ENERGY PERSPECTIVES 2050+
NET ZERO EMISSIONS BY 2050

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Bundesamt für Energie BFE
Office fédéral de l'énergie OFEN
Ufficio federale dell'energia UFE
Uffizi federal d'energia UFE
Most important findings from the Energy Perspectives 2050+:

How do we get to an energy system by 2050 that is compatible with the net zero target and at the same time, ensure a secure energy supply?
Climate neutral Switzerland by 2050

- Net zero emissions by 2050:
  Unavoidable residual emissions to be offset by natural or technical sinks
- Which paths enable achievement of target?
  → Working with scenarios

Delimitation

- $\text{CO}_2$, $\text{CH}_4$, $\text{N}_2\text{O}$, fluorinated gases
- Alongside the energy system, process emissions plus non-energy-related emissions form agriculture and waste treatment to be taken into account

**Greenhouse gas emissions & CCS/NET**

![Greenhouse gas emissions & CCS/NET chart]

- Source: Prognos AG / TEP Energy Gmbh / INFRAS AG, presentation Media Conference SFOE 26.11.2020

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### Scenarios and Variants

**Various Paths Leading to the Target**

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MODELLING OVERVIEW
CONSORTIUM OF 4 PROJECT PARTNERS

Energy demand
- Private households
- Services / Agriculture
- Industry
- Transport

Load profiles
- Inflexible/flexible consumers

El. market model
- Hydropower
- Conv. power plants
- Renewable energy

District heat
- Other conversion

Synthesis

Economic impacts
ECOPLAN

Prognos
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Net zero greenhouse gas emissions 2050:

- Net zero target is achievable
- In 2050, around 12 million tonnes of unavoidable residual CO₂-equivalent emissions
- Mainly in the following areas:
  - Agriculture
  - Industrial Processes (including cement)
  - Waste treatment (incineration plants)
- Application of CCS/NET necessary so that balanced zero can be achieved

Greenhouse gas emissions & CCS/NET

Scenario ZERO Basis
Strategic variant «even annual import-export balance 2050», lifetime NPP 50 years

Source: Prognos AG / TEP Energy GmbH / INFRAS AG (2020)
Development 2019 to 2050:

- Total: -31% (BAU -19%), additional saving versus BAU 91 PJ
- Strong reductions in:
  - Lightning -60%, BAU -51%
  - Heating -30%, BAU -22%
  - Mobility -44%, BAU -32%
- Heating and mobility remain the segments with the highest consumption
- Consumption in all segments decreasing, except “other uses” (collective group with electrical applications)
National electricity consumption:

- Increase in national consumption by around 24% by 2050
- Main drivers:
  - Electric vehicles (road transport) (13 TWh)
  - Heat pumps (9 TWh)
  - H₂ electrolysis (3 TWh)
  - CCS / NET (2 TWh)
- The increase is damped by efficiency: decrease in conventional electricity consumption

National consumption by application:

- Electric road vehicles
- Large heat pumps
- Electrolysis
- Other (incl. CCS)
- Heat pumps
- Conventional
- Losses
- National consumption

Scenario ZERO Basis
Strategic variant «even annual import-export balance 2050», lifetime NPP 50 years
Electricity supply system:

Up to 2050, Swiss electricity supply sourced by hydropower and renewable energy, temporarily supplemented by electricity imports.

- Increase in total consumption (including storage pumps) to 84 TWh in 2050.
- Sharp increase in domestic electricity generation through renewable energy and hydropower.
- Net imports balanced by 2050 after withdrawal form nuclear energy.
District heat production:
Expanding the heat networks is an essential measure for a CO₂-free heat supply.
- High potentials of renewable heat are available (waste heat, environmental heat in combination with large heat pumps, geothermal energy and biomass).
- Biomethane as substitute for natural gas to cover peak load.
- Rapid expansion is required here in order to create connection possibilities.
Annual net imports

Development 2019 to 2050:

- Sharp decrease in imports (-84%), especially for mineral oils, gas and nuclear fuels
- Temporary increase in electricity imports following withdrawal from nuclear energy
- Increasing biomass imports (especially biomethane) and imports of electricity-based energy sources (PtX)

Net imports by energy source

- Sharp decrease in imports (-84%), especially for mineral oils, gas and nuclear fuels
- Temporary increase in electricity imports following withdrawal from nuclear energy
- Increasing biomass imports (especially biomethane) and imports of electricity-based energy sources (PtX)
Accumulated figures 2020 to 2050:

- Total additional costs of 73 billion CHF* compared to BAU, of which
  - annualised investments: 109 billion CHF
  - maintenance costs: 14 billion CHF
  - saved energy costs: -50 billion CHF
- Additional investments of 109 billion CHF means an increase of 8% compared to the existing investments in the energy system of 1’400 billion CHF
- Average annual additional costs (2020 to 2050): 2.4 billion CHF/yr

* CHF in real terms at 2017 prices

Scenario ZERO Basis
Strategic variant «even annual import-export balance 2050», lifetime NPP 50 years
CLIMATE-NEUTRAL SWITZERLAND IN 2050

Hydrogen production at run-of-river sites (7 PJ)

Wind and geothermal energy with attractive generation profile

Heavy transport by rail, with bioenergy and hydrogen

3.6 Mio. battery-powered cars

Negative emissions technologies: storage in Switzerland (3 million t CO₂ pa)

38.6 TWh from hydropower (renewable net production)

High levels of efficiency in industrial processes

34 TWh from photovoltaic systems, 40% of production (2019: 2 TWh)

Well insulated buildings with low heating demand

Biomass for process heat

Expansion of heat grids in urban areas

Cement and chemicals factories with CCS (2.9 Mt CO₂ pa)

Waste treatment with CCS (3.6 Mt CO₂ pa)

1.5 million heat pumps (2019: 0.3 million)

Very high levels of efficiency in industrial processes

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