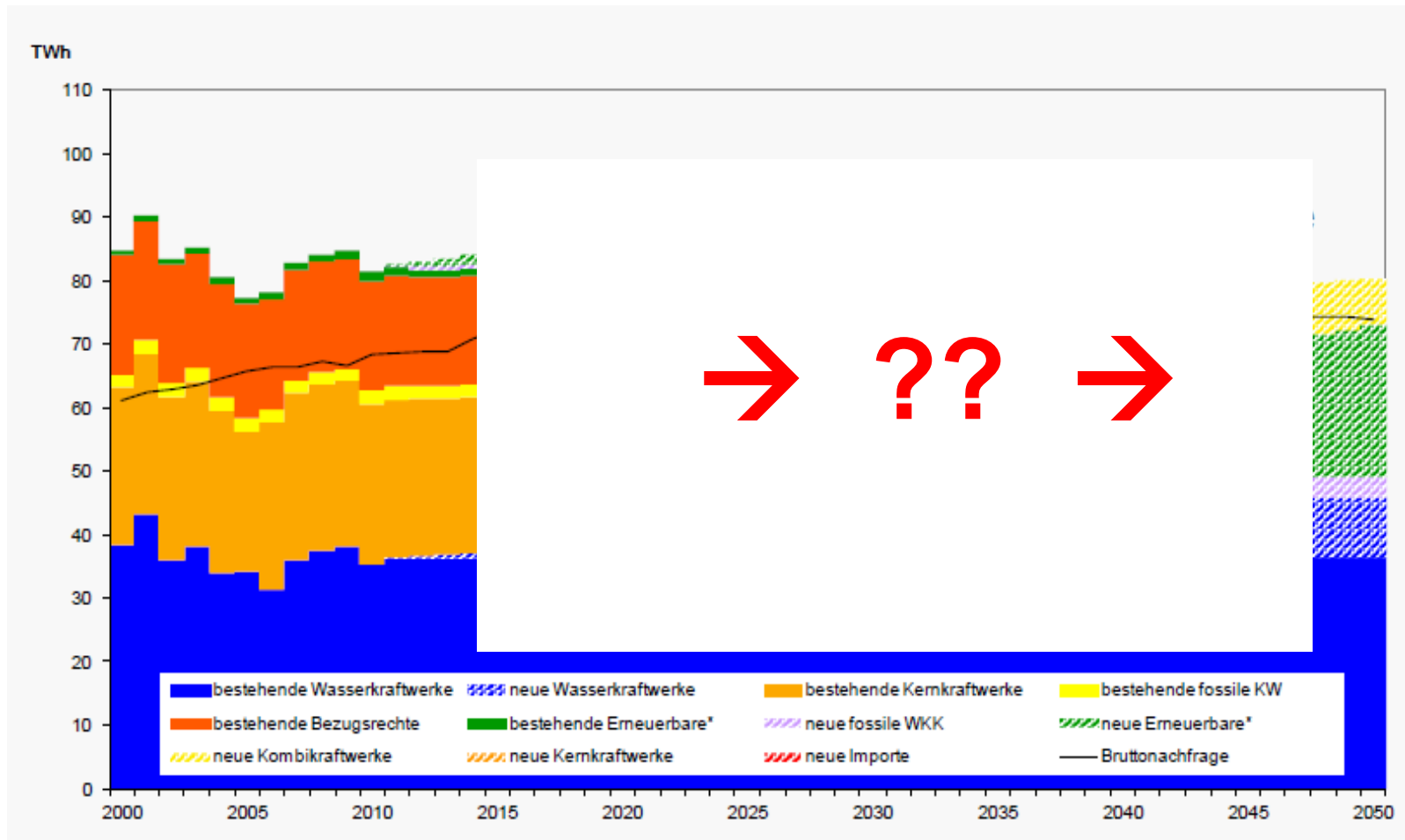


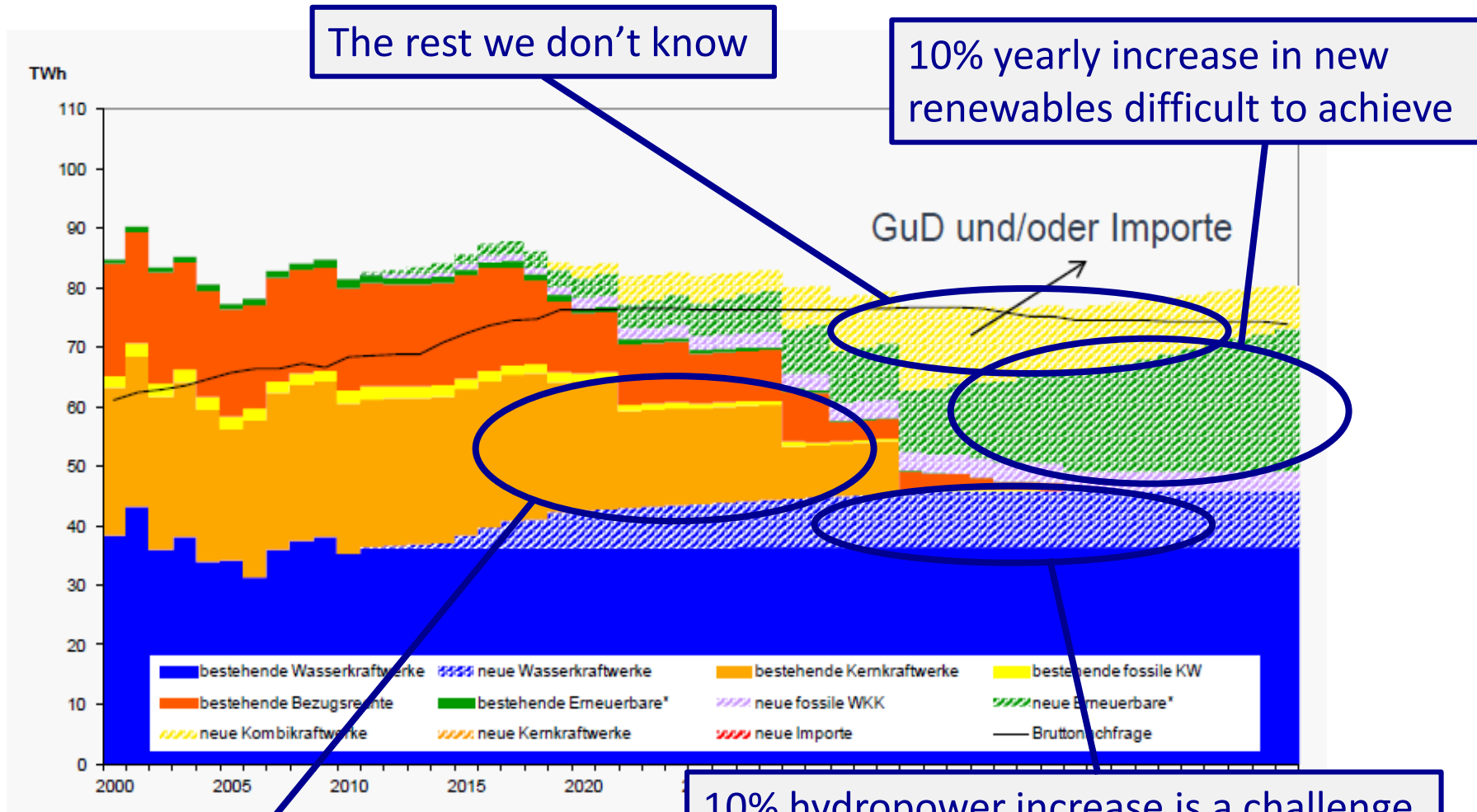
The Swiss Competence Center for Energy Research: Supply of Electricity

SCCER-SoE Annual Conference
Zurich, September 30, 2014

Prof. Domenico Giardini
Head, SCCER-SoE



Switzerland 2050: 9 mil population, 60% GDP increase, electricity-based mobility → same electricity consumption as today !



The rest we don't know

10% yearly increase in new renewables difficult to achieve

GuD und/oder Importe

Global nuclear industry is very vulnerable and would not survive another Fukushima

10% hydropower increase is a challenge with today's water, and we don't know what water we will have in 2050

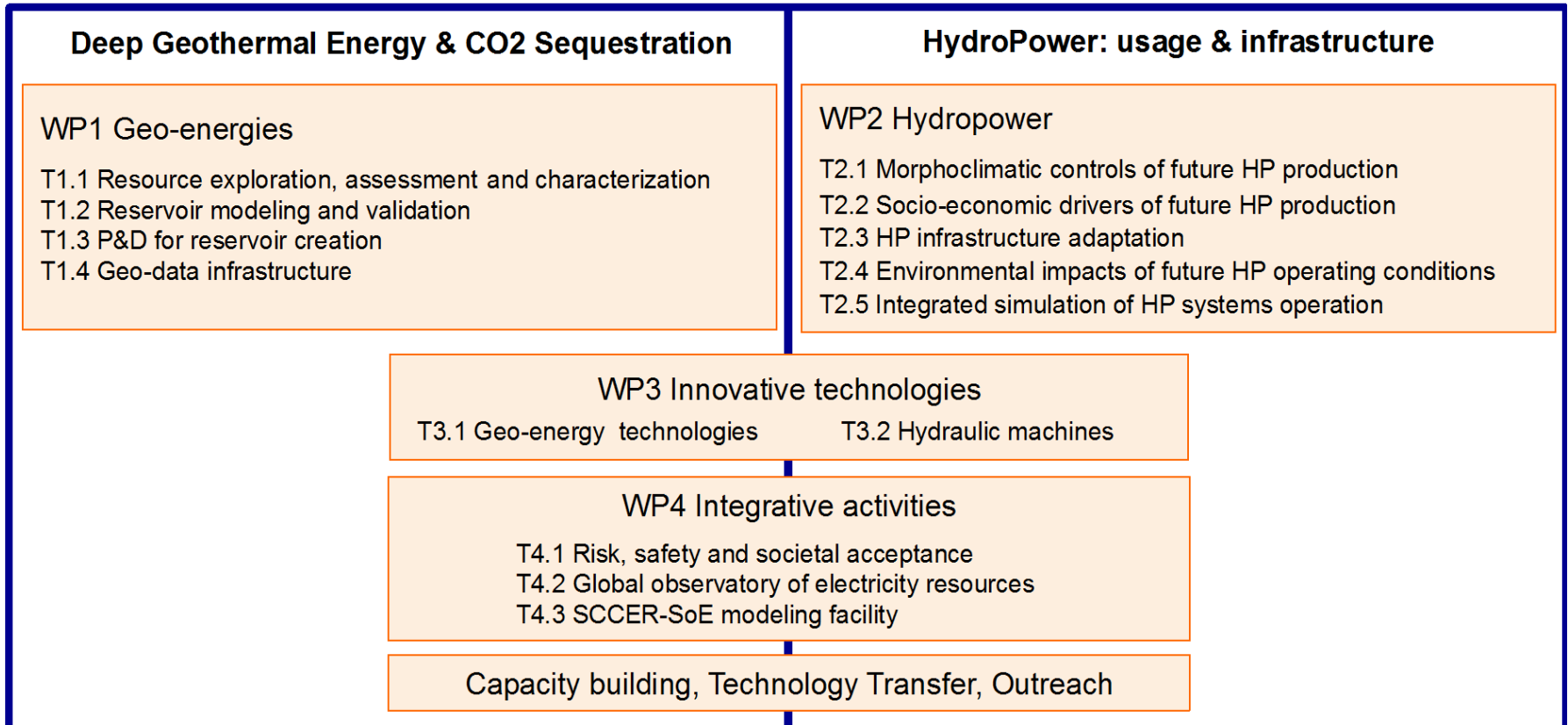
Since 2013, Switzerland has increased support to energy R&D, enlarging the range of support offers. In addition to the traditional SNF and CTI projects in energy, we now have:

- ✓ 8 new Swiss Competence Centers for Energy Research (grids, efficiency, mobility, supply ...)
- ✓ New SNF professorships
- ✓ Increased (almost doubled) CTI budget for energy R&D with new rules (projects without industry participation)
- ✓ P&D SFOE
- ✓ SNF NFP70 Energiewende

The SCCER-SoE was initiated on November 1, 2013, to respond to three questions posed by the Bundesrat and Parliament for electricity supply

- 1) can we extract safely the deep geothermal heat and produce at competitive costs a substantial portion of the national electricity supply, covering up to 5-10% of the national baseload supply ?
- 2) is the geological capture of CO₂ a viable measure to enable carbon-free generation of electricity from hydrocarbon resources ?
- 3) can we increase (i.e. by 10%) the present hydropower electricity production under changing demand, climate and operating conditions ?

- ✓ Phase I: 1.11.2013-31.12.2016
- ✓ Domains: Geo-Energies, Hydropower
- ✓ 4 Work Packages, 14 Tasks, 13+10 Research Partners
- ✓ CTI budget: 12 mln Fr



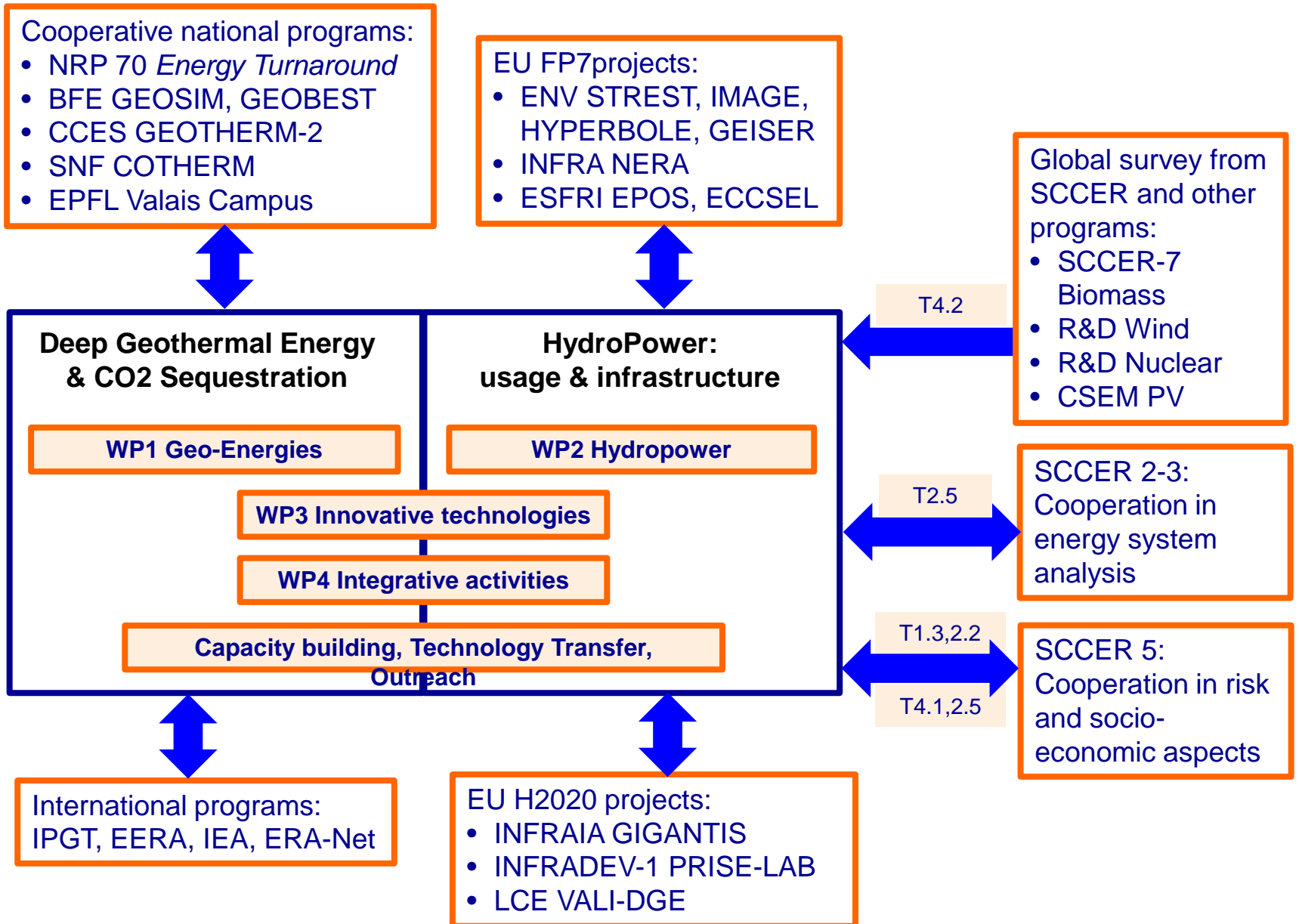
- Capacity building
- National embedding, coordination and integration
- Industry participation
- Ten year agenda with a 2050 outlook
- R&D roadmaps
- Big science: NFP, P&D, CTI cluster projects
- International embedding: IPGT, EERA, ERA-Net
- Focus on higher TRL
- In-kind and third-party matching funding
- New research infrastructures (DUG-Lab, turbine facility, ..)

Planned

- ✓ 3 new OP at ETHZ and EPFL; 1 new OP and 3 AP in the Universities
- ✓ 42 new and 29 contributed positions contributed at ETH
- ✓ 11 new and 7 contributed positions in the Universities
- ✓ 6 new and 3 contributed positions in the UAS

Achieved

- ✓ All KTI/SCCER research positions established by 1.11.2014
- ✓ New professors
 - ETHZ, OP DGE and geological reservoirs, M. Saar, start 1.1.15
 - ETHZ, OP Geoenergy Process Technology, on-going search
 - EPFL, OP Geoenergy, on-going search
 - UniNe, OP Geothermics, S. Miller, start 1.5.14
 - UniNe, AP Geothermal exploration, B. Valley, start 1.9.14
 - UniGe, AP, on-going search



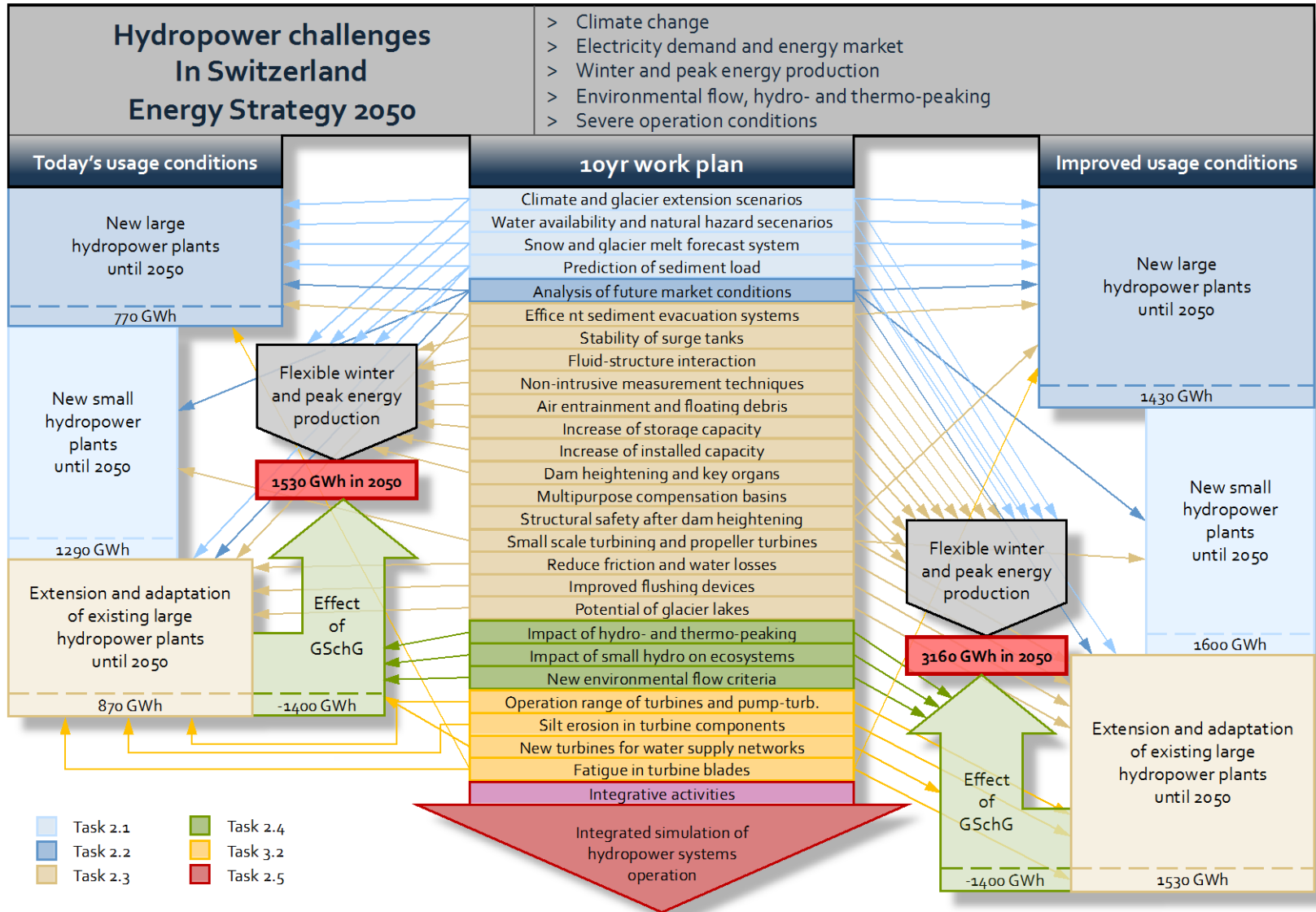
SCCER-SoE includes the different R&D strength in the Swiss schools in the fields of GeoEnergy and HydroPower:

- Geological sciences at ETHZ and several Swiss Universities
- HydroPower R&D at ETHZ, WSL and EPFL
- GeoEnergy and HydroPower technology developments, at ETHZ, EPFL, and various UAS
- Integrated energy system, best evaluated at ETHZ, PSI and EPFL
- Key industry partners involved in GeoEnergy and HydroPower
- National offices and services (SwissTopo, CSCS, SED)

Leading House ETHZ

Academic and Cooperation Partners

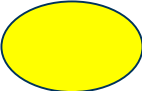
- | | |
|------------|----------------------|
| 1. EPFL | 1. AXPO |
| 2. UNIBE | 2. GeoEnergie Suisse |
| 3. UNIL | 3. BKW |
| 4. UNIGE | 4. ALSTOM |
| 5. UNINE | 5. SwissTopo |
| 6. USI | 6. Alpiq |
| 7. PSI | 7. UNIBA |
| 8. WSL | 8. Sulzer Pumps |
| 9. EAWAG | 9. Sarmap |
| 10. HES-SO | |
| 11. HSLU | |
| 12. HSR | |



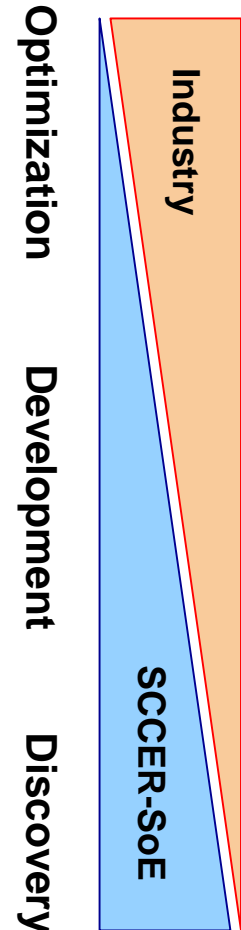
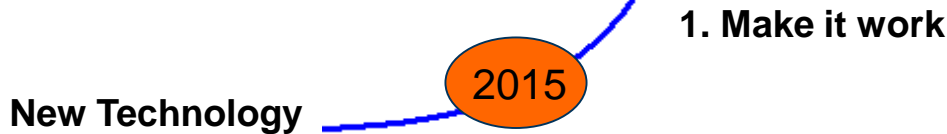
Targeted R&D will be required for each step of each technology, to demonstrate technical feasibility, maximize performance and reliability, minimize costs, maximize efficiency, demonstrate long-term feasibility.

H2020 LCE-2 call: TRL 3-4 to 4-5

H2020 LCE-3 call: TRL 4-5 to 6-7

 EGS

 Deep Hydrothermal



SoE-HPGE: Supply of Electricity for 2050

- ✓ a cluster of seven projects supporting 20 PhD students for fundamental R&D in key SCCER-SoE domains:
 - P1-P2: fundamental research in Geo-Energies, focused on understanding deep processes for deep heat mining and CO₂ circulation and on permeability and stimulation processes at high T-P conditions
 - P3-P4: development of HydroPower operations and infrastructures considering erosion and sediment handling in hydropower plants and the modifications in the peri-glacial environment
 - P5-P6: future hydropower operations, covering both demand and supply aspects under changing climate conditions
 - P7: comprehensive risk governance for both HydroPower and GeoEnergies, covering both supply and demand sides
- ✓ Budget 4.1M CHF
- ✓ Approved Sept. 2014

