From SUNRISE to SUN-ERGY EU-Initiative: Knowledge and Technology Transfer (KTT) for Impact

Results of the Interactive Swiss SUNRISE Stakeholder Workshop (27.9.2019, Empa Dübendorf)

Proposal for “Task Force 0: KTT for Impact” as part of the new SUN-ERGY Roadmap

PUBLIC VERSION
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1. Introduction

At the beginning of 2019, the European Commission has selected SUNRISE as one of six candidates for future European large-scale research initiatives. The vision of SUNRISE is to “propose a sustainable alternative to the fossil-based, energy-intensive production of fuels and base chemicals. The needed energy will be provided by sunlight, the raw material will be molecules abundantly available in the atmosphere, such as carbon dioxide, water and nitrogen”\(^1\). SUNRISE thereby embraces the economic model of a circular economy\(^2\).

During 2019, the EU funds the coordination and support action (CSA) of the SUNRISE consortium with € 1 million, enabling the research partners to prepare the full, long-term research initiative. In the framework of this CSA, the objectives have been:

- to develop the Scientific and Technological Roadmap (S&T Roadmap)
- to build the community including scientific, industrial and general public stakeholder,
- to establish an effective governance scheme for the large-scale research initiative

During the past few months, SUNRISE managed to establish a considerable network of partners and supporters and established the S&T Roadmap. During this preparation phase, two important changes took place:

- Initially, the future funding of the large-scale research initiative had been planned in the framework of the EU Flagship Program over the next 10 years. However, this program is no longer available so that other sources for funding on EU level are currently being evaluated.
- With the initiative Energy-X, the European Commission supports a CSA very similar to SUNRISE. In August 2019, the two consortia announced that they will join forces going forward. The new initiative is called SUN-ERGY.

In the work plan of the SUNRISE CSA, aspects of innovation and exploitation (WP 2, T2.1), dissemination, communication and education (WP 3 – e.g. T 3.2.3 Societal, ethical and legal implications) as well as quantitative sustainability assessments (Task Force 8) have been included as important aspects for the success of the initiative.

Given the high complexity and importance of the combined SUN-ERGY initiative, the authors of this paper propose to include an even more extensive system view and to increase the focus on the community building in the area of knowledge and technology transfer (KTT).

Researchers and KTT experts from WSL and novatlantis have been actively supporting the SUNRISE initiative in 2019. The information on a system-view, the workshop results and proposal for a future Task Force O ‘KTT for Impact’ provided in this document reflect the past commitment and the enthusiasm of the authors to become active partners for the future SUN-ERGY project.

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1.1. The Importance of a System View

Science and technology are crucial for the design of future energy systems and for setting targets for alternative economies. While most of the national energy strategies build on the use of renewable, yet limited natural resources for renewable energy production, the advancement of technologies within the SUN-ERGY (previously SUNRISE and ENERGY-X) framework draw from almost inexhaustible resources while delivering a broad spectrum of products – fuels and base chemicals - going far beyond mere energy provision.

When planning the transformation towards a low-emission society, sound information about the environmental and landscape risks entailed and the societal acceptance of new solar energy systems is needed to identify potential areas of conflicts as well as risks. These can be related to (i) input materials and resources required to build and operate a technology or facility, (ii) potential impacts of infrastructures, processes and technologies on landscape and the environment, which ultimately influence public acceptance, and (iii) final products, their storage, transport and use, related costs and possible rebound effects.

A comprehensive system understanding (compare Fig. 1) can help to identify most sustainable technologies, to prevent or mitigate unwanted impacts, and to reduce associated environmental and societal risks. In the same vein, it may shorten the implementation time required and could reduce the total cost of the new solar energy system.

![SUNRISE System view](image)

**Fig. 1: SUNRISE System view**

The right choice of SUNRISE technologies (green box) and related transformation pathways requires a system understanding. This includes information on input materials and resources (blue box), infrastructure, processes and technologies (brown box), and the entailed products (yellow) (Illustration: A. Björnsen Gurung 2019).
2. Interactive Swiss Workshop on Knowledge and Technology-Transfer

As part of the ‘SUNRISE Swiss Stakeholder Workshop’ that took place at Empa, Dübendorf on 27th September 2019, WSL together with novatlantis prepared an interactive workshop with all participants to gain insights on the system understanding and knowledge-transfer as outlined in Figure 1 in chapter 1. The workshop consisted of three parts, including:

a) ‘**Feeling the pulse**’ on target products, markets and process: Do we agree on what we want to achieve and how we plan to proceed?

b) ‘**Beyond research**’ on potential (national) collaborations within existing structures, stakeholder involvement and lobbying activities: How and to what degree to embed the SUNRISE initiative in existing strategies and structures?

c) ‘**Towards a system view**: impacts on environment, society and landscape’: Missing elements and linkages? Voting for crucial topics and topics of less minor relevance.

All participants had the opportunity to discuss the three above mentioned topics in small groups during 10-15 minutes.

2.1. ‘Feeling the Pulse’ on Target Products, Markets and Process

In this part of the workshop participants were asked their opinion regarding the target products of SUNRISE Switzerland, the intended markets (from local to global) and the expected progress within the 10 year framework. Participants could express their opinions through the placement of yellow stickers (one per question) as shown in Figure 2.

![SUNRISE Switzerland: Feeling the pulse](image)

**Fig. 2:** SUNRISE Switzerland: Feeling the pulse
Participants discussed vividly, which target products SUNRISE\(^3\) should focus on. As indicated by the yellow stickers placed mostly in the middle of the triangle (compare top part of figure 2, labeled a)), many voiced the opinion that hydrogen, fuels & hydrocarbons as well as chemicals & materials are equally important. While not all discussion points can be presented in this document, some statements that were mentioned several times include:

- **Hydrogen is a topic with a strong present research focus.** Some participants see this as ideal basis for further development and (applied) research activities, other participants feel that the focus of SUNRISE should be more directed towards products (and technologies) currently receiving less funding. Focusing on hydrogen as ‘high-value product’ may attract whole (industry, market, research) clusters with supporting technologies in Switzerland.

- **For some participants it was not clear, how the term ‘target product’ is defined.** This was particularly the case for chemicals and materials as they can serve as basis or intermediary products for other target products. Additionally, the distinction between ‘technology’ and ‘product’ was not always clearly made during the discussions.

- **Another way of looking at the outputs of research activities (instead of the target products indicated by the SUNRISE consortium) could be to identify the uses / needs or markets (e.g. division of fuels by various applications within the mobility sector).**

- **Some participants see the current Swiss industry as very good basis for further development and reasoned that attention should be paid to the currently available, national infrastructure.** Other participants believe in disruptive innovations, creating new research and industry clusters in Switzerland in the future without further considerations for existing industry.

Another point for discussion was the question, for which markets Swiss project partners should develop new technologies. Interestingly, a clear split between the focus on the European market and a global approach can be seen (compare figure 2, middle section labeled b)). Some participants reasoned that renewable technologies stand a higher chance of market success in the European market compared to the global market due to more stringent environmental regulations (e.g. adequate CO\(_2\)-pricing for fossil fuel). Others argued that technologies should be used where they are needed and / or where they work best. A highly successful technology should be applicable on a global level. Concerns were voiced regarding the adherence to IP rights in case of global markets (and production locations). Today’s political trend towards isolationism of states may hamper access to global markets. Switzerland as market has been considered as too small by many participants. One vote in favor of a national, Swiss focus was based on the reasoning to ‘know your own market (needs)’.

When asked what kind of progress the SUNRISE project should achieve within the next 10 years, most participants voted for what was often called a ‘realistic’ approach with pilot and demonstrator plants in place (compare Figure 2, lower section, labeled c)). The concern was voiced that a lot of the current research is focused on basic research and that the experience of the past allows us to see at which pace developments can be realistically expected to take place in the future (namely not on a very fast pace). Another statement favored the view of a

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\(^3\) As the workshop was conducted in the framework of the H2020 CSA ‘SUNRISE’ and most participants have been invited in their roles as partners and supporters of this CSA, this name – and not the one of the successor project SUNERGY – is used in chapter 2 of the document.
continuous progress, where ideally all development stages should be covered at all times ('pipeline' of new research and applied research).

2.2. ‘Beyond Research’ on Collaboration, Stakeholder Involvement and Lobbying

In the second part of the workshop participants were invited to discuss the role of SUNRISE within the Swiss framework regarding the integration of SUNRISE in other Swiss research efforts, best ways to gain support from relevant stakeholders and recommended lobbying activities. Participants could express their opinions in individual statements and short group discussions with key results as shown in Figure 3.

Fig. 3: SUNRISE Switzerland: Beyond research

How to integrate SUNRISE project in other Swiss research efforts?

The workshop participants agreed that an intensive exchange of the Swiss SUNRISE researchers with the current and future research in the field of energy and circular economy is not only desirable, but necessary.

Specifically named:

- National Centres of Competence in Research (NCCRs) of Swiss National Science Foundation (NF)
- Swiss Competence Centers for Energy Research (SCCERs)
• R&D in industry
• Public programs and P&D programs of Swiss Federal Office of Energy (SFOE) and Federal Office for the Environment (FOEN)
• Swiss Innovation Agency (Innosuisse)
• Universities of Applied Sciences and Arts

A central concern in the discussions was that, while exchanges with the relevant research community in these organizations are urgently recommended, the administrative burden should not be excessive. The right balance between efficient exchange of knowledge and technology on the one hand, and coordination and administrative effort on the other hand, the Swiss SUNRISE stakeholders consider a challenge.

Only one person took the view that cooperation was not useful as it would make SUNRISE more (too) complicated. All other workshop participants regard efficient cooperation with other Swiss research efforts as essential.

How to gain support from relevant stakeholders?

The question of supporting SUNRISE in Switzerland through relevant stakeholders initially seemed somewhat surprising to the workshop participants. This perhaps because, assuming the acceptance of the new major initiative SUN-ERGY from the merger of SUNRISE and EN-ERGY-X, the researchers expect a very high subsidy amount. However, the question of "support" clearly also applies to all non-financial areas. After a short discussion, on the kind of "relevant stakeholders" to be addressed, the brainstorming in the workshop groups led to the following results:

• SME: certificates, patents, trading etc.
• Industry: early adaption
• Politicians: finances, budgets, boundary conditions, political stability, reliability
• KLIK (Swiss Foundation for Climate Protection and Carbon Offset): CO₂-compensation
• General public
• Tourism sector
• Academia
• Think Tanks and Interest Groups (aee suisse: Umbrella Organization of the Swiss Economy for Renewable Energy and Energy Efficiency; Swisscleantech: Swiss Business Association for a climate-friendly economy)

Key arguments to convince important actors are “net zero CO₂”, cleantech business, security of supply, and circular economy.

SUNRISE Lobbying: Who, when, where, what?

The workshop participants had different attitudes to SUNRISE lobbying: while most researchers want to publish and advertise their research results also outside the academia by themselves, a minority of the participants felt that lobbying should be outsourced, as it would fall into the hands of PR experts and professional lobbying companies.

Who?

• Well-known professors
• Specific journalists and (social) media experts
• Grass-roots movements: Fridays for Future, Scientists4Future
When?

- In the very beginning
- When first products are available

What?

- Create a key picture or graphic
- Plan the budget process
- Integrate the right people
- Include a detailed timeline of actions

The lobbying discussions showed diverging views. Therefore, the SUNRISE community should discuss the topic in depth and debate early on a common strategy and attitude.

As an overall conclusion of the workshop “beyond research” it can be stated that:

- an effective cooperation and exchange of SUNRISE researchers with the other relevant Swiss research activities should be sought
- a broad support from relevant stakeholders across many industries/sectors is required
- an early and professional lobbying should take place (either by the different stakeholders and/or by a PR agency)
- the researchers in SUNRISE need a global view as much as a national perspective, where Swiss researchers must take into account, in particular, the specific national priorities and borders

2.3. ‘Towards a System View: Impacts on Environment, Society and Landscape’

As part of the evaluation of the system view, participants were asked to assess the impacts on society, environment and landscape as shown in Figure 4. The illustration takes the (original) SUNRISE proposal as starting point and adds elements and impacts regarding

- Input materials & resources,
- Infrastructure, processes, technologies,
- Products.

Specific questions asked were:

- What is missing in the illustration (processes, topics, linkages etc.)? Indicated by the yellow post-its added to the illustration
- What topics / elements are most relevant for the successful implementation of SUNRISE technologies into society? Why?
- Which aspects are less important to reach the goals, given limited resources? Why?
Fig. 4: SUNRISE: Workshop Towards a System View

Additional topics added to the illustration include:

Resources
- Consider the role of market price of electricity (demand > or < as supply)
- Land should be treated as a resource (shift to the left)

Infrastructure, processes, technologies
- Aim at an integration of technology as a positive (‘beautiful’) part of the landscape
- Make use of former industrial areas in city planning for the use of SUNRISE technologies
- Highlight the benefits of circular economy for local communities
- Set quantitative targets (processes, costs, potential, efficiency)
- Strive for a full cradle-to-grave system view

Products
- Green investments in SUNRISE technologies as a key focus and driver
- Provide incentives for early adopters
- Consider CO₂ transport and storage infrastructure
• How to guarantee security of supply for the new products?
• Be aware of the high cost of new infrastructure for individual users
• Need of a sound financial analysis and modeling

The topic of materials was seen by many participants as important point, indicated by the various green stickers. Other topics that were reviewed as most relevant system elements included user acceptance, ecological impact, financial and quantitative (product) aspects and transition challenges. The aspects of combined / multifunctional land-use systems and particularly rebound effects were seen as less relevant for the success of SUNRISE. The underlying reason would require a further discussion.

2.4. Summary of Workshop

The workshop gives a clear indication that views of the participants vary widely when it comes to the broad system-view of SUNRISE technologies.

The organizers of the workshop gained the impression that system-view topics had not yet been discussed by the Swiss partners and supporters previous to this workshop but are seen as important part to support the successful development of the SUNRISE / SUN-ERGY Roadmap and consecutive implementation.

This short workshop can only provide a starting point of how such a system-approach can look like in the framework of the newly combined SUN-ERGY initiative. It shows however, that the development of a concept in regards to system-view and KTT is necessary to (1) further shape the conceptual framework of SUN-ERGY and (2) to steer the initiative during its implementation.

Chapter 3 provides first information on how such a ‘Task Force 0 – Knowledge and Technology Transfer for Impact’ in the framework of SUN-ERGY could look like.
3. ‘Knowledge and Technology Transfer for Impact’ as Part of SUN-ERGY Roadmap

Both SUNRISE and EnergyX are science-driven, technology-oriented initiatives. The complex processes, materials and technologies that should be developed by the joint SUN-ERGY initiative (2020 - 2030) call for appropriate expertise not only for knowledge and technology transfer (KTT) throughout the entire program implementation, but also for skills to build the related system understanding, which again calls for a European SUN-ERGY KTT network.

To facilitate the transformation towards a circular economy while minimizing socioeconomic risks and unwanted environmental impacts, we strongly recommend to include an additional Taskforce 0 „KTT for Impact“ in the SUN-ERGY Roadmap. This Task Force coordinates and conducts national and European support activities throughout the SUN-ERGY implementation phase. These activities aim at supporting the inter- and transdisciplinary dialogue between project partners and relevant stakeholders from industry, SMEs, policy, community representatives, administration and others.

3.1. Proposed Work Packages

*Initial activities: set-up within the first year of SUN-ERGY (2020)*

a) KTT network development at the European scale (as a precondition for b. and c.).

All participating countries should aim at developing their own KTT network based on already existing national networks, initiatives and programs. The KTT efforts should be headed by one responsible person who acts as liaison with the SUN-ERGY KTT network.

b) National Workshops on „Rendering SUN-ERGY societally relevant“ (2 days each) with scientists and practitioners.

Workshop with key stakeholders of the SUN-ERGY program in participating countries on how to render scientific work (more) relevant. This workshop could e.g. be based on the research paper of Christian Pohl, ETHZ on ‘10 steps to make research societally relevant’ (Pohl et al. 2017)\(^4\)

c) National Workshops on „Elaborating the SUN-ERGY system view“ (1 day each) to identify relevant themes for socioeconomic research.

Based on the experience of the Swiss SUNRISE workshop (compare chapter 2), further national workshops regarding relevant topics (e.g. system view, framework conditions etc.) should be conducted to sensitize key stakeholders for important topics beyond technology research.

Consolidated results of such national activities provide important interdisciplinary and transnational insights, leading to research calls and KTT activities supporting the vision and targets of SUN-ERGY.

Continuous activities within the framework of SUN-ERGY (2nd to 10th year – 2021 - 2030)

d) Design and ensure Task Force management and coordination (including European KTT events) and overall KTT support to the SUN-ERGY Steering Committee.

e) Design, manage and coordinate one or several calls for socioeconomic research within the SUN-ERGY Program to support the transition towards a circular economy.

f) Design and conduct accompanying research on specific aspects of the SUN-ERGY Program implementation (e.g. stakeholder participation processes).

3.2. Next Steps

Dr. Astrid Björnsen (WSL) and Dr. Anna Roschewitz (novatlantis) will participate in the next EnergyX workshop, taking place in Frankfurt during 2nd December 2019. They have suggested to conduct a similar workshop to the one presented in this document to gain further insights and starting points for the development of a ‘Task Force 0’ as proposed in this chapter.

Based on the EnergyX workshop (Frankfurt) and the one conducted by SUNRISE (Dübendorf), WSL together with novatlantis could develop a concept for ‘Task Force 0: KTT for Impact’ for the integration into the SUN-ERGY roadmap by February 2020. Partners proposed for this preparatory work are:

- Dr. Astrid Björnsen Gurung, Swiss Federal Research Institute WSL
- Dr. Anna Roschewitz, novatlantis, Zurich
- Cornelia Moser, novatlantis, Zurich

3.3. Contacts

Contacts for further information regarding the SUNRISE workshop on system view and the proposed Task Force 0: ‘KTT for Impact’ are as follows:

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