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Bundesamt für Energie BFE
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ENERGY PERSPECTIVES 2050+
NET ZERO EMISSIONS BY 2050

ENERGY PERSPECTIVES 2050+
CONTENTS

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?

ENERGY PERSPECTIVES 2050+
ISSUES

Climate neutral Switzerland by 2050

- Net zero emissions by 2050:

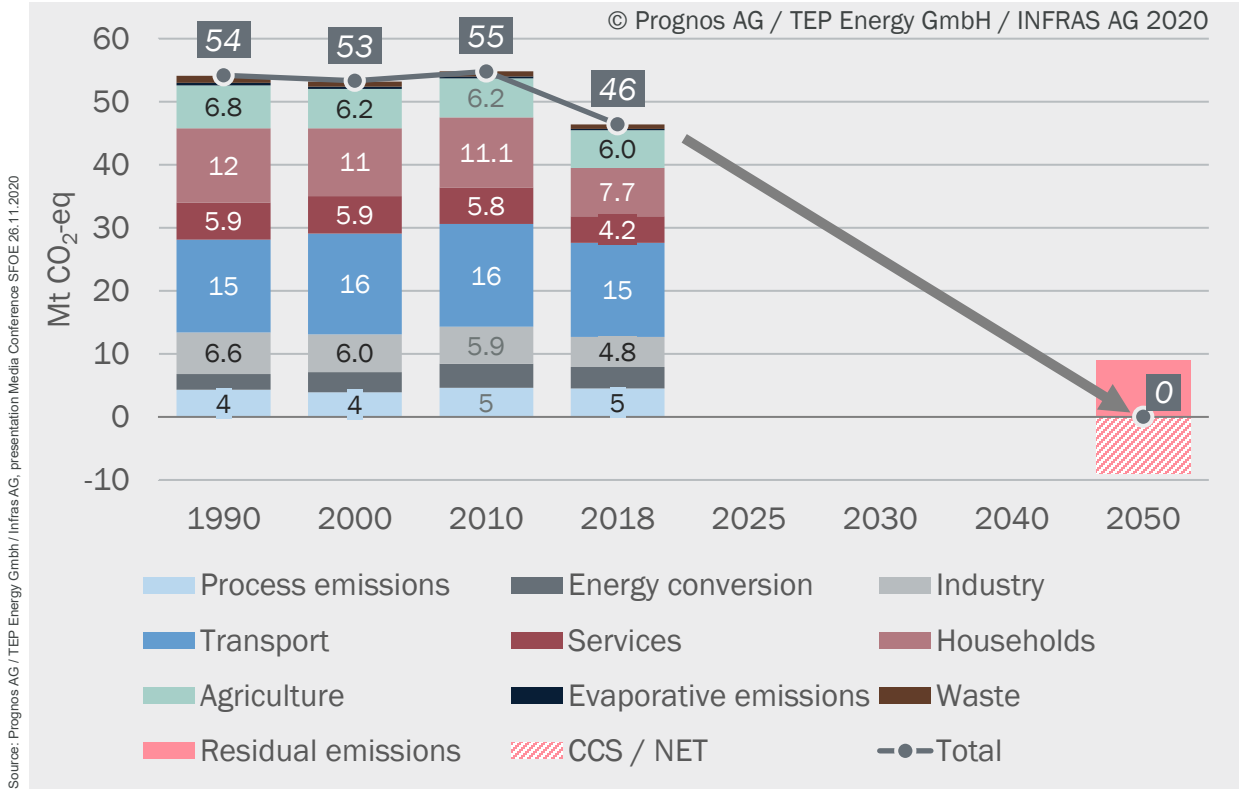
  Unavoidable residual emissions to be offset by natural or technical sinks
- Which paths enable achievement of target?

  → Working with scenarios

Delimitation

- CO_2, CH_4, N_2O, fluorinated gases
- Alongside the energy system, process emissions plus non-energy-related emissions form agriculture and waste treatment to be taken into account

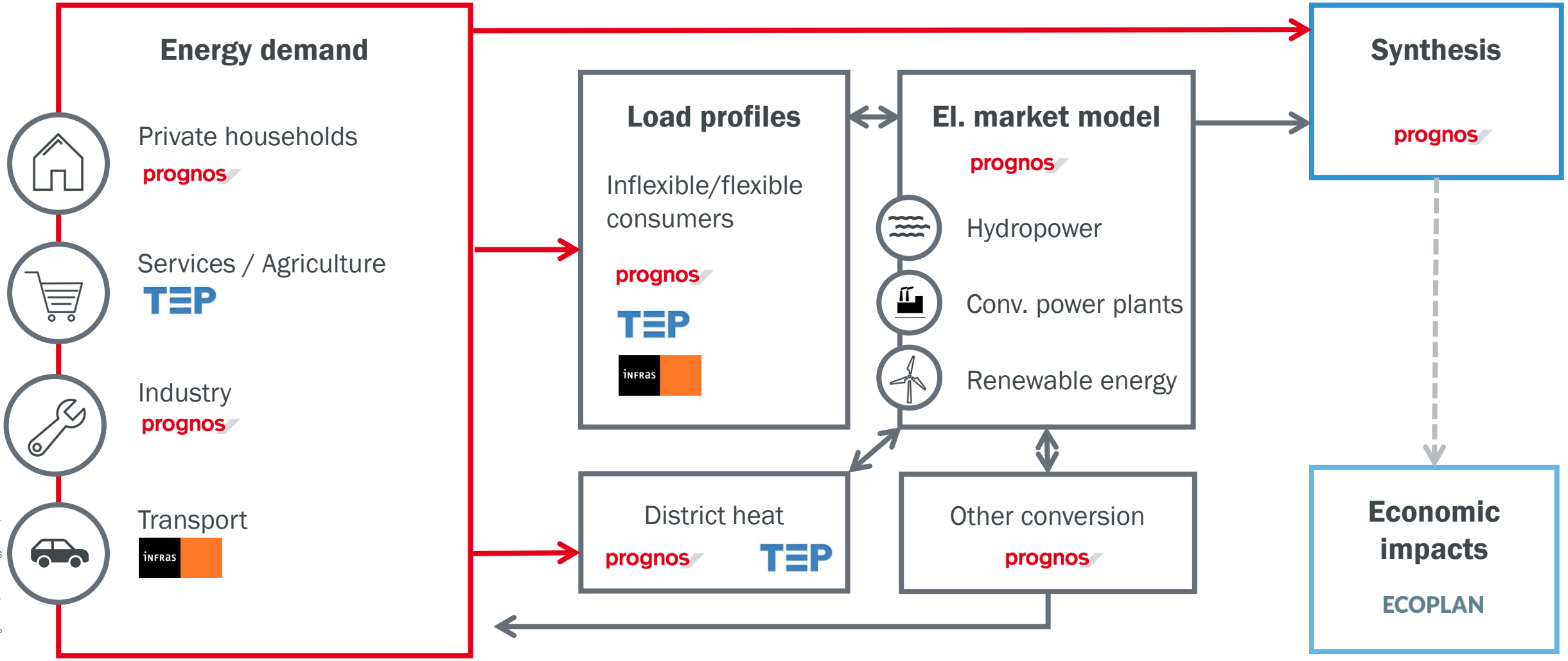
Greenhouse gas emissions & CCS/NET



SCENARIOS AND VARIANTS
VARIOUS PATHS LEADING TO THE TARGET

Scenario	Variant	Strategic electricity production variants
Net zero scenario (ZERO)	**Basis variant (ZERO Basis)**	Even annual import-export balance 2050
		Guidelines / expansion targets
		Current framework conditions
	Variant A (ZERO A) *extensive electrification*	Even annual import-export balance 2050
		Guidelines / expansion targets
		Current framework conditions
	Variant B (ZERO B) *stronger focus on gas*	Even annual import-export balance 2050
		Guidelines / expansion targets
		Current framework conditions
	Variant C (ZERO C) *stronger focus on heat networks and liquid fuels*	Even annual import-export balance 2050
		Guidelines / expansion targets
		Current framework conditions
Business as Usual scenario (BAU)	*Current energy and climate policy measures*	Existing legal and framework conditions

MODELLING OVERVIEW
CONSORTIUM OF 4 PROJECT PARTNERS

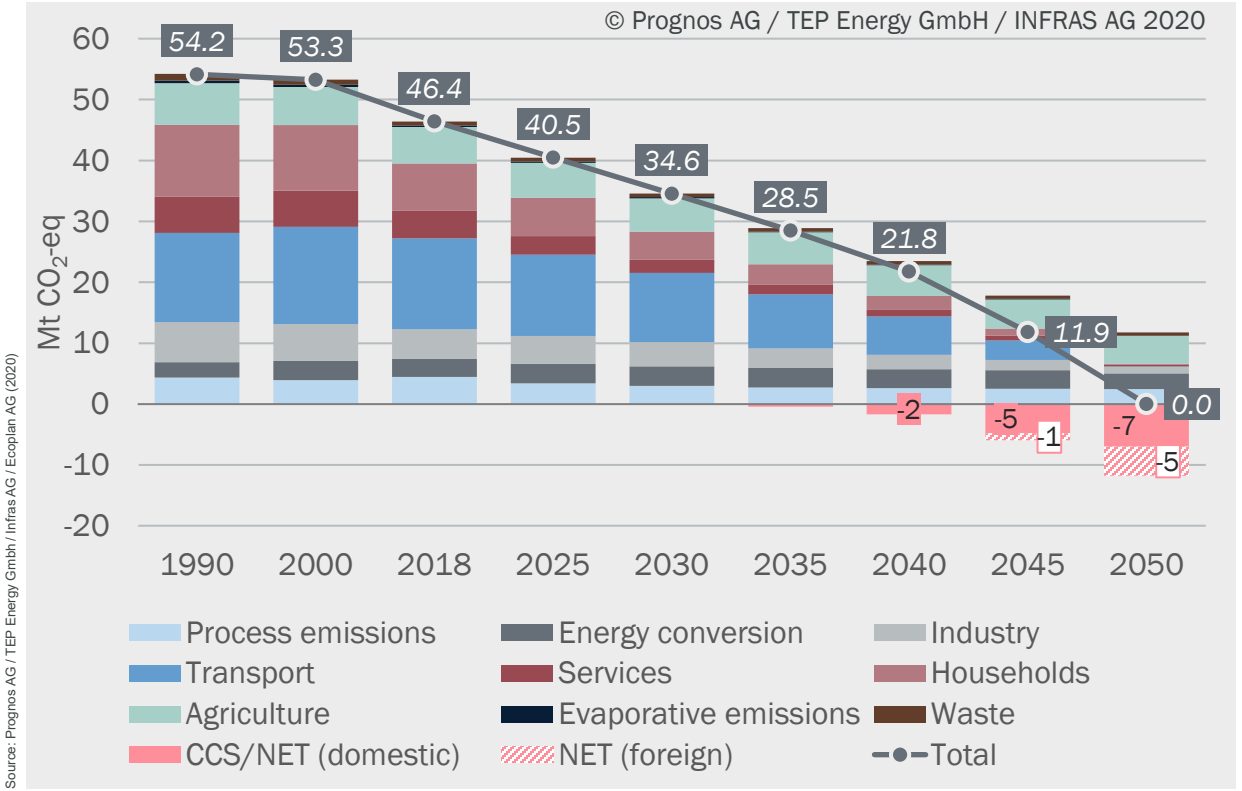


ENERGY PERSPECTIVES 2050+
GREENHOUSE GAS EMISSIONS

Net zero greenhouse gas emissions 2050:

- Net zero target is achievable
- In 2050, around 12 million tonnes of unavoidable residual CO_2-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

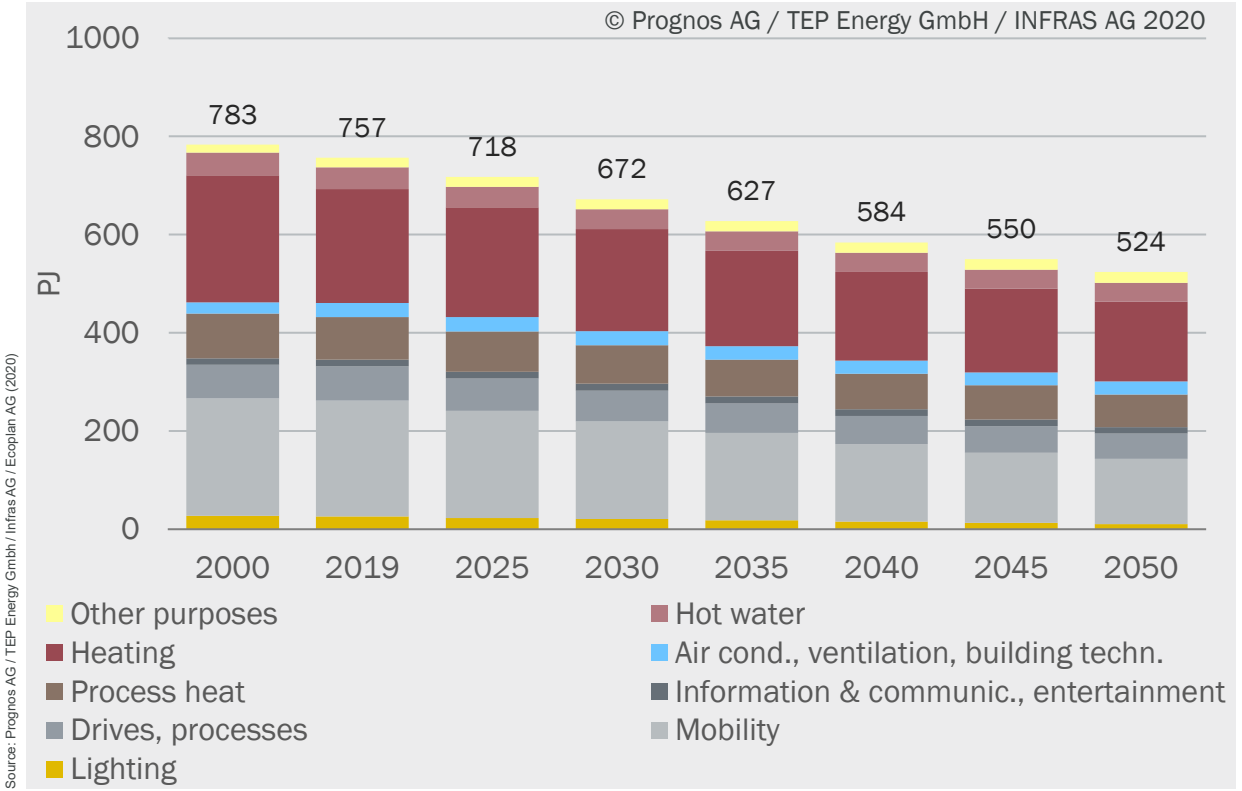
Strategic variant «even annual import-export balance 2050», lifetime NPP 50 years

ENERGY PERSPECTIVES 2050+
FINAL ENERGY CONSUMPTION

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)

Final energy consumption by purposes



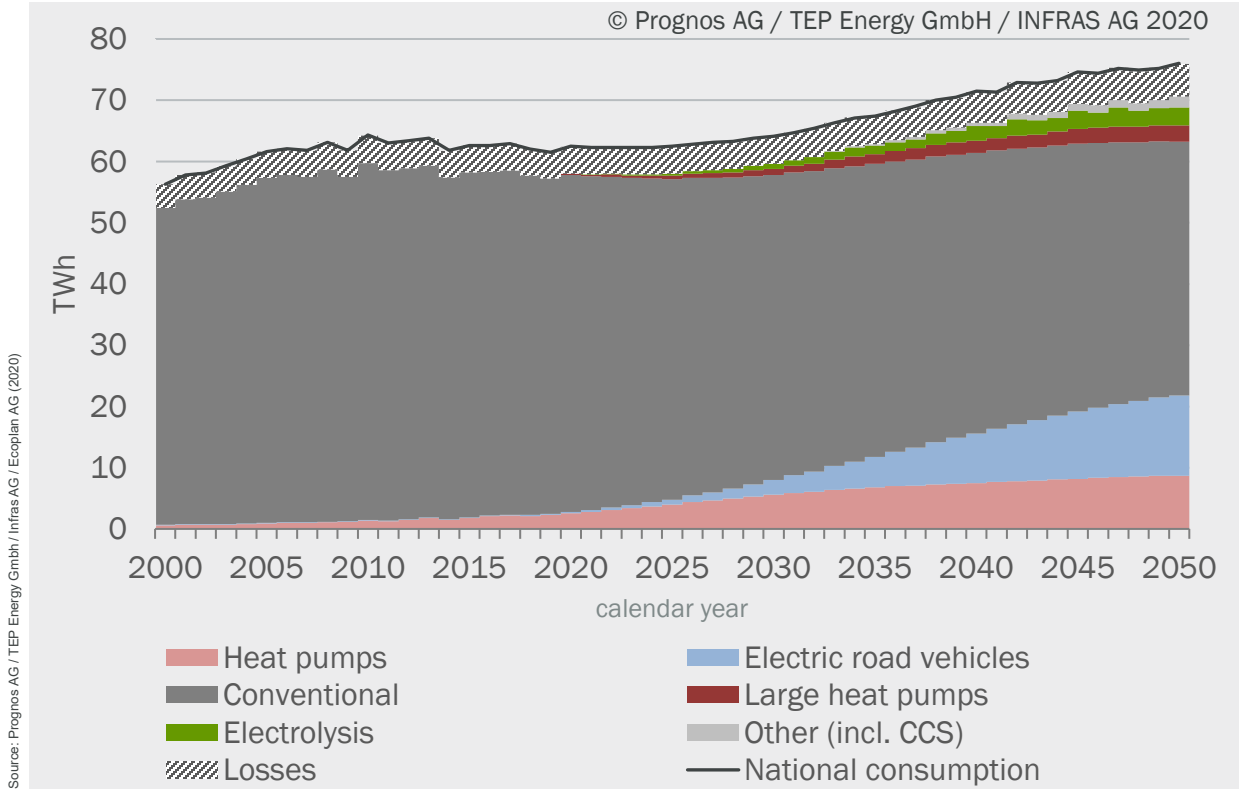
Scenario ZERO Basis

ENERGY PERSPECTIVES 2050+
ELECTRICITY CONSUMPTION

National electricity consumption:

- Increase in national consumption by around 24 % by 2050
- Main drivers:
  - Electric vehicles (road transport) (13 TWh)
  - Heat pumps (9 TWh)
  - H_2 electrolysis (3 TWh)
  - CCS / NET (2 TWh)
- The increase is damped by efficiency: decrease in conventional electricity consumption

National consumption by application



Scenario ZERO Basis

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

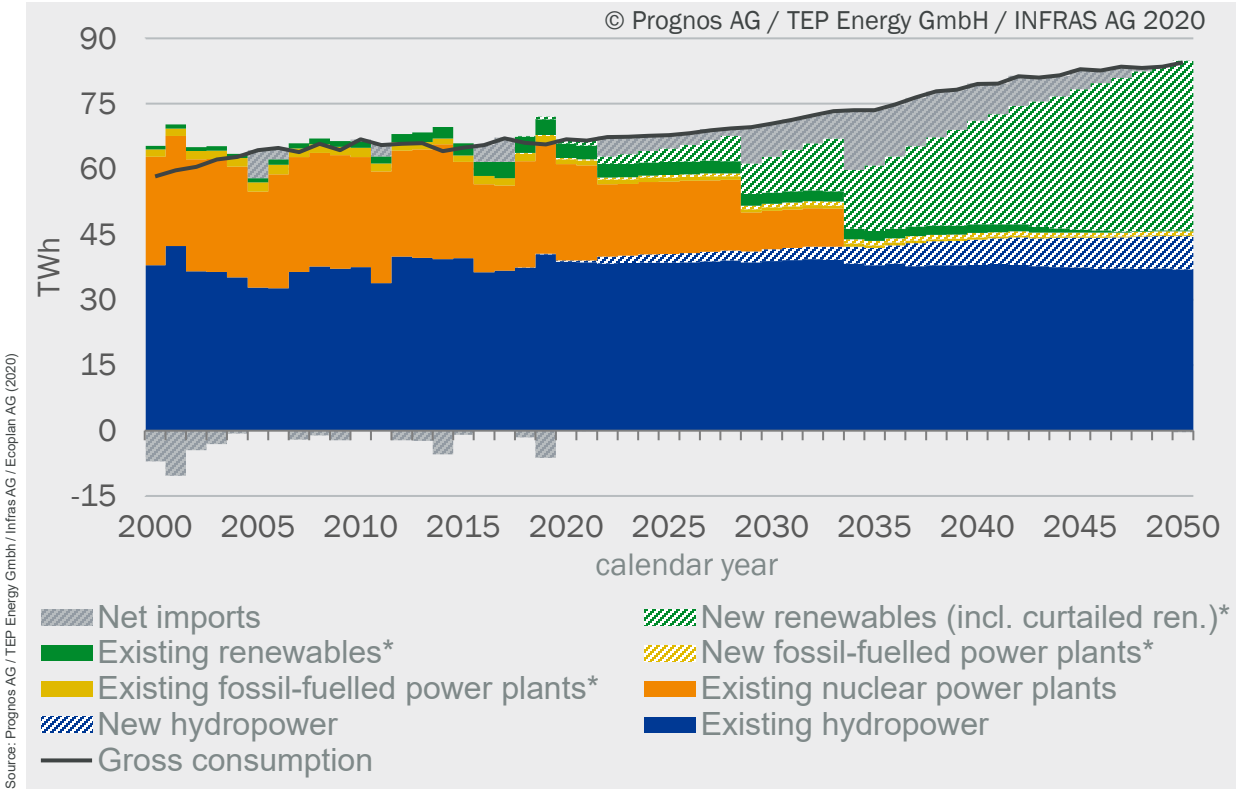
ENERGY PERSPECTIVES 2050+
ELECTRICITY SUPPLY

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.

Annual electricity generation by technology



Source: Prognos AG / TEP Energy Gmbh / Infras AG / Ecoplan AG (2020)

Scenario ZERO Basis

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

(* coupled and uncoupled)

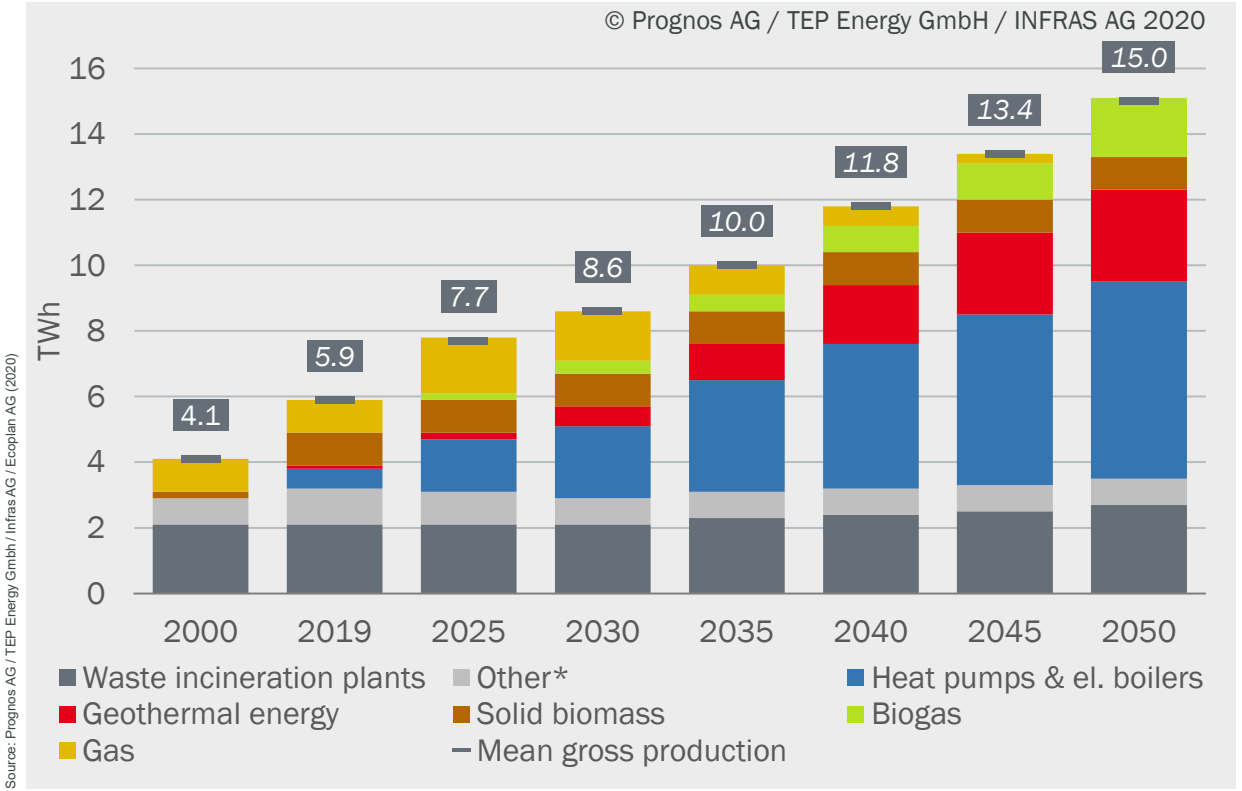
ENERGY PERSPECTIVES 2050+
DISTRICT HEAT SUPPLY

District heat production:

Expanding the heat networks is an essential measure for a CO_2-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.

Consumption and production of district heat



Scenario ZERO Basis

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

(* Nuclear power, industrial waste heat, other renewables)

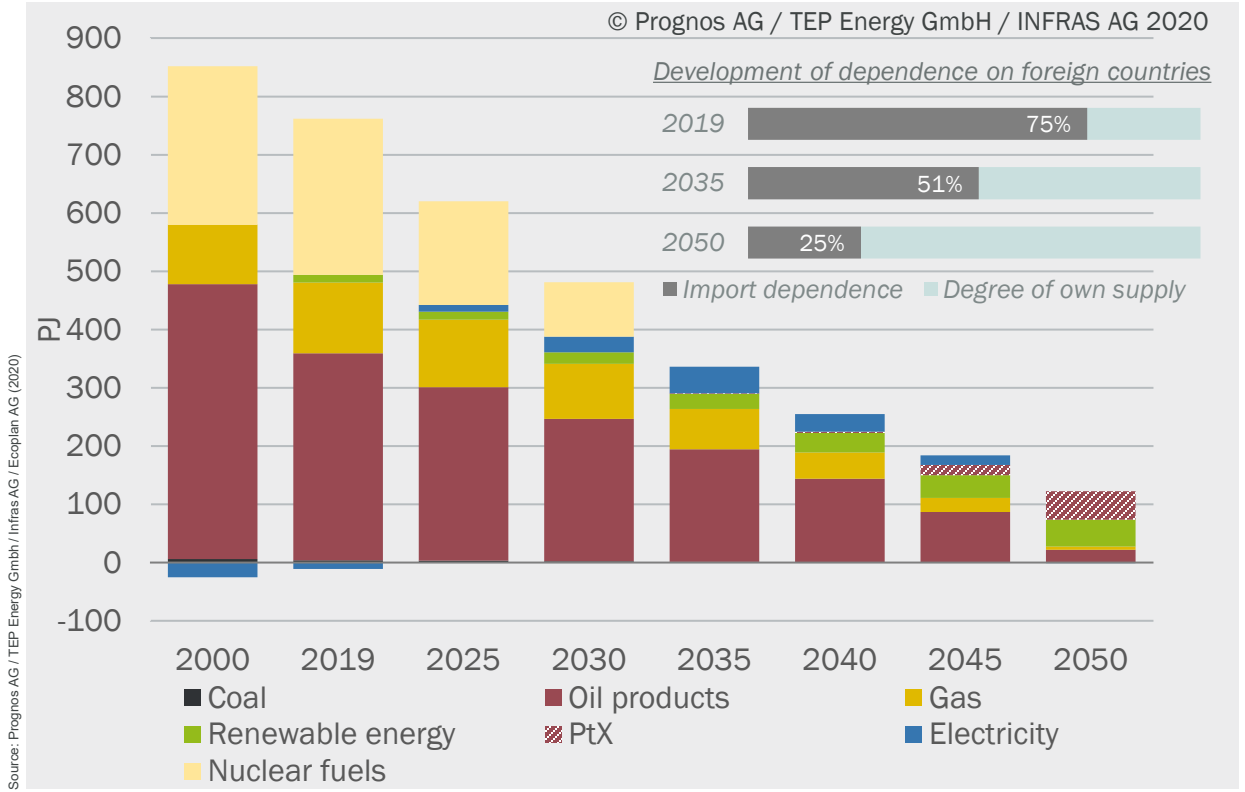
ENERGY PERSPECTIVES 2050+
NET ENERGY IMPORTS

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



Scenario ZERO Basis

Strategic variant «even annual import-export balance 2050», lifetime NPP 50 years (without international aviation)

EP 2050+
COSTS

Accumulated figures 2020 to 2050:

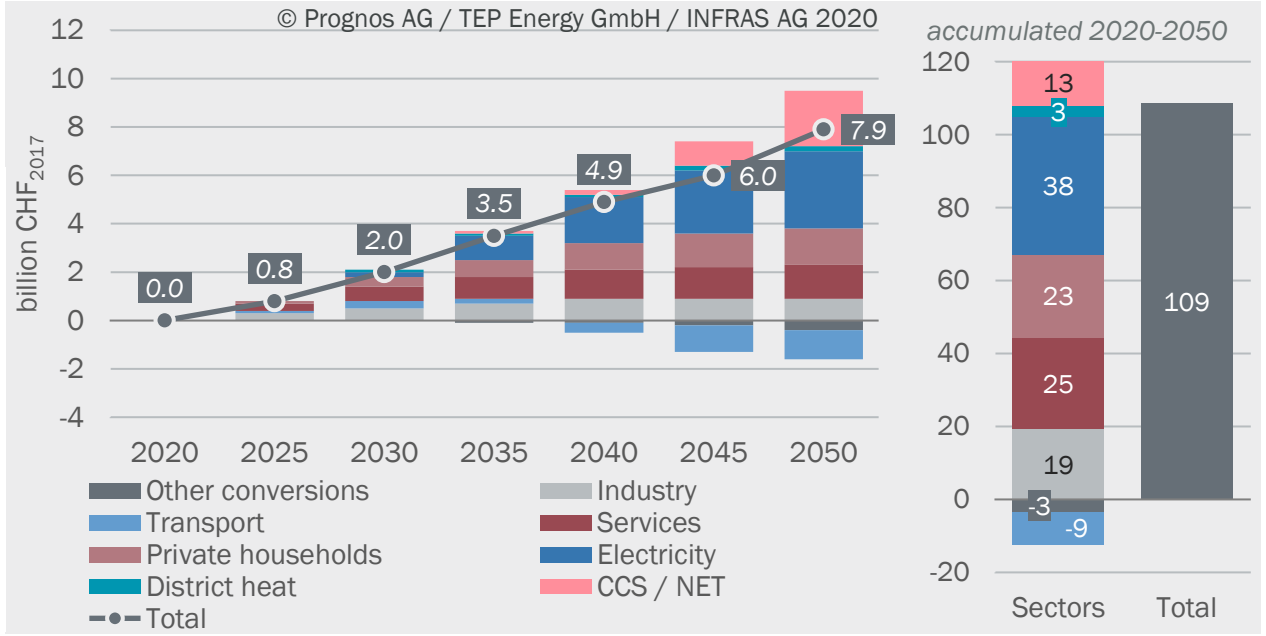
- Total additional costs of 73 billion CHF* compared to BAU, of which
  - annualised investments: 109 billion CHF
  - maintenance costs: 14 billion CHF
  - saved energy costs: -50 billion CHF
- Additional investments of 109 billion CHF means an increase of 8% compared to the existing investments in the 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

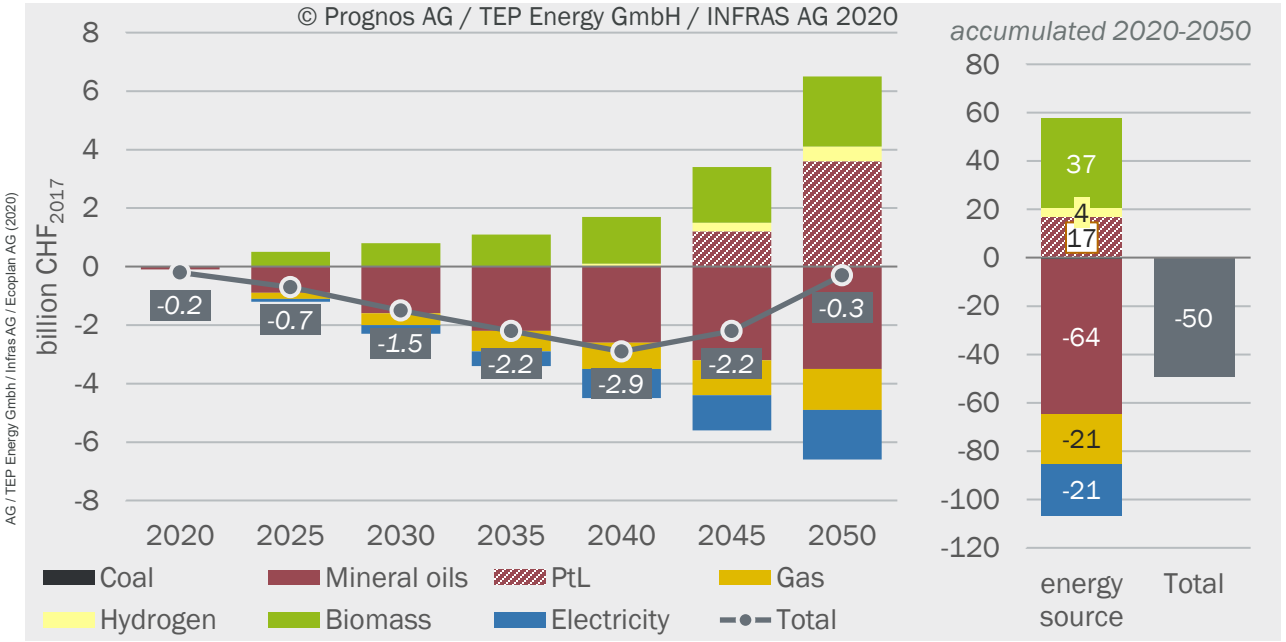
Scenario ZERO Basis

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

annualised difference investments



saved energy costs



CLIMATE-NEUTRAL SWITZERLAND IN 2050