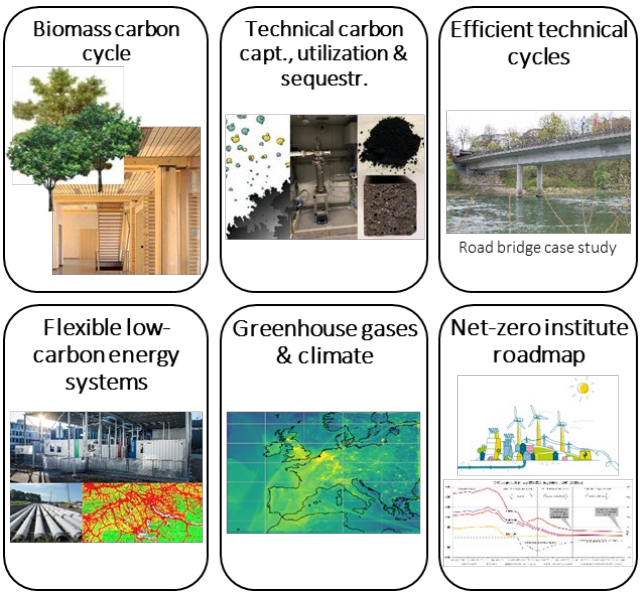
swiss center of excellence on net zero emissions
SCENE

Swiss Center of Excellence on Net-Zero Emissions (SCENE)

The ETH Board is co-financing six Joint Initiatives (JI) in the strategic area "Energy, Climate and Environmental Sustainability" for a duration of three years. These Joint Initiatives are large, strategic projects in which at least two institutes of the ETH Domain must be involved.



The SCENE Joint Initiative has established a Center of Excellence that covers a wide range of research areas related to net-zero emissions and provides a platform for cross-institutional collaboration in the ETH Domain. More than 100 researchers in 30 laboratories from all four Research Institutes of the ETH Domain (PSI, Empa, WSL, Eawag) and the two Technical Universities ETHZ and EPFL are involved. The project is led by PSI and runs from 1.1.2023 - 31.12.2025 with a total budget of approx. 17 million CHF.

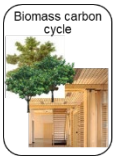
In order to support the achievement of the goal of net-zero emissions by 2050, described in the Federal Government's climate and energy strategy, SCENE performs holistic research in six Net-Zero Action Areas (Figure 1), covering the avoidance, removal, monitoring and analysis of greenhouse gas emissions.

In addition, an Expert Hub strengthens the network within the ETH Domain and pools a broad range of interdisciplinary expertise. It proactively publishes reports and white papers and responds to requests from stakeholders in order to achieve a strong, direct public impact.

In the long term, SCENE plans to create a platform that supports scientifically sound decisions, both at the national level and for stakeholders, so that the technologies, instruments and methods developed at the Center of Excellence can be put into practice in a timely manner.

Action Areas in SCENE

AA 1: Biomass carbon cycle

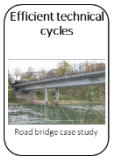


We demonstrate optimization pathways of forest and landscape management, the utilization of woody biomass, and substitution effects to mitigate climate change.

AA 2: Technical carbon capture, utilization, and sequestration

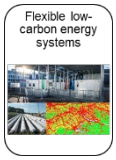
We establish a sustainable energy supply chain with negative CO_2 emissions, enabling global transport, large-scale seasonal storage, and carbon sequestration in Switzerland using existing infrastructure.

AA 3: Efficient technical cycles – Circular carbon-neutral infrastructure



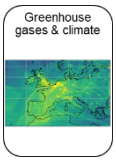
We support the decarbonization of the construction sector (30% of Swiss emissions) by providing decision-making tools and strategies, including design for disassembly and materials/component reuse, enabling carbon-neutral, circular infrastructure by 2050.

AA 4: Flexible low-carbon energy systems



We unlock the flexibility potentials of the Swiss energy system to ensure supply security and social acceptance in a renewable-based future, supporting decision makers with energy investments.

AA 5: Greenhouse gases and climate



We create a publicly-accessible interactive platform with information about integrated greenhouse gas mitigation scenarios towards net-zero, overarching sustainability implications, and related air quality evolution.

AA 6: Net-zero institute roadmap

We define science-based, net-zero roadmaps for the four Research Institutes using gap analyses, energy scenarios with possible cost developments, and considerations about the necessary measures and their impacts to reach net-zero.

Action Area 6: Net-zero institute roadmap

Motivation and Main Outcomes:

World governments decided within the Paris agreement, that global warming must be kept well below 2°C, preferably below 1.5°C to mitigate climate risks. To stay below 1.5°C of global warming, GHG emissions must be reduced by around 50% by 2030. From 2050, the entire annually emitted amount of anthropogenic GHG emissions must be removed from the atmosphere and permanently be stored (net-zero). In 2023, we have almost reached the 1.5°C global warming target for the first time with 1.48°C.

To align with the climate targets, we develop internal science-based net-zero roadmaps for the 4 Research Institutes, giving us a better understanding of the necessary measures and possible cost optimization measures on the way to net-zero. The roadmaps are based on an analysis of the target/actual deviation of the greenhouse gas emissions caused by the institutions. Possible cost developments based on energy scenarios will provide an orientation for the cost-efficient selection of the necessary measures with the required impact to reach the targets.

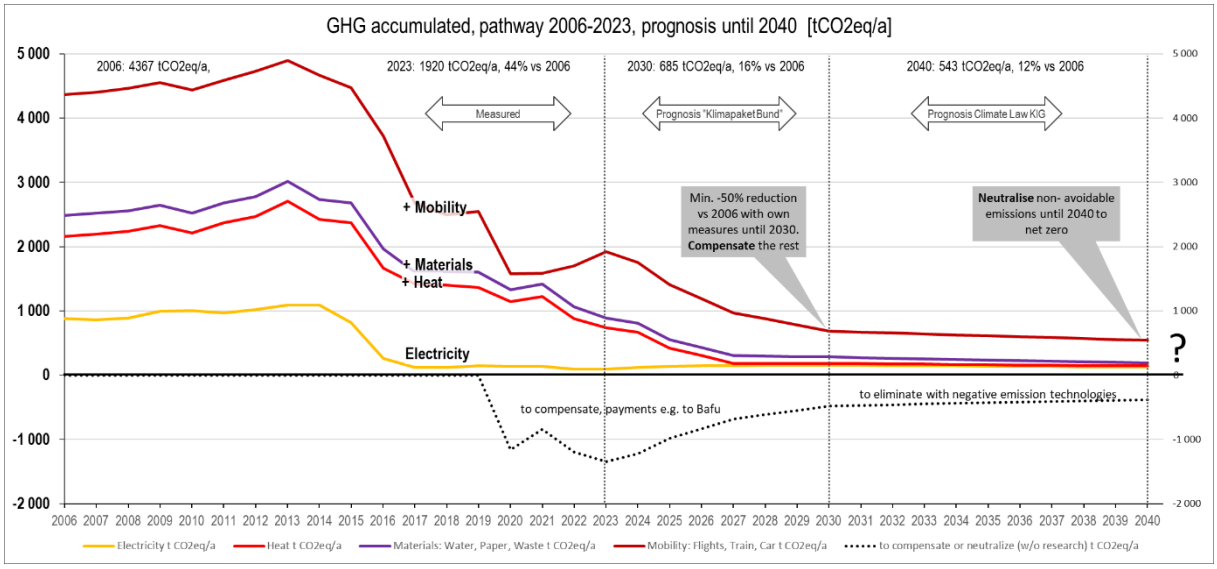


Figure 1: Exemplary GHG emissions reduction pathway as the basis for the net-zero roadmaps. Phase 1 until 2030 with compensation (according to 'Klimapaket Bund'), Phase 2 until 2040 with neutralization (according to Climate Law)

Figure 1 shows an exemplary GHG reduction path as the basis for a net-zero roadmap. All energy related aspects are included (electricity, heat, fuels) as well as consumables (water, paper) and waste, plus business travelling with trains, cars, and airplanes.

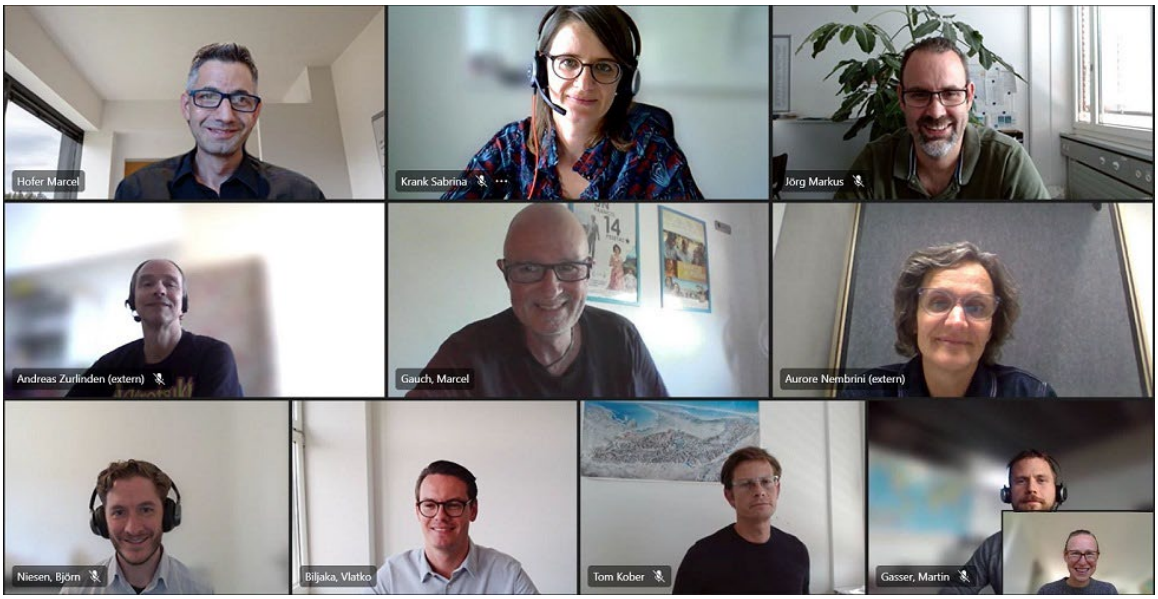
Discussions about the adaptation of system boundaries are ongoing, and realistic system boundaries will be explored. At the political level, the definition of system boundaries is still unclear with a possibility for more clarity defined in the implementation regulations for the role model function of the Climate and Innovation Law around 2025.

We are currently focusing our work on possible cost trends for different reduction measures implemented, for alternative measures to potentially improve the pathways, as well as for negative emissions to neutralize remaining emissions as a cost driver to select different measures on our way to achieve net-zero emissions.

Who we are:

A working group comprised of researchers, sustainability officers, and members of the operations/infrastructure management from each institute is coming together to enable an efficient inter-institutional and cross-disciplinary exchange on our way to net-zero.

The following institutes are contributing with their expertise: PSI, Empa, WSL, Eawag, and EPFL. EPFL is not included in the institutes' roadmaps (only the 4 research institutes). PSI is the leader of the AA 6.



PSI LEA: Laboratory for Energy Systems Analysis

PSI ESI: Energy System Integration

PSI U&E: Energy and Environmental management

PSI AIE: Infrastructure and Electrical Installations

Empa REM: Real Estate Management

Empa SMS: Scientific Management Support

Empa TSL: Technology & Society Lab

WSL EM: Energy and Environmental management

Eawag EM: Energy and Environmental management

EPFL SUS: Sustainability

ETH-Board REM: Real Estate Management (Coordination of the activities of the E+E WG of the ETH Domain in the context of the activities of AA6 in SCENE)

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Activities:

4-6 hybrid meetings are planned annually with the participation of the three levels of all of the institutions (researchers, sustainability officers, and members of the operations/infrastructure management), each rotating at different locations/institutions to enable networking. In parallel, another three sub-

groups advance the topics of methodology, cost developments and operational implementation. Several productive workshops have already been held, with involvement of the real estate management of the ETH Board and representatives of the Joint Initiative, SPEED2ZERO.

In 2023, we strongly contributed to defining individual CO2 strategies for the institutions of the ETH domain, leveraging synergies regarding strategy considerations and methodology. In the individual CO_2 strategies, each institution documented their historical and current emissions and emission reduction measures. Furthermore, the reports present reduction paths and sketch the required implementation steps, including cost estimates.