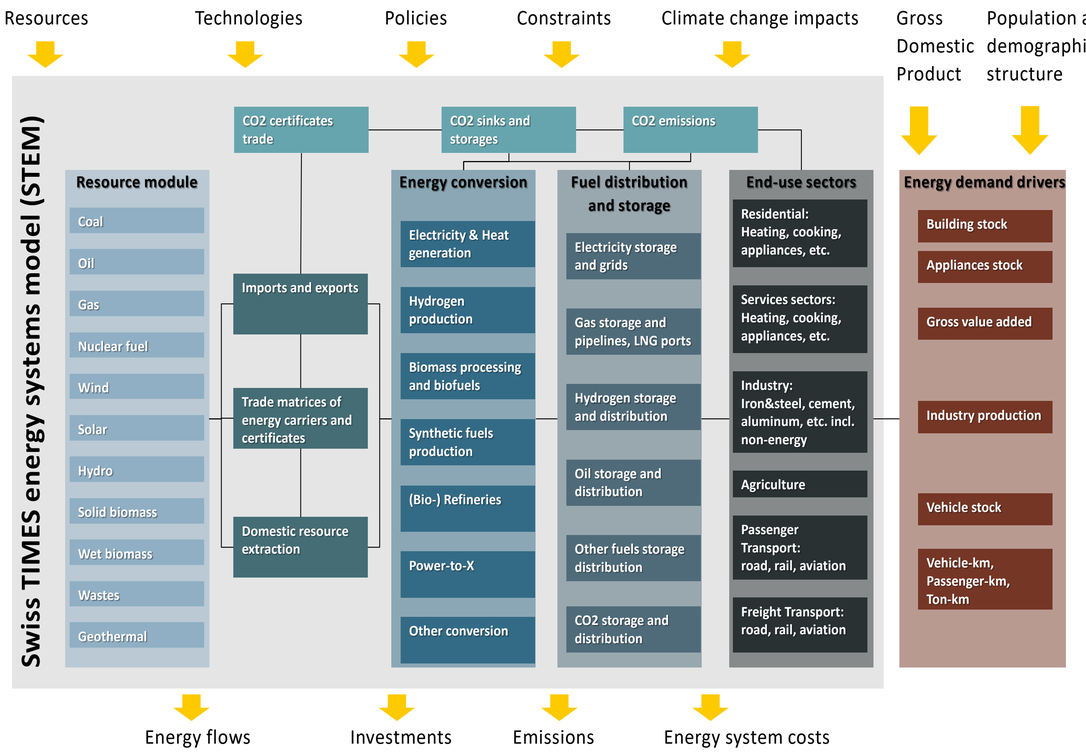
Quantification of the CROSS Scenarios with the Swiss TIMES Energy systems Model (STEM)

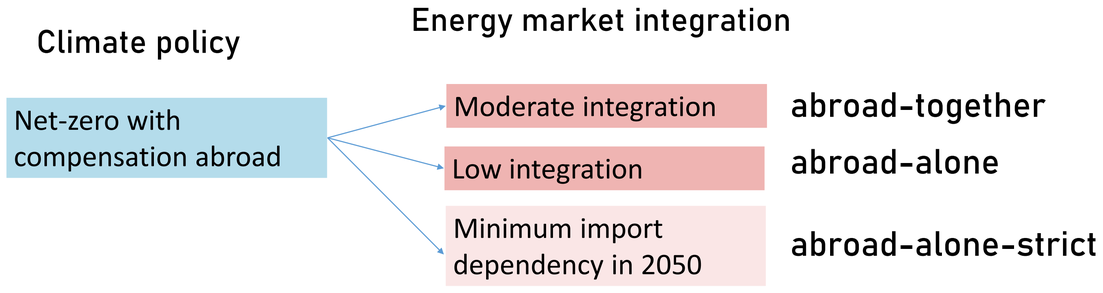
STEM model description



- Based on the open-source TIMES framework of IEA-ETSAP
- Long term horizon (2050+), in steps of 10 years
- Energy system transformation pathway analysis
- 288 hourly time steps within a year
- Technology-rich with detailed age structure of the assets
- Full energy system representation of Switzerland
- Endogenous infrastructure deployment
- Full unit commitment implementation for power plant dispatching
- Ancillary markets (operational reserve capacity markets)
- Endogenous variability of renewable energy sources
- Consumer segmentation in households and transport
- Endogenous hourly profiles for electricity, heat and mobility demands
- Demand response and several storage and flexibility options

CROSS Scenarios

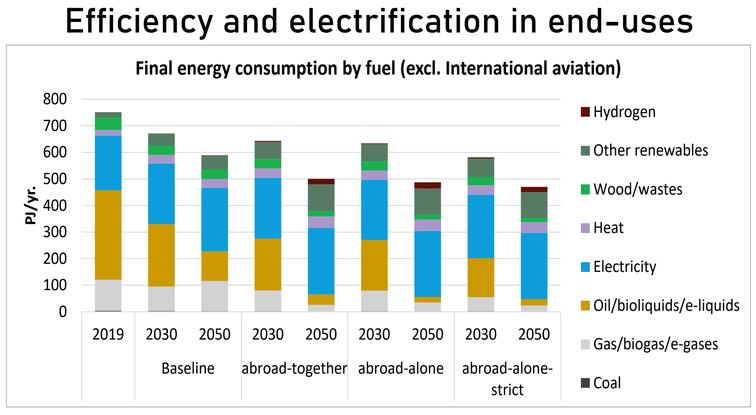
Harmonized scenario definition



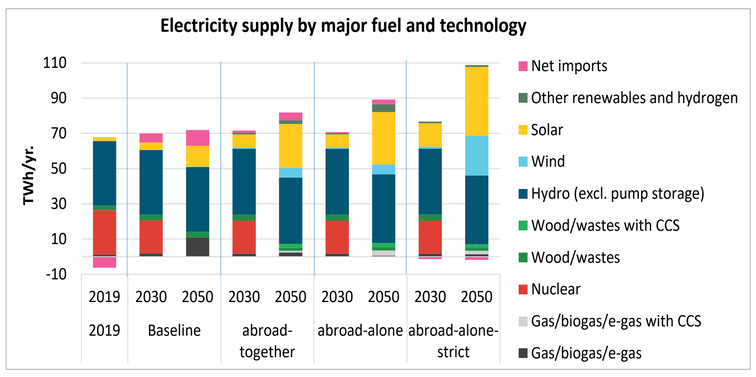
- Baseline (BAU): extrapolation of current trends, by considering the COVID-19 effects and the 2022 energy crisis and energy savings measures
- Abroad-together: implementation of the relevant CROSS scenario, by assuming that 5.7 Mt CO2-eq are compensated abroad in 2050.
- Abroad-alone: implementation of the corresponding CROSS scenario, which focuses on mitigation of electricity imports but allows other imports
- Abroad-alone-strict: own variant of abroad-alone aiming at reducing overall net import dependency on annual basis to almost 0 in 2050

SURE-CROSS-Results

Efficiency and electrification in end-uses

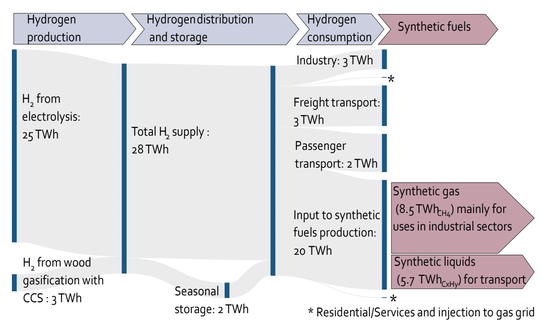


Electricity supply becomes weather dependent

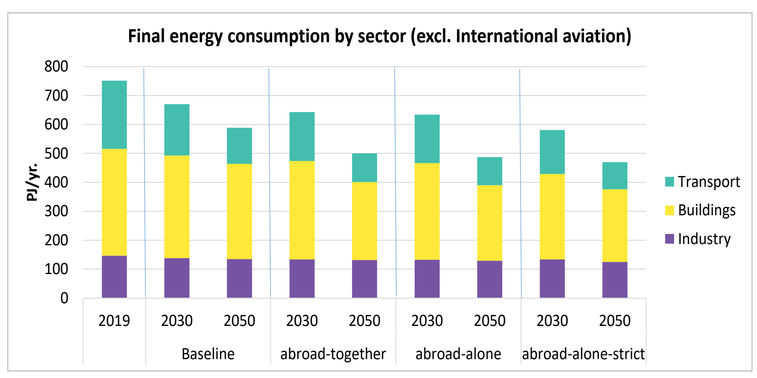


Power-to-X and synfuels contribute to autarky

In 2050, hydrogen based synfuels substitute in **abroad-alone-strict** scenario more than 90% of the gas imports in **abroad-together** scenario

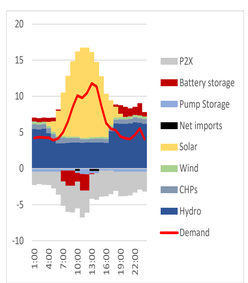


Transport & buildings with biggest efficiency gains

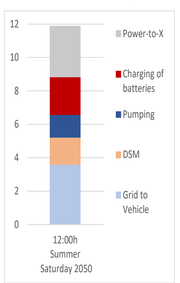


Coordinated flexibility (abroad-together scenario)

Electricity Supply and demand in Summer Saturday 2050 in GW



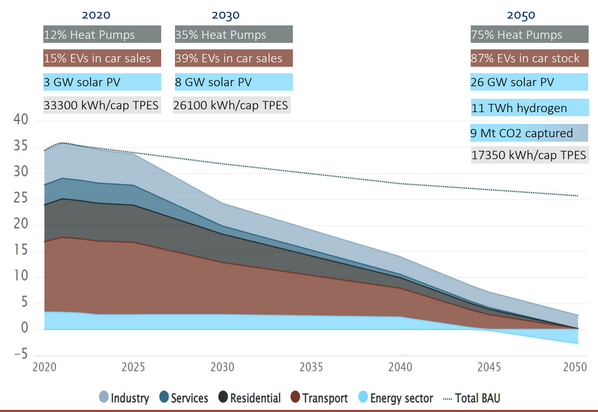
Coordinated flexibility deployment at 12:00 in Summer Saturday 2050 GW



Total deployment of flexibility options in 2050

Flexibility option	Deployment (capacity)
Pump storage	4.5 GW , 520 GWh
Stationary batteries	2.1 GW , 11.5 GWh
Thermal storage	5.8 GW , 35 GWh
Thermal storage (seasonal)	1.4 TWh
H2 storage (seasonal)	1.6 TWh
Vehicle-to-Grid (V2G)	output 0.5 TWh (from 13% of the electric cars)
FCR+ reserve demand	+ 45% from 2020 (624 MW)
Electricity shifts (DSM) in industry, services, residential	10% of demand (5.5 TWh)

Milestones to net-zero CO_2 emissions



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