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Swiss Federal Office of Civil Aviation FOCA
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Science and Technology

SWEET Call 2-2022: Call Guideline

Sustainable Fuels and Platform Chemicals

This call is jointly issued by the Swiss Federal Office of Energy (SFOE), the Swiss Federal Office of Civil Aviation (FOCA), and Federal Department for Defence Procurement (armasuisse)

The call for pre-proposals closes on
9 December 2022 at 12:00 noon CET

sweet swiss energy research for the energy transition

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1 Introduction

1.1 SWEET: Research for the energy transition

SWEET (SWiss Energy research for the Energy Transition) is a funding programme[1] owned and managed by the Swiss Federal Office of Energy (SFOE). The purpose of SWEET is to fund interdisciplinary and transdisciplinary research[2] and innovation activities with a focus on the goals of Switzerland's Energy Strategy 2050[3] and long-term climate policy.[4] SWEET targets solution-oriented research and innovation in the natural sciences and engineering as well as in the social sciences and humanities (SSH) in the domains of energy efficiency, renewable energy production and consumption, storage, networks, society and energy, and security and safety of critical energy infrastructures. Within these domains, the SFOE, after consulting the Federal Energy Research Commission CORE, set the guiding theme of the current call as "Sustainable Fuels and Platform Chemicals". Assisted by discussions with various stakeholders, the SFOE subsequently formulated the research challenge that is the subject of this call.

Meeting this research challenge specifically and Switzerland's energy- and climate-policy goals generally requires that solutions are developed not just from a technical perspective, but in the context of suitable legal and regulatory frameworks, innovative market designs, as well as social acceptance and agency. Therefore, interdisciplinary and transdisciplinary approaches that result from close collaborations between the SSH and the natural sciences and engineering are essential. Such collaborations, in the form of consortia that reflect the diversity of Switzerland's research and innovation community, are central to the SWEET programme.

In response to SWEET calls, consortia consisting of research and implementation partners are invited to propose portfolios of interrelated research projects, including pilot and demonstration (P+D) projects, see Figure 1-1. A portfolio should be composed of projects focusing on research, development, demonstration, and deployment/implementation, structured such that the projects build on and feed into each other. The portfolio may include projects that involve real-world laboratories and other formats in which the effects on and the agency of people can be explored. As a result, the consortia and project portfolios should cover significant parts of the innovation system depicted in Figure 1-2. Some projects may start as soon as a consortium is launched, while other projects may follow at a later stage as they build on the output of earlier projects. Iterative feedback loops between the projects are encouraged.

Successful consortia will normally receive SFOE funding to pursue their projects over 6 to 8 years. SFOE's funding is subject to the principles of subsidiarity. In the context of SWEET, this means that the consortium partners contribute financially, each according to its abilities, to supplement SWEET funding and thereby ensure that the total financial resources are sufficient for the work programme of the consortium.

SWEET consortia are managed by a host institution. Consortia should cover the best possible range of partners from the higher education sector, research institutes, industry/private sector, as well as partners from the public sector such as cantons, cities, communes, and districts/regions. Consortia should strive for gender balance and reflect Switzerland's diversity in terms of languages and regions. It is expected that every member of a consortium delivers complementary and significant contributions to the consortium's work programme. Members from the SSH are expected to be equitably represented in the consortia and their management.

[1] Further information is available at https://www.bfe.admin.ch/sweet.

[2] See the Appendix for descriptions of the terms "interdisciplinary research" and "transdisciplinary research".

[3] https://www.uvek.admin.ch/uvek/en/home/energy/energy-strategy-2050.html

[4] https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/emission-reduction/reduction-targets/2050-target/climate-strategy-2050.html

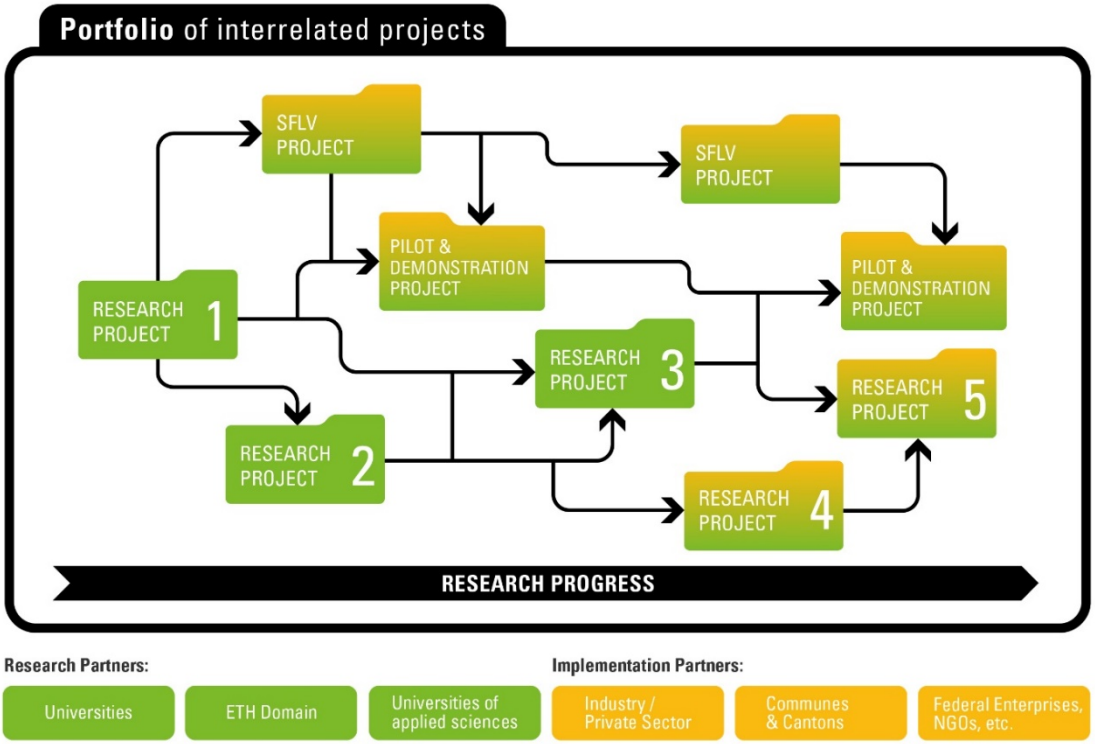

Figure 1-1: Schematic depiction of a portfolio of interrelated projects by a consortium of research and implementation partners for this SWEET call. In contrast to usual SWEET calls, the project portfolio may include not just research projects and pilot & demonstration projects, but also Spezialfinanzierung Luftverkehr (SFLV) projects. For SFLV projects, a separate proposal must be submitted to the Federal Office of Civil Aviation.

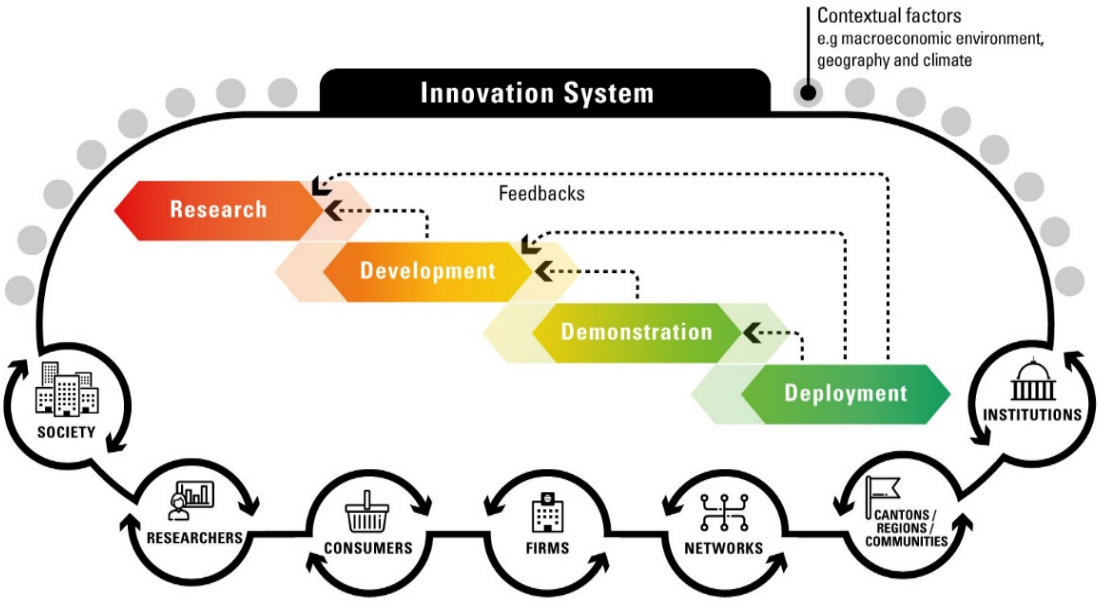

Figure 1-2: A schematic representation of the innovation system, significant parts of which should be covered by SWEET consortia and their project portfolios. The projects are expected to generate and exploit feedbacks, e.g., a market place or a community that demands innovations (deployment) is supplied with new knowledge and/or products from research, development, and demonstration. Adapted from International Energy Agency (2019), *Energy Technology Innovation Partnerships*, building on graphics and text sourced from Global Energy Assessment (2012), *Global Energy Assessment: Towards a Sustainable Energy Future*, Cambridge University Press and the International Institute for Applied Systems Analysis.

Since the outputs of the consortia are expected to be relevant to the implementation of Switzerland's Energy Strategy 2050 and climate policy, consortia will be closely accompanied by the SFOE, with particular attention being paid to knowledge and technology transfer (KTT).[5]

Table 1-1: Overview of GHGE by sectors in 1990 and 2019,[6] the 2050 targets according to the long-term climate policy,[7] and the main technical options for meeting the 2050 targets. The green background indicates those sectors in which SF are among the main options for meeting the 2050 targets.

System boundary	Sector	Subsector codes	GHGE (Mt CO_2eq)			Main technical options for meeting 2050 target and comments
			1990	2019	2050 target	
Kyoto protocol and Paris agreement Long-term climate strategy	Buildings	1A4a, 1A4b	16.65	11.20	0.0	Energetic renovations, heat pumps, thermal grids, solar-thermal energy, thermal storage
	Transport	1A3b (road transport)	14.26	14.59	0.0 (with a few exceptions)	BEV, SF (for FCEV and ICEV)
		1A3a, 1A3c, 1A3d, 1A3e, 1A5	0.65	0.41	No target	Electrification, SF (for FCEV and ICEV)
	Industry	1A1, 1A2, 1B, 2	13.62	11.20	Reduction of at least 90% relative to 1990 (incl. CCS)	Efficiency increases, process flexibilisation, integration of renewable energy sources, SF and SPC, CCS
	Agriculture	3A, 3B, 3D, 3G, 3H, 1A4c	7.41	6.37	Reduction by at least 40% relative to 1990	Few options exist (about 90% of GHGE are hard to avoid). SF can reduce GHGE from grass-drying facilities, greenhouses, and machinery.
	Waste	5	1.12	0.69	No target, anticipated GHGE: 0.5 Mt CO_2eq	None
	Synthetic gases		0.25	1.61	No target, anticipated GHGE: 0.3 Mt CO_2eq	Substitution with gases with lower greenhouse warming potential
	Subtotal		53.96	46.07	Anticipated remaining GHGE: 11.8 Mt CO_2eq	Remaining GHGE to be addressed with CCS & NET in Switzerland (5.0 Mt & 2.0 Mt CO_2eq, respectively) and NET abroad (4.8 Mt CO_2eq)
Long-term climate strategy	International air transport		3.09	5.74	No climate-impacting emissions as far as possible	SAF

1.2 Guiding theme: Sustainable fuels and platform chemicals

With the long-term climate strategy, Switzerland has committed to the net-zero greenhouse-gas emissions (GHGE) target in 2050. The corresponding sector targets and GHGE in 1990 and 2019 (the last year unaffected by the COVID-19 pandemic) are given in Table 1-1. In 2019, according to the system boundary specified in the Kyoto protocol and Paris agreement, which excludes international air and ship transport, Switzerland emitted 46.07 Mt CO_2eq. Fossil fuels contributed 70.2% to these emissions, 15.90 Mt CO_2eq from gasoline, Diesel, kerosene for domestic air transport, and natural gas and 16.53 Mt

[5] The SFOE has developed a toolbox with 30 suggestions for measures that SWEET consortia may use in planning their KTT activities. Further information on the toolbox is available from the SWEET Office.

[6] https://www.bafu.admin.ch/bafu/en/home/topics/climate/state/data/greenhouse-gas-inventory.html

[7] See Chapter 8 and Table 4 in Federal Council, *Switzerland's Long-Term Climate Strategy*, 2021, available at https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/emission-reduction/reduction-targets/2050-target/climate-strategy-2050.html.

CO_2eq from heating oil and natural gas.[8] Meeting the targets of the long-term climate strategy requires that fossil fuels be replaced either by carbon-free fuels (decarbonisation, e.g., through hydrogen or ammonia) or by carbon-neutral fuels (defossilisation, i.e., fuels containing non-fossil carbon from biomass or captured from flue gases or the atmosphere) or that fuels be avoided altogether (e.g., electrification).

In the context of this call, sustainable fuels (SF) are defined to be fuels that meet a set of environmental and social sustainability criteria. To give a precise definition is not fruitful at present because there is no universally applicable or accepted set of criteria and the legal bases at the national and European levels are still evolving. Nevertheless, it is clear that the GHGE over the whole life cycle of SF should be as low as possible to meet the targets of the long-term climate strategy and that the relevant environmental impacts along the whole life cycle have to be addressed. Therefore, the environmental criteria should also include an aggregated overall environmental impact or a set of relevant life-cycle impact indicators such as deforestation, biodiversity, direct and indirect land use change, water scarcity, and – for electricity-based fuels (see below) – the additionality and temporal correlation of electricity. Social criteria often include food security (food or feed competition), social justice, political stability, and the Fundamental Conventions of the International Labour Organization.[9] SF for aviation are referred to as sustainable aviation fuels (SAF) if they can be transported, distributed, and stored using existing infrastructures and if they can be used in existing aircraft engines.

As indicated in Table 1-1, SF are considered to be among the main options for meeting the 2050 targets in the transport and industry sectors. In the building sector, SF are not listed as a main option because more efficient options exist for the majority of buildings. SAF are considered to be essential for meeting the 2050 targets for long-distance flights for the foreseeable future.[10] There are three fundamental paths for producing SF, with "X" denoting a particular SF:

1. Power-to-X (PtX):[11] Hydrogen is produced from the electrolysis of water, optionally followed by ammonia synthesis to produce ammonia; Fischer-Tropsch synthesis to produce Diesel, gasoline, and kerosene; methanation to produce methane; or methanol synthesis to produce methanol. To produce hydrocarbon fuels from hydrogen, a carbon source is required, such as CO_2 captured from flue gases or the atmosphere or CO_2 from the anaerobic digestion of green waste, manure, or sewage sludge.
2. Biomass-to-X (BtX): Biomass may be classified into woody biomass, which includes various types of wood, and non-woody biomass, which includes manure, by-products from farming, the organic fraction of household waste, green waste from households, organic waste from industry and commerce, and sewage sludge. A broad array of processes can be used to convert biomass into SF, such as gasification of green waste and wood followed by methanation, Fischer-Tropsch synthesis, or the water-gas shift reaction and the above-mentioned anaerobic digestion of green waste, manure, or sewage sludge to produce methane.[12,13] An analysis of the energetic

[8] https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/emission-reduction/target-achievement-review/2020-target.html

[9] https://www.ilo.org/global/standards/introduction-to-international-labour-standards/conventions-and-recommendations/lang--en/index.htm

[10] International Civil Aviation Organization, *Report on the Feasibility of a Long-Term Aspirational Goal (LTAG) for International Civil Aviation CO2 Emission Reductions*, 2022

[11] T. Kober, C. Bauer (eds.), et al., *Perspectives of Power-to-X Technologies in Switzerland: A White Paper*, Paul Scherrer Institute, 2019

[12] Prognos AG, *Energieperspektiven 2050+ Exkurs Biomasse: Potenziale und Einsatz in den Szenarien*, 2021

[13] G. Guidati, A. Marcucci, T. Damartzis, V. Burg, T. Schildhauer, D. Giardini, and O. Kröcher, *Biomass and Waste Potentials and Conversion Pathways for Energy Use in Switzerland*, SCCER Joint Activity Scenarios and Modelling and SCCER BIOSWEET, 2021

uses of Swiss biomass found that manure has the largest additional usable primary-energy potential with 24.3 PJ per year, followed by forest wood with 9.0 PJ per year.[14,15]

3. Solar-to-X (StX): Solar energy can drive a variety of processes that result in SF. In thermochemical processes, for example, concentrated solar energy may be used to convert water and CO_2, optionally supplemented by methane produced from biomass, into syngas, followed by Fischer-Tropsch synthesis.[16] Alternatively, in photoelectrochemical processes, concentrated solar energy can be employed with integrated photovoltaic cells and electrolysers to produce hydrogen.

Hydrocarbon fuels produced by any of these paths can be used to generate negative emissions when their combustion is followed by carbon capture and storage.

Several of the SF mentioned above (hydrogen, ammonia, and methanol) are industrial commodities. They serve not only as fuels, but also as feedstocks for bulk products like fertilizers or as building blocks for specialty chemicals and materials (e.g., ethylene and propylene). In addition, Fischer-Tropsch synthesis delivers not only gasoline, Diesel, or kerosene, but a range of hydrocarbons, some of which have industrial uses. The further development of processes to produce SF can therefore also contribute to reducing the chemical sector's GHGE. Consequently, the guiding theme of this call is not just "Sustainable Fuels", but "Sustainable Fuels and Platform Chemicals". In the context of this call, "Sustainable Platform Chemicals" (SPC) should be understood in a broad sense to mean bulk chemicals that can feed into a variety of value chains and that also meet a set of environmental and social sustainability criteria.

The importance of SF and SPC goes beyond contributing to meeting the 2050 targets listed in Table 1-1, for two main reasons. First, the GHGE given in the table follow the system boundary adopted by the long-term climate strategy and therefore exclude the GHGE of imported goods and services. If these emissions are included, Switzerland's GHGE in 2019 amount to 108.8 Mt CO_2eq,[8] with the imports accounting for 63.5%.[17] Since the GHGE associated with the imports are partly due to the use of fossil fuels and platform chemicals, it follows that technical developments that contribute to meeting Switzerland's 2050 targets, when deployed on a global scale, can also contribute to reducing GHGE due to imports by Switzerland and other countries. The second reason is related to the integration of new renewable-energy sources. When the intermittent production of photovoltaic panels and wind turbines reaches a significant fraction of the total electricity production, some form of energy storage is likely to be necessary. SF are considered to be particularly attractive for the seasonal storage of energy on account of their comparably high volumetric energy densities and the relative ease with which they can be stored, transported, and distributed. SF are therefore regarded as a key component of sector coupling,[18] which denotes primarily those interconnections between traditional supply and/or demand sectors that enable integrating new renewable-energy sources and thereby support the defossilisation/decarbonisation of energy systems. In a broader sense, "sector coupling" may also include those interconnections that existed before the current focus on the defossilisation/decarbonisation of energy systems, such as supplying waste heat from power or combined heat and power (CHP) plants via thermal grids

[14] O. Thees, V. Burg, M. Erni, G. Bowman, and R. Lemm, *Biomassepotenziale der Schweiz für die energetische Nutzung. Ergebnisse des Schweizerischen Energiekompentenzzentrums SCCER BIOSWEET*, Report No. 57, Swiss Federal Institute for Forest, Snow, and Landscape Research, 2017

[15] V. Burg, G. Bowman, M. Erni, R. Lemm, O. Thees, *Analyzing the potential of domestic biomass resources for the energy transition in Switzerland*, Biomass and Bioenergy, 111:60-69, 2018

[16] K. Treyer, R. Sacchi, and C. Bauer, *Life Cycle Assessment of Synthetic Hydrocarbons for Use as Jet Fuel: "Power-to-Liquid" and "Sun-to-Liquid" Processes*, Paul Scherrer Institute, 2022

[17] The system boundaries used to determine the GHGE that include imported goods and services differ from the system boundaries used to determine the GHGE that exclude imported goods and services. Therefore, the figures given in the sentence cannot be directly compared to those given in Table 1-1.

[18] K. Boulouchos, U. Neu, et al., *Swiss Energy System 2050: Pathways to Net Zero CO_2 and Security of Supply. Basic Report*, Swiss Academies Reports 17(3), 2022

to buildings, but the term should then be restricted to the intensified exploitation of these interconnections.[19] When used in peaking power plants, SF can contribute to supply security.[18,20]

Table 1-2: Overview of the amounts of SF in PJ that are used in the various sectors in 2050 for the four net-zero scenario variants of the Energy Perspectives 2050+ (with 50-year duration of the nuclear power plants and annually balanced electricity imports/export in 2050).

Production path	Sector	Fuel	Scenario variants			
			ZERO Basis	ZERO A	ZERO B	ZERO C
PtX	Households	Methane	0	0	35	0
		Heating oil	0	0	0	14
	Services	Methane	0	0	5	0
		Heating oil	0	0	0	2
	Transport	Hydrogen	15	14	20	3
		Methane	0	0	16	0
		Gasoline	12	12	12	17
		Diesel	25	23	22	45
		Kerosene	3	3	3	3
	Int. Air Transport	Kerosene	59	59	59	59
	Conversion	Hydrogen	0	0	36	0
	Subtotal	Hydrogen	15	14	56	11
		Methane	0	0	63	0
		Heating oil	0	0	0	22
		Gasoline	12	12	12	17
		Diesel	25	23	22	45
		Kerosene	62	62	62	62
	Total		115	111	214	157
	Import		108	104	208	151
	Total share of final energy use (%)		20	19	36	27
BtX	Households	Biomethane	12	6	12	10
	Services	Biomethane	4	4	9	2
	Industry	Biomethane	16	12	17	16
	Transport	Biomethane	9	3	5	3
		Liquid fuels	8	8	8	8
	Agriculture	Biomethane	2	2	4	2
	Int. Air Transport	Liquid fuels	2	2	2	2
	Conversion	Biomethane	17	20	12	26
	Subtotal	Biomethane	60	47	59	59
		Liquid fuels	9	9	10	10
	Total		69	56	69	69
	Total share of final energy use (%)		12	10	12	12
PtX and BtX	Total		184	198	283	226
	Total share of final energy use (%)		32	34	47	38

[19] The literature does not contain a widely accepted definition of sector coupling. The definition presented here is similar to that of M. Wietschel et al., *Sektorkopplung – Definition, Chancen und Herausforderungen*, Working Paper Sustainability and Innovation, No. S 01/2018, Fraunhofer Institute for Systems and Innovation Research, 2018.

[20] Federal Electricity Commission, *Peak-load gas-fired power-plant concept to ensure grid security in extraordinary emergency situations*, 2022, available in German and French at https://www.elcom.admin.ch/elcom/en/home/topics/supply-security.html.

The net-zero scenario variants of the Energy Perspectives 2050+ indicate how SF might be used in the future Swiss energy system.[21] The variant ZERO Basis assumes marked increases in energy efficiency and electrification while SF play only a minor role. Compared to ZERO Basis, the variant ZERO A assumes greater electrification, whereas variants ZERO B and ZERO C are based on moderate electrification, with a greater role for gaseous fuels in the former and a greater role for thermal grids and SF in the latter. SF produced through PtX were assumed to be imported from the Middle East and North Africa (MENA) region.[22] A domestic production of hydrogen at run-of-river hydropower plants was included with operating hours determined by the wholesale electricity price. SF produced through BtX were mostly imported, with import potentials estimated to be 43.5 PJ/year for biomethane and 5.2 PJ/year for liquid biofuels.[12] Table 1-2 lists the amounts of SF in PJ that are used in 2050 for the four scenarios. It is seen that SF play a key role in meeting the net-zero target: Between 32 and 47% of the final energy use are due to SF. Furthermore, the largest individual contribution is due to kerosene, which is almost exclusively produced through PtX, and accounts for between 21 and 32% of the total SF use.

The significant contribution of kerosene to the final energy use, coupled with the abovementioned synergies between producing kerosene and other fuels, is one reason why the SFOE, the Federal Office of Civil Aviation (FOCA), and the Federal Department for Defence Procurement (armasuisse) collaborate on this SWEET call. A further reason is that the Action Plan Energy and Climate[23] of the Federal Department of Defence, Civil Protection and Sport contains the intention to cover its energy consumption primarily through renewable energies and its own production, and specifically mentions SF.

1.3 The application process

To render the application process more efficient for both consortia and evaluators, SWEET Call 1-2022 is organized into two steps, see Figure 1-3. In the first step, consortia submit a pre-proposal. All submitted pre-proposals will be subjected to an admissibility and eligibility check by the SFOE. The admissible and eligible pre-proposals will be evaluated and ranked by a panel of independent experts. The two highest-ranked consortia will be invited by the SFOE to submit more detailed full proposals. In the second step, the invited consortia prepare and submit full proposals that will again be evaluated by the expert panel. The consortium with the higher-ranked full proposal will be awarded with SWEET funding.

The pre-proposal contains only brief descriptions of the consortium, the objectives, the overall concept and methodology, the work packages, and the budget. Only the host institution must submit a letter of commitment. For the other applicants, letters of intent are sufficient. The full proposal will have to describe the work packages and budget in more detail and include letters of commitment for all applicants.

The process for submitting pre-proposals is described in Section 5.1. As explained in that section, consortia must notify the SFOE of their intent to submit a pre-proposal. The notification allows the SFOE to better prepare for the evaluation of the pre-proposals and in particular to appoint a sufficient number of evaluation panels. The relevant deadlines and other important dates associated with this call are given in Section 6.4.

[21] https://www.bfe.admin.ch/bfe/en/home/policy/energy-perspectives-2050-plus.html

[22] Based on assumptions from Prognos AG, *Kosten und Transformationspfade für strombasierte Energieträger*, 2020.

[23] Available in German, French and Italian at https://www.vbs.admin.ch/de/umwelt/umweltschutz/energie-und-klima.html.

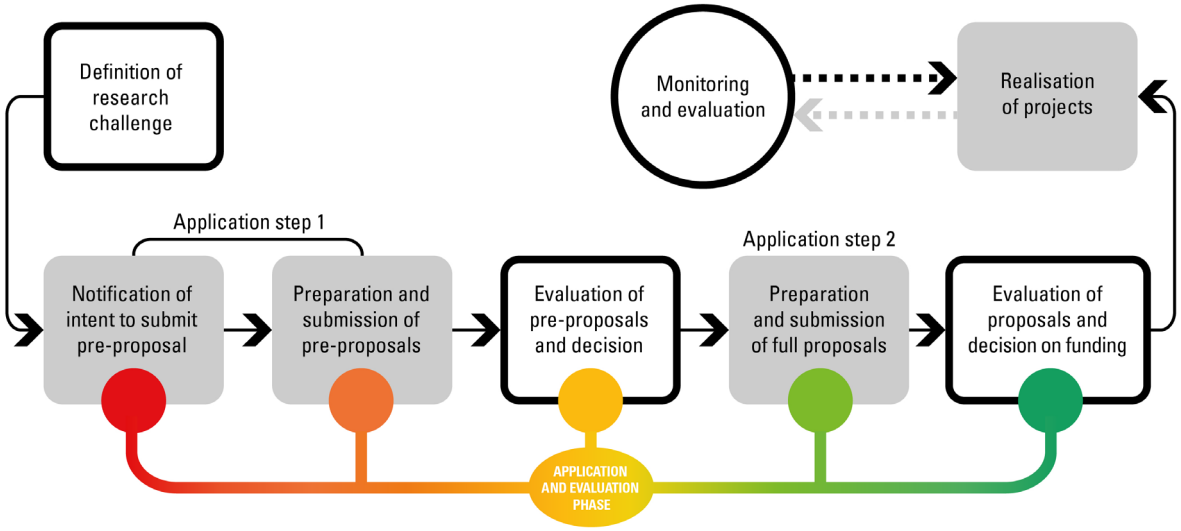

Figure 1-3: The two-step application process of SWEET Call 2-2022. The white and grey boxes indicate activities by the SFOE and the consortia, respectively.

2 Research challenge

This call comprises one research challenge. One consortium will be supported with a budget of at most CHF 15 Mio. to tackle the challenge over a period of 6 to 8 years, see Section 3.4.1. Supplementary funding of at most CHF 1.5 Mio. is available, see Section 3.4.2.

2.1 Sustainable fuels and platform chemicals

Consortia are required to address all research questions. The research questions are ordered according to the following hierarchy: pathways for SF and SPC in the Swiss energy system – development of technologies for the production, transport, storage, and use of SF and SPC – exploitation of Swiss animal manure for the profitable production of SF and SPC. The ordering itself should not be interpreted as suggesting where resources should be allocated. Instead, consortia should take into account that questions 1 and 3 focus on Switzerland whereas research question 2 has a much broader focus.

2.1.1 Research questions

Research question 1: *What are robust pathways for meeting future Swiss demands for SF and SPC between now and 2050 (including the Swiss Army's demand for SF[24]), how do these pathways compare, and what would be efficient policies and regulations to implement the most robust pathways?*

The pathways need to consider the entire life cycle of SF and SPC, i.e., where and how they would be produced, how they would be transported to and/or distributed within Switzerland, where and how they would be stored, and in which sectors and subsectors they would be used. The temporal component of the pathways needs to be considered also, i.e., how the demands in the sectors and subsectors may develop; when production, transport/distribution, and storage infrastructures may become operational; how their capacities may increase; and what investments may be required.

[24] The current demand of the Swiss Army for Diesel and kerosene is 20 and 40 million litres/year, respectively. The estimated demand in 2050 is 20 and at least 20 million litres/year, respectively.

A pathway can be said to be robust if uncertainties in the underlying assumptions, e.g., demand for SF and SPC; efficiencies, costs, and material requirements of the involved technologies; availabilities of production, transport/distribution, and storage infrastructures; and dependence on international policy decisions, do not significantly affect its assessment in terms of economic, environmental, and social criteria compared to alternative pathways. Therefore, a robust pathway focuses on "no-regret" applications, avoids lock-in effects, and preserves room for manoeuvring. In other words, future technical and political developments are more likely to validate than invalidate a robust pathway.

In responding to this research question, the consortium is expected to build on the results of the SHELTERED project,[25] which is scheduled to be completed in September 2024. In particular, the consortium is expected to broaden SHELTERED's scope from SF for the transportation sector by including SF and SPC for the industry sector also. In addition, the consortium is expected to compare the most robust pathways with the results from the four net-zero scenario variants of the Energy Perspectives 2050+. Given the consortium's duration, its approach to responding to this research question should be flexible enough to allow for periodically incorporating additional data that can be used to refine assumptions, scenarios, and narratives/storylines as well as considering scenarios that may be defined as part of a possible successor to the Energy Perspectives 2050+.

It is imperative that the consortium consider the international context, not just because it appears likely that most of the future Swiss demand for SF and SPC will be met by imports, but also because a possible domestic production to meet part of the demand may depend on imported electricity and biomass. The consortium is expected to critically investigate the advantages and disadvantages of a domestic production in terms of its impacts on the energy system and possible increases in supply security through seasonal storage and use in power/CHP plants. Since the VADER project[26] showed that a domestic production leads to higher costs, the investigation must investigate in particular the socio-economic question of how the increased costs should be weighed against the possible increases in supply security. The consortium must prioritize exploiting the additional potential of Swiss biomass[14,15] (see also research question 3) over importing biomass. In addition, the consortium must investigate how the Department of Defence, Protection and Sport's plan for partial self-sufficiency might create synergies that could reduce the costs of a domestic production of SF and SPC.

The consortium is expected to coordinate its work with that of other SWEET consortia, especially DeCarbCH, EDGE, PATHFNDR, and SURE. Furthermore, the consortium must build on the outputs of the CROSS activity[27] and contribute to the continuing harmonization of assumptions, scenarios, and narratives/storylines by the consortium that may be funded through the SWEET Co-Evolution Call.[28] The consortium is expected to set aside resources for these interactions with other SWEET consortia. The exploitation of synergies with other projects, e.g., the Innosuisse Flagships DeCIRRA and co2nvert,[29] is strongly encouraged.

Research question 2: *Which further technology developments for the production, transport, distribution, storage, and use of SF and SPC, preferably supported by P+D projects, will reduce the costs and environmental impacts of SF and SPC and make a concrete contribution toward reaching both Swiss and international energy- and climate-policy goals?*

[25] See https://www.aramis.admin.ch/Texte/?ProjectID=49507 for further information.

[26] See https://www.aramis.admin.ch/Texte/?ProjectID=51133 for further information.

[27] https://sweet-cross.ch/

[28] https://www.bfe.admin.ch/bfe/en/home/research-and-cleantech/funding-program-sweet/calls-for-proposals-overview/sweet-co-evolution.html

[29] https://www.innosuisse.ch/inno/en/home/promotion-of-national-projects/flagship-initiative/15-flagships.html

This research question is deliberately formulated in an open manner to include developments relating to any and all stages of the life cycle of SF and SPC. Furthermore, PtX, BtX, and StX production paths are all of interest, even if eventual production plants may ultimately be located abroad. The further developments mentioned in the research question may include investigations ranging from the fundamental level (e.g., reaction kinetics) to the component level (e.g., the use of SF in fuel cells, ICE, and gas turbines) to the plant level (e.g., biorefineries, synergies between production plants and industrial plants equipped with CO_2 capture).

Consortia are free to choose which stage(s) of the life cycle and which production path(s) they focus on. However, they are expected to justify their choices in the pre-proposal in terms of the anticipated reductions of the costs and environmental impacts relative to competing innovative and incumbent approaches. Irrespective of the choice, consortia must provide preliminary well-to-wheel/cradle-to-grave LCA estimates in terms of greenhouse-gas emissions and primary-energy consumption in an appendix of the pre-proposal. The work programme is expected to include comprehensive well-to-wheel/cradle-to-grave LCAs, including Life-Cycle Impact Assessments (LCIAs) with the Ecological Scarcity Method (UBP 21)[30] for all SF/SPC being investigated. Life-cycle inventories (LCI) developed by the consortium as part of the work programme must be submitted in the format of the Federal Department of the Environment, Transport, Energy and Communications (DETEC) database, see Section 3.5.1.

The results generated by addressing research question 2 must feed into the work being performed to address research question 1.

Research question 3: *How can the additional potential of Swiss animal manure be exploited for the profitable production of SF and SPC and how can possible advantages (e.g., generating negative emissions, closing of nutrient cycles, and contributing to self-sufficiency) be considered in ensuring its profitability?*

In addressing this research question, the consortium is expected to investigate the development of local/regional supply chains, from the collection of manure to the siting of production plants and to the supply of SF and SPC to customers. The consortium is expected to build on prior work on the additional potential of manure[31] and transport chains.[32,33] Further analyses to quantify the additional potential are not within the scope of this call. The consortium is expected to pursue a transdisciplinary approach by involving farmers and municipalities from the outset, to consider P+D projects at the local/regional level, and to contemplate how insights from such projects could be extrapolated to the national level.

The results generated by addressing research question 3 must feed into the work being performed to address research questions 1 and 2.

[30] https://www.bafu.admin.ch/bafu/en/home/topics/economy-consumption/economy-and-consumption-publications/publications-economy-and-consumption/eco-factors-switzerland.html

[31] V. Burg, G. Bowman, O. Thees, U. Baier, S. Biollaz, T. Damartzis, J.-L. Hersener, J. Luterbacher, H. Madi, F. Maréchal, E. Moioli, F. Rüsch, M. Studer, J. Van herle, F. Vogel, O. Kröcher, *White Paper: Biogas from animal manure in Switzerland: energy potential, technology development and resource mobilization*, SCCER BIOSWEET, Swiss Federal Institute for Forest, Snow and Landscape Research, 2021

[32] L. Mohr, V. Burg, O. Thees, E. Trutnevyte, *Spatial hot spots and clusters of bioenergy combined with socio-economic analysis in Switzerland*, Renewable Energy, 140:840-851, 2019

[33] V. Schnorf, E. Trutnevyte, G. Bowman, V. Burg, *Biomass transport for energy in Switzerland: Costs, energy and CO_2 performance of main forest wood and manure transport chains*, Final report, Swiss Federal Office of Energy, 2020

Important information specific to this call

The SFOE, FOCA, and armasuisse anticipate that exploiting synergies between the productions of various fuels could result in project portfolios in which some projects focus on SAF. For these projects, only brief descriptions need to be included in the SWEET pre-proposal and a separate proposal needs to be submitted to the FOCA for support through the Spezialfinanzierung Luftverkehr (SFLV). The SWEET project portfolio would then consist of research projects, P+D projects, and SFLV projects as depicted in Figure 1-1. Questions about the suitability of the funding instruments for specific projects should be directed to sweet@bfe.admin.ch, pilot-demo@bfe.admin.ch, and spezialfinanzierung@bazl.admin.ch.

Proposals to the SFLV must be submitted no later than 30 November (see MinLV Act Art. 8). Funding decisions are usually communicated in August/September of the following year. Since the deadlines for submitting the SWEET pre-proposals and full proposals are 9 December 2022 and around mid-May 2023 (see Section 6.4), respectively, researchers wishing to exploit synergies can pursue one or both of the following options:

1. They submit proposals to the FOCA no later than 30 November 2022 and then describe briefly the proposed work as a separate project in the SWEET pre-proposal.
2. They submit the SWEET pre-proposal in which they describe briefly the work they intend to submit as proposals to the FOCA no later than 30 November of 2023 or subsequent years.

The second option closely mirrors the procedure that is already being used for P+D projects in SWEET project portfolios (see Section 3.4.3): P+D projects are only described briefly in the SWEET pre-proposal and full proposal. If the consortium is funded, separate proposals for each P+D project must be submitted to the P+D programme.

It should be noted that researchers are encouraged to exploit the above-mentioned synergies but are not required to do so. Nevertheless, the exploitation of synergies will be viewed favourably in the evaluation of the SWEET proposals. To support the development of synergies, experts from FOCA will assist the panel evaluating the SWEET proposals. The panel's evaluation report will include feedback on the brief descriptions of SFLV projects, which may be used by the researchers in preparing proposals to FOCA. The evaluation of SFLV projects is independent of the evaluation of SWEET proposals (following the guidelines set out in the MinLV Act). However, to ensure a certain coherence, experts involved in the evaluation of SWEET proposals or the monitoring of the SWEET consortium can be asked to provide inputs during the evaluation of SFLV projects.

Finally, it should be noted that the design, construction, and operation of plants that produce fuels may be eligible for support through both the P+D programme and SFLV, provided that researchers comply with the Federal Subsidy Act, in particular Art. 12. For simplicity, researchers are encouraged to request support from only one instrument for each project. Researchers that nevertheless wish to apply for support through both instruments are advised to contact pilot-demo@bfe.admin.ch and spezialfinanzierung@bazl.admin.ch prior to submitting a SWEET pre-proposal or an SFLV proposal.

3 Participation

3.1 Need for consortia

Answering the research challenge requires interdisciplinary and transdisciplinary approaches. To this end, the research and innovation community has to organize consortia consisting of diverse partners, see Figure 3-1, that establish portfolios of interrelated projects. A consortium is a network of several members that adhere to the rights and obligations set forth in their compulsory consortium agreement. The consortium is managed by a host institution that represents the consortium to the SFOE and signs a subsidy contract with the SFOE. The subsidy contract ensures, among other things, the flow of funds that support the consortium's work programme and specifies the beneficiaries that receive funds via the host institution.

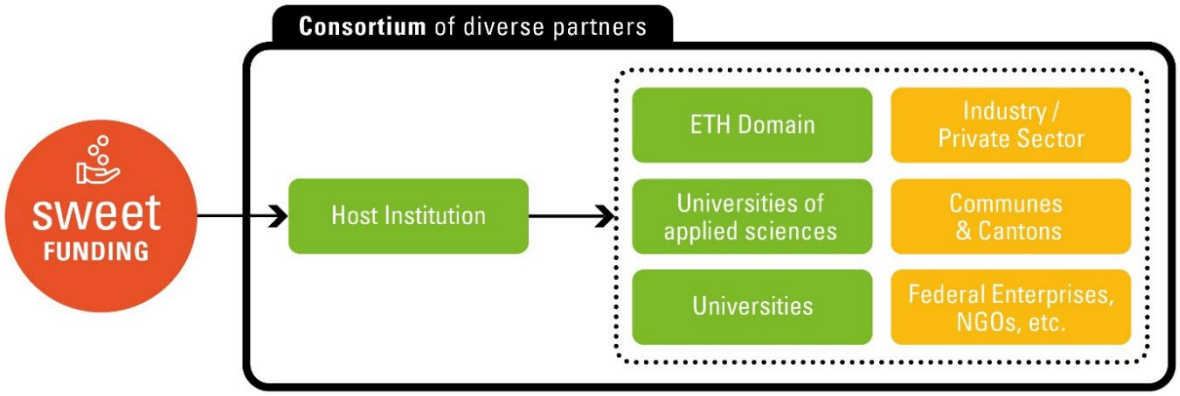

Figure 3-1: Structure of a SWEET consortium: The SFOE administers SWEET funding that flows via a host institution to the consortium partners. In return, the consortium implements a portfolio of interrelated projects that addresses the research challenge.

3.2 Consortium structure

3.2.1 Host institution

The host institution must be a Swiss institution of higher education entitled to receive SFOE funding[34] and is the legal entity applying for the funding on behalf of a consortium. The host institution must provide a letter of commitment to demonstrate its commitment to fulfil the obligations associated with its role in the consortium (see Section 4.2.1). The obligations include appointing a member of its staff to act as the consortium coordinator and, if the consortium is awarded funding, negotiating a subsidy contract between the host institution and the SFOE, and negotiating a consortium agreement with all the applicants.

The coordinator represents the consortium on behalf of both the consortium and the host institution and serves as the single point of contact for the SFOE regarding all administrative, legal, and financial matters. The coordinator is responsible and accountable for the preparation and submission of the pre-proposal and the full proposal.

[34] All institutions pursuant to Article 4 letter c of the Federal Act on the Promotion of Research and Innovation (RIPA; SR 420.1) are eligible as host institutions, see www.fedlex.admin.ch/eli/cc/2013/786/en.

The consortium agreement must be signed by all the applicants and submitted to the SFOE before the SFOE will sign the subsidy contract. Once the subsidy contract is signed, the coordinator is responsible and accountable for the administrative and financial management of the consortium.

3.2.2 Applicants

Applicants request SWEET funding from the SFOE through the consortium. Each applicant is a legal entity with due representation. Each applicant must submit a letter of intent with the pre-proposal (see Section 4.2.2). Applicants may join more than one consortium provided that they inform the coordinators of all affected consortia and that they do not offer substantially the same contribution to more than one consortium.

Upon award, all applicants become beneficiaries of the subsidy contract between the SFOE and the host institution and are henceforth referred to as members of the consortium.

3.2.3 Cooperation partners

Partners that choose not to apply for funding may participate in the work programme of the consortium as so-called cooperation partners. Cooperation partners must finance their activities from sources other than SWEET. Cooperation partners may join more than one consortium.

3.2.4 Changes to the consortium structure

Upon request and subsequent SFOE approval, the host institution may change during the application phase and the consortium's execution phase, provided that the new host institution makes similar commitments and that contracts are reassigned.

During the application phase, applicants may change subject to the restrictions given in Section 6.3. Similarly, during the consortium's execution phase, members may change subject to approval by the monitoring panel and the SFOE. Changes in the cooperation partners must be reported to the SFOE. New members and cooperation partners must fulfil all previously mentioned requirements.

The consortium has the right to reallocate SWEET funds to its members provided that the funding rules (see Section 3.4) are adhered to and that a transparent and traceable process is in place.

3.3 Consortium requirements

A consortium must meet the following requirements:

1. It is led by 1 host institution.
2. It consists of at least 5 applicants from different legal entities.
3. It consists of at least 1 applicant from each of the following entities:
    a. Swiss university or institute of the ETH domain (ETH Zurich, EPF Lausanne, Empa, Eawag, PSI and WSL),
    b. Swiss university of applied sciences,
    c. Swiss industry/private sector.

In addition, a consortium should:

1. Consist of applicants and cooperation partners that span the innovation system (see Figure 1-2) and thereby enable an interdisciplinary or a transdisciplinary approach commensurate with the research challenge.

2. Consist of applicants and cooperation partners that deliver complementary and significant contributions to the consortium's work programme.
3. Be gender-balanced[35] and reflect Switzerland's diversity in terms of languages and regions.

3.4 Funding rules

The SFOE funds in accordance with the principle of subsidiarity: To ensure that the overall funding is sufficient for the work programme of the consortium, members and cooperation partners contribute, each according to its abilities, with own and third-party contributions to supplement the requested SWEET funding. Own contributions are financial contributions (cash or in-kind) from applicants and cooperation partners, whereas third-party contributions are financial contributions (cash or in-kind) from sources other than the Federal Administration, applicants, and cooperation partners.

It should be noted that the SFOE does not require that the requested SWEET funding be matched with own or third-party contributions. Therefore, own and third-party contributions by applicants and cooperation partners do not enter into the evaluation of pre-proposals and full proposals. However, these contributions may be considered as a tie-breaking criterion when multiple full proposals have equal weighted scores.

Consortia are encouraged to apply for additional funding through other national and international programmes.

3.4.1 Core budget

The potential financial award as specified in the subsidy contract is referred to as the core budget and represents the SFOE's funding for research projects as well as management and coordination and KTT activities. To encourage the formation of compact consortia, the core budget is tied to the number of applicants *N*,

$$\text{core budget in Mio. CHF} = \begin{cases} 15 & \text{if} \quad N \leq 16\,, \\ 15[1 - 0.188(N - 16)] & \text{if} \quad N > 16\,. \end{cases}$$

The number of applicants must be equal to the number of entries in Table 1-1 of the pre-proposal template. P+D projects are not funded through the core budget, but may be funded through a separate application to the SFOE's P+D programme, see Section 3.4.3. SFLV projects are not funded through the core budget either, but may be funded through a separate application to the FOCA.

The core budget is subject to annual parliamentary appropriations, the federal council's decision to release the second tranche of SWEET funding that will include this call's core budget for 2029-2032, and the schedule of payments agreed to in the subsidy contract. The core budget cannot be revised to higher amounts.

3.4.2 Supplementary budget

Subject to the availability of additional funds, the SFOE may grant a supplementary budget in response to a request by the consortium or by the SWEET Office. The supplementary budget is limited to 10% of

[35] The Swiss Confederation attaches great importance to the adequate representation of women in management positions. Through its involvement in the Technology Collaboration Programme "Clean Energy Education and Empowerment (C3E)" (https://www.c3e-international.org) of the International Energy Agency (IEA), the SFOE actively supports the development of a community of women leaders in the field of clean energy across various sectors.

the core budget over the term of the consortium and is intended to support activities that were not included in the proposals. A consortium may receive a supplementary budget no earlier than 3 years after the launch of the consortium.

3.4.3 Pilot and demonstration projects

Through the SFOE's P+D programme,[36] additional funds are available to support P+D projects. To apply for these funds, legal and budgetary considerations require that a separate formal application be submitted, just like for P+D projects that are not part of a SWEET project portfolio.

It is important to note that consortia are not expected to propose fully elaborated P+D projects in the pre-proposal and the full proposal. Instead, the proposals should describe P+D projects at a conceptual level only, akin to a P+D project note, with each P+D project forming a separate work package. Once the activities of the consortium are under way and a P+D project has been fully elaborated, the above-mentioned formal application for funding must be submitted to the P+D programme.

The conceptual descriptions of the P+D projects will be assessed by the evaluation panel, including whether they are well integrated into the project portfolio. Favourable assessments of these projects do not guarantee funding by the P+D programme, however. Any decisions by the SFOE on P+D projects are subject to legal hearings and formal objections.

Work packages dedicated to P+D projects must not contain tasks for the elaboration of the projects and the preparation of the applications for funding. However, consortia may choose to include such tasks in the work package on management and coordination, see Section 3.4.4, in which case they must include the submission of the application for funding as a deliverable of that work package.

3.4.4 Further particulars

SWEET funding is primarily envisaged for research and innovation activities that are undertaken by Swiss institutions of higher education and non-commercial research organisations. For other entities, the following rules apply:

- Swiss private for-profit entities may be allocated SWEET funding.
- Swiss cantons, cities, communes, districts/regions, and enterprises affiliated with the Swiss Confederation may be allocated SWEET funding.
- Federal departments and their administrative units are prohibited from receiving SWEET funding. As a result, employees of federal departments and their administrative units may not participate in SWEET consortia.
- Foreign institutions of higher education, non-commercial research organisations, and private for-profit entities may apply for SWEET funding if their contributions are essential to achieving the consortium's objectives, cannot be provided by Swiss applicants, and generate added value in Switzerland. The inclusion of foreign applicants must be justified in the notification of intent to submit a pre-proposal (see Section 5.1.1) and is subject to approval by the SFOE.

Research projects at technology readiness levels[37] (TRL) 1 to 4 may be fully funded by SWEET, while research projects at TRL 5 and 6 may be partially funded. P+D projects cover TRL 4 to 9, will be financed

[36] https://www.bfe.admin.ch/bfe/en/home/research-and-cleantech/pilot-and-demonstration-programme.html

[37] See Appendix I of the SFOE's "Directive on the submission and evaluation of applications for financial support of energy research, pilot and demonstration projects", available at https://pubdb.bfe.admin.ch/en/publication/download/9952.

at the agreed level, but at no more than 40% of the non-amortisable supplementary costs.[38] Research projects in the SSH may be fully funded by SWEET.

In preparing their budgets, consortia must take into account the following:

- For research projects, the maximum remuneration must follow specified hourly rates.[39] For P+D projects, the maximum remuneration for applicants from institutions of higher education must follow these rates, while the maximum remuneration for other applicants should follow these rates.
- At least 10% of the core budget must be allocated to two work packages on management and coordination as well as KTT. While these work packages need not yet be detailed in the pre-proposal, the fraction of the core budget allocated to them must be reflected in the budget that must be submitted with the pre-proposal. The work packages on management and coordination as well as KTT may be fully funded by SWEET.
- The SFOE funds research activities through its SWEET programme pursuant to Article 16 of the Federal Act on the Promotion of Research and Innovation Promotion Act (RIPA).[40] Overhead costs are therefore not eligible.
- The cumulation of federal financial assistance to fund a project is inadmissible if the legal provisions or rules of any of the concerned funding instruments are breached. For instance, if funding from one instrument has been secured and that assistance is sufficient for the project to go ahead, applying for assistance from other instruments for the same project would result in an inadmissible cumulation (Article 6 letter c and Article 7 letters c and d of the Federal Subsidy Act[41]). Similarly, an inadmissible cumulation would occur if the maximum funding rate of one instrument is violated by the assistance from other instruments. To prevent inadmissible cumulations, applicants that seek financial assistance from several federal instruments must clearly disclose all sources of financing and inform all concerned authorities (Article 12 of the Federal Subsidy Act).

There is no entitlement to funding.

3.5 Data availability

3.5.1 Open science

The SFOE subscribes to the notion of Open Science and expects that results and data generated by funded projects are publicly accessible. Should legal restrictions prevent public access to the data as originally generated, the consortium is expected to create a publicly accessible version through aggregation, anonymization, or normalization. Furthermore, the consortium is encouraged to publish data that is of national interest on the Swiss public administration's central portal for open government data.[42] In the full proposal, the consortium will need to present a data management plan.

Measures must be included to provide open access (free on-line access, such as the gold model) to peer-reviewed scientific publications that result from the project.

[38] See Section 2 and Appendix II of the SFOE's "Directive on the submission and evaluation of applications for financial support of energy research, pilot and demonstration projects", available at https://pubdb.bfe.admin.ch/en/publication/download/9952.

[39] See Appendix VI of the SFOE's "Directive on the submission and evaluation of applications for financial support of energy research, pilot and demonstration projects", available at https://pubdb.bfe.admin.ch/en/publication/download/9952.

[40] https://www.fedlex.admin.ch/eli/cc/2013/786/en

[41] https://www.fedlex.admin.ch/eli/cc/1991/857_857_857/de (available in German, French, and Italian)

[42] https://opendata.swiss/en. The SFOE can be consulted at ogd@bfe.admin.ch for advice about publishing data on the portal.

When Life Cycle Inventories (LCI) are elaborated or updated as part of the work programme, they must be submitted in the format of the DETEC database based on ecoinvent v2.2 (ecoSpold v1, including metadata, quantified uncertainty, and technical report) for reasons of transparency and comparability. They can then be integrated into the federal administration's DETEC database so that they can subsequently be published free of charge in accordance with federal guidelines.

3.5.2 ARAMIS publication

By signing the pre-proposal on behalf of all applicants and cooperation partners, the consortium coordinator declares that they agree to the publication and distribution of the findings gained from the project in compliance with the Federal Act on Freedom of Information in the Administration (FoIA).[43] Specifically, final reports and the main project information will be published on the ARAMIS information platform[44] and, if deemed beneficial, on the geoportal of the Confederation.[45]

4 Application

The application to be submitted in response to this call for pre-proposals consists of the pre-proposal and letters of commitment and intent.

4.1 Pre-proposal

The pre-proposal must be prepared in English using the template that is available on the SWEET website. The font, font size, line spacing, and margins must not be changed, otherwise the pre-proposal will not be considered for evaluation. Furthermore, the page limits specified in the template must be obeyed. Content that exceeds a specified limit or that was not specifically requested will be removed before the pre-proposal is forwarded to the evaluation panel.

4.2 Letters of commitment and intent

The host institution must submit a letter of commitment whereas applicants must submit letters of intent. There are no templates for the letters. They must be printed on the host institution's or applicant's official stationery, be addressed to the SFOE, and be signed by authorized representatives.

Cooperation partners are not required to submit letters of commitment or intent as part of the application. It is the responsibility of the host institution to secure appropriate letters from cooperation partners, especially if their contributions are critical to the consortium's work programme.

4.2.1 Letter of commitment of the host institution

The letter of commitment must demonstrate the host institution's commitment to fulfil its obligations (see Section 3.2.1). Since the host institution will be the contractual partner of the SFOE, the commitment must be confirmed by the institution's board. The letter must contain the full name and contact information of the person who is authorized to act as the consortium coordinator. Own and third-party contributions must be specified in the letter.

[43] https://www.fedlex.admin.ch/eli/cc/2006/355/en

[44] http://www.aramis.admin.ch

[45] http://map.geo.admin.ch

The letter must be submitted with the pre-proposal and the full proposal.

4.2.2 Letters of intent of applicants

By submitting a letter of intent, applicants express their intent to become members of the consortium should it be awarded funding. The letter must include a list of the work packages that the applicant intends to participate in and outline the nature of the applicant's contributions. Own and third-party contributions must be specified in the letter.

If the consortium is invited to submit a full proposal, applicants will be required to submit letters of commitment.

5 Submission

5.1 Submission process

5.1.1 Notification of intent to submit a pre-proposal

Consortia that intend to submit a pre-proposal must inform the SFOE by sending a notification of intent to submit to sweet@bfe.admin.ch no later than **27 October 2022**. The notification must be prepared in English using the template that is available on the SWEET website. The SFOE will acknowledge having received the notification by contacting the coordinator named in the notification.

The template includes sections that must be completed if the consortium includes foreign applicants (see Section 3.4.4). The SFOE will strive to inform the coordinator within 10 working days whether the applicants are approved.

The notification is mandatory, i.e., if a consortium did not submit a notification by the deadline given above, its pre-proposal will fail the admissibility check and hence not be evaluated (see Section 6.1). However, the notification is not binding, i.e., a consortium may choose not to submit a pre-proposal although it had previously notified the SFOE of its intention to do so.

5.1.2 Submission of application

The coordinator submits the application by sending it to sweet@bfe.admin.ch no later than **9 December 2022 at 12:00 noon CET**. A complete application must consist of:

1. A Microsoft Word document containing only the pre-proposal, named *Acronym*_preproposal (where *Acronym* is replaced by the consortium's acronym).
2. A single pdf document containing the pre-proposal (distilled from the Microsoft Word document) and all letters of commitment and intent, named *Acronym*_ALL.

The SFOE will acknowledge having received the application by informing the coordinator.

If the combined size of the two documents exceeds 20 MB, they must be submitted via the file transfer system of the Swiss federal administration (www.filetransfer.admin.ch). To receive the required access credentials, the SWEET Office should be contacted well in advance of the submission deadline.

5.2 Data protection

Proposals submitted in response to this call will be treated confidentially. They will be checked by the SFOE and evaluated by an expert panel. Following the selection of a consortium for funding, the proposals will be studied by the SFOE and the monitoring panel (see Section 7).

Proposals and evaluation reports will be stored on secure servers. The experts will be required to sign declarations concerning confidentiality and conflicts of interest before they will be granted permission to access proposals.

By submitting proposals, consortia agree to them being forwarded to experts for the purposes of evaluation and monitoring.

6 Evaluation

6.1 Admissibility and eligibility check by the SFOE

The SFOE will check all applications for admissibility (completeness of the application and satisfaction of pre-proposal requirements) and eligibility (satisfaction of consortium and applicant requirements) prior to the pre-proposal being evaluated by the expert panel. An application is admissible and eligible if all of the questions in Table 6-1 have been answered with “yes”.

If any admissibility and eligibility criteria are not fulfilled, the application will be rejected and not evaluated. The SFOE will inform the coordinator of the rejected application in writing and state which of the criteria were not met.

Table 6-1: The admissibility and eligibility criteria.

Admissibility	
A1	Did the consortium notify the SFOE of its intention to submit a pre-proposal and did it do so by the deadline given in the call text (see Section 5.1.1)?
A2	Was the application received before the deadline given in the call text (see Section 5.1.2)?
A3	Is the application complete (see Section 5.1.2)?
A4	Was the pre-proposal prepared with the correct template and formatting (see Section 4.1)?
A5	Did the host institution submit a duly signed letter of commitment with the requested minimum content (see Section 4.2.1)?
A6	Did all applicants submit letters of intent (see Section 4.2.2)?
A7	Has at least 10% of the core budget been allocated to the two work packages on management and coordination as well as KTT (see Section 3.4.4)?
Eligibility	
E1	Is the host institution entitled to receive SFOE funding and has one consortium coordinator been appointed on its behalf (see Section 3.2.1)?
E2	Does the consortium consist of at least 5 applicants from different legal entities (see Section 3.3)?
E3	Does the consortium consist of at least one applicant from (a) Swiss universities or an institute of the ETH domain, (b) Swiss universities of applied sciences, and (c) Swiss industry (see Section 3.3)?
E4	Did the SFOE approve all foreign applicants (see Section 3.4.4)?

6.2 Evaluation by the expert panel

Admissible and eligible pre-proposals will be evaluated by an independent panel appointed by the SFOE. The panel will consist of recognized experts from fields relevant to this call.

6.2.1 Evaluation criteria

Pre-proposals will be evaluated according to the criteria shown in Table 6-2.

Table 6-2: Evaluation criteria and their weights.

Criterion 1: Excellence	**Weight: 30%**
a. Clarity of the objectives and pertinence to the research challenge(s) b. Soundness of the proposed concept, including exploitation of synergies between the production of various fuels and platform chemicals c. Credibility of the proposed methodology (in particular appropriateness of the inter- or transdisciplinary approach and scientific merit, including the preliminary life-cycle analyses) d. Novelty and originality, extent to which proposed work is beyond the state of the art and demonstrates innovation potential (e.g., ground-breaking objectives; novel concept and methodology; new products, services, or business and organizational models)	
Criterion 2: Consortium	**Weight: 25%**
a. Appropriateness of the consortium, i.e., is it large enough to bring together the necessary expertise and enable an inter- or transdisciplinary approach yet small enough to ensure that all applicants have substantial and distinct roles as well as adequate resources b. Gender balance and reflection of Switzerland's diversity in terms of languages and regions	
Criterion 3: Impact	**Weight: 25%**
a. Extent to which the consortium's results are likely to attain the expected outcomes and outputs b. Appropriateness of the KTT concept c. Appropriateness of the collaboration with stakeholders	
Criterion 4: Work programme	**Weight: 20%**
a. Quality and effectiveness of the work programme, including the extent to which the resources assigned to work packages are in line with their objectives and deliverables b. Appropriateness of the project portfolio given the consortium objectives, including the interrelation of research and P+D projects c. Appropriateness of the management (of the consortium) d. Appropriateness of the coordination (with other SWEET consortia)	

6.2.2 Evaluation process

Pre-proposals are evaluated in terms of major and minor flaws:

- Major flaws compromise the whole pre-proposal and can be remedied only with substantial effort. Major flaws are divided into two types:
  - A major flaw is considered to be corrigible if the evaluation panel believes that it can be eliminated during the preparation of the full proposal. Corrigible major flaws include, but are

not limited to, objectives that are unclear, a lack of expertise in a key area, unclear outcomes and outputs, and unclear collaboration with stakeholders.

- Otherwise, a major flaw is considered to be incorrigible. Incorrigible major flaws include, but are not limited to, objectives that are not pertinent to the research challenge(s), unsound concepts, a methodology that lacks credibility, and a lack of expertise in several key areas.

- Minor flaws do not compromise the whole proposal and can be remedied in the full proposal without substantial effort.

The evaluation of pre-proposals consists of the following steps:

1. For each of the criteria listed in Table 6-2, the panel assigns a score according to the presence of incorrigible and corrigible major flaws, see Table 6-3. It should be noted that minor flaws do not influence the scores at the pre-proposal stage. The panel may assign half-scores.
2. From the scores for each criterion and the associated weights given in Table 6-2, the panel determines a weighted score for each pre-proposal.
3. The panel ranks the pre-proposals according to their weighted scores:
   - If two or more pre-proposals have equal weighted scores, the pre-proposal with fewer applicants will be ranked higher.
   - If two or more pre-proposals have both equal weighted scores and equal numbers of applicants, the pre-proposal with the better gender balance at the levels of coordinator and work-package leaders will be ranked higher.
4. The panel produces a shortlist of those pre-proposals that reach two thresholds:
   - Individual threshold: The score of each criterion must be at least 3.
   - Overall threshold: The scores of the criteria must sum to at least 10.

   For this call, at most two pre-proposals will be shortlisted.
5. The SFOE will inform coordinators about their pre-proposal's rank and provide them with an evaluation report that lists the major and minor flaws identified by the panel. The coordinators of the shortlisted pre-proposals will be invited to submit a full proposal and provided with the corresponding templates and instructions.

The panel's evaluation cannot be rebutted. The coordinators of pre-proposals that are not shortlisted can submit a formal objection within 30 days. After this period, the SFOE's decision to invite the coordinator of the shortlisted pre-proposals to submit a full proposal enters into force.

If a pre-proposal is not short-listed, suitably improved and expanded parts of it may be submitted to the research programmes and the P+D programme of the SFOE.

Table 6-3: Determination of scores for pre-proposals.

<table>
<tr><th colspan="2" rowspan="2"></th><th colspan="3">Incorrigible major flaws</th></tr>
<tr><th>None</th><th>Few</th><th>Many</th></tr>
<tr><td rowspan="3">Corrigible major flaws</td><td>None</td><td>5
(excellent)</td><td rowspan="3">2
(fair)</td><td rowspan="3">1
(poor)</td></tr>
<tr><td>Few</td><td>4
(very good)</td></tr>
<tr><td>Many</td><td>3
(good)</td></tr>
</table>

6.3 Preparation of full proposal

The consortia that have been invited to submit a full proposal will be expected to take into account the feedback contained in the evaluation report. Changes to the work programme between the pre-proposal and the full proposal will have to be detailed in a dedicated section of the full-proposal template. Changes to the consortia through the addition or departure of applicants will also have to be detailed and will be permitted only if the associated total redistribution of SWEET funding amounts to less than 30% of the total requested SWEET funding.

6.4 Schedule

Important dates relevant to this call are:

27 October 2022	Deadline for notifying SFOE of intention to submit pre-proposal
9 December 2022	Deadline for submission of pre-proposals
Late February 2023	Announcement of evaluation results
Late February 2023	Invitation to submit full proposal sent to shortlisted consortium
Mid-May 2023	Deadline for submission of full proposal
Mid-July 2023	Announcement of funding decision
October 2023	Consortium starts operations

Dates in italics are provisional. The deadline for submission of the full proposal will be announced together with the invitation to submit full proposals.

7 Consortium monitoring and reporting

The SFOE will appoint a panel to monitor the consortium. Beyond standard reporting (final reports on research and P+D projects), the consortium will be required to provide annual progress and finance reports. Detailed monitoring guidelines including reporting templates will be provided after the publication of the funding decision.

8 Contacts and further information

Questions about this call should be directed via email or letter to the SWEET office:

Swiss Federal Office of Energy
SWEET Office
Section Energy Research and Cleantech
P.O. Box
CH-3003 Berne / Switzerland
sweet@bfe.admin.ch

The questions and answers will be published on the SWEET website and regularly updated.

Appendix: Descriptions of interdisciplinary and transdisciplinary research

As stated in Section 1.1, the purpose of SWEET is to fund interdisciplinary and transdisciplinary research. Because these terms are not well defined, the following provides brief descriptions of them as interpreted by the SFOE in the context of the SWEET programme.[46]

To clarify the characteristics of interdisciplinary and transdisciplinary research, it is instructive to contrast them with multidisciplinary research. In multidisciplinary research, each discipline receives input from other disciplines, for example in the form of knowledge and data, but the discipline boundaries remain distinct. However, each discipline retains its paradigms, nomenclature, knowledge, and methods and hence there is little to no lasting impact of the research on the disciplines. Multidisciplinary research is adequate for problems that can be solved by a single discipline but where the solution benefits from the input of other disciplines.

In interdisciplinary research, the disciplines provide inputs to each other to solve a problem that could not be solved by one discipline by itself. Thus, although the discipline boundaries remain distinct, there is an integration of the disciplines. The integration enriches each discipline's paradigms, nomenclature, knowledge, and methods. The enrichment in turn leads to the development of new knowledge, methods, and tools, thereby having a lasting impact on the disciplines.

Transdisciplinary research may be viewed as a deeper and broader form of interdisciplinary research. It is deeper because it transcends disciplines and thereby blurs discipline boundaries. It is broader because it includes not just scientists, but also stakeholders such as citizens and authorities, who should ideally participate in all phases of the research process. Transdisciplinary research represents a unified problem-solving approach in which problems are tackled not only from a disciplinary perspective but grappled with in their entire complexity. Therefore, transdisciplinary research is necessary to solve problems that arise at the intersection of science and society or what is sometimes referred to as the "life-world".[47] The outcomes of transdisciplinary research cannot be assigned to a single discipline and include not just new knowledge and methods but also new paradigms.

Transdisciplinary research that tackles problems at the intersection of science and society may be thought of as research that generates not only systems knowledge (what is?), but also target knowledge (what are desirable target states?) and transformation knowledge (how to change?).[48] Each discipline and stakeholder contributes to the three types of knowledge, depending on its methods, its approach to framing and formulating research questions, and its capacity to link abstract and context-specific knowledge. This heterogeneity of contributions is viewed as an asset in transdisciplinary research, but also requires a respectful collaboration that begins with a joint framing of the problem.

[46] A comprehensive overview of definitions of transdisciplinarity may be found in Annex A1 of C. Pohl and G. Hirsch Hadorn, *Principles for Designing Transdisciplinary Research, Proposed by the Swiss Academies of Arts and Sciences*, oekom Verlag, Munich, Germany, 2007.

[47] See, e.g., G. Hirsch Hadorn, S. Biber-Klemm, W. Grossenbacher-Mansuy, C. Pohl, U. Wiesmann, and E. Zemp, The Emergence of Transdisciplinarity as a Form of Research, in: *Handbook of Transdisciplinary Research*, G. Hirsch Hadorn, H. Hoffmann-Riem, S. Biber-Klemm, W. Grossenbacher-Mansuy, D. Joye, C. Pohl, U. Wiesmann, and E. Zemp (eds.), Springer, 2008, pp. 19-39.

[48] A description of the three types of knowledge may be found in C. Pohl and G. Hirsch Hadorn, *Principles for Designing Transdisciplinary Research, Proposed by the Swiss Academies of Arts and Sciences*. oekom Verlag, Munich, 2007, pp. 36-39.