INTRODUCING A CARBON PRICE ON HEATING FUELS: AN EFFECTIVE SIGNAL FOR FASTER DECARBONISATION IN THE BUILDINGS SECTOR?

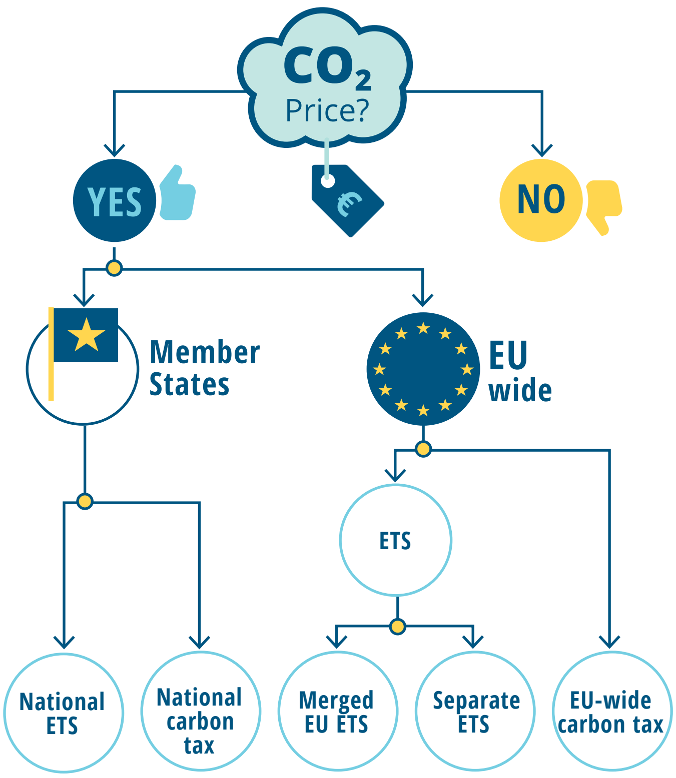
POLICY BRIEFING

JUNE 2021

The European Union has agreed on new climate protection targets in the European Climate Law. In 2030, the EU will have to reduce net greenhouse gas (GHG) emissions by 55% compared to 1990 and reach carbon neutrality by 2050. The EU Commission is now tasked to develop a robust strategy for increasing the ambition of the climate policy landscape to ensure all sectors deliver on the 2030 and 2050 targets.

According to the Renovation Wave Strategy, the buildings sector must contribute a 60% emission reduction to achieve the 2030 target. This requires a steep increase of deep renovations from the current 0.2% to 3% annually and a well-designed bundle of policies to overcome the distinct barriers of the sector (BPIE, 2020). To achieve ambitious reductions in the sectors outside the Emissions Trading System (ETS), European institutions are debating the introduction of an EU-wide CO_2 price in the buildings and transport sectors. In particular, discussions are centred on introducing an emissions trading system for transport and buildings, either by extending the current EU ETS, or by setting up a separate scheme for buildings and transport. Both options would imply a transfer of the compliance mechanism at least partly from the Member States to an emissions trading scheme and the regulated parties, and thus a reform of the Effort Sharing Regulation. Alternatively, national targets under the Effort Sharing Regulation could be strengthened to reflect the new climate protection targets.

Figure 1: Options to introduce a carbon price signal.



This briefing shows the role of a carbon price to reduce carbon emissions in the buildings sector, based on the literature, market insights of the buildings sector and experiences from European countries. After showing benefits and limitations of a carbon price in the buildings sector, the paper explains the implications for the design of a carbon price regime – either a carbon tax or an emissions trading scheme – and the resulting changes to the compliance mechanism for carbon reductions in the buildings sector.

FIT-FOR-55 PACKAGE EXPECTED IN JULY 2021

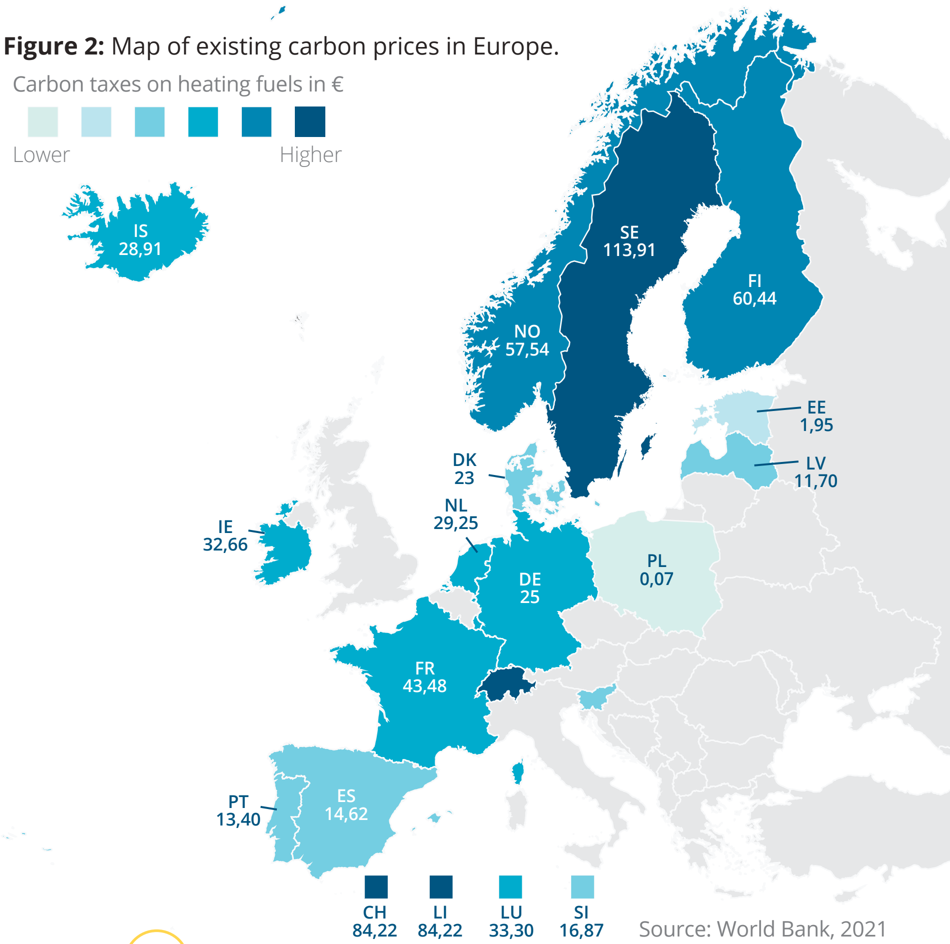
- The EU commission is expected to publish legislative proposals to increase the ambition of the climate policy framework according to the updated climate protection target (European Commission, 2020) in the Fit-for-55 package in mid-July, including a reform of the EU Emissions Trading Systems (EU ETS) and the Effort Sharing Regulation – the main climate policy regulations.
- The EU ETS exceeded a price of €50/tCO_2 for the first time in May 2021, thus starting to create momentum in its second decade of implementation. Research shows that the contribution of the EU ETS has to be increased from the current 43% to 63-67% CO_2 emissions reductions in 2030 to align with the new climate target which requires ambitious reforms including, for example, an update of the linear reduction factor (LRF) and a reform of the market stability reserve (Matthes, 2021).
- To increase ambition in line with the 2030 and 2050 target in the non-ETS sectors, different options are conceivable, including an expansion of the EU ETS or a separate carbon price for the buildings and transport sectors. Apart from a revision of the Effort Sharing Regulation, the Fit-for-55 package is expected to propose a revision of the Energy Tax Directive as well as amendments to the Renewable Energy Directive and the Energy Efficiency Directive to implement the ambition of the new 2030 target. All these will have to be aligned carefully to achieve the needed GHG emissions reductions in the buildings sector.

THE STATUS QUO OF VARYING CARBON PRICES IN THE EU

Although the EU introduces overarching energy and climate policies and sets long-term emissions reduction targets, EU Member States have implemented a broad range of energy and carbon taxes, levies, and support schemes to achieve their national GHG emissions reduction targets. Figure 2 shows the status quo of carbon taxes currently being implemented in the non-ETS sectors, complementing the EU ETS.

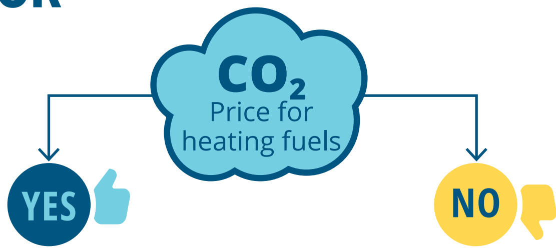
While some countries are making use of a carbon price at national level for heating fuels with price levels ranging from €24 to €114/tCO_2, not all European Member States reap the benefits of a CO_2 price signal. The introduction of an EU-wide CO_2 price in the buildings sector is thus a missing element in the policy instrument mix and worth considering.

Figure 2: Map of existing carbon prices in Europe.



Source: World Bank, 2021

THE ROLE OF A CARBON PRICE IN REDUCING CARBON EMISSIONS IN THE BUILDINGS SECTOR



Can a carbon price on heating fuel spur renovation and incentivise a fuel switch? While there is a high share of economically viable carbon emissions reduction potential in the buildings sector, building owners are not sufficiently investing in energy renovation due to many persisting economic and non-economic barriers.

Deep renovations are not only triggered by monetary incentives but depend on other non-economic factors that vary among different owner structures. The building stock is generally characterised by long lifetimes of building components and heating systems (several decades) and limited natural investment cycles. The average lifetime of a residential building is 70-100 years, while non-residential buildings have a much shorter lifetime (depending on the use, between 15 and 75 years on average). Heating systems will thus be replaced around 3-5 time during a building's lifetime, and the building envelope might only be refurbished once or twice during its lifetime. Triggering investments for a healthy building stock, increased comfort levels and energy poverty alleviation is not achieved solely by economic instruments.

Figure 3: Barriers and triggers for energy renovation in the buildings sector.

Non-economic barriers	Heterogenous owner landscape	Long-term investment cycles	Objectives of the buildings sector
Investment decisions in the buildings sector are highly influenced by non-economic barriers, such as lack of information, the split-incentive dilemma, lack of skilled workforce and energy efficiency experts, and institutional and cultural barriers.	Decision-making varies significantly across building segments, with large commercially driven residential housing companies, to smaller private owners and owner-occupiers driven more by social aspects, to institutional and commercial owners.	The natural investment cycles in buildings are quite long term, both for heating systems (15-20 years) and energy efficiency improvements of the building envelope (30+ years). Buildings are usually only renovated at certain intervalls (trigger points).	A highly energy efficient, low-carbon building stock not only saves GHG emissions but provides healthy living spaces and increased indoor comfort for people. These multiple benefits are currently not considered in investment decisions.

The benefits of a CO_2 price in the buildings sector

Price signals can contribute to making energy efficiency improvements more cost-efficient and thus be an important complementary policy instrument to the existing policy mix. However, the buildings sector is characterised by a large variety of owner - occupier relationships which have a significant impact on the potential effect of a CO_2 price signal. The design of the respective policy instrument must take this into account so that it will achieve the intended effect of increasing the incentives for deep renovation. A CO_2 price potentially reduces payback periods of long-term energy service contracts and thus makes innovative business models more attractive. Especially in the presence of a sufficiently high long-term price signal, earlier climate-proof investments can be incentivised, while still following the logic of the long-term investment cycles.

Figure 4: Impact of high CO_2 prices on different stakeholders.

Public authorities	Construction industry	Building owners	Tenants	Real estate investors
• Price level important argument for investment decisions that are based purely on cost-effectiveness considerations	• On-site renewable solutions and deep renovations become more viable • Low incentive for low-carbon construction materials without proper carbon border adjustment mechanism	• If passed on to tenants: low incentive for fuel switch or energy renovation • If not allowed to pass on to tenants: risk of lock-in of insufficient efficiency levels in the absence of long-term targets for the building envelope	• Short-term behavioural effects mitigating the rebound effect • If no proper redistribution mechanism: increased burden without achieving needed carbon emission reductions	• Reducing the payback period of efficiency investments and making innovative business models more attractive

To what extent deep renovations can be triggered by a carbon price and whether a CO_2 price is able to incentivise renovation activities depends on a variety of factors, as shown below.

Low price elasticity in the heating sector and non-economic barriers

The possible impact of a carbon price on energy saving measures or a fuel switch depends, among other factors, on how much the price increases. As price elasticity in the heating sector is rather low compared to the power sector (Pollitt & Dolphin, 2020; Cambridge Economics, 2020; Schulte & Heindl, 2016), consumption of heating fuels is not expected to change significantly in the short- and mid-term apart from ad hoc behavioural changes, such as individual consumer reductions in heat use. Low-income groups especially, who are more likely to live in rental housing, do not have the financial means nor the ability to invest in energy efficiency measures or a fuel switch. Due to the low price elasticity and high investment costs for building interventions, a carbon price in the buildings sector needs to be relatively high to initiate a fuel switch of the heating system or even energy efficiency improvements. In the short term it would most likely only trigger energy saving through limited behavioural changes.

An adequate price level may incentivise a fuel switch

Arguing primarily on the basis of cost-effectiveness of alternative investment choices, studies assume that even a carbon price of ~€150/tCO_2 on top of energy taxes in 2030 (EWI & FiFo, 2019; Matthes, 2020) would not be sufficient to incentivise efficiency improvements, especially if the buildings are not among the worst-performing buildings. To trigger investments in deep energy renovation, prices have to be well above €200/tCO_2 and exceed €250/tCO_2 after 2030 (EWI & Fifo, 2019)[1].

However, a steadily increasing carbon price can incentivise switching to low-carbon heating systems and create a level playing field for renewable energies with gas heating, for example. Heat pumps especially become increasingly attractive when electricity becomes cheaper and at the same time fossil fuels become more expensive. Germany,

[1] Estimations of the necessary price levels mainly draw on Germany-based analysis around the introduction of the national emissions trading scheme on heating and transport fuels. However, the carbon price in Sweden of >€110/tCO_2 mainly triggered fuel switching, but the level of medium to deep renovation is below the EU average. This gives an indication beyond a single country case that a price level of around €100/tCO_2 is insufficient.

for example, uses carbon revenues in its recently introduced emissions trading system to lower surcharges for renewable energy expansion, resulting in a decrease of consumer electricity prices. This provides an additional incentive for fuel switching (DEHSt, 2021). The Swedish carbon tax provides evidence of the climate mitigation effects in the buildings sector of a CO_2 price (see below).

Complementary policies are key to unlock the carbon abatement potential of a carbon price in the buildings sector

The low price elasticities in the heating sector and the diverse market barriers for renovation highlight the need for complementary policy instruments to unlock the carbon abatement potential of a carbon price in the buildings sector. A package of policies, including mandatory minimum energy performance requirements (MEPS), as well as financial and information support are needed to overcome the described barriers and to trigger investments in innovations (see also Agora Energiewende & Ecologic Institute, 2021).

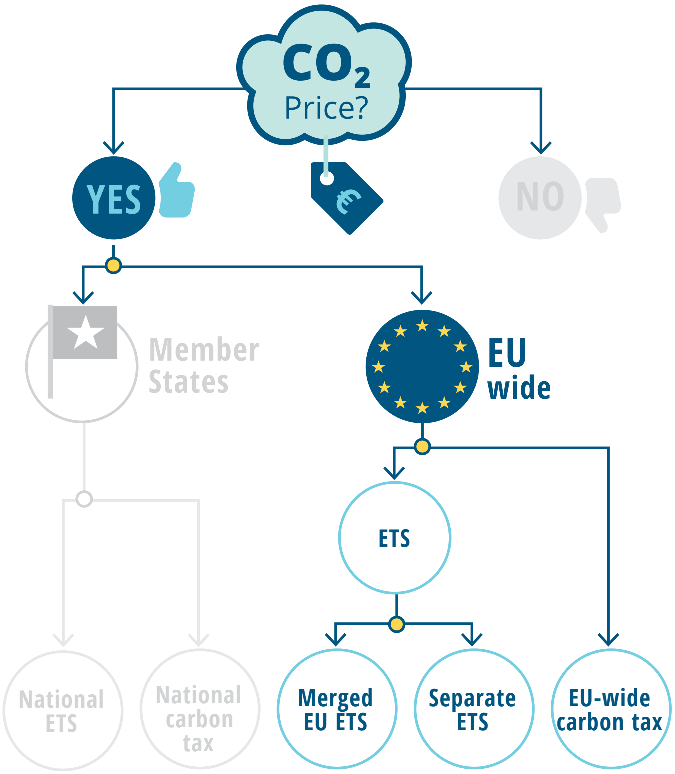
With an increasing carbon price, the financial support for renewable heating systems can be lowered as they become more economically viable. However, an additional positive impact on the cost-effectiveness of energy efficiency measures will only be generated at a high CO_2 price. Other financial incentives and minimum performance standards are needed to support deep renovation, especially in rental buildings.

Key takeaways

- Due to the distinct features of the building stock, including many non-economic barriers to building renovation, a price instrument alone cannot trigger the needed investments for deep renovation.
- At high price levels, a CO_2 price signal makes low-carbon investments more cost-efficient and may trigger fuel switch to renewable heating systems; however, to initiate deep renovation carbon prices above €250/tCO_2 after 2030 are needed.
- Apart from cost-effectiveness, other barriers persist such as long investment cycles for building components or lack of information on technical renovation options and related benefits.
- Mandatory performance requirements, tailored financial support and informational measures are key to unlock the full abatement potential in buildings sector.
- The economic theory that a subsidy can be lowered with a rising carbon price (making low-carbon technologies more cost-effective) is not necessarily valid in the heterogenous buildings sector with market barriers, information asymmetries and the split-incentive dilemma.

AVAILABLE OPTIONS TO DESIGN A EUROPEAN CO_2 PRICE AND IMPLICATIONS FOR THE COMPLIANCE MECHANISM

There are several options to introduce a European price for carbon emissions in the buildings sector. While the ongoing debate is focused on the introduction of an emissions trading scheme, we are going to highlight advantages and disadvantages of an EU-wide carbon tax as well.



Extending the European Emissions Trading Scheme

The existing EU ETS currently caps emissions from around 10,000 installations. It covers CO_2 emissions from electricity and heat generation (district heating) and energy-intensive industries including oil refineries, steel works, and production of iron, aluminium, cement, lime, glass and ceramics.[2] It could potentially be expanded to the buildings and transport sector by capping emissions from fuels burned for heating and transport, requiring fuel suppliers to hold emission allowances per tonne of CO_2 for the fossil fuel they bring to the market. Contrary to the current downstream EU ETS, the buildings and transport emissions would be regulated by an upstream design. It can be assumed that the carbon costs will the passed on completely to the end user to incentivise the required interventions (Pollitt & Dolphin, 2020).

In economic theory, emissions trading guarantees emissions reductions through a fixed cap on the allowed amount while reducing the emissions in the most cost-effective way. In practice, additional policy instruments, exemptions and other market effects lead to inefficiencies in the system and may distort the price signal. Economic theory shows that the direct interaction of a market instrument with ambitious complementary EU and national policies lowers the efficiency of the ETS (as seen in decreasing allowance (EUA) prices with an ambitious Renewable Energy Directive (Fischer & Preonas, 2017)). To counteract this "waterbed effect", a well-functioning market stability reserve is important. The ETS reform in 2018 strengthened the MSR, which resulted in increasing prices for allowances[3] (Pollitt & Dolphin, 2020). A further extension of the EU ETS to other sectors would need to be adjusted to the respective policy mix in place.

- An expansion of the EU ETS to buildings and transport would have effects on the CO_2 price. Some studies expect a price increase of the EU ETS in case of an enlargement of the existing scheme to heating fuels as abatement costs in the heating sector are higher than in the power sector. This would add to the already expected rise in EUA prices in 2030 with the new 55% reduction target (PIK, 2021), which would decarbonise the power sector (phasing out coal) sooner than expected. However, other experts are estimating uncertain price effects if the EU ETS is enlarged to heating fuels and highlight the volatile nature of the price formation in the ETS. Significantly higher prices due to the inclusion of the buildings sector could be a disproportionate burden for industries and for consumers, but may still be too low to make renovations cost-effective.
- Additional (national) measures to reduce CO_2 emissions in the buildings sector – such as standards or subsidies – would undermine the inherent efficiency of emissions trading and lower the price in the emissions trading scheme. If a strong price signal was to be maintained, a price corridor or a well-functioning adjustment mechanism/market stability reserve will have to be ensured.

[2] The list of energy-intensive industry is not exhaustive. In addition, the EU ETS covers other greenhouse gases as well as commercial aviation within the European Economic Area.

[3] The 2018 reform of the EU ETS directive reinforced the MSR, which balances the long-term supply of allowances by creating an upper bound of 833 million allowances in the market (total number of allowances in circulation – TNAC), increased the linear reduction factor to 2.2%, and introduced new rules for carbon leakage. From 2023 the EU Commission can delete allowances held in the MSR.

Setting up a separate ETS for buildings and transport

Another option is to cap emissions from heating and transport fuels and create a separate ETS. Such a scheme theoretically shares the advantages of any ETS if emissions are capped and traded.

- A separate emissions trading scheme for heating and transport fuels is expected to result in higher prices compared to the price level in the EU ETS due to the higher abatement costs in these sectors. Once the price levels between different systems converge, they could possibly be merged into one single EU ETS (Agora Energiewende & Ecologic Institute 2021; Edenhofer 2021).
- In a separate ETS, the price development would still be volatile compared to a carbon tax. A price corridor could alleviate some uncertainties and prevent any steep allowance price drops due to demand shocks as well as a too high burden to consumers and small industrial installations. This in turn would call for additional measures in the buildings sector to ensure that the target is reached.
- As additional measures are needed to achieve the GHG emissions reduction targets for the buildings sector, the Effort Sharing Regulation needs to be kept as a main or complementary compliance mechanism.

Both options, extending the EU ETS or creating a separate emissions trading system for buildings and transport, require considerable administrative efforts and would realistically only start in the second half of the 2020s, which would delay the crucial transformation in the buildings sector. Any renovations happening now or in the coming years should already be climate-proof.

Introducing an EU-wide carbon tax

While currently not debated intensely, the introduction of an EU-wide carbon tax on heating fuels would be a third option to introduce a CO_2 price for the buildings sector. It has the advantage of providing stable price signals, especially if designed progressively, providing early investment security for expected price levels until 2050.

- A carbon tax would provide a stable price signal and could be set at a price that would make deep renovation significantly more cost-effective.
- A dynamic design could adjust the price level if climate targets are not met (see example from Switzerland on page 11).
- Compared to the introduction of an ETS, introducing a carbon tax is politically more challenging at EU level since it requires unanimity voting. An ETS can be introduced by majority voting.
- Being implemented in an existing energy tax system that does not always exploit incentives to phase out fossil fuels, a uniform carbon price on heating fuels will create different effects across Member States. The EU Energy Taxation Directive from 2003 currently only requires minimum taxation levels, disregarding the carbon content of different energy carriers. An EU-wide carbon tax should be complemented by a general reform of the energy taxation and state aid rules to create a consistent framework to incentivise the phase-out of fossil fuels.
- Since it is a price and not a quantity-based instrument, a carbon tax would not be inefficient in the presence of other policy instruments such as standards or subsidies. Rather, it would leverage the effectiveness of standards since it increases the cost-effectiveness of abatement measures.

Implications for the compliance regime

A reliable compliance regime is key reducing GHG emissions in Europe and ensuring the sectoral targets are being met in time. The Effort Sharing Regulation is the current carbon emissions reduction compliance regime for buildings in Europe as buildings belong to the so-called non-ETS sectors. Member States are responsible to meet their individual emissions reduction targets. On the other hand, emissions of those sectors covered by the ETS (mainly the power sector and energy-intensive industries) are capped and compliance is ensured at the individual installation level.

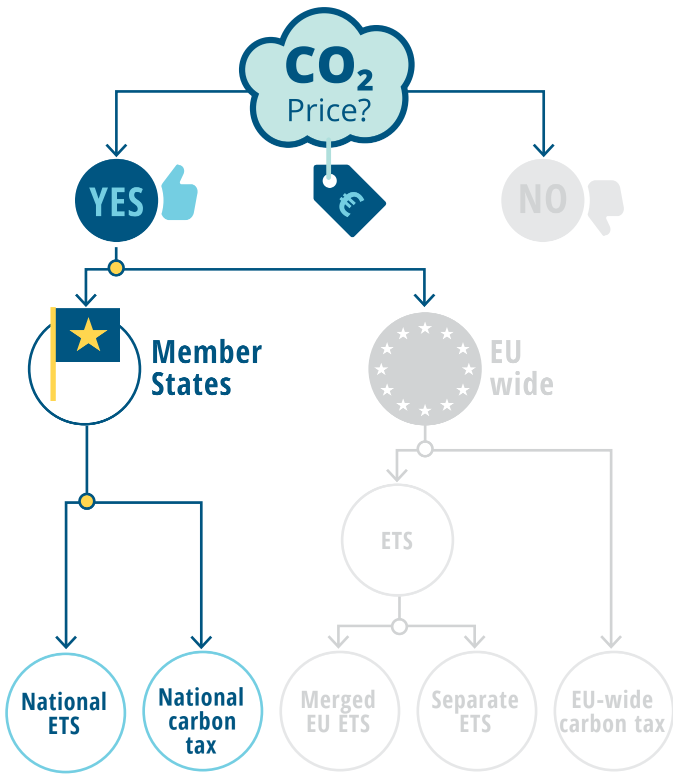
Obliging other actors than Member States to reduce heating emissions would rule out the Effort Sharing Regulation as a compliance system. In an ETS for the buildings sector, the responsible actor would most probably be the suppliers of heating fuels. If the target achievement cannot be guaranteed in an ETS for the buildings sector, for example due to loopholes, exemptions, price distortions or price caps, it is important to keep another compliance mechanism in place, i.e. the Effort Sharing Regulation. A mixed compliance scheme is however prone to creating loopholes or double-counting and is more complex to monitor compared to a clear separation of compliance regimes per sector.

An expansion of the EU ETS or a separate ETS instrument would transfer a large part of the emissions now covered under the Effort Sharing Regulation to the market-based ETS as a new compliance system. Keeping the Effort Sharing Regulation as a main compliance mechanism for the buildings sector would thus not be compatible with an expanded or a separate ETS and would require a revision.

Key takeaways

- The carbon price in an ETS is always volatile; in addition, ambitious national policies may cause inefficiencies in the market-based system.
- If an ETS is used, a minimum price and a robust market-stability mechanism are crucial to ensure sufficient price levels; a separate ETS is favourable over an expansion of the EU ETS to reflect the high abatement costs in the buildings sector.
- A carbon tax system is superior to an ETS as it can be designed independently and can be more easily adjusted if targets are not reached.
- For an EU-wide price signal, the current energy tax system needs to be reformed to align incentives with climate-neutrality targets.
- The compliance mechanism, currently regulated under the Effort Sharing Regulation, needs to be adjusted carefully to ensure targets are met and to prevent two parallel compliance regimes.

INSIGHTS FROM PRACTICE



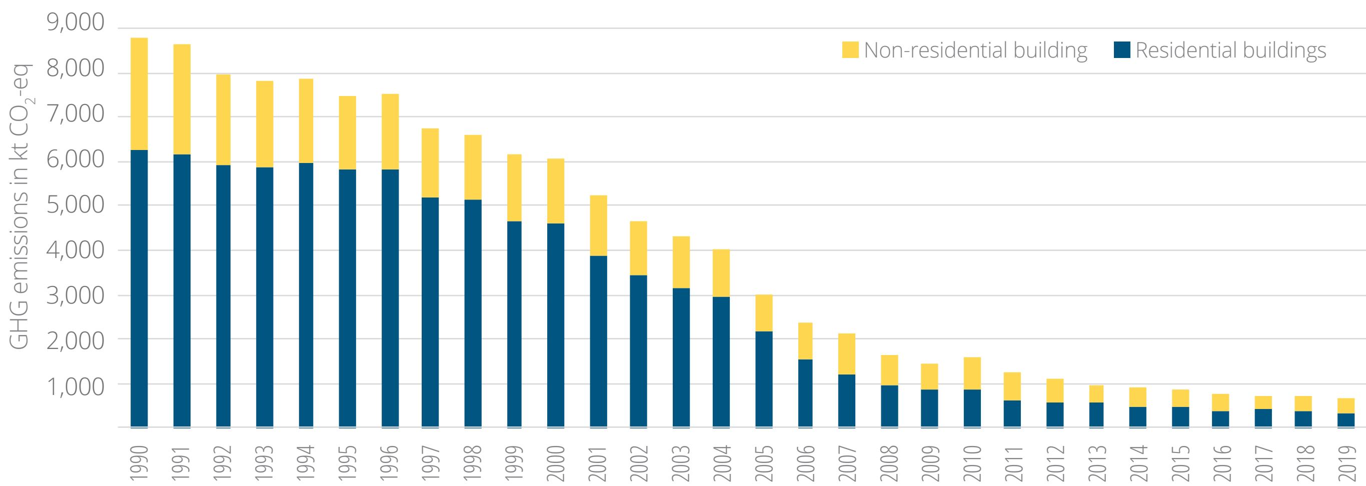
Some Member States have long-term experiences with carbon pricing in the buildings sector, most notably Sweden, which will be the focus of our analysis below. Across Europe, taxes and levies already make up a large share of household electricity (41%) and gas (32%) prices, but implicit carbon prices, e.g. through energy taxes, vary highly across sectors and Member States (Agora Energiewende & Ecologic Institute, 2021; Matthes, 2019). Transport fuels are usually subject to higher taxes and levies than heating fuels, and electricity prices can include high taxes and (grid) surcharges, which poses barriers to system integration in some Member States (Pollitt & Dolphin, 2020). In addition, fuel prices and the corresponding tax level differ across European Member States (European Commission, 2020a).

Moreover, an EU-wide price signal in the buildings sector will have different impacts across Member States as the share of emissions covered depends on the share of fossil fuels used for heating, which also varies across countries. Large shares of district heating are already covered by the EU ETS and would most likely be excluded from an additional price signal. This means that Member States with a high share of decentralised natural gas and oil heating systems (or solid fuels) will be especially affected by an ETS, such as Germany, the Netherlands, Hungary or Poland. For now, it remains a national decision to adjust any existing (carbon) tax and levy system to an EU-wide carbon price signal to alleviate an additional burden for consumers, so most countries have to date excluded installations already covered under the EU ETS from national carbon prices (e.g. Sweden, Germany).

Experience from Sweden: CO_2 tax incentivised fuel switching but had limited effects on deep renovations

The heating of buildings accounts for only about 3% of Sweden's GHG emissions. The phase-out of fossil fuels in heating has progressed since the 1970s and was accelerated by a CO_2 tax introduced in the early 1990s. Since the tax was introduced, the CO_2 emissions from buildings have decreased significantly (see figure 5). The development has been the result of several factors, including the CO_2 tax, high oil prices and the availability of cost-effective alternatives (Anderson, 2019). The CO_2 tax elevated already increasing energy prices and, together with a spiralling oil price, it led to a swift phase-out of oil boilers from the end of the 1990s, which had been the main source of CO_2 emissions.

Figure 5: GHG emissions from residential and non-residential buildings in Sweden, 1990-2019.



Evaluations show that an increasing carbon tax and oil price also led to a wide use of heat pumps and district heating (Swedish Energy Agency, 2006). Between 1994 and 2020, the number of heat pumps increased from less than 5 thousand to 1.2 million. In other words, in 2020 60% of all single-family buildings were equipped with a heat pump. While the CO_2 tax also made energy efficiency investments more cost-effective, it is difficult to estimate the exact impact of the tax compared to other policy instruments on building renovation. Due to a more stringent building regulation and investments in energy efficiency, the energy need has been decreasing despite an increasing building stock floor space. In 1995, the average energy need was around 170 kWh/m^2/year for an average building, which decreased to around 120 kWh/m^2/year by 2020, reflecting the EU average renovation rate of 1% per year. In line with this, a comparative study across EU Member States shows that the Swedish annual renovation rate is not significantly higher than the EU average while the rate of deep renovations is even lower (Ipsos & Navigant, 2019). The carbon tax was thus instrumental in triggering a fuel switch but was not effective in triggering deep energy renovation.

The Swedish government lowered the income tax simultaneously to create a higher disposable income and to avoid adverse social effects of the CO_2 tax. The lowered income tax compensated most building owners for the additional carbon costs and increased the acceptance for the policy. The CO_2 tax revenues also enabled the government to lower the income tax.

Experience from Germany: Introducing a national emissions trading system with fixed prices

After a long public debate, the German government introduced a carbon price in the form of a separate national ETS implementing the "Climate Action Programme 2030" in 2019[4]. The national emissions trading system complements the EU ETS in the German non-ETS sectors of buildings and transport as an upstream system which obligates suppliers and distributors bringing fossil fuels to the market to hold emissions allowances. To avoid double counting, fossil fuels burned in a plant covered by the EU ETS are excluded from the national scheme.

A fixed CO_2 price is set for transport (petrol, diesel) and heating fuels (heating oil, LPG, natural gas) from 2021 (€25/tCO_2) until 2025 (€55/tCO_2) which makes the system prone to criticism as it only unfolds its benefits of an expectedly higher market price in 2027. To phase in the formation of a market-based price, there will be a price corridor in 2026 of €55-65/tCO_2. Experts still doubt the legal compliance of the system due to the fixed price in the first five years and its resemblance to a carbon tax (Matthes, 2021).

At the moment there are doubts that the German national ETS with a starting price of €25 will trigger any change in investment patterns in the buildings sector. The expected (small) price increases for natural gas/kWh and heating oil/l are shown in Table 1. Example calculations show a cost increase of €120/ year in 2021 and €264/ year in 2025 for an old single-family house with heating energy consumption of 20,000 kWh/year with a gas boiler (202g CO_2/kWh) or €158/year in 2021 and €348/year in 2025 for an oil boiler (266g CO_2/kWh) respectively.

Table 1: Increase of fuel costs from 2021 – 2025 in the buildings and transport sector due to the carbon price in Germany.

	Unit	2021	2022	2023	2024	2025
Natural gas	kWh	0.5 cent	0.5 cent	0.6 cent	0.8 cent	1.0 cent
Heating oil	l	7 cent	8 cent	10 cent	12 cent	15 cent
Petrol	l	6 cent	7 cent	8 cent	11 cent	13 cent
Diesel	l	7 cent	8 cent	10 cent	12 cent	15 cent

4 The national law *"Brennstoffemissionshandelsgesetz – BEHG"* was adopted in December 2019 and amended in November 2020 to increase the certificate price for each year (starting with €25 instead of €10 in the beginning and ending with €60 instead of €55 in 2025).

Key takeaways

An EU carbon tax would have different impacts across Europe. Country experiences from, for example, Sweden, Denmark and Germany show that national adjustments of taxes, levies and surcharges were adapted in the respective countries following the introduction of a CO_2 price either as a tax or ETS. An EU-wide carbon tax should be complemented by a general reform of the energy taxation and state aid rules to create a consistent framework to incentivise the phase-out of fossils fuels.

The experience with a carbon price in Sweden shows an effect on CO_2 emissions reductions in the buildings sector mainly due to fuel switching. Although the high price level also made energy efficiency investments more cost-effective, research does not confirm a significantly increased renovation rate and the deep renovation rate is even below the European average.

Experiences regarding the implementation of a national CO_2 price through an emissions trading scheme in Germany cannot be retrieved yet as the system only started in 2021 with a fixed price; the rather low initial price will most likely not trigger significant energy saving measures.

DISTRIBUTIONAL EFFECTS

Redistribution of carbon costs can be designed for all carbon price schemes and is particularly important in the buildings sector to alleviate the burden on low-income households. Possible recycling of carbon revenues can, for example, be implemented as a per capita bonus, tax reductions/lower electricity prices (supporting system integration by making heat pumps and e-mobility more attractive) or earmarked financing for building renovation and low-carbon technologies. A properly designed redistribution systems can also lead to macroeconomic benefits (Cambridge Econometrics, 2021) and seems key for the acceptance of a tax, as examples in practice show.

Switzerland

The redistribution of tax revenues on a per capita basis is one of the key design features of the Swiss CO_2 tax. A CO_2 tax on fossil fuels used for heating (heating oil, natural gas) was introduced in Switzerland in 2008 to incentivise low-carbon solutions in the buildings sector starting at CHF 12/ tCO_2 (€10), rising to currently CHF 96/tCO_2 (€87). Two-thirds of the carbon revenue is redistributed to households (on a per capita basis) and companies directly, while one-third is invested in building a renovation programme to support energy-efficient buildings (Matthes, 2019). However, the impact of the Swiss carbon tax still has to be evaluated since prices for heating oil did not significantly increase despite an increasing CO_2 price due to the volatile wholesale price. The Swiss government introduced a mechanism to automatically readjust the carbon price in case emissions reduction targets in the buildings sector are not met, leading to more planning and investment security for investors and households. Companies have the chance to be excluded from the carbon levy if they commit to voluntary emissions reductions. Together with a low awareness about the CO_2 levy, this leads to high acceptance levels in the Swiss population (EWI & Fifo, 2019).

France

The French government introduced a CO_2 levy of €7/tCO_2 as part of the existing energy tax for the transport, buildings and industrial sector in 2014 with a foreseen steep price path from 2017 which would have resulted in €86 in 2022. This price increase was however taken back after mass protests in 2018 (the 'gilet jaune' movement) caused mainly by an increase of energy taxes on transport fuels. To decrease the burden on low-income households, a yearly climate bonus is today paid to private households to cover additional energy costs. Other carbon revenues are used to build renewable capacity (EWI & Fifo, 2019; Agora Energiewende, 2019).

Germany

The recently introduced national emissions trading system led to extensive political debates about who is going to pay the carbon costs in Germany. Heating oil or gas suppliers are expected to pass on the costs of CO_2 to their clients – that is, to building occupiers heating homes, public or commercial buildings.

After some debate about who is supposed to pay the carbon price in the rental sector, the German government decided in May 2021 on an equal split between building owners and their tenants ("Klimapakt Deutschland", Federal Ministry for the Environment, Nature Conversation and Nuclear Safety). Landlords are now allowed to pass on only 50% of the carbon cost to their tenants via the utility bill which creates a small incentive to implement energy performance measures, alleviates some of the burden on the final consumer and addresses in part the split-incentive dilemma.

Revenues of the CO_2 allowances are to be redistributed to households via a decrease of the renewable energy surcharge ("EEG Umlage"), which lowers electricity costs (DEHSt, 2021). The rest of the revenues will go to a federal energy and climate fund, to support, among others, energy efficiency measures. A lump sum repayment, which is more favourable for the lowest income groups (Cambridge Econometrics, 2021), is still being discussed, and could result in more changes to the national carbon price after the federal elections in September 2021.

Key takeaways

Carbon revenue recycling and distributional effects are crucial to ensure a just transition and gain acceptance for a carbon price.

A lower electricity price achieved by tax reductions through carbon revenue recycling can make the electrification of heat, e.g. heat pumps, more attractive but benefits higher-income groups to a larger extent as they consume more electricity.

A lump sum/per capita repayment is most favorable for low-income groups as it would represent a higher share of their income (see also Cambridge Econometrics, 2021).

Conclusions

The European Union has agreed on new climate protection targets in the recently agreed European Climate Law. To reach the new 2030 targets, the European buildings sector will have to reduce its GHG emissions by 60%. This requires a steep increase of deep renovations from the current 0.2% to 3% annually and, accordingly, a well-designed bundle of policies to overcome the distinct barriers of the sector (BPIE, 2020). A CO_2 price has several advantages, most directly incentivising fuel switching to renewable options, but also making renovation activities more cost-efficient, and potentially reducing payback periods of long-term energy service contracts and thus making innovative business models more attractive.

However, due to the distinct features of the building stock, including many non-economic barriers to building renovation, a price instrument cannot trigger the needed investments for deep renovation alone. In order to increase the leverage effect, the level of the carbon price is relevant but even a high carbon price is unlikely to achieve the necessary transformation in the building stock without additional regulatory policies. Mandatory performance requirements for new and existing buildings, tailored financial support and targeted informational measures are key to unlock the abatement potential in the buildings sector and should be strengthened. An acceleration of renovation activities is expected to be highest if a CO_2 price and mandatory minimum requirements, such as MEPS, both designed to increase progressively, are combined. Complementary policies are important to meet other policy objectives related to energy security, better indoor environmental quality and the alleviation of energy poverty.

Nevertheless, the CO_2 price level itself is also relevant to spur the right investments, especially for public buildings where investment decisions are mainly based on the criteria of cost-effectiveness and less affected by the above-described barriers. At high price levels, a CO_2 price signal makes low-carbon investments more cost-efficient and may trigger fuel switching to renewable heating systems, as the example of the Swedish carbon tax shows. To initiate deep renovation, carbon prices well above €200/tCO_2 after 2030 are needed.

We therefore consider a carbon tax system with a steady price increase path superior to an ETS as it can be designed independently and can be more easily adjusted if targets are not reached. This way, the buildings sector’s carbon reduction targets will remain under the Effort Sharing Regulation and avoid a complex mix of compliance regimes.

Compared to volatile prices, a carbon tax may provide stable long-term price signals and security for investors and thereby encourage the creation of innovative financing products not yet widely used, e.g. energy performance contracting to guarantee a net-zero carbon emissions standard over a long period of time. A carbon price compatible with the decarbonisation targets for 2045/2050 is also an important signal to incentivise investments in low-carbon technologies and help their diffusion in the market. However, to create a demand for the development of innovation, binding minimum requirements/standards and financial support are needed. In addition, the introduction of an EU-wide carbon tax should be taken as an opportunity to align the national tax, levy and subsidy schemes towards phasing out fossil fuels.

If an emissions trading system is the preferred option at the EU level, a separate system is favourable to an extension of the EU ETS to reflect the high abatement costs in the buildings sector; this would be the second-best option, if combined with a price corridor. If an emissions trading system is chosen, a price corridor and a robust market-stability mechanism are crucial to ensure sufficient price levels and contain price volatility.

Conclusions

Generally, as a carbon price signal can only work as a complementary instrument, the compliance mechanism for reducing GHG emissions from buildings and transport has to remain with the Member States under the Effort Sharing Regulation at least partly. A split of responsibility to reduce GHG emissions between parts that will be governed under a possible ETS and those governed by the Effort Sharing Regulation is not impossible but risks creating loopholes and double-counting of emissions reductions. The easiest and most straightforward solution is therefore to keep the Effort Sharing Regulation as the main compliance regime for the buildings sector and extend the policy mix to make sure that targets can be fulfilled. An extension of the EU ETS should be avoided.

Finally, experiences from Member States show that a fair redistribution of costs from a carbon price is crucial to ensure a just transition. Carbon revenue recycling is most effective in supporting low-income households if at least partly paid back as a lump sum to all citizens. In addition, earmarking revenues to spend on renovation activities provides a logical funding loop to increase renovation and create macroeconomic benefits. Low-income, vulnerable homeowners especially need to receive financial support to carry out energy efficiency improvements to ensure a just transition. We would therefore recommend earmarking 50% of the revenues to deep renovation programmes, and redistribute the remaining share as a lump sum to the final customers.

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