Innosuisse — Swiss Innovation Agency

SCCER Accompanying Research 2017–2019

Module 3a: Preparations for the permanent establishment of the SCCERs

Final report
Zurich, 12 July 2019

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Editorial Information

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Summary

The Swiss Competence Centers for Energy Research (SCCERs) aim to establish and operate interdisciplinary research networks between higher education institutions (HEIs). The eight SCCERs were initiated in 2013/2014. The focus of the first funding period, from 2013 to 2016, was to establish the centers, networks, and collaboration. The second funding period, from 2017 to 2020, is intended to consolidate the networks and cooperation, and to strengthen interdisciplinary collaboration. The SCCER concept — encompassing coordination, cooperation, and the capacity that has been established — is to be continued on a sustainable basis in the long term.

The present study investigates activities, perspectives, and needs with a view to the continuation of the SCCER concept. A total of 34 qualitative interviews were conducted with selected experts and with representatives of higher education institutions.

Empirical results

All interviewees stated that SCCER funding has made a positive overall contribution to Energy Strategy 2050 objectives. The networks and collaboration that have been established are considered particularly valuable, while the capacity that has been built up provides the necessary energy research momentum.

The most important factors are the availability of funds, a framework for coordination, and experiences with cooperation. Depending on the particular form that these factors take, they either support or hinder the permanent establishment of the SCCER concept.

Higher education institutions have stated their commitment to maintaining their new capacity — that established during the SCCER funding period — after 2020. However, the empirical findings show that these statements are not specific, their fulfilment is unclear, and there is uncertainty about the feasibility of maintaining all of the capacity that has been created. Established professorships are nonetheless likely to be maintained. The SCCERs had only few preparatory activities ongoing or planned at the time the interviews were conducted during the first half of 2018. Innosuisse expects the SCCERs to take responsibility for preparations, but the SCCER heads generally believe that the process should be led by Innosuisse, the Federal Energy Research Commission CORE, and the State Secretariat for Education, Research and Innovation SERI. The SCCERs – and HEIs in general – are thus awaiting the new Federal Council dispatch on the promotion of education, research and innovation for the 2021–2024 period.

Conclusions and recommendations

The SCCER concept creates added value by coordinating and fostering interdisciplinary collaboration between different higher education institutions and building up needed capacity. It should therefore be maintained.

The preparatory activities that have been reported are not yet sufficient to maintain the SCCER concept. Instead of seeking new funding options for the capacity that has been established, to replace SCCER funds that may no longer be available, the SCCERs have been rather inactive. HEIs do not feel responsible for preparations, and have thus done little. Given the vague statements made in the letters of intent, Innosuisse should have asked HEIs and SCCERs to report what activities they were considering or planning. Furthermore, the fact that the process of defining the future of energy research funding after 2020 began relatively late has created uncertainty for both SCCERs and HEIs that might impact negatively on the continuation of the SCCER concept.

Under the current circumstances, capacity, coordination and collaboration in energy research will be reduced without federal funding after 2020. Established professorships will be kept, but other current research and management capacity may not. The number of these positions is likely to fall because, to a large extent, they depend on available funding, and it is unlikely that other funding sources will be sufficient fully to make up for the federal funding that has been lost.

The following recommendations build on the measures that have been identified as necessary to foster the positive development of the SCCER concept:

- The added value of the SCCER concept should be maintained. Therefore, the path of coordinated energy research should be continued. In this way, energy research can be managed and coordinated to maximise its contribution to Energy Strategy 2050 objectives.
- HEIs, professorships, and SCCERs should become more engaged in finding options to maintain coordination and cooperation, and to sustain the capacity that has been created to date. The federal administration should demand that preparations be expanded.
- A long-term strategy should be developed by the federal administration (SERI, CORE, SFOE, and Innosuisse). It should define the needs and principles of energy research and how it should be funded going forward, for at least the next decade. For instance, HEIs should assume a higher share of management costs in the future, and acquire more third-party funds for research projects. Federal SCCER funding could therefore be reduced. This strategy must be laid down as part of a research funding instrument that is updated at regular intervals. The funding instrument should support the SCCER concept by partially financing network management efforts and coordination, as well as by means of a project-based funding

approach. The allocation of project funding should be competitive, and open to all potential partners and HEIs.

Zusammenfassung

Die Kompetenzzentren für Energieforschung (Swiss Competence Centers for Energy Research, SCCERs) sollen interdisziplinäre Forschungsnetzwerke zwischen Hochschulen aufbauen und betreiben. Die acht SCCERs wurden in den Jahren 2013/2014 initiiert. Im Mittelpunkt der ersten Förderperiode (2013 bis 2016) stand der Aufbau der Kompetenzzentren, der Netzwerke und der Zusammenarbeit. In der zweiten Förderperiode (2017 bis 2020) sollen die Netzwerke und die (interdisziplinäre) Zusammenarbeit gestärkt werden. Das SCCER-Konzept – bestehend aus verstärkter Koordination und Zusammenarbeit sowie den aufgebauten Forschungskapazitäten – soll langfristig und nachhaltig weitergeführt werden.

Das Modul 3a der Begleitforschung der SCCER 2017–2019 untersuchte den Bedarf, die vorbereitenden Aktivitäten und die erforderlichen Massnahmen zur Weiterführung des SCCER-Konzepts. Dazu wurden 34 qualitative Interviews mit ausgewählten ExpertInnen und VertreterInnen von Hochschulen geführt.

Empirische Ergebnisse

Die Befragten sind sich einig, dass die finanzielle Förderung der SCCER einen positiven Beitrag zur Zielerreichung der Energiestrategie 2050 leistet. Als besonders wertvoll werden die etablierten Netzwerke und Kooperationen erachtet. Die aufgebauten Forschungskapazitäten haben eine Intensivierung der Energieforschung ermöglicht.

Als wichtigste Faktoren für eine Weiterführung des SCCER-Konzepts werden die Verfügbarkeit von finanziellen Mitteln, die Koordination der Energieforschung sowie die Kooperationserfahrungen genannt. Je nach Ausgestaltung dieser Faktoren unterstützen oder behindern sie die Verstetigung des SCCER-Konzeptes.

Die Hochschulen haben sich grundsätzlich verpflichtet, die durch die Förderung aufgebauten personellen Kapazitäten auch nach 2020 zu erhalten. Die empirischen Ergebnisse zeigen jedoch, dass die von den Hochschulen abgegebenen Absichtserklärungen nicht sehr konkret formuliert sind, deren Erfüllung unklar ist und unsicher ist, ob die gesamten neugeschaffenen Forschungskapazitäten zukünftig erhalten werden können. Die Befragten gehen jedoch davon aus, dass die etablierten Professuren bestehen bleiben werden. Zum Zeitpunkt der Interviews (erste Jahreshälfte 2018) erwähnten nur wenige SCCERs laufende oder geplante vorbereitende Aktivitäten zur längerfristigen Weiterführung des SCCER-Konzepts. Während Innosuisse von den SCCER und den Hochschulen entsprechende Vorbereitungsarbeiten erwartet, vertreten die SCCER die Ansicht, dass der Prozess zur Verstetigung des SCCER-Konzepts von Innosuisse, der Eidgenössischen Energieforschungskommission CORE und dem Staatssekretariat für Bildung, Forschung und Innovation SBFI vorangetrieben werden sollte. Entsprechend warten die SCCER

– und die Hochschulen – die neue Botschaft des Bundesrates zur Förderung von Bildung, Forschung und Innovation für den Zeitraum 2021–2024 ab.

Folgerungen und Empfehlungen

Das SCCER-Konzept schafft einen Mehrwert und sollte daher auch zukünftig weitergeführt werden. Der Mehrwert liegt insbesondere in der Koordination und der Verstärkung der interdisziplinären Zusammenarbeit zwischen verschiedenen Hochschulen und dem Ausbau der Forschungskapazitäten.

Die bisherigen Vorbereitungsarbeiten reichen noch nicht aus, um das SCCER-Konzept längerfristig zu erhalten. Die meisten SCCER waren diesbezüglich nicht sehr aktiv. Insbesondere haben sie sich noch nicht für neue Finanzierungsmöglichkeiten für die geschaffenen Forschungskapazitäten bemüht. Die Hochschulen fühlen sich für die Vorbereitungsarbeiten nicht verantwortlich und haben entsprechend wenig unternommen. Angesichts der vagen Absichtserklärungen der Hochschulen bezüglich des Erhalts der geschaffenen Forschungskapazitäten hätte Innosuisse die Hochschulen und SCCERs auffordern können, ihre diesbezüglichen Pläne zu konkretisieren und deren Umsetzung vorzubereiten. Zu berücksichtigen ist jedoch auch, dass der Prozess seitens des Bundes zur Konkretisierung der Energieforschungsförderung nach 2020 relativ spät gestartet wurde. Daraus ergeben sich für die SCCERs und die Hochschulen Unsicherheiten, die sich nachteilig auf die Fortführung des SCCER-Konzepts auswirken könnten.

Unter den aktuellen Umständen werden die Kapazitäten, die Koordination und die Zusammenarbeit in der Energieforschung ohne weitere zusätzlich Bundesmittel nach 2020 reduziert werden. Etablierte Professuren werden voraussichtlich beibehalten, andere aufgebaute Forschungs- und Managementkapazitäten jedoch nicht unbedingt. Da diese Stellen in hohem Masse von den verfügbaren finanziellen Mitteln abhängen, dürfte sich deren Anzahl reduzieren. Es scheint unwahrscheinlich, dass die wegfallenden Bundesmittel durch andere Finanzierungsquellen kompensiert werden können.

Im Hinblick auf eine längerfristige Weiterführung des SCCER-Konzepts ergeben sich folgende Empfehlungen:

- Aufgrund des erzielten Mehrwerts sollte das SCCER-Konzept bzw. der Weg der koordinierten und verstärkten Energieforschung weitergeführt werden. Dadurch könnte ein möglichst grosser Beitrag an die Ziele der Energiestrategie 2050 geleistet werden.
- Hochschulen, ProfessorInnen und die SCCER sollten sich verstärkt darum bemühen, die Koordination und die Zusammenarbeit sowie die bisher geschaffenen Forschungskapazitäten zu erhalten. Der Bund sollte eine Verstärkung der entsprechenden Vorbereitungsaktivitäten einfordern.

- Der Bund (SERI, CORE, BFE und Innosuisse) sollte ein langfristiges Konzept zur Förderung der Energieforschung erarbeiten. Das Konzept sollte den Bedarf und die Finanzierungsgrundsätze für die künftige Energieforschung festlegen, zumindest für das nächste Jahrzehnt. Die Hochschulen sollten in Zukunft einen höheren Anteil an den Managementkosten übernehmen und mehr Mittel für Forschungsprojekte akquirieren. Entsprechend könnten die Fördermittel des Bundes reduziert werden. Basierend auf dem langfristigen Konzept sollte der Bund ein Förderinstrument ausarbeiten, das in regelmässigen Abständen zu aktualisieren ist. Im Sinne des SCCER-Konzepts sollte das Förderinstrument eine gewisse Unterstützung der Anstrengungen in der Netzwerkarbeit und der Zusammenarbeit sowie eine projektbezogene finanzielle Förderung umfassen. Die Vergabe der Projektmittel sollte wettbewerblich erfolgen und für alle Forschungsinstitute offen sein.

Résumé

Les pôles de compétence interuniversitaires pour la recherche énergétique (Swiss Competence Centers for Energy Research, SCCER) ont pour vocation de créer et d'exploiter les réseaux de recherche interdisciplinaires qui font le lien entre les hautes écoles en Suisse. Ces huit SCCER ont été lancés dans les années 2013/2014.

Alors que durant la première période de financement (2013-2016), il s'agissait avant tout de mettre en place les SCCER, des réseaux et des collaborations, la deuxième période de financement (2017–2020) vise la consolidation des réseaux et de la collaboration (interdisciplinaire). Le système des SCCER, axé sur le renforcement de la coordination et de la collaboration ainsi que sur l'accroissement des capacités de recherche, doit être poursuivi à plus long terme et de manière durable.

Le module 3a d'évaluation des SCCER 2017–2019 a analysé les besoins, les activités préparatoires et les mesures requises pour reconduire le système des SCCER. Cette évaluation se base sur 34 entretiens qualitatifs menés avec des expert-e-s et des représentant-e-s de hautes écoles.

Les résultats des études empiriques

Les personnes interrogées sont unanimes : le soutien financier accordé aux SCCER constitue une contribution efficace à la réalisation des objectifs de la Stratégie énergétique 2050. Les réseaux bien implantés et les coopérations sont considérés comme des facteurs particulièrement positifs. Quant à l'augmentation des capacités de recherche, elle a permis d'intensifier la recherche énergétique.

Les facteurs principaux nommés pour justifier la reconduction du système des SCCER sont les moyens financiers disponibles, la coordination de la recherche énergétique et les expériences faites en matière de coopération. Suivant le poids accordé à ces facteurs, ces derniers facilitent ou freinent la pérennisation du système des SCCER.

Les hautes écoles se sont en principe engagées à maintenir au-delà de 2020 les capacités personnelles mises en place grâce aux soutiens financiers. Les résultats empiriques montrent toutefois que les déclarations d'intention des hautes écoles ne contiennent pas de formulations très concrètes, que leur mise en œuvre reste floue et que rien ne garantit que les capacités de recherche créées en commun puissent être maintenues à l'avenir. Les personnes interrogées pensent en revanche que les chaires bien établies subsisteront. À l'époque de l'entretien, survenu durant le premier semestre de 2018, les SCCER ont été peu nombreux à mentionner des activités en cours ou agendées qui étaient destinées au maintien à long terme du système des SCCER. Alors qu'Innosuisse attend de tels préparatifs de la part des SCCER et des

hautes écoles, les SCCER sont d'avis que le processus de pérennisation du système des SCCER doit être piloté par Innosuisse, la Commission fédérale pour la recherche énergétique CORE et le Secrétariat d'Etat à la formation, à la recherche et à l'innovation (SEFRI). Par conséquent, le SCCER et les hautes écoles sont actuellement dans l'attente du nouveau message relatif à l'encouragement de la formation, de la recherche et de l'innovation pendant les années 2021-2024.

Conclusions et recommandations

Le système des SCEER crée une valeur ajoutée et par conséquent, il mérite d'être pérennisé. Cette valeur ajoutée concerne en particulier la coordination et le renforcement de la collaboration interdisciplinaire entre les hautes écoles, mais aussi les capacités de recherche.

Les travaux menés jusqu'à ce jour pour assurer la pérennité du système des SCCER sont toutefois insuffisants. La plupart des SCCER n'ont pas été particulièrement actifs et ils ont en particulier manqué d'entreprendre les démarches nécessaires pour assurer la poursuite du financement des capacités de recherche nouvellement créées. Les hautes écoles ne se considèrent pas responsables des préparatifs de pérennisation et n'ont pas entrepris grand-chose dans ce but. Les déclarations d'intention des hautes écoles à propos du maintien des capacités de recherche créées auraient dû inciter Innosuisse à demander aux hautes écoles et aux SCCER à concrétiser leurs plans et à préparer leur mise en œuvre. Il faut se rappeler toutefois que la Confédération a lancé plutôt tardivement le processus de concrétisation de l'encouragement de la recherche énergétique au-delà de 2020. Les incertitudes qui en découlent pour les SCCER et les hautes écoles pourraient avoir un impact négatif sur le maintien du système des SCCER.

Dans les conditions actuelles et sans ressources fédérales supplémentaires au-delà de 2020, les capacités, la coordination et les collaborations connaîtront un recul dans le domaine de la recherche énergétique. Si les chaires bien établies ont des chances d'être maintenues, d'autres capacités de recherche et de gestion, mises en place dans ce cadre, ne seront pas nécessairement reconduites. Ces postes dépendant dans une très grande mesure des ressources financières disponibles, leur nombre sera sans doute réduit. Il est peu probable que la contribution financière manquante de la Confédération puisse être compensée par des ressources tierces.

Si le système des SCCER doit être maintenu à long terme, les recommandations ci-après s'imposent :

La valeur ajoutée générée par le système des SCCER incite à poursuivre sur la voie d'une recherche énergétique coordonnée et renforcée, apte à contribuer de manière substantielle à la réalisation des objectifs de la Stratégie énergétique 2050.

Les hautes écoles, les professeur-e-s et les SCCER sont invité-e-s à intensifier leurs efforts pour maintenir les démarches de collaboration et de coordination ainsi que les capacités de recherche créées à ce jour. La Confédération est appelée à demander un renforcement des travaux préparatoires correspondants.

La Confédération (SEFRI, CORE, OFEN et Innosuisse) est invitée à élaborer une conception à long terme pour l'encouragement de la recherche énergétique. Cette conception doit arrêter les besoins en matière de recherche énergétique future ainsi que les modalités de financement de la prochaine décennie au moins. Les hautes écoles devraient ainsi prendre en charge une plus grande partie des frais de gestion et acquérir davantage de ressources pour financer leurs projets de recherche ; les subventions de la Confédération pourraient ainsi être réduites en conséquence. La Confédération est invitée à créer un outil d'encouragement, basé sur la conception à long terme et à actualiser à périodiquement. Conformément à l'esprit des SCCER, cet outil devrait comporter un soutien aux réseaux et à la collaboration ainsi qu'un encouragement financier lié aux projets. Il est souhaitable que les ressources soient allouées sur la base de concours ouverts à tous les instituts de recherche.

1. Introduction

1.1. Tasks and questions

The SCCER initiative aims to achieve the long-term expansion of research capacity, and the sustainable optimisation of the structures of energy research. The SCCERs are part of the 'Swiss Coordinated Energy Research' action plan, jointly managed by Innosuisse and the Swiss National Science Foundation (SNSF).

According to the Federal Council and the SCCER Steering Committee, the SCCER concept is intended to be continued on a sustainable basis in the long term. It should maximise the contribution of research and innovation to the objectives of the Energy Strategy 2050. In our understanding, the continuation of the SCCER concept comprises the following aspects:

- **Capacity:** Maintaining the research capacity that has been established by the participating higher education institutions (HEIs), and self-financing for management positions.
- **Coordination:** Continuing the SCCERs with a common organisational structure and common thematic orientation.
- **Cooperation:** Continued networking and strengthening of cooperation between various types of higher education institution and disciplines, and with industry.

The first SCCER funding period (2013–2016) facilitated the establishment of networks and research collaboration. The current, second SCCER phase (2017–2020) is helping to consolidate the networks and partnerships that have been built up. SCCER funding is organised via the Innosuisse Energy Funding Programme, and will end in 2020. The future of SCCER support and available funding after 2020 is currently under discussion.

This study focuses on preparatory activities on the part of SCCERs, HEIs, and the federal administration, and the additional measures that are needed to establish the SCCER concept on a permanent basis. Factors supporting and hindering the continuation of cooperation after 2020 were of specific interest. The following questions were investigated in qualitative interviews:

1. Is there a need for the SCCER concept to be established on a permanent basis?
2. What factors support and/or hinder the permanent establishment of the SCCER concept?
3. Are preparatory activities sufficient to maintain the SCCER concept?
4. What are the consequences if federal funding for the SCCERs ends after 2020?
5. What measures are needed to maintain the SCCER concept?

This report is based on empirical data collected in the first half of 2018. The findings and initial conclusions were delivered to Innosuisse in June 2018. When the conclusions and recommendations of this study were being drawn up, preparatory activities and discussions about the future of SCCER funding after 2020 were still ongoing. This must be borne in mind when interpreting the results, conclusions, and recommendations.

The SCCER Accompanying Research 2017–2019 is organised into four thematic modules[1]. The subjects of the other modules are not discussed in this report. However, cross references are given where relevant.

1.2. Methodology

Our approach was to combine the individual analyses of the SCCERs with a cross-comparison of the empirical results. For this purpose, we analysed documents and held qualitative interviews. The latter provided the empirical basis of this study.

Document analysis

Documents were analysed before the qualitative interviews took place. This analysis considered relevant conceptual texts (Federal Council 2012, CTI 2013, and CTI 2016), as well as SCCER monitoring and evaluation reports. The documents were reviewed in the light of the set requirements and preparatory activities towards the permanent establishment of the SCCER concept. The findings were used as a basis and as inputs for the interviews. Specifically, prior to interviews with the SCCER heads, relevant SCCER documents such as concepts/plans and monitoring or evaluation reports were reviewed on a sample basis as interview preparation. Two letters of intent from the application for the second SCCER phase were also reviewed. An analysis of letters of intent and their effectiveness with a view to the permanent establishment of the SCCERs did not form part of the SCCER Accompanying Research, however.

Qualitative interviews

In total, 34 qualitative interviews were conducted between December 2017 and June 2018. In a first phase, 22 selected experts were interviewed. These interviews served to identify the objectives and expectations associated with the consolidation of the SCCERs and to examine preparations on the part of the SCCERs, as well as the supporting and hindering factors for each SCCER.

[1] Module 1: Coordination and synthesis; Module 2: Implementation of scientific results; Module 3a: Preparations for the permanent establishment of the SCCERs; Module 3b: Networking and (inter-disciplinary) collaboration; Module 4: Collected set of indicators.

Based on the findings of the first interview phase, 12 additional interviews were conducted in a second phase (see Table 1). The aim of these additional interviews was to gather more insights about the higher education institutions' willingness to establish the SCCERs permanently, and their preparatory activities. Nine representatives of higher education institutions were interviewed. In addition, three interviews with representatives of Innosuisse, SERI, and CORE provided more information from a political perspective.

Table 1: Qualitative interviews with selected experts and HEI representatives

First phase: 22 interviews	**Number of interviews**
3 members of the Innosuisse Energy Funding Programme	1
Chair and members of the SCCER Steering Committee	5
Head and 4 members of the SCCER Evaluation Panel Core Group and 2 technical experts from the SCCER Evaluation Panel	7
One expert and member of the SCCER Accompanying Research 2017–2019 Advisory Group	1
SCCER heads (5, together with the SCCER managers/coordinators)	8
Second phase: 12 additional interviews	
Interviews with board members of Innosuisse and CORE, and department head at SERI	3
Interviews with representatives of HEIs (FHNW, ZHAW, BFH, University of Basel, PSI, Empa, EPFL, ETHZ, UNIGE)	9
Total number of interviews	**34**

A detailed list of interview partners can be found in Annex A1.

Table: INFRAS.

The qualitative interviews were conducted as follows:

- The interviews were held either by telephone or in person and lasted between 30 minutes and two hours. The interview duration depended on the set of questions discussed. First-phase interviews contained questions on all modules of the SCCER Accompanying Research 2017–2019;
- Open-ended questions were asked based on an interview guide comprising the main questions. The interview guide was shared with the person to be interviewed and communicated well in advance. Additional questions raised in the interviews were specified in an internal guide[2];
- Detailed minutes of the interviews were taken, structured according to the questions in the interview guide. Draft minutes were sent to the interviewees for verification.

[2] Two examples of the interview guides that were used can be found in Annex A2.

The findings of the interviews were described in terms of the research questions (cf. Section 2). By means of a cross-comparison, we analysed perceptions of the need for the permanent establishment of the SCCER concept, and examined the factors that support and hinder its continuation. Based on the analysis, and the interpretation of the empirical results, we answered the research questions and gave recommendations for the future of the SCCER concept (cf. Section 3).

2. Empirical results

2.1. Is there a need for the SCCER concept to be established on a permanent basis?

Positive overall contribution of SCCER funding to Energy Strategy 2050 objectives

All interviewees see positive effects from SCCER funding phases one (2013–2016) and two (2017–2020). The networks and collaboration that have been established are considered particularly valuable[3].

Eight out of the nine representatives of higher education institutions (HEIs) who were interviewed indicated that the SCCERs have a positive effect on collaboration between different types of HEI. The SCCERs have also strengthened energy research at HEIs. The participation of HEIs in SCCERs has supported the establishment of energy research focus areas, especially at universities and universities of applied sciences. In addition, three HEI representatives mentioned the integration of industry partners into the SCCER network as a positive effect.

Two general perspectives on the permanent establishment of the SCCER concept

Opinions about the need for the permanent establishment and further development of the SCCER concept are somewhat more diverse than the general view of the positive effects of SCCERs. The answers of the 34 interviewees can be grouped into two general perspectives, shared by 25 and 6 interviewees, respectively[4]. These are as follows:

Perspective 1: The SCCER concept should be maintained

Of the 34 interviewees[5], 25 share the view that the SCCER concept should be continued. These interviewees regard SCCER activities (coordination, networks, and cooperation) and research capacity as valuable and important in achieving Energy Strategy 2050 objectives. They cite the following reasons, specifically:

- The research capacity that has been established generates positive momentum in energy research, and has also increased its importance. In addition, some interviewees point out that awareness has been raised among graduates and researchers, who will leverage their knowledge later in their careers in the private sector. In doing so, they can further advance the Energy Strategy 2050.

[3] The results of Module 3b of the SCCER Accompanying Research support this finding.

[4] Three interviews (members of the Innosuisse Energy Funding Programme, CORE and SERI) cannot be attributed to either of the two perspectives. The interviewees made no statement about this owing to their involvement in the ongoing process.

[5] Five members of the SCCER Steering Committee, three Evaluation Panel members and experts, one member of the Advisory Group, six SCCER heads, and ten interviewees in the second interview phase - including all nine HEI representatives.

- Traditional research in individual domains does not meet current needs. Managing research topics and target-oriented research, as well as an analysis of systems and interrelationships, are key elements in a successful contribution to Energy Strategy 2050 objectives. It is also important to pursue integrated and systemic solutions.
- Networks, cooperation and a focus on transfer from research to use cases and market uptake were named as important success factors. Many interviewees stressed the importance of joint projects, dealing with systemic questions and multiple research partners, and collaborating with industry partners.

Furthermore, in addition to the discussion about the design of any future funding mechanism, three of the interviewees that share the first perspective highlighted various needs in the development of the SCCER concept:

- One member of the Steering Committee stressed that the time horizon of the Energy Strategy – up to 2050 – demands a long-term perspective. A longer time horizon is needed to come up with innovative, disruptive, and systemic solutions.
- Two SCCER heads added that, in addition to the management of research topics and target-oriented research, there must be a strategic analysis of the SCCER concepts' added value in terms of the priorities and levers associated with their contribution to the Energy Strategy 2050.

Perspective 2: Coordinated energy research is needed, but not necessarily the SCCERs as such

Six out of the 34 interviewees[6] share a slightly different view of the need for the SCCER concept in the future. The main difference compared with the first perspective is that these interviewees no longer see a need for the SCCERs as organisations with independent structures. Most of all, the continued financing of networks and cooperation is not seen as necessary to achieve Energy Strategy 2050 objectives. However, the interviewees agree that the two initial SCCER phases were important, and that energy research must be coordinated.

Coordination and management could be achieved without being organised via SCCERs. The networks have been established, and could be maintained post-2020 via new projects that are organised on the basis of calls for submissions. There is thus a need to shift from capacity and management funding to project-specific funding. This is seen as the most important characteristic of federal energy research funding in the future, because it allows requirements to be set and projects to be managed individually. It might be achieved, for example, by defining relevant research topics and setting requirements in project calls for research group composition and cooperation. In this way, there would be no further need for the financing of networks and

[6] Four members and experts of the Evaluation Panel and two SCCER heads.

cooperative structures of today's SCCER framework. Four of these six interviewees described other current funding programmes run by Innosuisse, the SFOE, and the SNSF as sufficient. The SCCERs would therefore not require continued funding after 2020. Two interviewees would nonetheless consider the option of endowing the existing funding programmes with additional funds after 2020, in order to maintain the research capacity that has been established.

Two SCCER heads who share this perspective emphasised that more flexibility is needed in the SCCER structure to cope with changing operating frameworks and research topics. This can also be achieved by funding projects instead of a fixed number of full-time-equivalent staff.

The individual views on the specific means of maintaining coordinated energy research and networks after 2020 are as follows:

- Four interviewees stated that project-specific and competitive funding with requirements for cooperation and topics will be sufficient;
- One interviewee added that, on top of competitive funding, the SCCERs might be integrated into the National Centres of Competence in Research (NCCR) framework;
- One interviewee suggested that a loose construct with very low administrative costs would be sufficient, for instance with two or three annual meetings for networking and exchange.

2.2. What are the supporting and hindering factors?

There are several factors that might support – or hinder – the permanent establishment of the SCCER concept, i.e. the established energy research capacity, coordination, and cooperation. The most important and obvious factor with regard to research capacity is naturally the availability of energy research funding. The factors mentioned most often by the interviewees are listed below, and supported with relevant statements from them.

Main supporting factors related to the permanent establishment of the SCCER concept

1. The availability of energy research funding beyond 2020 would be a positive factor:
   - The SCCER heads and HEI representatives who were interviewed made it clear that research activities are dependent on the available funding. This opinion is shared by most Evaluation Panel and Steering Committee members and experts.
2. The commitment of SCCER heads is seen as an important supporting factor. Even more important is the commitment of the HEIs and professors involved:
   - The CORE, SERI, and Innosuisse view is that the HEIs concerned have an interest in continued energy research. By signing letters of intent, HEIs have also stated their commitment to maintaining established capacity beyond the SCCER funding periods.
   - All nine HEI representatives who were interviewed see an interest in their institution maintaining the energy research activities and capacity that have been established.

Their willingness and commitment are related to the perception that SCCER activities and research capacity have positive effects and generate added value, for example for the research group or the HEI. Five of the HEI representatives pointed out their institution's strong commitment to energy research, as they have invested considerable resources of their own in the field of energy research and in building up research capacity.

3. Successful experience with collaboration supports the continuation of networks and cooperation:
   - Many interviewees said that it was very likely that established collaboration will be continued, and that at least parts of the network would remain. Younger professors, in particular, are likely to continue networks and cooperation in the future.

Main hindering factors related to the permanent establishment of the SCCER concept

1. A reduction in the overall funds available for energy research would negatively affect the continuation of the SCCER concept:
   - Most interviewees state that research capacity will be reduced if less energy research funding is available. Research capacity relies on available funding — such as that from the federal administration, EU, or industrial partners — as they cannot be supported by the HEI's own funds alone (cf. Section 2.4 for more details).
2. HEIs and SCCERs are not able or willing to self-finance management positions for coordination and cooperation:
   - Most interview partners, including those who represent CORE and Innosuisse, expected that coordination and cooperation will be scaled back if there are no additional incentives or support.
   - All nine HEI representatives stated that the institutions are not able or willing to finance administrative positions for networking and coordinating purposes by themselves.
3. A lack of evidence of added value, in particular where research quality and findings are concerned, can impact on willingness to finance SCCER activities:
   - Some interviewees mentioned that a lack of evidence of added value generated by established networks and cooperative projects might be an obstacle to HEIs financing such activities.

2.3. What preparatory activities are ongoing or planned?

This section describes preparatory activities reported by the SCCERs, HEIs, and the federal administration (CORE and SERI). [7]

Preparatory activities on the part of SCCERs

The interviews with the SCCER heads show that the SCCERs have few preparatory activities ongoing or planned. Also, the SCCER documents, such as monitoring and evaluation reports, that were reviewed contained neither information about preparation activities nor plans for the permanent establishment of the SCCER concept. Most SCCERs and HEIs do not see themselves as responsible for such preparations. The general view among the SCCER heads is that the process should be led at the federal administration level (Innosuisse, CORE, and SERI). The SCCERs contribute to federal preparatory activities (cf. 'Preparatory activities on the part of the federal administration' section below) by defining relevant topics for future energy research.

Individual SCCER heads mentioned that the following preparations had been implemented, were ongoing, or were planned:

- Two SCCER heads pointed out their work packages and roadmap, with time horizons beyond 2020. This reflects their commitment to continuing SCCER activities:
  - One of these SCCER heads expects his HEI to be willing to co-finance management costs, if there are federal funds to match.
  - The other SCCER head is endeavouring to secure financial support from the lead HEI to cover management costs. However, if granted this might be at the expense of available research funds.
- One SCCER is in active discussions and a consultation process to clarify the options for internal financing by the higher education institution.
- Three SCCERs are in 'wait and see' mode. They are awaiting the outcomes of CORE's analysis and SERI's proposal for the new Federal Council dispatch on the promotion of education, research and innovation.
- Two SCCER heads pointed out planning difficulties owing to the uncertainty about the programme's future. One of these SCCERs has suspended its project acquisition activities as a result[8].

[7] Note: The statements reflect the status in the first half of 2018, when the interviews were conducted (see Section 1.2).

[8] This decision might have consequences for staff. The enlarged research teams and administrative (coordinating) positions might be affected, as they depend on SCCER funds. Professorships and PhD students are not affected in this case, as they are financed by the HEI's regular budget or funding sources.

Preparatory activities on the part of higher education institutions

The interviewees representing HEIs report no specific preparatory activities that are planned or ongoing in advance of the end of the second SCCER phase. However, six HEI representatives stated that energy research is part of their HEI's strategy, or that energy research planning at their HEI extends beyond 2020. Two HEI representatives mentioned that HEIs can only begin organisational preparations when they know what the post-2020 funding situation will be.

In the SCCER application (cf. CTI 2013 and CTI 2016), HEIs were asked to maintain current research capacity beyond 2020. They had to state this in a letter of intent. The level of commitment described in these letters of intent differs widely, however[9]. The main common element is a motivational statement about the specified professors', research groups' and HEIs' interests and activities in the field of energy research, as well as plans for closer collaboration. Neither of the two letters of intent that were reviewed contains a clear statement about how the HEI intends to finance established research capacity after 2020, or its options in this regard:

- In its letter of intent, one HEI describes its commitment to matching the external funding that can be secured for an assistant professorship. The letter also sets out the HEI's plan to include an increase in research staff beyond 2020 (i.e. the newly established assistant professorship) in its strategic planning.
- The other letter of intent makes a statement about stabilising the financing of existing technical staff and the HEI's laboratory in the long-term. It also sets out its intention to create new research positions. The technical staff and the additional research positions are to be financed from SCCER funds. There is no statement about financing options or intentions after 2020.

It is unclear to a couple of interviewees how their institutions will interpret or realise their letters of intent, and how committed they will be. It will depend on the institution's priorities, the strategic relevance of the SCCER and energy research, and on the institution's financial capabilities. The latter factor is seen as particularly critical for universities of applied sciences owing to their funding system.

Preparatory activities on the part of the federal administration

Innosuisse and other interviewees regard the HEIs' letters of intent as a basis for the permanent establishment of the SCCERs. According to the interviews with CORE, SERI, and Innosuisse there will be no continued funding for research capacity after the second SCCER phase ends in

[9] Note: Two randomly chosen letters of intent from the second SCCER phase application were examined. An analysis of letters of intent and their effectiveness in securing the permanent establishment of SCCERs did not form part of the SCCER Accompanying Research.

2020. However, a discussion of research topic priorities and the future of energy research funds is ongoing. In the course of updating the Federal Council dispatch on the promotion of education, research and innovation for 2021–2024, SERI mandated CORE to work with the SFOE to assess the overall situation. CORE will provide recommendations for general directions and schemes for energy research, and will update the Swiss energy research map. The SCCERs contributed to this process by defining relevant research topics and by taking part in the Swiss Future Energy research workshop held by CORE in February 2018. The decisions by SERI will largely rely on the CORE recommendations (planned for early 2019).

2.4. What are the consequences if federal funding for the SCCERs ends after 2020?

All interviewees share the opinion that a substantial part of today's SCCER activities would disappear if federal funding ceases after 2020:

- The HEI representatives and some of the SCCER heads who were interviewed expect that HEIs will keep established professorships. The research capacity that has been built up is also likely to be maintained, but depends on available funds. If the overall energy research funding that is available contracts, this will eventually lead to a reduction in energy research. That is because, if less energy research funding is available, professors might have problems acquiring sufficient funds to maintain current research group sizes. At universities and universities of applied sciences, in particular, professorships and research staff are dependent on federal and third-party funding, in addition to the HEI's own funds (stated by all five representatives of universities and universities of applied sciences).
- Two SCCER heads expect that researchers, and especially those in the top flight, will leave their research groups before the SCCERs run out of funds. They state that such researchers will look for new positions and change jobs before SCCER research capacity is cut. Professors and research groups might also shift research topic (as stated by one interviewee).
- Coordination is expected to diminish, and cooperation will also be reduced. Most interview partners agreed that HEIs are unwilling or unable to finance additional administrative positions to keep these SCCER activities going. However, in view of the added value that they generate for research institutes and the researchers themselves, well-established partnerships are expected to be continued[10]. About half of the interviewees expect successful cooperation and parts of the network to remain in place. Furthermore, two SCCER heads pointed out that cooperation and research in connection with pilot and demonstrator projects will go forward.

[10] The results of Module 3b of the SCCER Accompanying Research support this finding. Networks and collaboration create added value.

2.5. What measures are needed to maintain the SCCER concept?

Of the 34 interviewees, 27 see a need for continued funding. The achievements of the first two SCCER phases — notably networks and cooperation — as well as complementary and superordinate research (in the sense of a full programme of research) can be maintained if SCCER activities continue to be funded.

Support for coordination, cooperation, and networks

Most of the interviewees share the opinion that activities that are not in the direct interest of the research institute concerned must be funded by other means to maintain SCCER activities at the current level. As the most important examples, they named management activities in connection with networks, and coordination between different types of HEI and different disciplines. This perception was confirmed by all nine HEI representatives who were interviewed. Their appraisal was that their institution and other HEIs in general will not or cannot fund administrative positions to support coordination and collaboration in the SCCER network. Thus, broad and coordinated collaboration is expected to disappear without federal support.

- A total of 21 interviewees, including seven HEI representatives, see a need for administrative support funds that cover the expense of maintaining networks, and coordination and cooperation activities in joint projects.
- Additionally, four of the HEI representatives proposed that requirements for collaboration and consortia could also be integrated into calls for research projects.
- Two HEI representatives pointed out the need for a third SCCER phase in which funding is gradually tapered off.

A more flexible funding scheme for energy research

The interviewees representing CORE and Innosuisse state that retaining the capacity that has now been established will eventually depend on available energy research funds. This perspective is shared by representatives of HEIs and most of the other interviewees. The prevailing opinion is that the funding scheme should be developed further, and should become more flexible:

- Half of the interviewees representing SCCERs, the Evaluation Panel, and the Steering Committee share the opinion that there is a need for a more research programme-based funding scheme, in particular where the Energy Strategy 2050 objectives are concerned.
- Fourteen interviewees advocated the allocation of project funds via competitive tenders. This means that additional funding for energy research projects would be granted on a competitive basis.

- Some interviewees mentioned the following reasons and characteristics with regard to the future of energy research funding:
  - According to three SCCER heads, the project-based funding of research capacity — rather than of the capacity per se — would result in a much more flexible structure. Project partners and research topics could be adjusted much faster according to actual needs.
  - Three HEI representatives also emphasised that a new energy research funding scheme, or any additional funding, should be more easily accessible and open to all researchers, more flexible in terms of collaboration and topics, and less bureaucratic.
- Individual HEI representatives suggested further adjustments:
  - The allocation of research funds should be based on peer reviews to ensure quality and equal opportunities.
  - In the future, particularly as available funds for energy research might contract, a focus on priority topics should be considered. The available funds could thus be concentrated on the most relevant research areas.
  - Knowledge and technology transfer should be supported via other funding schemes, for example by Innosuisse. This approach would promote effective structures and reporting efforts.

Further suggestions for the permanent establishment of the SCCER concept

In addition to continued funding, individual interviewees mentioned further possible measures to support the permanent establishment of the SCCER concept:

- Three SCCER heads suggested new a structure, with HEIs taking the lead. They suggest one of the following options:
  - SCCER ownership should shift to HEIs. The SCCERs should be established as legal entities with institutes as shareholders. The federal administration would still be required to match fundraising, but in return, its representatives would have seats on the board of directors. In addition, since HEIs already have the necessary organisational structures, the Evaluation Panel and the Steering Committee would no longer be needed.
  - HEIs should organise national research hubs. The federal administration would still be required to match fundraising to maintain these hubs.
  - Leadership of SCCERs should shift from Innosuisse to HEIs.
- Two SCCER heads suggested an analysis of the SCCERs' added value. If this value is clear to higher education institutions, they will be more committed to the SCCER venture.

3. Conclusions and recommendations

3.1. Conclusions

The empirical results presented in Section 2 lead to the following conclusions.

Is there a need for the SCCER concept to be established on a permanent basis?

The SCCER concept creates added value and contributes positively to Energy Strategy 2050 objectives[11]. Therefore, the SCCER concept (capacity, coordination, and cooperation) should be maintained to preserve that value. Coordinated energy research and interdisciplinary collaboration are particularly important in respect of Energy Strategy 2050 objectives. In the interests of sustaining the effects of the first two SCCER phases, it is also worth retaining the research capacity that has been established. Two principal interviewee perspectives are described in Section 2.1. The authors share the first of these, because the result would otherwise be a lack of funds for energy research, and less coordination and collaboration.

What factors support and/or hinder the permanent establishment of the SCCERs?

The most important factors are the availability of funds, a framework for coordination, and experience with cooperation. Depending on the particular form that these factors take, they either support or hinder the permanent establishment of the SCCER concept:

- Funding for research capacity can come from different sources. HEIs also have their own funds. However, the funds available for professorships, research capacity, and administrative positions vary considerably between the different types of HEI. They all rely on federal and third-party funding, i.e. industry and others, including the EU, the UN, and industry funding for R&D projects. If the overall funds available for energy research decline, this will have a negative impact on established research capacity. If they stay at the same level, or if funding that is running out can be replaced by other funding sources, this will support the maintenance of that capacity.
- A federal framework for coordinated energy research would support continued activities in this area by HEIs. Similarly, the absence of such a framework would hinder coordinated research.
- Positive experience of collaboration on the part of professors and researchers during the first two SCCER phases support continued cooperation and networking. It also bolsters the commitment of HEIs and SCCER heads to maintaining the SCCER concept. The lack of proof

[11] Note: We are referring here to the SCCER concept and not to the individual SCCERs. The Accompanying Research did not assess the organisational and thematic structure of the SCCERs.

of the SCCERs' added value, and negative experience of collaboration are thus hindering factors, because they can have a negative effect on the willingness of SCCER heads and HEIs to maintain research and collaboration post-2020. This level of commitment, on the part of all of the actors mentioned, is a factor in their involvement in securing funding for capacity and for coordination and cooperation activities.

Are preparatory activities sufficient to maintain the SCCER concept?

The activities described in Section 2.3 on the part of SCCERs, HEIs, and the federal administration are not enough to maintain the SCCER concept after the second SCCER financing period ends: [12]

- None of the reported activities or plans by the SCCERs include acquiring new funding sources for the research capacity or administrative positions that have been established. Most preparations are at the thematic level. There were only two cases in which current activities were reported as striving to establish management capacity to keep coordination and networks/cooperation running. The SCCERs should have been more active, and should already have discussed options with the HEIs involved to secure the SCCER concept after 2020, regardless of the federal funding situation.
- According to the interview results and the letters of intent that were reviewed, HEIs do not believe that they are responsible for ensuring that the SCCER concept continues beyond 2020. The two letters of intent examined on a sample basis do not seem to meet the application requirements in terms of statements and thoughts about the permanent establishment of SCCER-funded research capacity[13]. Thus, HEIs are neither preparing to bring in substitute sources of funding to maintain established research capacity, nor planning to take over management costs for coordination and cooperation (with a few exceptions, where this is being attempted or is under discussion). Based on our assessment of the status of preparatory activities by HEIs, only some elements of the SCCER concept would be continued, in the sense that established professorships would be kept. In general, little has yet been done to maintain other capacity or SCCER activities, such as coordination and cooperation.
- The letters of intent that were accepted in the SCCER application phase appear rather vague, and are not specific about plans for action to establish the SCCER concept on a permanent basis. This should have led Innosuisse to ask HEIs to either formulate the letters of intent in

[12] This assessment is based on the empirical results. It does not consider activities that might have been initiated after the summer of 2018, but were not yet planned when the interviews took place.

[13] CTI (2016) "…higher education institutions must confirm their willingness to continue to sponsor the created positions after 2020 as part of their regular funding budget" (page 9) and "with the letters of commitment (LoC), participating higher education institutions are required to indicate how they intend to maintain funding of the newly created positions from 2020 on-wards after CTI funding has ended" (page 11). Note: We use the term "letter of intent" for both; the demanded "letter of intent" in the application for the first and "letter of commitment" in the application for the second SCCER funding period.

their SCCER application more clearly or, afterwards, to report their intended preparations during the second SCCER phase. As a result, Innosuisse, the lead institute for the Energy Funding Programme, should have demanded that the SCCERs and HEIs develop and report plans or strategies to support the SCCER concept beyond 2020.

- Preparations by the federal administration (SERI and CORE) are very important and will help HEIs and SCCERs to identify the preparatory measures that they themselves need to take. However, the process of defining the energy research funding scheme after 2020[14] is happening at a late point in time and has caused uncertainty. Owing to the uncertainty, there is a risk that the SCCER concept will be discontinued. If the situation after 2020 had been defined at an earlier stage, all of the parties involved could have initiated the appropriate preparations already.

What are the consequences if federal funding for the SCCERs ends after 2020?

Under the current circumstances, and if less federal funding is available for energy research after 2020, research capacity is expected to contract. There will be continued cooperation, but not on the same scale. The end of SCCER funding might also mean the end of systematic, coordinated energy research. The management of thematic and target-oriented research, and its systemic importance in delivering relevant contributions to Energy Strategy 2050 objectives, depend on a federal framework. The following staff consequences are expected if federal funding for the SCCERs ends:

- Research capacity – professorships: HEIs generally want to keep the research capacity that has been created. Current professorships will also be kept, whether or not funding is continued after 2020. However, their research topics might shift over time, depending on the availability of energy research funds.
- Research capacity – researchers: The question about the future of the established research capacity in general – aside from professorships – is a different one. This research capacity is highly dependent on federal and third-party funding. Thus, the decision about whether or not to retain all of the established research capacity is not one for HEIs or professors alone. If less energy research funding is available overall, the consequence will be reduced capacity. This, in turn, will result in a generally decline in energy research momentum.
- Management positions: Based on the empirical results, it is unlikely that HEIs will self-finance the management activities of today's SCCERs. Consequently, coordination, networking, and cooperation will be reduced without federal funding or incentives.

[14] Federal Council dispatch on the promotion of education, research and innovation for the 2021–2024 period.

SCCER heads and HEI representatives might be suspected of giving strategic responses about the need for federal funding. However, their view is also shared by other interviewees who have no obvious motivation to respond strategically. Therefore, the statements appear credible. Moreover, the authors recognise that funding options for HEIs and professorships are limited. It appears unlikely that a loss of federal SCCER funds could be replaced one-to-one by other funds, e.g. from industrial partners or European funds. This was not assessed further in the Accompanying Research, however.

What measures are needed to retain the SCCER concept?

Based on the empirical results, we identify three main measures:

- HEIs, professorships, and SCCERs should become more active to establish the SCCER concept on a permanent basis:
  - SCCERs and HEIs should intensify their efforts to increase the relevance of energy research in their institutions and adopt the SCCER concept into their strategic planning. Efforts should be made to establish structures for coordination and cooperation on a permanent basis at HEIs. Furthermore, research projects following the SCCER roadmaps should be acquired continuously. The federal administration should require HEIs and SCCERs to step up such preparatory activities.
- A long-term strategy would support the positive development of coordinated energy research and avoid the disintegration of SCCERs as a result of emerging uncertainties about their future framework:
  - The strategy should be developed by the federal administration. It should define principles and should also contain the requirements that must be fulfilled for additional energy research to contribute to Energy Strategy 2050 objectives, and the need for and development of additional energy research funds, including a definition of the financing mix (federal contributions and the HEI share, as well as funding from private or industry partners). It should also determine the direction of research as it affects technology readiness levels (TRLs), and should have a time horizon of ten years or more.
  - For the next phase after 2020, HEIs should already begin to take more responsibility, as well as a greater share of management costs. Furthermore, professorships/research groups should strive to acquire more third-party funds for research projects, e.g. from industrial partners or European funds. Such efforts could significantly reduce the overall federal budget for SCCERs. However, at least in the medium-term, some funding for SCCER activities (supporting coordination and cooperation), and particularly project funding (supporting capacity and coordination), will be needed to maintain the SCCER concept at today's level.

  - Managing and coordinating energy research is crucial if it is to contribute to the Energy Strategy 2050. Attractive framework conditions (such as energy and climate policies, e.g. energy prices or CO_2 taxes) are also vital, especially with a view to higher TRLs, more application-oriented research, and market implementation. Long-term strategies and more incentives to reduce CO_2 emissions are very important when third-party funding from the private sector is required.
- The long-term strategy (described above) must be defined specifically in a research funding instrument. This should set out support for networks, and project funding, in greater detail in terms of research focus, requirements, and available resources. The challenge will be to create sufficient incentives to maintain the SCCER concept and, at the same time, to reduce federal funds for SCCER activities (particularly for coordination and networking/cooperation):
  - The allocation of research project funds should be determined by a competitive scheme and replace the capacity-based funding of the first two SCCER phases. The benefits of a scheme like this are a more efficient allocation of funding to the best projects, and more flexibility in the formation of research groups and collaboration with new partners.
  - The research funding instrument should be updated periodically (e.g. at four-year intervals) to redefine the focus of research and funding parameters. In a framework like this, HEIs and other research partners should develop research plans and roadmaps together, and apply for research projects. An important feature of the programme is that it must be open to all potential partners and HEIs — including those not yet part of today's SCCERs.

3.2. Recommendations

Based on the results of this study, we have identified a variety of needs and options to secure the future of the SCCER concept. The following recommendations build on the measures that were identified and described in the previous section.

1. Continued coordinated energy research contributes to Energy Strategy 2050 objectives

The SCCER concept creates added value and is contributing to Energy Strategy 2050 objectives. We therefore recommend continuing along this path of coordinated energy research, which also strengthens interdisciplinarity and collaboration between different higher education institutions[15].

2. More engagement on the part of HEIs

HEIs, professors, and SCCERs should become more active in finding options to maintain coordination and cooperation. Furthermore, HEIs should address the required – and possibly stated – commitment in letters of intent to sustain established capacity after 2020. The federal administration, particularly Innosuisse, should demand that this be done.

3. Need for a long-term strategy and a federal funding instrument

The federal administration (SERI, CORE, SFOE, and Innosuisse) should develop a long-term strategy to provide additional support for energy research. Drawing on the objectives of the Energy Strategy 2050, this strategy should define the additional need for energy research (coordination role), as well as principles for funding. Here, we recommend a combination of competition-based project funding and support for networking. Over time it should be possible to reduce federal funding that is provided, and increase the resources supplied by HEIs and implementation partners themselves.

Based on the long-term strategy, a research funding instrument should be drawn up that ensures coordination and sets out support for cooperation (specifically networking), and competition-based project funding in greater detail in terms of research focus, requirements, available resources, etc.

[15] The findings of the SCCER Accompanying Research Module 3b support the recommendations.

Annex

A1. Interview partners

Table 2: Interviewees

Name	Organisation	Interview type
Kathrin Kramer, Marc Gerber, and Alessia Salmina	Members of the Innosuisse Energy Funding Programme	In person
Walter Steinlin	Former Head of SCCER Steering Committee	In person
Dr. Martin Riediker	Member of SCCER Steering Committee	Telephone
Prof. Frank Scheffold	Member of SCCER Steering Committee	Telephone
Prof. Marcel Mayor	Member of SCCER Steering Committee	Telephone
Bernhard Eschermann	Member of SCCER Steering Committee	Telephone
Dr. Adriano Nasciuti	Head of SCCER Steering Committee	Telephone
Dr. Stefan Nowak	SCCER Evaluation Panel Core Group	Telephone
Prof. Dr. Andreas Balthasar	SCCER Evaluation Panel Core Group	Telephone
Prof. Dr. Hans-Rudolf Schalcher	SCCER Evaluation Panel Core Group	Telephone
Prof. Philippe Thalmann	SCCER Evaluation Panel Core Group	Telephone
Prod. Dr. Eberhard Umbach	SCCER Evaluation Panel Core Group	Telephone
Rolf Schmitz	Head of Energy Research Section at SFOE	In person
Nicole Mathys	Technical expert on SCCER Evaluation Panel	Telephone
Sandra Hermle	Technical expert on SCCER Evaluation Panel	In person
Prof. Matthias Sulzer (and Programme Manager Dr. Stephan Fahlbusch)	Head of SCCER FEEB&D	In person
Prof. Dr. Philipp Rudolf von Rohr	Head of SCCER EIP	In person
Prof. Dr. Mario Paolone (and Programme Manager & KTT Officer Georgios Sarantakos)	Head of SCCER FURIES	In person
Prof. Dr. Thomas Justus Schmidt (and Programme Coordinator Dr. Jörg Roth)	Head of SCCER HaE	In person
Prof. Domenico Giardini (and Programme Manager Dr. Gianfranco Guidati)	Head of SCCER SoE	In person
Prof. Dr. Frank Krysiak	Head of SCCER CREST	In person
Prof. Konstantinos Boulouchos (and SCCER Mobility Managing Director Dr. Gloria Romera)	Head of SCCER Mobility	In person
Prof. Dr. Oliver Kröcher	Head of SCCER BIOSWEET	In person

Name	Organisation	Interview type
Dr. Martin Näf	Chairman of Federal Energy Research Commission (CORE)	Telephone
Gregor Häfliger	Head of Research and Innovation Division at SERI	Telephone
Prof. Dr. Martina Hirayama	Vice President of the Innosuisse Board	Telephone
Prof. Dr. Detlef Günther	Vice President for Research and Corporate Relations at ETH Zurich	In person
Prof. Dr. Andreas Mortensen	Vice President for Research at EPFL	Telephone
Dr. Peter Richner	Deputy CEO Empa	In person
Prof. Dr. Joël Mesot	Director of PSI	Telephone
Prof. Dr. Edwin Charles Constable	Vice President for Research at University of Basel (until 2018)	Telephone
Prof. Dr. Andreas Gerber-Grote (and Head of R&D Unit Dr. Martin Jaekel)	Dean of the School of Health Professions at Zurich University of Applied Sciences (ZHAW)	In person
Prof. Dr. Martin Patel	Head of the Chair for Energy Efficiency at the University of Geneva (UNIGE)	Telephone
Prof. Rainer Schnaidt	Head of Applied Research and Development at FHNW	Telephone
Prof. Dr. Andrea Vezzini	Head of BFH-CSEM Energy Storage Research Centre at Bern University of Applied Sciences (BFH)	Telephone

Table: INFRAS.

A2. Interview guides

Interview guide — expert interviews (extract from interview guide for SCCER heads)

1. How important is closer networking and cooperation in energy research with regard to the goals of the SCCERs? Have closer networking and cooperation proven their worth? What added value could be achieved through this (in particular with regard to the Energy Strategy 2050)? [16]
2. Which factors support and which factors hinder the continued existence of the SCCERs after 2020? In particular:
   - How do you assess the interest and willingness of the HEI in continuing their SCCER (including partial financing)?
   - What are the prerequisites?
3. What preparatory work has your SCCER done to maintain the capacity that has been established, the SCCER network, and networking?
   - What work is planned before 2020?
   - Are any changes to the current SCCER concept planned after 2020?
   - How do you assess this preparatory work?
4. In order to maintain the SCCER concept at least at the same level after 2020, what measures would have to be taken? Which measures would be necessary for expansion (e.g. integration of further cooperation partners)?

Interview guide — additional interviews with HEI

1. How do you assess your HEI's interest in the continuation of SCCERs?
2. To what extent is your HEI willing to continue the capacity and activities it has built up, even without further federal funding?
3. What preparatory work has been undertaken by the SCCERs and the universities with a view to its continuation? How do you assess the status of this work?
4. How do you assess the willingness and the possibility of your HEI to finance, at least in part, the established capacity and activities of SCCERs? What are the prerequisites for this?
5. In order to continue the SCCER concept at least at today's level, how would any financial support from the federal administration beyond 2020 have to be structured (taking into account an appropriate financial contribution from HEIs)?
6. What are the consequences for the achievement of Energy Strategy 2050 objectives if the SCCER concept cannot be maintained at the current level from 2020?

[16] This question was mainly designed for and assessed in SCCER Accompanying Research Module 3b: Networking and (interdisciplinary) collaboration. However, it was also an important question for the analysis in Module 3a.

Abbreviations

CORE	Federal Energy Research Commission
HEI	Higher education institution
SCCER	Swiss Competence Centers for Energy Research
SERI	State Secretariat for Education, Research and Innovation
SFOE	Swiss Federal Office of Energy
SNSF	Swiss National Science Foundation
TRL	Technology readiness level

Glossary

Permanent establishment	Continued existence of the main SCCER features, such as established capacity, (interdisciplinary) collaboration, networks and coordination.
SCCER activities	Refers to the two activities of the SCCER concept: coordination and cooperation.
SCCER concept	In our understanding, the SCCER concept comprises the three pillars of capacity (research and management positions), the coordination of research topics and projects, and cooperation between various types of HEI, disciplines, and industry.

Literature

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