Swiss Competence Center on Energy Research
Area: Grids and their Components – Energy Systems

SCCER FURIES

Future Swiss Electrical Infrastructure

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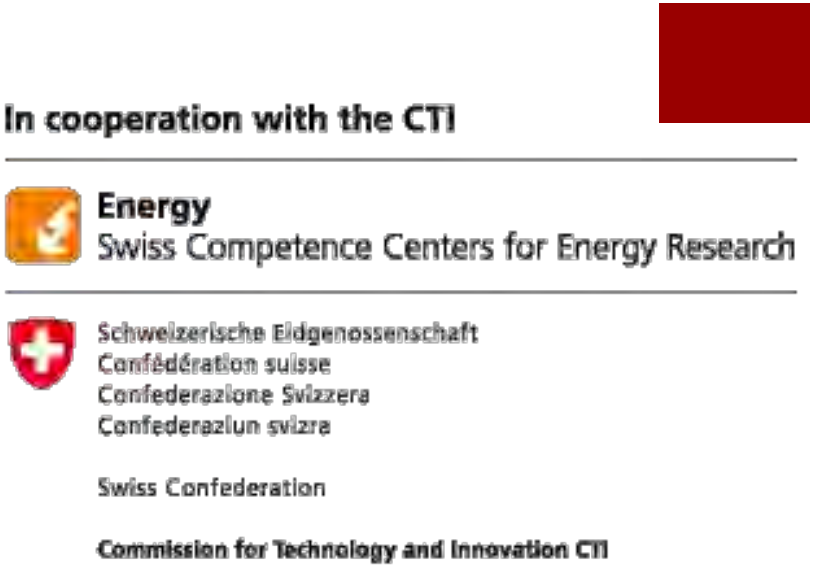
The Swiss Competence Centers for Energy Research – SCCERs

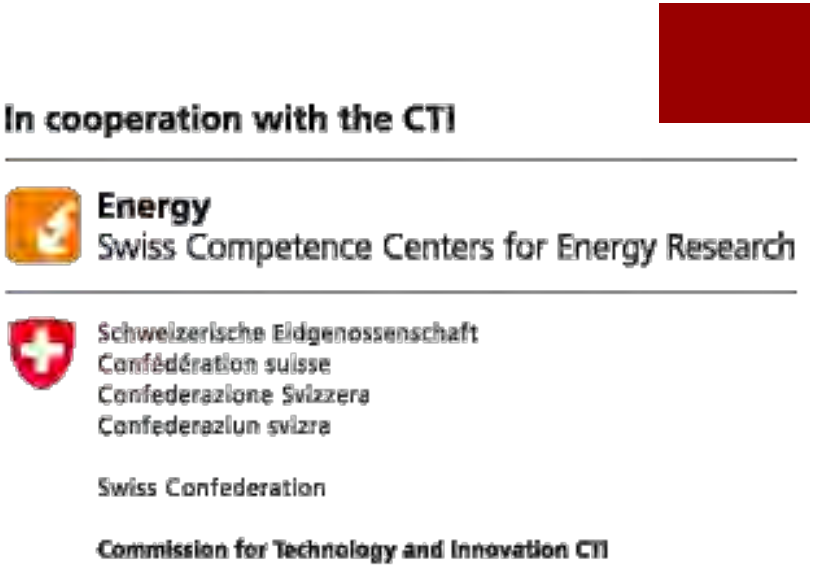
What are the SCCERs ?

- On 25 May 2011 the Swiss Federal Council decided to **gradually phase out nuclear power** ending in **2035**.



- The **energy system in Switzerland will be reshaped**, taking into account potential conflicts with climate, water protection, landscape protection and spatial planning objectives.
- **Applied research** and **science-based innovation** are expected to make a **long-term contribution** towards the implementation of the **2050 Energy Strategy**. **Research and innovation** promotion is therefore a **key instrument**.

What are the SCCERs ?



- Consideration must be given to the **entire knowledge production chain** and the benefits it can deliver, from **basic research through the development of implementation models and prototypes to demonstration installations and implementation on the market**.
- **A number of Swiss Competence Centres for Energy Research (SCCER) have been established to this aim.**

The framework: 2050 Swiss energy strategy

2050 Swiss energy strategy
Status and perspective for electricity

2010:

- Domestic electric energy consumption: **60 TWh**
- Domestic production & consumption balanced over the year.
- Domestic production:

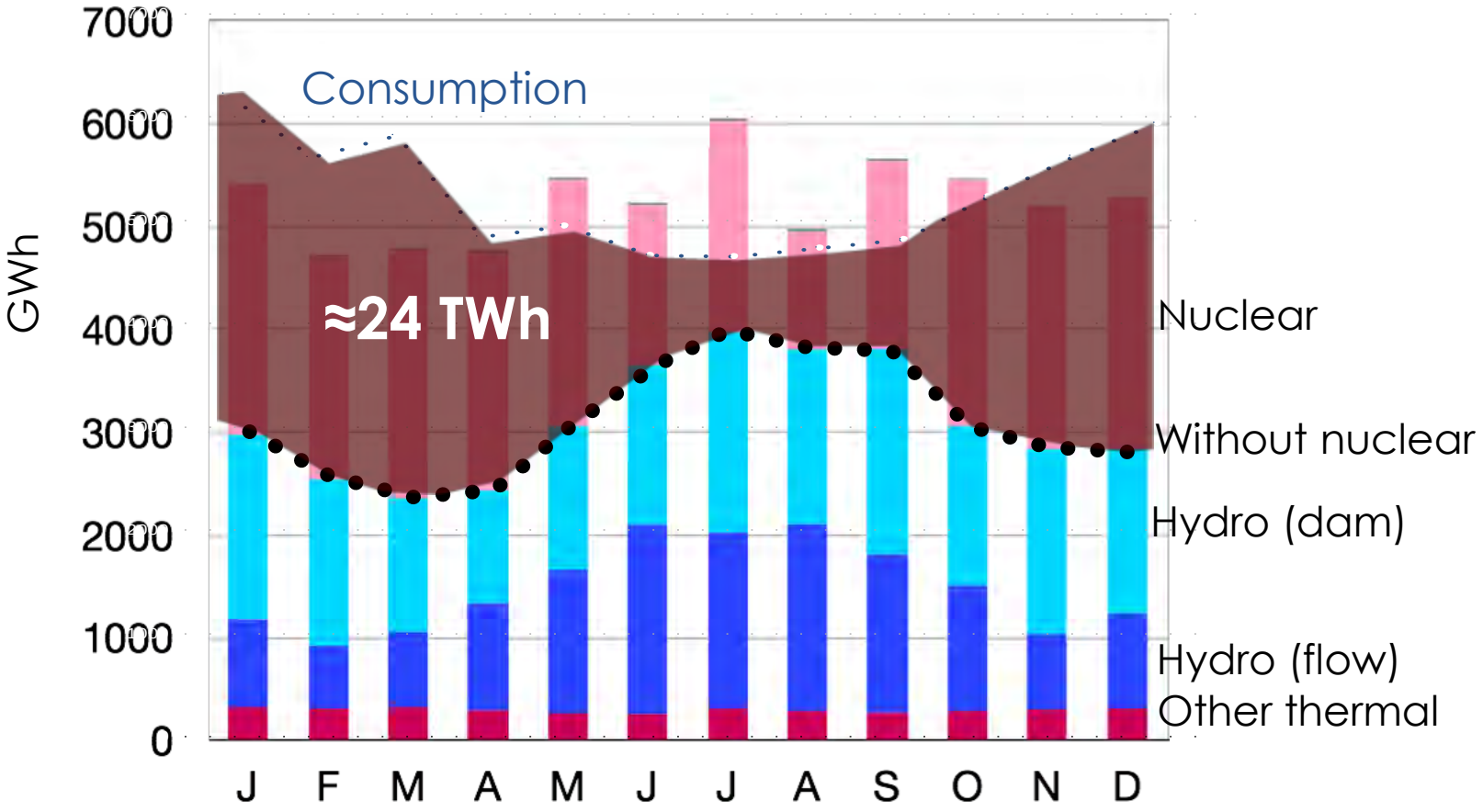
56.5% hydro	**34 TWh**
38.1% nuclear	**23 TWh**
5.4% other	**3 TWh**

2050-horizon assumptions:

- If no hanges in the consumption profile: **84 TWh**
- Economies: **24 TWh** in the consumption → **60 TWh** (as in 2010 but 9M inhab.)
- Hydro: **36 TWh**
- **New renewable energies: 24 TWh (predominantly PV and wind)**

2050 Swiss energy strategy

Year-profile for electricity production in 2011



Status in 2011 for **non-hydro renewables**:

- biomass =0.67%
- solar PV =0.24%
- wind=0.11%

2050 Swiss energy strategy

Main challenges for the electrical infrastructure

Remark: technologies for the the production of electricity from renewables are nowadays quite **consolidated**.

New questions to be addressed:

1. Which **electrical infrastructure** (**regional** and **country scales**) is needed to allow the **penetration of 30-40%** of electricity production from **non-hydro renewables** ?

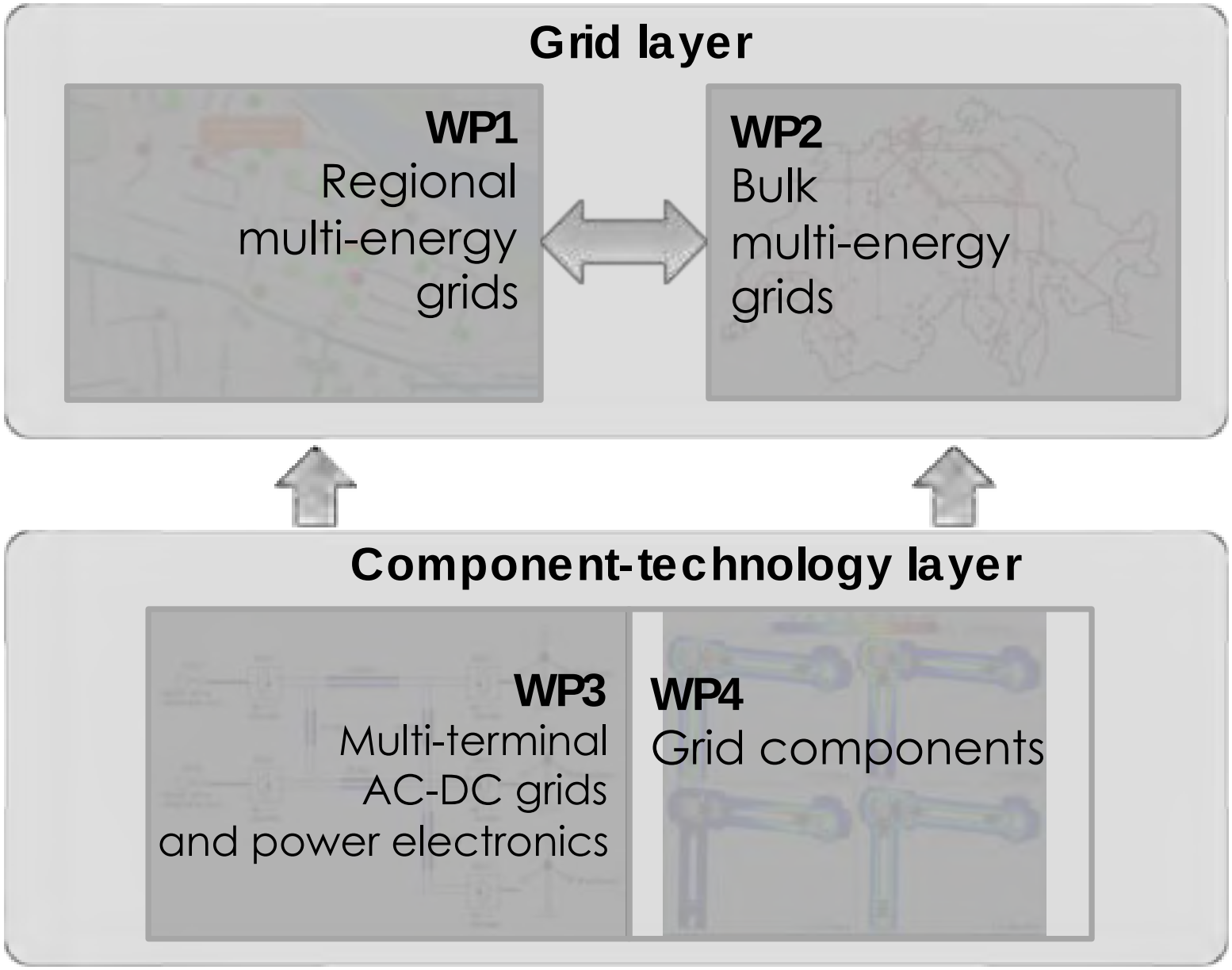
1. Which **processes** and **components** we need to develop and deploy for the **monitoring and control** of the electrical grid ?

2. **How far can we decentralize** the **production** electricity and the **storage** of energy ?

SCCER FURIES
Structure and Workplan

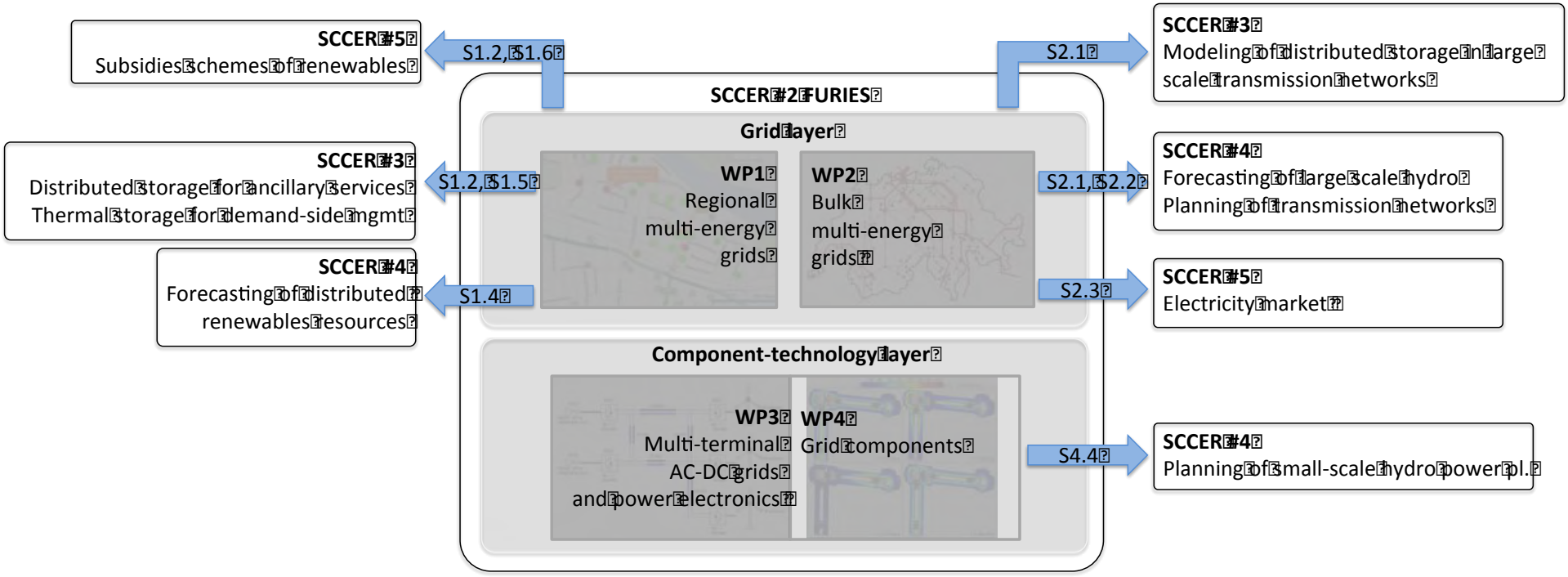
Structure and workplan

Interlink among the WPs



Structure and workplan

Interlink with other SCCERs



Structure and workplan

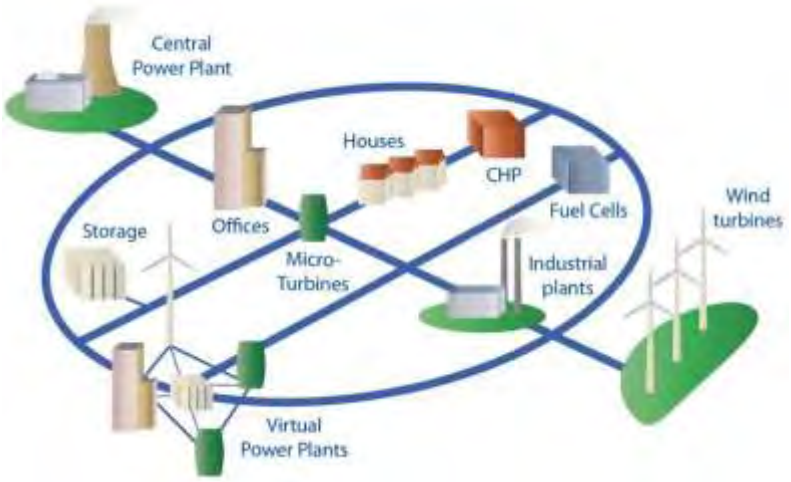
WP #1 – Regional multi-energy grids

Sub-Tasks

S1.1. Smart metering infrastructure

S.1.2. Demand side response/management

S1.3. Ancillary services for distribution grids



S1.4. Forecasting tools of renewable energy production

S1.5. Planning procedures of regional energy systems

S1.6. Development of standards/grid codes for distribution networks

Structure and workplan

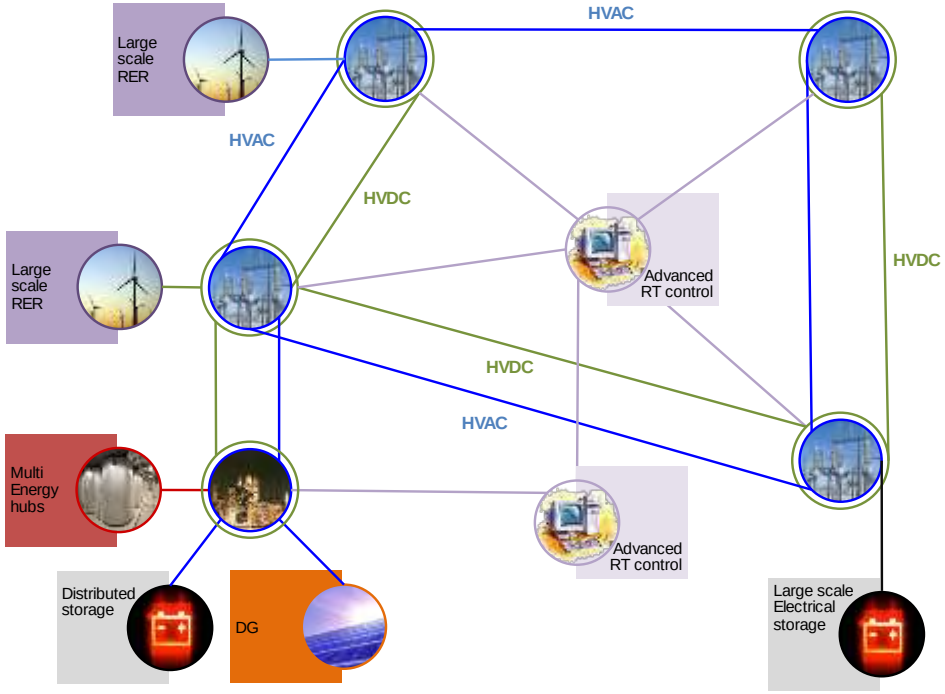
WP #2 – Bulk multi-energy grids

Sub-Tasks

S2.1 Modelling of large scale multi-energy systems

S2.2 Transmission system upgrade

S2.3 Market coupling

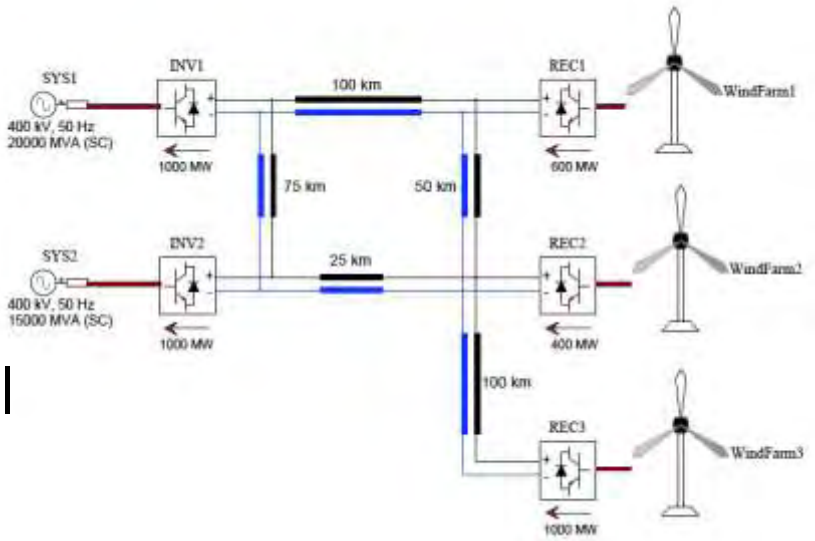


Structure and workplan

WP #3 – Multi-terminal AC-DC grids and power el.

Sub-Tasks

S3.1. Multi-terminal HVDC system design and operation



S3.2. Fault clearing in multi-terminal HVDC

S3.3. Enabling technologies

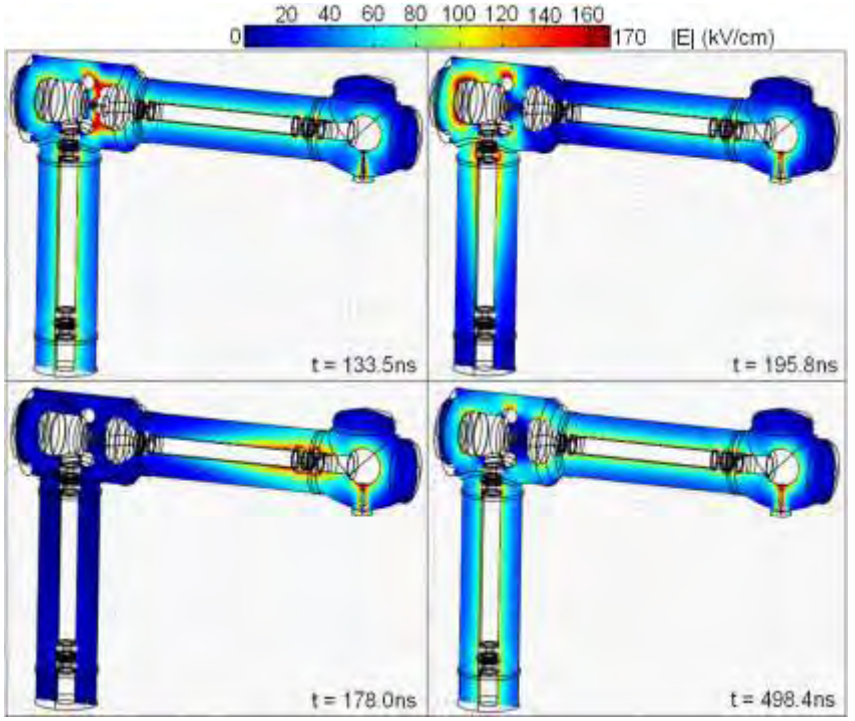
Structure and workplan

WP #4 – Grid components

Sub-Tasks

S4.1. Modelling and experimental investigation of Very Fast Transient (VFT) in DC installations

S4.2. Life-cycle optimization of power system components and reliability analysis



Adapted from Cigré TB C4.501-2013 "Guide For Numerical Electromagnetic Analysis Methods: Application to Surge Phenomena And Comparison With Circuit Theory-based Approach"

S4.3. Addressing instability of hydro power plant during their design

S4.4. Embedded systems for the electrical grids real-time monitoring

SCCER FURIES structure

Academic partners

Total 32 labs involved

1. EPFL (Leading house)
2. ETH-Z
3. University of Basel
4. Università della Svizzera Italiana
5. Haute Ecole Spécialisée de Suisse occidentale
6. University of Applied Sciences and Arts of Southern Switzerland
7. Zurich University of Applied Sciences
8. University of Applied Sciences of Northwestern Switzerland
9. Bern University of Applied Sciences
10. University of Applied Sciences of Eastern Switzerland
11. Lucerne University of Applied Sciences of and Arts
12. Swiss Center for Electrotechnic and Microtechnic

SCCER FURIES structure

Industrial partners

Confirmed

1. ABB
2. Siemens
3. Andritz Hydro
4. Brunner + Imboden AG
5. Sputkik Engineering AG / SolarMax
6. Helion Solar AG
7. Axpo
8. BKW
9. Romande Energie
10. EWZ

Perspective

11. Alstom Grid
12. SwissGrid

SCCER FURIES
Evaluation and outcomes

Evaluation

- **Monitoring Report** (yearly-base)**:** status report of the **scientific progress of the projects** where FURIES stands in terms of the overall strategy, information about staff creation etc. The report will be used for the scientific evaluation of FURIES.

- A **fundamental metric** that will be used by the **Evaluation Panel** (yearly review) is the **involvement of industrial partners.**

- **Tech-transfer is a key aspect for the project success.**

- **Contracting with industry and their involvement on demo/pilot project is fundamental as well.**

Expected outcomes

- The SCCER FURIES project **join the competences of the top Swiss academic and industrial actors** in the area of power systems. FURIES is expected to **shape the next generation of the electrical Swiss infrastructure in all its layers**, from transmission to distribution, enabling a **vast penetration of renewable energy resources in order to facilitate the Swiss nuclear-power phase-out**.

- The project has **different action scales** that range from the **system dimension to its components**. In particular, FURIES will research **up-to-date planning, monitoring and control strategies of the electrical grid together with the study of new components**. The proof-of-concept of the research will be deployed towards **real-scale experimental demonstrators**.