THE PROPOSED NATIONAL EMISSIONS TRADING SYSTEM IN GERMANY - DISCUSSION OF IMPLICATIONS FOR THE BUILDINGS SECTOR

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Abstract

The heating and cooling sector is responsible for around half of the EU´s energy demand and its decarbonisation is a key element for meeting the EU's energy and climate targets. Due to the sector's complexity with its variety of energy sources, technologies and actors, policy efforts for achieving substantial emissions reductions have shown limited success so far. The German government has recently decided to implement a national emissions trading scheme (ETS) covering the transport and the building sectors as a key instrument to help reach its climate targets. The scheme is foreseen to start with a fixed price of 25 EUR per allowance (t CO_2-eq) in 2021, subsequently increasing to 55 EUR in 2025. In 2026 the auctions will start with a price corridor between 55 and 65 EUR.

The implementation of the German national ETS is planned with an upstream approach, i.e. the participants of the auctions are not the end-users themselves, but the suppliers of the fuels. To our knowledge, the proposed national ETS in Germany is the only scheme that relies exclusively on an upstream approach. In view of the novelty of the approach, we analyse the experiences from ETSs covering the heating sector in jurisdictions across the globe and estimate the direct and indirect effects that can be expected from an upstream ETS for the heating sector. Furthermore, we address the challenge of intra-yearly fluctuations of heating demand due to temperature differences (warm/cold winters) on the ETS for the heating sector.

To estimate the direct and indirect effects on the reduction of GHG emissions, we conduct a screening of all ETSs that are currently implemented in order to identify the ones covering the heating sector. For the ETSs that have been identified, a detailed literature analysis is conducted focusing on the impacts and challenges.

We estimate the impact of yearly temperature fluctuations on the ETS proposed in Germany by comparing the total emissions covered in the system with the yearly fluctuations: The yearly fluctuations of emissions are calculated based on the fluctuations of final energy demand for heating between 2008 and 2017 [2] as compared to the average over the ten-year period.

The analysis of the current emissions trading systems implemented (Table 1) shows that buildings are covered in 10 of the 27 schemes. Among these 10 schemes, only four cover the building sector upstream (California, New Zealand, Nova Scotia, Quebec), while the remaining ones take a downstream approach, limited to larger commercial buildings.

All of the four schemes covering the building sector upstream furthermore include the power sector, industry and transport and thus cover a larger share of the total emissions in the respective jurisdictions. Due to the wider coverage including the power and industry sector, unlike the system proposed in Germany, the schemes include obliged parties that can directly implement measures to reduce emissions.

In all of the four schemes, the main effect of the ETS on the heating sector is based on the price signal induced through the carbon pricing schemes, while the cap does not directly influence the emissions.

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This is partly due to the fact that a maximum price is set and certificates are introduced in the market as the maximum price is reached.

As a result of the limited sectoral coverage of the German ETS, the emissions from the buildings sector take a considerably larger share and yearly fluctuations due to temperature differences may have an important impact on the availability of certificates. The average fluctuations are estimated to 6 Mt of CO_2-eq, accounting for about than half of the annual emissions reduction foreseen in the ETS.

1. Introduction

The German government has recently decided to implement a national emissions trading scheme (ETS) covering the transport and the buildings sectors as a key instrument to help reach its climate targets [1]. The national ETS thus addresses the key emitting sectors that are currently not covered by the European emissions trading system.

The proposed carbon pricing scheme foresees a first phase with fixed carbon prices from 2021 to 2025, followed by a trading scheme with a price corridor starting from 2026. While the initial proposal for the price path published in the climate protection programme ("climate package") [2] ranged from 10 EUR in 2021 to 35 EUR in 2025, the price path was increased to 25 EUR in 2021 to 55 EUR in 2025 in December 2019 [1].

As of 2026, Germany foresees a cap-and-trade system, in which "the total number of CO2 emissions certificates will be limited to achieve climate targets" [1], while introducing a price corridor of at least 35 EUR/t CO2 and no more than 60 EUR/t CO_2 in 2026. In 2025, it will be determined to what extent maximum and minimum prices for the period from 2027 are useful and necessary.

The implementation of the German national ETS is planned to use an upstream approach, i.e. companies trading with heating oil, liquefied petroleum gas, natural gas, coal, petrol or diesel are required to present certificates for every t CO_2 emitted by the products. The upstream approach has the advantage of limiting the administrative burdens of schemes in sectors with large numbers of individual actors, such as the buildings and transport systems. In addition, the upstream approach allows for exploiting as many synergies as possible with the current energy taxation scheme.

The upstream approach implies that the parties that are required to present the certificates have limited direct possibilities to induce GHG reduction measures. In case of the buildings sector, emission reductions are mainly driven by energy efficiency measures in the building envelope and the diffusion of heating equipment based on renewable energies. In an upstream ETS, besides blending of green fuels/gases, the obliged parties (e.g. the operators of the tax warehouses for fuel oil or the gas suppliers) have limited access to GHG reduction measures.

In view of the novelty of the proposed approach, this paper analyses experiences from ETSs covering the building sector in jurisdictions across the globe and estimates the direct and indirect effects that can be expected from an upstream ETS for this sector. Furthermore, we address the challenge of yearly fluctuations of heating demand due to temperature differences (warm/cold winters) on the ETS for the heating sector.

The paper is structured as follows: Section 2 provides an overview of the buildings sector in Germany, focusing on the sectoral emissions reduction targets and the possible role of carbon pricing in meeting these targets. Section 3 presents an analysis of the various ETSs currently implemented in different jurisdictions across the globe. Section 4 estimates the role of weather conditions on the fluctuations of available certificates. Section 5 provides a summary and conclusions.

2. Overview of the buildings sector in Germany

The buildings sector accounts for around 15 % of the total GHG emissions in Germany (14.6 % in 2017) [3]. The GHG emissions in the buildings sector are largely driven by the combustion of fossil fuels for space and water heating. With shares of 47 % and 22 % respectively, natural gas and heating oil are the dominant energy carriers used for space and water heating (see Figure 1).

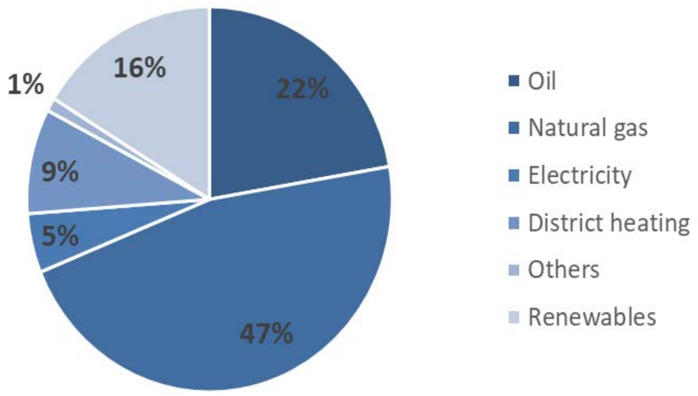

Figure 1: Final energy demand for space and water heating in Germany (2018): Share of energy carriers.

The German Climate Action Plan 2050 [4], sets a reduction target for GHG emissions in the buildings sector to a maximum of 70 to 72 million t CO_2-eq by 2030, corresponding to a reduction of at least 67 to 66 percent by 2030 compared to 1990 levels.

Figure 2 shows that there is a considerable gap between the current levels of emissions from the buildings sector and the target for 2030, indicating a need for ambitious climate action in this sector in order to meet the target.

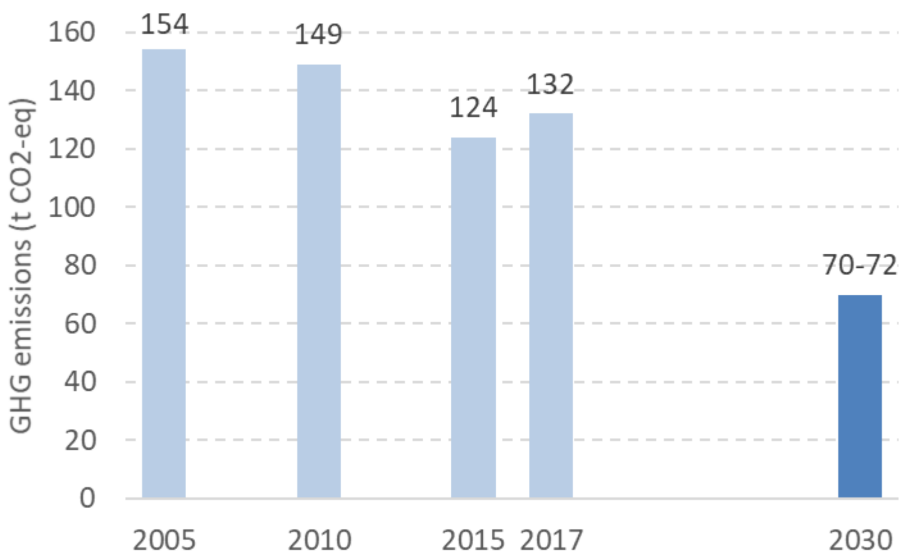

Figure 2: GHG emissions in the buildings sector in Germany 2005-2017 and target for 2030.

The climate protection programme [2] adopted in September 2019 proposes several measures to reduce emissions in the buildings sector, including an expansion of the existing support and incentive programmes, tax-deductions for energy-efficient retrofitting of buildings, and the introduction of a carbon pricing scheme for the buildings and transport sectors.

Figure 3 shows the prices for heating oil and natural gas in 2018 and indicates the price increases according to the carbon pricing path adopted by the German government (25 EUR/t in 2021, increasing to 55 EUR/t in 2025). The (moderate) price increases foreseen in the years from 2021-2025 are likely to have a limited effect on GHG emissions reductions due to the low price elasticities in the sector (for a review see e.g. [5]). Furthermore, due to the large share of rented housing in Germany, split incentives pose a further challenge. Under the current legal framework, the landlord can simply pass on the CO2 costs to the tenant and thus has no incentive to refurbish the rented building. The remaining part of the paper analysis to what extent the proposed national ETS may have additional effects for reducing GHG emissions in the buildings sector.

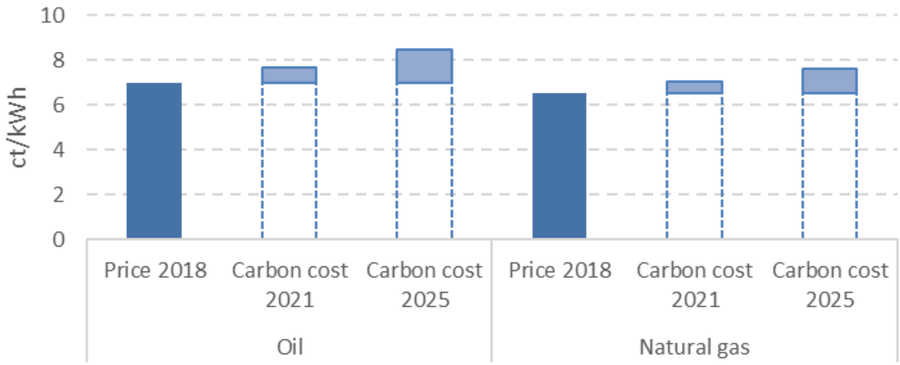

Figure 3: Prices for heating oil and natural gas in 2018 and corresponding carbon cost in 2021 and 2025.

3. Analysis of currently implemented ETSs for the building sector

To estimate the direct and indirect effects that an emissions trading scheme covering the building sector may have on the reduction of GHG emissions, we analyse experiences from the ETSs covering the building sector that are currently implemented globally. The analysis takes the following approach (see Figure 4): As a first step, we conduct a screening of all ETSs in order to identify the ones covering the heating sector. As a second step, among the schemes covering buildings we identify those that take an upstream approach (as is the case for the proposed approach in Germany). As a third step, we analyse the experiences from the systems covering buildings upstream and draw conclusions for the proposed German system.

For the ETSs that have been identified, a detailed literature analysis is conducted focusing on the impacts and challenges.

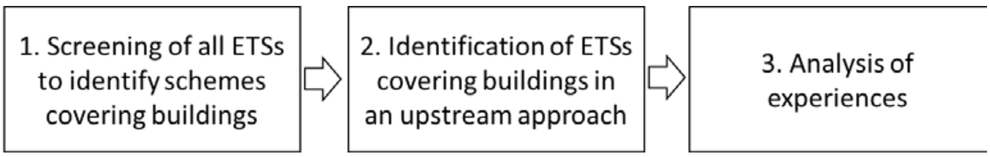

Figure 4: Methodological approach for the analysis of currently implemented ETSs

1. Screening of all ETSs to identify schemes covering buildings

The analysis of the currently implemented emissions trading schemes is based on the information provided by the carbon pricing dashboard[4] and the International Carbon Action Partnership [6] (status December 2019).

Table 1 summarizes the ETSs that are currently implemented and shows that buildings are covered in 10 of the 27 schemes (status December 2019).

Table 1: Overview of ETSs implemented in 2019 and sectors covered.

	Power	Industry	Transport	Buildings	Others*
Alberta CCIR					
Australia ERF Safeguard M.					
BC GGIRCA					
Beijing pilot ETS					
California CaT					

[4] https://carbonpricingdashboard.worldbank.org/

Canada federal OBPS					
Chongqing pilot ETS					
EU ETS					
Fujian pilot ETS					
Guangdong pilot ETS					
Hubei pilot ETS					
Kazakhstan ETS					
Korea ETS					
Massachusetts ETS					
New Zealand ETS					
Newfoundland and Labrador PSS					
Nova Scotia CaT					
Quebec CaT					
RGGI					
Saitama ETS					
Saskatchewan OBPS					
Shanghai pilot ETS					
Shenzhen pilot ETS					
Switzerland ETS					
Tianjin pilot ETS					
Tokyo CaT					
Washington CAR					

* including domestic aviation, waste, forestry

2. Identification of ETSs covering buildings in an upstream approach

For the 10 systems that cover the building sector, Table 2 provides an overview of the implementation of the ETSs with respect to obliged parties and point of regulation for the building sector. The analysis shows that only four schemes cover the building sector upstream (California, New Zealand, Nova Scotia, Quebec), while the remaining ones take a downstream approach, limited to larger commercial buildings.

Table 2: Analysis of ETSs covering buildings (upstream and downstream). Data sources: [6] [7]

	Obliged parties (buildings/heating)	Point of regulation (buildings/heating)
Beijing pilot ETS	Large Private and Public Buildings	Downstream
California CaT	Suppliers of natural gas, suppliers of reformulated blendstock for oxygenate blending and distillate fuel oil, suppliers of liquid petroleum gas in California, and suppliers of liquefied natural gas. Inclusion thresholds: Facilities ≥2 5,000 tCO2e/year	Upstream
Korea ETS	Buildings (Inclusion thresholds: company >125,000 tCO2/year, facility >25,000 tCO2/year)	Downstream
New Zealand ETS	Fuel producers or importers, with the possibility for large businesses to opt into the ETS	Upstream
Nova Scotia CaT	Fuel suppliers (petroleum product suppliers selling ≥ 200 liters of fuel into the Nova Scotia market) and	Upstream

	natural gas distributors producing ≥ 10,000 tCO2e/year.	
Quebec CaT	Distribution and importation of fuels used for consumption in the transport and building (thresholds: >25,000 tCO2e/year[5].	Upstream
Saitama ETS	Commercial and industrial buildings (thresholds: Facilities that consume energy more than 1,500kL of crude oil equivalent/year)	Downstream
Shanghai pilot ETS	Large buildings (threshold: 10,000t CO2/year).	Downstream
Shenzhen pilot ETS	Large public buildings and enterprises (threshold: annual emissions of 3,000 tCO2e/year) and large government buildings (threshold: 10,000m2).	Downstream
Tokyo CaT	Building owners of large commercial and industrial buildings with energy consumption above 1,500kL of crude oil equivalent per year[6].	downstream

3. Analysis of existing systems

For the four schemes using an upstream approach to cover the emissions from the buildings sector, we analyse experiences with respect to the design features regarding cap setting and price corridors, which are key elements of the German proposal (Table 3).

Table 3: Overview of cap-setting and price control mechanism

	Cap setting	Price floor	Price ceiling
New Zealand ETS	As of 2019, the New Zealand ETS has not included a cap for domestic emissions [8] as was designed to operate within a broader global cap set by the Kyoto Protocol[7] [8]. The New Zealand Ministry for the Environment is now proposing to introduce a cap on domestic emissions in alignment	The New Zealand ETS has so far operated without a price floor. The proposal for the revision of the ETS foresees a price floor of NZ$20 [6].	The New Zealand ETS currently uses a price ceiling mechanism set at $25 with no limitation on its use [10]. In 2018 emission prices reached the fixed-price level (NZ$25 per t) and remained there through November 2019. The proposal for the revision of the New Zealand ETS foresees a cost containment reserve mechanism, releasing a specified volume of additional certificates onto the ETS market if a pre-determined price trigger level of

[5] As of 2016, fuel distributors that have distributed 200L or more of fuel (in 2015) are also subject to inclusion even if the combustion of their fuel resulted in the emission of less than 25,000 tCO2e) [6]
[6] Large tenants may assume obligations jointly or in place of building owners

[7] https://www.mfe.govt.nz/climate-change/new-zealand-emissions-trading-scheme/about-nz-ets

	with the climate change targets.		NZ$50 is reached during an auction [6].
California CaT	The caps in the California CaT are in alignment with the GHG reduction targets. However, as the revised system contains a hard price ceiling from 2021 (see column on the right), additional certificates may be introduced to the market.	The California CaT includes an auction reserve price which increases annually by 5% plus inflation, as measured by the Consumer Price Index [6].	The California CaT has so far used an auction reserve price and an Allowance Price Containment Reserve (APCR), i.e. the absolute number of certificates has been limited [11]. The mechanism has not been used so far as certificate prices have been lower. Starting in 2021, the revised system includes a hard price ceiling at US$65 besides two price containment points triggered at increasing price [6].
Quebec CaT	The cap in the Quebec system is set in alignment with the province´s GHG reduction targets.	The Quebec ETS sets a minimum price that increases by 5% per year. For 2019, the minimum price was CA$ 15.31 [6].	The Quebec ETS uses an allowance price containment reserve with three tiers at CA$ 56.96, CA$ 64.07, and CA$ 71.19 in 2019. Reserve prices increase annually by 5% plus inflation [6]. The scheme is linked to the California ETS since 2013, before which prices were high due to a lack of liquidity [10].
Nova Scotia CaT	The Nova Scotia ETS sets caps on the total amount of GHG emissions allowed in the province for the years 2019–2022, reflecting the pathways to reaching the 2030 reduction targets [9].	The Nova Scotia ETS uses a minimum price of CA$20 in 2020, increasing by 5% plus inflation per year [6].	The Nova Scotia ETS contains a cost containment reserve with up to four reserve sales in a calendar year. The initial price is CA$ 50 in 2020, rising annually by 5% plus inflation [6].

4. Temperature fluctuations and emission reduction path

We estimate the impact of yearly temperature fluctuations on the ETS proposed in Germany by comparing the total emissions covered in the system with the yearly fluctuations.

The yearly fluctuations of emissions are calculated based on the fluctuations of final energy demand for heating between 2008 and 2017 [12] as compared to the average over the ten-year period. Table 1 shows the final energy consumption for heating in Germany between 2008 and 2017 and estimates the corresponding fluctuations of CO_2 emissions.

Table 4: Final energy consumption for heating in Germany and estimated fluctuation of CO_2-emissions.

Year	Final energy comsumption (PJ) [2]	Difference to average final energy consumption (2008-2017)	Estimated fluctuation of CO_2 emissions (Mt)
2008	3 451	6%	7,7
2009	3 319	2%	2,5
2010	3 619	11%	14,4
2011	3 144	-3%	-4,5
2012	3 230	-1%	-1,1
2013	3 418	5%	6,4
2014	2 937	-10%	-12,7
2015	3 102	-5%	-6,1
2016	3133	-4%	-5,0
2017	3214	-1%	-1,7

In order to estimate the influence of the yearly fluctuations on the availability and price levels of the certificates, the average fluctuations are compared to the required emissions reduction path necessary to reach the climate target. The estimates in Table 1 show, that the yearly fluctuations of GHG emissions due to weather conditions range up to 14 Mt, with an estimated average of 6 Mt. In order to reach the 2030 targets, CO_2-emissions in the non-EU-ETS sectors have to be reduced by around 15 Mt per year between 2020 and 2030 [13]. The yearly fluctuations due to temperature differences may thus have an important impact on the availability and price level of certificates.

5. Summary and conclusions

The paper analysed existing ETSs covering the buildings sector and draws conclusions for the proposed national ETS in Germany:

- Cap vs. price ceiling: The schemes use different approaches for certificate price management, ranging from a fixed upper price limit to cost containment reserve mechanisms. While the New Zealand ETS is currently changing from a fixed-price limit to a cost containment reserve mechanism, the California ETS is taking the opposite direction by introducing a fixed price ceiling starting from 2021. The implementation of a fixed price ceiling may have an important impact on the effectiveness of the programme, as additional certificates introduced at the upper price level lead to emissions exceeding the cap thus undermining the essence of a pure cap and trade scheme. The price ceiling should therefore be specified at levels exceeding the expected mitigation costs necessary to meet the GHG reduction targets. The German Environment Agency estimates the CO_2-prices necessary to meet the climate targets to 180-205 EUR/t [14], such that any price ceiling below these levels is likely to be reached.
- None of the existing systems rely exclusively on an upstream approach. The four existing schemes covering the building sector upstream (California, New Zealand, Nova Scotia, Quebec) furthermore include the power sector, industry and transport and thus cover a larger share of the total emissions in the respective jurisdictions. Due to the wider coverage including the power and industry sector, unlike the system proposed in Germany, the schemes include obliged parties that can directly implement measures to reduce emissions.
- Due to the limited sectoral coverage of the proposed German ETS, a higher share of emissions results from space heating in buildings. For this reason, weather conditions leading to higher/lower heating demand may have an important impact on the availability of certificates and thus cause price fluctuations and therefore need to be considered in the design of the scheme.

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