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FSO News

02 Territory and environment

Neuchâtel, February 2022

Environmental accounting

Households and climate from the perspective of environmental accounts

Between 2000 and 2019, the greenhouse gas footprint of households declined by 4%. The emissions generated by households in Switzerland fell by 15% while those they caused abroad rose by 8%. In 2019, households paid CHF 3.1 billion[1] in taxes on fossil motor and heating fuel. Around CHF 550 million drawn from the CO_2 taxes were redistributed to them. The households also held more than 83 000 full-time equivalent jobs related to climate and thus contributed to the creation of CHF 13.8 billion in value added, i.e. 1.9% of the gross domestic product (GDP). These are some results from the environmental accounts of the Federal Statistical Office illustrating the relationship between households and climate.

Environmental accounting completes the National Accounts with an environmental dimension. Like the National Accounts, overall it provides – in contrast to usual environmental statistics – data on the households and on the economy, by economic activity. In so doing, it contributes to a better understanding of the interactions between the environment and the economy and to measuring the extent to which the green economy and sustainable development goals have been achieved. Its production is based on the System of Environmental-Economic Accounting (SEEA) developed under the aegis of the United Nations[2].

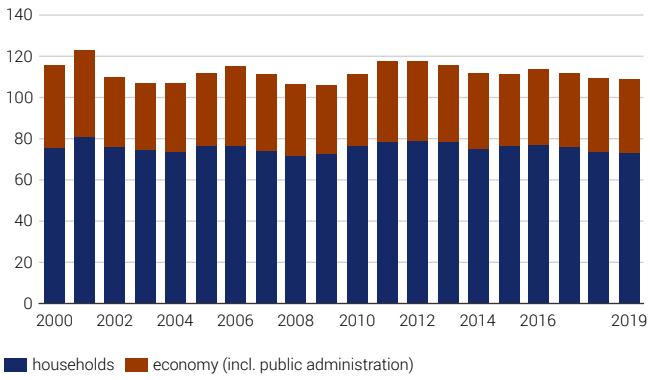
In particular, the environmental accounts enable footprint-like indicators to be calculated to estimate the pressure exerted by the consumption of a country's population, for example on the climate, while taking into account the emissions associated with the production of imported goods and services.

Switzerland's pressure on the climate is decreasing

Between 2000 and 2019, Switzerland's greenhouse gas footprint declined by 6% (G 1). This footprint corresponds to the emissions resulting in Switzerland or abroad from the final demand for goods and services from households and the economy. Over same period, the permanent resident population grew. Therefore, Switzerland's per capita greenhouse gas footprint declined. In 2019, it was 12.6 tonnes of CO_2 equivalent, 64% of which was emitted abroad.

Greenhouse gas footprint of Switzerland and households[1]

Million tonnes of CO_2 equivalent — **G1**



[1] The estimate of the greenhouse gas footprint for years prior to 2008 is based on less complete source data than for the period after.

Source: FSO – Environmental accounting

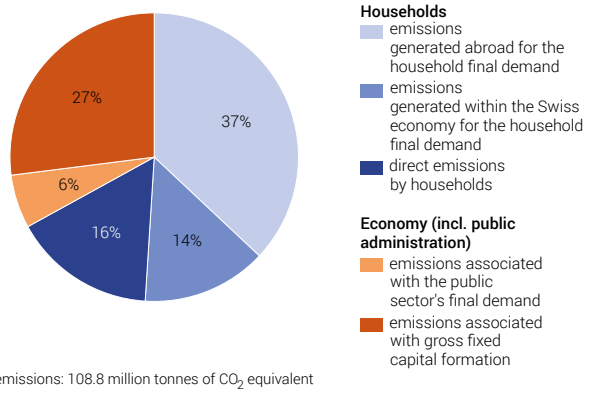
[1] Monetary variables are shown at current prices.

[2] https://seea.un.org/

Households are responsible for around two thirds of the greenhouse footprint

The greenhouse gas footprint is an estimate partly based on modelling[3]. The greenhouse gas emissions included in the footprint can be divided into the components of final domestic demand of the households and of the economy (G2)[4].

Greenhouse gas footprint by components of final domestic demand, 2019 **G2**



total emissions: 108.8 million tonnes of CO_2 equivalent

Source: FSO – Environmental accounting © FSO 2022

From this perspective, goods and services consumed by Swiss households account for the largest part of the footprint. Taking into account direct emissions from transport in private vehicles and heating and emissions generated both abroad and within the Swiss economy for the final demand of households, the households were responsible for 73.1 million tonnes of CO_2 equivalent (Mt CO_2 eq.) of greenhouse gas emissions in 2019, equal to roughly 67% of the Switzerland's greenhouse gas footprint.

In comparison, the footprint associated with the public administration's final consumption expenditure amounted to 6.3 Mt CO_2 eq.

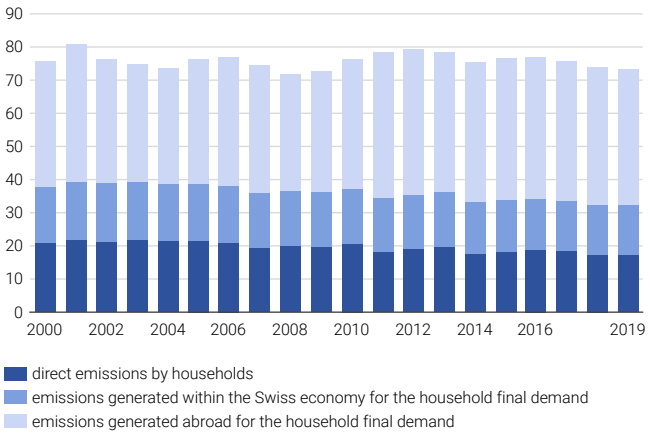
Another component of the final demand is gross fixed capital formation. This refers to investments[5] in fixed assets such as machinery, property or IT infrastructure. Gross fixed capital formation generated a total of 29.3 Mt CO_2 eq. of greenhouse gas emissions.

The household footprint is decreasing in Switzerland but not abroad

The household greenhouse gas footprint includes direct emissions and the so-called indirect emissions caused by household consumption expenditure within the Swiss economy or abroad (G3).

Household greenhouse gas footprint[1]

Million tonnes of CO_2 equivalent **G3**



[1] The estimate of the greenhouse gas footprint for years prior to 2008 is based on less complete source data than for the period after.

Source: FSO – Environmental accounting © FSO 2022

In 2019, with 17.4 Mt CO_2 eq., around 24% of the household greenhouse gas footprint was directly emitted by transport in private vehicles and heating. A further 14.9 Mt CO_2 eq., or 20%, were generated in the Swiss economy through the production of goods and services that were consumed by the households. The greatest part of the footprint, however, is "hidden" in imports: These are generated abroad in the production of goods and services that are imported and consumed by the households. In 2019, import-related emissions at 40.8 Mt CO_2 eq. accounted for 56% of the entire household footprint.

Between 2000 and 2019 the household greenhouse gas footprint decreased by 4% overall. However, the components of the household footprint evolved in different ways. Domestic emissions decreased between 2000 and 2019 by 15%. With a decline of 17%, direct emissions decreased more than emissions generated by the Swiss economy for the household final demand, which showed a decline of 12%. Conversely, emissions occurring abroad rose over the same time period by 8%.

[3] Various methods exist for this purpose: the results presented here are based on the air emissions accounts, the input-output tables (IOT) from the national accounts and a weighting of imported emissions.

[4] As the footprint only considers the greenhouse gas emissions due to Switzerland's final domestic demand, export-related emissions are not included in the calculation.

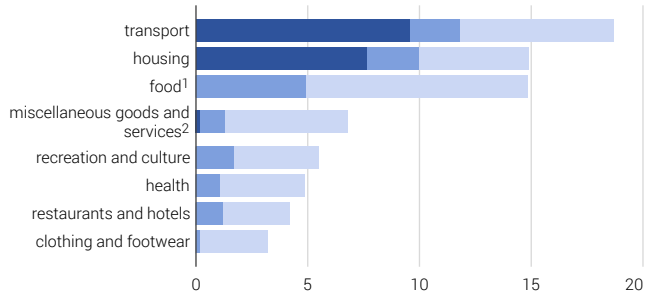
[5] Investments by the economy, public administration and households. Household investments cannot be separated from the basic data. However, they account for only a fraction of all investments.

Transport and housing account for about half of the greenhouse gas footprint of households

The share of the household greenhouse gas footprint that is directly or indirectly attributable to them can be broken down in greater detail by expenditure categories (G 4).

Household greenhouse gas footprint by expenditure categories, 2019

Million tonnes of CO_2 equivalent **G4**



direct emissions by households
emissions generated within the Swiss economy for the household final demand
emissions generated abroad for the household final demand

[1] food, non-alcoholic and alcolohic beverages and tobacco
[2] furniture, household equipment, communication, education, etc.

Source: FSO – Environmental accounting © FSO 2022

The category generating the largest share is transport, i.e. 18.7 Mt CO_2 eq.in 2019. This is equal to 26% of the household footprint although transport accounts for only 10% of household consumption expenditure. The greenhouse gas footprint due to transport includes both direct emissions caused by households transport in private vehicles as well as emissions caused by the economy. These include emissions from air transport, public transport, mineral oil refining as well as the trade, manufacture and maintenance of vehicles. Transport-related emissions are, however, also found in other expenditure categories. For example, the emissions arising from the transport of food are attributed to food.

The household greenhouse gas footprint due to housing as well as expenditure on housing both accounted for just over a fifth of the total footprint and consumption expenditure of households, respectively. In a similar fashion to that of the transport footprint, the housing footprint is composed of both direct emissions from heating on the one hand and of emissions from a series of economic activities that produce or provide housing-related goods and services on the other. These include the supply of energy as well as sewerage and waste disposal. However, emissions arising from housing construction are not included here as they belong to the gross fixed capital formation (see G 2).

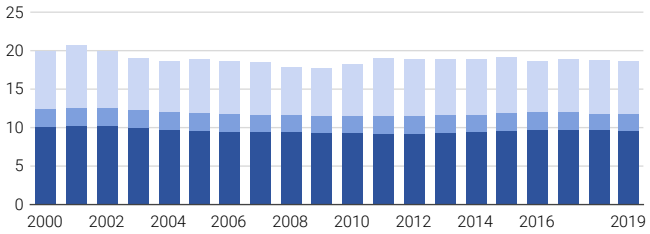
With the exception of transport and housing, where a large part of the footprint arises from direct emissions, import-related emissions generate a larger share of the footprint than domestic emissions in all other expenditure categories. At 94%, the share of emissions arising abroad was particularly high for clothing and footwear; for food it was 67%.

Emissions from transport and heating are evolving in different ways

Between 2000 and 2019, the household greenhouse gas footprint due to transport decreased overall by 6% (G 5). The evolution of direct emissions was similar and also showed a decline of 6%. The economy-related emissions evolved in a different way, however. Emissions generated within the Swiss economy for example, fell by 1%, emissions generated abroad by 9%.

Household greenhouse gas footprint due to transport[1]

Million tonnes of CO_2 equivalent **G5**



direct emissions by households
emissions generated within the Swiss economy for the household final demand
emissions generated abroad for the household final demand

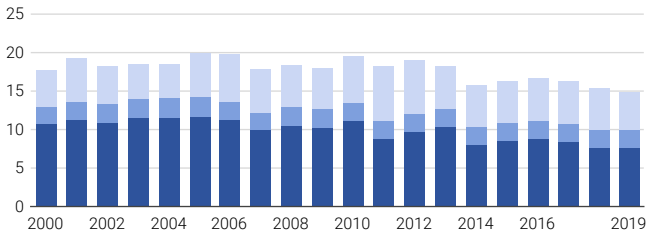
[1] The estimate of the greenhouse gas footprint for years prior to 2008 is based on less complete source data than for the period after.

Source: FSO – Environmental accounting © FSO 2022

A different picture again was shown for economy-related emissions due to household housing. While an increase of 6% was observed for emissions generated within the Swiss economy, emissions generated abroad increased by 3% (G 6). Overall the household greenhouse gas footprint caused by housing decreased by 16%. This was due to a 28% reduction in direct emissions from households.

Household greenhouse gas footprint due to housing[1]

Million tonnes of CO_2 equivalent **G6**



direct emissions by households
emissions generated within the Swiss economy for the household final demand
emissions generated abroad for the household final demand

[1] The estimate of the greenhouse gas footprint for years prior to 2008 is based on less complete source data than for the period after.

Source: FSO – Environmental accounting © FSO 2022

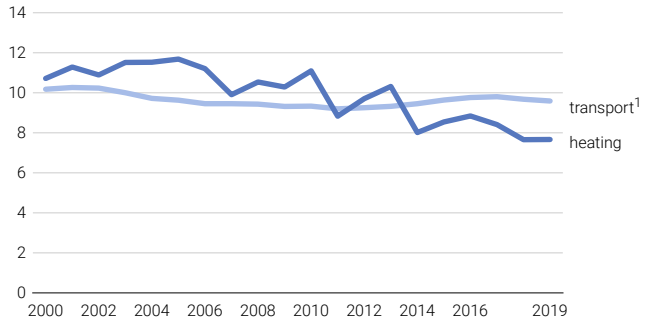
Below a closer look is taken at the household direct emissions as they account for around half of the greenhouse gas footprint due to household transport and housing.

Decline in direct emissions by households

Between 2000 and 2019, direct household emissions generated by transport in private vehicles and by domestic heating fell overall by 17%. However, the two types of emission developed in contrasting ways. The first declined from 2000 to 2011 then rose by almost as much again from 2011 to 2019, reaching 9.6 Mt CO_2 eq. in the year 2019. The second, is by nature more likely to fluctuate as it is dependent on winter conditions; these emissions remained stable overall from 2000 until the year 2008 when they started to fall. In 2019, they amounted to 7.7 Mt CO_2 eq. (G 7).

Direct greenhouse gas emissions by households

Million tonnes of CO_2 equivalent **G7**



[1] transport in private vehicles

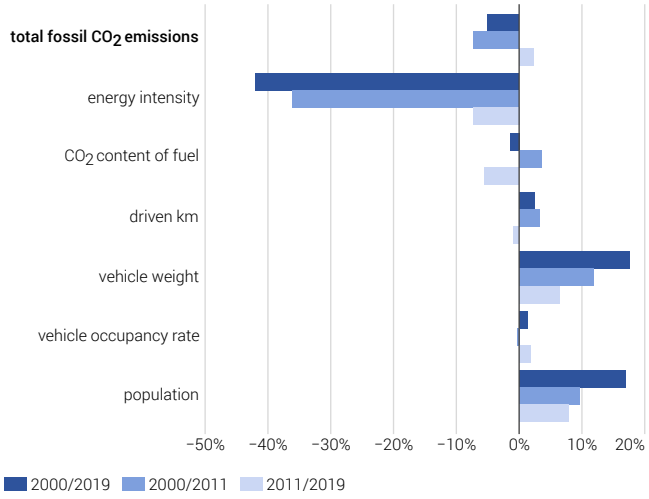
Source: FSO – Environmental accounting © FSO 2022

In contrast to emissions associated with household final demand, a large part of which is generated abroad and upon which households have less control, direct household emissions can be influenced more, in particular by tax incentives.

Slight decline in car emissions despite much greater energy efficiency

Between 2000 and 2019, CO_2 emissions from fossil fuels generated by household car use fell by 5%, in particular due to a decline in their fuel consumption per km and per kg, i.e. their energy intensity. This means that if all other factors had remained unchanged, the decline in the energy intensity of cars would have led to a decrease of 42% in emissions between 2000 and 2019, whereas the changeover to energy carriers emitting less CO_2 would have reduced emissions by 1%. However, the increase in vehicle weight and population growth would have led to an increase in CO_2 emissions of 18% and 17% respectively (G 8).

Factors explaining the evolution of CO_2 emissions due to household car transport **G8**



X-Axis: change compared to the baseline year

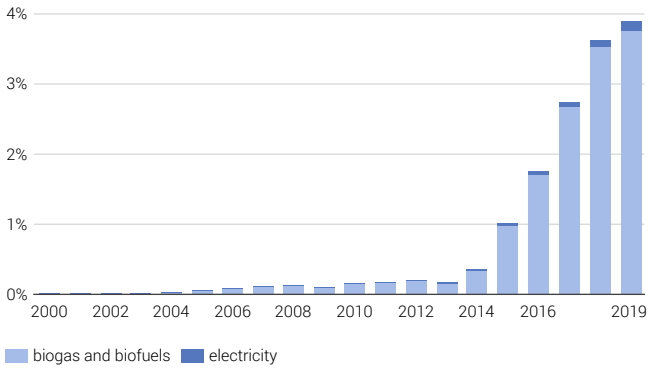
Source: FSO – Environmental accounting © FSO 2022

Separate analysis of the period from 2000 to 2011 – characterised by a decline in emissions generated by household car use – and of the period from 2011 to 2019 – marked by an increase in these emissions – show that the decline in the energy intensity of cars essentially took place during the first period. This decline was enough to compensate for factors leading to rising emissions, specifically an increase in population and vehicle weight, which was not the case in the second period.

However, the decrease in fuel CO_2 content took place almost exclusively in the second period, thanks to the ever-growing use of non-fossil fuels and electricity since 2014 (G 9).

Indeed, the share of biogas and biofuels in the total energy used by households for their transport in private vehicles gradually rose between 2000 and 2013, rising from almost zero to around 0.2%. From 2014 onwards, this share rose at a faster pace, reaching around 4% of the total in 2019. Electricity consumption also increased, in particular from 2014. Nevertheless, use of electricity remains marginal. In 2019 it represented around 0.1% of total energy consumption for household transport in private vehicles.

Share of biofuels and electricity in total energy used by households for transport in private vehicles **G9**

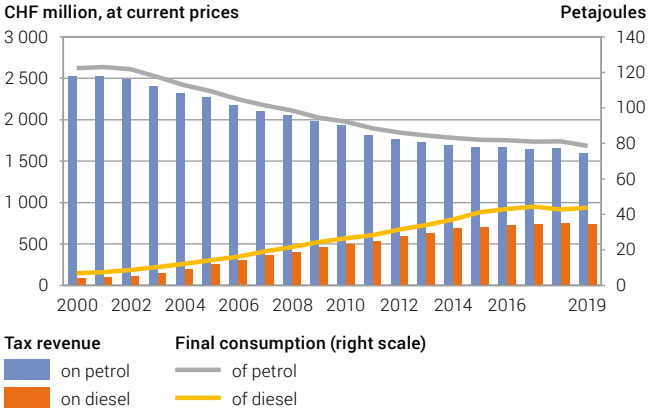


Source: FSO – Environmental accounting © FSO 2022

The decrease in household consumption of petrol and diesel has an impact on tax revenue

CO_2 emissions from fossil fuels generated by household transport in private vehicles are directly linked to the trends in household consumption of petrol and diesel[6], which in this case were contrasting (G10).

Revenue and final consumption of petrol and diesel for household transport **G10**



Source: FSO – Environmental accounts © FSO 2022

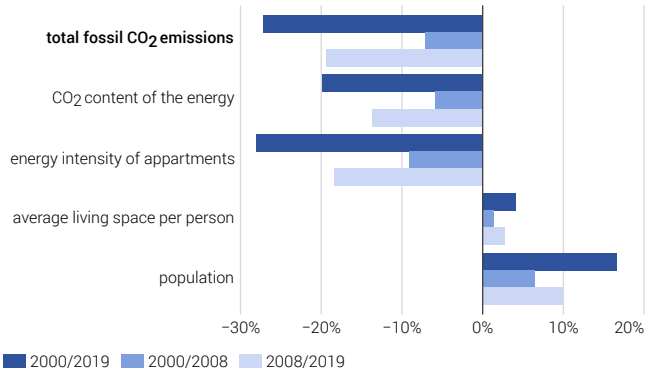
In fact, the consumption of petrol fell by more than a third, whereas the consumption of diesel saw a more than sixfold increase. The stock of passenger cars saw a decline of 9% for petrol-driven vehicles, whereas that of diesel-driven vehicles grew almost tenfold. In 2019, petrol-driven vehicles represented 67% of the stock of passenger cars, diesel-driven vehicles 30%.

Tax revenue from household consumption of petrol and diesel followed a similar trend. It depends directly on the quantities consumed and tax rates. The latter remained practically unchanged throughout the period considered. In 2019, these rates were 73 and 76 centimes per litre of petrol[7] and diesel, respectively. These consisted mainly of the petroleum tax and the petroleum surtax. For example, between 2000 and 2019, this revenue fell from CHF 2.6 to 2.3 billion, i.e. a decline of 10%. It represented 6.8% of household final consumption expenditure for transport[8] in 2019, compared with 9.9% in 2000.

Net decrease in household heating emissions despite growing population

Between 2000 and 2019, fossil fuel CO_2 emissions from household heating fell by 27%. Several factors contributed to this to varying degrees. If all other factors had remained unchanged, the decline in energy intensity – due for example to an improvement in building insulation or to more energy-saving ways of heating – would have led to a decline of 28% in these CO_2 emissions. In the same way, considered in isolation, the shift to energy carriers emitting less CO_2 – for example from heating oil to natural gas or from natural gas to heat pumps – would have reduced the CO_2 emissions of household heating by 20%, i.e. a more marked reduction than in the case of fuels used by households for their car transport. However, population growth and the increase in living space per person would have led to an increase in these emissions of 17% and 4% (G11).

Factors explaining the evolution of CO_2 emissions due to household heating **G11**



X-Axis: change compared to the baseline year

Source: FSO – Environmental accounting © FSO 2022

Separate analysis of the period from 2000 to 2007 – characterised by almost zero taxation of fossil heating fuels – and of the period from 2008 to 2019 – characterised by the introduction at the start of the period of the CO_2 tax on fossil heating fuels – shows that emission fell more markedly during the second period.

On one hand, the CO_2 tax makes fossil heating fuels more expensive, encouraging households to reduce their consumption – for example by heating less or by improving their home insulation

[6] The consumption of one litre of diesel emits about 14% more CO_2 than the consumption of one litre of petrol.

[7] Unleaded petrol 95

[8] Includes in particular the purchase of new and second-hand vehicles, repair and maintenance costs, parking and toll fees, transport passenger costs by road, rail and air as well as postal and delivery services.

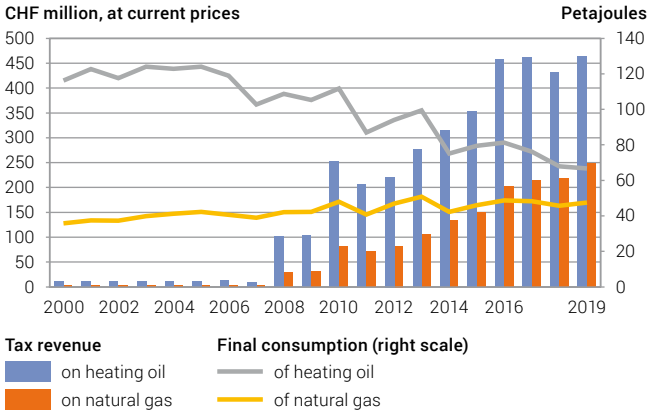
– as well as choosing to use energy carriers that generate fewer emissions – by switching for example from heating oil to natural gas or from natural gas to a heat pump.

On the other hand, around a third of revenue from this tax is allocated to the Building Programme to promote measures to reduce CO_2 emissions, such as energy renovation and the promotion of renewable energy. CO_2 tax contributes, therefore, to the reduction of the CO_2 content of the energy used but also to reducing energy intensity from housing. The combination of these two factors leads to an overall reduction in emissions linked to household heating, despite population growth and the increase in living space per person.

Decline in the consumption of household heating energy, but increase in tax revenue due to CO_2 tax

Between 2000 and 2019, the consumption of heating oil and natural gas for household heating declined overall by 25%. Depending on the energy carrier considered, however, contrasting trends can be seen. While fluctuating, heating oil consumption fell by 43%, falling from 116 to 67 petajoules (PJ) between 2000 and 2019, whereas that of natural gas rose by 32%, rising from 36 to 47 PJ (G 12).

Revenue and final consumption of heating oil and natural gas for household heating **G12**

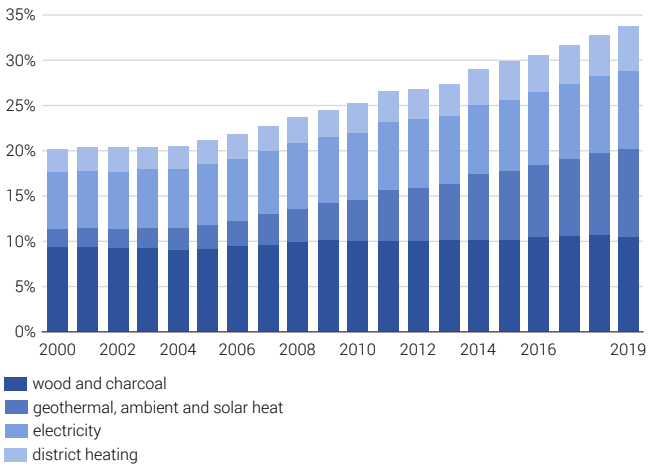


Source: FSO – Environmental accounts

The accelerated decline in heating oil consumption seen from 2008 seems to reflect, at least in part, the incentive effect of the CO_2 tax introduced in that year. Initially fixed at CHF 12 per tonne of CO_2 in 2008, the rate of this tax has since been increased several times as the goals for emission reduction defined by the Federal Council had not been achieved. In 2019, it was CHF 96 per tonne of CO_2. Between 2000 and 2019, tax revenue from heating oil and natural gas used to heat households rose from CHF 12 to 713 million. It represented 0.8% of household final consumption expenditure for the housing[9] in 2019, compared with a share close to zero in 2000.

At the same time that consumption of fossil fuel energy carriers for household heating was declining, that of non-fossil energy carriers and electricity rose (G 13), rising from 20% to almost 34% of total energy used for this purpose between 2000 and 2019. Geothermal energy, ambient heat and solar energy increased the most. Their share in total energy used for household heating rose from 2% to almost 10% over this period.

Share of non-fossil energy carriers and electricity in total energy used for household heating **G13**



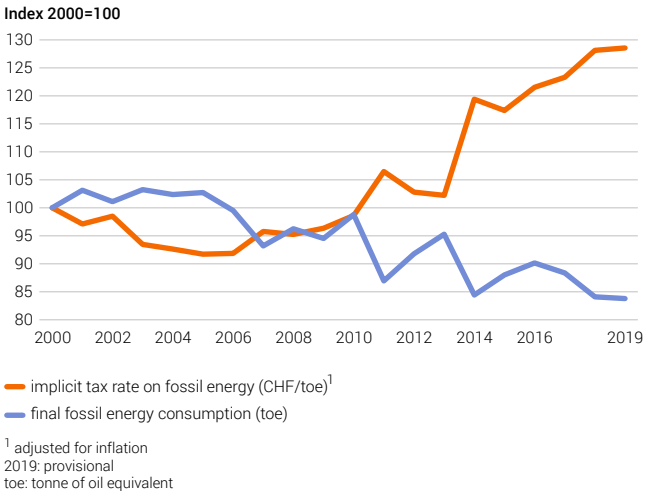
Source: FSO – Environmental accounting

[9] Includes in particular goods and services related to the dwelling, to its maintenance and repair, to the supply of water and energy used for heating or air conditioning.

Taxation of fossil fuels in the interest of the climate

The implicit tax rate on fossil fuels is measured by the ratio between tax revenue from fossil fuels and final consumption of fossil fuels (G14). Between 2000 and 2019, calculated for households, this rate rose by 29%, adjusted for inflation, reaching CHF 506 per tonne of oil equivalent (toe) in 2019. This increase, as well as the decline in household final consumption of fossil fuels, seem to reflect, at least in part, the incentive effect of the CO_2 tax. Between 2000 and 2019, the implicit tax rate on fossil fuels consumed by households rose from CHF 3 to CHF 248/toe for heating fuels, whereas it fell by CHF 838 to CHF 740/toe for motor fuels.

Implicit tax rate on fossil energy consumed by households **G14**



[1] adjusted for inflation
2019: provisional
toe: tonne of oil equivalent

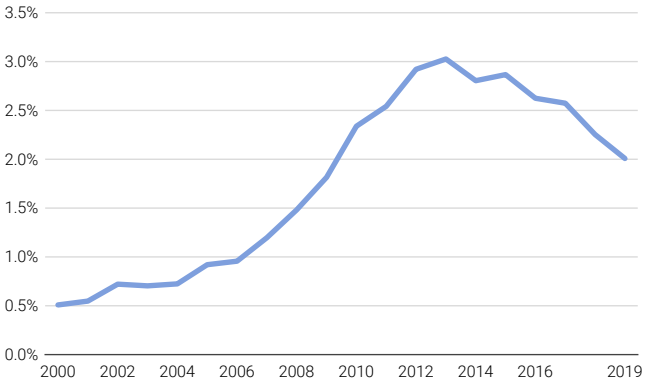
Source: FSO – Environmental accounts, National accounts

Almost fivefold increase in climate-related jobs in twenty years

Between 2000 and 2019, the number of climate-related jobs increased almost fivefold, rising from 17 500 to almost 83 100 full-time equivalents. This trend results mainly from activities linked to energy saving measures in building construction and the production of renewable energy. Over the same period, total employment rose by around 20%. The share of climate-related jobs in total employment therefore increased, rising from 0.5% to 2.0% (G15). Over this same period, the climate-related gross value added more than tripled, rising from CHF 4.1 to 13.8 billion, i.e. from 0.9% to 1.9% of the gross domestic product (GDP). The decline in climate-related jobs and gross value added observed since 2017 is basically the result of a decline in activities related to the construction of certified low-energy buildings.

Climate-related jobs

Share in total employment **G15**

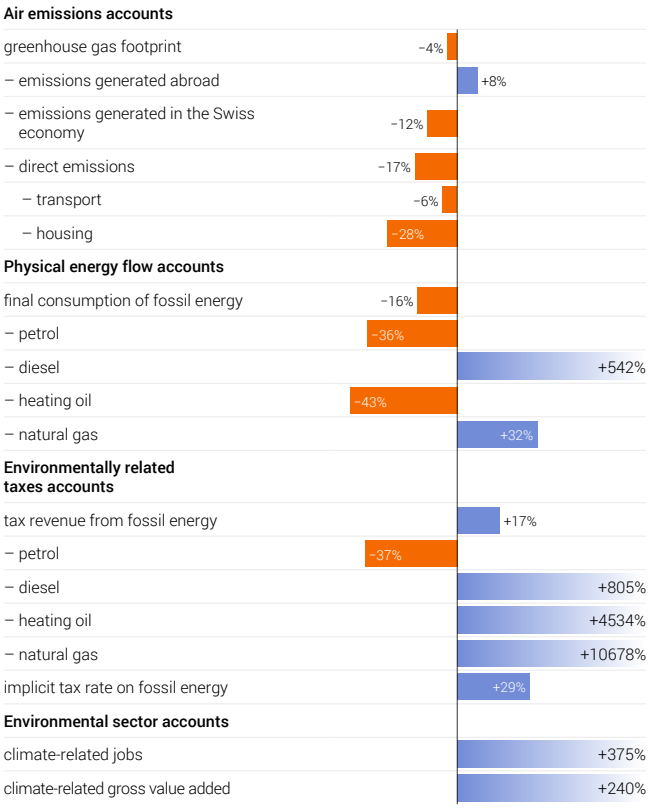


Source: FSO – Environmental accounting, STATENT

The diagram below (G16) gives an overview of the main key figures from this publication.

Households and climate from the perspective of environmental accounts

Some key trends between 2000 and 2019 — **G16**



Source: FSO – Environmental accounting

Methodological note

Environmental accounting completes the National Accounts with an environmental dimension. Comprising both physical accounts and monetary accounts, it provides, like the National Accounts, data on households and the economy by economic activity. It thus contributes to a better understanding of the interactions between the environment and the economy and to measure the extent to which the green economy and sustainable development goals have been achieved. Its production refers to the System of Environmental-Economic Accounting (SEEA) developed under the aegis of the United Nations (https://seea.un.org).

The environmental physical accounts provide information in particular on material and energy flows entering and circulating in the economic system, on greenhouse gas emissions and the resulting air pollutants, as well as on the forests' stock of standing timber.

The monetary accounts provide information on the value added and employment in the environmental and clean technology sectors, as well as on environmentally related expenditure, investments, subsidies and taxes. In this way, they enable the origin and the use to be established of the financial means implemented by Switzerland to environmental protection and natural resource management, as well as to measure economic activity in these areas.

Lastly, ecosystem accounts provide information on the economic importance of ecosystem services used by society and make it possible to estimate the economic asset value of ecosystems. In cooperation with the Federal Office for the Environment (FOEN), the FSO will shortly be examining the possibility of developing ecosystem accounting in Switzerland. Such accounting would contribute to measuring the goals of the Federal Council's Swiss Biodiversity Strategy.

The FSO produces the following environmental accounts:
Monetary accounts
→ Environmental protection expenditure
→ Environmental subsidies and other transfers
→ Environmental taxes
→ Environmental goods and services

Physical accounts
→ Material flows
→ Air emissions
→ Energy

Asset accounts
→ Forests

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