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Disentangling the Effects of Swiss Energy and Climate Policies

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Abstract

Switzerland is embarking on a new energy strategy by phasing out nuclear power, increasing renewables and energy efficiency as well as meeting its Kyoto target of the Second Commitment Period. We contribute to this new cruise by disentangling the effects of the Swiss economic policies to promote energy efficiency and the use of less CO_2 intensive energy sources. Those policies encompass a CO_2 levy, an emissions trading scheme (ETS), a renewable feed-in tariff as well as some national and international offsetting and target agreements.

The policies target different sectors and are linked in various ways either by exchanging tradable units or by serving as exemption criteria. For example, companies can negotiate target agreements or participate in the Swiss ETS in order to be exempted from the CO_2 levy. Given these interactions, those policies form a world-wide unique instrument-mix in combining a tax, emissions trading, voluntary agreements, subsidies and project-based mechanisms on a national and international level.

Our findings show that this combination of policies leads to inefficiencies. For example, external costs of road-based mobility have been inadequately internalised and emissions abatement efforts are unevenly spread among sectors. They also reveal that, due to the interactions, the emission reductions from each policy are difficult to predict and complex rules are required to avoid double counting. Finally, meeting future targets domestically seems ambitious, when less surplus is carried over from the previous commitment periods, given the low emissions intensity of the Swiss electricity-mix and high efficiency in the industry sector.

1. Introduction

Switzerland is one of the few non-European Union countries which participates in the second Kyoto Commitment Period (2013-2020). It has committed itself to reduce its emissions in 2020 by 20% below 1990 levels. The national legislation requires that this target is achieved by domestic measures only (Swiss Confederation 2013). This seems rather ambitious given that the 8% reduction target under the first Kyoto Commitment Period (2008-2009) was only achieved by making use of a high share of international units and carbon sequestration effects of domestic forests (see Figure 1). The intended, nationally determined, contribution for 2030 is 50% below 1990 levels in 2030 of which 30% have to be achieved domestically (Swiss Confederation 2015). In addition to those climate policy targets, Switzerland's government and parliament decided to phase out nuclear power, possibly until 2034. In order to achieve this transformation, the government adopted the "Energy Strategy 2050" in 2012, laying out a roadmap with medium-term and long-term policy measures (Swiss Federal Council 2013). Thus, in order to achieve both aims, a broad set of policies has been introduced or is in the pipeline.

Since theory predicts that economic instruments are more efficient than others instruments (e.g. regulatory), we will focus in our analysis only on market and price-based instruments, such as taxes, subsidies and trading schemes, which are at present part of the Swiss energy and climate-policy-mix. In case policies have changed over time or inter-temporal connections exist e.g. between the Commitment Periods, former policies are also assessed.

This paper contributes to existing literature in three ways: first, by disentangling the effects of the various energy and climate policies and their complex linkages including inter-temporal effects; secondly, by qualitatively evaluating the efficiency, effectiveness and both the advantages and disadvantages of international links of the closely intertwined policy-mix; thirdly, by detecting empirical research gaps in Swiss energy and climate policy ex-post evaluation.

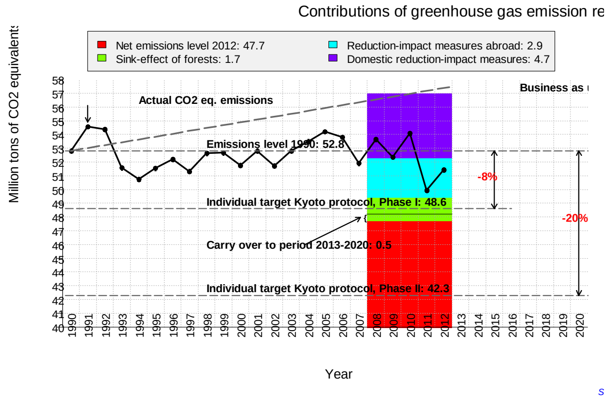
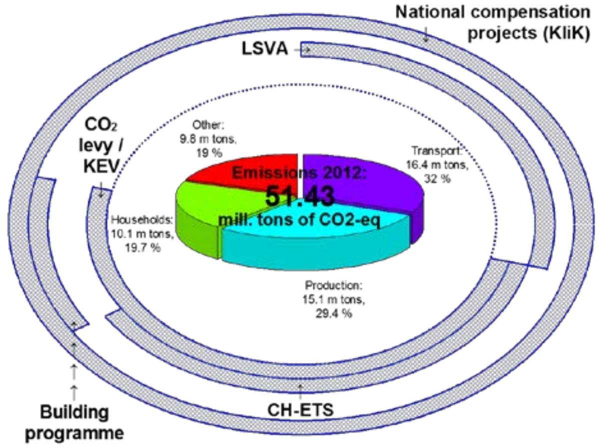


Figure 1. First and Second Swiss Kyoto Commitment Period Targets and Reductions.

The paper is structured as follows: It first describes each policy separately, assigning it to the sector for which it is most relevant. Policies include the CO_2 levy, Swiss emissions trading scheme (CH ETS), the renewable feed-in tariff as well as some domestic and international offsetting and quasi-voluntary target agreements. It then assesses the linkages between the different policies and assesses potential impacts on effectiveness, inefficiencies and cost-benefits of including international linkages. It finishes with suggestions for future improvements and by addressing research gaps.

2. Swiss Energy and Climate Policy

Swiss greenhouse gas emissions in 2012 reached 51.43 million tons of CO_2 equivalent of which 43.24 million tons were direct CO_2 emissions. Figure 2 depicts the share of greenhouse gas emissions by different sectors.



Note: LSVA is a tax on heavy vehicle road transport
Figure 2: Swiss climate and energy policies by targeted sector (Source: Authors)

It shows that the transport sector makes the largest sectorial contribution (32%), followed by the emissions of the production sector, which includes industry and services, and the household sector. Waste and agricultural emissions are included in others. Consistent with the classification in the following subsections, we assign the different policies to one particular sector, usually the main targeted sector for the emissions reductions. However, it has to be mentioned that most of the policies, e.g. the CO_2 levy, may also be relevant for other sectors, e.g. the production sector. Particularly challenging was the assignment of domestic compensation projects and programmes, as they can reduce emissions in any sector. Since those projects and programmes are financed by fossil fuel producers and importers, and managed by a foundation called Climate Protection and Carbon Offset (Klimaschutz und CO_2-Kompensation, KliK), they are reported under the heading of KliK and the transport sector in this paper.

2.1. Household sector

Emissions from heating and cooking in the household sector are subject to the CO_2 levy (see section 2.1.1). Part of the generated revenue is used to finance the buildings programme (see section 2.1.2). Households are also the major target group for the network surcharge to finance the cost-reflective feed-in tariff (see section 2.1.3).

2.1.1. CO_2 levy on heating and process fuels

Since 2008, Switzerland has applied a CO_2 levy on fossil heating and process fuels in order to incentivise a more efficient use of fossil fuels and a fuel switch to carbon-free energy sources. Exemptions apply to companies which are particularly emission intensive and trade- exposed, provided they commit to emission reduction targets (see Section 2.2). The initial rate of the levy was set at CHF 12 per ton of CO_2 and has been increased over the years to CHF 60 per ton of CO_2 at the beginning of 2014. This means that a levy of CHF 0.159 per litre is paid for extra light heating oil and CHF 0.1536 per kg for natural gas (see Table 1). The rate may increase further, depending on the achieved emission level, since the levy is raised if the actual level of CO_2 emissions from heating and process fuels in a year is above the annual target. The maximum level is set at CHF 120 per ton of CO_2 by current legislation but new legislation for the second package, starting in 2021, is under discussion (Baur and Himmel, 2012).

The revenue generated by the CO_2 levy is refunded to households and the production sector in proportion to their respective payments. While households are compensated per capita, the redistribution to firms occurs relative to their social security payments and, thus, constitutes a small element of an environmental tax reform. One third of the proceeds, i.e. around CHF 300 million of totally 900 million per year, is not redistributed but allocated for the building programme (see Section 2.1.2). The programme is partly co-funded out of cantonal budgets and co-managed by the federal government and the cantons.

Most research regarding the CO_2 levy or ecological tax reform use economic models to predict the impact of different tax levels on the Swiss economy. Boehringer and Mueller (2014) use a computable general equilibrium (CGE) model, calibrated to empirical data for Switzerland, in order to quantify the economic impacts of environmental tax reforms. The key findings are that compliance with the CO_2 reduction targets requires high CO_2 taxes on economic activities that are not eligible for international emissions trading. Likewise, electricity consumers are burdened with substantial electricity taxes. Environmental tax reforms are not likely to generate welfare gains without accounting for the benefits of improved environmental quality. The analyses of Kiuila and Rutherford (2013) suggest that the current climate policy in Switzerland will not be able to move the economy towards the required 10% CO_2 reduction. Krysiak and Oberauner (2010) theoretically assess the implications of giving companies the choice of being regulated by either a CO_2 tax or by an emissions trading scheme, taking asymmetric information between regulator and companies as well as uncertainty on actual abatement costs into account. They show that when both instrument types are offered simultaneously, it will never be optimal for all firms to participate in emissions trading but for the tax there exist multiple optimal equilibria. Thus, the usual price-versus quantity criteria do not apply for companies which are indifferent regarding the policy options. To sum up, there seems to be a lack of empirical ex-post evaluation of the CO_2 levy, assessing the effectiveness so far.

Table 1: Swiss CO_2 levy development over time (Source: Swiss Confederation 2013 and own calculations).

	2008	2009	2012	2014	2016	2018
CHF / ton CO_2	12	24	36	60	72-84	96-120
Extra Light heating oil CHF / l	0.0318	0.0636	0.0954	0.159	0.1908	0.2226 - 0.318
Natural Gas CHF / kg	0.03072	0.06144	0.09216	0.1536	0.18432	0.215 - 0.3072

2.1.2. Building programme

Buildings account for around 28% of CO_2 emissions in Switzerland in 2012. This high share of greenhouse gas emissions is due to the fact that most houses are heated with fossil fuels. In order to reduce energy use and CO_2 emissions, refurbishment is promoted through the buildings programme. As mentioned above, it is financed via a share of CO_2 levy revenues (at most CHF 300 million per year) and funds from the cantons. The programme has two components: first, a federal, nationwide programme for the improvement of building shells; secondly, various cantonal programmes for promoting renewable energy, the use of waste heat and the optimisation of energy systems.

In 2013, nearly 10’000 applications for insulation support were granted and the programme is planned to be extended in the Swiss energy strategy. It is considered that by the year 2020, the entire programme will result in a cumulative reduction of up to 2.9 million tons of CO_2 (Swiss Confederation, 2013).

2.1.3. Cost-reflective feed-in tariff (KEV)

Renewable policies are not directly in the focus of this paper. However, given the fact that exemptions for the network surcharge levy which is used to finance the cost-reflective feed-in tariff (called Kostendeckende Einspeisevergütung, KEV) are granted for companies which commit to a target agreement on energy efficiency, a short description of the policy is included in this paper.

The KEV was part of the Energy Act (EnG), which came into force in January 2009 yet allows to support installations built from 2006 onwards. It aims to promote the uptake of both renewable energy and efficient electricity use. It applies to various technologies and the level of the feed-in tariff aims to fund the gap between the cost-covering remuneration and the income from selling electricity. Given the technological progress and higher market penetration over time, it is expected that the fees for new installations will gradually decrease. The following technologies are eligible: hydropower (up to 10 MW), photovoltaics, wind, geothermal, biomass and waste. Technology specific tariffs are listed in Table 2. In order to accelerate their uptake, PV installations of less than 10 kW have since 2014 the option, to receive up to 30% of investment cost upfront instead of feed-in tariffs. Another new feature is that producers of renewable electricity have the explicit right to directly consume it without feeding it into the grid. Deep geothermal investors can receive a risk guarantee.

Table 2: Renewable production and feed-in tariffs in 2013.

Technology	Number of Installations 2013	Total Production hours 2013	Production MWh 2013	Tariff paid 2013 CHF / kWh
Biomass	212	3,025	580,451	0.1947
Photovoltaic (10-30 kW)	6164	797	139,278	0.4691
Wind (2-3 MW)	17	1,734	51,217	0.1887
Small Hydro (<10 MW)	334	4,299	617,927	0.1551
Geothermal*	0	6,000-8,000		0.40
TOTAL	6727	2,570	1,388,874	

**Potential production hours and tariff*
Source: http://www.stiftung-kev.ch/fileadmin/media/kev/kev_download/de/140320_KEV_Bericht_2013_DE.pdf

The KEV is funded through a network surcharge which is capped by law at CHF 0.015 per kWh. In 2014, consumers paid effectively only CHF 0.006 per kWh (CHF 0.005 per kWh for cost-covering remuneration and CHF 0.001 per kWh for water protection measures), but the Federal Council decided to increase the current network surcharge from CHF 0.006 per kWh to CHF 0.011 per kWh on January 1st, 2015.

In 2014, total funds available for feed-in tariffs amounted to CHF 284 million. Given the fact that remuneration is granted for 20 to 25 years, depending on the technology, a high share of the annual income is already committed for accepted renewable investment. In addition, Swissgrid, which is managing the fund, has to bear the uncertainty of the future development of the electricity price since it is financing the gap between the electricity price and the cost-covering remuneration. Therefore, at the end of 2014, waitlisted applications for new renewable electricity facilities amounted to more than 35’000, most of them PV. As mentioned above, exemption from the network surcharge are granted for energy-intensive industries if they commit to both a target agreement on energy efficiency and to investing 20% of the saved network surcharge over 3-5 years into energy efficiency measures which are not economically viable or in the installation of renewables. In 2013, 1'388 GWh of renewable electricity was generated by the KEV, which corresponds to a share of 2.4% of Swiss final electricity consumption. Small hydro amounted to 617 GWh and biomass to 580 GWh, PV generated 139 GWh and wind 51 GWh (see Table 2).

There has been little research published regarding an evaluation of the KEV so far. One study has compared the costs and production potential of renewables in Switzerland and has assessed current investment barriers. Based on the authors’ assessment, the barriers vary by technology: Biomass investments are viewed as risky since it is difficult to ensure the supply of the input and the buyer for the output (heat) in the long run. Roof-top PV is seen to be too small for utilities to invest in. Wind, geothermal and hydro face often regulatory problems, clashes with environmental regulations and acceptance issues (Wenger and Operto 2013). There seems to be a lack of more in-depth empirical ex-post evaluation that assesses the impact of the KEV on electricity prices, the impact on investments in energy efficiency or any possible distributional consequences.

2.2. Production sector

The industry sector can broadly be split up into ETS and Non-ETS companies. Since 2013, ETS participation has been mandatory for certain companies (see Annex 6 of the CO_2 regulation). There is an opt-in provision for other companies if they fulfil certain criteria. In contrast to the European Union, ETS fossil fuel power plants and combined heat and power plants need to compensate their emissions and are currently excluded from the ETS (see Section 2.2.2). For Non-ETS companies, target agreements allow for the refund of the CO_2 levy and the network surcharge to finance the KEV (section 2.2.3). ETS companies may also set an energy efficiency target in order to have the network surcharge refunded.

2.2.1. Swiss Emissions Trading Scheme (CH ETS)

In 2008, in conjunction with the CO_2 levy, Switzerland introduced its first emissions trading scheme (CH ETS). Companies were incentivised to participate voluntarily in the ETS by being exempted from the CO_2 levy. Companies received freely allocated allowances according to agreed emissions reduction targets, which were negotiated on the basis of technological potential of economic viability measures to reduce greenhouse gas emissions within the company (see section 2.2.3). Around 450 companies participated voluntarily in the scheme and accepted emissions targets. As can be seen from Table A1 in the Annex, freely allocated allowances were higher than the obligations based on emissions, which means that the scheme was in total over allocated. Trading volumes have been negligible, apart from the transfers of the surplus to the Climate Cent Foundation (see section 2.3.2).

Since 2013, the rules for the ETS have been aligned with the European Emissions Trading Scheme (EU ETS) with a view to link both systems in the future. Thus, the new scheme is a mandatory scheme which allows for opt-in of companies which want to participate voluntarily. However, no companies have voluntarily opted-in so far, thus, the number of participating companies is much smaller in Phase II. The number of covered installations has been reduced from 450 to around 54 installations or 35 companies in Phase II, but the coverage of emissions has increased by more than 40% from an average of 3.1 million ton CO_2 per year in Phase I to 5.3 million tons CO_2 per year in Phase II (based on allocation). This increase in emissions, in conjunction with a 90% lower number of companies covered, is due to the fact that more emissions intensive companies (e.g. refineries, cement and combustion installations from communes for district heating) have been regulated in Phase II.[1] Given that most of the covered installations belong to sectors with a high risk of leakage, most allowances are still allocated for free. In Phase II harmonized allocation rules apply which are based on the same benchmarks of emissions performance as in the EU. The benchmarks are based on the goods produced (e.g. tons of paper) or on heat. The formula is the following (see also Table 3):

$$Allocation_i = Benchmark \times activity\ rate_i \times adoption\ factor_i \times reduction\ factor_i$$

Table 3: Adoption and reduction factor for Swiss Allocation Formula.

Year	2013	2014	2015	2016	2017	2018	2019	2020
Adoption factor	0.8	0.7286	0.6571	0.5857	0.5143	0.4429	0.3714	0.3
Swiss reduction factor	99.91%	98.55%	97.17%	95.78%	94.38%	92.96%	91.54%	90.09%
EU ETS reduction factor	94.27%	92.64%	90.98%	89.30%	87.61%	85.90%	84.17%	82.44%

The activity rate is either the average of production in 2005–2008 or 2009–2010, depending if a company did already participate in Phase I. The adoption factor does not apply if a company is part of a sector which is defined as high risk of leakage, which is the case for most of the manufacturing companies covered. However, the factor may apply for some of the waste incineration companies or district heating plants. The reduction factor is defined in the CO_2 regulation and ensures that the sum of calculated allocations per company in Switzerland is equal to the cap set for the ETS-sector.

One of the other amendments in Phase II is the introduction of auctioning of unused units of a new entrant reserve. The reserve consists of 5% of the cap (see Table A1 in Annex). The withholding of 5% of allocation results in an average under-allocation of installations of around 2000 tons of CO_2 (see Figure 3). Most of the installations belonging to manufacturing industries are, however, long. Whereas combined heat and power producing installations such as, for example, airport Zurich or refineries, e.g. Tamoil, which has announced to close down in 2015, are under-allocated.

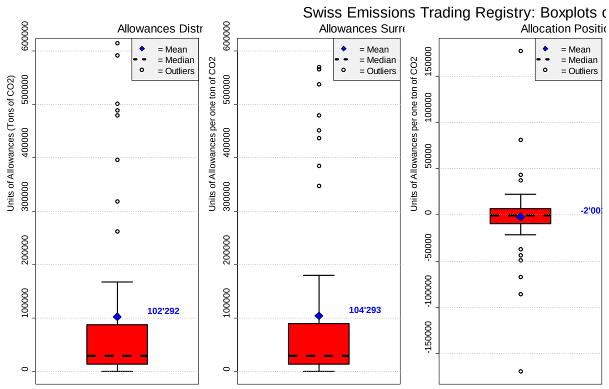


Figure 3: Individual and average allocation position CH ETS Phase II

The overall scarcity of the scheme depends not only on the allocation and emissions in Phase II, but also on two other factors which will have a major impact. First, the carry-over of national CHUs, international units like Certified Emissions Reductions (CERs, see Section 2.3.2) and Emissions Reduction Units (ERUs) from Phase I into Phase II. For international units, rules apply that limit the banking to a level of 6'070'960 CERs and 6'070'960 ERUs (Art. 139 Abs. 3 CO_2-Verordnung).[2] Based on the registry information, the maximum of bankable CHU1 and CERs/ERUs from Phase I is estimated to be around 1.6 million units for installations which were covered in both phases (see Table A1 in Annex). However, most of the installations have made use of the opportunity to sell their surplus from Phase I to the Climate Cent Foundation at a price of CHF 50 per CHU1 (Climate Cent 2013), therefore, it is assumed that most of the surplus has not been transferred into Phase II.

Secondly, the possibility to use additional international emissions reduction units reduces the pressure of national emission cutbacks. Again, limits for international units apply which are determined in Art. 48 (CO_2-

[1] The cement sector has been covered in Phase I by cemsuisse, the Swiss association of cement producing companies, but not all companies and installations were covered, therefore, the mandatory coverage has increased the covered emissions substantially and Holcim became the biggest player in the Swiss ETS.

[2] Based Article 3, paragraph 13 of the Kyoto Protocol there is no banking restriction for Assigned Amount Units and a limit of 2.5% of the assigned amount for CERs and ERUs. RMUs cannot be carried over.

Verordnung) as follows: first, for installations that already participated in Phase I a maximum of 11% of the allocated CHU1 in 2008-2012 can be used for compliance in both phases. Thus, used CERs and ERUs in Phase I have to be subtracted from the total eligible amount in Phase II. Secondly, installations which have only participated since Phase II are allowed to make use of 4, 5 % of their actual greenhouse gas emissions in 2013 to 2020.

In Figure 4, the overall scarcity is estimated, taking both inter-temporal and international flexibility into account. As mentioned above, the banking from Phase I to Phase II may be much lower, given the sales to Climate Cent Foundation. Nevertheless, there seems to be no overall scarcity in the Swiss ETS in Phase II, just by accounting for the potential use of international emissions reduction units.

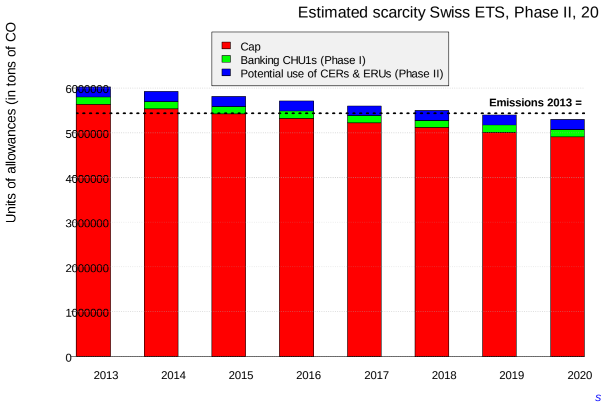


Figure 4: Estimated Scarcity Swiss ETS Phase II

Most research regarding the Swiss ETS estimates the effects of linking with the EU ETS either based on computable general equilibrium models (Voehringer 2012) or by qualitative analysis by Oberauner and Krysiak, (2008). There seems to be a lack of empirical ex-post evaluation of Phase I of the Swiss ETS. This paper has made some first contributions towards this required research area by assessing the over-allocation of units, the use of banking between Phase I and Phase II and the number of units sold to the Climate Cent Foundation. Further research could assess the effectiveness of emissions reductions by estimating a baseline without emissions trading or the functioning of the ETS in terms of efficiency by assessing if companies with low abatement costs did reduce emissions as well as distributional impacts.

2.2.2. Compensation requirements for new Fossil-fuel thermal plants

New fossil fuelled thermal plants will only be approved if 100% of the CO_2 emissions are compensated. Those new plants can use up to 50% international units whereas the other half needs to be domestic offset units. Today only one new, combined cycle gas power plant has been approved in Chavalon, which is expected to emit 750’000 tons of CO_2 annually. This special treatment for new fossil fuel plants has been chosen since the demand of those new plants would distort the Swiss ETS market, given that the new entrant reserve under the emissions trading scheme is, with around 281'643 CHUs, too little to cover such large new investments.

2.2.3. Target agreements

Target agreements which establish a linear reduction path are set between companies and institutions, such as the ministry of environment (BAFU), and are a common element of Swiss climate policy. Their role has changed over time and they have developed from a voluntary approach in early days to a legally binding commitment. We refer to them as “quasi-voluntary” since the choice to participate is up to the company. Once the choice is made, however, the target is legally binding. The incentive to participate is provided by the possibility to apply for an exemption from the CO_2 levy and the surplus charge for the KEV. Different thresholds and preconditions to be eligible for exemptions apply for the different policies.[3] In some Swiss cantons, those target agreements are also used to fulfil requirements on the cantonal level. Large-scale consumers can, for example, choose a universal target which enables them to not having to fulfil the regulations on cantonal level, e.g. maximum of non-renewable energy. In case of non-compliance, the company has to pay either the CO_2 tax including any interest retroactively for the entire period or the network surcharge.

The Energy Agency for Industry (Energieagentur der Wirtschaft, EnAW) and Cleantech Agentur Schweiz ACT are responsible to support companies in developing target agreements. Both assist to formulate specific company-related targets up to 2020 either on the basis of CO_2 emissions or energy efficiency (including electricity) which both can be met through the implementation of economically viable measures.[4] Companies

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[3] In order to be eligible for the CO_2 levy exemption companies have to belong to one of the sectors listed in annex 7 of the revised CO_2 Law and emit 100 tons of CO_2 annually. Companies may apply for a reimbursement of the network surcharge which finance the KEV if electricity costs ≥ 5-10% gross value added and the total reimbursement is ≥ CHF 20’000. For cantonal requirements, large-scale consumers are defined as > 5 GWh of annual heat consumption or > 0.5 GWh electricity consumption.

[4] Two different pay-back periods are used to determine if a project is economically viable: pay-back of 8 years for infrastructure projects and 4 years for all other energy projects.

will be treated according to one of the three models. The first model, which sets the target as a 15% reduction in 2020 compared to 2012, applies if the company participated already in Phase I. The second model of individual targets applies if the company is entering the agreements for the first time. The third model applies for smaller companies which set a list of economically viable measures that need to be implemented. In the first two cases, if companies are performing better than the set reduction path, they are able to sell the surplus of achieved emissions reductions, e.g. to KliK. If they have problems, they may use a limited number of international units to achieve their target (BAFU 2013).

To assist, a comprehensive range of products for practical support such as, for example, an energy-check-up tool and monitoring tools, is provided by EnAW. Energy intensive companies (> 1'500 tons of annual CO_2 emissions) participate in a different programme with an energy expert (called energy model) compared to small and medium-sized companies which do not have an own energy expert and fall below this threshold (called small and medium-sized model). In 2013, around 2'661 companies from a broad range of sectors ranging from service industry to food and animal, obtained target agreements with EnAW (EnAW 2014).

The target agreements up to 2012 were intended to save about up to 15% of energy in ten years. Based on the latest assessment by EnAW, the target was overachieved by 25% (EnAW 2014). The cumulative impact of all measures to reduce greenhouse gas emissions since 2001 was estimated at 1.4 million tons of CO_2 in 2012 and for energy savings at 6'140 GWh, respectively. With the start of the Second Kyoto Commitment Period in 2013, new targets had to be agreed on. Given that companies apply for several exemptions (CO_2 levy, network surcharge and cantonal regulations), a coordination of CO_2 and energy efficiency targets is underway.

We are not aware of any independent evaluation of the target agreements. This seems to be relevant given the potential conflict of interest between EnAW and companies. Assessing the effectiveness of past targets (e.g. which sectors overachieved, which companies underachieved their target and why?) and the efficiency (e.g. how strict were targets set and did they account for different abatement costs?) would be interesting future research topics.

2.3. Transport sector

As mentioned above, the transport sector is completely exempted from the CO_2 levy, which applies only to heating fuels but not to motor fuels. However, road traffic is subject to a series of other charges. Not all of these charges are motivated by energy or climate objectives but they, nevertheless, have an impact on transport behaviour and, therefore, on fossil fuel use and CO_2 emission.

The mineral oil tax on gasoline and diesel is currently CHF 0.7312 (0.4312 plus 0.30 surcharge) and CHF 0.7587 per litre (0.4587 plus 0.30 surcharge), respectively. 50 % of the base tax and 100 % of the surcharge are earmarked to finance traffic outlays, such as road construction and maintenance. In 2013, total revenue amounted to almost CHF five billion which corresponds to eight percent of total tax revenue by the federal government.

In addition, the transport sector is subject to the general value added tax at the rate of eight percent. The value added tax is calculated on the gross price, i.e. including the mineral oil tax and the HVT.

Compared to the existing taxes, the planned surcharge by the petrol and diesel importers of around CHF 0.02 per litre in order to finance the domestic offsets is very small and emphasizes its fiscal character. Assuming a price elasticity of -0.5 a one percent increase of gasoline and diesel prices will yield an almost negligible incentive effect. Therefore, the reductions due to the investments in emissions reduction measures is more important, which will be explained in more detail in section 2.3.2.

Beside these fiscal measures, the transport sector is subject to several other regulations that do not directly have an impact on user prices. The revised CO_2 law restricts the average CO_2 emissions of passenger cars newly put on the market to 130 g CO_2 per kilometre from 2015 onwards. The restriction must be met by each importer or producer of cars. However, importers and producers are allowed to merge their emissions in order to meet the target. In case of non-compliance, a penalty is imposed, which will amount to CHF 142.50 per gram above the target by 2019. To illustrate this, for a car with 200 g CO_2 per kilometre, the penalty would add up to almost CHF 10'000.

2.3.1. Heavy vehicle fee (LSVA)

Since 2001, a performance-related heavy vehicle fee (Leistungsabhängige Schwerverkehrsabgabe, LSVA) has been in power. The objective of the LSVA is to induce a shift of goods transportation from road to rail and, at the same time, to finance infrastructure projects for public transport. The law explicitly states that the tax rate includes, among others, external costs[5]. Thus, the LSVA comes close to a Pigouvian-tax, which is remarkable since most of the market based instruments applied in practice follow a price standard approach.

Depending on the emission performance of the vehicle, the tax rate varies from CHF 0.0205 to 0.031 per ton and kilometre. Note that the taxable base is the maximal possible weight of the vehicle and not the actual weight. For example, a 40 ton vehicle crossing Switzerland from Basel to Chiasso pays a tax between CHF 230 and 350. Yearly revenue add up to CHF 1.5 billion, of which one third goes to the Cantons and two thirds are used federally to support new railway projects.

With little surprise, the determination of the external costs, namely congestion costs, led to a legal dispute between the Swiss Road Transport Association (ASTAG) and the Swiss Directorate General of Customs in charge of collecting the LSVA. The dispute was finally settled by the Swiss Federal Tribunal in 2013.

Lüchinger and Roth (2014) estimate a significant negative effect of around 4-6% for the LSVA, which are in line with the ex-ante elasticity estimates of the Federal Office for Spatial Development in 2007. Most likely the effect is due to a shift of transit traffic to the shortest way through the Alps and a substitution towards rail traffic.

2.3.2. National Compensation Projects (Climate Cent / Climate Protection and Carbon Offset, KliK)

Transport fuels have been exempted from the CO_2 levy from the very beginning. Instead a surcharge is levied on all petrol and diesel imports and the revenue is used to finance offsets in Switzerland and abroad. This arrangement was the outcome of interest groups of the oil importers with the support of other industry groups such as Strasse Schweiz (Swiss road traffic association) (Brönnimann et al. 2014).

The first programme called the "Climate Cent" was voluntary and ran from 2005 – 2013 with a surcharge at a rate of CHF 0.015 per litre of fuel. The implementing entity was the Climate Cent Foundation which had to meet the reduction target of totally 17 million ton CO_2 over the period 2008-2012. It received approximately CHF 100 million per year to invest into mitigation projects. Of the total reductions, at least 2 million tons needed to be offset within Switzerland, either in the transport, the building or the production sector. Up to 15 Million tons CO_2 could be met by international emissions reduction units either Joint Implementation (JI) projects (Article 6 Kyoto Protocol) which are called Emissions Reduction Units (ERUs) or Clean Development Mechanism (CDM) projects (Article 12 Kyoto Protocol) which are called Certified Emissions Reductions (CERs). Instead of planning and financing CDM or JI projects, the Climate Cent Foundation was also able to buy ERUs or CERs directly on the market from third parties.

Since 2014, the Climate Cent has been replaced by an obligation for fossil fuels importers to compensate part of the transport-generated CO_2 emissions (see revised CO_2 Act). Given the new mandatory character of the successor of the Climate Cent Foundation, a new Foundation called Climate Protection and Carbon Offset (Klimaschutz und CO_2-Kompensation, KliK) was created. Importers of petrol, diesel, natural gas and kerosene that exceed the threshold of 1'000 tons of CO_2 are required to offset a share of their emissions which is determined by the Federal Council. This share ranges from 2% in 2014-2015, 5% in 2016-2017, 8% in 2018-2019 up to 10% in 2020 and may reach a maximum of 40% which will result in around 6.5 million tons of CO_2 in total for the period 2013-2020 (around 1.5 million tons CO_2 in 2020). The surcharge rate has tripled but is not allowed to exceed CHF 0.05 per litre of fuel. Apart from the higher rate, KliK is not allowed to be meet its target by using international offsets anymore.

The final report of the Climate Cent Foundation shows that the targets for 2005-2012 were slightly overachieved by around 1.7 million tons of CO_2 equivalent emission reductions, of which around 1.1 million CHU1 were sold to KliK for CHF 53.8 million (KliK 2014). A total of 2.69 million tons CO_2 emission reductions were achieved within Switzerland, more than half stem from the overfullfilments of the target agreements of combustibles in the industry sector. The other half has been achieved by reductions in motor fuels, buildings programmes and industrial heat or waste heat recovery. The highest direct costs occurred in the buildings programme with an average of CHF 838 per ton compared to CHF 93 per ton in the other programmes (Climate Cent Foundation 2014). Around 16 million units were acquired internationally with the vast majority of international credits from CDM projects which were bought via brokers or traders (7.9 million tons of CO_2 equivalent), only 0.5 million tons of CO_2 equivalent were ERUs from JI projects. Around 2.6 million tons of CO_2 equivalent were received due to the participation in the Asia Pacific Carbon Fund of the Asian Development Bank. The shortfall rate was 7.8 % for certificates which were directly purchased from project developers and 0% for traders. With regard to the quality of the international credits, the Climate Cent Foundation excluded certificates stemming from e.g.

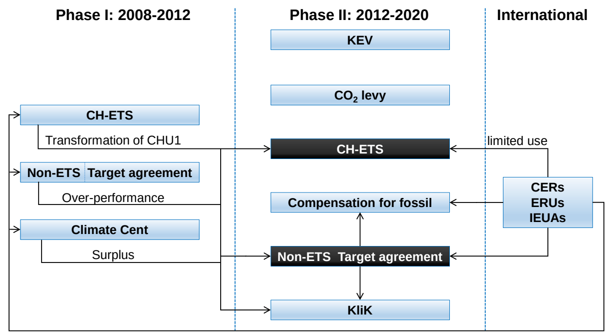
[5] The law explicitly states that the proceeds of the LSVA must not exceed road infrastructure and external cost (Schwerverkehrsabgabegesetz, Art. 7).

carbon sinks, large hydro and industrial gases projects. However, the targeted amount of Gold Standard labelled certificates had not been achieved, given a lack of supply.

The costs for the international units with direct costs of CHF 15 per ton was substantially lower compared to Swiss emissions reductions which ranged from 93 to 838 CHF per ton (Climate Cent Foundation 2014). However, what needs to be taken into account is that the domestic programmes will generally deliver emission reductions beyond the commitment period of the Foundation. As Kunz and Muller 2010 show in their assessment, given the short contract time project developers accounted for those costs were put in relation to the shorter timeframe which made the projects more costly. In particular the projects under the building programme were sensitive to this calculatory cut-off given their high upfront fixed costs (e.g. wall insulation or efficient windows). This artificial effect has a negative impact on the overall efficiency of the Climate Cent investments, since projects that may have lower life-time costs may not have received funding, whereas those with higher life-time costs but lower costs within the commitment period were supported. Another critique which leads to inefficiencies is that the Climate Cent Foundation mainly assesses their funding on a type or programme basis, comparing average costs rather than developing a marginal abatement costs curve for any type of possible reduction project. Finally, it seems that proving additionality of the projects was sometimes challenging, especially when the effect of other policies had to be delimited e.g. in the Eco-Drive programme (Climate Cent Foundation 2014).

Up to now, research regarding the domestic offsets and exemptions of transportation fuels from the CO_2 levy has been twofold. First, based on a static computable general equilibrium model, Imhof 2012 examines the efficiency losses and distribution impacts of the exemptions of the transport sector from the CO_2 levy. Secondly, as mentioned above, an early empirical analysis of the Climate Cent Foundation was undertaken by Kunz and Mueller in 2010. However, there seems to be a lack of an empirical ex-post evaluation of the entire Phase I.

3. Economic assessment of Swiss Policy Mix



Note: Policies which can be used to be exempted from KEV and / or CO_2 levy are highlighted in white font in black boxes.

Figure 5: Disentangling the inter-temporal linkages of policies and unit flows

After describing the economic policies separately, this section aims at putting those pieces of the jigsaw together on order to detect interdependencies and inter-temporal effects. As Figure 5 depicts, surplus accumulation of CHUs as well as the use of international credits in Phase I has several impacts on Phase II: First, it has direct impacts on scarcity in Phase II of CH ETS and on KliK. Secondly, it has indirect impacts on the compensation of new fossil plants and on the target agreements since they allow for the use of international credits and are linked through KliK. In the following sections, effects of the mix of instruments on effectiveness, efficiency as well as advantages and disadvantages of international links are assessed.

3.1. Effectiveness

The criteria effectiveness assesses the ability of achieving the given emissions reduction target, here the 20% reduction in 2020 compared to 1990 within Switzerland. Assuming mechanisms are in place to ensure compliance at each individual policy level, effectiveness of the policy mix can be determined by assessing the expected emission reductions for each policy, taking policy overlaps into account. The most important elements to determine effectiveness are the actual emissions reduction contributions within Switzerland, potential leakage effects[6] and the quality of offsets[7]. The aim of this paper is, however, not to quantitatively assess the effectiveness but rather to describe the interaction between the different policies which may make it more

[6] Leakage-shifts of production and emissions to other countries can compromise the effectiveness of any instrument and even increase emissions globally, thus, negatively impact effectiveness.

[7] Non-additional offset projects (meaning those that would have occurred in a business-as-usual scenario without the offset scheme or via the incentive of other policies) will lead, through the link to e.g. new fossil fuel plants, to an actual increase in domestic emissions as new plants will be allowed to emit more using those credits.

challenging in achieving the domestic reduction target. This is a necessary first step before future research can be undertaken in quantifying the overall effectiveness.

Two aspects are important to understanding the interaction between the various policies and to detect potential overlaps and double counting: First, the inter-temporal link between Phase I and Phase II through banking, which illustrates the overlaps of periods and instruments between periods (see Figure 5). Secondly, there is the challenge of quantifying additional emissions reductions of domestic offsets when policies overlap.

Taking the surrendered CERs and ERUs in Phase I into account, a surplus of 3'615'655 CHUs was accumulated (Table A1 in Annex) at the end of Phase I and different options were offered to companies: First, they were able to either bank those units if they participated in Phase II of the ETS (around 0.9 Million CHU's). Secondly, in case they stayed under the target agreement, they were able to use them for achieving the targets for Phase II. Thirdly, they were able to sell those surplus units to the Climate Cent Foundation which in turn was selling its surplus to KliK at CHF 58 per unit (Climate Cent Foundation 2014). Based on the Swiss National Communication (Swiss Confederation 2013), the banking of companies into the second commitment period is only around 0.4 to 0.6 million units. Given those wide ranging figures, it is unclear how much of the achieved surplus in the First Commitment Period is actually transferred into Second Commitment Period. Nevertheless, it shows that achieving the target in the Second Commitment Period 2013-2020 will be easier given the substantial inter-temporal transfers. However, achieving those reductions domestically (domestic target) will be more challenging. It also shows that the quality of negotiated target agreements and the additionality requirements for domestic offsets under Phase I have impacted, through the carry-over provision, on the ease of achieving the Phase II target. As mentioned before, there seems to be a lack of independent evaluation of the negotiated agreements programme. The overachievement of the targets of 25% reported by EnAW may be an indicator that some economically feasible potential was not taken into account when setting the targets or that economic growth was lower than expected. It may also reflect a lack of political ambition in setting targets.

With regard to the quality of offsets, two different elements have to be assessed: firstly, the additionality of domestic projects which includes investment as well as emissions additionality. Secondly, potential double counting of emissions reductions, especially if more than one policy has been applied, needs to be looked into. Figure 6 shows how additionality is determined if other policies need to be taken into account. To ensure that no double counting of emission reductions occurs, when a domestic compensation project receives money from different programmes (e.g. an energy efficiency project which got subsidies by the Cantonal Building Programme), the Ministry of Environment has developed three different methods. The first method tries to disentangle the impact of each policy similar to Figure 6 in order to quantify the additional emissions which allow for the creating of domestic offset credits. This means they differentiate each emissions level which would have been achieved by climate and / or energy policy, respectively in order to calculate the number of certificates to be issued. Two other methods apply if it is not possible to disentangle the impacts of each policy separately: the second method is to share emissions reductions equally on a cost basis among the stakeholders (e.g. by subsidies level) or the third method is that stakeholders agree on a different split of the emissions reductions (BAFU 2015).

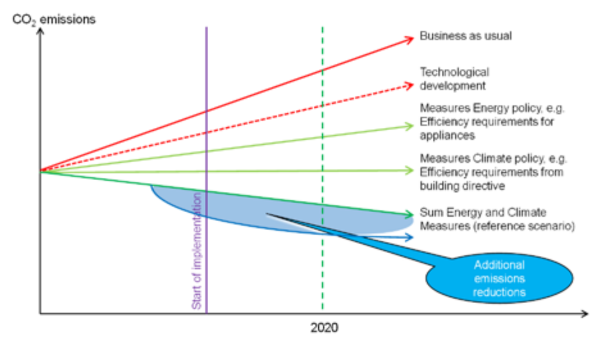


Figure 6: Accounting for investment / emissions additionality and policy overlap (Source: BAFU 2013)

All methods seem to be complicated and will need consensus of different institutions. Which of those approaches are mainly used could be an interesting future research project. However, the complexity involved in administrative costs of allowing multiple instruments to target the same reduction opportunity may be higher than the benefits and, therefore, policy makers may want to go back to a world in which one single policy can be applied for one emissions reduction (e.g. either building programme or generation of domestic offsets).

3.2. Inefficiencies

An equal price for CO_2 emissions across all sectors is a necessary condition for an efficient reduction of CO_2 emissions. Ideally, this yields equal marginal abatement cost across all emitters and, therefore, minimal total cost. It is, however, not a sufficient condition because a cost minimizing reaction on price signals is not always guaranteed. It is quite obvious that the current policy scheme in Switzerland does not fulfil the necessary condition. There are several measures with different explicit or implicit CO_2 prices. Also, these measures are not or only poorly interconnected so that an alignment of prices is hindered. Table 4 gives an overview of the current CO_2 prices as well as the estimated abatement costs of the Swiss policy-mix.

As mentioned before, the CO_2 levy currently is set at CHF 60 per ton and, if needed, can be raised up the CHF 120. The subsidies paid to the national building refurbishment programme triggered investments with average abatement costs of CHF 126 per ton CO_2 for insulation and CHF 185 for renewable energy projects.

For the Swiss ETS, prices are available for the last three auctions. The price steadily decreased from CHF 40.25 in the May auction 2014 to CHF 20 in the November auction and to CHF 12 in the latest auction dating from January 2015. These prices display an upper limit of expected abatement costs of firms regulated within the ETS scheme. The foundation KliK offers non-ETS firms with a target agreement to buy their certificates at a price of CHF 100 per ton CO_2 reduced. Note again that these firms can sell the emissions reductions that go beyond 95 % of their individual target to KliK but not to ETS companies. Thus, the upper limit of abatement costs at CHF 100 for non-ETS firms is substantially higher than those for ETS participants. In the transportation sector, KliK collects a fee that amounts to approximately CHF 0.015 per litre which translates into CHF 6.25 per ton CO_2. The revenue then is used to finance programmes with average abatement costs of CHF 58 to 168 per ton CO2 (KliK Jahresbericht 2013). Finally, the heavy vehicle fee is calculated on the basis of external cost estimates (Ecoplan and Infras 2014). These estimates explicitly include climate cost at the rate of CHF 93 per ton CO_2.

Table 4: Prices and abatement costs per ton of CO_2.

	Price CHF / ton CO_2	Costs CHF / ton CO_2
CO_2 levy	60 (Maximum: 120)	-
Building programme (Konferenz kantonaler Energiedirektoren)	-	126, 185
CH ETS (http://www.bafu.admin.ch/emissionshandel/05545/12435/index.html?lang=de)	12, 20, 40.25	
Target agreements: CO_2 exemption from CO_2 levy for non-ETS companies (KliK Jahresbericht 2013)	-	100
Obligation for compensation for transport fossil fuel importers KliK (KliK Jahresbericht 2013)	6.25 (Max: 20.8)	58 – 168 (Mean: 109)
Heavy vehicle fee	93	-

Table 4 shows that range of prices and cost per unit CO_2 is substantial. Low prices and, thus, low abatement cost apply to private passenger transport which is only subject to a small fee as well as to firms within the ETS scheme. On the other side of the spectrum, the national building refurbishment programme supports renewable energy projects with average abatement costs of CHF 185 per ton CO_2. Our findings are supported by other researchers such as Sceia et al. (2012) who use a Computable General Equilibrium and two sectorial energy models to evaluate the current policy-mix. They find higher welfare costs due to disparities in the prices and compared to a scenario using a uniform carbon tax. Likewise Wölfl and Sicari (2012) suggest applying the same implicit carbon price within and across broad sectors in order to achieve the targets more efficiently. They also suggest to switch from "quasi-voluntary" measures towards more effective price-based instruments.

While the special arrangement with energy- and export-intensive companies can be justified by international competitiveness and possible carbon leakage, the exemption of motor fuels from the CO_2 tax seems mainly politically motivated. The original CO_2 legislation in Switzerland foresaw a tax on motor fuels in case of non-compliance with the targets of the first Kyoto Commitment Period. In the revised CO_2 law, however, the tax applies to burning fuels only. The political process leading up to these exemptions showed that the Swiss Oil Association, with the support of automobile associations, was successful in imposing only a very small price increase to be passed on to their consumers in order to obtain the funds to buy offsets mainly from other sectors. The different policies have also different distributional impacts: For example, the revenues of the CO_2 tax are mainly recycled to industry and households whereas the offset arrangement are not (Thalmann and Baranzini, 2007).

Unfortunately, even when taking such distributional or political aspects into account, the existing policy-mix, with a trading scheme for energy- and export-intensive firms and a CO_2 tax for households, is far from second-best. A better trade-off between efficiency and political feasibility still requires a uniform price for CO_2 emissions. Distributional objectives, on the other hand, can be achieved by the initial endowment of emission rights or the redistribution of revenues from market based instruments.[8] Neither are administrative costs a convincing argument for a different regulation of emissions from the household sector and the production sector. There is no obvious reason why in one sector a tax and in another sector an emission rights scheme should entail more or less administrative costs.

[8] For a proposal to reap a weak double dividend with little political opposition, see Felder and Schleiniger (2002).

3.3. International versus domestic reduction

In contrast to the policy until 2012, the Swiss climate and energy policy until 2020 aims to reduce greenhouse gas emissions for the most part domestically. However, greenhouse gases such as CO_2 emissions have a global impact which is completely independent from its emission location. Therefore, as long as greenhouse gas emissions are considered by themselves, a global policy approach is paramount. The efficiency criterion requires that emissions are reduced where its cost are lowest globally.

So much for theory. The political reality, on the other hand, is that the implementation of a comprehensive global climate policy seems to be an almost insurmountable task. As a consequence, regional initiatives led to international cooperation among selected countries, whereby the European ETS is by far the widest-reaching. For Switzerland, an alignment with the EU ETS has been discussed for quite a long time. At present, its realisation seems to be in a deadlock due to other bilateral problems between Switzerland and the EU which have to be solved first.

Beside the efficiency argument for international cooperation in tackling the climate problem, there are two counterarguments that may be in favour of a unilateral policy. The first argument is based on a possible double dividend and, the second, on local external costs.

Firstly, the double dividend theory states that “the revenue neutral substitution of the environmental tax for typical or representative distortionary taxes involves a zero or negative gross cost” (Goulder 1994, p. XX). If the double dividend holds an environmental tax reform that substitutes environmental for existing taxes such as income taxes would be beneficial even without considering environmental impacts. In this case, the fact that the environmental impacts occur abroad does not speak against a unilateral policy since the benefit of a less distorting tax system still accrues domestically. However, Bovenberg and De Mooij (1994) showed that increasing the tax on environmentally harmful activities “typically exacerbate, rather than alleviate, pre-existing tax distortions – even if revenues are employed to cut pre-existing tax distortions” (p. XX). This is due to a higher consumer price for dirty goods which lowers the real after tax wage. The lesson learnt from this discussion is rather simple: As long as taxing labour-income is second-best, a substitution of a narrow-based consumption tax on dirty goods for a broad-based labour tax cannot yield a double dividend. Thus, in general, an environmental tax cannot reduce the purely fiscal distortion of the domestic tax system and must be motivated by external environmental cost. De Mooij (2000) expresses the conclusion rather bluntly: “The double dividend is dead, long live the first dividend”.

According to the second argument, the burning of fossil fuels does not only causes CO_2 emissions and, thus, contributes to global warming but, at the same time, produces a variety of air pollutants, such as particulate matter or nitrogen oxide. In contrast to global warming, air pollution is more of a local or regional problem which can be dealt with on a national level. Therefore, even a unilateral policy to reduce CO_2 emissions can yield a net benefit domestically as long as the improvement of local air quality due to less consumption of fossil fuels is strong enough.

Ideally, the consideration of both, local and global externalities due to fossil fuel use, comprises two distinct instruments. The first instrument can be implemented unilaterally and aims to internalize domestic externalities. The domestic scheme can be adjusted to take into account the differing external cost. For example, a different tax rate might apply for burning fuels and for motor fuels. The second instrument, on the other hand, attempts to exclusively reduce greenhouse gas emissions on an international level. Here, a co-ordination or even a merger of the Swiss climate policy with the EU policy is sensible.

4. Summary and Conclusions

The present paper describes and economically assesses the current Swiss energy and climate policy. Its focus is on market based instruments since these measures are – at least in theory – efficient and are planned to take an ever increasing share in the Swiss policy-mix. It is a typical characteristic of the Swiss policy that different market based instruments are applied to various sectors with little or no connection. The CO_2 tax which is levied on burning fuels aims mainly at the household sector. Large energy-intensive enterprises are exempted from the CO_2 tax and take part in the Swiss emissions trading scheme. Smaller energy-intensive firms, on the other hand, are also exempted from the tax but do not participate in the ETS. They are, however, subject to an individual emission target. Finally, in the transport sector a small charge between CHF 0.01 and 0.02 per litre is levied whose proceeds are used to finance projects to reduce CO_2 emissions domestically. Additionally, for heavy road traffic, a very specific performance related fee, the LSVA, serves to internalize local and global external cost.

While the effectiveness of the policy-mix crucially depends on the stringency of the set targets and the height of the tax rates, there are further aspects that need to be considered when assessing the emission reduction potential of the instrument-mix in power. First and foremost, there is the additionality problem which requires the quantitative determination of a hypothetical situation without policy measures. The problem is well-known and heatedly debated with respect to flexible mechanisms of the Kyoto Protocol and applies in equal measure to national policies in case they need to add up to specific emission reduction. In addition, the inter-temporal linkages increase the difficulty for Switzerland to achieve its national 2020 target which is according to national legislation, and in contrast to the international commitment, to be achieved by domestic measures only.

With the rather complex scheme of policy measures in Switzerland, special attention needs to be given to the danger of double counting. The effectiveness of each measure must not be evaluated stand-alone but within a given sequence of all the measures. This paper has described the interaction between the different policies, therefore, a quantitative assessment of the effectiveness of the mix would be a task for future research. With respect to efficiency, it is little surprising that the Swiss policy-mix with its wide array of independent measures hardly attains a cost minimizing reduction of domestic CO_2 emissions. Our analysis shows that abatement costs between different emissions sources vary from CHF 6 to CHF 186 per ton CO_2 with the lowest price incentives to reduce emissions for the given fleet of passenger cars. While administrative costs will make it impossible or at least too expensive to perfectly equalise marginal abatement cost across all emitters, the current policy scheme seems to have potential for substantial efficiency gains.

Given the political opposition against a comprehensive CO_2 policy across all emitters, a future differentiation should not focus on the price but on the endowment of emissions rights or the redistribution of public revenues. This can include grandfathering emission rights or, in case of a CO_2 tax on motor fuels, the simultaneous reduction of automobile taxes that are not performance related. Such amendments allow taking account of political aspects without scarifying efficiency. In fact, the Swiss climate policy encompasses – with the notable exception of international aviation – almost all emitters. Therefore, a more efficient scheme does not require the inclusion of hitherto unregulated groups but rather a more coherent approach to the already regulated sectors.

The literature review seems to suggest that there are a number of studies published using economic models to estimate impacts of different policies ex-ante. However, a gap has been identified for empirical ex-post analysis of some policies, namely the CO_2 levy, CH ETS, the offset schemes and target agreements.

Also, a conceptual separation of local and global external cost has not been considered yet. Although the federal administration comprehensively assesses external costs, the existing instruments do not tackle local and global objectives separately. It is still an open question how a policy-mix that distinguishes local and global objectives and at the same time takes domestic and international political restrictions into account could look like.

Since the new energy and climate policy in Switzerland will not come into power before 2020, there is now potential for future research in this area which will be valuable in order to develop the long-term policies and measures under the Swiss Energy Strategy 2050.

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Annex

Table A1: Phase I allocation and banking.

Usually refers to CHUs	2008	2009	2010	2011	2012	Total Phase I	2013
Total free Allocation	3'259'764	3'309'016	3'337'581	3'162'554	3'454'474	**16'523'389**	5'356'061
Total Auctioning	0	0	0	0	0	**0**	281'643
Total Obligation	2'783'715	2'571'092	2'844'033	2'671'779	2'592'567	**13'463'186**	5'429'951
Overallocation	476'049	737'924	493'548	490'775	861'907	**3'060'203**	202'913
% Total Allocation	15%	22%	15%	16%	25%	**19%**	4%
Total Surrendered CHU1	2'787'942	2'572'990	2'833'520	2'701'072	2'126'128	**13'021'652**	28'636
Total Surrendered CHU2							4'175'922
Total Surrendered CERs	1'292	2'850	2'682	19'809	459'140	**485'773**	1'219'781
Total Surrendered ERUs	0	0	0	0	69'679	**69'679**	0
Total Overallocation	477'341	740'774	496'230	510'584	1'321'047	**3'615'655**	1'422'694
% of Total Allocation	15%	22%	15%	16%	38%	**22%**	25%
Total Overallocation by Phase II companies	181'875	305'919	182'594	186'680	538'133	1'361'124	
Total Use CERs & ERUs	0	0	0	7'600	253'706	**261'306**	
Total potential banking by Phase II companies	**147'798**	**192'628**	**85'121**	**16'183**	**463'205**	**904'935**	

Note: No banking for Cimex the cement association is assumed which took part for example for Holcim.

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