Environmental Ambitions Meet Industry Protection

The Swedish Approach to Energy Taxation

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2023

Document Version:
Publisher's PDF, also known as Version of record

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IMES/EESS Rapport 131

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LUND UNIVERSITY
Environmental and Energy Systems Studies
P.O Box 118
SE-221 00 Lund, Sverige
Telephone: int+46 46-222 86 38
Telefax: int+46 46-222 86 44

Dokumentnamn/Type of document Report

Utgivningsdatum/Date of issue 2023-10-01

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Dokumenttitel och undertitel/Title and subtitle
Environmental Ambitions Meet Industry Protection: The Swedish Approach to Energy Taxation.

Abstrakt/Abstract
Since the 1990s, economic policy instruments have become increasingly important to Swedish climate policy. To understand the characteristics of current systems, this paper presents an analysis of the development of economic policy instruments since the 1950s, with a focus on Swedish industry. Since the introduction of energy taxation, industry has received preferential treatment in the interests of protecting competitiveness. Path dependency, as well as concerns regarding competitiveness, have hampered major reforms necessary to make the system more feasible for CO_2 mitigation. Although this was less critical while climate policy goals were relatively modest, as the level of ambition grew it became more problematic. To this end, complementary instruments have been proposed and to a certain extent, implemented.

Nyckelord/Keywords
Carbon pricing, carbon tax, path dependency, industry, Sweden

Omfång/Number of pages 35

Språk/Language English

ISRN ISRN LUTFD2/TFEM-- 23/3122--SE + (1-35)
ISSN 1102-3651
ISBN 978-91-86961-57-2

Intern institutionsbeteckning/Department classification
IMES/EESS Rapport No. 131
Lund 2023

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Preface

This report has been developed within the research project "The politics of economic policy instruments- between idea and practice" (No 48456–1) funded by the Swedish Energy Agency. The purpose of the project was to increase the understanding of the conditions for implementing an effective policy design and how these are affected by the institutional, political, and social context.

The aim of this study was to contribute to this understanding by studying the historic development of energy taxation in the Swedish industrial sector. The fact the policies often develop through policy pathways motivates such a historical perspective.

Bengt Johansson

Jamil Khan

Summary

Since the 1990s, economic policy instruments have become increasingly important to Swedish climate policy. To understand the characteristics of current systems, this paper presents an analysis of the development of economic policy instruments since the 1950s, with a focus on Swedish industry. Since the introduction of energy taxation, industry has received preferential treatment in the interests of protecting competitiveness. Path dependency, as well as concerns regarding competitiveness, have hampered major reforms necessary to make the system more feasible for CO_2 mitigation. Although this was less critical while climate policy goals were relatively modest, as the level of ambition grew it became more problematic. To this end, complementary instruments have been proposed and to a certain extent, implemented.

This study illustrates the long history of energy and environmental taxation in Sweden and how important concerns about industrial competitiveness have been when designing energy and climate policies. It has also shown that the introduction of carbon pricing was not a radical policy shift but rather an adaptation of the existing system to new circumstances. The development could thus be seen as an example of policy path dependency.

1 Introduction

Carbon pricing has grown in importance over recent decades and, by 2021, 64 different systems had been implemented globally covering approximately 23% of global greenhouse gas emissions [1]. Although carbon pricing is generally recognised as an efficient instrument, its efficacy and cost effectiveness is dependent on the design of the system (see e.g. [2]). Efficacy and cost-effectiveness are, for example, positively affected by high stringency, broad coverage and uniformity, while deviations from the ideal are often motivated by a need to take other policy goals, such as industrial competitiveness or a fair distribution of economic resources, into consideration. This may also be the result of historical lock-ins and the influence of powerful stakeholders.

Influential business interests have had a negative impact on carbon pricing [2] through effectively lobbying politicians, as has a broader political interest in protecting industry in the pursuit of economic growth and high employment. As a result, various forms of differentiation and exemption are widespread [2]. While this preferential treatment of industry was deemed relatively unproblematic while climate policy goals remained modest, given our current understanding of the need for major and rapid reductions in greenhouse gas emissions, significant mitigation in the industrial sector can no longer be avoided. However, as long as different nations pursue their mitigation ambitions at their own varying paces, politicians in ambitious countries are faced with the dilemma how to implement potentially cost-effective instruments such as carbon pricing while maintaining the competitiveness of their industries (cf., inter alios, [3, 4]). Managing this dilemma would require cleverly designed pricing systems in combination with other instruments such as environmental regulation that encompasses environmental permits, voluntary agreements, support for technological development or a carbon border adjustment mechanism (cf., inter alios, [5])

Over recent years, several authors have proposed ideas on a green industrial policy with the dual goals of supporting industrial development and facilitating the decarbonisation of industry. Nilsson et al. [4] for example, argue for a more comprehensive green industrial policy that includes clear roadmaps and goals, policies for knowledge-creation and innovation, the creation and reshaping of markets, and a plan for phasing out fossil fuels. International coherence will be important, and attention must be paid to the socioeconomic implications of decarbonisation. Busch et al. [6] offer similar arguments, including an emphasis on renewables, the circular economy and green financing. Bataille [7] emphasises

the need to combine increasingly ambitious carbon pricing policies with complementary policies and measures. Discussing climate policies and decarbonisation in general, both van den Bergh et al. [8] and Tvinnereim and Mehling [9] conclude that a successful policy mix must necessarily include both carbon pricing and other policies that foster innovation and long-term change.

There are several structural conditions that present challenges to substantially reducing greenhouse gas emissions in the industrial sector, particularly when it comes to the energy and emission intensive industries (EEIIs) that are responsible for a large proportion of total emissions [10]. The large energy demands of EEIIs, often met by fossil fuels, contribute significantly to production costs, while some sectors such as steel and cement also contribute significant process emissions. Most EEIIs are capital intensive with long investment cycles. Major investments in new technology are few and far between, highly expensive and fraught with risk and in between these major investments technological advance is mainly incremental. Many EEIIs operate on global markets and are sensitive to international competition and fluctuations in global demand and prices.

Techno-economic lock-ins in existing infrastructure and political lock-ins in institutional structures can lead to path dependence in policymaking, thus narrowing the range of options deemed to be feasible [11,12, 13]. Strong lobbies clinging to the benefits of the status quo, ideational limitations to what is seen as viable and institutional attachments to certain policies all limit the opportunities for progressive policy reform. That said, change still occurs, sometimes driven by crises or sudden windows of opportunity. Levin et al. [14] emphasise the often neglected "progressive incremental" type of policy change, representing situations in which a series of incremental steps over time accumulate and lead to changes of an increasingly progressive nature.

In order to better understand future freedom to design policies, and to place proposed policy reforms in context, it is of interest to study the development of policy instruments from a historical perspective. Carbon pricing in Sweden is an interesting case in point. Today, the nominal price for carbon in Sweden is among the highest in the world [1], although this is combined with significant variations among consumer groups and uses. Sweden has a long history of broad energy taxation dating back to the 1950s, while at the same time having several significant EIIIs with historically close relationships to the state [10].

In this paper, we study how Swedish industry has been treated in national energy and carbon tax systems and the EU Emissions Trading System (EU ETS) since the beginning of the 1950s, and how this has impacted efficacy and cost effectiveness. Our interest is in long-term trends in the development of pricing as a policy instrument, and how current policymaking can be informed by past experiences. The main research questions in this study are:

- How has the dilemma of using taxation for certain aims (fiscal income, energy policy, environmental policy) and the need for industrial protection been treated historically?
- Which exemptions have been used and how have they been justified?
- What effects have these exemptions had on the efficacy of policies in terms of incentivising change?
- How have taxation and other carbon pricing instruments been combined with other policy initiatives to reduce goal conflict between mitigation and competitiveness?

The paper is structured as follows: Section 2 presents a brief overview of the role of industry in Swedish environmental policy; Section 3 presents the method, material, and analytical framework; Section 4 examines the use of energy taxes and carbon pricing in Sweden between 1950 and 2020; Section 5 offers an in-depth analysis highlighting some important characteristics of the Swedish developments found in the material; and in Section 6, the key findings are presented.

2 Industry in Swedish environmental policy: A brief overview

While Sweden has often been described as a pioneer in environmental policy [16, 17 18], the country's implementation of environmental policy for industry has been characterised by the dual goals of protecting industry and reducing its environmental impact (10, 17]. The strategic economic importance of the industrial sector, particularly EEIIs, granted it a special status in the Swedish welfare model, which is characterised by cooperation and dialogue between state, industry, and the trade unions [10, 18, 19]. As this status as welfare bearer and job provider has diminished over time, so the sector has increasingly become only one of many interests to be taken into consideration when shaping policy [19]. Nevertheless, over the past decade the important role of EEIIs in the green transition has been articulated.

The privileged position of industry made it a priority for policymakers to provide industry with cheap electricity and low energy taxes. The conditions for this changed in the 1990s, when deregulation opened up the electricity market nationally and regionally. Still, policy instruments such as renewable certificate obligations and electricity taxes were designed to keep industry's electricity bills as low as possible within the constraints of EU market regulation. Industry in general has also remained a strong lobbyer for nuclear power, one of the key controversies in Swedish energy policy since the 1970s [20].

Although industrial emissions to air and water have been regulated for more than a century, more comprehensive environmental legislation was not introduced until the end of the 1960s. Many important point source emissions have been successfully mitigated by this regulatory model, including through environmental licensing. The licensing system has been based on iterative improvements in close interaction between industry and public authorities [21, 22]. Söderholm et al. [22] argue that regulation-driven green transition has benefitted from trust-based bargaining processes in which companies are involved in repeated interactions with regulatory authorities and where extended probation periods have allowed the testing of novel technologies. Knowledge sharing and substantive research, development and demonstration (RD&D), with significant economic resources provided by the state, have also been an important driver of change [23]. While in some sectors, such as the paper and pulp industry, CO_2 emissions have decreased significantly [24], progress in other sectors has

been modest. Other instruments such as taxes, emission fees and voluntary agreements have been gradually introduced to complement statutory requirements.

As climate change began its rise up the Swedish policy agenda at the beginning of the 1990s, ambitions were still fairly modest, and requirements placed on industry even more so. The first climate target, introduced in 1988, was that by 2010 emissions of carbon dioxide should have been stabilised at the 1990 level, and industry was expected to do no more than to continue its efforts to conserve energy that had been in place since the oil crises in the 1970s. With the signing of the Kyoto Protocol in 1997, Swedish ambitions increased to a 4% reduction in greenhouse gas emissions from 1990 levels by 2012, although even then very little effort was expected from industry [25]. Emission reduction efforts were focused on other sectors such as domestic heating and transport, while industry was largely exempt. With the introduction of the EU ETS, most Swedish industrial CO_2 was included in the EU system. Swedish national climate targets now only covered the sectors that were not included in the EU ETS, such as transport, agriculture and domestic boilers. Consequently, the focus on industrial emissions was limited in the 2009 Governmental Bill [26].

At the beginning of the 2010s, a more ambitious long-term approach was adopted in low-carbon roadmaps in both the EU and Sweden, with the aim of near-zero emissions [27, 28]. Despite this, there were still very few robust initiatives for most of Swedish industry. This changed in 2016, when the Cross-Party Committee on Environmental Objectives presented a proposal for a new climate strategy with a far greater emphasis on the need to decarbonise the industrial sector. This came as something of an eye-opener for industry stakeholders (cf., inter alios, [10] for whom the writing was now on the wall: they could no longer remain on the sidelines of the green transition. The Fossil Free Sweden initiative was subsequently launched to promote public-private partnerships to develop roadmaps for the fossil-free competitiveness of Swedish industries. There was now widespread recognition of the need to develop and implement zero-carbon technologies, and the opportunities these presented. Proposals were made for the division of responsibilities between the government and industry, although it was stressed that this was to be achieved while preserving the competitiveness of Swedish industry [29].

3 Method and material

In this paper, we analyse how industry has been treated by the Swedish energy taxation system over time (including an overview of the EU ETS) and how this interrelates with the stated purpose of the tax, existing environmental ambitions, and other contextual factors. We investigate how the energy tax system has changed since the 1950s, the context in which these changes have taken place and how they relate to the priorities and governing principles during the different periods. This is intended to increase knowledge about how policies evolve over time influenced by the historical, geographical and political context. The analysis is broadly divided into the following four approximate periods: 1950–1970, 1970–2000, 2000–2010, and 2010 onwards. For each period, an analytical framework has been applied consisting of the following elements:

- Motivation for energy tax reforms.
- Climate policy ambitions in society.
- Arguments justifying the preferential treatment of industry in terms of policy differentiation.
- Types of preferential treatment implemented.
- Relationship between taxation and other policy instruments.
- Interaction with processes at international and EU level.

The method is a document analysis in which we have studied the main carbon pricing policy instruments for each period and analysed them based on this framework. The studied material consists mainly of official government documents, such as reports by government commissions of inquiry and government bills. The main conclusions of consultation processes with various stakeholders are included in the government bills and have thereby been included in the analysis. The aim has been to include all relevant government bills and reports in the material and in total 62 documents have been studied. The studied material is listed in Appendix. Even if not all material is referred to directly in this paper, all documents have contributed jointly to a comprehensive understanding of the Swedish policy process and government and stakeholder considerations.

4 Energy taxation and other economic policy instruments 1950–2022

4.1 The introduction phase (1950–1970)

Even though a tax on fuels used for transportation was introduced in Sweden as early as 1924, mainly to finance the Swedish road system [30], it was not until the 1950s that taxes were more directly applied to energy used in industry, first through a tax on electricity (introduced in 1951) and then an energy tax on fuels (introduced in 1957).

During this period, energy taxes were mainly motivated by fiscal needs. For example, the introduction of a tax on electricity was motivated by the need to meet "unavoidable public expenditures" [31, p.1]. These revenues were needed to reduce public debt, to cover rising salary costs for civil servants, and to increase defence spending [31, p.7]. The energy tax on fuels and electricity introduced in 1957 was in turn motivated by the need for an extensive investment programme in the field of energy [32, p.1].

Taxation was not seen as a policy instrument to change energy supply or demand or mitigate environmental impacts. Indeed, electricity was viewed as an important vehicle for rationalisation and economic development, and it was not deemed desirable to reduce consumption. The government agency responsible for electricity supply, Vattenfallsstyrelsen, argued that taxation would erode the existing good-will connected to electricity and electricity companies [31, p. 28]. Industry organisations expressed the fear that, in essence, any tax on electricity was another form of corporation tax, since at the time businesses accounted for 90% of consumption. Taxing the use of electricity in metallurgical, electrochemical, and electro-thermal processes was seen as particularly problematic and it was argued that these uses should be exempted, especially as these industries were subject to significant international competition [32, p.25]. Although no such exemption was adopted at that time [33, p. 501], a tax ceiling was introduced (see below) to protect industry from many of the negative effects on competitiveness.

When the energy tax on fuels was introduced in the 1957 budget, there was no difference in tax levels between different consumers. The tax on electricity was however lower for non-

industrial consumers than for industry (5% compared to 10%). This differentiation was removed in 1970.

Instead of preferential treatment for industry through different tax levels, the legislation opened the way for the National Board of Excise (Kontrollstyrelsen) to reach individual decisions on tax exemptions and tax ceilings. The legislation did not specify exactly how such exemptions were to be designed, but in drafting the bill it was stated that i) fuels used as feedstock and process fuels should not be taxed and ii) taxes for individual energy intensive companies were to be adjusted to a level equivalent to the average tax burden for industry in general [32, p. 90].

As energy taxes in this period were not intended as energy or environmental policy instruments, tax exemptions and tax ceilings were less problematic. It was not until later, when energy taxes were designed as policy instruments, that this emerged as a problem, as we will see in subsequent sections.

4.2 From fiscal income to policy instrument (1970–2000)

From the beginning of the 1970s, taxes on energy started to be seen as an instrument for achieving energy and environmental goals. During the 1970s, Swedish energy policy was strongly affected by the two oil crises of 1973/74 and 1978/79, since Sweden was heavily dependent on oil at that time (cf., inter alios [20, 34]). Reducing oil dependency became a political priority, with the focus on energy conservation [35] but also on the substitution of alternative fuels [36]. This period also saw the large-scale introduction of nuclear power. Oil import targets were used to indicate the direction of change (cf. [36. p. 52 and Appendix 1 5.2.]) and an oil storage system coordinated by the International Energy Agency was also introduced to reduce vulnerability to oil shocks [37].

Starting in the beginning of the 1970s, tax rates on oil and electricity gradually increased [38]. A small differentiation in electricity tax favouring industry was introduced in 1977, when consumers using more than 40,000 kWh a year received lower tax rates [38]. Although the role of taxation in limiting energy consumption was noted, energy taxation was not considered the main instrument for reducing oil dependency. Instead, more attention was paid to various forms of regulation and planning tools, as well as investment support for energy conservation measures for industrial processes [37]. Although, the government acknowledged that removing tax ceilings for industry would provide better incentives for energy conservation [39], tax ceilings were preserved in order to avoid increasing the tax burden on industry (cf., inter alia, [40, p. 112f).

During the 1980s, several government commissions of inquiry [41-45] investigated potential energy tax reforms. According to the 1981 energy policy bill [36], taxes should be considered

the main instrument for achieving energy policy objectives, which at that time still mainly consisted of reducing oil dependence. It was now widely recognised that existing tax exemptions and deductions reduced incentives for industry to respond to energy policy in a relevant manner (cf., inter alia [42, p. 134]). There was also a parallel broad discussion about the need for a wider tax reform in society in order to broaden the tax base, with one of the principal aims being to reduce the marginal tax rate [46,47].

Environmental and climate issues also grew in importance in the Swedish policy debate during the 1980s. The role of economic policy instruments was highlighted in the 1988 bill on environmental policy for the 1990s [48], which also set the first Swedish climate mitigation target (stabilisation of emissions at 1990 levels). In 1989, the Swedish Government appointed a commission of inquiry to examine the use of economic instruments in environmental policy, specifically in energy and transport. In its interim report [45] the commission proposed the introduction of carbon, sulphur and nitrogen taxes; however, as the carbon tax was deemed similar in design (and impact) to already existing energy taxes, it was envisioned that these taxes would be simultaneously reduced, meaning that the total tax burden would not be greatly increased.

The inquiry also anticipated that tax deductions for certain uses, such as industrial energy, would be required in future. Reforms were however suggested in this and other government inquiries (cf., inter alia, [42]) to improve incentives to achieve policy goals, including alternatives such as tax ceilings for individual companies, reduced tax rates for industry without tax ceilings, or refunds based on production levels. The latter would give more energy-efficient companies a relative advantage over less efficient ones. While these solutions would not provide the same incentives for mitigation in industry as in other parts of society, they would be an improvement on the present situation at that time.

A carbon tax was introduced in 1991 in line with the commission's proposal (0.25 SEK/kg CO_2). Energy taxes were preserved but at lower rates. The introduction of a carbon tax had broad political support [49], even if there were differences regarding exactly how it should be designed (for example, the Moderate Party argued that carbon taxes should completely replace traditional energy taxes). Designs to protect industry from excessively high taxes received broad cross-party support (see e.g. [50]). Initially, the same carbon and energy tax rates were applied to industrial and other consumers, with the continued use of tax ceilings despite the widely recognised problem that this did not incentivise emission mitigation.

In July 1991, Sweden applied to join the European Community (EC) and the same year the newly elected centre-right government proposed changes to energy taxes on industry. The need for Sweden to adapt to EC taxation levels [51] was used to justify the abolition of energy tax and a reduction in carbon tax by around two thirds for industrial consumers. This was to be financed by increases in carbon tax on other consumers (to 0.32 SEK/kg CO_2). As a result,

industry was paying about one quarter of the carbon tax rate applied to fuels used for heating and transport. The bill [51] also proposed the abolition of tax ceilings in order to give industry at least some incentive to mitigate its carbon emissions, albeit at a significantly lower level than other consumers. Although this change was postponed, a reformation of the system did begin later in the 1990s. Nevertheless, the final remnants of this system were not removed until 2015 (see below). While no major changes to energy taxation were introduced between 1993 and 2000, tax levels were gradually but slowly increased [38].

The tax reform led to lower tax rates for industry compared to other sectors of society and thus less incentive to mitigate CO_2 emissions. The relatively modest CO_2 target (stabilisation at the 1990 level) meant that there was no perceived urgency to drive mitigation in industry while additional measures could be imposed in other sectors that were not exposed to international competition, such as heating and transport. No additional policy instruments were introduced for industry.

Although the incentives were lower for industry, fossil fuels were still substituted, especially in the forest industry, where the structure of the industry made the use of biomass residues cost-effective even at lower carbon prices.

4.3 The increasing role of EU policy in Swedish energy governance (2000–2010)

In the 1990s, the European Union began to take a leading role in international climate negotiations. It was one of the signatories to the United Nations Framework Convention on Climate Change (UNFCC) in 1992 and the Kyoto Protocol in 1997. As EU climate policy ambitions grew, so they became increasingly important to Member States. Launched in 2001, the European Climate Change Programme (ECCP) included a proposal for a European Union Emissions Trading System. In addition, the common Energy Taxation Directive was implemented in 2003. Swedish climate ambitions gradually increased and in 2001 a short-term goal equivalent to a 4% reduction on 1990 levels by 2008–2012 [52] and a long-term goal of per capita emissions of less than 4.5 tonnes CO_2eq by 2050 were adopted (at the time of the decision, per capita emissions were 7.9 tonnes CO_2eq).

The EU Emissions Trading Scheme (EU ETS) was introduced in 2005, covering the lion's share of Swedish industry's CO_2 emissions, most significantly steel, cement, paper and pulp industries and refineries. The combustion of fuels in installations with a total rated thermal input exceeding 20MW was also included, bringing several industrial plants into the scheme. Industries not listed in the directive and with combustion installations with a thermal input below 20 MW were not covered by EU ETS. Over 90% of industry's greenhouse gas emissions are currently covered by the EU ETS.

The functioning of the EU ETS has been thoroughly analysed elsewhere and we will not go into details here. A main feature of the system was the initial use of a free and generous allocation of emission allowances, something decided on in order to gain acceptance for the system from both industries and Member States. The Commission assumed that once the system was up and running it would be possible to introduce the desired allocation by auctioning at a later stage [53]; in other words, the Commission first built the legitimacy of the system before increasing the level of ambition [54]. Even today, after many reforms that have increased the role of auctioning as an allocation rule, free allowances are still the main option for those sectors that are at highest risk of relocating their production outside of the EU.[1]

Initially, Swedish industries covered by the EU ETS faced two costs for carbon dioxide: the cost of the emission allowances, and carbon tax. In 2011, the Swedish Government exempted industrial facilities covered by the EU ETS from Swedish carbon tax [55]. It was argued that carbon taxes within the EU ETS would not reduce emissions but only affect where emissions took place. To continue to meet EU minimum taxation requirements (see below), an energy tax on fuels was re-introduced for industrial consumers. The introduction of the EU ETS was also followed by an amendment to the Swedish Environmental Code prohibiting the regulation of CO_2 emissions in environmental permits for industrial facilities. This was in line with changes in the EU's Integrated Pollution Prevention and Control (IPPC) directive.

For industrial facilities outside the EU ETS, carbon tax continued to be the main economic policy instrument for CO_2 mitigation. It remained on a significantly lower level than for non-industrial users but has been on a higher level than the price of emission allowances within the EU ETS at that time.

One main difference between the carbon tax and the EU ETS was that free allocation of emission allowances meant that the total cost for industries within EU ETS was lower than a carbon tax at the same level as the price of emission allowances would result in (cf. [56]). There were however also indirect effects of the EU ETS through the scheme's impact on electricity prices. EU ETS also covered process emissions, which were not covered by Swedish carbon taxes.

In 2003, the EU implemented a directive restructuring the framework for the taxation of energy products and electricity. The aim was to avoid distortions of competition between Member States due to different tax systems, but this had relatively little impact on Sweden as the minimum levels were lower than those used in Sweden. There was one major difference for industry, however, since a total tax exemption on electricity implemented in 1993 was no longer permitted and a tax on a low level (0.005 SEK/kWh) was instead required. There was

[1] However, recent reforms under the fit for 55 package include the gradual removal of this free allocation in combination with the introduction of a carbon border tax (CBAM).

some room for exemptions if it could be shown that other policy instruments were used instead. For this reason, Sweden introduced a new system of voluntary agreements, the Programme for Improving Energy Efficiency in the Energy Intensive Industry which was launched in 2005 [57]. To join this five-year programme and obtain an total exemption from the tax on industrial process-related electricity, a company was required to introduce a system of energy mapping and identify cost-effective measures for energy savings [58] The programme was not, however, open to all companies, only those who met specific criteria for energy intensive companies. [57]. Evaluations of the policy provide mixed results. According to Stenqvist and Nilsson [59], the Programme for Improving Energy Efficiency had effectively and at a low cost exceeded the estimated impact of a minimum tax and could thus be judged successful, whereas the Swedish National Audit Office [60] expressed doubts that it had contributed to significant efficiency improvements.

4.4 Towards a zero-emission future (2010–2022)

The earlier relatively short-term perspective on emission mitigation gradually grew into a more long-term strategy that recognised the need for the complete decarbonisation of society. This ambition was manifested in the Paris Agreement, as well as in EU and Swedish low-carbon roadmaps. In 2017, the Riksdag adopted the new Swedish Climate Act (SFS 2017:720) and the Climate Policy Framework, including the long-term target of zero net greenhouse gas emissions by 2045 at the latest and a number of interim targets. Similar targets have also been introduced within the EU.

Given the net zero target, it became clear that industrial emissions needed to be reduced significantly and both the Swedish Environmental Protection Agency [29] and the Committee on Environmental Objectives [61] proposed an increased role for the state in supporting the development of low carbon technologies for energy intensive industries, including through an intensified industrial policy of direct financial support to RD&D, technological and financial risk sharing, and public procurement [61, p. 285–305]. This did not imply that carbon pricing had lost its prominence, only that there was a need to complement it with instruments more focused on technological change. This emphasis on EEIIs and their industrial process-related emissions was warranted given that these are the most difficult to reduce and to do so will require technological innovation.

State support for technological development for low-carbon industries was especially apparent in high-profile projects related to low-carbon steel. Launched in 2018, the Industrial Leap (Industriklivet) investment programme was motivated by the potential to achieve technological leaps in the industrial sector, where carbon pricing alone was deemed

insufficient to address all existing market barriers [62] Another line of national industry policy was the initiative Fossil Free Sweden, which is intended to promote and develop public-private partnerships to address common problems.

In parallel, carbon pricing policies have become more stringent. The increasing level of ambition at EU level has reduced the number of allowances allocated to the installations in the emissions trading system, leading to rapidly rising carbon prices. That said, for the fourth trading period (2020–2030) free allowances are still being allocated to those sectors with the highest risk of relocating their production outside the EU.

5 Discussion

This historical account of how energy taxes, carbon taxes and the EU ETS have been applied to Swedish industry sheds light on several issues related to the climate governance of industry. While industry's energy consumption has been taxed since the 1950s, the motives for doing so have varied, see Table 1. Where the motive was initially purely fiscal, in the 1970s energy policy became an additional motivation, at that time mainly to reduce oil dependence. From 1990s onwards, taxes started to be seen largely as a way to reduce CO_2 emissions.

5.1 Exemptions for industry: An integral part of energy taxation

The risk that energy taxes might have a negative impact on industry and its competitiveness was recognized from the start and this has continuously influenced policy choices, leading to special rules to protect industry in general and EEIIs in particular, while simultaneously reducing incentives to change. The main types of special rules include:

- total tax exemption for energy used for certain purposes (e.g. fuels used for non-energy purposes, as feedstocks, etc., or used in processes such as steelmaking);
- differentiated tax levels between industrial and non-industrial energy use and/or between industrial sectors;
- tax ceilings, where taxation above a certain threshold (measured as tax/sales values) was either totally removed or led to lower marginal tax levels; and
- the reduction or removal of taxes on facilities meeting the criteria of other policy instruments (e.g. carbon tax exemptions for facilities within the emissions trading system, electricity tax exemptions in exchange for a participation in voluntary agreements).

Table 1. Summary of main developments in taxes and other policy instruments in the industrial sector. The period 1950–2020 is divided into four subperiods. There are no strict delimitations between the periods and those presented here are only rough estimates.

	Main developments in energy taxation/carbon pricing	*Background and motivation*	*Preferential treatment of industry*	*Complementing instruments to achieve energy and environmental objectives*
Introduction phase (1950-1970)	-Energy tax implemented on electricity (1951) and on fuels (1957)	-Energy demand expected to increase to secure economic growth -Financial needs for infrastructure expansion.	-No tax on energy used as feedstock and as input to processes -Tax ceilings: 3% of sales value. Government can decide on further reductions.	-Tax not used as a policy instrument
From fiscal incomes to policy instruments (1970-2000)	-Increased taxes on oil to encourage energy conservation and fuel substitution (1970s) -Several investigations on reformed systems during the 1980s -Tax reform implemented including carbon tax and VAT on energy (1991)	-Oil crises -Energy security through reduced oil dependency -Liberalisation and increasing interest in market-based policy instruments -Structural problems in taxation system -Environment and climate policy increasingly important	-Tax ceilings preserved. The actual level varies from year to year around a general level of 1-2% -0.8% and 1.2% rules introduced for further reductions or exemptions -Energy taxes removed and lower carbon taxes (1993)	-Environmental regulation -Investment support -RD&D support
The increasing role of EU policy in Swedish energy governance (2000-2010)	-EU minimum tax directive (2003) -EU ETS introduced (2005)	-Increasing role for EU in Swedish environmental and energy policy making -Avoidance of double instruments	-Continuation of tax exemptions but process emissions included in EU ETS. -Carbon taxes removed for industrial facilities in EU ETS. -Energy taxes re-introduced to meet EU tax directive requirements -Free allocation of emission allowances	-Environmental regulation -Voluntary agreements
Towards a zero-emission future (2010-2022)	-Slight increase in tax levels. -Existing deductions reduced for some consumers	-Increased climate ambitions. -Steering towards net zero emissions. -Paris agreement	-Tax ceilings removed. -Reductions in CO_2 taxes for industries outside EU ETS gradually removed -Energy taxes slowly increased	-Industrial leap supporting investments and RD&D -Public private partnership including low carbon roadmaps

At first, when taxes were imposed for purely fiscal reasons, exemptions were not particularly problematic from an energy policy perspective. On the contrary, taxes were seen as a threat to a desirable expansion in energy consumption that would drive economic growth. The need to protect industry from high energy prices was considered almost self-evident. With the introduction of environmental and climate taxes intended to trigger change, the dilemma of choosing between effective policy and protecting industry became apparent. This dilemma was mainly handled by continuing to grant exemptions to industry while taxation was gradually increased for other sectors such as households and transport. When the most energy and emission intensive industries entered the EU ETS, and were exempted from national carbon taxes, the issue of industrial carbon pricing was moved from the Swedish to the EU arena.

As Johansson [56] illustrated, both the existing Swedish carbon taxes and the EU ETS as it was initially designed offered flawed incentives for carbon mitigation. The most glaring of these flaws (such as tax ceilings and free allocation based on historical emissions) were however identified by policymakers and gradually rectified over the subsequent decade.

5.2 The role of path dependency

The roles of institutional context and path dependency are central to understanding the development of energy and carbon taxes on industry. Firstly, carbon taxes were not introduced in a vacuum but were facilitated by an institutional path dependency. While the implementation of the carbon tax at the beginning of the 1990s was certainly to some extent a novelty, at the same time it was structurally aligned with the already existing tax system, making the introduction less radical in terms of implementation and design. It was also in line with the ongoing trend towards privatisation and the marketisation of public services.

At the same time, the historical existence of generous tax exemptions for industry made it difficult to reform the system towards greater coherence. While carbon taxation levels continuously increased for households and the transport sector, in principle they remained constant for industry for two decades until around 2010. The handling of tax ceilings for industry is another interesting case in point. As early as the 1980s it was recognised that the existing system of tax ceilings was problematic and prevented the use of taxes to incentivise industry to become more energy efficient. Still, reforms of the tax ceiling system were difficult to introduce, and it was not until 2015 that the final remnants of the system of tax ceilings were finally abolished. This persistent use of tax ceilings can be seen as an example of policy path dependency, given that it took some three decades from when the problem of tax ceilings

was recognised until they were finally removed, even though more efficient alternatives had been on the agenda since 1982.

A shift in the view of industry's role in greenhouse gas mitigation occurred in the 2010s, when Swedish climate goals became considerably more ambitious, accentuating the need for greater mitigation efforts on the part of industry. Carbon taxes on industries outside the EU ETS were gradually increased and reached the same level as for other sectors in 2022.

While carbon taxes fit well with the historical regulatory structure, the EU ETS represented a new institutional approach for both the EU and Sweden. One strategy to enable the introduction of a novel system such as the EU ETS was to initially pitch it at a relatively modest level in terms of mitigation ambition [53,54]. From the starting point of very lax regulation, the idea has been to continuously increase stringency in mitigation policies, including putting more pressure on protected sectors. This could be seen as an attempt to build a new institutional lock-in, in order to enable a more ambitious climate policy.

In summary, the Swedish experience highlights three main points regarding policy path dependency: i) the implementation of a system can be helped by the existence of similar systems; ii) historical path dependencies make improvements to the system difficult and slow to implement; and iii) breaking these institutional lock-ins and path dependencies could be helped by a strategic approach, introducing a soft version initially and then gradually making it stronger. This could mitigate some of the opposition from existing strong vested interests.

5.3 Use of complementary instruments

Several policies for emission mitigation in industry have been in place in Sweden in parallel with the economic instruments; comprehensive environmental legislation, for example, was first introduced in 1967. Another example is the voluntary agreement scheme introduced in 2005, participation in which was a requirement for obtaining an electricity tax exemption. Support for investments and research into oil substitution, energy efficiency improvements and technological innovation have also frequently been used (cf., inter alia, [24,35].

There are three roles for instruments in complementing carbon pricing. Firstly, they can compensate companies or other stakeholders for some or all of the extra costs accruing from an economic policy instrument. This has not been used to any great extent in Sweden in relation to industry. In the EU ETS, there is a mechanism that can be used by Member States to compensate industries for increased electricity prices that follow from the resulting carbon price. However, Sweden has chosen not to use this mechanism. The proposed introduction of a border carbon adjustment mechanism at EU level can be seen as another example of a complementing instrument to protect industrial competitiveness from the effects of a more stringent EU ETS.

A second approach to complementary instruments has been more common in Sweden. In this case, the economic instrument is set at low levels in order to protect industry but will then have only a minor impact on emissions and thus contribute only marginally to achieving policy objectives. The role of the complementary instrument – a regulation or subsidy, for example – is then to drive change at a lower financial cost to industry. The voluntary energy efficiency agreement is one main example of such a policy instrument in Sweden.

A third role for complementary instruments is to overcome certain market barriers when general economic instruments will be insufficient. These could include support for technological development and building markets for new technologies (cf. [63])

During the last decade or so there has been an increased use of complementary instruments in Sweden targeting industry, such as government support for technological development, climate financing, risk sharing, and joint roadmaps. This kind of directed support breaks with a long tradition of trying not to choose winners and can be seen as a response to the realisation that industry must undergo a fundamental transformation if it is to achieve zero emissions.

It therefore seems that, in future, it will be necessary to develop policy packages that can integrate the advantages of carbon pricing (making the cost of pollution visible for actors) with other instruments that can support rapid technological innovation, thus increasing the available alternatives on the market. History shows that instrument design matters, both in terms of efficiency and providing a policy that is acceptable to stakeholders and policymakers.

6 Conclusion and Policy Implications

This study illustrates the long history of energy and environmental taxation in Sweden and how important concerns about industrial competitiveness have been when designing energy and climate policies. The introduction of carbon pricing was not a radical policy shift but rather an adaptation of the existing system to new circumstances. The development could thus be seen as an example of policy path dependency.

Although high climate ambitions have been voiced for decades, the high priority placed on industrial development and growth has led to less stringent policy instruments in the industrial sector, with the focus very much on mitigation efforts in other sectors. Economic policy instruments have had broad support from most political parties and are well-aligned with dominating market perspectives. Exemptions and lower tax levels for industry were less problematic as long as Sweden's overall climate goals were relatively modest. With more stringent climate goals and a long-term objective of decarbonisation, it has become evident that the industrial sector can no longer remain on the sidelines.

Although it has long been understood that the way industry has been sheltered from strong policy instruments is inefficient in terms of achieving policy goals, and that better solutions are available, it has taken a long time to eradicate policy deficiencies. This could be seen as another example of policy path dependency.

The Paris Agreement and the net zero emissions goal have made it readily apparent that industry must undergo a low-carbon transformation. Such a transformation presents a challenge as long as countries progress at different speeds. Competitiveness will therefore continue to be an issue when designing adequate industrial policy strategies for the future. Most likely, it will be difficult to set a highly stringent economy-wide carbon price, and complementary policy instruments that directly support industry's low-carbon transformation or protect industry from unfair competition will be needed.

When designing new policies, the policymaker should take the historical and geographical context into account to design effective policy packages that will be deemed acceptable by stakeholders and thus have the potential to be implemented. Although important, carbon pricing will need to be supported by other instruments in order to cope with the negative side-effects, such as lost competitiveness, as well as specific market barriers that it will take more than a carbon price to overcome.

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