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SCCER SoE
SWISS COMPETENCE CENTER for ENERGY RESEARCH
SUPPLY of ELECTRICITY

White papers on the main results from SCCER-SoE

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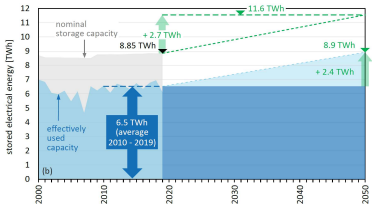
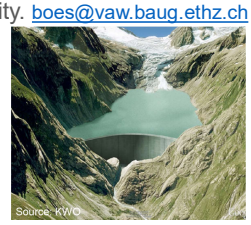
Motivation

A series of six white papers will make the key results of SCCER-SoE available to a broader audience. They will be published on www.sccer-soe.ch early 2021.

Hydropower potential & storage

Future hydropower generation is impacted by climate change, water protection legislation, market and regulatory frameworks. According to the most likely scenario, annual net generation will stay approx. constant until 2050. Increasing the storage volume by dam heightening is promising as it will help to generate much needed winter electricity. boes@vaw.baug.ethz.ch

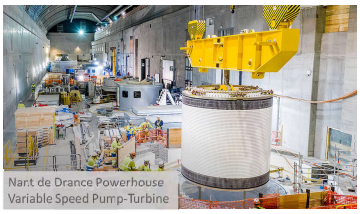




Upper-bound scenario increase of Swiss hydropower storage (left) and planned multi-purpose reservoir below the retreating Trift glacier (right)

Hydropower flexibility

The need for flexibility in the range of seconds to hours will strongly increase with the expected growth of photovoltaics and wind intermittent renewables. An array of flexibility technologies are needed: Enhanced forecast tools, Unit digitalization, Predictive maintenance, Variable speed power electronics, Unit battery hybridization, PSP Hydraulic short-circuit. Francois.Avellan@epfl.ch



Geothermal energy

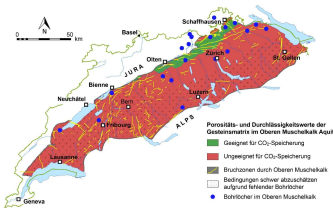
Geothermal energy can serve the energy transition by delivering heat to districts and industry, by storing heat from summer to winter and by generating electricity. All relevant aspects are considered: geodata infrastructure, resource exploration and characterization, drilling, reservoir stimulation and engineering, risks & social perception. Focus is on demonstration from heat storage in the sedimentary basin of Geneva to soft stimulation techniques in the granite of the Bedretto underground lab. andrea.moscariello@unige.ch

Drilling of the Geo-02 well in Lully (GE)

Placement of seismic sensors in the Bedretto underground lab

Carbon capture & storage

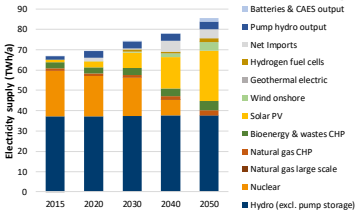
In order to reach the net-zero GHG emission target, the energy sector (electricity, heat, mobility) needs to turn from a net emitter of CO_2 to a sink. This requires to cut non-avoidable emissions as in cement production but also to remove CO_2 from the atmosphere through BECCS and DACCS. Key requirement to any strategy is the possibility for geological storage, either in Switzerland or abroad. Workflows for assessing domestic potential were developed and applied to three sites. Alternatives to export CO_2 to Norway are also considered. marco.mazzotti@ipe.mavt.ethz.ch



A storage potential of 50 Mt_{CO2} was found in the Upper Muschelkalk

Net-zero GHG scenarios

Reaching the climate targets requires well-known measures such as efficiency in buildings and industry, electro-mobility and heat pumps, and a massive growth of PV and other renewables. In addition, CO_2 capture and Storage (CCS) is essential, and needs to be applied to waste incineration plants, cement plants and possible new gas power plants.

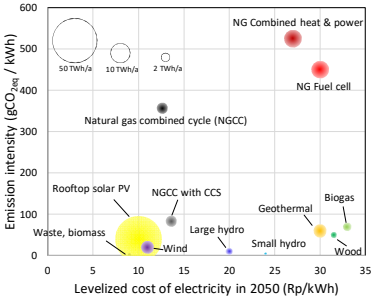


A possible transition pathway to net-zero emissions from the energy system was calculated using the Swiss TIMES energy systems model of PSI

Hydrogen plays a crucial role, both as a means to decarbonize freight transport and to generate negative CO_2 emissions needed to compensate f.i. agriculture. See also www.sccer-jasm.ch

Future electricity generation

Photovoltaic (PV) power generation exhibits a large potential of at least 25 and maximal 50 TWh/a. Smart PV installations in the mountains allow to shift summer peak generation to winter.



The exploitation of all other renewables is crucial for a resilient power sector. Overall electricity supply costs are likely to increase, despite declining costs of renewables. Finally, all renewables are expected to represent low-carbon generation by 2050, with hydro, wind and PV performing best. peter.burgherr@psi.ch

Research supported by:

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