CO_2 Tax Switzerland

KEY CHARACTERISTICS

Introduced in 2008

Cross-cutting sectoral scope

Businesses can apply for an exemption and in turn commit to a legally binding emission reduction target. Companies are also exempt from the tax if they are subject to the Swiss emissions trading system

Aim to reduce CO2 emissions by 20% by 2020 in comparison to 1990

Levied onto fossil fuels used for energetic use, but excludes motor fuels

Price per ton of CO2 steadily increased from 12 CHF in 2008 to 96 CHF in 2018

KEY RESULTS

Success/effectiveness of CO2 tax is regularly evaluated, distinguishing between: short and medium/long-term impacts; and also between impacts on households and the economy

Estimated 4.1 - 8.60 million tons of CO2 emission reductions (2005-2015)

Majority of CO2 emission reductions through substitution of heating oil in households with less CO2-intensive energy sources

CO2 intensive businesses exempt from the tax commit to and undertake the most extensive CO2 emission reduction measures

Tax revenue is recycled back into companies and to the population

SUCCESS FACTORS

Adaptability: The tax is re-evaluated and adjusted based on current CO2 emissions and goals set by the government (dynamic pricing). Incremental increases to tax rate were crucial to making the CO2 tax effective

Longevity: The comprehensive legal framework that underpins the tax is key to its longevity. It is a long-standing element of Switzerland's energy policy and ensures that the tax is embedded in a broader climate policy

Exemptions: The exemption scheme ensures not only that businesses approve of the tax (or at least do no oppose it), but also support reduction commitments by companies

IMPLEMENTATION & REPLICATION PROCESS

Define the tax base → Identify the persons subject to the tax (the taxpayer/collection point) → Specify the tax rates → Use revenues generated by the tax

CO_2 Tax in Switzerland

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This case study is part of a series of six studies which show good practice examples for reducing greenhouse gas emissions in the sectors covered under the Effort Sharing Legislation. It has been developed on behalf of DG CLIMA.

The CO_2 tax is a carbon pricing instrument introduced to Switzerland in 2008. The tax covers approximately 35% of all CO_2 emissions in Switzerland and applies primarily to the use of thermal fuels. The tax is not levied onto motor fuels, companies (and their installations) participating in the Swiss Emission Trading Scheme (CH ETS) and exemptions are available to other companies. Significant emission reductions can be attributed to the CO_2 tax in Switzerland and lessons from the development and implementation of the instrument can be applied to other national contexts.

The case study provides an overview of the CO_2 tax, including the key actors involved, primary objectives, and how it interacts with other schemes. The study then focuses on the implementation of the CO_2 tax and finally offers an assessment of the tax. This examines both the successes and the limitations of the CO_2 tax and considers its future potentials.

1 Description of Case Study

1.1 CO_2 Tax Overview, its operation and governance

Energy and carbon taxes were introduced across Europe in the 1990s, although enthusiasm for these taxation measures dissipated as the European Emissions Trading System (EU ETS) was established as a market instrument of EU climate policy. Following this, carbon taxes shifted their focus onto emissions and energy consumption that was not regulated by the EU ETS. Hence most CO_2 related taxes in Europe are primarily targeted at energy consumption in private households. A report by the World Bank from 2017 reported that 23 national CO_2 tax schemes were in operation worldwide of which 15 are coordinated with the EU-ETS (World Bank and Ecofys, 2017). Notable schemes include the Swedish carbon tax, one of the earliest carbon taxes to be introduced, the carbon tax in the Canadian district of British Columbia, one of the first in North America, and the CO_2 tax in Switzerland (an overview of CO_2 taxation schemes in EU Member States please see Annex I and for a more detailed selection of best-practice examples Annex II)[1][2].

The Swiss CO_2 tax was introduced legislatively 1999 as part of a nationwide effort to reduce the emission of greenhouse gases and has been operational since 2008. The tax is levied onto emissions resulting from the energetic use of fossil fuels which make up the highest level of emissions in Switzerland, such as heating in dwellings. The tax does not affect motor fuels. The tax functions as a carbon pricing imitative alongside a national emissions trading scheme (ETS) in Switzerland. Companies (and their installations)[3] that are subject to the Swiss ETS (CH ETS) are not additionally taxed by the CO_2 tax. Additionally, certain companies (that are not regulated under the ETS) can apply for an exemption from the tax if they commit to reducing their CO_2 emissions. The carbon tax currently stands at 96 CHF per ton of CO_2 (approx. 88 EUR/t CO_2[4]). This is below the CO_2 tax rate in Sweden which stands at 114 EUR per ton of CO_2, but above the tax rate of the carbon tax in British Columbia at 40 CAD per ton of CO_2 (approx. 27 EUR/t CO_2)[5] which does, however, cover a larger proportion of CO_2 emissions than Switzerland (Adelphi et al, 2019).

In 2016, 1.17 billion CHF (approx. 1.05 billion EUR) were collected through the CO_2 tax in Switzerland. Approximately a third of the revenue from the tax collection (but only up to a maximum of 450 million CHF) is designated for a national housing programme that subsidises energy efficiency measures. A further 25 million CHF is deposited annually in technology bonds[6]. The other two thirds of the tax income are redistributed back to the population and the national economy. Tax revenue is redistributed through a rebate of the health insurance payments that are mandatory for everyone living in Switzerland regardless of their individual energy consumption. In 2018, a total of 640 million CHF (approx. 590 million EUR) were redistributed amounting to approximately 90 CHF (approx. 83 EUR) per person. The redistribution to the companies occurs through a rebate on the social security

[1] France also introduced a CO_2 tax in 2014, it is included in the Annex but has not been given further consideration in this study due to its short operational period.

[2] For a more comprehensive summary of carbon taxation schemes please see Whitana et al (2013) – a report prepared by the IEEP - and World Bank & Ecofys (2017)

[3] Companies are defined by the BAFU in Switzerland in the CO_2 Ordinance as follows: "*companies* means operators of fixed installations at a site". The CH ETS applies to installations rather than companies, but consistency with the language used by the Swiss government in official legal documentation companies will be used throughout the paper to refer to companies and their installations. See: CO_2 Ordinance Article 2 at https://www.admin.ch/opc/en/classified-compilation/20120090/index.html#app7

[4] Currency exchange rate from 12.11.2019

[5] Exchange rate from 12.11.2019

[6] The federal technology bond promotes innovative technologies that reduce greenhouse gas emissions, support renewable energy uses, and improve energy efficiency. For further information see: https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/climate-policy/technology-fund.html

payments that are made by individual companies and is proportional to the total wages paid by the employer (Bundestag, 2018).

While in Switzerland the CO_2 tax revenue is recycled back into companies and to the population, there are other possible avenues for revenue redistribution. In Sweden the introduction of the CO_2 tax in 1991 was accompanied by a reduction of income and labour taxes. In essence, the income from the carbon tax was used to reduce the social contributions made by employers and vulnerable households benefited from income tax exemptions (Metivier and Postic, 2018). In British Columbia tax revenue is also redistributed through a reduction in income tax. In Ireland the carbon tax was introduced in 2010 as part of a broader tax reform, but unlike in Sweden, the income from the carbon tax becomes part of the government's overall revenue in an effort to recover from the 2008 financial crisis (Metivier and Postic, 2018). Most CO_2 tax schemes in Europe redistribute their tax revenue through a reduction in income tax. Infras and Ecologic (2007: 14) conclude that redistributing tax revenue through a reduction of income tax functions well and goes some way towards compensating the negative/regressive economic effects of the tax.

1.2 Primary objective(s) of the schemes

Carbon taxes are economic measures based on a regulatory mechanism that assumes that as prices for energy intensive sectors, services and goods rise, demand falls and shifts towards more sustainable energy production and more efficient energy use. In turn, this would reduce CO_2 emissions. The CO_2 tax in Switzerland is one element of the so-called CO_2 law, which was introduced in 1999. The target of the law is a 20% reduction of CO_2 emissions in comparison to 1990 by 2020 (FOEN, 2018). This included an interim target of a reduction of CO_2 emissions by 10% between 2008 and 2012 with differential targets for heating and process fuels (-15%) and motor fuels (-8%) in comparison to 1990 emission levels. As already mentioned, the CO_2 tax does not cover motor fuels and hence was implemented to aid in meeting the reduction target of -15% for heating and process fuels. By anchoring the CO_2 tax in federal law the scheme also addresses structural barriers within existing legal frameworks by producing favourable legal stipulations for environmentally friendly action.

1.3 Eligibility criteria and target groups

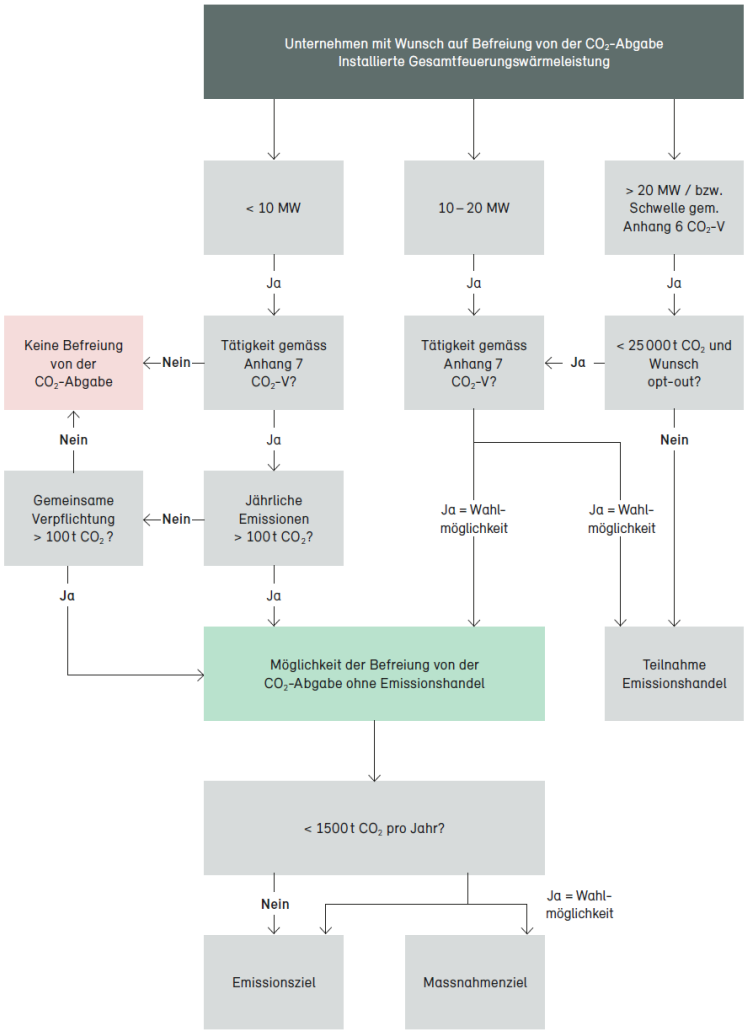
The Swiss CO_2 tax applies to all fossil fuel purchases related to the energetic use of fossil fuels, such as heating oils, natural gas, coal and others. This means that it primarily affects the use of fuels to produce heat, generate light, in thermal installations for the production of electricity and the operation of heat-power cogeneration plants[7] (FOEN, 2019). It does not apply to wood or other biomass used for energetic purposes because they are considered CO_2 neutral energy sources (i.e. the CO_2 released during fuel combustion is equal to CO_2 absorbed during growth/formation). The carbon tax also does not affect motor fuels (petrol and diesel), which is relatively unique to Switzerland. Most countries in the EU that have a CO_2 tax in place, such as Sweden, Denmark and Norway, all tax motor fuels. The tax is also not levied onto companies that take part in the CH ETS.

The Swiss ETS was introduced on a mandatory basis for certain companies that were in turn exempt from the CO_2 tax. Chapter 8, Section 2, Article 96, 2.a. of the CO_2 Ordinance states that ETS companies (Art. 17 CO2 Act); power plant operators (Art. 25 CO2 Act); and companies with reduction obligations (Art. 31 CO2 Act) are exempt from the CO_2 tax. The figure below demonstrates which companies must participate in the CH ETS, what exemptions are possible and when companies would be eligible for the CO_2 tax instead. Demonstrates that companies conducting activities that

[7] Combined heat and power (CHP) plants that do not conduct activities listed in Annex 6 of the CO_2 Ordinance (this is the list of activities that obliges companies to participate in the ETS) and therefore are not subject to the CH ETS are taxed by the CO_2 levy. CHP plants that are subject to reduction obligations may be refunded up to 60% of the CO_2 tax and those that operate CHP plants, which neither participate in the ETS nor are subject to a reduction obligation may apply for a full refund from the CO_2 tax. See Chapter 8, Section 2 of the CO_2 Ordinance: www.admin.ch/opc/en/classified-compilation/20120090/index.html#app7

qualify for the participation in the ETS under Annex 7 in the CO_2 Ordinance are either obliged to participate in the CH ETS, may opt-in, or apply for an exemption under Article 31 in the CO_2 Act depending on their MW outputs. Companies that do not conduct activities listed in Annex 7 of the CO_2 Ordinance or those producing over 100 t CO_2 per annum are subject to the CO_2 tax under Article 29 of the CO_2 Act.

Figure 1: Exemption possibilities for companies



Source: BAFU (2019)

An additional tax exemption for certain companies is however possible under specific conditions (see Box below for details). This relates primarily to large companies, associations of energy consumers, and energy-intensive companies that are subject to international competition and that additional taxation would adversely affect their ability to remain competitive. These companies must apply for a tax exemption which only gets approved subject to a formal commitment made to the federal government to limit the absolute amount of CO_2 emissions. If an exemption is granted, the company must provide a detailed annual report on these emission reductions and how they have been met[8]. This means that large, energy-intensive companies are on the whole exempt from the CO_2 tax in Switzerland and are instead obligated to actively reduce CO_2 emissions through other means. Such exemptions for energy intensive industries in carbon tax schemes are relatively common in Europe

[8] For further information on the specifics of exemption criteria see: https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/climate-policy/co2-levy/exemption-from-the-co2-levy-for-companies.html

and are also in place in Denmark, Sweden, Norway and the Netherlands for example (Infras and Ecologic, 2007: 10-11). Considering these criteria, Metivier and Postic (2018) estimate that the Swiss carbon tax covers around 36% of national CO_2 emissions.

Box 1: CO_2 Tax or tax exemption for companies in Switzerland

Through the exemption scheme companies in Switerland essentially fall into one of the following operational models (Jakob et al, 2016: 10):

- Tax paying companies *without* a voluntary emission target agreement
- Tax paying companies *with* a voluntary emission target agreement
- Exempt companies with a legally binding reduction commitment
- Exempt companies (and their installations) in the CH ETS

Jakob et al (2016) conducted a study to examine how companies come to make a decision about which one of the models suits them best and what this means for the effectiveness of the CO_2 tax. To begin with, it should be noted that knowledge about the CO_2 tax is wide-spread across different branches, company sizes and independent of their preferred model.

Those companies that choose not to apply for a tax exemption or do not have a voluntary emission reduction target in place do so mainly because the extra costs incurred through the CO_2 tax do not have a significant effect on the operational and end-costs of the companies. Several companies who did not apply for a tax exemption also had a voluntary emission reduction target agreement in place before 2008. These "voluntary" targets were often set as part of other legal obligations not related to the CO_2 tax and were aimed at the reduction of electricity consumption rather than fossil fuels which the CO_2 tax targets. The CO_2 tax hence had little additional effect on the costs of the company. The existing reduction agreement had to stay in place to fulfill other legal obligations and switching to a tax exemption model with a reduction commitment would have incurred significant costs and thus the tax was paid. Finally, those companies that did apply for an exemption from the CO_2 tax did so because committing to a reduction target was more economically viable than paying the CO_2 tax. Larger companies are, however, more likely to establish a voluntary emission target agreement or a reduction commitment than smaller companies. This might also be coupled to the ability of companies to enact change. Companies that are renting office and industry space, for example, and thus have less control over heating costs and arrangements are 50% less likely to establish a voluntary agreement or a reduction commitment that companies who have a more pronounced ability to enact energy-related changes.

1.4 Key actors involved in the delivery of the scheme

The CO_2 tax is applied at the point of purchase of fossil fuels for end use purpose (e.g. heating oil, natural gas for heating etc.), which means that it is consumer based. In other cases, such as in British Columbia the tax is applied at the wholesale payment of fossil fuels. It should be noted, however, that the EU energy tax directive stipulates that primary energy carriers should not be taxed. The taxation of end use energy instead circumvents issues that would otherwise adversely affect the international competiveness of electricity imports (Infras and Ecologic, 2007: 13).

1.5 Interaction of schemes with instruments

Following Switzerland's ratification of the United Nation's Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol the federal government introduced a combination of measures and policies. The primary elements of the national strategy are the Federal Energy Law and the 'CO_2 Law' on the reduction of CO_2 emissions. The Energy Law was introduced in 1998 and replaced the 'Energy 2000' initiative. It focuses on collaborations between government, the private sector and the public

primarily to promote energy efficiency, but also the use and development of renewable energies. The CO_2 law was passed by parliament in 1999 and became law in 2000, and covers a range of sectors, measures and instruments to reduce national CO_2 emissions. This includes the CO_2 tax, as well as regulations in the building and transport sectors, climate training and communication programmes, and a technology fund amongst other things. The CO_2 tax was only to come into force if other CO_2 reduction measures under the CO_2 law did not sufficiently curb CO_2 emissions.

Finally, another key element of the CO_2 law was the implementation of a Swiss emission trading system (CH ETS). The CH ETS operated on a voluntary basis from 2008-2013, before the introduction of mandatory participation for certain companies for a period from 2013-2020. Participation in the CH ETS is obligatory for most companies in Switzerland. The CH ETS and the CO_2 tax are entirely separate in scope, meaning that companies that are covered by the ETS are not taxed. Switzerland does not currently participate in the EU ETS, but discussions to form a joint CO_2 market have been held since 2011. The agreement to link the EU ETS and the CH ETS was signed in 2017 and approved by the EU and Swiss Parliaments in 2018 and 2019 respectively. This joint carbon market initiative will come into force on 1 January 2020.

1.6 Previous experiences and background to the case study

Discussions around the implementation of CO_2 taxes were prominent across Europe in the 1990s. Finland (1990), Norway (1991), Sweden (1991), Denmark (1992), and the Netherlands (1996) had all implemented carbon taxes around this time period. Past experiences with energy taxation schemes also provided a knowledge base from which to draw for a carbon tax, as this would require only a change in the criteria of what the tax applies to. This provided a favourable political climate for the introduction of a CO_2 tax in Switzerland and offered first insights into early experiences in those Nordic countries. Political discussions around the CO_2 tax in Switzerland carried on throughout the 1990s as numerous iterations of the tax were presented to the government. Although these proposals bore a similarity to the CO_2 tax schemes already in place across Europe, implementing a carbon tax in Switzerland required a careful consideration of the social, political and economic specificities of the national context.

2 Implementation

2.1 Drivers and key actors for setting up the scheme

The CO_2 tax was implemented in conjunction with the CO_2 law to reduce Switzerland's CO_2 emissions in the ratification of the Kyoto Protocol. This implementation spanned a number of years and was introduced by parliament.

2.2 Lead times

The first draft of a CO_2 tax reform was submitted for parliamentary debate in 1994. This original draft suggested an unconditional tax, which meant that there would be no exemptions possible for companies or industries of any kind and all fossil fuels would be taxed equally. This first draft was going to cover 90% of all CO_2 emissions produced in Switzerland and 75% of all GHG emissions. This was, however, met by strong opposition both from political parties and economic sectors that feared that the tax would adversely affect their international competitiveness. Following this backlash the CO_2 tax bill was revised substantially and resubmitted to parliament in 1997. This revised version of the CO_2 tax included possible exemptions for certain companies and energy-intensive industries (as described above) and introduced a revenue redistribution system that both individuals and companies would benefit from.

Before the implementation of the CO_2 tax and during the planning phases a public referendum vote was held on three possible energy tax schemes in September 2000. All three proposals were ultimately rejected which went some way to ensuring that the CO_2 tax implemented only a few years

later did not apply to motor fuels. Thalmann (2004) in his study of this referendum decision suggests that the rejection of an energy tax in Switzerland was not necessarily indicative of a complete rejection of the implementation of environmental policy, which is why the introduction of the CO_2 tax in 2008 was nonetheless met with popular support. Key insights from this early, energy tax referendum about the importance of support from industry and companies and the role that the socio-economic and political context plays in determining public acceptance made the implementation of the CO2 tax a few years later a much smoother process.

2.3 Lessons to be learned from the scheme development and initial stages of implementation

The initial stages of implementation highlight that it is important to have broad support both from government (across political parties) and from industry. The changes made to the CO_2 tax in the 1990s to include exemptions for companies under specific conditions were key to implementing the scheme. The specificities of a carbon tax need to cater to the concerns of all actors and stakeholders involved. Company and industry lobbies in particular can become strong opponents to a CO_2 tax if their concerns around international competitiveness and rising prices are not taken into account during the initial phases.

Gaining support from the general population and ensuring social acceptability of a CO_2 tax is also important. The prevalence of a direct democracy system in Switzerland through the frequent referendum voting meant that gaining a sense of public opinion was relatively easy. Initial referendum votes on the implementation of the CO_2 law in 1999 showed a general approval for its implementation. Following referendum votes on the introduction of an energy/carbon tax had less favourable results, but a general acceptance for environmental action and policy remained strong within the Swiss population. In Sweden the implementation of a CO_2 tax was also not met by any significant resistance, for example, because it was introduced in 1991 as part of major tax reform which also included significant reductions in income tax. Since the carbon tax was only one element in a larger tax overhaul it did not receive as much media attention as in other countries. In British Columbia, on the other hand, the CO_2 tax was met with strong and vocal opposition in particular from rural Northern regions. These regions felt they would be disproportionally affected by the carbon tax due to colder weather conditions and their rurality leading to higher energy consumption and less potential to reduce CO2 emissions without significant impacts on quality of life. These concerns were disproven by various newspaper and governmental sources but had no impact on the claims made by local politicians and campaigners against the carbon tax. Often the *perceptions* rather than facts about costs and benefits carry significant weight in public opinion. The introduction of the tax in British Columbia also coincided with a significant increase in gasoline prices significantly curbing public acceptance of the tax (Peet and Harrison, 2012). Despite these grievances from the public, British Columbia continued the implementation of the CO_2 tax and popular support for the tax increased over the time of its implementation as concerns brought forward from the public were addressed (Adelphi et al, 2019).

2.4 Adjustments made during the scheme

The main changes made to the CO_2 tax during the scheme come in the form of increases in the tax rate, because the prices of the CO_2 tax are set dynamically by the Swiss Federal Council. The Council sets interim targets for emission reductions and if those targets are not met the price of the CO_2 tax is adjusted accordingly (Bundestag, 2018: 9). Initially the CO_2 tax was set at 12 CHF per ton CO_2 in 2008. This was increased in 2014 to 60 CHF per ton of CO_2, 84 CHF per ton of CO_2 in 2016, and adjusted again in 2018 to 96 CHF per ton of CO_2 (Bundestag, 2018: 10; MURE, 2018). Such a gradual increase of the tax is common across Europe and tends to increase public acceptability of the tax (Infras and Ecologic, 2007: 14). In comparison to other CO_2 tax prices levied across the EU, Switzerland has one of the highest tax rates (Adelphi et al, 2019). It should be noted, however, that

the CO_2 tax in Switzerland has a much narrower field of applicability than in other countries through the lack of taxation of motor fuels and the extent to which exemptions from the tax are possible.

During the initial CO_2 tax implementation phase the CH ETS was not yet in place and hence was not explicitly considered during implementation. The CH ETS was introduced on a voluntary-basis in 2008 together with the CO_2 tax. This meant that companies that chose to operate under the national ETS were not subject to the CO_2 tax. The implementation of the mandatory phase of the CH ETS (2013-2020) which obligated certain companies to take part in the ETS was preceded by the legislative regulation of the CO_2 Act in 2011 (came into effect 1st January 2013). The CO_2 act clarifies what companies (and their installations) are required to operate under the CH ETS and companies that are not will be taxed by the CO_2 tax.

3 Assessment

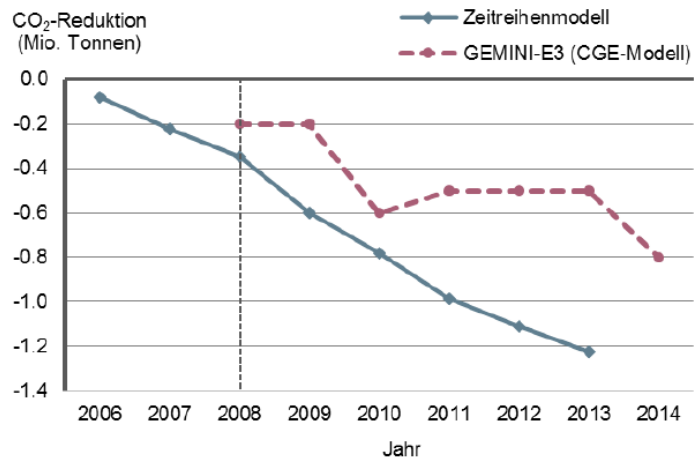
3.1 Successes

The CO_2 tax in Switzerland is considered a success (Jakob et al, 2016). Evaluations of the effects of the tax indicate that it has a significant effect both on energy consumption in private households and on companies lowering their CO_2 emissions.

3.1.1 How successful was the scheme?

Measuring the actual impact of the CO_2 tax must be done indirectly and hence is difficult. The Swiss government commissioned a number of studies to assess the impact of the CO_2 tax and consider both the short- and long-/medium-term impacts of the tax. The studies also differentiate between the impact the carbon tax has on households and on the economy. All studies show that the CO_2 tax has contributed significantly to the reduction of CO_2 emissions. A model-based analysis by Ecoplan et al (2015, 2017) assumes a cumulative total impact for the period 2005-2015 of 4.1 to 8.6 million tons of CO_2 reductions. This corresponds to a 0.7-1.5% reduction of emissions in relation to the total cumulative GHG emissions (excluding aviation) in Switzerland between 2005-2015. The lower limit is calculated using a general-equilibrium model which considers the short-term effects of the tax, while the upper limit also takes longer-term impacts into account in a time-series approach. This explains the relatively large bandwidth suggested by the studies. The figure below demonstrates the CO_2 emissions reductions achieved through the CO_2 tax differentiated by the time-series model (in blue) and the general-equilibrium model (dotted-purple). These reductions are those attributed to the CO_2 tax from households and companies that are not exempt from the tax or operating under the CH ETS. An interesting observation from Ecoplan et al (2015) also shows that the impact of the CO_2 tax can be observed from 2006 onwards, two years before the CO_2 tax was introduced. For 2015, CO_2 emission reductions of 0.8-1.8 $MtCO_2$ are attributed to the CO_2 tax (FOEN, 2018). This corresponds to a 1.7-3.7% reduction in relation to total GHG emissions in 2015, and a 4.3-9.6% reduction in relation to all levy relevant CO_2 emissions from fossil thermal fuels.

Figure 2: Reduction effect of the CO2 tax (calculated using two different methodological approaches)

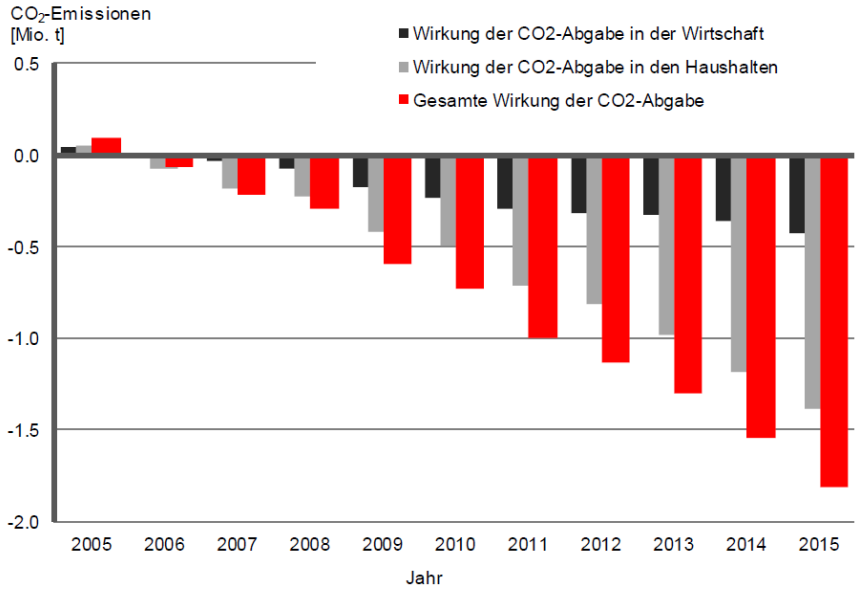


Source: Ecoplan et al (2015)

In comparison, Norway achieved an 11% reduction in CO_2 emissions affected by the CO_2 tax between 1990 and 1999. Finland achieved a reduction of 7% between 1990 and 1998, Denmark reduced their tax-related CO_2 emissions by 25% between 1990 and 2000 and Sweden a modest 2% between 1990 and 2002 (Infras and Ecologic, 2007: 16). Measuring the effectiveness of the CO_2 taxes is however dependent on the initial reduction potentials that could be achieved in the first place. In Sweden, for example, the existing energy mix was relatively low in CO_2 and industries had a relatively low CO_2 intensity, meaning that CO_2 reduction potentials were relatively low to begin with (Infras and Ecologic, 2007: 16). More recent numbers suggest, however, that a significant portion of the total 26% reduction in CO_2 emissions between 1990 and 2018 in the sectors that were subjected to the full tax rate over this period can be attributed to the CO_2 tax (Scharin and Wallström, 2018: 4). Denmark on the other hand has a relatively CO_2 intensive energy mix and hence had a high potential for CO_2 reductions when the CO_2 tax was introduced. The comparison of various CO_2 taxes across Europe also demonstrates that the introduction of a carbon tax always resulted in a reduction of CO_2 emissions even if the carbon tax does not cover all energy consumption or is relatively specific and targets only carbon emissions resulting from certain types of energy combustion.

The majority of the CO_2 reduction achieved through the tax is achieved by households. This is primarily due to the fact that a significantly higher proportion of the CO_2 emissions produced in households are subject to the CO_2 tax than in the economy (FOEN, 2018). The CO_2 reductions in the household sector are primarily achieved through the substitution of heating oil with less CO_2-intensive energy sources such as natural gas and renewables. The figure below shows the differential impact of the CO_2 tax in the company and industry (black) and households (grey) between 2005 and 2015 (Ecoplan, 2017).

Figure 3: Impact of the CO2 tax – econometric model



Source: (Ecoplan, 2017)
Note CO_2 tax became operational in 2008.

A closer look should be given to companies and exemptions possibilities to assess the tax scheme's success. Jakob et al (2016) conducted a survey-based study to examine the impacts of the CO_2 tax on companies between 2008 and 2016. Essentially, the CO_2 tax is only paid by companies where the extra costs incurred through the tax are relatively insignificant due to their low CO_2 emissions and low energy intensity. The higher the CO_2 emission were in a company, the more extensive the reduction measures were meaning that decisions made about the CO_2 tax were generally dependent on whether companies had high CO_2 emissions or not. More CO_2 intensive companies were more likely to have either a voluntary reduction target or be exempt from the tax and have a binding emission reduction commitment in place. These companies also reacted earlier and more frequently to the implementation and changes to the CO_2 tax. While the exemption from the CO_2 tax led to the reduction of CO_2 emissions which otherwise would not have occurred, companies undertook few significant emission-related changes to their company operations. Often changes were limited to adjusting internal processes, modes of production, and changing heating areas. Significant changes were made in choosing less CO_2 intensive energy sources, heating and process heat energy. The exemptions allowed for a broader acceptance of the carbon tax amongst companies, but it is unclear whether being subject to the CO_2 tax would have had more or less significant impact on CO_2 emission reductions within companies.

3.1.2 Measures of Success

3.1.3 Key factors that ensured success

One of the key factors that contributes to the success of the CO_2 tax in Switzerland is its ability to adapt to the changing circumstances. The fact that the tax is re-evaluated and adjusted based on current CO_2 emissions and goals set by the government (dynamic pricing) means that the tax can be easily adjusted when it becomes clear that Switzerland is not on track to meet its emission targets. The incremental increases in the tax rate were crucial to making the CO_2 tax effective. The low initial tax rates had little effect on consumer behaviour, as the initial price set at 12 CHF per ton of CO_2 in 2008 for example made up less than 4% of the heating oil price. Further increasing the CO_2 tax, Ecoplan et al (2015) argue, would continue to result in CO_2 emission reductions.

While the CO_2 tax's adaptability is key to its success, the comprehensive legal framework that underpins the tax is key to its longevity. The scheme has been successfully in place since 2008 and anchored in law since 2000. It thus becomes a long-standing element of Switzerland's energy policy and, most importantly, ensures that the tax is embedded in a broader climate policy that is supported by the government.

Finally, a key element of the scheme's success is the general approval for the tax from both households and companies. Especially within the industry and economic sectors, the exemption scheme has been instrumental in making the tax a success. The exemptions ensure not only that companies approve of the tax (or at least do not oppose it), but as evaluations from Jakob et al (2016) have shown, also support reduction commitments by companies that are having a significant effect of emission reductions.

3.1.4 Support measures that contribute to the success of the scheme

Public perception and acceptability of a carbon tax is a key component of its success and longevity. Information campaigns in the run-up to the introduction of the CO_2 law and the CO_2 tax may have contributed to the general public acceptance of the scheme by increasing knowledge about the CO_2 tax and the importance of environmental action in this regard. It is however hard to assess the direct impact information campaigns had.

3.1.5 Cohesive interactions with other schemes and instruments

As already mentioned, the CO_2 tax functions as an essential element of a more comprehensive CO_2 law that aims to reduce CO_2 emission in Switzerland. In this sense, the CO_2 tax is effectively integrated in the broader energy and carbon policy agenda. The forthcoming integration of the Swiss ETS and the EU ETS also ensures that the CO_2 tax does not affect those companies subjected to the interregional and international carbon market.

3.2 Assessment - Limitations

3.2.1 Aspects for Improvement

The incremental increase of the CO_2 tax rate was on the one hand a tactical decision (to increase public acceptability of the tax), but it also reflects that the CO_2 tax (in conjunction with the other energy and carbon policies) is not sufficiently curbing CO_2 emissions. Jakob et al (2016) found that the initial low CO_2 tax rates had little impact on low-emission companies and assume that only a significant rise in the tax rate would lead to a more significant effect across companies. A lesson to be taken from this is to carefully consider the emission reduction potentials of a carbon tax and not overestimate the effect it can have, and ensure that it is one element of a broad and varied climate policy. The Swiss CO_2 tax case also demonstrates that the system needs to be sufficiently flexible to include exemptions and function alongside other mechanisms (such as the CH ETS/EU ETS) so that companies and industry sectors are not doubly affected by numerous economic instruments.

No studies exist as of yet that can determine whether the carbon tax including the revenue distribution schemes in Switzerland has any unforeseen negative distributional effects, e.g. if products become more expensive when CO_2-related costs are passed through by companies. The extent to which this might be the case is, however, unknown and difficult to determine although the per capita revenue redistribution offsets some of these effects. In Sweden, lower energy taxes are offered to low-income households to avoid excessive costs for vulnerable sub-groups and in British Columbia, specific subsidies are offered to groups with high heating needs (Adelphi et al, 2019).

3.2.2 External factors that may affect schemes success

Increases in the tax rate reflect the results of interim evaluations of the Swiss carbon policies which showed that Switzerland was not on track to meet its targets and hence had to increase their tax rates. Meeting the set CO_2 reduction targets requires high CO_2 taxes on economic activities that are

not eligible for international emissions trading. Especially in the electricity sector, higher taxes are required to meet the more ambitious reduction targets for CO_2 emissions and electricity demand (Böhringer and Müller, 2014: 2). Increases to the CO_2 tax are currently legally capped at 120 CHF per ton of CO_2, which also means that the tax rate cannot be increased indeterminately at the current rate. This might prove to be problematic as tax rates would have to increase to meet CO_2 emission reduction goals. On the other hand, such high CO_2 prices would be problematic economically. Böhringer and Müller (2014: 19) conclude from their qualitative study of the CO_2 tax scheme that the high CO_2 taxes required to meet emission reduction targets would have negative implications for the economic performance of the Swiss economy. Jakob et al's (2016) study indicated, however that the CO_2 tax did not also lead to any locational disadvantages for companies, in the sense that that no company relocated (part) of their production elsewhere due to the tax. Adverse reactions from the public or industry following an increase in the CO_2 tax prices could also put pressure on the political system to curb the tax although to date the increases made to the carbon tax have not met with any significant resistance.

3.2.3 Negative interactions with other schemes or instruments

There is no evidence or indication in the existing literature that the Swiss CO_2 tax interacts negatively with other schemes, instruments or measures either on the national or the EU level.

3.3 Assessment - Future Potentials

3.3.1 Scalability

The carbon tax in Switzerland functions on a nation-wide scale. This is different from British Columbia for example, where the CO_2 tax applies to a regional area. In cases such as this, where the carbon tax is not part of a national legal or policy framework, problems can arise for companies and sectors that compete nationally and may be put at a significant disadvantage in comparison to their other national competitors. This is of course also a relevant concern for companies that may be taxed uniformly nationally but compete on an international market.

3.3.2 Replicability

Milne (2008) argues that the design of any carbon tax requires four essential elements, which are important for the transfer of a CO_2 tax between different national contexts:

- The definition of the tax base - what types of CO_2 emission does the tax cover?
- The identification of the persons subject to the tax (the taxpayer/collection point) - who, when and how is the tax going to be collected?
- The specification of the tax rates – how much will be levied for what kind of emissions over what time period?
- The use of revenues generated by the tax - when, how and to whom is the tax revenue redistributed?

A CO_2 tax has been introduced in several countries and regions, indicating that a CO_2 tax can be transferred to various national contexts. There are, however, factors that could be a source of hesitation for some countries. Countries with low GDP are unlikely to find a CO2 tax an attractive prospect due to the potential adverse effect on their economy. Equally the public and industry must accept the carbon tax for successful implementation. There must be a political willingness to consider a carbon taxation scheme. While these are significant concerns the examples shown in this study have demonstrated that these can be overcome. Furthermore carbon taxes in operation in Poland and Slovenia demonstrate that countries with a lower GDP than Switzerland can introduce a taxation measure with the support of politics, industry, and the general public. It is important to add that the carbon tax rates in Poland and Slovenia are relatively low and that this limits their effectiveness. Countries should always consider how effective a CO_2 tax would be in the scope that is possible for

them to implement and in turn, whether the introduction of other measures would be more effective. Nonetheless, the best-practice examples examined in this paper can become a useful starting point for other countries to begin a public discussion of a carbon tax and begin the process of implantation.

Infras and Ecologic (2007) in their extensive comparison of CO_2 tax schemes in Europe find that the specifics of the implementation and functioning of carbon taxes vary greatly between countries. From this they conclude that the success of a carbon tax is at least to some extent dependent on the national context and specificities. They do, however, tentatively indicate several factors that are likely to contribute to the success of a carbon tax (ibid.: 17):

- Clearly defined step-by-step introduction with acceptable levels of increase in rates
- Redistribution of revenue to the economy and possibly private households
- Earmarking of a portion of the revenue for programmes aimed at promoting energy efficiency and the use of renewables
- Cushioning measures for internationally exposed energy-intensive sectors and/or companies, possibly in combination with target agreements and/or commitments for the exempted companies/sector
- Compensation measures (e.g. reduction of supplementary wage costs) to cushion undesirable social distributional effects.

4 References

Adelphi, Climate Focus & Perspectives Climate Group (2019). *Tipping the balance: Lessons on building support for carbon pricing*. Policy Brief. Policy Brief commissioned by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). Berlin/Amsterdam/Freiburg: adelphi/Climate Focus/Perspectives Climate Group.

Bundesamt für Umwelt (BAFU) (Hg.) 2019: CO2-Abgabebefreiung ohne Emissionshandel. Ein Modul der Mitteilung des BAFU als Vollzugsbehörde zur CO2-Verordnung. 3. aktualisierte Auflage, Mai 2019. Bundesamt für Umwelt, Bern. Umwelt-Vollzug Nr.1316: 88 S

Böhringer, C., & Müller, A. (2014). “Environmental Tax Reforms in Switzerland. A Computable General Equilibrium Impact Analysis”, *Working Paper* V-361-14, University of Oldenburg, Department of Economics, revised January 2014.

Bundestag (2018). *Die CO2-Abgabe in der Schweiz, Frankreich, und Großbritannien – Mögliche Modelle einer CO2-Abgabe für Deutschland*. Berlin: Deutscher Bundestag.

Ecoplan (2017). *Wirkungsabschätzung CO2-Abgabe – Aktualisierung bis 2015*. Bern: FOEN.

Ecoplan, EPFL & FHNW (2015). *Wirkungsabschätzung CO2-Abgabe*. Synthese. Bern: FOEN.

Federal Office for the Environment (FOEN) (2018a). *Fact Sheet on the Impact Assessment and Evaluation of the CO2 levy on Thermal Fuels*. Bern: FOEN, 19 February 2018.

Federal Office for the Environment (FOEN) (2018b). *Swiss climate policy*. Available at: https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/climate-policy.html

Federal Office for the Environment (FOEN) (2019). *Imposition of the CO2 levy on fuels*. Available at: https://www.bafu.admin.ch/bafu/en/home/topics/climate/info-specialists/climate-policy/co2-levy/imposition-of-the-co2-levy-on-thermal-fuels.html#legislation__content_bafu_en_home_themen_thema-klima_klimawandel-stoppen-und-folgen-meistern_schweizer-klimapolitik_co2-abgabe_erhebung-der-co2-abgabe-auf-brennstoffen_jcr_content_par_tabs

Infras & Ecologic (2007). *Erfahrungen mit Energiesteuern in Europa*. Bern: Bundesamt für Energie BFE.

Jakob, M., Rosskopf, Y., Kendall, I., Looser, R., Forster, R., Reiter, U., Nathani, C. & Hoff, O. (2016). *Wirkungsabschätzung CO2-Abgabe auf Brennstoffe – Direktbefragungen zur Abschätzung der Wirkung der CO2-Abgabe auf Unternehmensstufe*, Study by TEP Energy, Rütter Soceco, Bern: FOEN, 14 April 2016.

Kasa, S. (2000). "Policy networks as barriers to green tax reform: The case of CO2-taxes in Norway", *Environmental Politics*, 9:4, pp. 104-122.

Landis, F., Rausch, S. & Kosch, M. (2016). *Is a Uniform Carbon Tax a Good Idea? The Case of Switzerland.* SCCER-CREST Working Paper.

Metivier, C. & Postic, S. (2018). "Carbon pricing across the world: how to efficiently spend growing revenues?" *Institute for Climate Economics*, Climate Brief, no. 5.

MURE (2018). *Swiss CO2 Levy*. Odyssee and Mure.

Peet, C. & Harrison, K. (2012) "Historical Legacies and Policy Reform: Diverse Regional Reactions to British Columbia's Carbon Tax", *BC Studies*, no. 173, Spring 2012, pp. 97-122.

Scharin, H. & Wallström, J. (2018). *The Swedish CO2 tax – an overview. Study by Anthesis Enveco and Borg & Co AB*. Japan: Institute of Energy Economics.

Thalmann, P. (2004). "The public acceptance of green taxes: 2 million voters express their opinion". *Public Choice*, 119, pp. 179-217.

Withana, S., ten Brink, P., Kretschmer, B., Mazza, L., Hjerp, P., Sauter, R. (2013). Evaluation of environmental tax reforms: International experiences. A report by the Institute for European Environmental Policy (IEEP) for the State Secretariat for Economic Affairs (SECO) and the Federal Finance Administration (FFA) of Switzerland. Final Report. Brussels.

World Bank & Ecofys (2017). Carbon Pricing Watch 2017. Washington, DC: World Bank

World Bank (2020). „Carbon Pricing Dashboard". Available at: https://carbonpricingdashboard.worldbank.org/

Annex I – CO_2 Tax Schemes in EU Member States

Country	Year of Implementation	Tax Rate (EUR tCO_2e)
Denmark	1992	23.42 (fossil fuels); 20 (F-gases)
Estonia	2000	2
Finland	1990	62 (liquid transport fuels); 53 (other fossil fuels)
France	2014	44.6
Ireland	2010	20
Latvia	2004	5
The Netherlands	1996	53
Poland	1990	<1
Portugal	2015	12.74
Spain	2014	15
Slovenia	1996	17
Sweden	1991	114
UK	2013	18.67

Source: World Bank, Carbon Pricing Dashboard (2020)

Annex II – Best-Practice Overview

Country	Year of Implementation	Tax Base	Tax Rate	Exemptions	Use of Tax Revenue
Switzerland	2008	CO_2 content of energy carriers; Excludes fossil fuels for transport	CHF 96/tCO_2 (EUR 88/tCO_2)	Available for certain companies, CH ETS emissions are exempt	Reduction in health insurance contributions; Reduced social security contributions for employers; Funding for energy-efficiency and low-emission technology programmes
Sweden	1991	CO_2 content of fossil energy carriers	EUR 114/tCO_2	Exemptions and lower tax rates available for certain companies, EU ETS emissions are exempt	Reduction of income tax and social security contributions; Partial redistribution to industry
Canada - British Columbia	2008	CO_2 content of fossil energy carriers	CAD 40/tCO_2 (EUR 27/tCO_2)	Available for certain sectors including agriculture and in rural areas; companies that meet low carbon intensity benchmarks are also exempt	Revenue is not earmarked for investments or redistributed; Becomes part of tax revenue for British Columbia
Denmark	1992	CO_2 content of fuels and electricity	1-20 EUR/tCO_2 depending on fuel type	Available for certain companies, EU ETS emissions are exempt	Finances energy-efficiency programmes; Reduction of social security contributions
Norway	1991	CO_2 content of fossil energy carriers	24-27 EUR/tCO_2 depending on fuel type	Lower rates available for certain industries, EU ETS emissions are exempt	Reduction of income tax; reduction of supplementary wage costs for employers
The Netherlands	1996	CO_2 content of fossil energy carriers	4 - 53 EUR/tCO_2 depending on fuel type	Available for certain companies; Tax allowances available for gas and electricity, EU ETS emissions are exempt	Reduction of income tax; reduction of supplementary wage costs for employers; increased tax allowances for small companies
France	2014	CO_2 content of fossil energy carriers	EUR 45/tCO_2	Lower tax rates for big companies and subsectors including aviation, freight and agriculture, EU ETS emissions are exempt	Increase employment and competitiveness of companies through funding programme (CICE); Finance energy transition

Source: Adapted from Withana et al (2013)