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Eidgenössisches Departement für Umwelt, Verkehr,
Energie und Kommunikation UVEK
Bundesamt für Umwelt BAFU
Abteilung Klima

Switzerland's Long-Term Climate Strategy and the Role of Negative Emission Technologies



Overview

- **Context**
 - Scientific basis provided by the Intergovernmental Panel on Climate Change (IPCC)
 - Temperature development, emissions by sector
 - Swiss climate policy: Milestones and reduction targets
 - Glacier Initiative
- **Long-term climate strategy**
 - Mission, core messages, basic principles,
 - Targets and emission trends
- **Role of carbon capture and storage (CCS) and negative emission technologies (NETs)**
- **Glossary**
- **Further information**



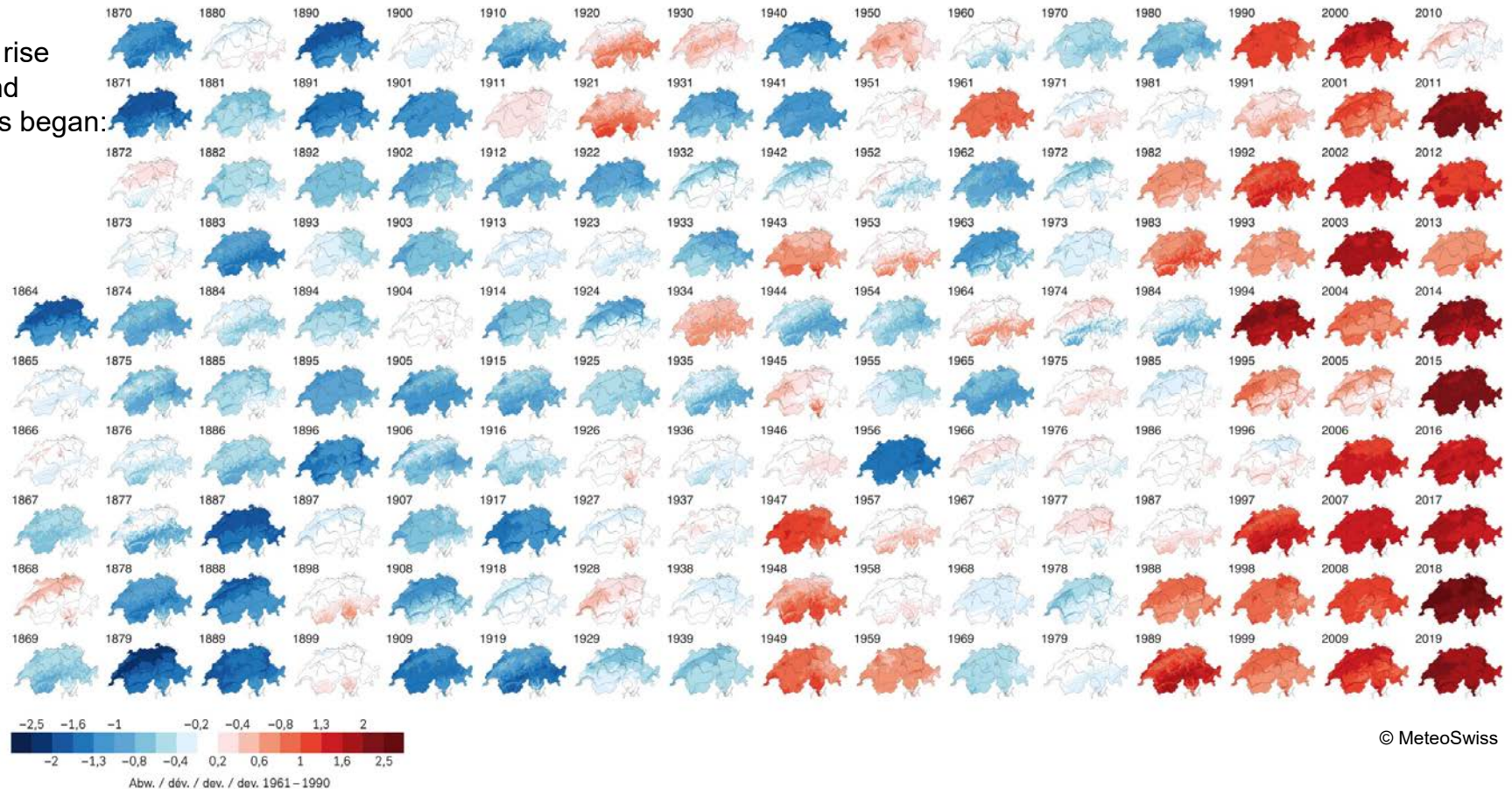
Context



Swiss mean annual temperature since 1864

Average temperature rise in Switzerland since records began: 2 °C

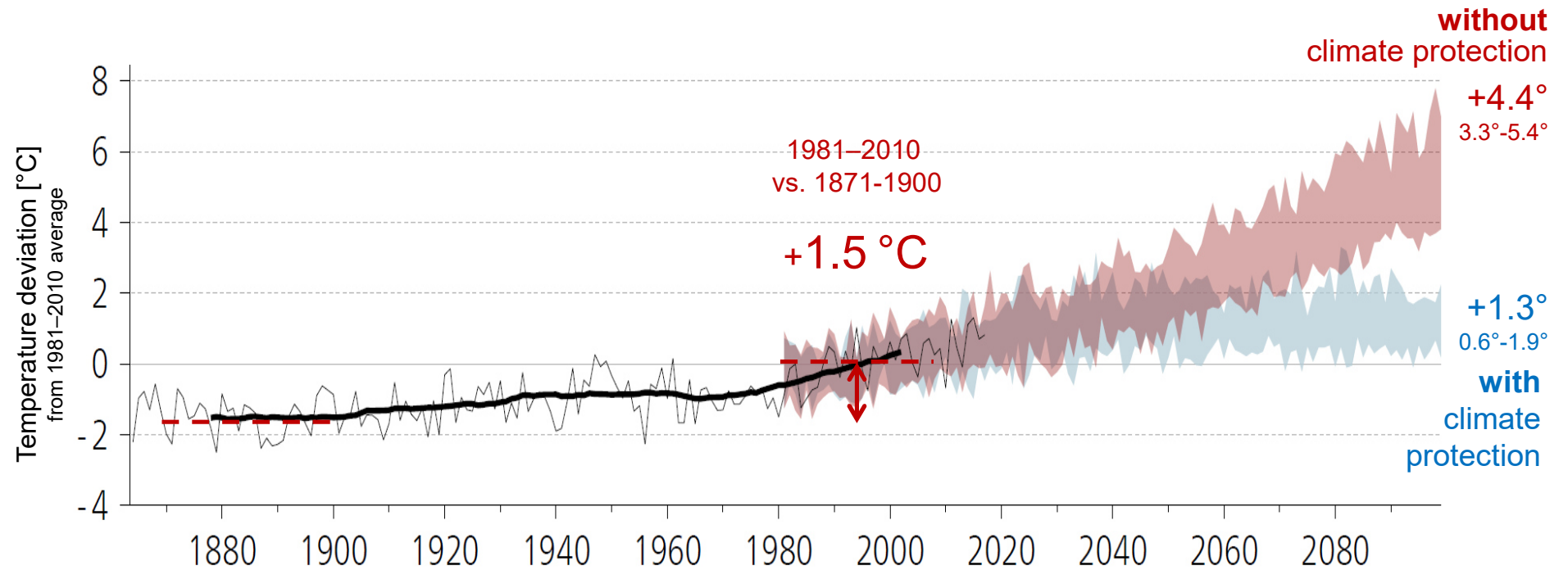
= 2 x global temperature rise



© MeteoSwiss



Possible temperature development in Switzerland to end of century

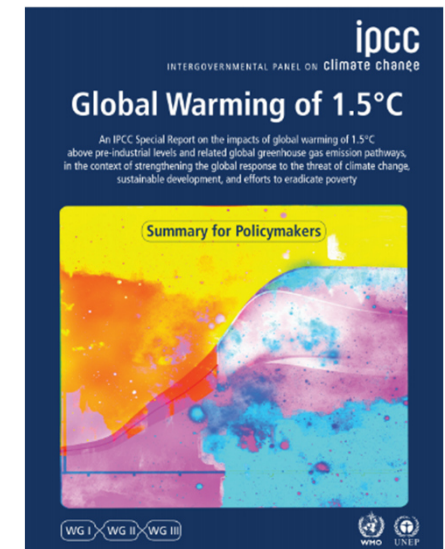


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IPCC special report on global warming of 1.5°C

- In 2018, the Intergovernmental Panel on Climate Change (IPCC) revealed that dramatic changes to ecosystems can be expected with as little as 1.5°C global warming.
- The IPCC predicts that global warming can only be limited to 1.5°C if **global carbon emissions** are reduced to **net zero around the year 2050**. Remaining emissions must then be offset by permanently removing CO₂ from the atmosphere (so-called negative emissions).
- On the basis of what we know now, we need to reduce global CO₂ emissions to **net negative** by the **end of the century**; negative CO₂ emissions must then be greater than the CO₂ emissions emitted.
- Based on these findings, the Federal Council decided on 28 August 2019 that **Switzerland** should reduce **its greenhouse gas emissions to net zero by 2050**.



[Report:
www.ipcc.ch/sr15](http://www.ipcc.ch/sr15)



Milestones in Swiss climate policy 2019–2021



2019

2020

2021

Federal Council adopts net-zero target for 2050 (Sept. 19)

Glacier Initiative submitted and meets requirements (Nov./Dec. 19)

Final vote in Parliament CO₂ Act (Sept. 20)

Federal Council adopts report on negative CO₂ emissions (Po.18.4211 Thorens) and presents direct counter-proposal to Glacier Initiative (Sept. 20)

Federal Council adopts long-term climate strategy (Jan. 21)
CO₂ Act rejected in referendum (June 21)

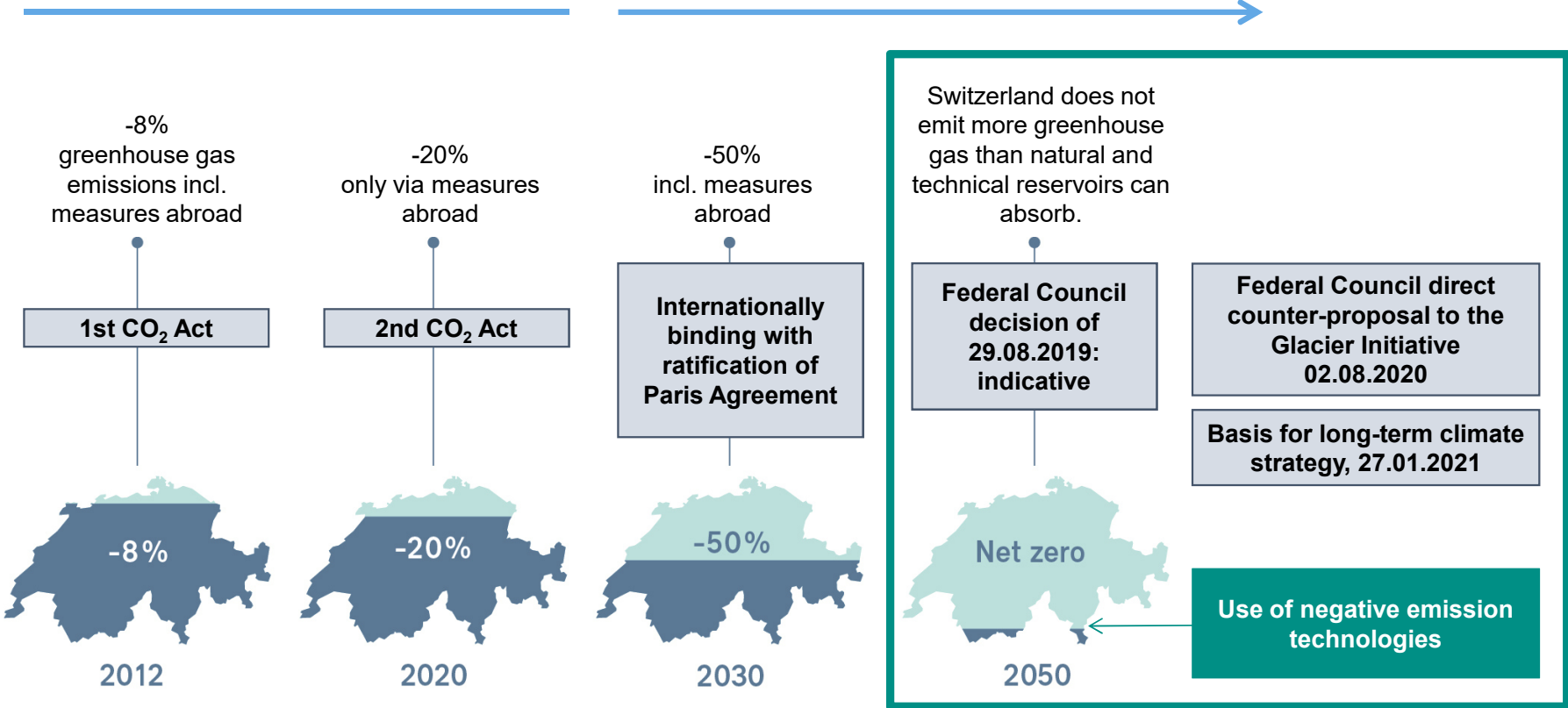
Federal Council adopts dispatch on direct counter-proposal to Glacier Initiative (Aug. 21)



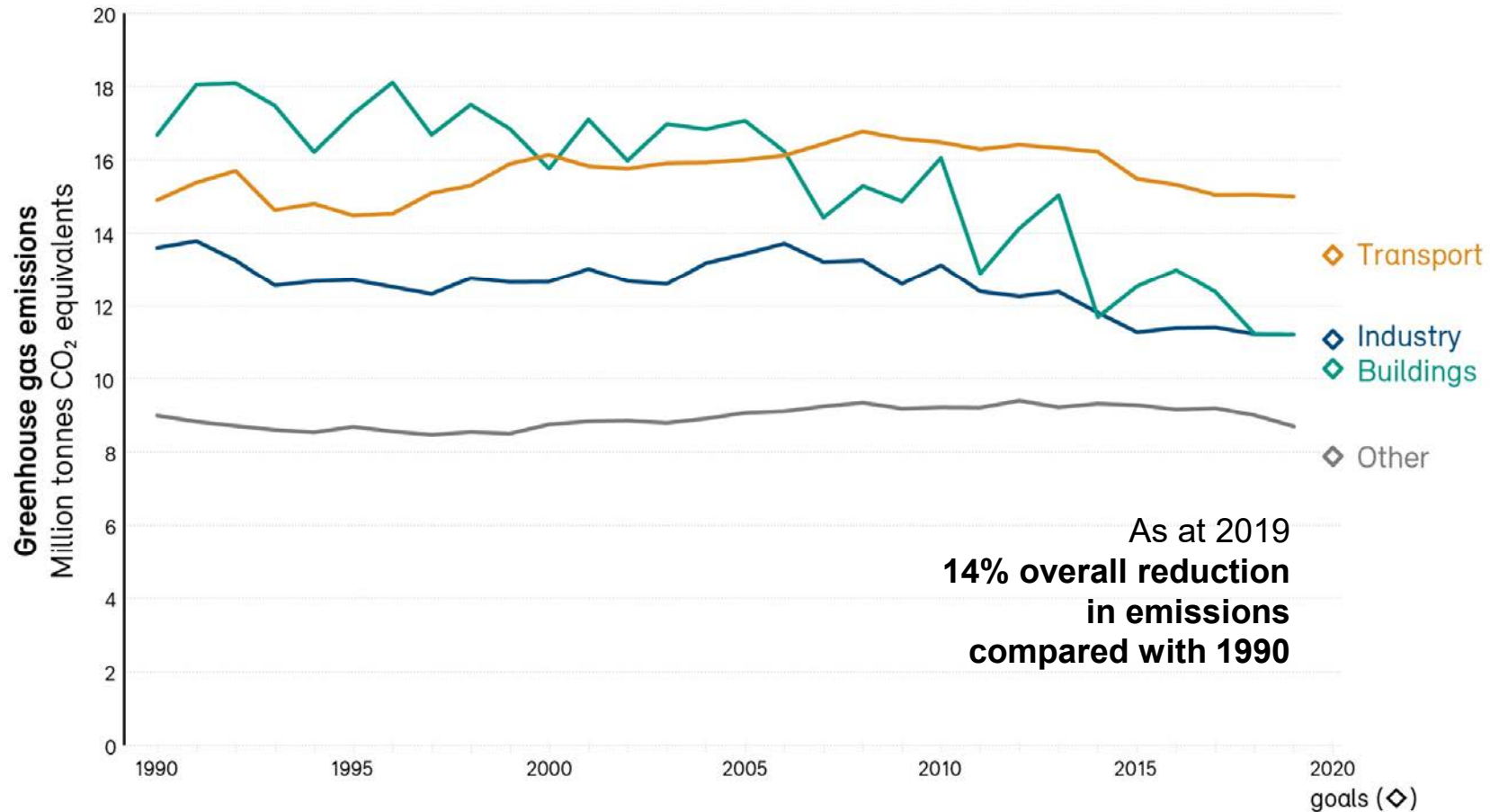
Overview of reduction targets

Kyoto Protocol

Paris Agreement



Emissions in Switzerland by sector





Popular initiative 'For a healthy climate' (Glacier Initiative) Submitted: 27.11.2019

The Glacier Initiative wants...

- ...to enshrine the net-zero goal in the Constitution: Switzerland should not emit more greenhouse gases than can be permanently stored in safe greenhouse gas sinks from 2050;
- ...the greenhouse gas emission reduction path defined in the implementing legislation to be linear at the least;
- ...a total ban on the use of fossil fuels from 2050. Exceptions are only possible for applications for which there are no technical alternatives;
- ... remaining CO₂ emissions from fossil energy sources to be offset by safe greenhouse gas sinks on Swiss soil only.





Federal Council's direct counter-proposal to the Glacier Initiative

In principle, pursues the same objective: enshrine net-zero target 2050 in the Constitution. **But:**

- No ban on fossil fuels. Instead, an obligation to reduce consumption where technically feasible, economically and socially viable and compatible with maintaining inland security.
- Climate policy should be both socially acceptable (as in Initiative text) and take account of special situation of mountain and peripheral regions.
- Any emissions remaining in 2050 to be offset with sinks in CH or abroad.



Long-term climate strategy



Long-term climate strategy: mandate



Federal Council mandate (August 2019):
FOEN to develop long-term climate strategy
based on the new 2050 target (net zero)
→ [Adopted on 27.1.2021](#)

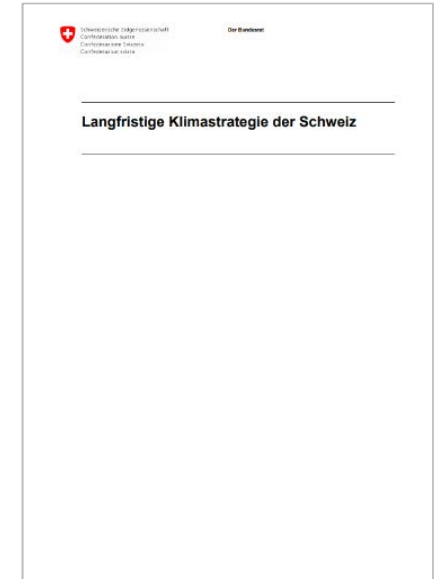


Paris Agreement:
All states invited to develop long-term climate
strategies (Art. 4.19) and to submit them to the
Secretariat of the UN Framework Convention on
Climate Change (UNFCCC)
→ [Submitted on 27.1.2021](#)



Long-term climate strategy 2050: Key messages

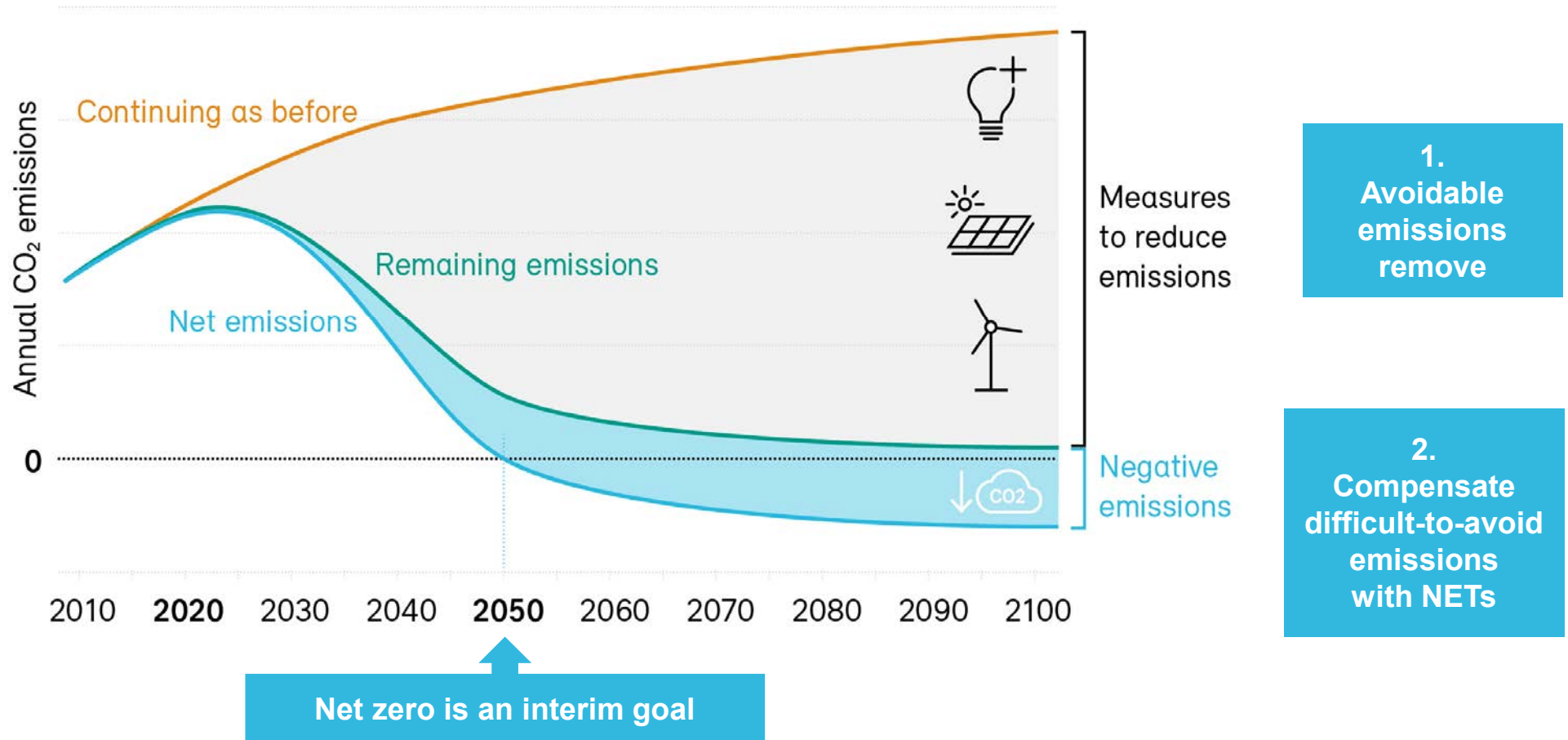
- Net-zero emissions by 2050 **realistic and technically feasible**.
- By 2050, Switzerland can **largely phase out fossil fuels**
→ **Priority: reduce emissions**.
- **Emissions difficult to avoid** in Switzerland must be reduced using technologies for **carbon capture and storage** and **compensated with negative emission technologies**.
- Measures **abroad** can help to achieve this.
- Halving emissions by 2030 is an important step towards the net-zero target.



<https://www.bafu.admin.ch/climate-strategy-2050.html>

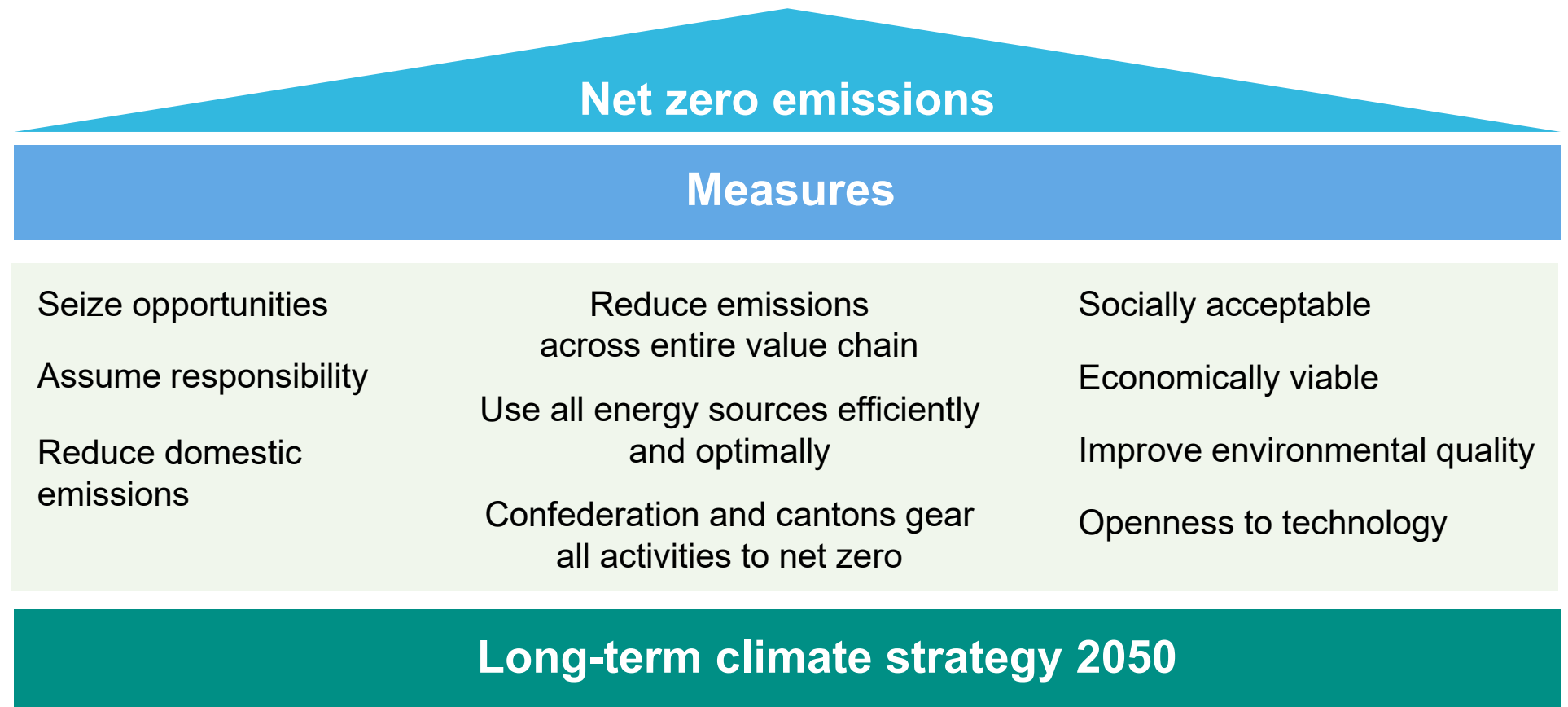


Long-term climate strategy: Net zero by 2050 (illustrative)





Long-term climate strategy: 10 principles





Long-term climate strategy: Energy Perspectives 2050+ provides basis

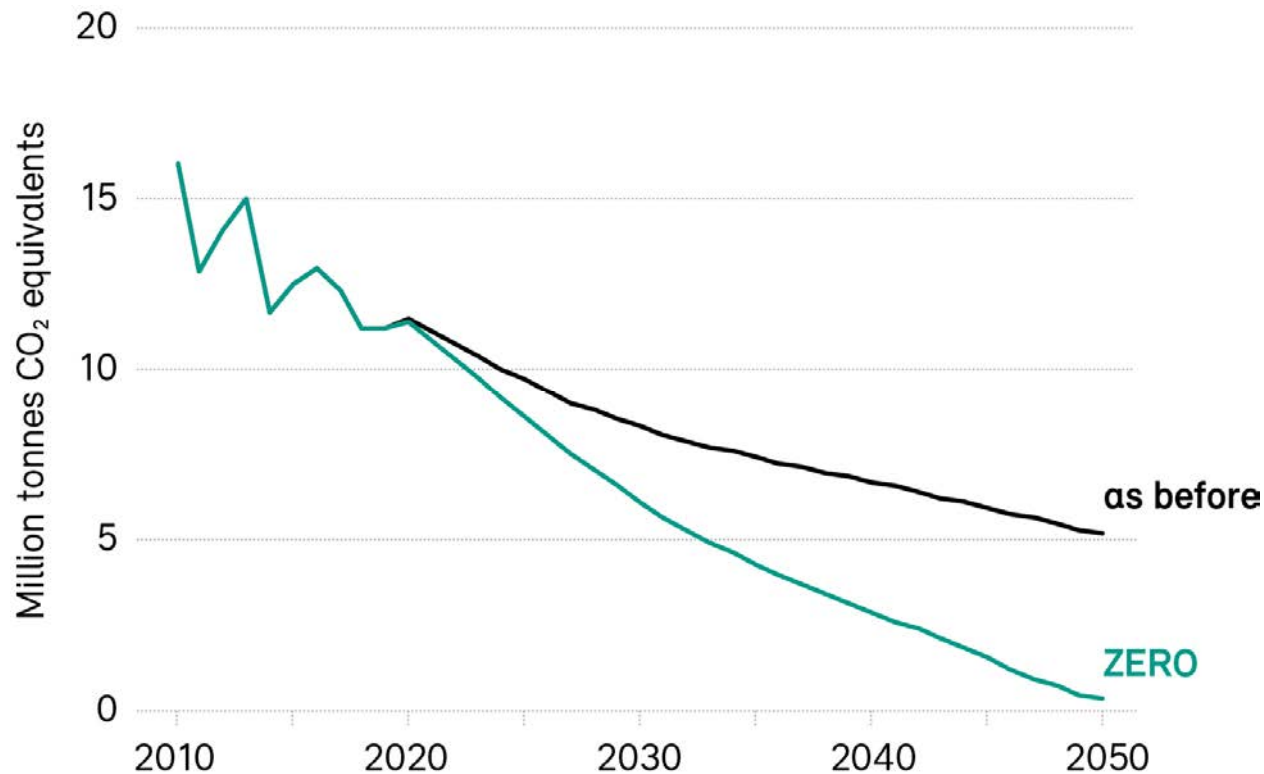
- Energy Perspectives 2050+ (EP2050+) net-zero emissions scenario (ZERO): analyses development of energy system compatible with net-zero greenhouse gas emissions by 2050 and secure energy supply.
- Energy and climate policy objectives presented together for the first time.
- Models show possible technological developments to achieve targets by 2050.
- EP2050+ provides important basis esp. for sectoral target values in long-term climate strategy.



Source: www.bfe.admin.ch/energieperspektiven



Long-term climate strategy: Buildings

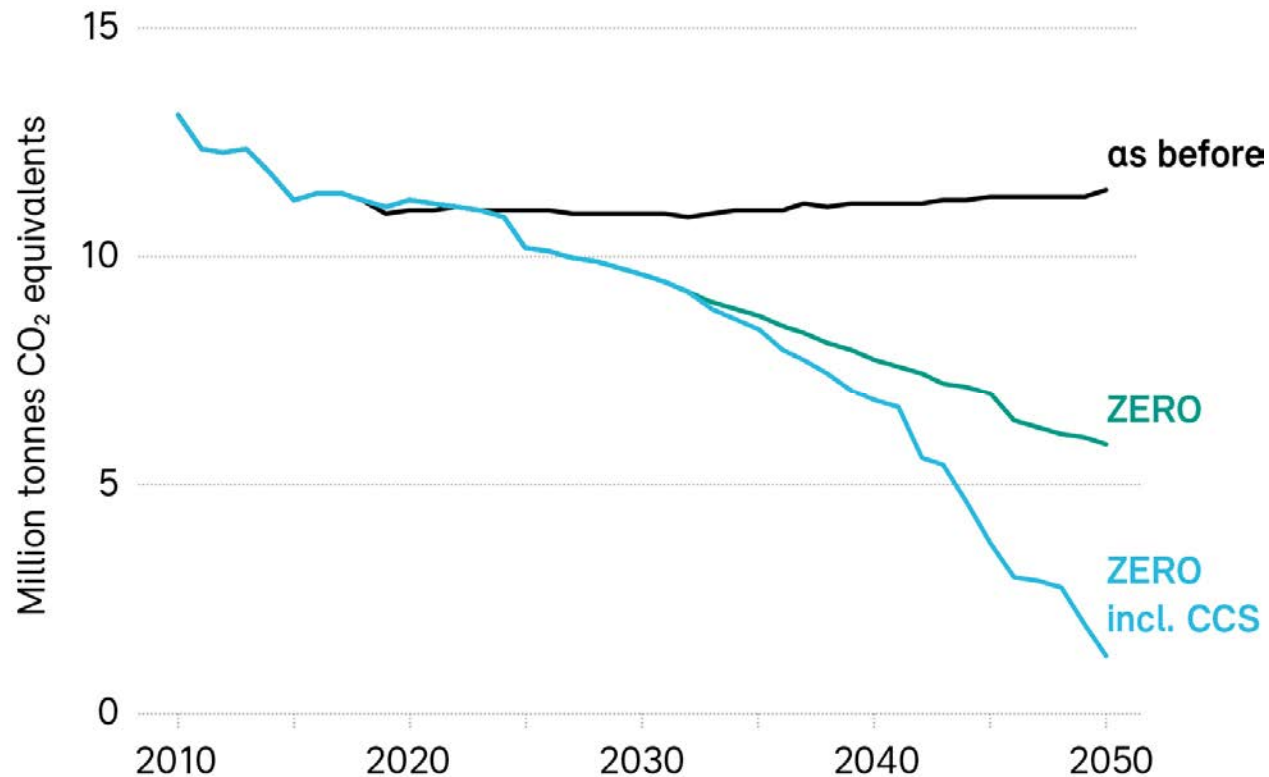


Target for 2050:
Building stock no longer produces greenhouse gas emissions.

- Phase out oil and gas for heating
- Increase energy efficiency
- Shorten refurbishment cycles and increase refurbishment quality



Long-term climate strategy: Industry



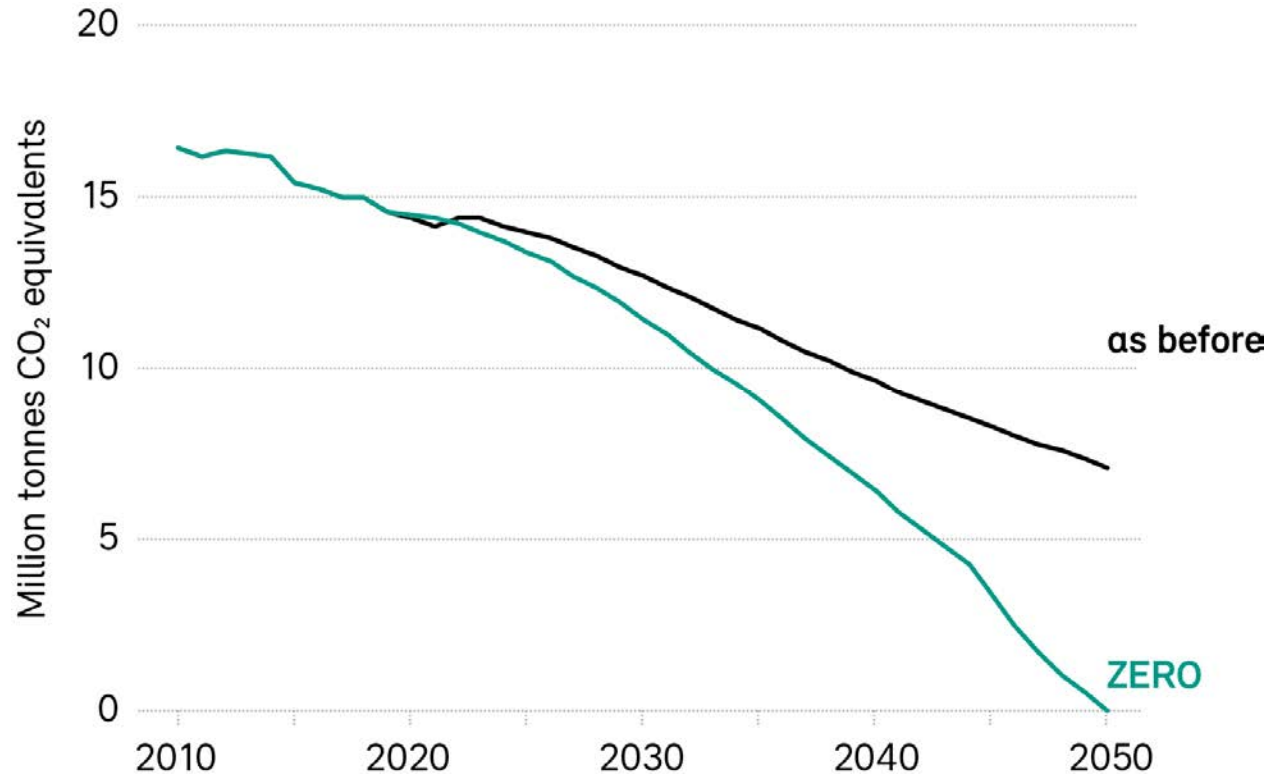
Target for 2050:

Greenhouse gas emissions are reduced by at least 90% compared to 1990.

- Phase out oil and gas in industrial processes
- Use all available efficiency potentials
- Carbon capture and storage (CCS) for large point sources (cement, waste incineration)



Long-term climate strategy: Transport



Target for 2050:
With few exceptions,
no more greenhouse
gas emissions.

- Drive forward electrification and use of greenhouse gas-neutral fuels and propulsion technologies
- Potentials for modal shift and for climate-friendly building development

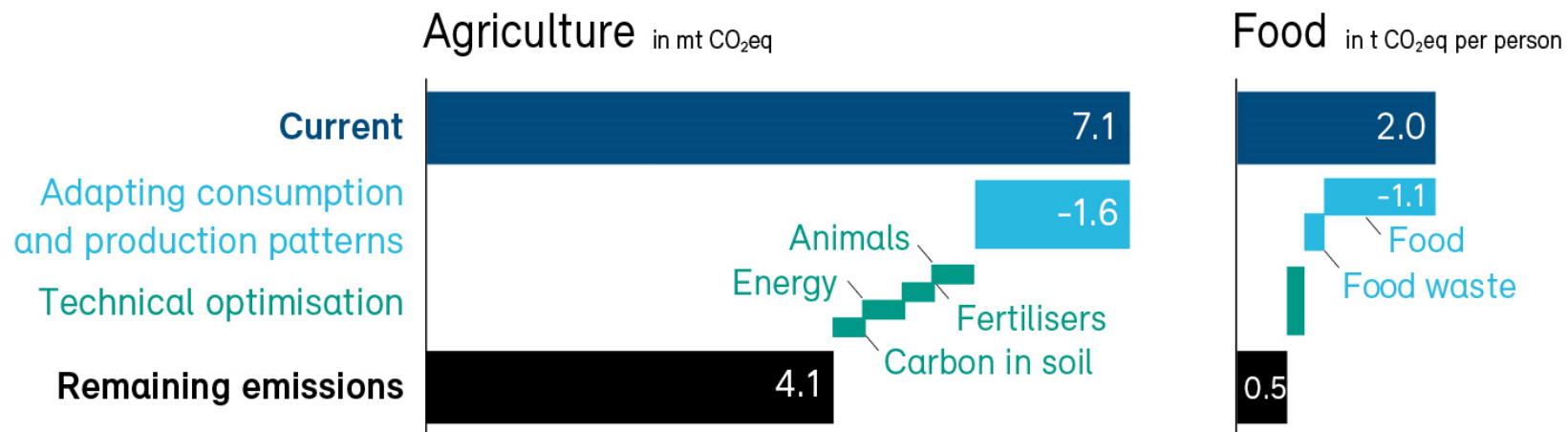


Long-term climate strategy: Agriculture



Target for 2050:

- The carbon footprint of food production decreasing thanks to promotion of sustainable food systems. No emissions shifted abroad.
- Greenhouse gas emissions from domestic agricultural production reduced by at least 40% compared with 1990.
- Swiss agriculture contributes at least 50% to food supply.





Long-term climate strategy: Other sectors

Air transport 2050 target:

International air traffic from Switzerland no longer causes net climate-impacting emissions, i.e.:

- Fossil CO₂ emissions are net zero.
- Other climate impacts reduced or offset by other measures.



Financial market 2050 target:

Switzerland's financial flows moving towards low greenhouse gas emissions and climate-resilient development in accordance Paris Agreement target.



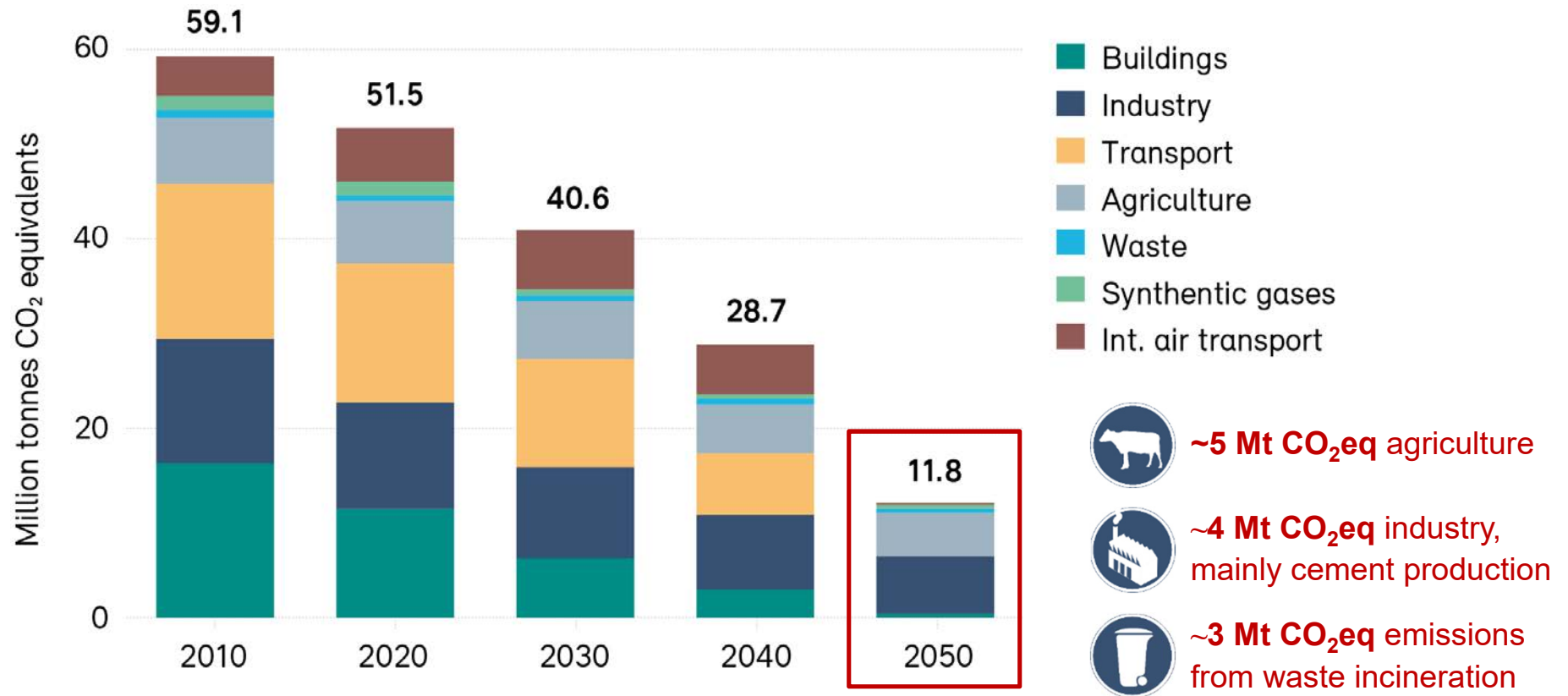
Waste sector 2050 target (not incl. incineration) and synthetic gases:

Emissions reduced to ca. 0.8 m tonnes CO₂eq.



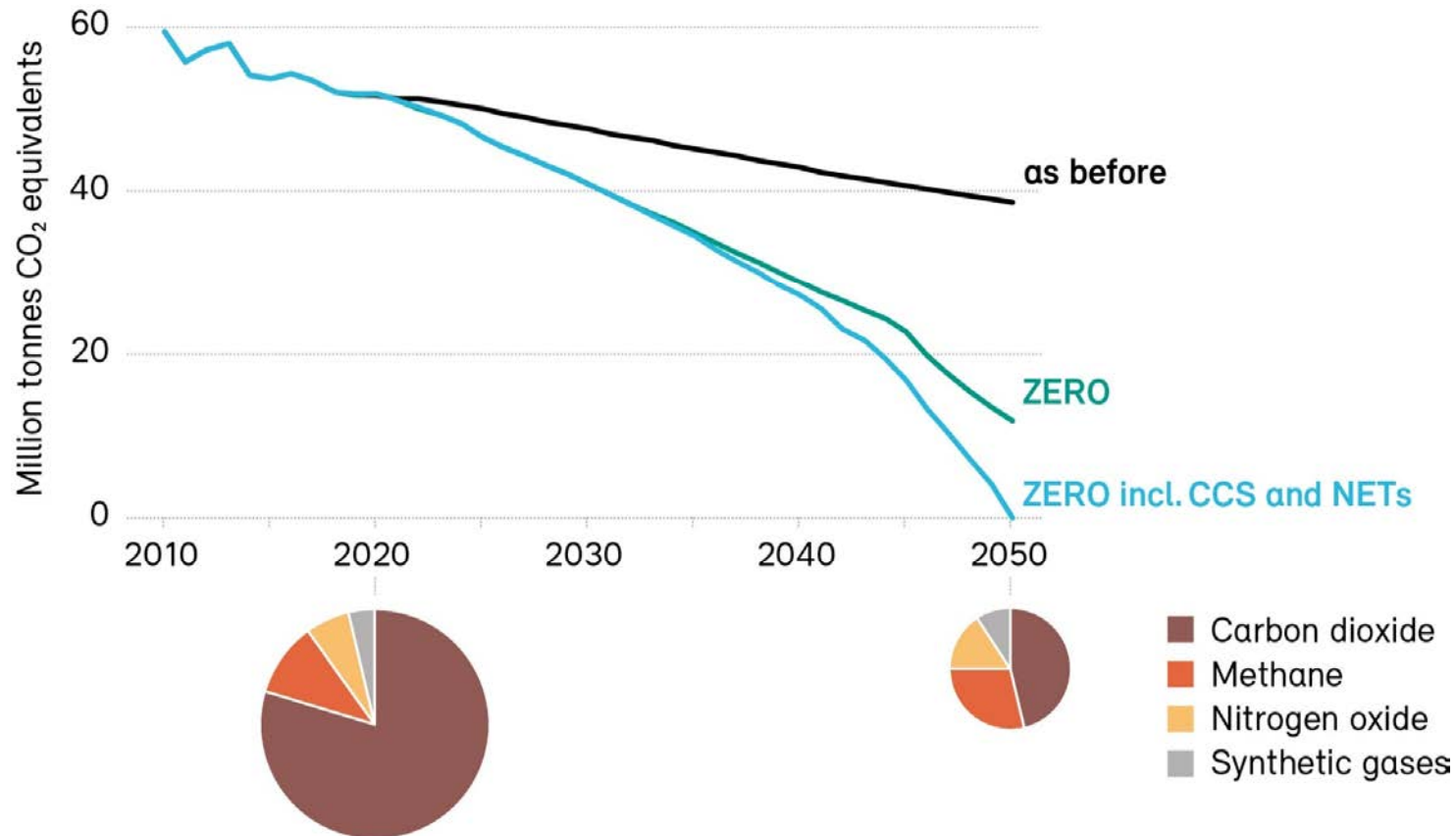


Long-term climate strategy: Difficult-to-avoid emissions 2050





Long-term climate strategy: Reductions across all sectors

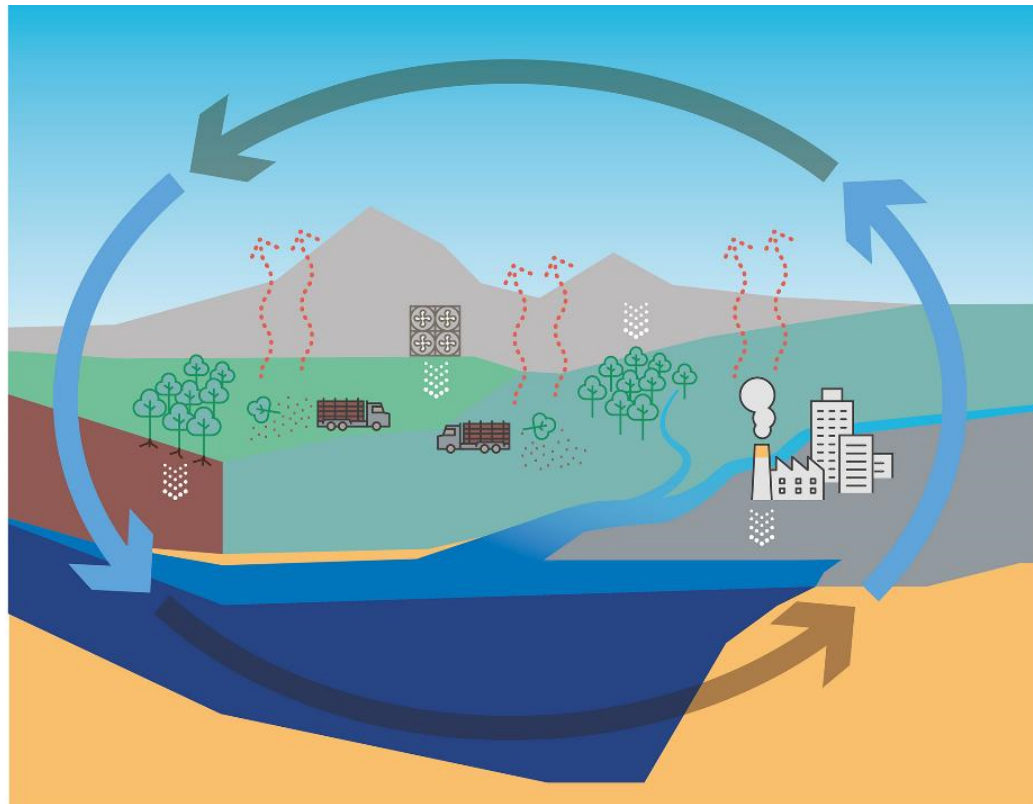




Role of carbon capture and storage (CCS) and negative emission technologies (NETs)



Clarification of terms: CCS and NET in the carbon cycle



Greenhouse gas emissions enter the atmosphere from various **sources**. **CO₂** is removed from the **atmosphere** and stored in **sinks**.



Excess **human-generated emissions** upset the natural balance.



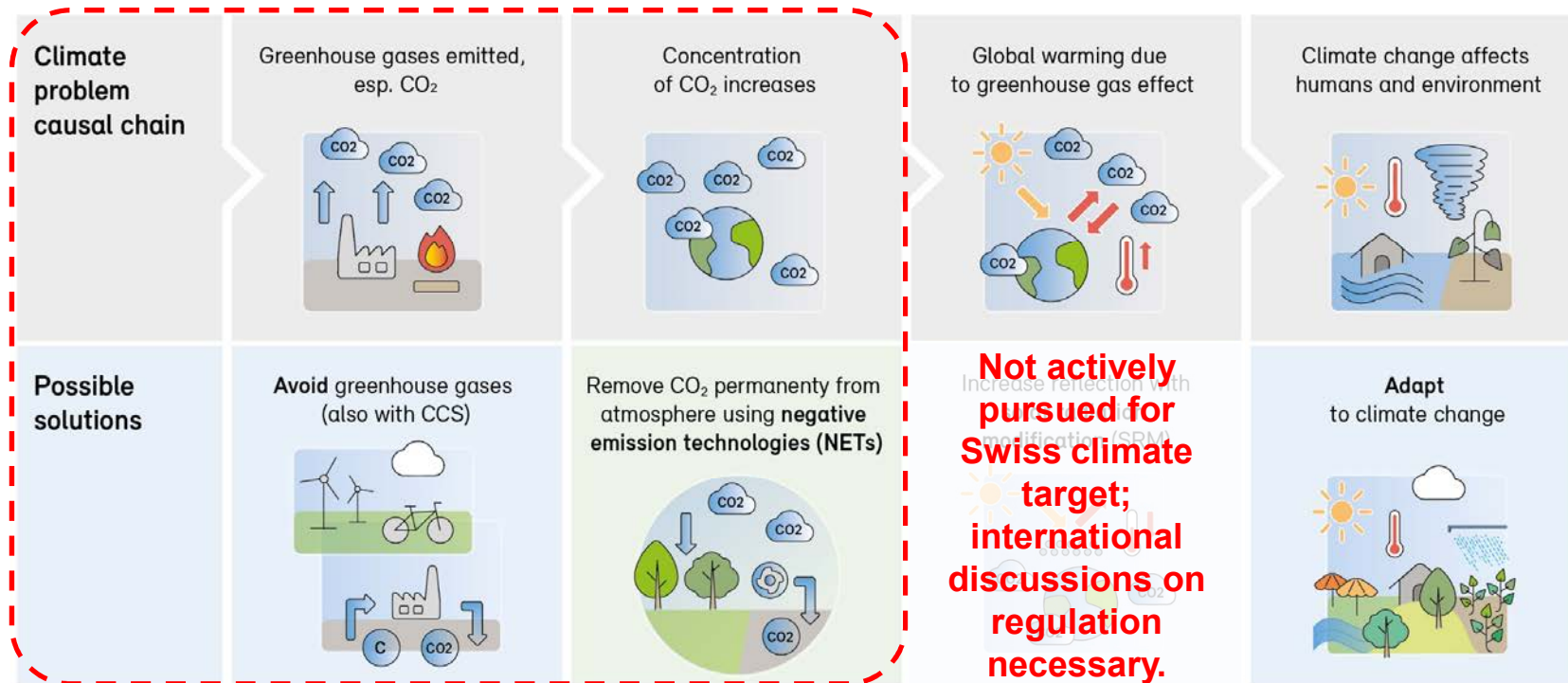
CCS reduces **CO₂** from **fossil fuels** and chemical processes in the atmosphere.



With **NETs** humans **increase** the **sink effect** to remove **CO₂** **permanently** from the atmosphere.



Achieving net zero: Avoid emissions when possible (also with CCS), compensate remainder with NETs



Further information:
bafu.admin.ch



Achieving negative emissions – but many questions are still unanswered

<p>Reforestation, forest management, wood use Growing trees removes CO₂ from the air. CO₂ stored in trees, soil and wood products.</p>	<p>Soil management (incl. charcoal) Carbon stored in soils e.g. leaving crop residues or charcoal; can increase carbon levels</p>	<p>Direct air carbon capture and storage (DACSS) CO₂ is removed from the air in chemical processes and stored in the ground.</p>
<p>Bioenergy with carbon capture and storage (BECCS) Plants transform CO₂ into biomass; this is used to generate energy. CO₂ is captured and stored in the ground.</p>	<p>Accelerated weathering Crushed minerals bind CO₂ in a chemical process and can be stored in products, the ground or ocean.</p>	<p>Ocean fertilisation Iron or other nutrients are added to the ocean to increase the absorption of CO₂ by algae.</p> <p>Not actively pursued for Swiss climate target; international discussions on regulation necessary.</p>

Aspects: Durability of carbon storage, technical maturity, economic, ecological and international aspects, political and social acceptance, regulatory framework

See also: Federal Council report in response to Postulate 18.4211



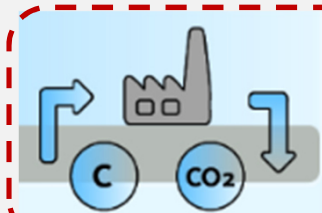
Waste: a special case

CCS + burnt biomass (BECCS) > negative emissions

Avoiding CO₂ with CCS

CO₂ from fossil fuels and chemical processes, is captured and stored directly

Special case: waste incineration

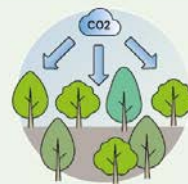


Capturing CO₂ with NETs

CO₂ is extracted from the atmosphere

Possible approaches for negative emissions

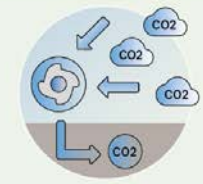
Reforestation, forest management, wood use
Growing trees removes CO₂ from the air. CO₂ stored in trees, soil and wood products.



Soil management (incl. charcoal)
Carbon stored in soils e.g. leaving crop residues or charcoal; can increase carbon levels



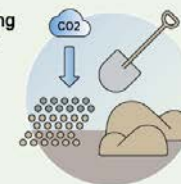
Direct air carbon capture and storage (DACSS)
CO₂ is removed from the air in chemical processes and stored in the ground.



Bioenergy with carbon capture and storage (BECCS)
Plants transform CO₂ into biomass; this is used to generate energy. CO₂ is captured and stored in the ground.



Accelerated weathering
Crushed minerals bind CO₂ in a chemical process and can be stored in products, the ground or ocean.



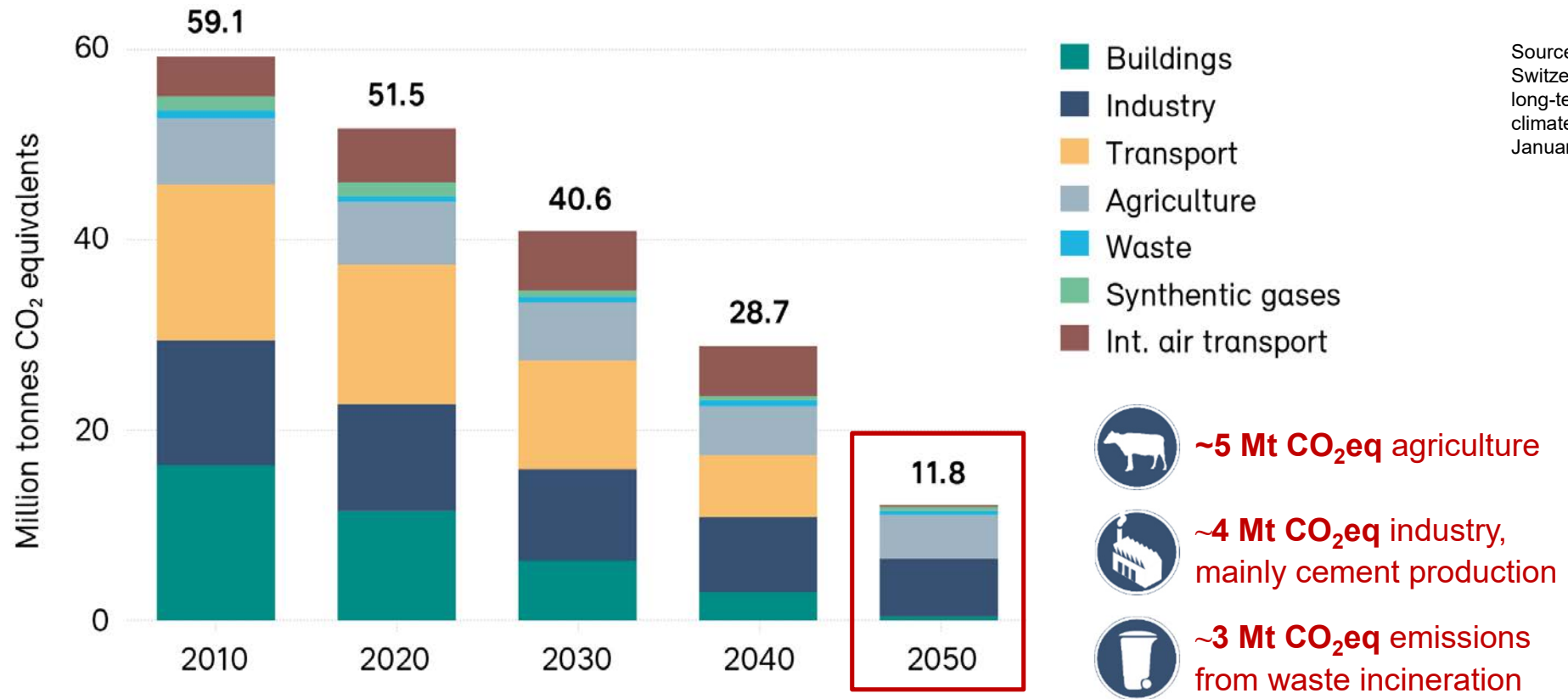
Ocean fertilisation
Iron and other nutrients are added to the ocean to increase the amount of CO₂ absorbed by algae.



Not actively pursued for Swiss climate target; international discussions on regulation necessary.

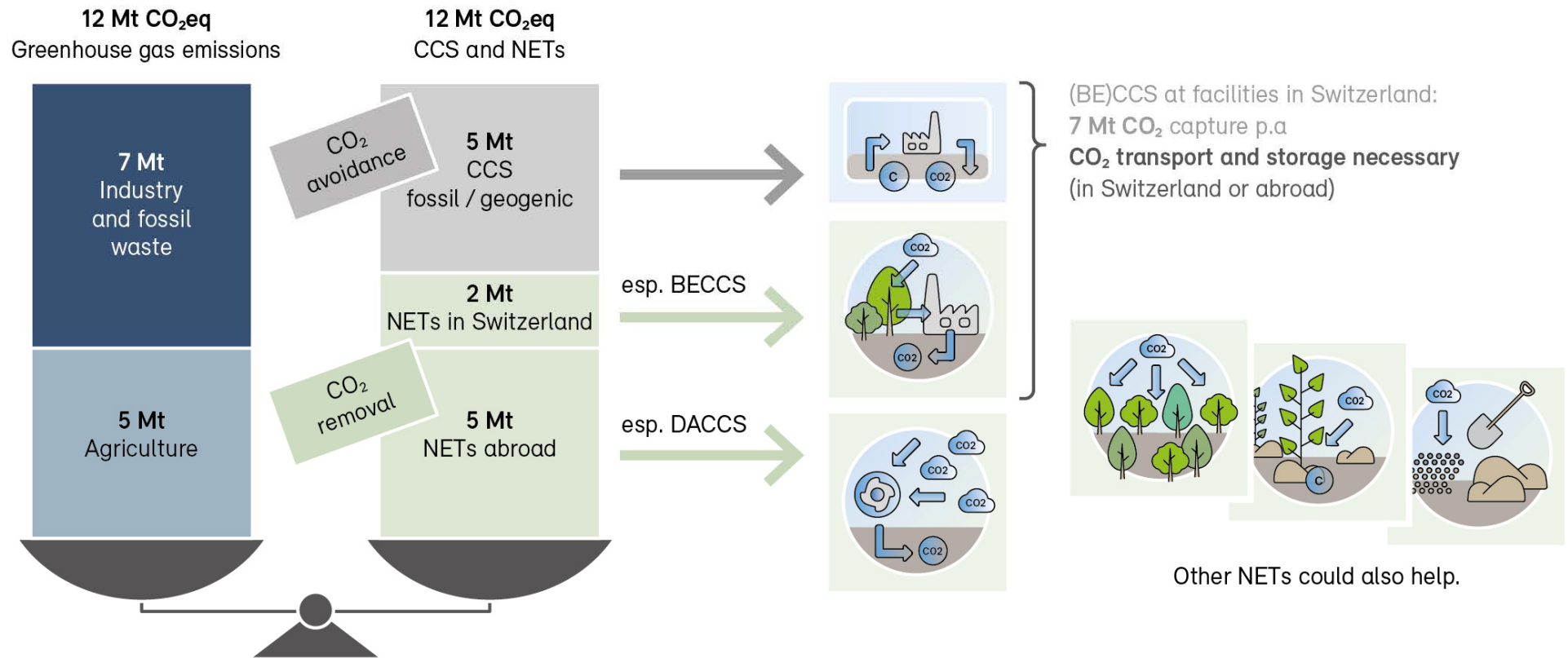


2050: Difficult-to-avoid emissions from industry, waste recycling and agriculture





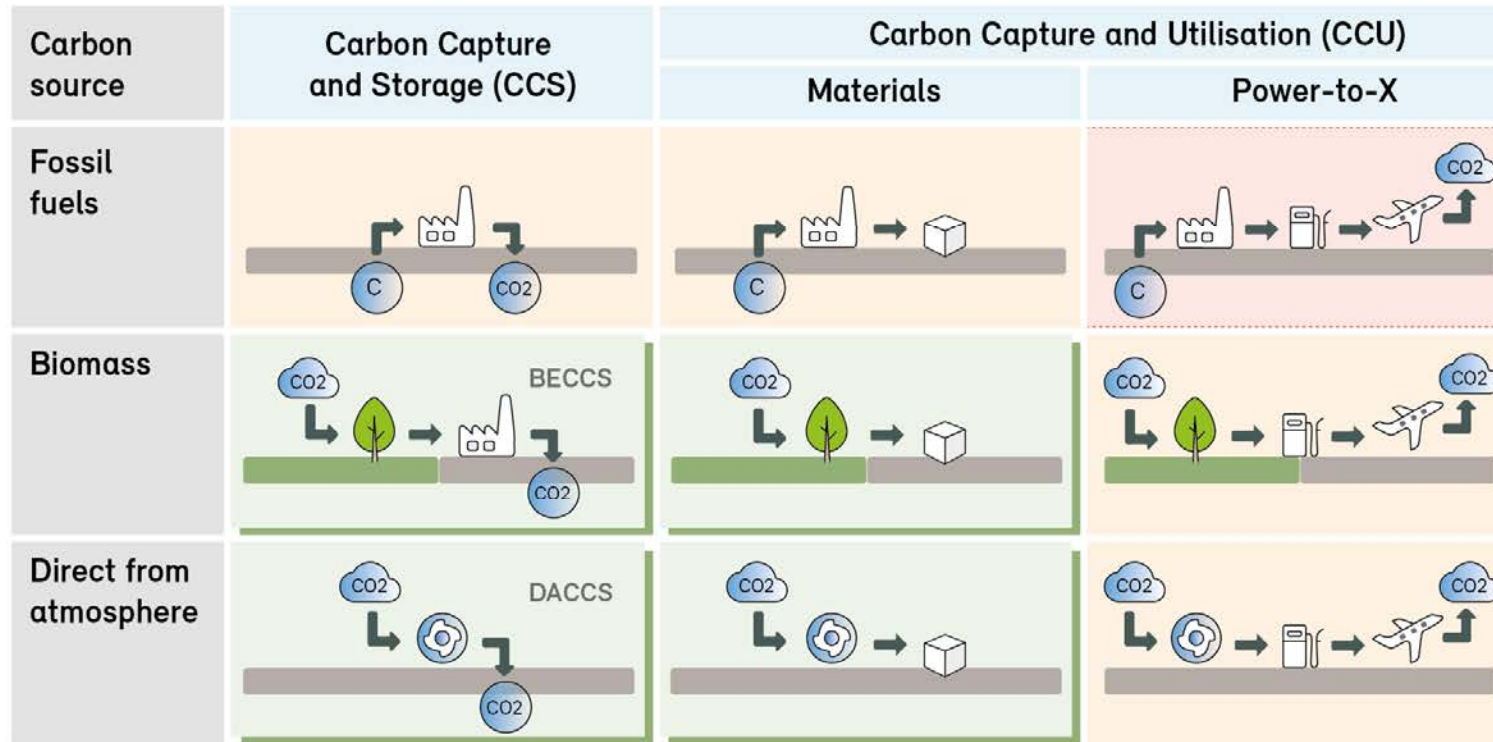
How CCS and NETs contribute to net zero in 2050



Source: Switzerland's long-term climate strategy, January 2021; SFOE Energy Perspectives 2050+, November 2020



CO₂ utilisation: Climate impact depends on storage time and carbon source



It is assumed that the energy used was generated in a climate-friendly way.

- Negative emissions
- Climate neutral
- CO₂ emissions



Abbreviations / Glossary

BECCS	Bioenergy CCS; CCS in combination with biomass energy (→ CCS, NETs)
CCS	Carbon Capture and Storage; Carbon is captured at a facility and then permanently stored. CCS in combination with biomass energy can produce negative carbon (→ NETs).
CCU	Carbon Capture and Utilisation; e.g. in building materials or synthetic fuels (→ CCS, NETs).
CO ₂ eq	CO ₂ equivalents
DACCS	Direct Air Carbon Capture and Storage; (→ NETs)
IPCC	Intergovernmental Panel on Climate Change
Carbon store, reservoir	Climate system components (not the atmosphere) that can store, accumulate or release carbon (C). The origin of the carbon is undefined; the carbon could be extracted from the atmosphere (→ NETs) or directly at a plant (→ CCS). Storing carbon in this way can reduce CO ₂ emissions or result in negative emissions.
NETs	Negative emission technologies; Anthropogenic, i.e. man-made activities that remove greenhouse gases, usually CO ₂ , from the atmosphere using natural and technical processes and store them permanently (→ Sink).
Power-to-X	Technologies for the storage and use of electricity surpluses. E.g. synthetic fuels can be produced by means of hydrogen production (electrolysis) and in combination with CO ₂ .
Sink	Reservoir, natural or otherwise, that accumulates and stores greenhouse gases and thereby lowers their in the atmosphere. Can also occur without human intervention and is not necessarily permanent (→ NETs). Since CO ₂ is the main and longest-lived greenhouse gas, and processes for removing other greenhouse gases from the atmosphere are not yet developed, the discussion about greenhouse gas sinks focuses on CO ₂ ; also known as carbon sink (→ carbon store, reservoir).



Further information and contact

Long-term climate strategy www.bafu.admin.ch/climate-strategy-2050

NETs www.bafu.admin.ch/net-e

Energy Perspectives 2050+ www.bfe.admin.ch

IPCC 1.5°C report www.ipcc.ch/sr15

CH2018 climate scenarios www.nccs.admin.ch/ch2018

Contact: climate@bafu.admin.ch