Innovative climate policy instruments

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Outline

- Existing instruments of Swiss climate policy are not effective enough and tightening them seems difficult → let us think of new instruments, to replace them
- Proposals:
  - Flexible carbon tax
  - National and personal carbon budgets
  - Negative emissions fund
  - Flying quotas
  - Changing norms

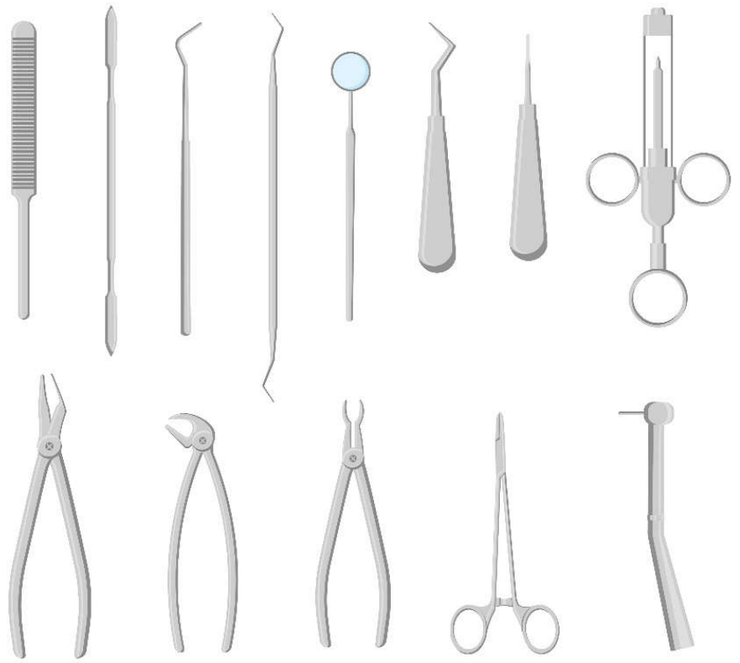
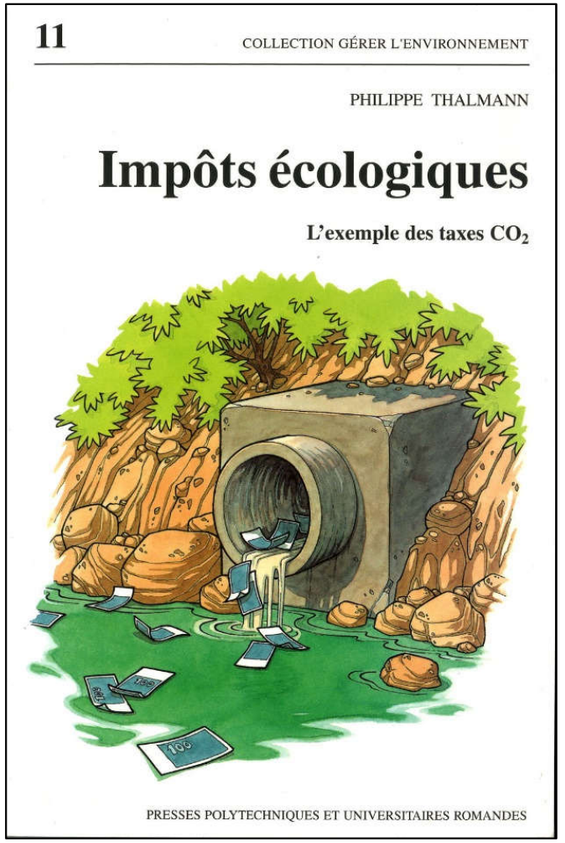
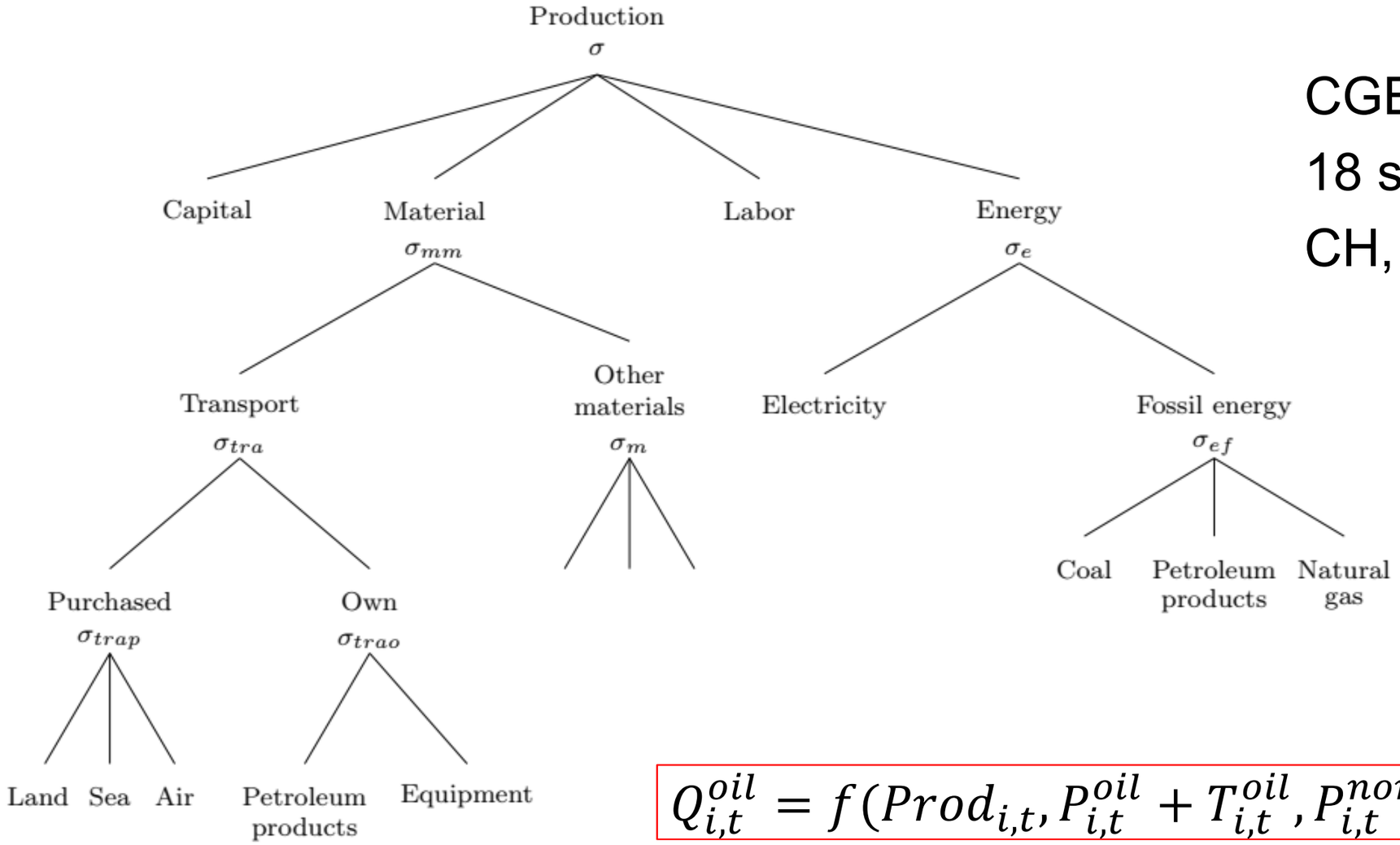


Illustration: Adobe Stock n° 501115563



EFFECTIVENESS OF THE CO_2 LEVY

Energy demand



CGE model GEMINI-E3

18 sectors, 1 household,

CH, EU, USA, BRIC, RoW

$$Q_{i,t}^{oil} = f(Prod_{i,t}, P_{i,t}^{oil} + T_{i,t}^{oil}, P_{i,t}^{non-oil}, ener.eff._{i,t}^{oil})$$

T is average CO_2 price in sector i in year t

CO_2 price

In each sector i, a firm could be facing four different prices for its emissions of CO_2 depending on its situation: the CO_2 levy, the ETS price, a cost of abatement related to its offsetting commitment, or nothing for its emissions that are not covered by the CO_2 Act (e.g. transport fuels)

Hence, the average CO_2 price in sector i is:

$$CO_2\ price_i = (1-\alpha_i-\beta_i-\mu_i)\cdot CO_2levy+\alpha_i\cdot PriceETS+\beta_i\cdot PriceNonETS+\mu_i\cdot 0$$

E.g. 'Basic metals' in 2013:

$\alpha = 47\%, \beta = 15\%, \mu = 0\%, (1-\alpha-\beta-\mu) = 38\%$

CO_2 levy = 60 CHF/t, CO_2 price = 23 CHF/t

Replicating observed emissions

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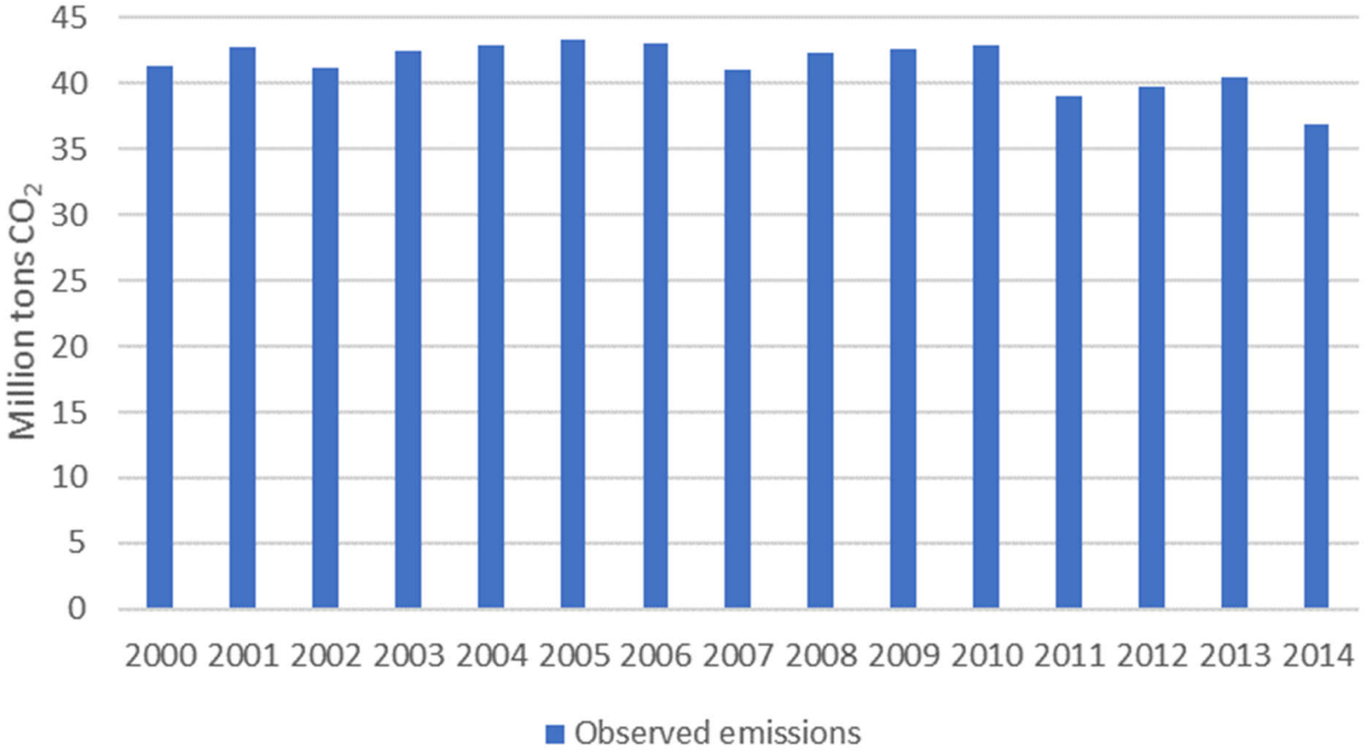
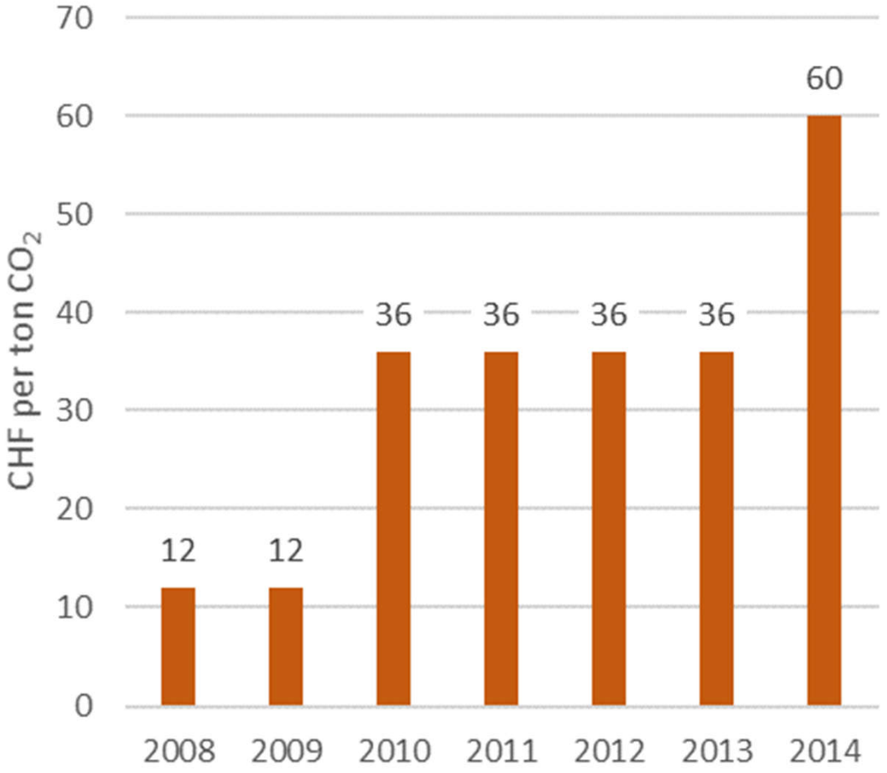
CO_2 emissions from energy



Rate of CO_2 levy



Setting the CO_2 price to zero

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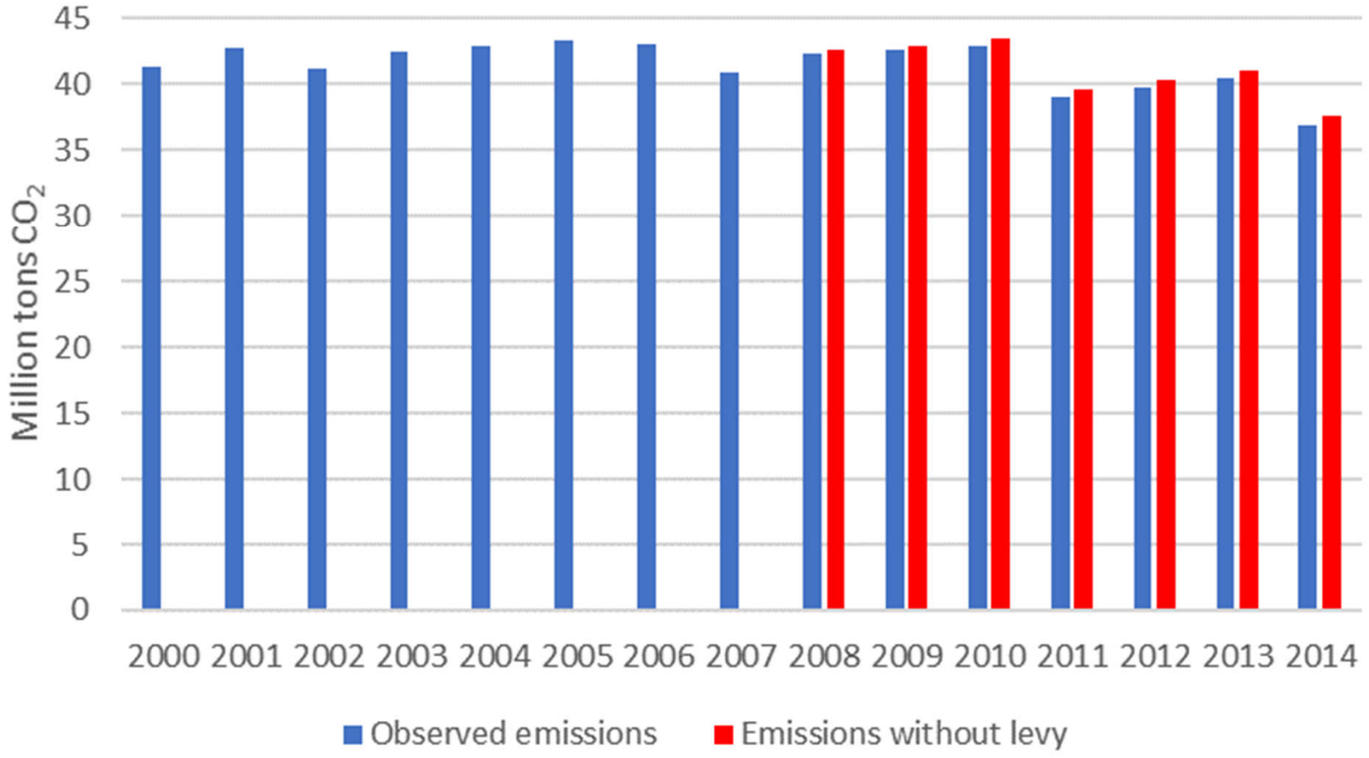
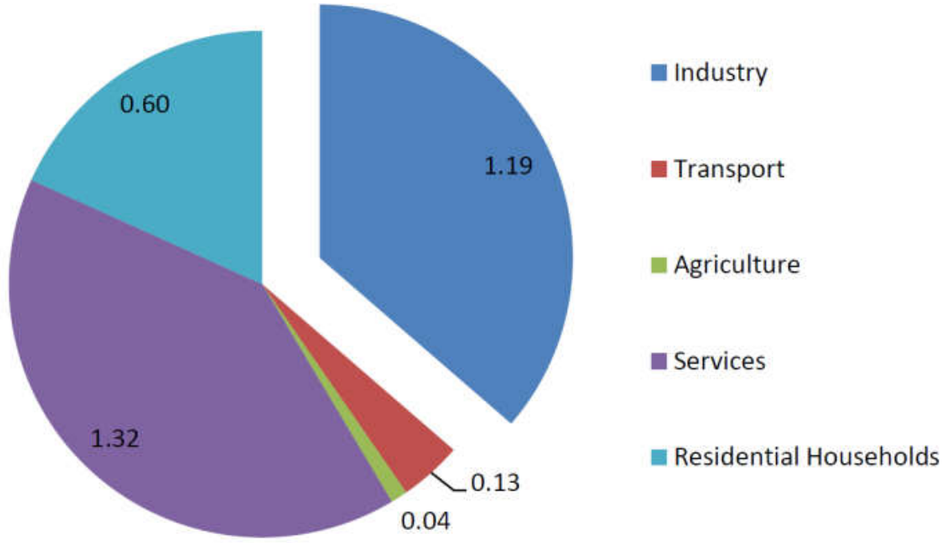
CO_2 emissions from energy



Impact of CO_2 levy on total emissions from energy:

2014:	−2.1%
2008-2014:	−1.2%

CO_2 abatement by sector Mt, 2008-2014



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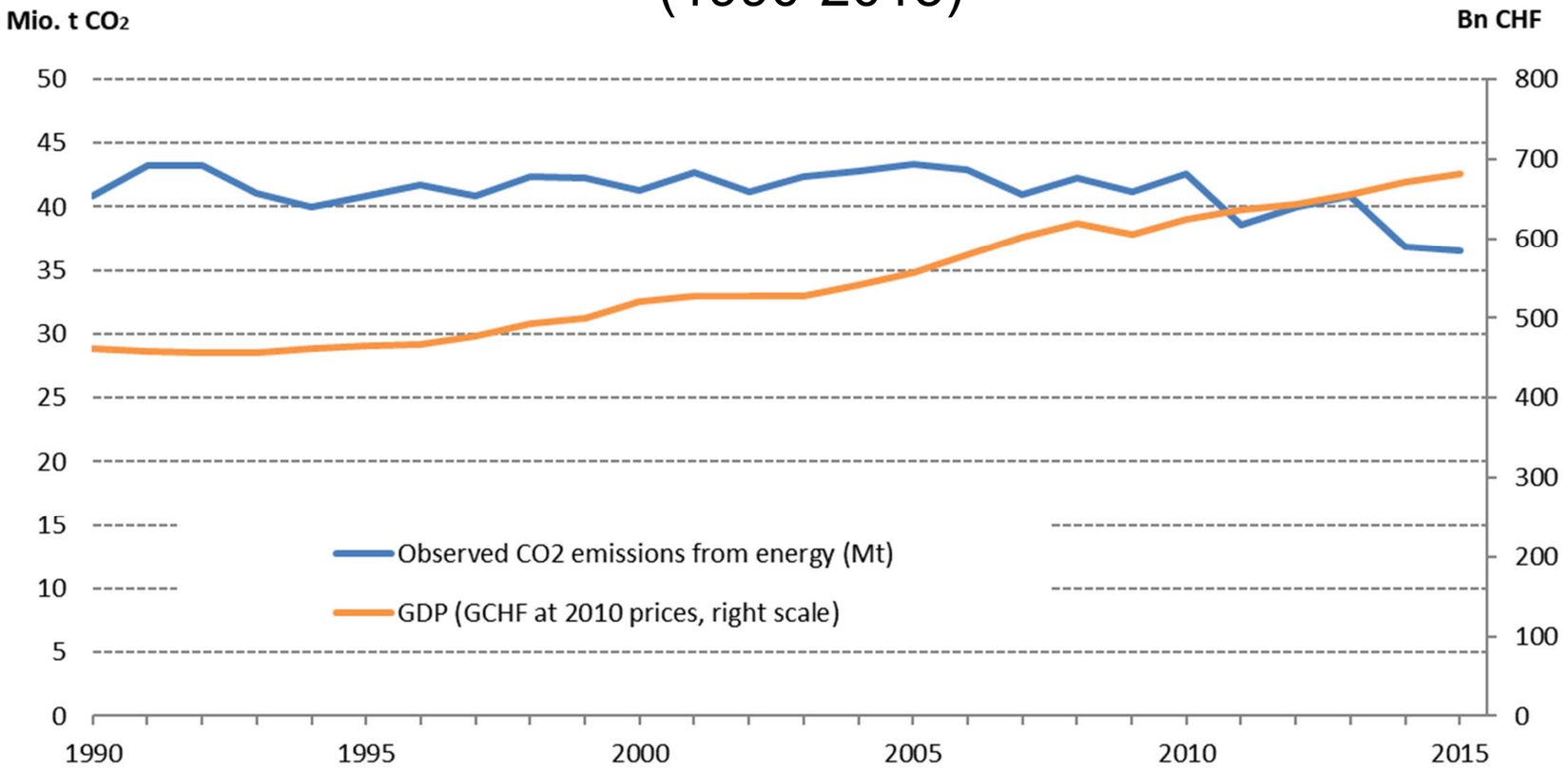
EFFECTIVENESS OF CLIMATE POLICY

What is to be explained

CO_2 emission from energy and real GDP (1990-2015)



UNFCCC reporting demands an assessment of the emissions reductions achieved through policy

By how much did the full set of climate and energy policy instruments reduce CO_2 emissions from energy?

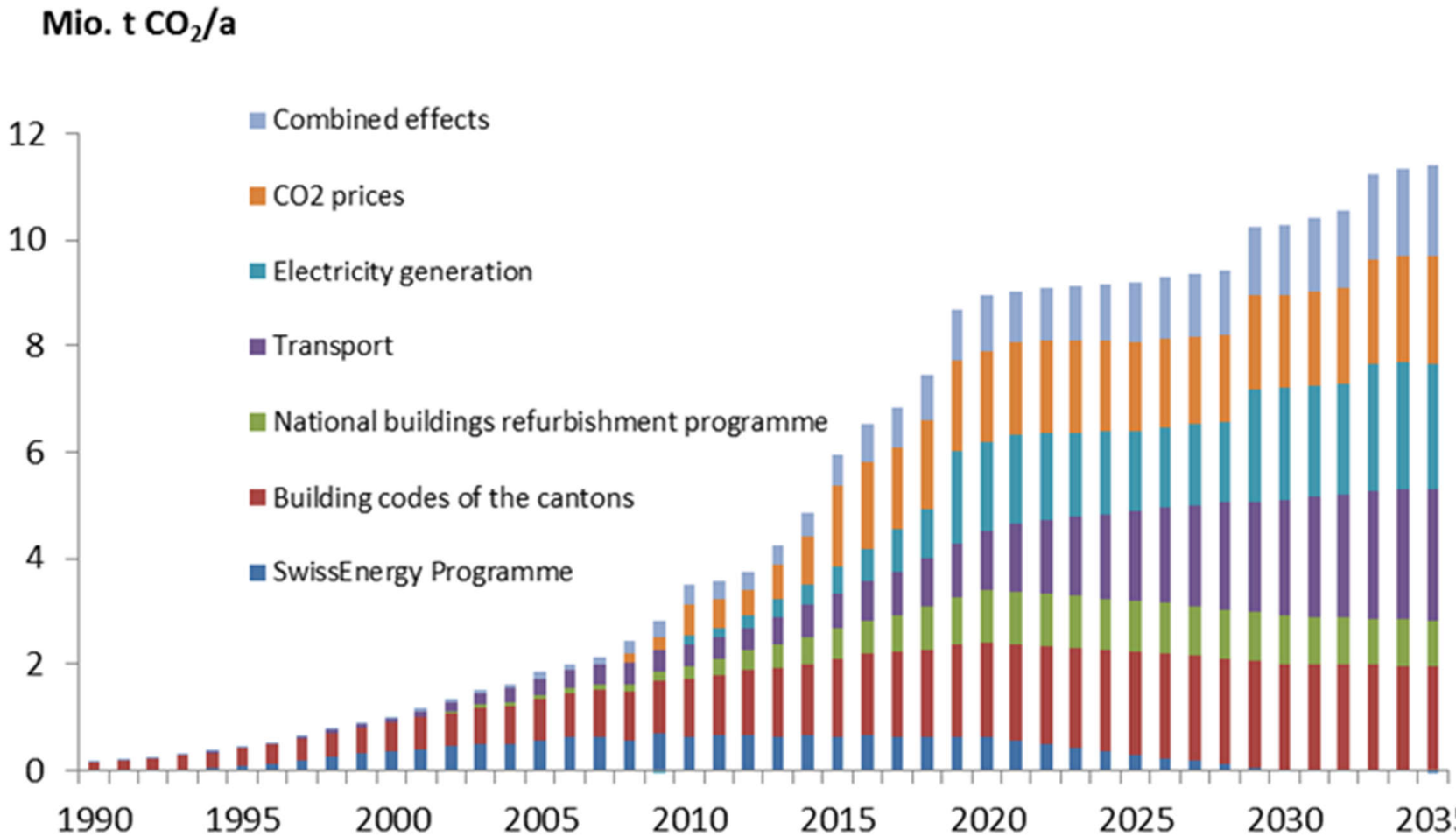
Many instruments are already in use

CO_2 Act	Cantons and cities	Energy Act	Other policies
CO_2 levy on fossil heating and process fuels	Building codes	Renewable electricity support (feed-in tariff, investment subsidies)	Tax rebate for agrofuels
Building refurbishment support (Buildings programme)	Building refurbishment support	Energy efficiency prescriptions for devices and equipment	Direct payment for more sustainable agriculture
Target agreements with industry	Specific support for large emitters	SwissEnergy programme	Prescriptions against chemical risks
Cap and trade	Public transport	Energy efficiency labels	Public transport
Compensation obligation for motor fuels (climate 'cent')	Tax rebate for fuel efficient and electric vehicles		Heavy goods vehicles levy
CO_2 emission limits for new cars			Prescriptions on waste
Technology fund			Wood promotion

Carbon price | Subsidy | Prescription | Information

Effectivity of different components of energy and climate policy

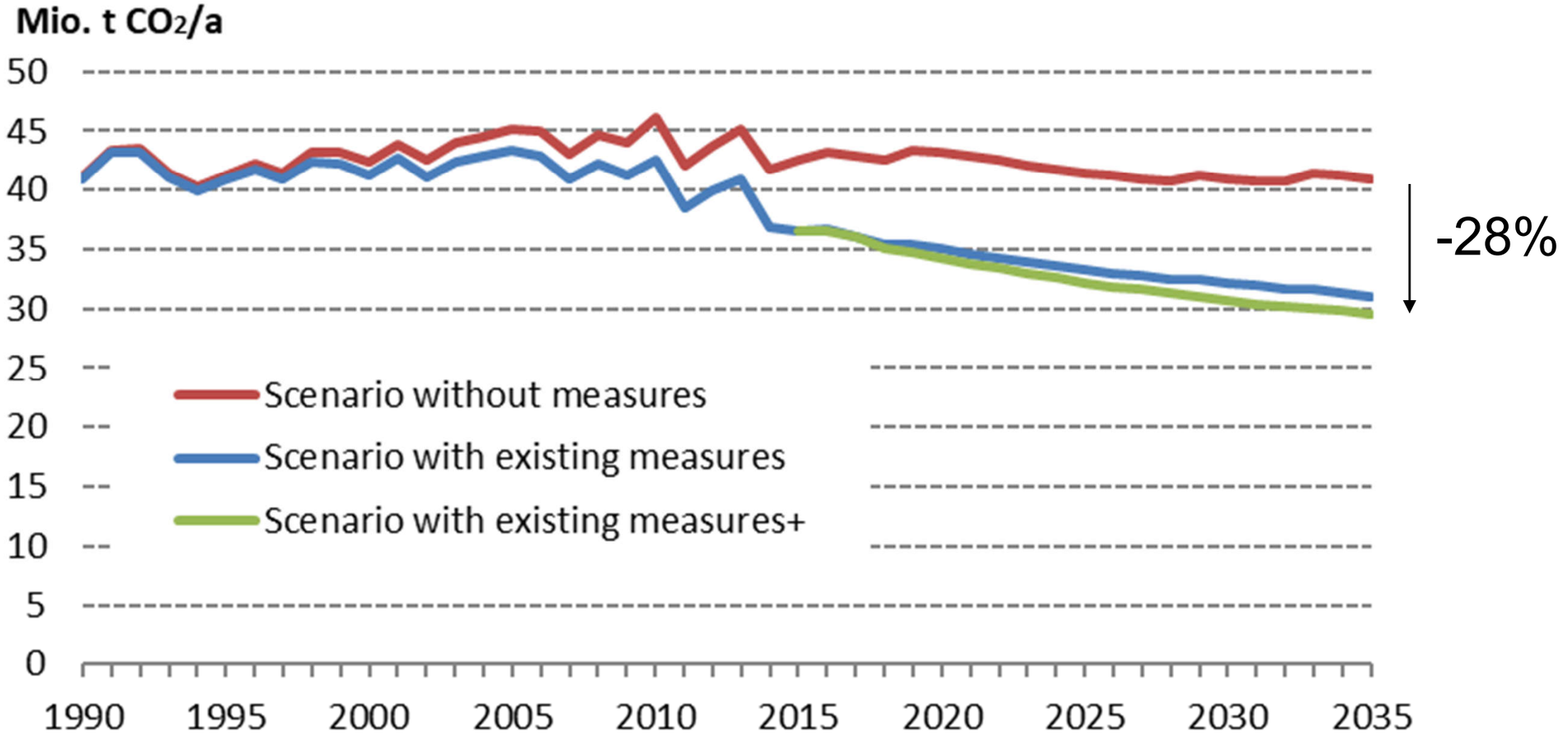
Total reduction of CO_2 emission in scenario with decided measures compared to scenario without measures, by group of measures (1990-2035)



Vielle, Marc, and Philippe Thalmann, "Updated emissions scenarios without measures, 1990-2035", Report for Federal Office for the Environment, Lausanne, 12 October 2017

How much is attributable to policy?

Energy-related CO_2 emissions in a scenario without measures and two scenarios with existing and announced measures (1990-2035)



Vielle, Marc, and Philippe Thalmann, "Updated emissions scenarios without measures, 1990-2035", Report for Federal Office for the Environment, Lausanne, 12 October 2017

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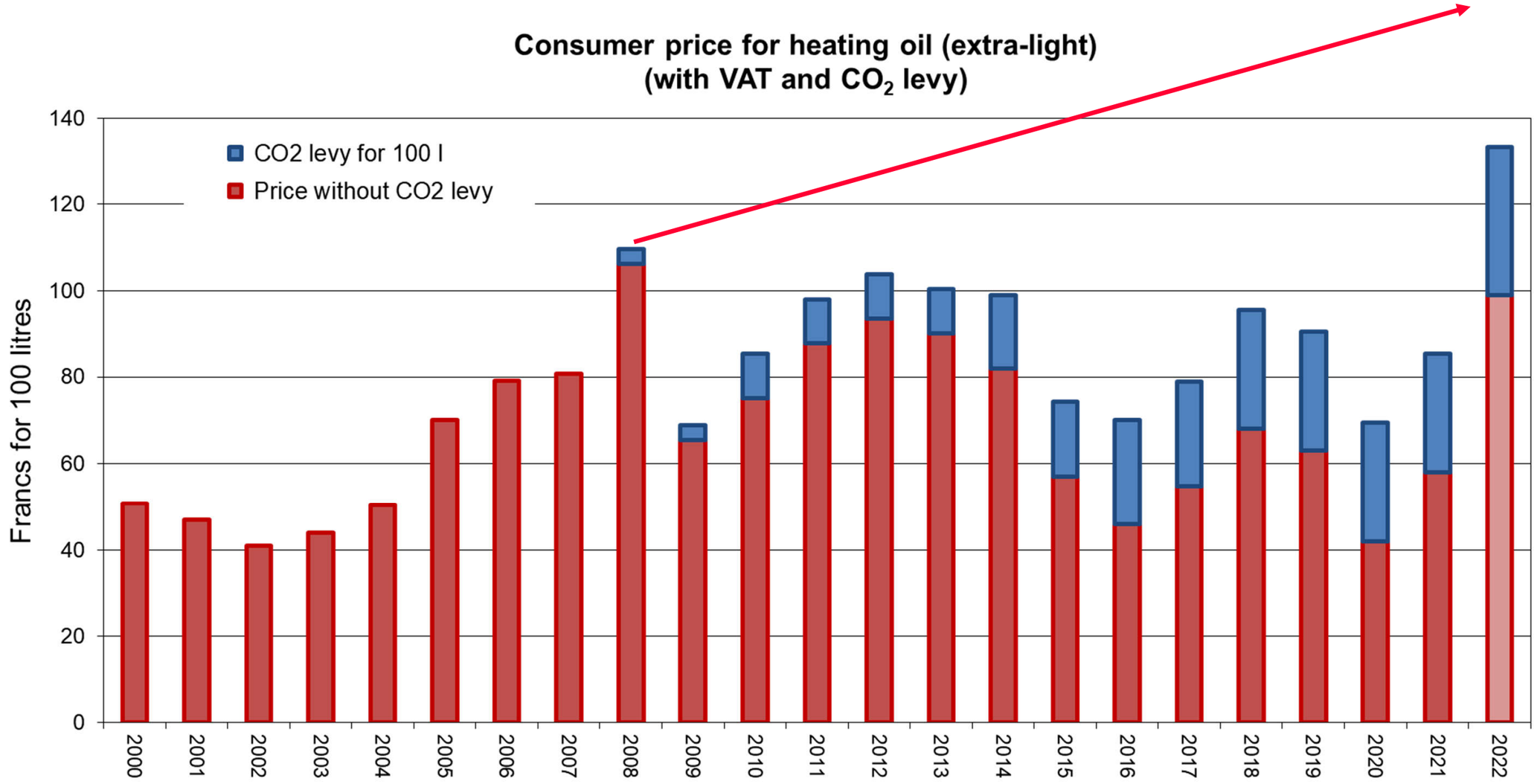
New instruments

MAKING SURE THAT FOSSIL ENERGY PRICES RISE

Heating oil price with CO_2 levy



Source of data: Swiss Federal Office of Statistics, CPI data, and own calculations; 2022: January-July

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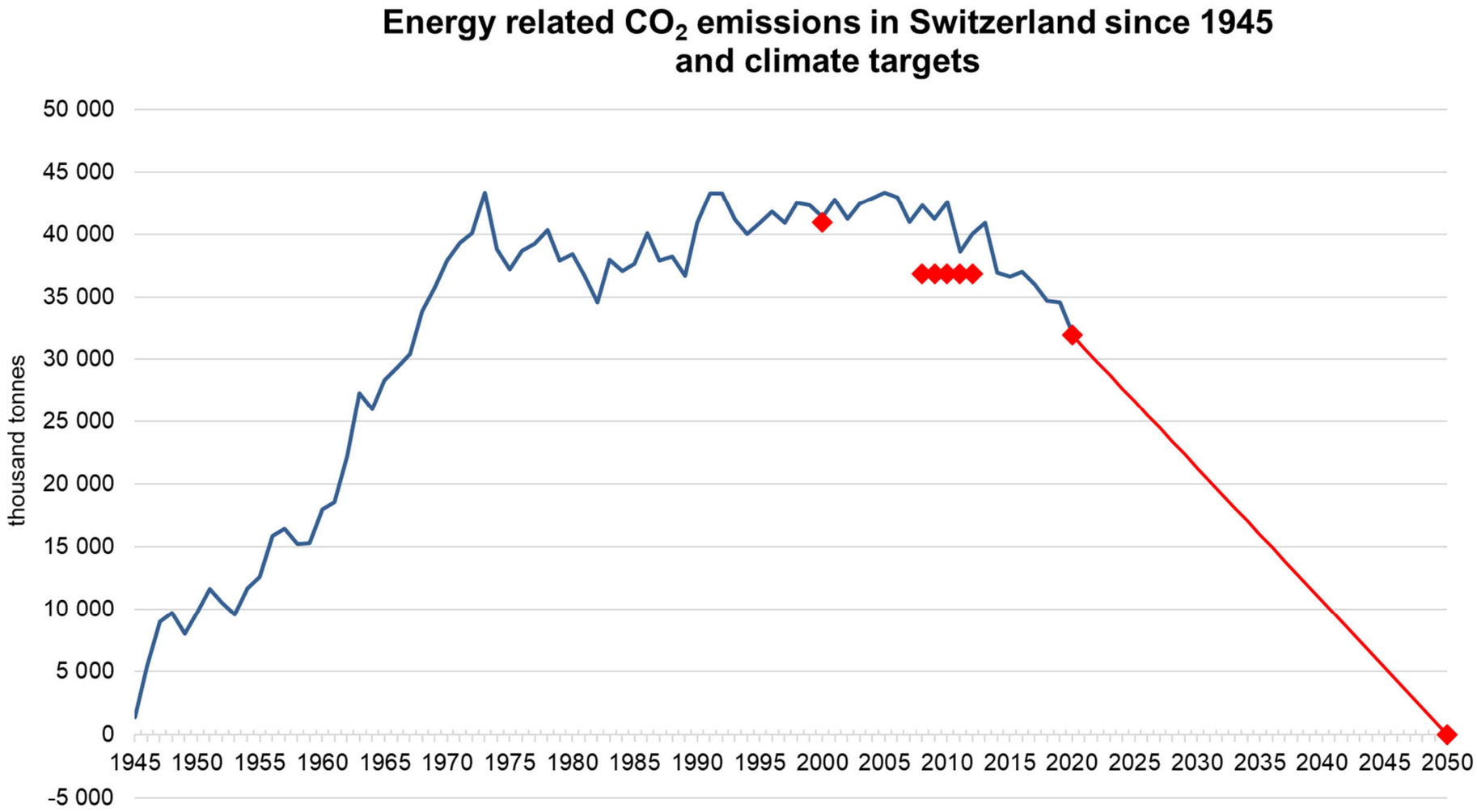
Instruments

FOSSIL ENERGY IMPORT CAP

National carbon budgets



Paris Agreement, Federal Council's long-term climate strategy, Glacier initiative: Fossil fuel use must be virtually eliminated by 2050

Translate emission limits into yearly import caps (e.g. 26.6 MtCO2 in 2025)

Fossil energy import quotas are sold by auction

Data source: FOEN, Greenhouse gas inventory, April 2022

Implementation of import cap

- European Commission proposal 'Fit for 55' (July 2021): include motor and heating fuels into a new emissions trading system
- In EU proposal, 'tax warehouses' – the wholesalers who already pay the various taxes on petroleum products – must buy permits corresponding to the emissions from their energy sales, starting in 2026
- Existing policy instruments that make fossil energy more expensive can be rescinded (e.g. CO_2 levy and 'climate cent')
- Policy instruments that facilitate decarbonisation should be kept
- In January 2022, the Environment & Energy commission of the Council of states requested from the government a report on a system of import quotas for fossil energy (initiative Adèle Thorens Goumaz)

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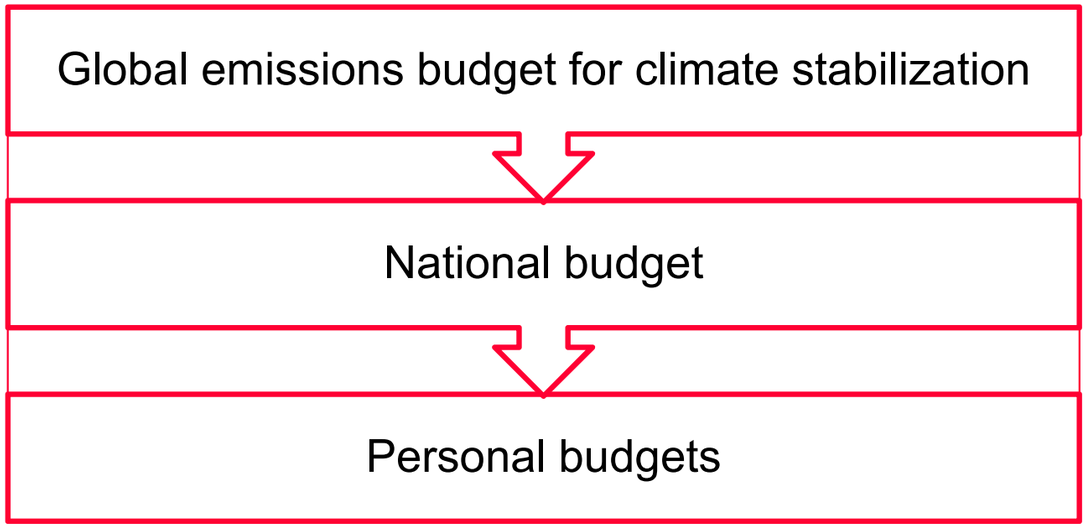
New instruments

PERSONAL CARBON BUDGETS

An OcCC* proposal



OcCC

Organe consultatif sur les changements climatiques
Beratendes Organ für Fragen der Klimaänderung

20.7.17

OcCC-Empfehlungen – „Persönliche CO_2-Budgets“

* OcCC: Advisory body on climate changes for the Federal department for the environment, transports, energy and communications (1996-2021)

Illustration

- Remaining world carbon budget from beginning of 2020 for +1.7° with 67% probability: 700 $GtCO_2$ (IPCC AR6 WG I, Table SPM.2)
- World population in 2020 = 7.76 G
- Per capita budget = 700 / 7.76 = 90 tCO_2
- Swiss CO_2 emissions per capita in 2020 = 4 tCO_2 domestic (GHG Inventory, April 2022), 13 tCO_2 consumption based (Global Carbon Project)
- Per capita budget left beginning 2024 = 90 – 4×13 = 38 tCO_2
- Linearly decreasing per capita budgets:

2024	2025	2026	2027	2028	2029	2030
11.1	9.3	7.4	5.6	3.7	1.9	0

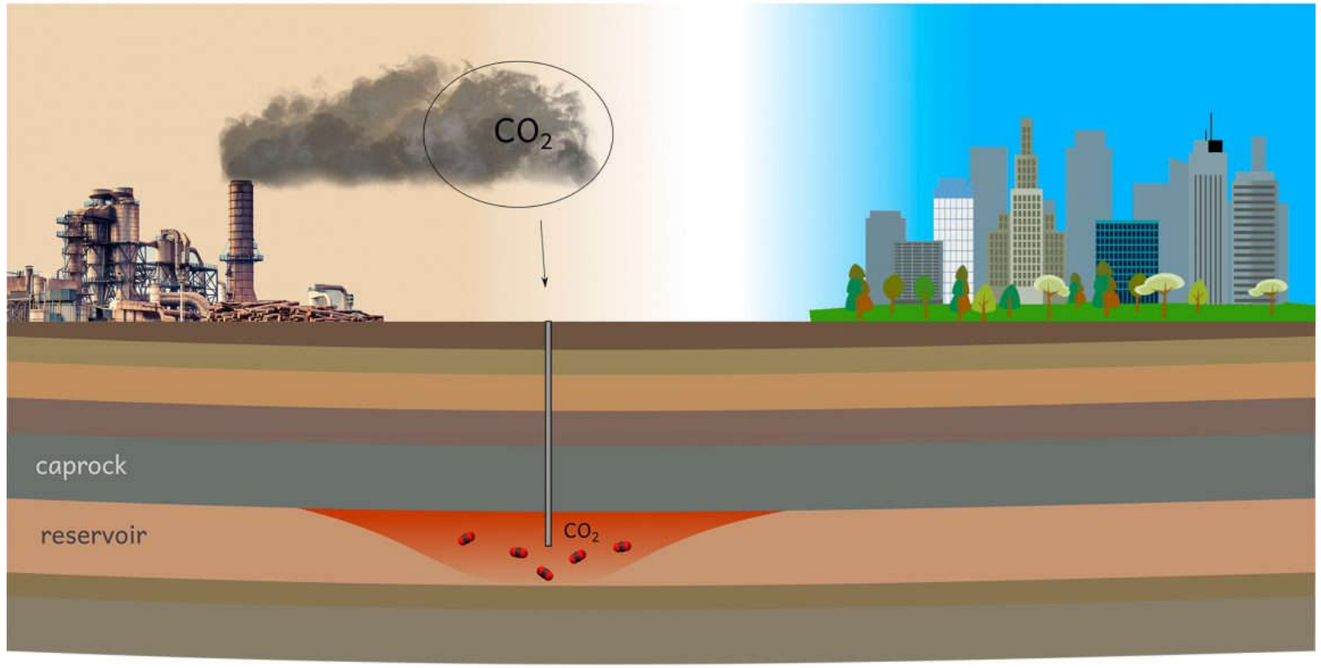
The tons add up…

From 13 tCO_2 to 0 in 7 years, –1.9 tCO_2 every year…

Consumption	Emissions (tCO_2)	Comment
Heating a 140 m^2 house with oil for one year	5.7	divide by number of inhabitants
Heating a 90 m^2 flat with oil for one year	3.1	divide by number of inhabitants
Travelling 10,700 km with a medium-sized car consuming 8 litres/100 km	2.0	divide by number of passengers
A flight from Switzerland to a European destination and back in Economy	0.3	
A flight from Switzerland to a destination on another continent in Economy	1.6	
Same flight in Business	5.0	
A ten-day cruise	3.4	
A standard meat diet over a year	2.1	
A vegetarian diet over a year	1.3	

Implementation of personal carbon budgets

- Every resident is credited his/her personal CO_2 budget on Jan. 1st, e.g. on credit card or smartphone
- Goods are given a 'carbon tag' next to the price tag
- Unused credit can be saved or transferred
- Start with 'simple' goods such as fossil energy, electricity, transportation services incl. aviation
- This would encourage suppliers to offer low-carbon goods
- Existing policy instruments that make high-carbon goods expensive can be rescinded in those areas where the carbon budget applies (e.g. CO_2 levy and 'climate cent')
- Policy instruments that facilitate decarbonisation should be kept



https://www.epfl.ch/labs/lms/co2-storage/

New instruments

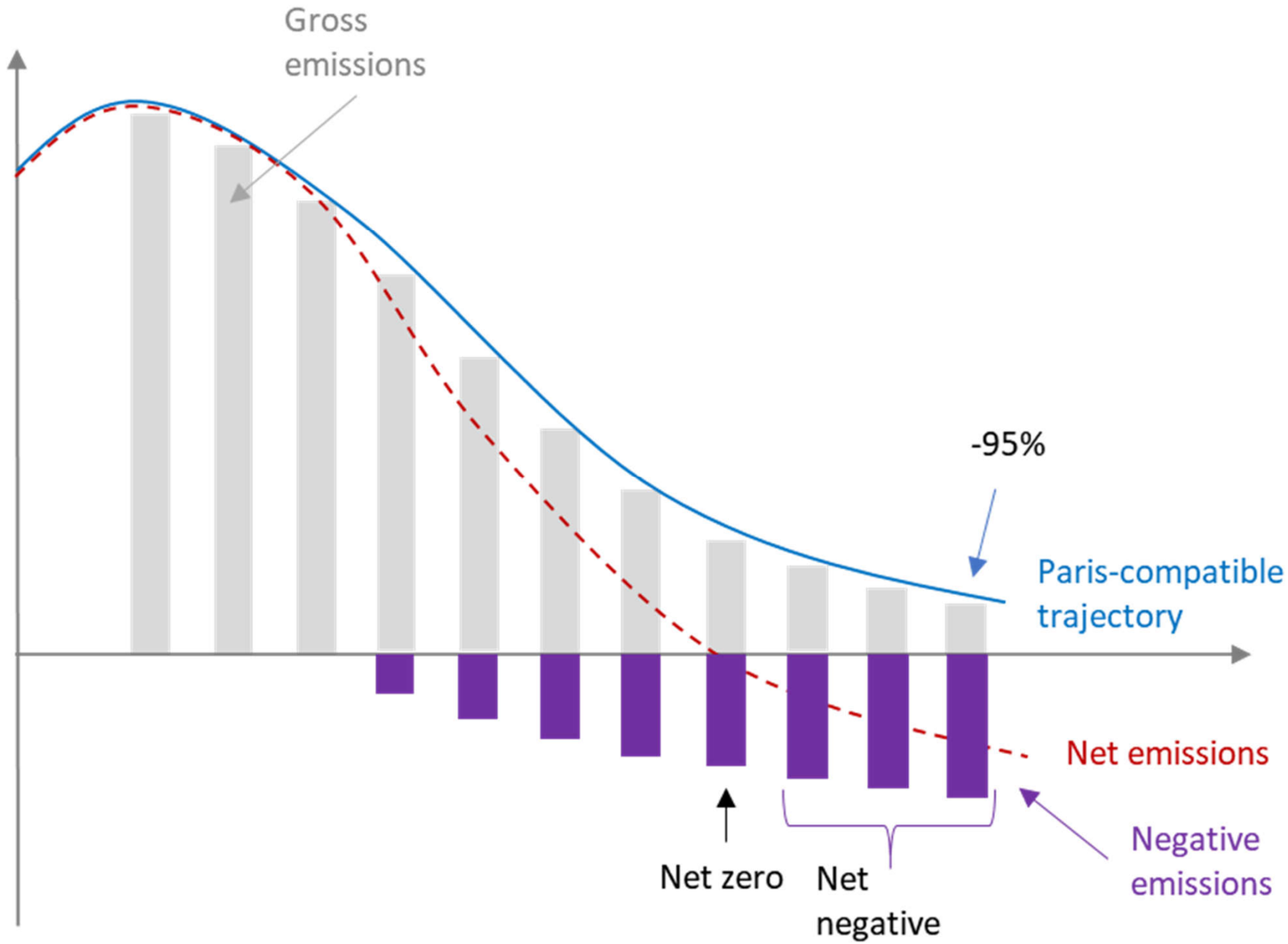
NEGATIVE EMISSIONS

Compensation and funding of negative emissions

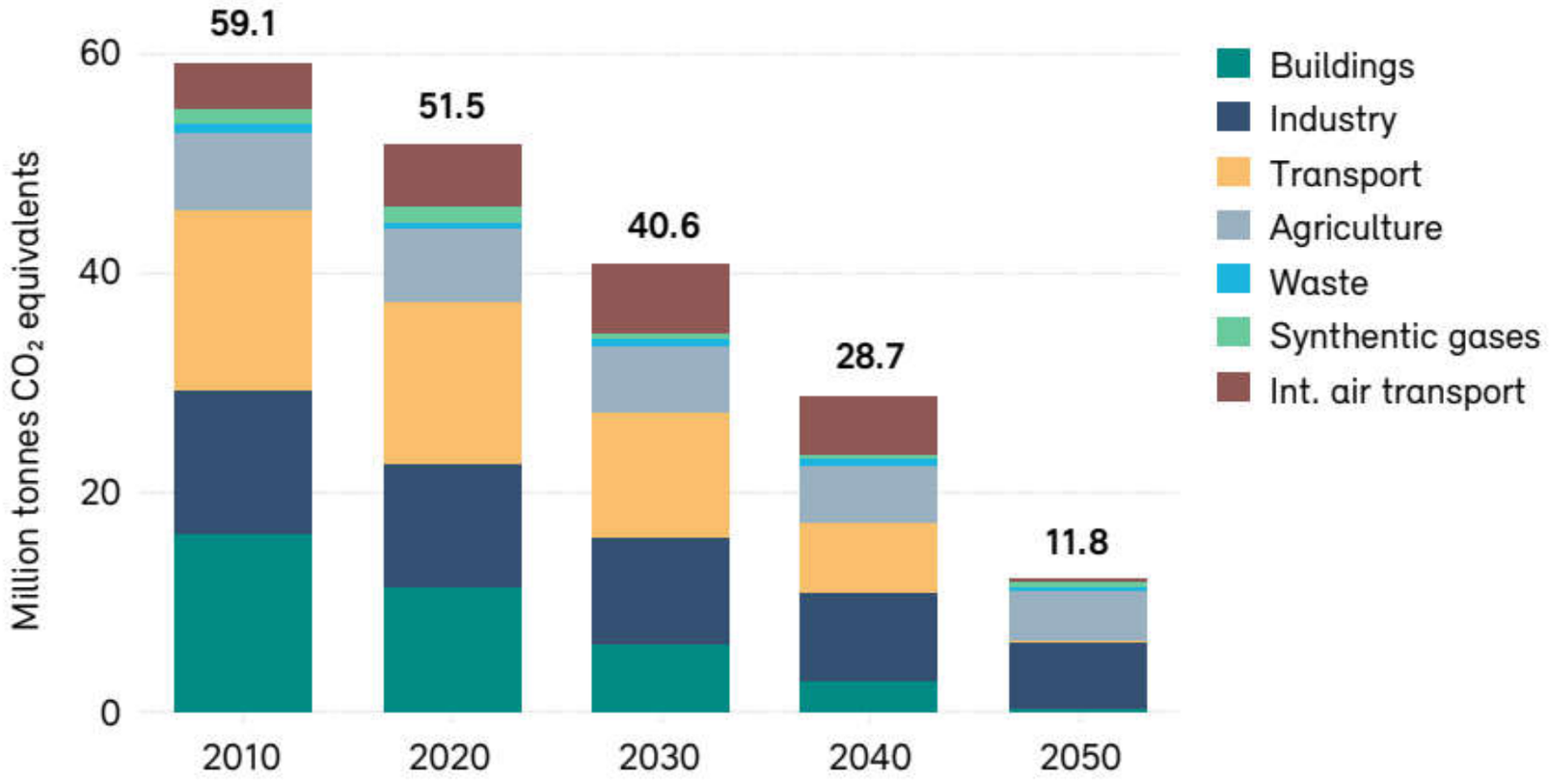
- We will not be able to eliminate all greenhouse gas emissions, but we must stop increasing their concentration
- Excess GHGs already emitted will have to be removed
- Who will pay for the removal of GHGs?
- Proposal: polluter pays
- Problem: time lag
- Proposal: 'Swiss negative emissions fund' *

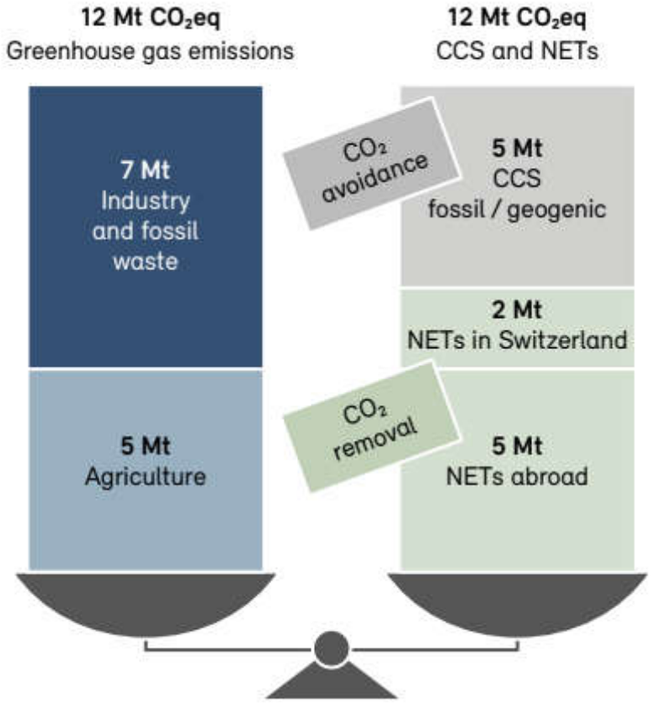
* https://go.epfl.ch/SNEF

The role of negative emissions



Negative emissions in Swiss long-term climate strategy

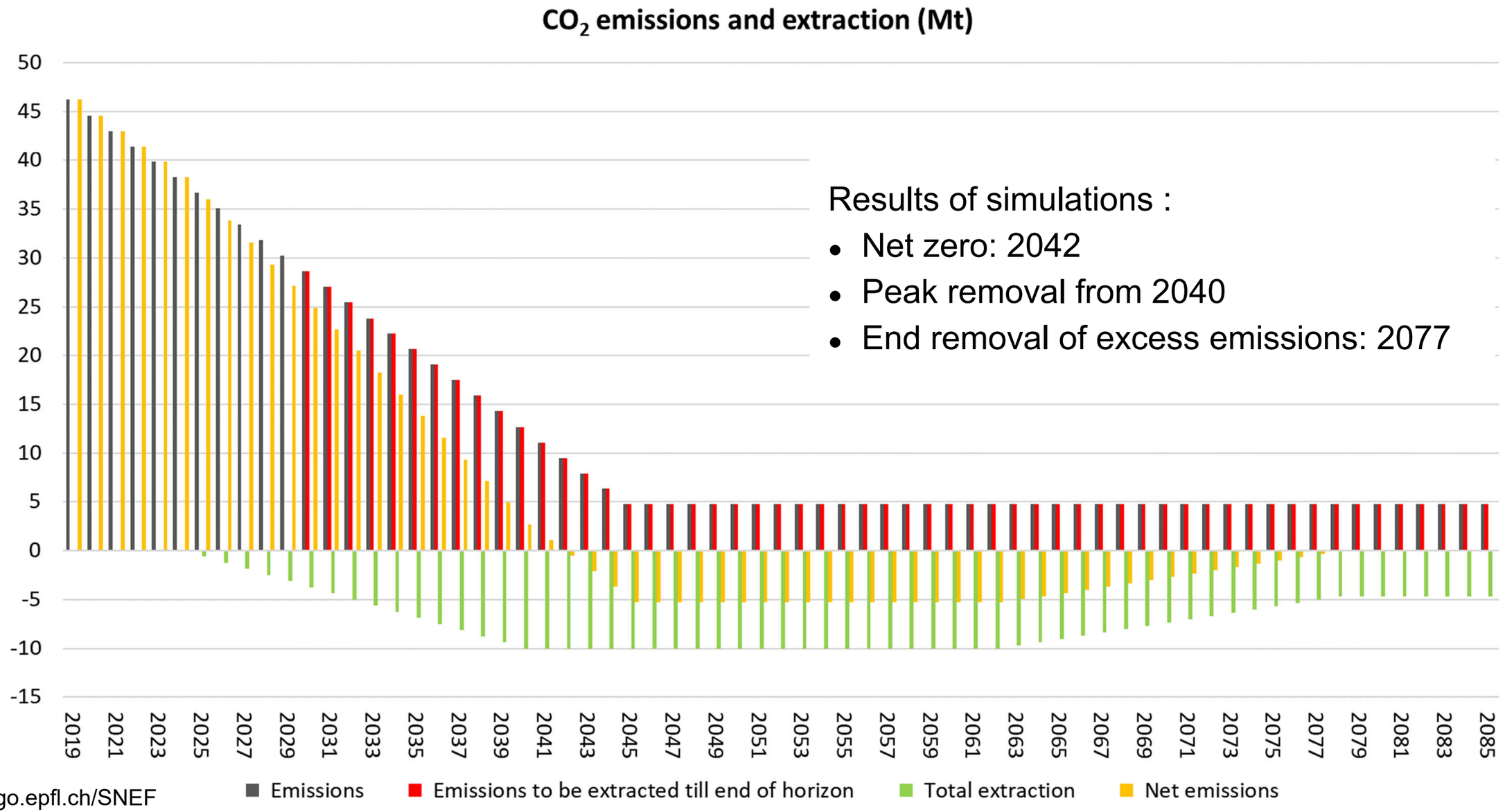




From 59.1 Mt to 11.8 − 5 Mt: −90%

FOEN, Long-term climate strategy, Factsheet, 2021

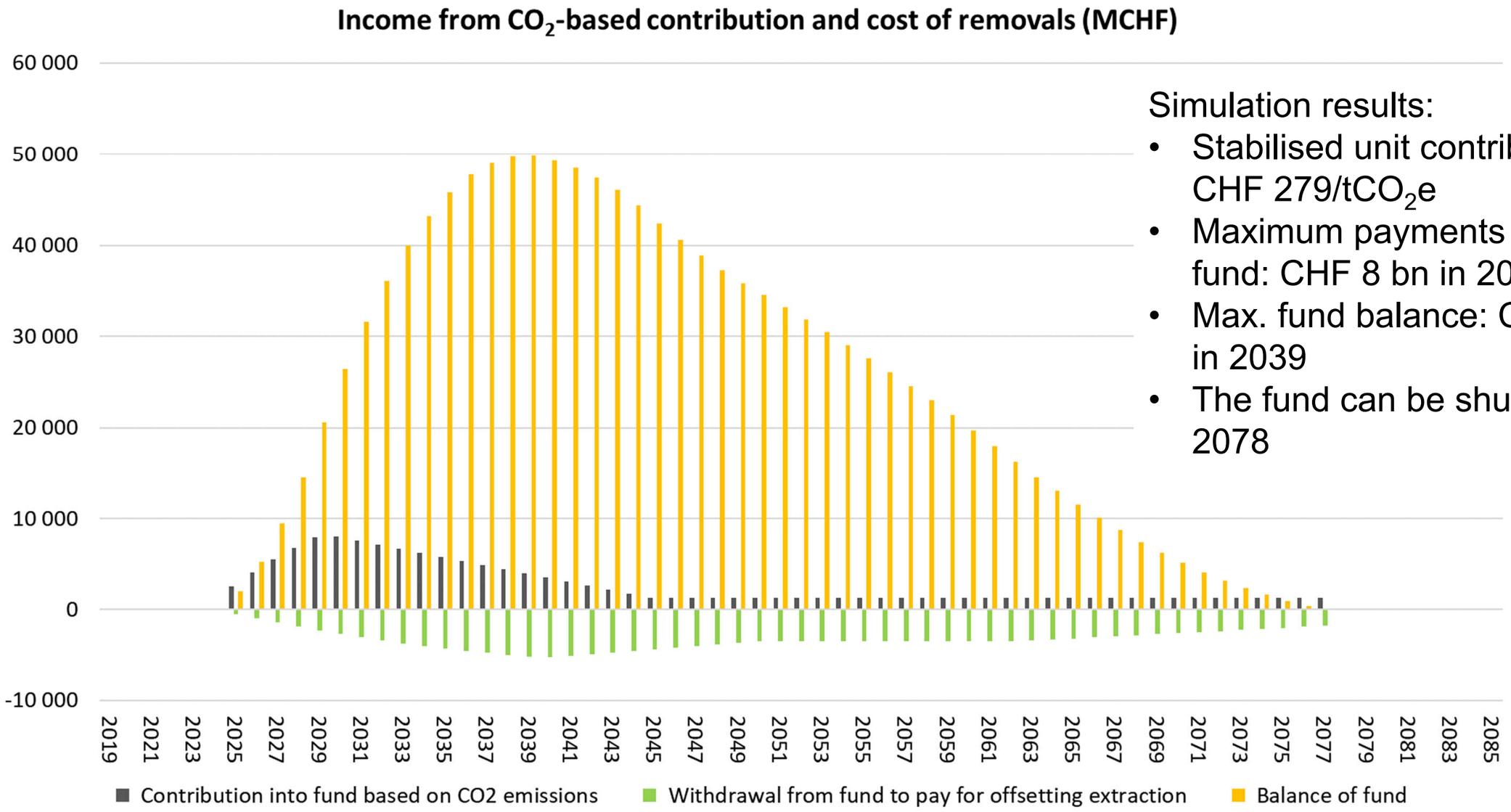
GHG emissions and removal



Results of simulations :

- Net zero: 2042
- Peak removal from 2040
- End removal of excess emissions: 2077

Evolution of fund balance



Simulation results:

- Stabilised unit contribution: CHF 279/tCO_2e
- Maximum payments into the fund: CHF 8 bn in 2030
- Max. fund balance: CHF 50 bn in 2039
- The fund can be shut down in 2078

https://go.epfl.ch/SNEF

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Implementation

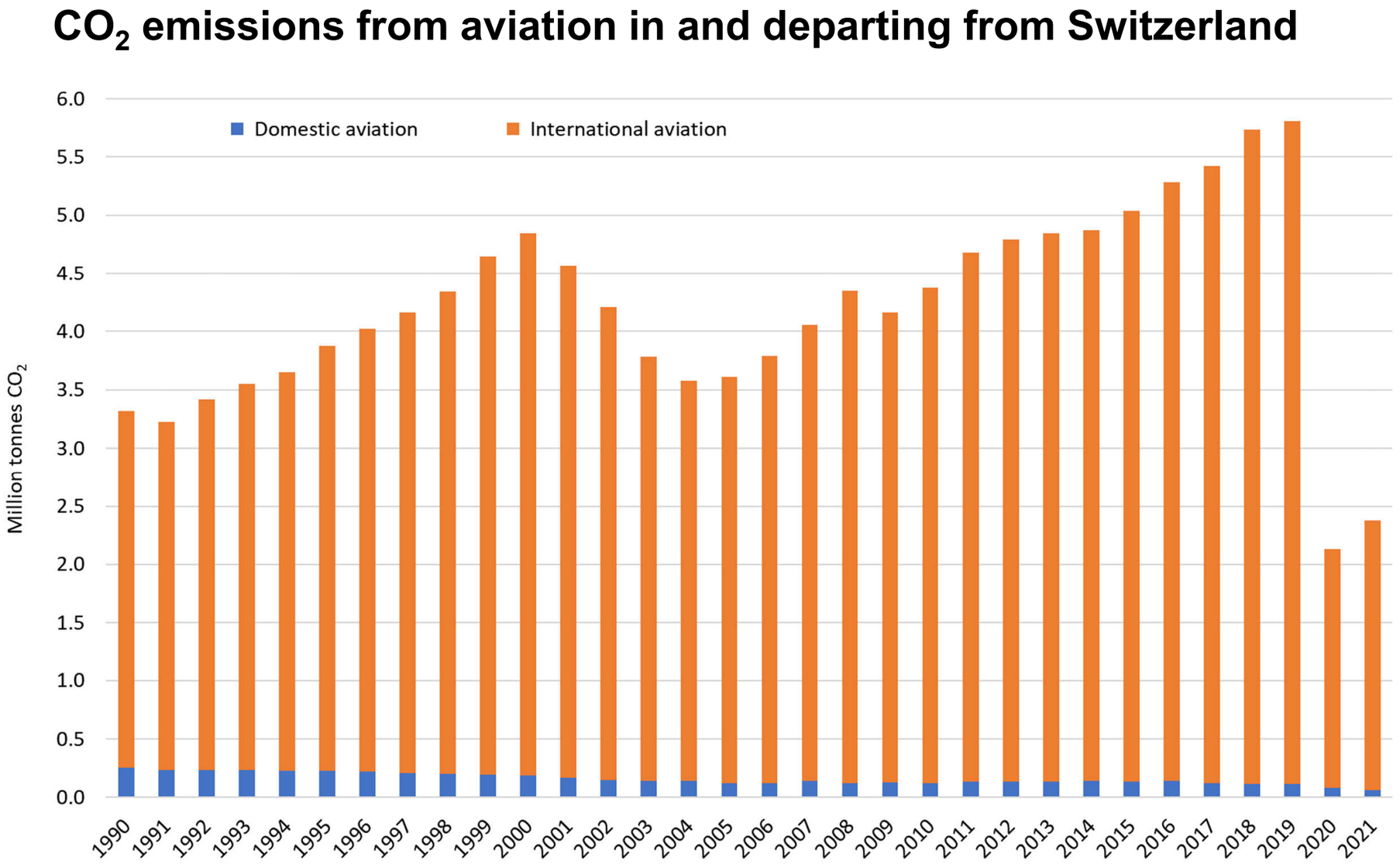
- Start with pilot fund, created as an independent foundation by voluntary organisations (EPFL, UNI Lausanne, Holcim…)
- Contributing to the fund can make them 'really' climate neutral
- They can participate in the pilot negative-emissions projects
- We are trying to propose this also as a solution for the aviation sector

https://www.swiss.com/ch/EN/fly/fleet/boeing

New instruments

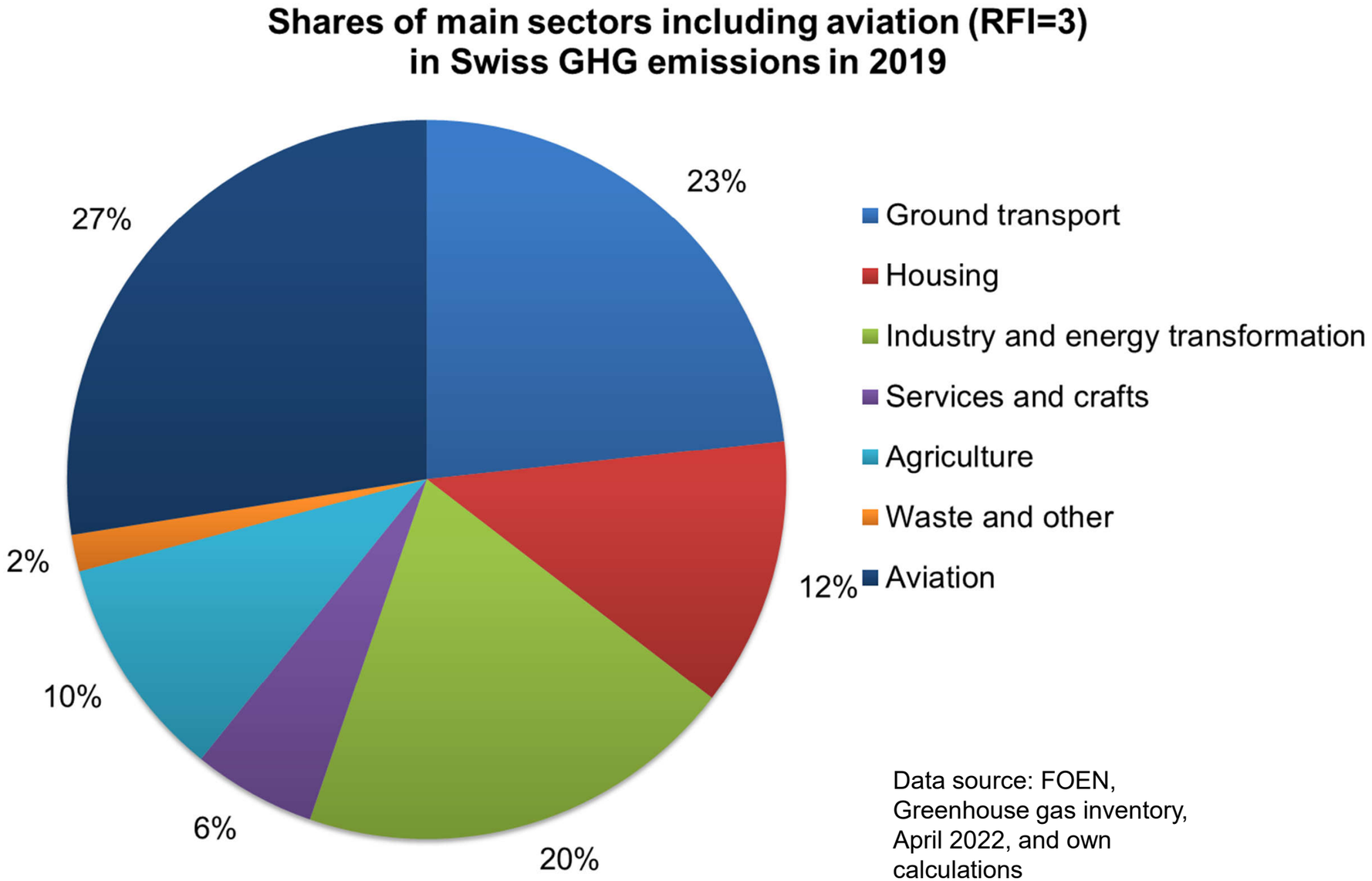
AVIATION

Aviation – CO_2 emissions



Data sources: FOEN, Greenhouse gas inventory, April 2022, and FSO, Civil aviation statistics, sept. 2022

Aviation – share in total Swiss emissions



Data source: FOEN, Greenhouse gas inventory, April 2022, and own calculations

Aviation – proposed measures

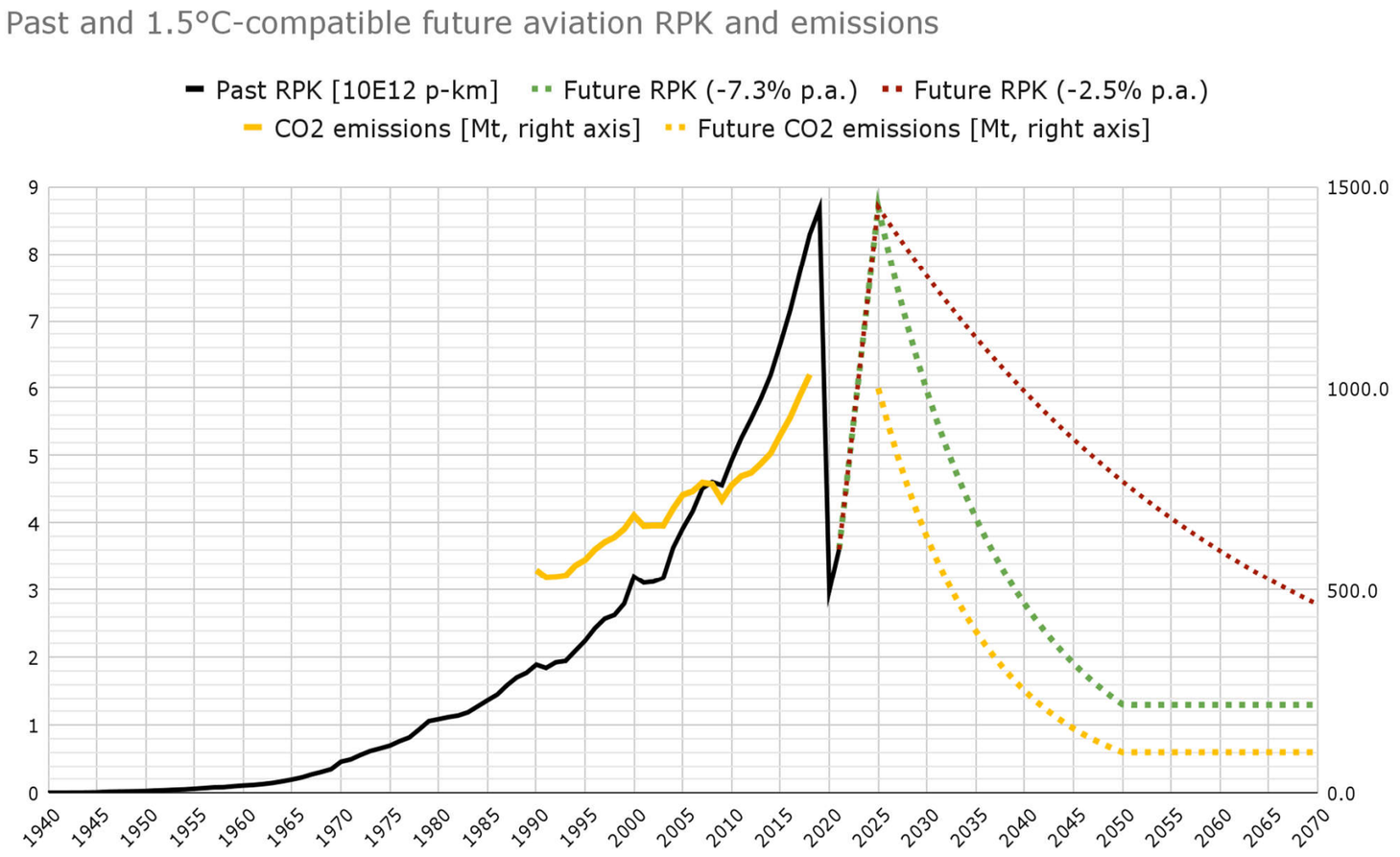
1. Tax on air tickets linked to CO_2 emissions*
2. Target agreements with airlines
3. Responsibility of airports for the climate impact of aircraft taking off within their boundaries
4. **Tradable kilometre quota per person**, which is reduced every year (average air travel from Switzerland: 9,000 km per person in 2015)
5. **Negative emissions fund** to pay for (later) clean-up of emissions

* https://e4s.center/document/introducing-an-air-ticket-tax-in-switzerland-estimated-effects-on-demand/

Negative emissions fund for international aviation (NEFA)

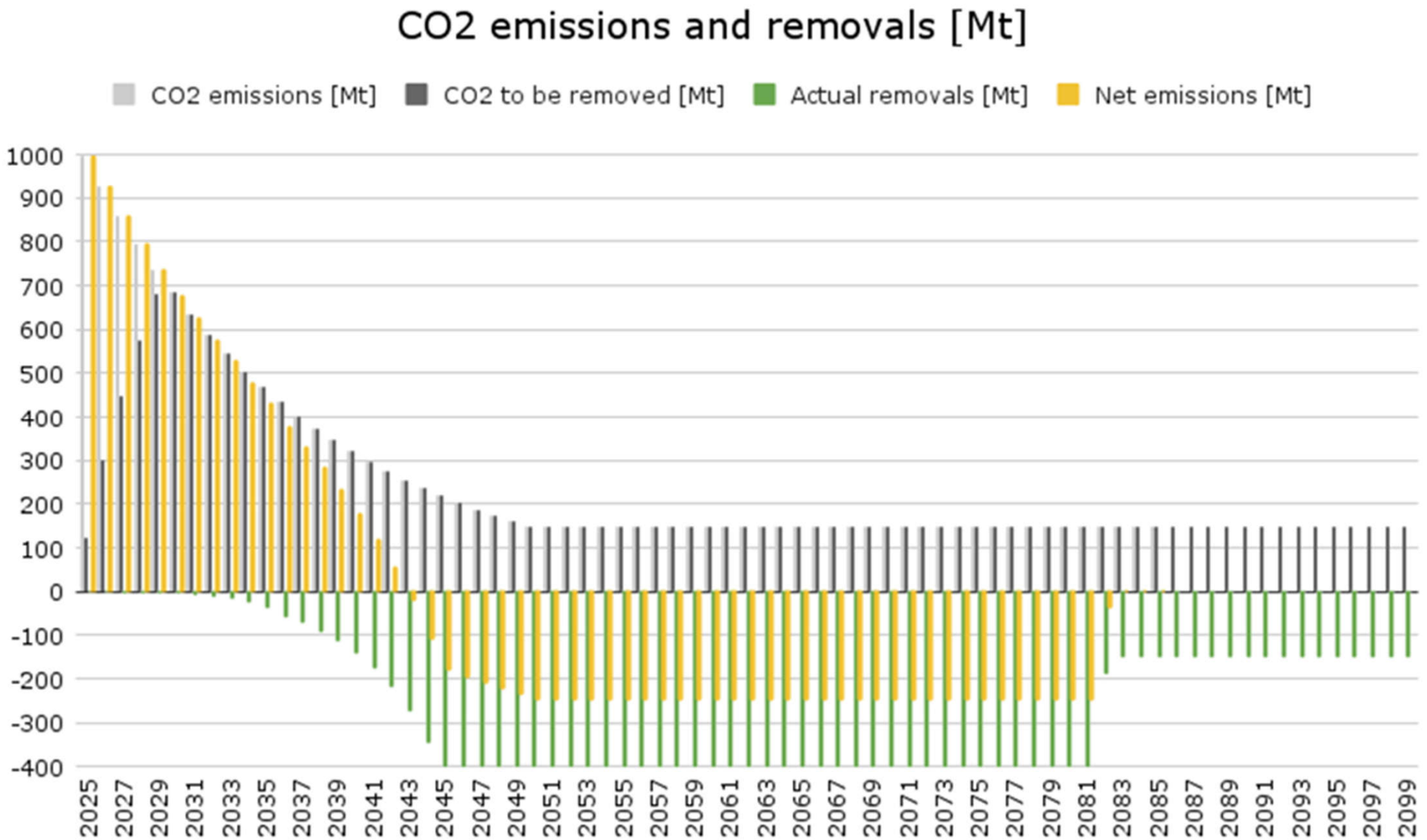
- International Civil Aviation Organization (ICAO) sells annual flying rights by auction to airlines for a total amount shrinking along a 1.5°C-compatible pathway
- Airlines pay a contribution to NEFA in proportion of their CO_2 emissions after each flight
- The proceeds of the auction and the NEFA contribution are made available to participating countries for negative emissions projects, selected and governed by NEFA
- This creates an incentive for countries to join; closing airports to non-participating countries would strengthen the incentive

1.5°C-compatible pathways



Past revenue passenger-km (Ritchie, Roser, and Rosado 2020; Airlines for America 2022) (black) and CO_2 (Lee et al. 2021) (yellow) of aviation, and two 1.5°C compatible future pathways: -7.3% p.a. (RPK green, CO_2 yellow dotted line) with aviation using its “fair” share of limited CO_2 removal capacity, and -2.5% p.a. (brown) requiring a much higher (unfair) share of resources

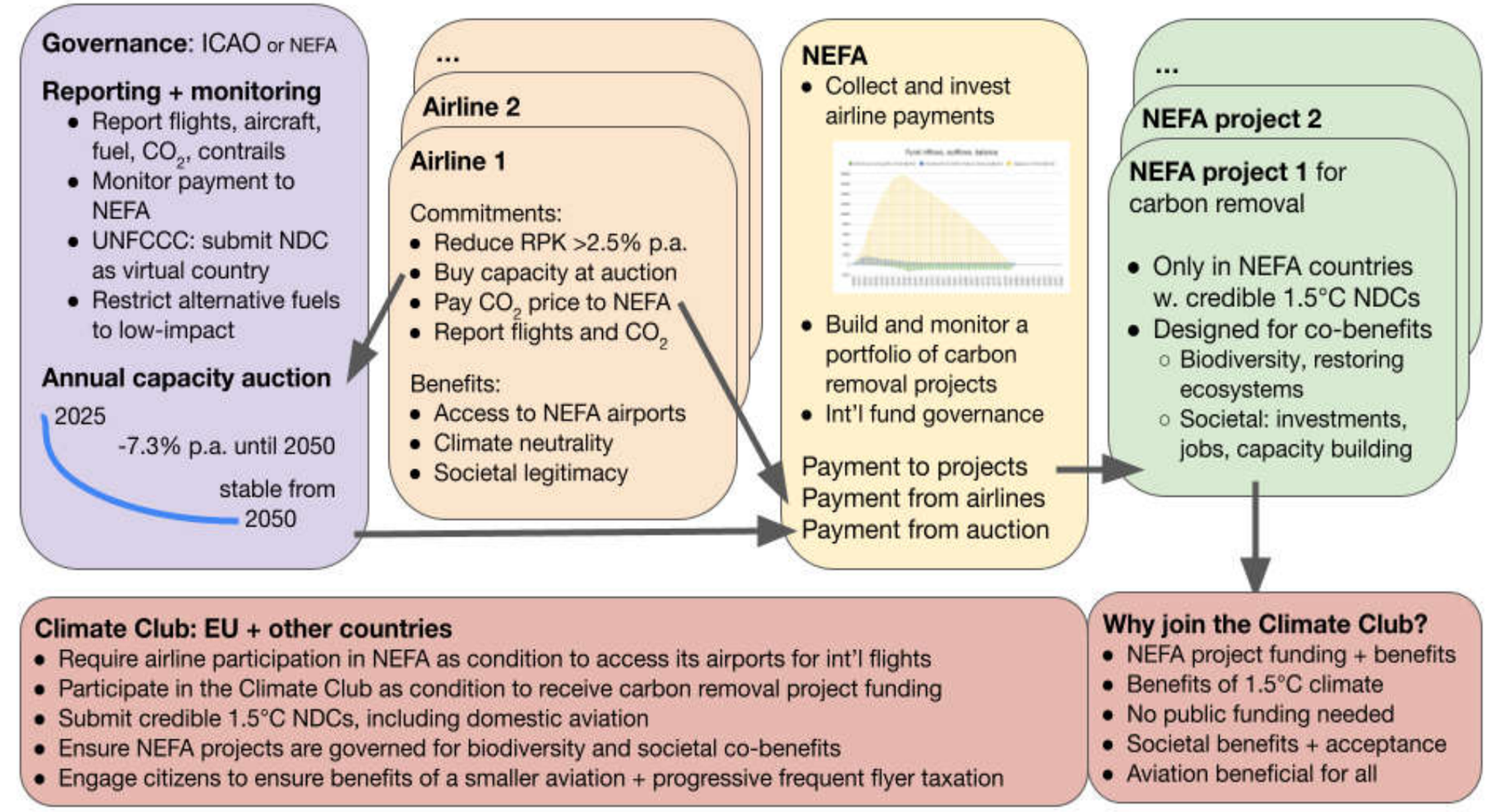
Emissions and removals



Simulated CO_2 flows showing global aviation reaching net zero in 2043 on an annual basis, and all aviation CO_2 from 2030 removed by 2083

Possible governance

Structure of the proposed Negative Emissions Fund for Airlines (NEFA)



CHANGING NORMS

Today we can hardly believe that this was ever the norm…

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How long will we consider this to be normal?

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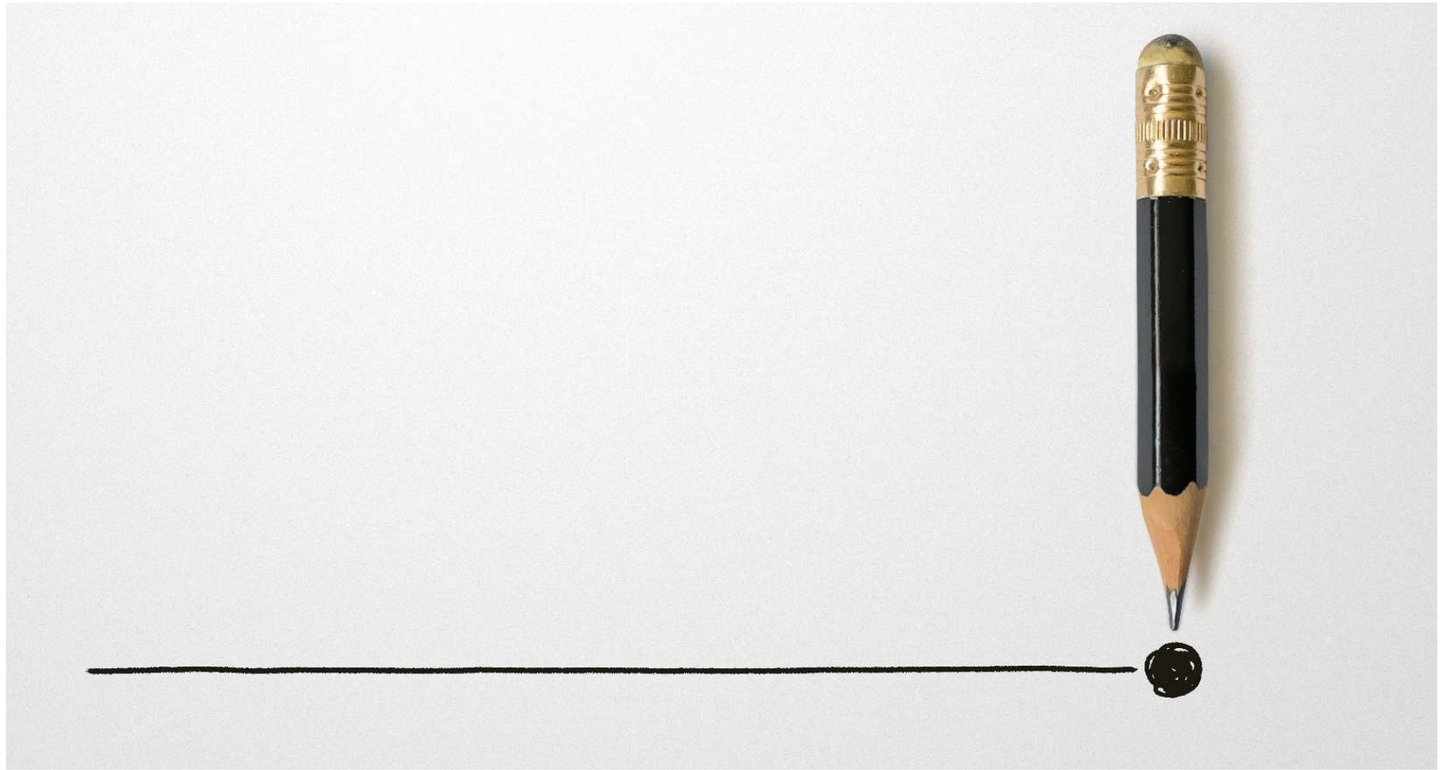

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CONCLUSION

More research is needed…

- These proposals are challenging, some **utopian**, but so was emissions trading, first simulated in the late 1960s and introduced in the USA in 1995 (SO_2 and NO_x under Acid Rain Program)
- A lot become possible when **emergency** is acknowledged
- Much research is needed to **configure** these instruments: practical, legal and political feasibility
- Much research is needed to **assess** these instruments: effectiveness, cost-efficiency, equity
- Some instruments can be started as **pilots**
- We need also to think about instruments that can be **dropped**: instrument replacement is better than addition

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