SCCER CREST
Swiss Competence Centers for Energy Research
Competence Center for Research in Energy, Society and Transition

UNIVERSITÉ DE GENÈVE
INSTITUT DES SCIENCES DE L'ENVIRONNEMENT

In cooperation with the CTI
Energy funding programme
Swiss Competence Centers for Energy Research
Schweizerische Eidgenossenschaft
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Swiss Confederation
Commission for Technology and Innovation CTI

How carbon tax could contribute to greater CO_2 and electricity savings in Switzerland

Alisa Yushchenko
Martin Patel



Context

- Carbon tax in the focus of policy and research
- Tax revenue used differently in practice









Switzerland

- **70%** of carbon tax **revenue** redistributed **to consumers**
- **Max. 30%** of carbon tax revenue used **for energy programs**
- In **2008-2016:**



3'335 millions CHF

1'584 millions CHF

Le Programme Bâtiments

100 millions CHF

Fonds de technologie

GARANTIES POUR UNE PROTECTION

6'162 millions CHF



2'968 millions CHF

CSS

Versicherung
Assurance
Assicurazione



2'827 millions CHF

1'388 millions CHF



Development of carbon tax policy and its results

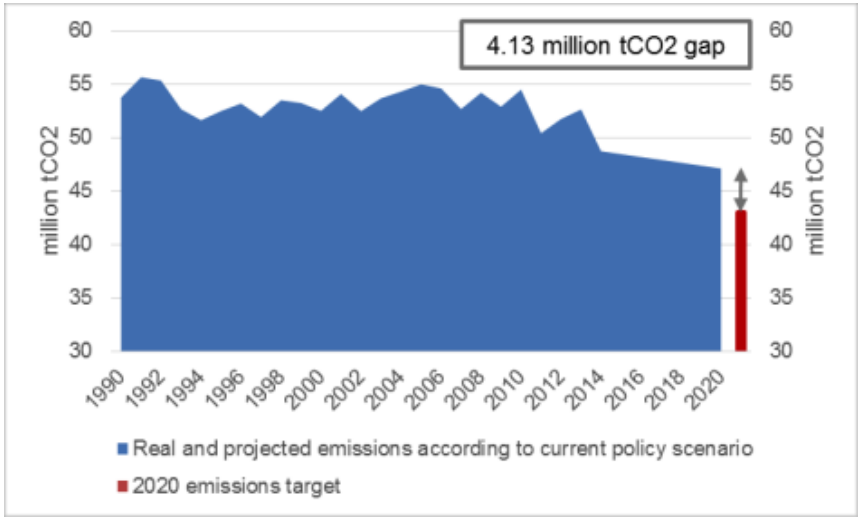
- **Carbon tax rate** continues to **increase**

  From 12 CHF / tCO_2 in 2008 to 84 CHF / tCO_2 in 2016, to 120-240 CHF / tCO_2 in 2018-2030

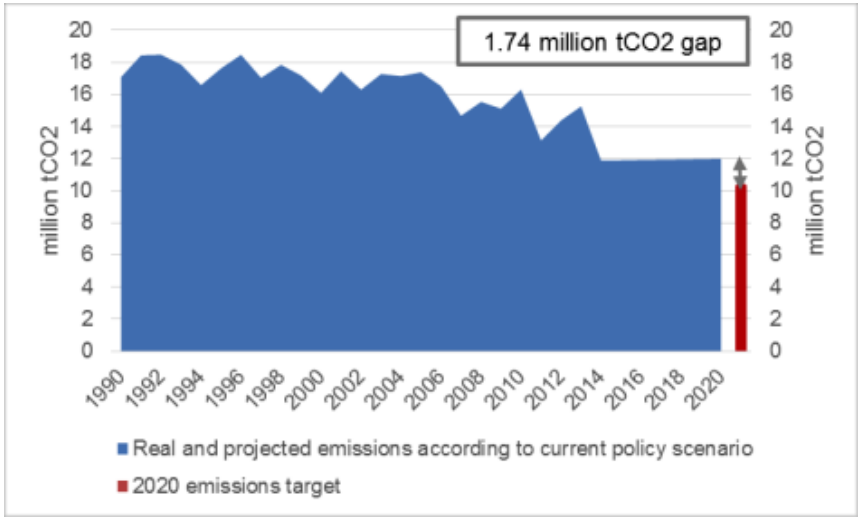
- **Future** of **energy programs** under **discussion**

  Financing from 0 % or 30 % max. of carbon tax revenue

- **Attainability** of carbon emissions reduction **targets** is still **in question**



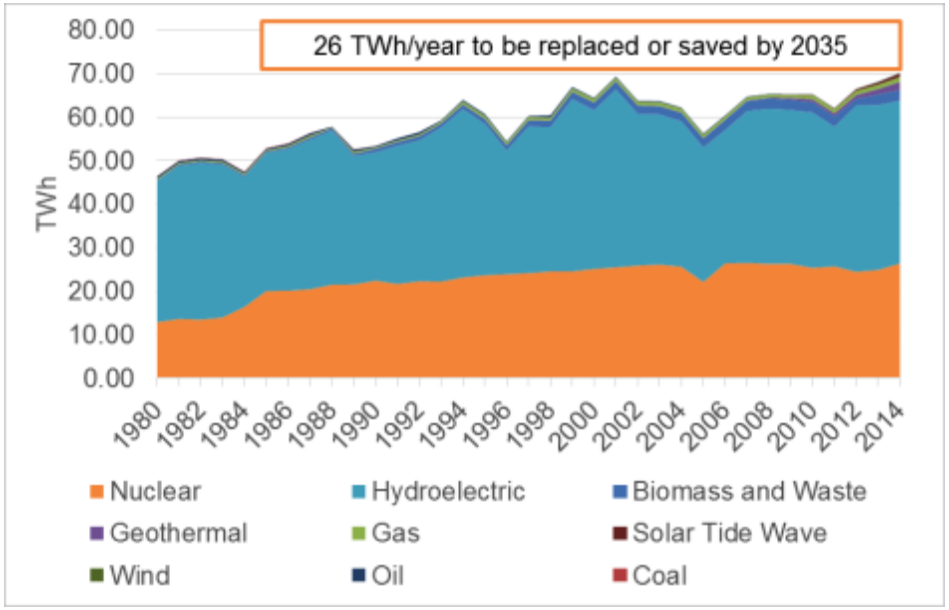
Total CO_2 emissions according to current policy scenario and CO_2 emissions target 2020 (all sectors) *(DETEC, 2016; Federal Council, 2011, 2012; FOEN, 2016e)*



Total CO_2 emissions according to current policy scenario and CO_2 emissions target 2020 (buildings) *(DETEC, 2016; Federal Council, 2011, 2012; FOEN, 2016e)*

Other energy policy targets

- Nuclear power generation **phase-out in 2030s**
- **40%** share of nuclear power **in Swiss generation**



Electricity generation in Switzerland by energy source, TWh *(The Shift Project, 2016)*

What if carbon tax revenue redistributed to consumers was used to finance energy programs?



8'449 million CHF

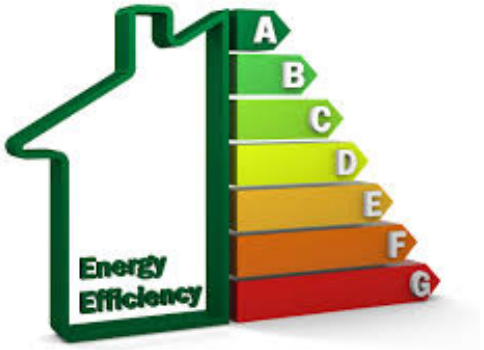


8'223 million CHF

16'672 million CHF

16'397 million CHF

275 million CHF

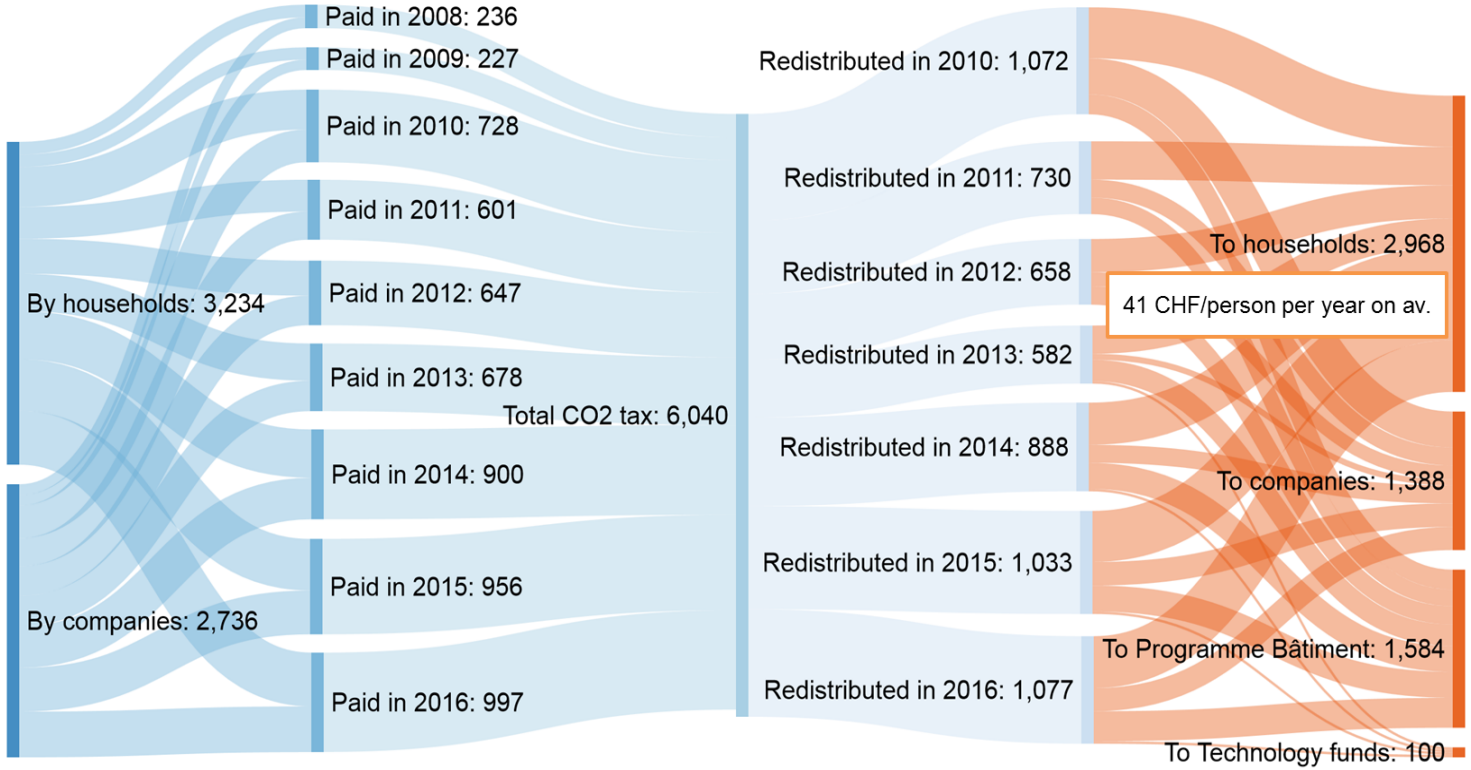




Fonds de technologie
GARANTIES POUR UNE PROTECTION INNOVANTE DU CLIMAT

Carbon tax revenue and use

- Estimate *carbon tax revenue* and *use* in 2008-2016

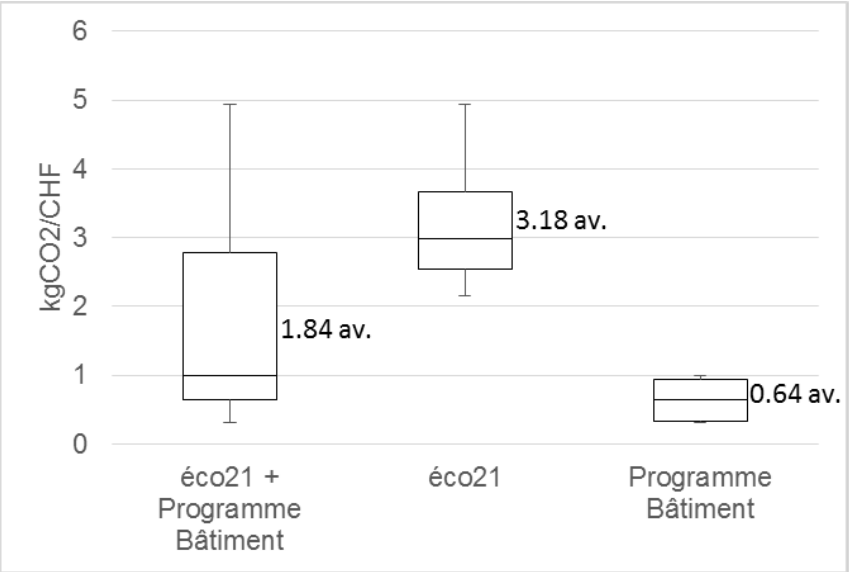


- *Total budget* = *Carbon tax revenue* - Expenditure on the *Technology Fund*
- *Additional program budget* = *Carbon tax revenue* - Expenditure on the *Technology Fund* and on *Programme Bâtiment*

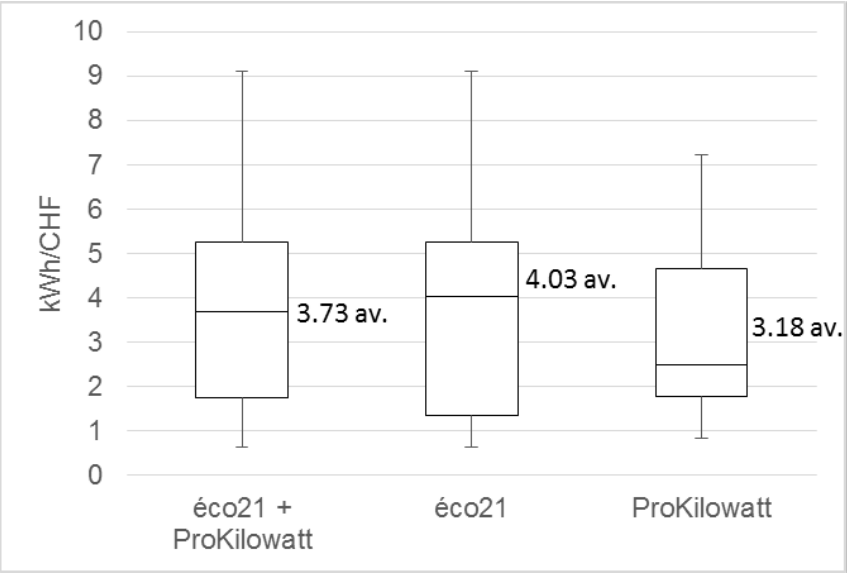
Existing energy programs in Switzerland

Le Programme Bâtiments	ProKilowatt	eco21
Federal program for	Federal program for	Cantonal program (in Geneva) for
CO2 savings through	Electricity savings through	Electricity and CO2 savings through
EE and RE measures in	EE measures in	EE and RE measures in
Buildings	Residential, Non-residential sectors	Residential, Non-residential sectors

CO_2 and electricity savings per unit of financial incentives



First-year CO_2 savings per unit of financial incentives paid by Swiss energy programs



First-year electricity savings per unit of financial incentives paid by Swiss energy programs

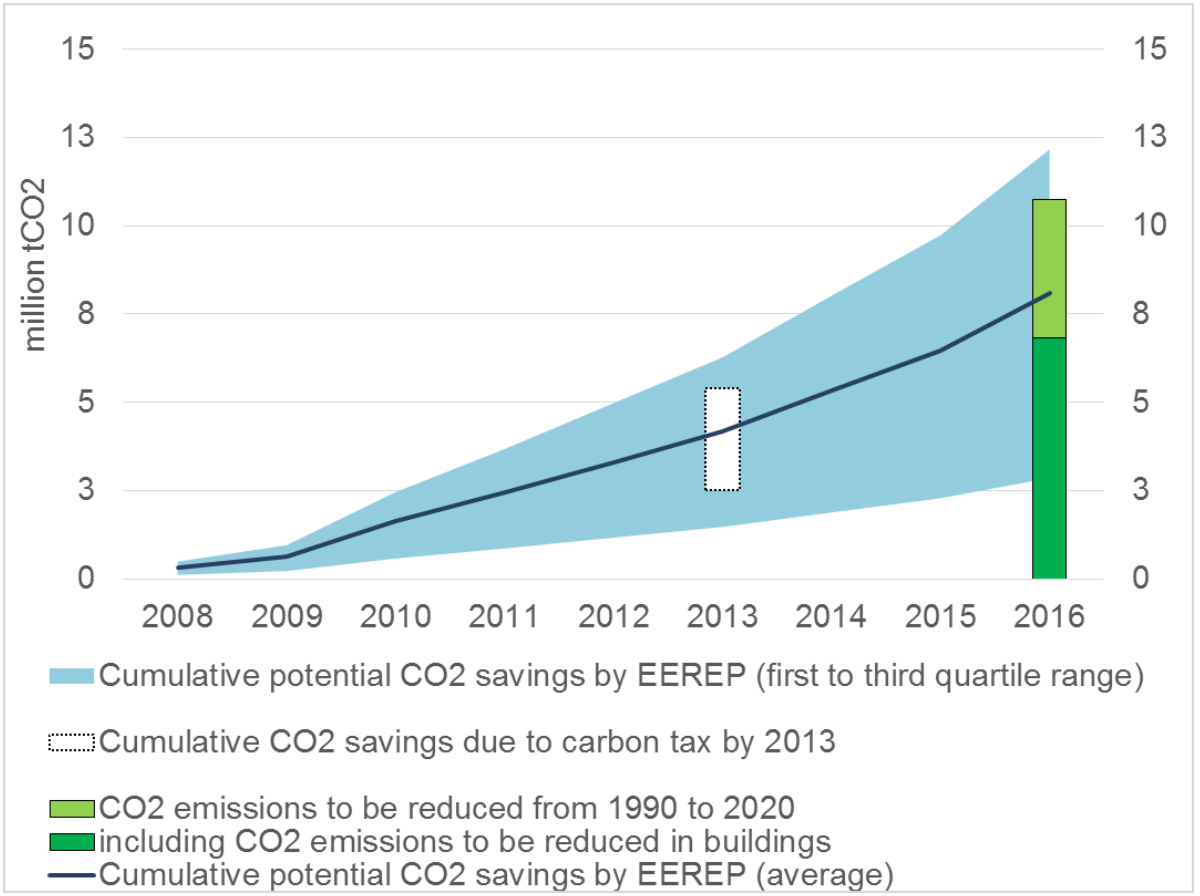
Calculations

- *Potential CO_2 and electricity savings = (Program budget - Program administration costs) * Ratios of first-year CO_2 and electricity savings per unit of financial incentives*

- *Impact on GDP and employment over lifetime of technical measures* -> according to input-output model by Yushchenko and Patel (Appl. En. *179*, 2016)

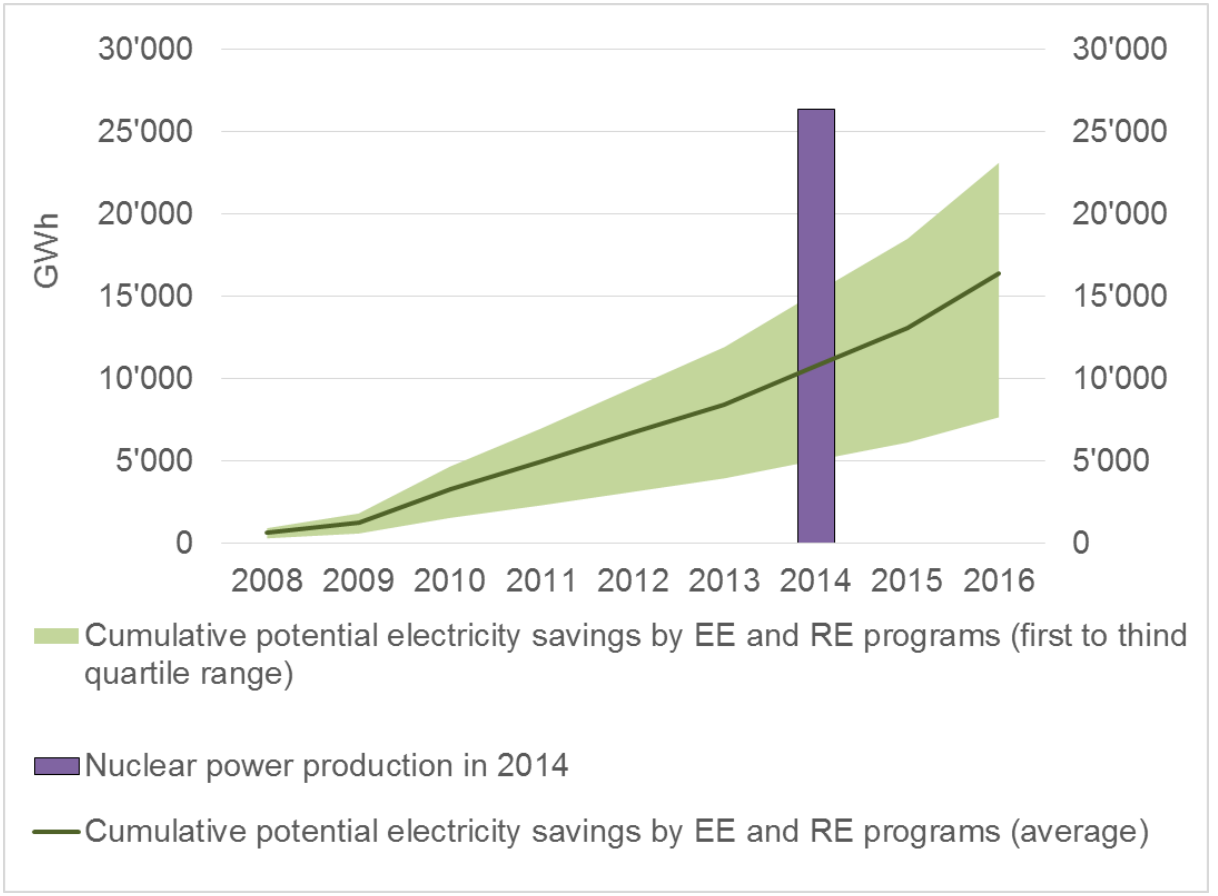
Potential impacts of CO_2-saving programs
(with a use of *total budget*)

- Estimated emissions reduction:
  - 8.1 million t CO_2 saved annually by 2016
  - = 75 % of overall CO_2 emissions reduction target 1990-2020
  - = 118 % of buildings emissions reduction target 1990-2020
- Comparable to the impacts of CO2 tax



Potential impacts of electricity-saving programs
(with a use of *total budget*)

- Estimated consumption reduction:
  - 16.4 TWh saved annually by the year 2016
  - = 25 % of all power generated in Switzerland
  - = 60 % of nuclear power generation



Socio-economic impacts of EEREP
(by providing *additional budget*) [2]

	CO_2 saving programs	Electricity-saving programs
Incremental energy impacts		
Cumulative first-year CO_2 savings, million t CO_2	1.96	0.00*
Cumulative first-year final energy savings, GWh	7'790	11'610
Incremental costs		
Program costs (financial incentives + program administration), million CHF	4'480	4'480
Costs for program participants (costs of EEREM minus financial incentives), million CHF	9'556	11'122
Incremental benefits		
Energy cost savings for participants, million CHF	20'050	22'950
Net GDP, million CHF	7'187	2'047
GDP change	1.43	1.11
Net employment, FTE	61'900	30'600
Employment change	1.61	1.26

[2] In case of CO_2-saving programs we use example of *Programme Bâtiment* (i.e., conservative approach)

Results

- Use of carbon tax revenue to finance energy programs could enforce carbon tax mechanism by providing with:
  - **Additional CO_2 and electricity savings**
  - **Net benefits to energy consumers**, while implying redistribution effects (not everybody will participate in the programs)
  - **Increased GDP and employment**

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Thank you for your attention!

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