- excerpt of the call for bids: description of the main themes and issues in the relevant action area;
- excerpt of the proposal and road map: executive summary and roadmaps
- participating institutions from the financial monitoring

A-2.1 Future Energy Efficient Buildings & Districts (FEEB&D)

Action area «efficiency», along with the other action areas, was first put out to tender in May 2013 (CTI, 2013a). The steering committee then decided to launch a renewed call for bids for the action area on efficiency in mid-November 2013, whereupon SCCER FEEB&D and EIP made a specific bid (CTI, 2013b):

Call for bids in action area 1 on 'Efficiency' (original tender document for the action area «efficiency»)
Efficiency is important both in energy supply and rational energy use. This affects the whole building sector (building shell and utilities, renewable energy, integration etc.). The need for electrical energy and heat is particularly large in construction, industrial processes and large data centers. A considerable amount of energy is embodied in materials. Creative approaches for new materials, components and systems are just as necessary as new solutions for small- and large-scale energy management, such as the integration of buildings and districts or decentralized power, heating and cooling systems. Attention should be paid to developing materials for controlled heat transfer in order to increase the efficiency of heat usage. Efficiency in mobility and transport is covered by the SCCER MOBILITY. The main research areas mentioned in the dispatch and the decisions of the SCCER Steering Committee are: – Highly efficient materials for thermal insulation particularly in old buildings, manageable heat conduction – Energy use and climate dependent energy management in residential, services and industrial buildings, sufficiency potentials and energy recovery – Waste heat utilization – Integration of buildings and districts, heat supply, decentralized power generation, heating and cooling systems for districts and settlements as well as office and commercial zones.

Table 10: Call for bids in action area 1 «efficiency» (CTI, 2013b)

SCCER FEEB&D developed the following roadmap based on their proposal:

Roadmap of SCCER FEEB&D
Executive Summary
Close to 50% of the end energy demand in Switzerland is caused by buildings and should be reduced considerably according to the Energy Strategy 2050. The Swiss Competence Center for Energy Research "Future Energy Efficient Buildings and Districts" (SCCER FEEB&D) is addressing this challenge in a combined effort by leading partners from academia and industry. FEEB&D develops new materials, components, systems and concepts which will enable the reduction of the final energy demand of the Swiss building stock by a factor of five during the next decades. FEEB&D is focusing on high performance insulation materials, advanced glazing and use of day lighting, integration of renewable energies in buildings, efficient operation of buildings and their integration into local multi-energy grids. To complete the holistic approach, socio-economic issues related to the implementation of these new concepts in practice are addressed as well. FEED&B has the four work packages (see below):

Roadmap of SCCER FEEB&D
Work packages
WP1 Building envelope – Building envelope retrofit – Dynamic glazing
WP2 Building energy management – Active building energy management – Self-sufficient lighting systems – Building systems integration
WP3 Urban decentralized energy systems – Data mining – Modeling and simulation – Guidelines for energy infrastructure realization
WP4 Market diffusion and implementation of technologies – Development and diffusion of efficient building technologies – Techno-economic assessment and socio-economic implementation of multi-energy-hubs – Implementation of energy efficiency in buildings at large scale

Table 11: Roadmap of SCCER FEEB&D (SCCER FEEB&D 2015)

According to the financial monitoring the following institutions participate in FEEB&D:

Participating institutions in SCCER FEEB&D		
Research entity	Institute	No. of researchers
EMPA	BSTL	17
ETHZ	BP	5
ETHZ	ifA	8
ETHZ	SuAT	1
ETHZ	SUSTEC	5
EPFL	LESO	10
HSLU	LUCERNE	1
HSLU	ZIG	7
HSLU	EASE	1
HSLU	PIM	1
HSLU	CESAR	3
UNIGE		11
FHNW	IEBau	6

Table 12: Participating institutions in SCCER FEEB&D (CTI, 2014b)

A-2.2 Efficiency of Industrial Processes (EIP)

In the second round of the tender process action area 1 «Efficiency», was split in the SCCER FEEB&D and the SCCER «Efficiency of Industrial Processes» (EIP). The EIP receives about 2.7 Mio. CHF. The tender document for the part of EIP in the former action area «Efficiency»:

Call for bids for EIP in the action area «Efficiency»
The call for bids in the action area «Efficiency of Industrial Processes», emerging from the original «Efficiency» call, mentions the following main research areas outlined in the dispatch and the decision of the SCCER Steering Committee: – Usage and climate dependent energy management in (residential, services and) industrial buildings, sufficiency potentials and energy recovery – Industrial efficiency, energy saving processes and procedures, process heat from renewable energies, waste heat utilization

Table 13: Call for bids for EIP in the action area 1 «Efficiency» (CTI, 2013b)

SCCER EIP developed the following roadmap based on the EIP proposal:

Roadmap of SCCER EIP
Executive Summary
The vision of SCCER «Efficiency of Industrial Processes» is to enhance the energy efficiency of the Swiss industry. Research and development capacities have to be increased to develop advanced concepts and innovations, enabling the industry sector to reach their energy efficiency targets according to the "Energy Strategy 2050" for Switzerland and to improve their competitiveness. The SCCER-EIP will offer the required increase of research capacities and will furthermore provide the framework to establish a national interdisciplinary competence center based on selected partners from the ETH domain (ETHZ, EPFL), universities (UNIGE), universities of applied science (FHO, HSLU) as well as several industry partners. New concepts and processes, innovations and demonstration facilities are developed, tested and evaluated. R&D addresses systems at different scales, from individual process units to integrated processes up to integrated sites connected with their surroundings, with a focus on technological innovation but also addressing organizational and managerial aspects.
Work packages
WP1: Monitoring and Implementation – Observatory of industrial energy utilization and management – Mapping of opportunities and assessment of potential energy savings – Facilitating technology transfer and implementation *WP2: Energy Efficiency (direct)* – Multi temperature heating/cooling equipment at systems and component level – Energy efficient process heat and steam generation using renewables combined with vapor recompression and co-generation – Tri-generation using and combining ORC and heat pumps – Waste water usage and treatment combined with thermal storage *WP3: Process Efficiency (indirect)* – Advanced approaches to continuous manufacturing of particles – New processes and materials for low energy separations – Holistic processes of energy expenditure minimization with waste heat reuse: Advanced concepts of highly efficiency heat exchange and its process integration *WP4: Plant-wide Integration* – Process efficiency for process integration – Process integration and heat recovery in batch processes – Industrial symbiosis and large scale process integration

Table 14: Roadmap of SCCER EIP (SCCER EIP 2015)

According to the financial monitoring the following institutions participate in the EIP:

Participating institutions in SCCER EIP			
Research entity	Institute	Professor in charge	No. of researchers
ETHZ	LTR Lab for transport processes and reactions at the institute for process engineering	Prof. von Rohr	5
ETHZ	SPL Separation process lab at the institute for process engineering		4

ETHZ	LTNT Laboratory of Thermodynamics in Emerging Technologies		4
EPFL	LAMD Lab for applied mechanical design	Prof. Schiffmann	1
EPFL	IPESE Industrial process and energy systems engineering	Prof. Maréchal	6
HSLU	LUCERNE	Prof. Wellig	2
HSLU	CC TEVT		3
NTB (FHO)	Prof. Bertsch (Interstaatliche Hochschule für Technik Buchs)	Prof. Bertsch	6
HSR (FHO)	SPF, Prof. Rommel, Institute for solar technology	Prof. Rommel	2

Table 15: Participating institutions in SCCER EIP (CTI, 2014b)

A-2.3 Future Swiss Electrical Infrastructure (FURIES)

Action area «grids and their components, energy systems», along with the other action areas, was first put out to tender in May 2013 (CTI, 2013a). The tender document for the action area «grids and their components, energy systems» goes as follows:

Call for bids in action area «grids and their components, energy systems»
The rapidly growing field of renewables and – increasingly – of fluctuating energy sources, coupled with technological developments and international interaction on a growing scale, place complex demands on energy grids and systems. In order to respond to this dynamic environment, we need to engage in both short- and long-term, ongoing research activities. This area of action focuses on power grids. Central issues include the stability of the electricity grid, security of supply in Switzerland – also considering available storage technology – and the integration of intermittent renewable power and smart grids. The technological aspects of energy storage are covered by the SCCER Heat and Electricity Storage HaE. The main research areas mentioned in the dispatch to the coordinated energy action plan are: – Grid stability; – Load flow management; – Integration of intermittent renewable power; – Intelligent grids and high performance electronics; – System aspects of power storage.

Table 16: Call for bids in action area «grids and their components, energy systems» (CTI, 2013a)

SCCER «Future Swiss Electrical Infrastructure» (FURIES) developed the following roadmap based for their proposal:

Proposal of SCCER FURIES
Executive Summary
The SCCER Future Swiss Electrical Infrastructure (FURIES) joins the competences of the top Swiss academic and industrial actors in the area of power / energy systems. FURIES is expected to shape the next generation of the electrical Swiss infrastructure in all its layers, from transmission to distribution, enabling a vast penetration of renewable energy resources in order to facilitate the Swiss nuclear-power phase-out. The project has different action scales ranging from the system to its components. In particular, FURIES will research up-to-date planning, monitoring and control strategies of the Swiss electrical/energy grids together with the study of new technologies and components. The proof-of-concept of the research will be deployed towards dedicated simulation tools and experimental demonstrators designed in collaboration with the industry partners

Proposal of SCCER FURIES
Work packages
WP1 Regional multi-energy grids – smart metering infrastructure; – forecast of renewable energies production for both photovoltaic and wind generation; – regional multi-energy grid systems to consider the possible interactions with the heating and cooling systems considering combined heat and power production, the integration of solar heat and biomass as well as the heat pumping options. – ancillary services (i.e., frequency/voltage support, loss compensation, black-start and islanding operation, system coordination and operational measurements) potentially provided by different distributed storage technologies will be studied. Particular attention will be devoted to small hydropower pumping units; – demand side response/management; – definition and performance benchmarking of different control approaches (i.e. centralised vs decentralised) and their scalability from micro-grids to the entire power system. – Micro-grid components and their optimal control; – distributed energy storage: modelling, optimal planning and control. *WP2 Bulk multi-energy grids* – location of renewable generation and the limited predictability of these sources; – location of storage devices, both large scale, i.e. pumped hydro storage, and distributed devices; – interconnections with regional grids; – interconnections on the bulk power level, i.e. high voltage lines and gas pipelines; – possibility to interface it with models for market and other economic simulations *WP3 Multi-terminal AC-DC grids and power electronics* – multi-terminal HVDC system design and operation; – fault detection and clearing in multi-terminal HVDC; – enabling technologies. *WP4 Grid components* – switching very fast transients (VFTs) modelling and experimental investigations; – improvement of performances of existing devices for high voltage and high power system; – improvement of the design of reversible pump-turbines.

Table 17: Roadmap of SCCER FURIES (SCCER FURIES 2013)

According to the financial monitoring following institutions participate to the FURIES:

Participating institutions in SCCER FURIES			
Research entity	Institute	Professor in charge	No. of researchers
EPFL	DESL		12
EPFL	LCA2	Prof. Le Boudec	2
EPFL	LMH		1
EPFL	PV LAB		
EPFL	LA-CO		4
EPFL	WIRE		3
EPFL	IPESE		8
EPFL	LEI		3
ETHZ	HPE		2
ETHZ	HVL		4
ETHZ	PES	Prof. Kolar	2
ETHZ	FEN		1
ETHZ	LEC		3
ETHZ	IKG		2
ETHZ	PSL		2
USI	ICS/ALaRI	Prof. Malek	7

Participating institutions in SCCER FURIES			
Research entity	Institute	Professor in charge	No. of researchers
HES-SO	EIA-FR; Different supervising professors (Prof. Münch, Gabioud) - no further division into institutes	Prof. Münch, Prof. Gabioud	12
ZHAW (ZFH)	Prof. Korba	Prof. Korba	3
SUPSI	Prof. Rudel	Prof. Rudel	6
FHNW	Prof. Gysel	Prof. Gysel	4
HSR (FHO)	Prof. Smajic	Prof. Smajic	5
BFH	ESL		6
BFH	PV-LAB		9
HSLU	Prof. Casartelli	Prof. Casartelli	2

Table 18: Participating institutions in SCCER FURIES (CTI, 2014b)

A-2.4 Heat and Electricity Storage (HaE)

Action area «storage», along with the other action areas, was first put out to tender in May 2013 (CTI, 2013a). The tender document for the action area «storage» goes as follows:

Call for bids in action area «storage»
How to store heat at different temperature levels, store electrical, chemical and mechanical energy and convert it into a useable form are important elements of future energy supply. Using non-nuclear energy sources, the highest mass-to-energy density can be achieved with hydrogen, and the highest volume-to-energy density with hydrogen-rich liquid hydrocarbons. Important storage technologies are water-pump storage, fuel storage, electrochemical storage, thermal storage, hydrogen technology. The main research areas mentioned in the dispatch are: – Fundamentals of power storage; – Batteries; – Efficient electrolysis; – Heat management; – Mechanical, chemical and pneumatic storage technologies.

Table 19: Call for bids in action area «storage» (CTI, 2013a)

SCCER «Heat and Electricity storage» (HaE) developed the following roadmap for their proposal:

Proposal of SCCER HaE
Executive Summary
The contribution of renewable energy to the grid can increase rapidly (as recent developments in Germany have shown). Renewable energy sources are energy fluxes, i.e. heat and electricity and need to be stored over various timescales: hours (day/night cycle), weeks (due to unforeseeable weather conditions) and years (due to seasonal differences). Both direct storage of electricity (WP 1) and heat (WP2) and the production of chemical energy carriers, hydrogen (WP 3) and synthetic hydrocarbons (WP 4), is crucial for long-term energy storage and for mobility/transport. Optimizing the interaction of energy converters in energy systems and decoupling the power of energy sources and the power of energy use (WP 5) is vital. Within these five work packages and capacity areas (CA) we will form trans-institutional R&D teams consisting of the leading scientists and engineers in Switzerland.
Work packages of HaE
WP1; Storage of Electricity for use as electricity (e.g. batteries): This WP will develop electrochemically active materials and batteries. The materials will be combined with conductivity. The research focus is not on single materials alone. The interplay in the entire cell system will also be improved. The WP encompasses broad, integrated compe-

Proposal of SCCER HaE
tences in solid state chemistry, materials chemistry, inorganic chemistry, nanoscience, electrochemistry, battery technology, theory, and modelling. WP2; Storage of heat for the use of heat (e.g. latent heat): This WP will address the storage of thermal energy for water and space heating in residential applications. Storage of thermal energy for electricity generation and the process industry will also be studied. Addressing the industrial need for high-temperature heat is imperative. WP3; Conversion of electricity into hydrogen and storage of hydrogen (e.g. electrolysis, hydrides): The WP builds competences in science and technology development for new competitive conversion and storage systems and pilot and demonstrator activities. H2 production by electrolysis is an especially important issue since this is the first step in the conversion of electricity to synthetic fuels and realizes a closed material cycle for energy. This WP focusses on emerging technologies in the field including redox flow batteries, radically lower cost catalysts, and high energy density liquid storage routes. A high impact on industry is expected by focusing on these promising routes. WP4; Reduction of CO2 to hydrocarbons: The development of a Swiss platform to associate a critical volume of experts from various fields and to bridge the shortcoming between several disciplines, to develop optimal processes for CO2 conversion, and provide an expert reference platform. ETH is setting up a high-throughput screening technology platform for catalyst discovery. Electro-catalytic approaches on the co-electrolysis of carbon dioxide and water will benefit from complementary highly specialized lab-scale in-situ surface spectroscopic and imaging tools at UBERN and the technology scale diagnostic and engineering facilities at PSI. The first phase will employ small scale techniques and establish strong links with industry to evaluate potential pilot scale processes. WP5; Interaction of Storage Technologies (e.g. demonstrators): This WP seeks to build on existing competence in Switzerland. The team ensures the sound evaluation of storages and brings this know-how back into fundamental and applied research within the SCCER. Competencies on how to improve the flexibility between power, heat and fuel are addressed in WP5 by building up competencies for storages for flexibility between power and heat and by proactively running ideation workshops. The goal of these workshops is to actively generate new storage concepts.

Table 20: Proposal of SCCER HaE (SCCER HaE 2015)

According to the financial monitoring following institutions participate to the SCCER HaE:

Participating institutions in HaE			
Research entity	Institute	Professor in charge	Researchers
PSI	SCCER (leading house)	Prof. Dr. T.J. Schmidt and Prof. Dr. A. Züttel	5
EMPA	Hydrogen & Energy	Prof. Dr. Züttel	6
EMPA	Materials	Dr. Sennhauser	4
EPFL	ISIC-LIMNO (Molecular Engineering of Optoelectronic Nanomaterials Lab)	Prof. Dr. Sivula	5
EPFL	LRESE (Laboratory of Renewable Energy Science and Engineering)	Prof. Haussener	3
EPFL	LMM (Laboratory of Mechanical Metallurgy)		1
EPFL	LEPA (Laboratory of Physical and Analytical Electrochemistry)	Prof. Dr. Girault	5
EPFL	SB ISIC LCOM (Institute of Chemical Sciences and Engineering, Laboratory of Organometallic and Medicinal Chemistry)	Prof. Dyson	10
ETHZ	LAC (Laboratorium für Anorganische Chemie)	Prof. Dr. Maksym, Kovalenko	7
ETHZ	IET (Institute of Energy Technology)		3
PSI	LEC (Electrochemistry Laboratory)		11
PSI	TA (Technology assessment group)		7
BFH	TI (Technik und Informatik)	Prof. Hungerbühler	3
FHNW	IBRE (Institute for Biomass & Resource Efficiency)	Prof. Roth	6
FHNW	ITFE (Institute for Thermo- and Fluid Engineering)	Prof. Dr. Ribi	3
HSR (FHO Rapperswil)	IET (Institut für Energietechnik)	Prof. Dr. Friedl	3

HSR (FHO Rapperswil)	SPF (Institut für Solartechnik)	Prof. Rommel	3
HSLU	TEVT		6
SUPSI – UAS of Italian Switzerland	ICIMSI (Institute CIM for Sustainable Innovation)		6
UNIBE	DCB (Department of Chemistry and Biochemistry)	Prof. Wandlowski	11
UNIFR	CHEM (Department of Chemistry)	Prof. Dr. Fromm	4

Table 21: Participating institutions in SCCER HaE (CTI, 2014b)

A-2.5 Supply of Electricity (SoE)

Action area «Power supply» (supply of electrical energy), along with the other action areas, were first put out to tender in May 2013 (CTI, 2013a). The tender document for the action area «Power supply» (supply of electrical energy) goes as follows:

Call for bids in action area «Power supply (supply of electrical energy)»
Today's hydropower infrastructure provides a sustainable source of electrical energy which meets about 55% of our power requirements.5 It is also an attractive and well-used storage option. Switzerland's natural advantages – large differences in altitude and enough rainfall – combined with technical innovations for existing and new facilities need to be exploited to increase the electrical energy generated by hydropower. Mechanisms to control and link water supply and electricity production optimally must be developed. In this, special attention should be paid to infrastructure security. There is extensive untapped geothermal and storage potential in Switzerland, which may mean that deep geothermal energy can be used to meet base load demand. To achieve this, geological studies must be conducted and better materials and technologies for deep drilling, heat transfer and ways of converting heat into electricity as directly as possible are required. The main research areas mentioned in the Dispatch are: – Deep geothermal; – CO2 storage; – Use of hydropower; – Hydropower infrastructure

Table 22: Call for bids in action area «Power supply» (supply of electrical energy, CTI, 2013a)

SCCER SoE was granted the award and developed the following roadmap based on their proposal:

Roadmap of SCCER SoE
Executive Summary
The Swiss Competence Center on Supply of Electricity (SCCER-SoE) will be established to develop fundamental research and innovative solutions in the domains of geo-energies (Deep Geothermal Energy and CO2 sequestration) and hydropower. SCCER-SoE will build a true national competence center, with research and cooperation partners from the ETH schools and research centers, six Universities, three UAS, key industry partners, federal offices and services. SCCER-SoE will focus on sustainable competence expansion, by establishing new professorships and research positions, building new technology platforms, laboratories and testing facilities, working with industry to design and implement Pilot and Demonstration programs, enabling the testing and installation of future technologies. SCCER-SoE will work on a 10-years roadmap aiming at substantial progress towards the challenges of the Energy Strategy 2050.
Work packages
WP1 Geo-energies: The overarching goals of WP1 in the 2013-2016 initial phase of the SCCER-SoE are to complete the planned capacity building, establish the Masterplan for Deep Geothermal Energy development, establish the CCS Roadmap and initiate all the planned R&D activities in the identified critical areas of the roadmap. The work planned for 2013-2016 will be conducted in 4 Tasks. – Task 1.1 Resource exploration, assessment and characterization

Roadmap of SCCER SoE
– Task 1.2 Reservoir modeling and validation – Task 1.3 Pilot & Demonstration projects for reservoir creation – Task 1.4 Data infrastructure *WP2 Hydropower usage:* The research activities funded with SCCER resources are complemented, as indicated in the description of each task. This shows R&D activity tasks that are addressing the innovation challenges either as part of this WP or through activities, which are formally part of other WPs or of other SCCERs, but are key boundary conditions for the development of the tasks of this WP. The latter are linked, feed each other and provide feedbacks in order to account for interdependencies among technical, economic, social and regulatory aspects of hydropower. The roadmap is articulated through five tasks, which include several research themes addressing the roadmap research questions (a) to (d), and links to tasks that address the roadmap research questions (e) and (f) and are developed in other WPs of this and other SCCERs, as further specified below. The planned studies will for the most part refer to the scale of Switzerland and assess future water resources both for alpine and run-of-river plants. The workplan will focus on specific case studies in the canton Grisons, Valais and Ticino together with the cooperation partners. – Task 2.1 Morphoclimatic controls on future hydropower production – Task 2.2 Socio-economic drivers of future hydropower production – Task 2.3 Hydropower infrastructure adaptation to requirements of future operating conditions – Task 2.4 Environmental impacts of future hydropower operating conditions – Task 2.5 Integrated simulation of HP systems operation *WP3 Innovative technologies:* In the period from 2013-2016, SCCER-SoE has identified a number of technologies for early development, some for Geo-energies (Task 3.1) and some for Hydropower (Task 3.2). Each selected technology development will be conducted by one or more SCCER-SoE partner, collaborating where appropriate with one or more industry partners. Such collaborations will be formalized and supported with dedicated KTI applications. Some of these technologies are already under development. The establishment of SCCER-SoE will allow focusing and speeding up development of these technologies, other technologies are innovative and need a full feasibility analysis. – Task 3.1 Geo-energy technologies – Task 3.2 Hydropower technologies *WP4 Integrative activities:* Activities developed in WP4 are of an integrative nature, to be conducted across the two main domains covered by SCCER-SoE – Geo-energies and Hydropower – as well as across the whole domain of electricity and energy supply, with the goal of providing an integrated analysis and forecasting capability of present and future challenges in electricity supply. For the 2013-2016 implementation phase, efforts will concentrate on creating an integrated framework for the assessment of risk, safety and societal acceptance (Task 4.1), setting up a Global observatory of electricity resources (Task 4.2) and setting up the SCCER-SoE modeling facility (Task 4.3). – Task 4.1 Risk, safety and societal acceptance of SoE – Task 4.2 Global observatory of electricity resources – Task 4.3 SCCER-SoE modeling facility

Table 23: Roadmap of SCCER SoE (SCCER SoE 2014)

According to the financial monitoring following institutions participate to the SCCER SoE:

Participating institutions in SCCER SoE		
Research entity	Institute	No. of researchers
ETHZ	SCCER (Leading House)	20
ETHZ	SED (Swiss Seismological Service)	9
ETHZ	BAUG (Department of Civil, Environmental and Geomatic Engineering)	1
ETHZ	EEG (Exploration and Environmental Geophysics)	1
ETHZ	IfG (Institute of Geophysics)	7
ETHZ	IG (Geological Institute)	4
ETHZ	IGP (Institute of Geodesy and Photogrammetry)	4
ETHZ	VAW (Laboratory of Hydraulics, Hydrology and Glaciology)	6
ETHZ	C2SM (Center for Climate System Modeling)	1

ETHZ	IED (Institute for Environmental Decisions)	1
ETHZ	IBK (Institute of Structural Engineering)	1
ETHZ	GI	2
ETHZ	IFD (Institute of Fluid dynamics)	1
ETHZ	IGP (Institute of Geodesy and Photogrammetry)	4
ETHZ	IPE (Institute of Process Engineering)	6
ETHZ	IfU (Institute of Environmental Engineering)	1
ETHZ	SEG (Seismology and Geodynamics)	1
ETHZ	IfB (Institute for Building materials)	1
EPFL	LMH (Laboratory for Hydraulic Machines)	6
EPFL	AHEAD (Applied Hydro-economic and Alpine Environmental Dynamics group)	3
EPFL	LCH-ECHO (Hydraulic Constructions Laboratory)	1
EPFL	LMS (Soil Mechanics Laboratory)	1
EPFL	CRYOS (Laboratory for Cryospheric Sciences)	1
PSI		11
WSL	Mountain Hydrology	6
EAWAG	Fish Ecology and Evolution	4
EAWAG	Aquatic Ecology	2
EAWAG	Surface Waters	3
HES-		12
HSLU		1
HSR	Hardegger, Bommer	1
UNIBE		7
UNIL		4
UNIGE		8
UNINE	CHYN	6
USI		1

Table 24: Participating institutions in SCCER SoE (CTI, 2014b)

A-2.6 Energy, Society and Transition (CREST)

Action area «economy, environment, law, behaviour», along with the other action areas, was first put out to tender in May 2013 (CTI, 2013a). The tender document for the action area «economy, environment, law, behaviour» goes as follows:

Call for bids in action area «economy, environment, law, behaviour»
For the energy revolution to be successful, many institutional changes in policy and in the energy markets need to take place in addition to technological innovation. Above all, adjustments to the regulatory framework as well as supply-side and demand-side incentive mechanisms are required. In this action area, experts from a wide range of social sciences (e.g., psychology, economics, political science, law) are called upon to ascertain the social, political and economic implications arising from certain institutional structures and incentive systems at the micro-level (consumers, voters), meso-level (companies, investors) and macro-level (society, state). Central research issues in these areas can be investigated by conducting field and laboratory experiments, surveys, observational case studies, micro- and macro-economic models and legal analyses. The research results should lead to concrete proposals on how existing regulatory frameworks and incentive structures in the energy markets can be developed. The main research areas based on the dispatch are: – Regulatory issues and market conditions; – Analyses of individual and group behaviour and general trends; – Sufficiency; – Incentive systems.

Table 25: Call for bids in action area «economy, environment, law, behaviour» (CTI, 2013a)

SCCER CREST developed the following roadmap for their proposal:

Proposal of SCCER CREST
Executive Summary
The SCCER CREST will contribute to the energy transition in Switzerland by providing detailed, evidence based recommendations on policies that help to reduce energy demand, foster innovation, and increase the share of renewables in a cost-efficient way. It will cover the complete action area “economy, environment, law and behaviour” with three lines of research that develop innovative concepts for energy policy, provide an in-depth analysis of drivers and barriers to energy efficiency, produce detailed strategies that help firms and regions in adjusting to the new energy system, and develop novel assessment tools for policies and technological solutions. The SCCER CREST will bring together research groups from almost all major Swiss research institutions and fill important shortcomings in the research landscape. It will be one of the strongest research centers in this field worldwide, cooperate closely with partners from industry, public administration, and policy consulting and will work together closely with the technical SCCER.
Work packages
The research done in the SCCER CREST is organized in three work packages that correspond to the three levels at which the transition of the Swiss energy system needs to occur (micro, meso, macro): – WP1 “Energy, Innovation, Management” (meso level): Addressing the role of firms and regions for the energy transition, including innovation, new business models, investment, regional development, and social acceptance of new technologies. – WP2 “Change of Behaviour” (micro level): Addressing behavioural aspects of individual energy consumers to provide a better understanding and a quantification of determinants of energy consumption and insights how to influence individuals to achieve demand efficiency objectives. – WP3 “Energy Policy, Markets and Regulation” (macro level): Addressing the energy policy and energy market regulation from a legal, political and economic perspective. Research covers the design and implementation of new policy measures, energy market regulation, the national and international legal context, and simulation-based policy assessment. Together the three WPs cover the most important aspects and research shortcomings needed to provide detailed proposals on how existing regulatory frameworks and incentive structures in the energy markets can be optimized. Thereby, all aspects of the action area are adequately covered:

Table 26: Proposal of SCCER CREST (SCCER CREST 2013)

According to the financial monitoring the following institutions participate in CREST:

Participating institutions in SCCER CREST			
Research entity	Institute	Professor in charge	No. of researchers
ETHZ	CEPE (Centre for Energy Policy and Economics)	Prof. Filippini, Prof. Rausch	9
ETHZ	LEC (Laboratory for Energy Conversion)	Prof. Abhari	4

Participating institutions in SCCER CREST			
Research entity	Institute	Professor in charge	No. of researchers
ETHZ	CER (Chair of Economics/Resource Economics)	Prof. Bretschger	3
ETHZ	SUSTEC (Chair of Sustainability and Technology)	Prof. Hoffmann	5
EPFL	CDM (College of Management and Technology) ITPP (Institute of Technology & Public Policy)	Prof. Finger	6
EPFL	CDM (College of Management and Technology) MTEI (Management of Technology and Entrepreneurship Institute)	Prof. Foray, Prof. Tucci	4
UNIBAS	UniBas (leading House)		1
UNIBAS	Environmental Economics	Prof. Krysiak	3
UNIBAS	FoNEW (Forschungsstelle für Nachhaltige Energie- und Wasserversorgung)	Prof. Weigt	7
UNIBAS	Sustainability Research, (Department of Social Science)	Prof. Burger	2
UNIBAS	Public Economics	Prof. Hintermann	1
UNIBAS	Angewandte Ökonomie/ Applied Econometrics	Prof. Schmidheiny	1
UNIBAS	Phil. Seminar		1
HSG	IWÖ (Institute for Economy and the Environment)	Prof. Wüstenhagen	14
HSG	FIR (Research Center for Information Law)	Prof. Hettich	2
HSG	ior/cf (Institute for Operations Research and Computational Finance)	Prof. Frauendorfer	7
HSG	ITEM (Institute for Technology Management)	Prof. Gassmann	12
HSG	IPW (Institute of Political Science)	Prof. Davis	2
UNIGE	Faculty of Science, ISE (Institute for Environmental Sciences), Institut Forel	Prof. Patel, Dr. Romerio	5
UNIGE	Faculty of Psychology and Educational Science, CISA (Le Centre Interfacultaire en Sciences Affectives)	Prof. Sander	2
UNILU	CLS (Center for Law and Sustainability)	Norer/Mathis/Beer/Boes	10
UNILU	KSF (Kultur- und Sozialwissenschaftliche Fakultät, cooperation partner of CLS)	Prof. Heselhaus, Prof. Lüchinger	4
UNINE	Economics: Institute of Economic Research (IRENE); Enterprise Institute (IENE)	Prof. Farsi, Prof. Bezençon, Prof. Reiner	12
ZHAW (ZFH)	INE (Institute of Sustainable Development)	Prof. Furrer	13
ZHAW (ZFH)	CIE (Center for Innovation and Entrepreneurship)	Dr. Cometta	9
ZHAW (ZFH)	ZOW (Center for Public Commercial Law)	Prof. Abegg/Prof. Wiederkehr	6
ZHAW (ZFH)	Other institutes (mentioned in the proposal)	Prof. Breymann, Dr. Betz,	

Table 27: Participating institutions in SCCER CREST (CTI, 2014b)

A-2.7 Efficient Technologies and Systems for Mobility (MOBILITY)

Action area «efficient concepts, processes and components in mobility», along with the other action areas, was first put out to tender in May 2013 (CTI, 2013a). The tender document for the action area « economy, environment, law, behaviour» goes as follows:

Call for bids in action area «efficient concepts, processes and components in SCCER MOBILITY»
About 34% of total energy use in Switzerland is in the transport sector – moving people and goods around on roads, rail and in the air. Road and air transport mainly involves the use of fossil fuels, with associated high levels of CO2 emissions. Road transport in Switzerland has the greatest innovation potential in terms of efficiency. On the one hand, vehicles can be made more efficient by improving the combustion engine, with lighter vehicles, more efficient, low-pollution propulsion systems and increased security by means of sensors and guidance systems. On the other hand, further intensive research into electrical propulsion systems on the basis of fuel cells is required before vehicles with this technology can really make a breakthrough on the market. Research into new, considerably more powerful and reliable electrochemical batteries is a key issue in developing electrically powered transport, as is the integration of decentralized renewable electrical energy. We require new urban models – including experimental approaches – to reduce work-related mobility and the use of transport to distribute goods. The main research areas mentioned in the dispatch are: – Electrically powered transport; – Batteries; – Fuel cells; – Integration decentralized renewable electric power; – Light-weight vehicles; – Experimental aspects of new urban models

Table 28: Call for bids in action area on «efficient concepts, processes and components in MOBILITY» (CTI, 2013a)

SCCER MOBILITY developed the following roadmap for their proposal:

Proposal of SCCER MOBILITY
Executive Summary
This SCCER 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 (IF) A deals with components and devices: Capacity Area (CA) 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 (aerodynamics, light weighting). IF B composes of CA-B1 targeting infrastructure, logistics and ICT-systems and CA-B2 cover the assessment of the transportation system. The program aims at creating synergies at the interfaces of these five CAs serving as virtual research teams, composed by new and rededicated key researcher positions from ETH-Domain and the Universities of Applied Sciences. Many relevant Swiss and foreign companies have expressed their interest to actively participate.
Work packages
Capacity Area A1: Components and Systems for E-Mobility – Research Topic A1.1 Battery Research Platform *Capacity Area A2: Chemical Energy Converters* – Research Topic A2.1 Fuel Cell Systems – Research *Topic A2.2 Internal Combustion Engines* *Capacity Area A3: Minimizing Vehicle Energy Demand* – Research Topic A3.1 New Routes to high volume lightweight components – Research Topic A3.2 Bioinspired lightweight composites – Research *Topic A3.3 Thermal management including thermal insulation* *Capacity Area B1: Integration, Operation & Optimization of Mobility Systems* – Research Topic B1.1 Integration, Infrastructure & New Urban Transport – Research Topic B1.2 Spatio-temporal Data Acquisition & Analysis, Monitoring Devices and User Communication – Research *Topic B1.3 Urban Planning and Environmental Impact* *Capacity Area B2: Integrated Assessment of Mobility Systems* – Research Topic B2.1 Drivetrain Technology and Fleet Scenario Analysis (ETH-LAV & PSI-LEA) – Research Topic B2.2 Transportation Impact Analysis (PSI-LEA) – Research Topic B2.3 Energy Economic Modeling (PSI-LEA) – Research Topic B2.4 Socio-Economic Aspects (ZHAW-INE & SUPSI-ISAAC) – Research Topic B2.5 Integration analysis (PSI-LEA in co-operation with ZHAW-INE & SUPSI-ISAAC, B1 *and with inputs from SCCER 5)*

Table 29: Proposal of SCCER MOBILITY (SCCER MOBILITY 2013)

According to the financial monitoring the following institutions participate in MOBILITY:

Participating institutions in SCCER MOBILITY		
Research entity	Institute	No. of researchers
Empa	EMR (Electronics/Metrology/Reliability Laboratory)	3
Empa	ICEL (Internal Combustion Engines Laboratory)	7
EPFL	LTC (Laboratory of Composite and Polymer Technology)	3
ETHZ	Management and Leading House	4
ETHZ	HPE (Laboratory for High Power Electronic Systems)	1
ETHZ	IDSC (Institute for Dynamic Systems and Control)	4
ETHZ	LAV (Laboratory for Aerothermochemistry and Combustion)	11
ETHZ	IDMF CMAS (Institute of Design, Materials and Fabrication) (Laboratory of Composite Materials and Adaptive Structures)	3
ETHZ	CML	7
ETHZ	IfU (Institute for Environmental Engineering)	4
ETHZ	IKG (Institute of Cartography and Geoinformation)	2
ETHZ	IVT-Ax (Institute for Transport Planning and Systems)	1
ETHZ	IVT-Weidmann (Prof.) (Institute for Transport Planning and Systems)	2
PSI	ECL	6
PSI	CRL (Combustion Research Laboratory)	1
PSI	LEA (Laboratory for Energy Systems Analysis)	8
BFH	Deputy Head	1
BFH	IEM (Electrochemical Storage and Converter Group)	4
BFH	AHB (Architecture Wood and Civil Engineering)	4
FHNW	IKT (Institut für Kunststofftechnik)	16
HSLU	IIEE/ES (Integral, Intelligent & Efficient Energy Systems)	6
NTB	EMS (Institut für Entwicklung Mechatronischer Systeme)	6
SUPSI	ISAAC (Institute for Applied Sustainability to the Built Environment)	2
ZHAW	ICP (Institute of Computational Physics)	3
ZHAW (ZFH)	INE (Institute of Sustainable Development)	2

Table 30: Participating institutions in SCCER MOBILITY (CTI, 2014b)

A-2.8 Biomass for Swiss Energy Future (BIOSWEET)

Action area «Biomass», along with the other action areas, was first put out to tender in May 2013 (CTI, 2013a). The tender document for the action area «Biomass» goes as follows:

Call for bids in action area «Biomass»
If biomass is to become an efficient and widespread source of renewable energy, more efficient end use technologies need to become established on the market. The aim is to use biomass in such a way that the greatest possible savings can be made in the use of non-renewable resources whilst causing a minimum amount of damage to the environment. Biomass is mainly used to generate biogas, which is then converted directly into energy for heat or indirectly into electrical energy, or it is condensed to a liquid fuel. In focusing research on these areas, existing techniques need to be refined and new processes developed. In this, it is essential to consider environmental and safety aspects. The particular opportunities offered by the situation in Switzerland should be exploited. The main research areas mentioned in the dispatch are: – availability and use of biomass; – use of biogas to generate electricity and heat; – gas and liquid energy sources from biomass.

Table 31: Call for bids in action area biomass (CTI, 2013a)

SCCER BIOSWEET was granted the award and developed the following roadmap for their proposal:

Proposal of SCCER BIOSWEET
Executive Summary
SCCER BIOSWEET focuses on the biochemical and thermochemical conversion of wood, bio-waste / manure and algae to gaseous and liquid biofuels with the vision to contribute additional 100 PJ towards fulfilment of the Swiss Energy Transition by 2050. Research will be directed towards small and medium-size installations in order to meet the needs of the Swiss market and to exploit the high innovation potential in both fields together with Swiss industry. This SCCER unifies major research teams in Switzerland and has strong links to international activities. The Paul Scherrer Institute will be the leading house of SCCER BIOSWEET.
Work packages
WP1: Biochemical fuels and power 1a: Bio-methane from manure, wet residues, and algae through pretreatment, enzymatic hydrolysis and fermentation – Improvement of the overall energy conversion from traditional biogas substrates – Exploitation of new substrates for bio-methane production – Increase of the process efficiency of the anaerobic digestion chain – Development of new and customized technologies for anaerobic digestion – Use of CO 2 as energy carrier / Development of P2G routes 1b: Liquid biofuels from wood, agricultural residues, and algae through pretreatment, enzymatic hydrolysis and fermentation – Biomass pretreatment and enzymatic hydrolysis for biological fuel production – Ethanol and other liquid fuels 1c: Sustainable production of micro-algal biomass using different waste streams / energetic use of micro-algal biomass and biomass residuals – Production of algal biomass – Energetic use of micro-algal biomass (this is done together with WP2b) *WP2: Thermochemical fuels and power* 2a: Bio-methane from wood by gasification-methanation – Gas cleaning – Methanation – H2-Production *2b: Bio-methane from wet residues, bio-wastes, and algae by hydrothermal conversion* *2c: Liquid biofuels from wood* – *Systematic fuel design* – *Hydrothermal Liquefaction (HTL)* – *Catalytic pyrolysis* *2d: Advanced Combined Heat and Power (CHP) for producing renewable electricity from biomass*

Proposal of SCCER BIOSWEET
WP 3: Assessment and Availability 3a: Biomass resources characterization for Switzerland 3b: Computer aided biomass conversion process development and integration$ 3c: Environmental and thermo-economic assessment 3d: Flagship projects 3e: Long term assessment

Table 32: Proposal of SCCER BIOSWEET (SCCER BIOSWEET 2015)

According to the financial monitoring the following institutions participate in BIOSWEET:

Participating institutions in SCCER BIOSWEET		
Research entity	Professor in charge	No. of researchers
ETHZ	Christoph Müller, Javier Perez-Ramirez	9
EPFL	Jeremy Luterbacher, Oliver Kröcher, François Maréchal	19
PSI	Serge Biollaz, Oliver Kröcher, Frédéric Vogel	22
WSL	Marc Hanewinkel, Oliver Thees	5
BFH	Michael Studer	5
FHNW	Timothy Griffin	6
HES-SO	Jean-Bernard Michel	18
SUPSI	Pamela Principi	5
ZHAW	Dominik Refardt, Urs Baier	8

Table 33: Participating institutions in SCCER BIOSWEET (CTI, 2014b)

A-3 Overall assessment by the SCCER heads and shortcomings without recommended action

The following subchapters contain complementary information to chapter 3. For each SCCER the overall assessment by the SCCER heads and identified shortcomings without recommended action are listed. According to the appraisals of the evaluation panel, the SCCER heads, the literature analysis and the project team there are no recommended actions for these shortcomings, since they have less priority or relevance considered the limited funds available. The subchapters are structured in shortcomings regarding thematic coverage, integration of research institutions and coverage of the knowledge production chain.

A-3.1 Future Energy Efficient Buildings & Districts (FEEB&D)

Thematic shortcomings FEEB&D		
Overall assessment by the SCCER head and the experts		Recommended action
No obvious shortcomings except the sufficiency issue and photovoltaics (PV): Elaborated roadmap is consistent and a comprehensive implementation of the research topics in the call, except sufficiency potentials which are not addressed (the head doesn't believe in the potentials of sufficiency) and PV which is excluded deliberately (separate network) but which is nevertheless missed by several SCCER.		Check if the sufficiency issue is to be addressed stronger in the second call: We distinguish several possible addressees for sufficiency: – FEEB&D regarding user behaviour in the building (e.g. room temperature, warm water use) – CREST regarding awareness and personal needs and resulting behaviour (e.g. living area per person demanded) as well as for impact assessments of more sufficiency or a sufficiency strategy – MOBILITY regarding consumer behaviour in the transport sector (e.g. commuter behaviour) PV: see below
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Not sufficient socio-economic research	Head considers socio-economic research covered adequately: WP4 of FEEB&D is dedicated to socio-economic research, which is more problem or building oriented than socio-economic research in CREST. Investigated areas: Drivers and barriers in the economy for technology development and acceleration of innovation processes, exploration of performance shortcomings and existing potentials.	No action

Table 34: Thematic shortcomings in SCCER FEEB&D – Overall assessment by the SCCER head and shortcomings without recommended action.

Institutional shortcomings FEEB&D		
Overall assessment by the SCCER head		Recommended action
Inadequate participation of UAS: During the bidding process the number of network partners had to be reduced (due to funding constraints and the EP-feedback to the first application): Mainly reduction of the number of participating UAS to the most prominent and excellent UAS with respect to the FEEB&D topics. Non-participation of HES-SO is questionable. Existing problem of UAS (view of the SCCER head): In the building area there lacks a coordination and thematic differentiation among the UAS (similar to the establishment of competence centers like CCEM on the ETH level). HES-SO is quite partitioned which complicates participation and FHNW was retiring the leading Prof. A. Binz at the time of the bidding process.		In the second funding period, potential contributions and participation of HES-SO and FHNW should be considered
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Not integrated new professorship energy efficiency UNIGE	Head states the purpose to integrate this institution/professorship in the 2nd funding phase	No action, since involvement is already planned.
Not integrated: BFH, Institute for Timber Construction, Structures and Architecture,	Is rather "nice to have"	No action (clarify if participation in 2nd phase would bring added value and relevance is high enough to justify allocation of available funds.)
Not integrated: ZHAW, Life Sciences and Facility Management	Could be valuable to cover the shortcoming identified with respect to facility management as research topic.	No action (clarify if participation in 2nd phase would bring added value and relevance is high enough to justify allocation of available funds.)
Not integrated: HES-SO University of Applied Sciences and Arts Western Switzerland	Can possibly be a shortcoming (Prof. Jessen Page)	No action (clarify if participation in 2nd phase would bring added value and relevance is high enough to justify allocation of available funds.)

Table 35: Institutional shortcomings in SCCER FEEB&D – Overall assessment by the SCCER head and shortcomings without recommended action.

Shortcomings in the knowledge production chain		
Overall assessment by the SCCER head and the experts		Recommended action
Considers value chain as covered. Degree of coverage depends on time horizon. The head thinks it is too early to really assess coverage. FEEB&D does research for topics with low TRL (dynamic glazing) to high TRL, the latter in cooperation with industry partners. There is the problem of high costs for pilots. Considers the value chain as covered. Expects even better coverage once more results of current research can be applied, but this takes some time. Head thinks that expectations regarding the inclusion of the whole value chain are partly unrealistic, at least for new and innovative research activities on still low TRL (in contrast to research continuing already existing research activities)		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Integrate further partners for the energy hub concept, in addition to Geneva	The appraisal of possible shortcomings is controversial: Between certain shortcomings with respect to districts and building partners to no relevant shortcomings existing. FEEB&D is also active in Suurstoffi Rotkreuz, does modelling in Altstetten, FEEB&D has contacts to BKW which is interested. Expects more partners once the tools are ready.	No action except check if expectations become true

Table 36: Shortcomings in the knowledge production chain in SCCER FEEB&D – Overall assessment by the SCCER head and shortcomings without recommended action.

A-3.2 Efficiency of Industrial Processes (EIP)

Thematic shortcomings EIP		
Overall assessment by the SCCER head		Recommended action
In the formation process of the SCCER, the EIP put a strong focus on the large consumers (e.g. sectors of chemistry and food) and the existing competences of the Swiss researchers. A central topic is «Process intensification». Due to the smallest budget among all SCCERs (approx. 2.7 Mio. CHF), courage to leave shortcomings was needed.		Take up the topic of electricity and its efficiency potential which is not covered yet
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Electricity generation from excess heat is missing	Reasons: EIP has the smallest budget among all SCCERs what required a strong focus. The relevance of the topic is only limited within the timeframe of the E2050. It is still on a very low TRL.	No action

Table 37: Thematic shortcomings in SCCER EIP – Overall assessment by the SCCER head and shortcomings without recommended action.

Institutional shortcomings EIP		
Overall assessment by the SCCER head		Recommended action
– The EIP was able to start quickly because it bases on the existing resources. A large portion of the relevant Swiss research actors is part of the EIP. There is no need for reorganization, but in order to add new topics, new researchers/institutes are needed. For this additional funding is needed. At present, the EIP's size is subcritical. The head considers necessary to double the funding. A minimum of 100 – 150 kCHF or one full-time equivalent per institute is necessary to achieve a critical mass within an institute. – Important for the success of a SCCER is the ability of the institutes to collaboration with each other. This is has personal aspects and is also a question of geographical distance. – Good results are mainly depending on the qualifications of the researchers. Good researchers need long-term perspectives.		Check if the funding can be increased in order to integrate new researchers/institutes, which cover relevant topics.
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Not integrated: PSI and FHNW	FHNW (Prof. Vogel) is already part of the SCCER BIOSWEET.	No action/implementation Check coordination with Prof. Vogel (BIOSWEET).
PSI is not part of the EIP	Reasons: The PSI is already part of many SCCER, but its contribution to EIP is very welcome by the head, if EIP receives more funding. For example, PSI could bring in their competences in conditioning and application of biomass for process heat.	No action/implementation Check coordination with BIOSWEET.
Not integrated: EPFL, Prof. Smit, Laboratoire de simulation moléculaire LEPA	Prof. Smit will be included in the 2. Phase.	No action

Table 38: Institutional shortcomings in SCCER EIP – Overall assessment by the SCCER head and shortcomings without recommended action.

Shortcomings in the knowledge production chain EIP	
Overall assessment by the SCCER head	Recommended action
– EIP focuses on applied research and pilots. There is not enough funding for basic research. – The contact with companies is established. From these contacts, new projects arise. This bottom-up approach is important. He sees the cooperation with industrial partners mainly via CTI-projects and less via direct involvement in the SCCER. – Some concrete measures/modifications of processes have been realized. – There is not much money in most industrial sectors. They are becoming interested when a	

Shortcomings in the knowledge production chain EIP		
new solution is (close to) completely developed.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
-	-	-

Table 39: Shortcomings in the knowledge production chain in SCCER EIP – Overall assessment by the SCCER head and shortcomings without recommended action.

A-3.3 Future Swiss Electrical Infrastructure (FURIES)

Thematic shortcomings FURIES		
Overall assessment by the SCCER program manager and the experts		Recommended action
No thematic extension planned, but in the upcoming phase development towards higher TRL and more demonstration by testing/pilots of what has been developed. During 2nd funding phase reality check of ongoing research. FURIES tries to enforce the network with the functionalities the utilities need. Smart grid is multidisciplinary and therefore, it is not clear-cut where to allocate the resources available.		Pilots and demonstrators are expensive and need possibly more funding in 2nd phase
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
-	-	-

Table 40: Thematic shortcomings in SCCER FURIES – Overall assessment by the SCCER head and shortcomings without recommended action.

Institutional shortcomings FURIES		
Overall assessment by the SCCER program manager		Recommended action
FURIES is a research network with a broad range of topics which covers every aspect of smart grids: The 40 academic partners of FURIES are supposed to cover the relevant aspects of smart grids. The EP requested to cut back the original first proposal. Cutting back was done more with respect to the budget than to the partners involved. FURIES also acts as umbrella for energy projects which are funded by other funding agencies (active network).		FURIES will apply for more funds in funding phase 2.
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Département de physique UNIFR?	Tentatively no shortcoming, since UNIFR (Prof. Bernard) works on superconductivity and would need extension of focus of FURIES which is not really related to smart grids.	No action
Systèmes énergétiques UNIGE,	No shortcoming, topic is covered by participating Prof. U. Muntwyler, Prof. Ballif, Prof. Rudel.	No action
Institut de physique UNINE?	No shortcoming, rather indirectly related to FURIES' topics.	No action
University of St. Gallen?	No shortcoming since UNISG is primarily involved in CREST, FURIES has intense collaboration with CREST and CREST is not connected to the market as FURIES.	No action

Table 41: Institutional shortcomings in SCCER FURIES – Overall assessment by the SCCER head and shortcomings without recommended action.

Shortcomings in the knowledge production chain FURIES	
Overall assessment by the SCCER program manager and the experts	Recommended action
Good balance of basic science/ research and market needs. Try to go more towards marketability in the future. Work is partly on high technology readiness level, good collaboration with industry part-	FURIES plans to extend demonstration and pilots to go to the market. For demonstration and pilots

Shortcomings in the knowledge production chain FURIES		
ners and matching funds with industry. Collaboration with SNSF if basic science. The SCCER FURIES has 40 partners from all of the areas needed, including power industry and the public sector. Projects include partners across the domains, i.e. ETH, UAS, UNI, and industry. Consequently, there is a good mixture of project scopes. 30 new R+D projects, 22 demonstration and pilot projects, 15 new services, products and processes, respectively and 6 patents (2015). Industry is willing to go on with cooperation in 2nd funding phase.		(expensive), more funds are needed.
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
-	-	-

Table 42: Shortcomings in the knowledge production chain SCCER FURIES – Overall assessment by the SCCER head and shortcomings without recommended action.

A-3.4 Heat and Electricity Storage (HaE)

Thematic shortcomings HaE		
Overall assessment by the SCCER head		Recommended action
Thematic coverage is ok, no clear shortcomings. HaE encompasses a broad thematic range. It could be discussed if all of the priorities are adequate. The head considers the choice as adequate.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
High temperature electrolysis is not covered	This topic is given low priority since the strategy of E2050 targets to a high share of renewable electricity which will lead to increasing intermittent electricity supply in the future but high temperature electrolysis is continuous process.	no action
Socio-economic aspects are not sufficiently covered in technology research of HaE	Socio-economic aspects are addressed in WP 5 and through active exchange with CREST. However the other WPs may also benefit from looking at economic aspects of their technology development in comparison with competing technologies (see above).	No action except the issues mentioned above by the EP

Table 43: Thematic shortcomings in SCCER HaE – Overall assessment by the SCCER head and shortcomings without recommended action.

Institutional shortcomings HaE		
Overall assessment by the SCCER head		Recommended action
Institutional coverage is ok, no clear shortcomings HaE was looking for the key players who are integrated. None of the remaining researchers are considered to be a must for integration into HaE. The head considers the concentration on the key researchers in the domain as justified and necessary to ensure a critical volume per research institution and research topic for efficient research and allocation of the funds available. Considers the wide range of actual topics covered already as critical, regarding the funds available.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
-	-	-

Table 44: Institutional shortcomings in SCCER HaE – Overall assessment by the SCCER head and shortcomings without recommended action.

Shortcomings in the knowledge production chain		
Overall assessment by the SCCER head		Recommended action
HaE is active on TRL 3-4 up to TRL 7-8. Considers TRL 8-9 as task for the industry not for the universities. There are common CTI projects of particular HaE researchers with the industry. Since the need for power storage is expected to arise only in about 20 years and the political as well as the economic framework conditions (which storage capacities? which technologies will be accepted as renewable ones? tax deductions possible? etc.) are not clarified yet, industry hesitates to invest, (needs planning security). Companies are interested but not willing to invest. The head claims that it is difficult to get public funding for lighthouse projects and demonstrators.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Many industry contacts, often continuing collaboration within already ongoing research	HaE established an impressive number of (also international) industry contacts, 25 companies have signed cooperation agreements with the SCCER and competitive funding was obtained for HaE projects. In many cases, the proposals had started prior to the establishment of HaE, but were reshaped to address the specifics of HaE.	No action

Table 45: Shortcomings in the knowledge production chain in SCCER HaE – Overall assessment by the SCCER head and shortcomings without recommended action.

A-3.5 Supply of Electricity (SoE)

Thematic shortcomings		
Overall assessment by the SCCER head and other experts		Recommended action
– The relevant topics largely covered. Due to the limited funding, not everything is dealt in depth with. Especially in the deep geothermal energy, the implementation of new technologies is very cost-intensive, but never the less crucial to make progress in the research. This by testing in real plants. – A four-year plan covers a too short period of time for setting new research topics and for retaining the best personnel. A ten-year plan would be needed. – For phase 2, SoE is planning to redirect 10% of the funding to strengthen the cooperation with other SCCERs and new activities. – Petro-thermic energy is covered on all levels: exploration, development (drilling, fracking), exploitation, social acceptance and health, safety and environmental management. TRL is lowest in development, where SoE is putting a focus. Capacity building went well. SoE positioned itself on development and management. – Deep geothermal energy has a long time perspective. This is respected in the roadmap adequately. – The relevant topics of CCS are well covered. Characterizing of the underground is the most important topic.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Research on societal acceptance of the technologies within the SoE.	Statement in the evaluation 2014: «Societal acceptance is a key issue for more hydropower generation in the future and should be given very much attention. No matter what technical progress is presented, if the society does not support additional hydropower it will be impossible to reach certain goals. We are not sure if the focus on risks does consider this sufficiently.» SCCER Head: For the societal acceptance of hydropower, SoE cooperates with CREST. Questions of societal acceptance of deep geothermal energy is covered by the SoE itself, this in cooperation with CREST, the Institute for Environmental Decisions at the ETH Zurich as well as the departments of the ETH Zurich MTEC, GESS and MAVT. Other experts state, that the topic is already covered sufficiently comprehensively in the Task 4.1 «Risk, safety and societal acceptance of SoE». Information on ongoing work in this field: NRP 70/71 (by Michael Stauffacher), TA-Swiss (large study), Stiftung Risikodialog.	No action

Table 46: Thematic shortcomings in SCCER SoE – Overall assessment by the SCCER head and shortcomings without recommended action.

Institutional shortcomings		
Overall assessment by the SCCER head		Recommended action
– The SoE counts over 50 involved chairs and 150 – 240 researchers. The four Universities are very important for geothermal studies. – At this moment, SoE is not missing any relevant partners, but they will redirect 10% of the funding for new activities and possibly to new partners. – Professors are independent and get involved only if the research topic and the framing conditions are interesting. In this perspective the involvement of the many researchers in the SoE is a success. Nevertheless, there are professors which are working to capacity and are not interested in participating in an SCCER. – It has been expected that the UAS would play a more significant role in the SoE. Because the UAS were not able to acquire sufficient matching funding, the UAS contribute less to the SoE then expected. More implementation projects were needed.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
EMPA	EMPA is only associated partner of SoE. Cooperation is elaborated.	No action

Table 47: Institutional shortcomings in SCCER SoE – Overall assessment by the SCCER head and shortcomings without recommended action.

Shortcomings in the knowledge production chain		
Overall assessment by the SCCER head and the experts		Recommended action
Deep geothermal energy The relevant developing and researching Swiss actors are involved: local partners and the joint-venture with six regional utilities «Geo-Energie Suisse». Large research infrastructures and demonstration projects are needed now in the field of geothermal energy, but there is a lack of funding for such projects. A mechanism is needed, which provides adequate funding for the new resources developed and their needed research infrastructures. *CCS* Relevant companies in the field of CCS are located in Switzerland, such as General Electric, MAN and Sulzer. TRL of CCS is still low. Therefore it is important, that research is conducted in Switzerland. It increases the option value of the technology. *Deep geothermal energy and CCS* Mainly focused on applied basic research.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
-	-	-

Table 48: Shortcomings in the knowledge production chain in SCCER SoE – Overall assessment by the SCCER head and shortcomings without recommended action.

A-3.6 Energy, Society and Transition (CREST)

Thematic shortcomings CREST		
Overall assessment by the SCCER head		Recommended action
The thematic field of the call is very broad and comprehensive. It is not possible to cover all the topics within the field. Head considers the main topics of the call as covered by the work packages and the road map of CREST. – Limited resources require priority setting with respect to the topics as well as to the research institutions involved. – Would like to do even more research in some of the topics if the funding is available (techno-economic modelling, research regarding the impacts of policy instruments, relationship markets-policy-technology, transfer of innovation to the markets). – Notices preference for technical research by the call and given the resource allocation. – Other expert considers that the most important socio-economic topics are covered by CREST, except the subsequent topics. – Too much funding of salaries and too little for projects.		Check the thematic priorities for funding phase 2 in the light of the results of the different work packages in phase 1. Consider the share of funding for salaries and for research projects, respectively.
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
-	-	-

Table 49: Thematic shortcomings in CREST – Overall assessment by the SCCER head and shortcomings without recommended action.

Institutional shortcomings CREST		
Overall assessment by the SCCER head		Recommended action
There are some non-technical energy researchers/institutions not involved in CREST: UNIZH, UNIBE, some UAS. There are already about 200 researchers involved in CREST. If the aim is real cooperation, effort will increase with the number of partners. There are some groups which were welcome, but there is limited funding.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Non-funded academic partners	Contributions are differing, HES-SO. FHO, EAWAG are	No action

Institutional shortcomings CREST		
(associated partners)	very active, cooperation on NRP 70/71, set up of a common working group.	
Not integrated: HES-SO	CREST is in touch with HES-SO (Prof. Baranzini) was abandoned during the second phase of the tender process, while reducing requested funding application from 21 Mio. CHF to 11 Mio. CHF.	No action (clarify if participation in 2nd phase would bring added value and relevance is high enough to justify allocation of available funds.)
UNIFR, environmental sciences and of geosciences	Environmental sciences (Prof. Voelkle) was very active at the beginning of the bidding process but withdrew, because of the narrow deadline of the tender process which made impossible to organize required funding.	No action
UNIL industrial ecology; geosciences and environment; energy law; standards and international politics	Have communicated in an early moment of the bidding process that they are not willing to provide financial resources.	No action
UZH; department of political science; social research unit; department of history;	Not willing to provide financial resources. department of political science (Prof. Michaelowa) is thematically more focused on climate issues.	No action
FHNW, IGS	Couldn't organize own financial funding during the seven weeks of the tender process. The topic they proposed was not preferred by the EP.	No action
WSL Birmensdorf	Some WSL researchers participate as non-funded partners in the social acceptance issue.	No action

Table 50: Institutional shortcomings in SCCER CREST – Overall assessment by the SCCER head and shortcomings without recommended action.

Shortcomings in the knowledge production chain		
Overall assessment by the SCCER head		Recommended action
Cooperation and collaboration with industry and municipalities is established. – Current working group «new business models» with industry. – Cooperation with national/cantonal policy makers has been launched: Grimsel workshop, planned white papers. Own understanding as agent of change. – Projects in Winterthur and St. Gallen. Utilities: Collaboration with SIG Geneva, contacts with BS and SG – Contacts/cooperation with public administrations by projects of CREST partners		Ensure ongoing cooperation with policy makers/public administrations and delivery of planned white papers. Policy makers are supposed to participate in workshops and conferences with the target of knowledge transfer and exchange.
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
-	-	-

Table 51: Shortcomings in the knowledge production chain in SCCER CREST – Overall assessment by the SCCER head and shortcomings without recommended action.

A-3.7 Efficient Technologies and Systems for Mobility (MOBILITY)

Thematic shortcomings SCCER MOBILITY	
Overall assessment by the SCCER head	Recommended action
Basically good thematic coverage of topics from the call, except socio-economic mobility research and integration of decentralized renewable electricity generation. With the funding available ist is not possible to deal comprehensively with all of the subjects of the call. Integration of decentralized renewable electricity generation is	Require uptake/extension of socio-economic energy research and systemic research in MOBILITY. Check if this

Thematic shortcomings SCCER MOBILITY		
therefore not considered to be a priority topic for MOBILITY (→ FURIES; MOBILITY-co-head Vezzini participates also in FURIES). There is an agreement with HaE that portable batteries are dealt with in In MOBILITY systemic issues are very important. Accordingly the socio-economic research of such topics in MOBILITY is not adequate and sufficient. Socio-economic research in CREST follows the specific CREST agenda and does not cover thematically the most relevant areas of socio-economic research in MOBILITY. Therefore, MOBILITY should to establish an own major research focus on socio-economic and systemic issues. Collaboration with CREST might make sense but a clear division of work is needed		needs additional funding and provide additional funding in phase 2 if this is necessary to ensure adequate research activities.
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Link between living and working	Missing link could be a shortcoming	No action

Table 52: Thematic shortcomings in SCCER MOBILITY – Overall assessment by the SCCER head and shortcomings without recommended action.

Institutional shortcomings SCCER MOBILITY		
Overall assessment by the SCCER head		Recommended action
Good involvement of academic research institutions, including UAS. There are more qualified researchers and ideas in Switzerland than available funding. For the future research of MOBILITY, there is need for researchers who have the potential to build up and finance a research group. Common projects of MOBILITY and CREST need additional funding to be carried out.		Check if additional funding is needed for inter-SCCER cooperation (MOBILITY / CREST)
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
University of Basel (fuel cells)	Much more basic fuel cell research.	No action

Table 53: Institutional shortcomings in SCCER MOBILITY – Overall assessment by the SCCER head and shortcomings without recommended action.

Shortcomings in the knowledge production chain		
Overall assessment by the SCCER head		Recommended action
Considers the spectrum of the knowledge production chain more or less covered. MOBILITY has common projects with more than 20 (also international) partners It is too early to expect already implementation and bringing to the market of new products and services emerging from the SCCER research. At the time being, the most likely shortcomings are in the development towards serial products and services, the development of business models, establishing of new services and service providers and in logistics. But it is expected that such results become real in the near future. Most challenging is the sustaining building up of partnerships for long run projects.		-
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Intelligent communication concepts and systems, traffic management systems are not covered	These topics are missing.	No action (clarify if participation in 2nd phase would bring added value and relevance is high enough to justify allocation of available funds.)
Industry cooperation still has to be substantiated	System integration of projects, services and products from industry partners has to be ensured in the process of further developing MOBILITY activities	Ensure more involvement of industry partners: Collaboration and cooperation

Table 54: Shortcomings in the knowledge production chain in SCCER MOBILITY – Overall assessment by the SCCER heads and shortcoming without recommended action.

A-3.8 Biomass for Swiss Energy Future (BIOSWEET)

Thematic shortcomings SCCER BIOSWEET		
Overall assessment by the SCCER head and the experts		Recommended action
– The topics of the call for bids in the action area «Biomass» cover the relevant issues and are well reflected in the roadmap of BIOSWEET. Particularly relevant are the topics of the potential of biomass, biogas for power and heat generation and gaseous and liquid energy carriers from biomass. – The framing conditions of bioenergy are difficult in Switzerland. The large utilities do not have bioenergy in their focus (see also subchapter on the coverage of the knowledge production chain). – In order to bring forward bioenergy, research on different sources and processing paths has to been conducted. Otherwise we risk backing the wrong horse. However, such an approach results in flagship project of smaller scale. – Other experts state, that there is a desire for focusing on the most promising technologies. – Furthermore, technologies with a low TRL need more time for market integration than the time frame of the SCCER. Therefore continuity is needed.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
Genetically modified microbiological methods	Genetically modified microbiological methods are not applied in BIOSWEET. Reason: No research partner with required competences could be found. Additionally, the legislative framework regarding GMO was unclear.	No action (clarify if take up in 2nd phase would bring added value and relevance is high enough to justify allocation of available funds.)

Table 55: Thematic shortcomings in SCCER BIOSWEET – Overall assessment by the SCCER head and shortcomings without recommended action.

Institutional shortcomings BIOSWEET		
Overall assessment by the SCCER head and the experts		Recommended action
– The results from the screening in the application phase were that mainly the UAS and ETH Domain are conducting research in the area of Biomass. Microbiological topics are mainly covered by the UAS, whereas thermochemical processes are mainly covered by the ETH Domain. Universities were barely active in the topic. – Cooperation within the SCCER is crucial for the success of BIOSWEET. – The relevant players are part of BIOSWEET with the exemption of Prof. Nussbaumer.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
UNIGE Systèmes énergétiques,	Systèmes énergétiques (Prof. Lachal) could be of relevance for BIOSWEET.	No action (clarify if participation in 2nd phase would bring added value and relevance is high enough to justify allocation of available funds.)
EMPA	EMPA is not part of BIOSWEET, but of MOBILITY. The cooperation is established. BIOSWEET has biofuels to be tested by the EMPA.	No action

Table 56: Institutional shortcomings in SCCER BIOSWEET – Overall assessment by the SCCER head and shortcomings without recommended action.

Shortcomings in the knowledge production chain	
Overall assessment by the SCCER head and the experts	Recommended action
– Basic research and pilots are well covered by BIOSWEET. Prototypes exist for some technologies (fermentation). But there are no pilots or prototypes for thermochemical processes, due to the high investment costs. Therefore the support from large players is needed.	

Shortcomings in the knowledge production chain		
– BIOSWEET focuses on applied basic research (low TRL). – The unique selling point of bioenergy is the capability of seasonal storage. In order to improve the attractiveness of the topic, energy policy measures for the compensation of the seasonal storage are needed. – BIOSWEET has a WTT-Officer since 1 October 2015.		
Shortcomings without recommended action	Reasons for and relevance of the shortcoming	Recommended action
-	-	-

Table 57: Shortcomings in the knowledge production chain in SCCER BIOSWEET – Overall assessment by the SCCER head and shortcomings without recommended action.

A-4 Experts interviewed

The following table lists all experts with whom phone interviews were done, including details on their institution/position.

Expert	Institution/Position
SCCER heads	
Dr. Peter Richner	FEEB&D
Prof. Dr. Philipp Rudolf von Rohr	EIP
Georgios Sarantakos (Program Manager)	FURIES
Prof. Dr. Thomas Justus Schmidt	HES/HaE
Prof. Dr. Domenico Giardini	SoE
Prof. Dr. Frank Krysiak	CREST
Prof. Dr. Konstantinos Boulouchos	MOBILITY
Prof. Dr. Oliver Kröcher	BIOSWEET
Research area manager SFOE-research	
A. Eckmanns	Area Manager of I.1 Energie in Gebäuden II.4 Solarwärme und Wärmespeicherung
M. Pulfer	Area Manager I.2 Verkehr I.3 Akkumulatoren und Superkondensatoren I.4 Industrielle Prozesse (IP) II.5 Wärmepumpen
M. Moser	Area Manager I.5 Elektrizitätstechnologien und -anwendungen I.6 Netze II.8 Wasserkraft
S. Hermle	Area Manager I.7 Wärme-Kraft-Kopplung (WKK) I.8 Verbrennung II.6 Holzenergie II.7 Biomasse (ohne Holz)
G. Siddiqi	Area Manager I.9 Kraftwerk 2020 und Carbon Capture & Storage (CCS) II.9 Geothermie
S. Oberholzer	Area Manager I.10 Brennstoffzellen II.1 Wasserstoff II.2 Photovoltaik II.3 Industrielle Solarenergienutzung (Solare Hochtemperaturprozesse)
G. Darbre	Area Manager II.11 Talsperren
A.K. Faust	Area Manager IV.1 Energie - Wirtschaft - Gesellschaft (EWG)
Evaluation Panel SCCER	
Stefan Nowak	Member of the core group of the evaluation panel SCCER
Philippe Thalmann	Member of the core group of the evaluation panel SCCER

Table 58: Experts interviewed by phone for Modul 1

A-5 References from the statistics on energy research regarding to institutional shortcomings

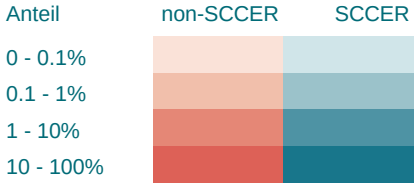
The Swiss Federal Office of Energy (SFOE)'s statistics on energy research comprehend data on research projects, development projects and demonstration projects on energy in Switzerland. Only projects party or fully funded by public authorities (Swiss federation, cantons, communities), the Swiss National Science Fund (SNSF), the Commission for Technology and Innovation (CTI) or the European Commission are included (Statistics on energy research of 2013, SFOE 2015).

The following tables reference institutional shortcomings in the eight SCCERs. Research institutions doing research that is relevant to the respective SCCER but are not involved represent possible institutional shortcomings in the SCCER consortia. Among those, special attention must be given to research institutions receiving more than 1% of the public budget in a given research area (marked dark red in the tables below).

SCCER Future Energy Efficient Buildings & Districts (FEEB&D)

2010 - 2014 FORSCHUNGSSTÄTTE / FORSCHUNGSGEBIETE	Total	ETH-Bereich						Uni										FH								Privatwirtschaft
		ETHZ	EPFL	EMPA	PSI	EAWAG	WSL	Universität Basel	Universität Bern	Universität Freiburg / Université de Fribourg	Université de Genève	Université de Lausanne	Universität Luzern	Université de Neuchâtel	Universität Zürich	Universität St. Gallen	Università della Svizzera italiana	Berner Fachhochschule	Fachhochschule Nordwestschweiz	Fachhochschule Ostschweiz	Hochschule Luzern	Haute Ecole Spécialisée de Suisse occidentale	Fachhochschule Kalaidos	Scuola universitaria professionale della Svizzera italiana	Zürcher Fachhochschule	
I. EFFIZIENTE ENERGIENUTZUNG	169.68	46.06	6.63	41.43	29.68	0.00	0.00	0.52	0.60	0.00	0.43	0.00	0.00	0.00	0.05	0.30	0.00	1.19	2.84	3.11	11.16	10.71	0.00	1.19	6.00	7.80
1.1 Energie in Gebäuden	70.12	19.23	2.70	24.65	0.00	0.00	0.00	0.00	0.55	0.00	0.26	0.00	0.00	0.00	0.05	0.00	0.00	0.94	1.17	0.22	7.04	6.03	0.00	1.15	2.81	3.32
1.4 Elektrizitätstechnologien & -anwendungen	48.51	18.69	2.62	8.67	0.74	0.00	0.00	0.00	0.06	0.00	0.08	0.00	0.00	0.00	0.00	0.30	0.00	0.05	1.52	2.86	3.88	4.46	0.00	0.04	2.11	2.44
1.6 Wärme-Kraft-Kopplung (WKK)	4.01	1.29	0.00	1.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.03	0.00	0.20	0.00	0.00	0.00	0.57
1.7 Brennstoffzellen	47.04	6.85	1.31	6.33	28.94	0.00	0.00	0.52	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.24	0.01	0.00	0.00	1.08	1.48
II. ERNEUERBARE ENERGIEN	102.63	37.01	4.60	12.38	22.01	0.00	0.00	0.17	0.00	0.00	0.14	0.01	0.00	0.39	0.00	0.02	0.00	0.68	2.06	6.88	3.66	4.42	0.00	0.02	2.58	5.58
2.1 Sonnenenergie																										
2.1.1 Solarwärme (aktive und passive Nutzung, inkl. Wärmespeicherung)	32.61	14.49	0.95	9.04	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.22	5.17	0.50	1.13	0.00	0.01	0.18	0.76
2.3 Umgebungswärme (inkl. Wärmepumpen, Kälte)	6.92	1.10	0.68	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.22	1.60	1.29	0.53	0.00	0.00	0.00	0.50
2.4 Biomasse & Holz (inkl. Abfälle, Klärschlamm)	38.21	0.23	2.36	3.34	22.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.62	0.11	1.87	2.77	0.00	0.00	2.16	2.06
2.5 Geothermie	24.90	21.19	0.62	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.01	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.24	2.26
2.6 Windenergie	142.74	30.13	19.27	44.37	13.65	0.00	0.00	0.38	0.00	0.00	0.14	0.00	0.00	0.05	0.17	0.05	0.00	2.02	0.74	14.14	0.95	2.28	0.00	3.21	2.64	8.54
TOTAL	272.31	83.07	11.23	53.81	51.69	0.00	0.00	0.68	0.60	0.00	0.57	0.01	0.00	0.39	0.05	0.32	0.00	1.88	4.90	9.98	14.82	15.13	0.00	1.21	8.58	13.38
							199.80										2.63								56.50	

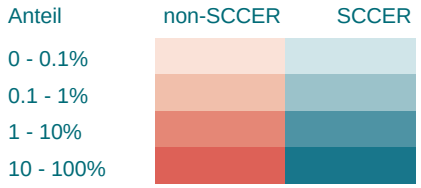
Table 59: Relevant research institutions in the research areas relevant to SCCER Future Energy Efficient Buildings & Districts (FEEB&D) (source: statistics on energy research 2010 – 2013).
Institutions marked blue are part of SCCER FEEB&D
Caption: Share of the research institutions in the total budget in the respective research area



SCCER Efficiency of Industrial Processes (EIP)

2010 - 2014 FORSCHUNGSSTÄTTE / FORSCHUNGSGEBIETE	Total	ETH-Bereich						Uni										FH								Privatwirtschaft
		ETHZ	EPFL	EMPA	PSI	EAWAG	WSL	Universität Basel	Universität Bern	Universität Freiburg / Université de Fribourg	Université de Genève	Université de Lausanne	Universität Luzern	Université de Neuchâtel	Universität Zürich	Universität St. Gallen	Università della Svizzera italiana	Berner Fachhochschule	Fachhochschule Nordwestschweiz	Fachhochschule Ostschweiz	Hochschule Luzern	Haute Ecole Spécialisée de Suisse occidentale	Fachhochschule Kalaidos	Scuola universitaria professionale della Svizzera italiana	Zürcher Fachhochschule	
I. EFFIZIENTE ENERGIENUTZUNG	183.82	42.50	8.25	29.59	71.26	0.00	0.00	0.82	0.06	0.00	0.17	0.03	0.00	0.00	0.00	0.30	0.00	0.47	4.11	4.09	4.97	6.69	0.00	0.37	4.68	5.46
1.4 Elektrizitätstechnologien & -anwendungen	48.51	18.69	2.62	8.67	0.74	0.00	0.00	0.00	0.06	0.00	0.08	0.00	0.00	0.00	0.00	0.30	0.00	0.05	1.52	2.86	3.88	4.46	0.00	0.04	2.11	2.44
1.6 Wärme-Kraft-Kopplung (WKK)	4.01	1.29	0.00	1.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.03	0.00	0.20	0.00	0.00	0.00	0.57
1.7 Brennstoffzellen	47.04	6.85	1.31	6.33	28.94	0.00	0.00	0.52	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.24	0.01	0.00	0.00	1.08	1.48
1.8 Verbrennung	58.51	9.17	0.00	12.81	33.67	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.09	1.91	0.00	0.00	0.00	0.00	0.33	0.01	0.48
1.10 Verfahrenstechnische Prozesse (VTP)	25.76	6.51	4.32	0.00	7.91	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.53	1.20	0.85	2.01	0.00	0.00	1.48	0.51
II. ERNEUERBARE ENERGIEN	24.90	21.19	0.62	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.01	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.24	2.26
2.1 Sonnenenergie																										
2.1.3 Industrielle Solarenergienutzung (Solare Hochtemperaturprozesse)	36.58	14.09	0.49	0.00	13.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.79	0.00	0.00	0.00	0.61	0.00	1.29
2.5 Geothermie	24.90	21.19	0.62	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.01	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.24	2.26
TOTAL	208.72	63.70	8.87	29.59	71.26	0.00	0.00	0.99	0.06	0.00	0.17	0.05	0.00	0.39	0.00	0.30	0.00	0.47	4.11	4.09	4.97	6.69	0.00	0.38	4.92	7.72
							173.42										1.94								25.63	

Table 60: Relevant research institutions in the research areas relevant to SCCER Efficiency of Industrial Processes (EIP) (source: statistics on energy research 2010 – 2013). Institutions marked blue are part of SCCER EIP
Caption: Share of the research institutions in the total budget in the respective research area



SCCER Future Swiss Electrical Infrastructure (FURIES)

2010 - 2014 FORSCHUNGSSTÄTTE / FORSCHUNGSGEBIETE	Total	ETH-Bereich						Uni										FH								Privatwirtschaft
		ETHZ	EPFL	EMPA	PSI	EAWAG	WSL	Universität Basel	Universität Bern	Universität Freiburg / Université de Fribourg	Université de Genève	Université de Lausanne	Universität Luzern	Université de Neuchâtel	Universität Zürich	Universität St. Gallen	Università della Svizzera italiana	Berner Fachhochschule	Fachhochschule Nordwestschweiz	Fachhochschule Ostschweiz	Hochschule Luzern	Haute Ecole Spécialisée de Suisse occidentale	Fachhochschule Kalaidos	Scuola universitaria professionale della Svizzera italiana	Zürcher Fachhochschule	
I. EFFIZIENTE ENERGIENUTZUNG	24.03	11.40	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.42	0.19	0.17	0.01	0.96	2.74	0.00	1.12	1.26	4.39
1.5 Netze & Systeme	24.03	11.40	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.42	0.19	0.17	0.01	0.96	2.74	0.00	1.12	1.26	4.39
TOTAL	24.03	11.40	1.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.42	0.19	0.17	0.01	0.96	2.74	0.00	1.12	1.26	4.39
		12.46															0.73								6.45	

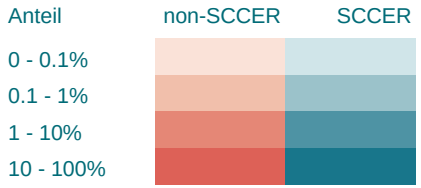
Table 61: Relevant research institutions in the research areas relevant to SCCER Future Swiss Electrical Infrastructure (FURIES) (source: statistics on energy research 2010 – 2013). Institutions marked blue are part of SCCER FURIES
Caption: Share of the research institutions in the total budget in the respective research area

Share	non-SCCER	SCCER
0 - 0.1%		
0.1 - 1%		
1 - 10%		
10 - 100%		

SCCER Heat and Electricity Storage (HaE)

2010 - 2014 FORSCHUNGSSTÄTTE / FORSCHUNGSGEBIETE	Total	ETH-Bereich						Uni										FH								Privatwirtschaft
		ETHZ	EPFL	EMPA	PSI	EAWAG	WSL	Universität Basel	Universität Bern	Universität Freiburg / Université de Fribourg	Université de Genève	Université de Lausanne	Universität Luzern	Université de Neuchâtel	Universität Zürich	Universität St. Gallen	Università della Svizzera italiana	Berner Fachhochschule	Fachhochschule Nordwestschweiz	Fachhochschule Ostschweiz	Hochschule Luzern	Haute Ecole Spécialisée de Suisse occidentale	Fachhochschule Kalaidos	Scuola universitaria professionale della Svizzera italiana	Zürcher Fachhochschule	
I. EFFIZIENTE ENERGIENUTZUNG	11.94	1.35	1.23	4.29	3.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.60	0.70	0.22	0.00	0.00	0.00	0.43
1.3 Akkumulatoren und Supercaps	11.94	1.35	1.23	4.29	3.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.60	0.70	0.22	0.00	0.00	0.00	0.43
II. ERNEUERBARE ENERGIEN	53.98	11.83	5.00	24.87	10.17	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	1.41
2.1 Sonnenenergie																										
2.1.1 Solarwärme (aktive und passive Nutzung, inkl. Wärmespeicherung)	32.61	14.49	0.95	9.04	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.22	5.17	0.50	1.13	0.00	0.01	0.18	0.76
2.2 Wasserstoff	53.98	11.83	5.00	24.87	10.17	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.39	0.00	0.00	0.00	1.41
TOTAL	65.92	13.19	6.23	29.15	13.29	0.00	0.00	0.00	0.00	0.00	0.31	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.60	0.70	0.61	0.00	0.00	0.00	1.84
							61.86										0.31								1.91	

Table 62: Relevant research institutions in the research areas relevant to SCCER Heat and Electricity Storage (HaE) (source: statistics on energy research 2010 – 2013). Institutions marked blue are part of SCCER HaE
Caption: Share of the research institutions in the total budget in the respective research area



SCCER Supply of Electricity (SoE)

2010 - 2014 FORSCHUNGSSTÄTTE / FORSCHUNGSGEBIETE	Total	ETH-Bereich						Uni										FH								Privatwirtschaft
		ETHZ	EPFL	EMPA	PSI	EAWAG	WSL	Universität Basel	Universität Bern	Universität Freiburg / Université de Fribourg	Université de Genève	Université de Lausanne	Universität Luzern	Université de Neuchâtel	Universität Zürich	Universität St. Gallen	Università della Svizzera italiana	Berner Fachhochschule	Fachhochschule Nordwestschweiz	Fachhochschule Ostschweiz	Hochschule Luzern	Haute Ecole Spécialisée de Suisse occidentale	Fachhochschule Kalaidos	Scuola universitaria professionale della Svizzera italiana	Zürcher Fachhochschule	
I. EFFIZIENTE ENERGIENUTZUNG	20.02	2.33	0.93	7.74	3.78	0.00	0.00	0.00	0.03	0.00	0.00	0.38	0.00	0.10	0.00	0.00	0.00	0.01	0.43	0.00	0.00	0.55	0.00	0.00	1.01	2.74
1.9 Kraftwerk 2020 & CCS	20.02	2.33	0.93	7.74	3.78	0.00	0.00	0.00	0.03	0.00	0.00	0.38	0.00	0.10	0.00	0.00	0.00	0.01	0.43	0.00	0.00	0.55	0.00	0.00	1.01	2.74
II. ERNEUERBARE ENERGIEN	36.78	26.65	3.60	0.03	0.00	0.05	0.00	0.17	0.40	0.00	0.00	0.01	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	1.10	1.63	0.00	0.01	0.24	2.49
2.5 Geothermie	24.90	21.19	0.62	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.01	0.00	0.39	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.24	2.26
2.7 Wasserkraft und 2.8 Stauanlagen	11.88	5.46	2.98	0.03	0.00	0.05	0.00	0.00	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	1.63	0.00	0.00	0.00	0.23
TOTAL	56.80	28.98	4.53	7.76	3.78	0.05	0.00	0.17	0.43	0.00	0.00	0.40	0.00	0.49	0.00	0.00	0.00	0.01	0.43	0.00	1.10	2.19	0.00	0.01	1.25	5.23
							45.10										1.48								4.99	

Table 63: Relevant research institutions in the research areas relevant to SCCER Supply of Electricity (SoE) (source: statistics on energy research 2010 – 2013). Institutions marked blue are part of SCCER SoE
Caption: Share of the research institutions in the total budget in the respective research area

Anteil	non-SCCER	SCCER
0 - 0.1%		
0.1 - 1%		
1 - 10%		
10 - 100%		

SCCER in Energy, Society and Transition (CREST)

2010 - 2014 FORSCHUNGSSTÄTTE / FORSCHUNGSGEBIETE	Total	ETH-Bereich						Uni										FH								Privatwirtschaft
		ETHZ	EPFL	EMPA	PSI	EAWAG	WSL	Universität Basel	Universität Bern	Universität Freiburg / Université de Fribourg	Université de Genève	Université de Lausanne	Universität Luzern	Université de Neuchâtel	Universität Zürich	Universität St. Gallen	Università della Svizzera italiana	Berner Fachhochschule	Fachhochschule Nordwestschweiz	Fachhochschule Ostschweiz	Hochschule Luzern	Haute Ecole Spécialisée de Suisse occidentale	Fachhochschule Kalaidos	Scuola universitaria professionale della Svizzera italiana	Zürcher Fachhochschule	
IV. ENERGIEWIRTSCHAFTLICHE GRUNDLAGEN UND TRANSFER	29.22	16.16	2.52	0.00	4.94	0.00	0.00	0.36	0.00	0.00	0.40	1.02	0.00	0.01	0.09	0.33	0.00	0.04	0.01	0.19	0.07	0.44	0.00	0.00	1.36	1.28
4.1 Energiewirtschaftliche Grundlagen (EWG)	29.22	16.16	2.52	0.00	4.94	0.00	0.00	0.36	0.00	0.00	0.40	1.02	0.00	0.01	0.09	0.33	0.00	0.04	0.01	0.19	0.07	0.44	0.00	0.00	1.36	1.28
TOTAL	29.22	16.16	2.52	0.00	4.94	0.00	0.00	0.36	0.00	0.00	0.40	1.02	0.00	0.01	0.09	0.33	0.00	0.04	0.01	0.19	0.07	0.44	0.00	0.00	1.36	1.28
							23.62										2.22								2.10	

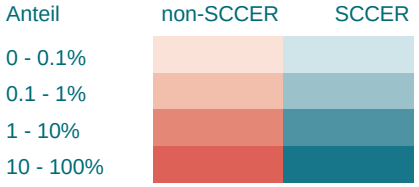
Table 64: Relevant research institutions in the research areas relevant to SCCER in Energy, Society and Transition (CREST) (source: statistics on energy research 2010 – 2013). Institutions marked blue are part of SCCER CREST
Caption: Share of the research institutions in the total budget in the respective research area

Anteil	non-SCCER	SCCER
0 - 0.1%		
0.1 - 1%		
1 - 10%		
10 - 100%		

SCCER Efficient Technologies and Systems for Mobility (MOBILITY)

2010 - 2014 FORSCHUNGSSTÄTTE / FORSCHUNGSGEBIETE	Total	ETH-Bereich						Uni										FH								Privatwirtschaft
		ETHZ	EPFL	EMPA	PSI	EAWAG	WSL	Universität Basel	Universität Bern	Universität Freiburg / Université de Fribourg	Université de Genève	Université de Lausanne	Universität Luzern	Université de Neuchâtel	Universität Zürich	Universität St. Gallen	Università della Svizzera italiana	Berner Fachhochschule	Fachhochschule Nordwestschweiz	Fachhochschule Ostschweiz	Hochschule Luzern	Haute Ecole Spécialisée de Suisse occidentale	Fachhochschule Kalaidos	Scuola universitaria professionale della Svizzera italiana	Zürcher Fachhochschule	
I. EFFIZIENTE ENERGIENUTZUNG	105.33	21.57	5.81	23.05	35.96	0.09	0.00	0.60	0.90	0.56	0.08	0.00	0.27	0.00	0.00	0.00	0.00	1.89	1.02	0.85	2.42	2.69	0.00	0.55	3.56	3.46
1.2 Verkehr	46.35	13.37	3.28	12.44	3.90	0.09	0.00	0.08	0.90	0.56	0.00	0.00	0.27	0.00	0.00	0.00	0.00	1.68	1.02	0.25	1.48	2.46	0.00	0.55	2.48	1.56
1.3 Akkumulatoren und Supercaps	11.94	1.35	1.23	4.29	3.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.60	0.70	0.22	0.00	0.00	0.00	0.43
1.7 Brennstoffzellen	47.04	6.85	1.31	6.33	28.94	0.00	0.00	0.52	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.00	0.00	0.24	0.01	0.00	0.00	1.08	1.48
TOTAL	105.33	21.57	5.81	23.05	35.96	0.09	0.00	0.60	0.90	0.56	0.08	0.00	0.27	0.00	0.00	0.00	0.00	1.89	1.02	0.85	2.42	2.69	0.00	0.55	3.56	3.46
							86.48										2.41								12.98	

Table 65: Relevant research institutions in the research areas relevant to SCCER Efficient Technologies and Systems for Mobility (MOBILITY) (source: statistics on energy research 2010 – 2013). Institutions marked blue are part of SCCER MOBILITY
Caption: Share of the research institutions in the total budget in the respective research area



SCCER Biomass for Swiss Energy Future (BIOSWEET)

2010 - 2014 FORSCHUNGSSTÄTTE / FORSCHUNGSGEBIETE	Total	ETH-Bereich						Uni										FH								Privatwirtschaft
		ETHZ	EPFL	EMPA	PSI	EAWAG	WSL	Universität Basel	Universität Bern	Universität Freiburg / Université de Fribourg	Université de Genève	Université de Lausanne	Universität Luzern	Université de Neuchâtel	Universität Zürich	Universität St. Gallen	Università della Svizzera italiana	Berner Fachhochschule	Fachhochschule Nordwestschweiz	Fachhochschule Ostschweiz	Hochschule Luzern	Haute Ecole Spécialisée de Suisse occidentale	Fachhochschule Kalaidos	Scuola universitaria professionale della Svizzera italiana	Zürcher Fachhochschule	
I. EFFIZIENTE ENERGIENUTZUNG	62.51	10.45	0.00	14.60	33.67	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.09	2.06	0.03	0.00	0.20	0.00	0.33	0.01	1.04
1.6 Wärme-Kraft-Kopplung (WKK)	4.01	1.29	0.00	1.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.15	0.03	0.00	0.20	0.00	0.00	0.00	0.57
1.8 Verbrennung	58.51	9.17	0.00	12.81	33.67	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.09	1.91	0.00	0.00	0.00	0.00	0.33	0.01	0.48
II. ERNEUERBARE ENERGIEN	38.21	0.23	2.36	3.34	22.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.62	0.11	1.87	2.77	0.00	0.00	2.16	2.06
2.4 Biomasse & Holz (inkl. Abfälle, Klärschlamm)	38.21	0.23	2.36	3.34	22.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.68	0.62	0.11	1.87	2.77	0.00	0.00	2.16	2.06
TOTAL	100.72	10.68	2.36	17.94	55.68	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.77	2.68	0.14	1.87	2.97	0.00	0.33	2.17	3.10
							86.66										0.03								10.93	

Table 66: Relevant research institutions in the research areas relevant to SCCER Biomass for Swiss Energy Future (BIOSWEET) (source: statistics on energy research 2010 – 2013). Institutions marked blue are part of SCCER BIOSWEET
Caption: Share of the research institutions in the total budget in the respective research area

Anteil	non-SCCER	SCCER
0 - 0.1%		
0.1 - 1%		
1 - 10%		
10 - 100%		