JUNE 2021

REGULATORY ASSISTANCE PROJECT

Pricing is just the icing:
The role of carbon pricing in a comprehensive policy framework to decarbonise the EU buildings sector

Samuel Thomas, Louise Sunderland and Marion Santini

Executive summary

This report explores the role of carbon pricing in delivering rapid and deep building decarbonisation across the European Union. It makes the case for the gradual and measured introduction of carbon pricing, either at the national or EU level, as one part of a broader package of measures to meet increased Effort Sharing Regulation (ESR) targets.[1]

The 2020s must be the decarbonisation decade for European buildings. To meet the EU's carbon goal of reducing emission by at least 55% net from 1990 levels, the EU Commission wants the buildings sector to take the lead. The EU's Climate Plan Impact Assessment sees building renovations and sustainable renewable heating system replacements cutting carbon emissions in the sector by 60% by 2030 (relative to 2015) in line with the ambition of the Renovation Wave. At the same time, this transformation must be equitable. This is a massive task and at the same time an opportunity to transform the EU's built environment for the better.

A comprehensive framework of policies and a step change in ambition is needed. Emissions reduction targets should be aligned with the 2030 climate goal to ensure environmental integrity. To meet those targets, a mixture of regulation, carbon pricing and supporting policy measures will be needed. Regulatory measures will be crucial in driving demand for building decarbonisation. Subsidy programmes will have to stop supporting fossil fuel burning technologies, such as fossil gas boilers. The supply chain will need to adapt, reskill and grow. To support the investments needed, energy prices should reflect environmental costs and send the right signals to consumers and producers. Revenues from carbon pricing must support decarbonisation efforts and target energy-poor, vulnerable and low-income households in the worst performing buildings.

55%-proof Effort Sharing Regulation (ESR) targets are essential for the sensible introduction of carbon pricing. The current climate target architecture places the obligation to decarbonise those sectors that fall outside the EU Emission Trading Scheme (ETS) on Member States through binding ESR targets. If these national targets were strengthened in line with the carbon goal, Member States could put in place national pricing measures to support target achievement as part of their policy packages. Nine Member States, including seven with relatively high ESR targets, have already introduced national carbon pricing measures covering the buildings sector, and a tenth is expected to follow suit. Judging by the responses of those countries with challenges to meet their current targets, higher ESR targets would likely lead to carbon pricing being introduced in more Member States.

European carbon pricing measures could also support the achievement of higher ESR targets. EU-wide minimum carbon taxation levels, adopted through changes to the Energy Taxation Directive, could provide a floor for national pricing

[1] The authors would like to acknowledge and express their appreciation to the following people who provided helpful insights into drafts of this paper: Brigitta Bozso, Edoardo Concari Coppola and Theodora Petroula (CAN Europe); Sam Van den plas (Carbon Market Watch); Femke de Jong (European Climate Foundation); Barbara Mariani and Davide Sabbadin (European Environmental Bureau); Bram Claeys, David Farnsworth, Andreas Jahn, Jan Rosenow and Dominic Scott (Regulatory Assistance Project); and Carlos Calvo Ambel and Sofie Defour (Transport & Environment). Tim Simard provided editorial assistance.

measures. A proxy carbon tax could also be introduced through a separate EU ETS for buildings and road transport with a minimum and maximum price (a price corridor). This would be more administratively complex but would put in place the accounting framework to allow for its amalgamation with the current EU ETS at an appropriate point beyond 2030, when the market for building decarbonisation actions will be more developed. Increasing ESR targets allows for all these possibilities.

Carbon pricing has two important roles in the building decarbonisation policy framework. By applying the polluter pays principle, it makes investments in sustainable renewable heat and energy efficiency more cost effective. And it generates revenues that can be used to support energy efficiency and heat decarbonisation policy measures, delivering many more emissions savings than the effect of the price alone. The revenues should be targeted at supporting the households that would be most affected by price increases and least able to invest in low-carbon technologies. Explicitly linking the carbon price to supporting policy measures could increase public support for carbon pricing.

Fossil gas and electricity prices are not aligned with the 60% building decarbonisation goal. Even in the EU Member States that have introduced carbon pricing, fossil gas is cheaper than electricity as a result of the energy transition policy costs added to electricity prices through levies. Rebalancing the prices of the fuels used for space heating, through a fair distribution of taxes and levies, is important in order to send the right signals to building owners and the heating system supply chain. Not doing so would undermine decarbonisation efforts. How can we expect people to switch to sustainable renewable heating systems if we add more policy costs to electricity than the dirtier alternatives?

Relying on carbon pricing alone to drive building decarbonisation would be catastrophic. Without regulatory and supporting policy measures, the responsiveness of building owners to energy price signals is notoriously small. The sector is beset by market failures and barriers that have stopped the weighted average renovation rate from rising above 1% per year. Addressing these issues requires the adoption of regulatory and supporting policy measures — like funding, finance and practical support — alongside carbon pricing. An overreliance on pricing would hit vulnerable households, with no means of investing in decarbonisation technologies. This would be the definition of an unjust transition.

Carbon revenue recycling can help renovate the worst performing homes first. Timing of investment is key. Carbon pricing should only be ramped up once the supporting policy framework has become fully operational and at sufficient scale, including a targeted strategy for renovating the worst performing homes of those in energy poverty or on low incomes. In this way, the most regressive effects of carbon pricing can be mitigated through sustainable changes to the building stock, limiting the need for longer-running financial transfers to supporting the incomes or reducing the bills of those most in need. This renovation support to target households can be partly funded by revenues from the carbon price, alongside recovery funds and other sources. Carbon price revenues must be 100% recycled and brought forward in time through, for example, the use of a climate bond.

Not increasing 2030 ESR targets would make emissions trading without a price ceiling a necessity to maintain the integrity of the EU's climate architecture. Without higher national emissions reduction targets, the only other instrument in the climate target toolkit is the regulation of fuel suppliers to cap emissions. This would transfer the obligation to meet 2030 climate targets from Member States to the private sector and ultimately consumers. Emissions would need to be capped in line with the carbon goal in 2030 to ensure the environmental integrity of the EU's climate target architecture. The existing EU ETS could be extended to buildings (and transport), or a separate ETS could be set up covering these sectors. A separate ETS could be linked to the existing ETS through a mechanism to allow for some fungibility between the two sets of allowances. Any one of these strategies would be fraught with risks.

The risks of relying on emissions trading alone to meet building decarbonisation goals are not worth taking. A hard cap on emissions would guarantee emissions reductions as long as the possibility of very high carbon prices is politically acceptable. However, the risk of very high heating fuel prices in the 2020s should not be acceptable. With a separate ETS, this issue would be felt most keenly by the poorest households in the worst performing buildings. With an ETS extension, the risk would be spread across all bill payers, including electricity consumers and industrial users. Either option would risk diverting scarce policy resources away from the proper design and implementation of the supporting policy framework. Perhaps more importantly, the introduction of an emissions trading cap would risk complacency with respect to the need for effective supporting policies. The outcome of either of these two risks would be slower decarbonisation in the buildings sector and rising energy bills, which would be an unjust slow transition.

Whatever the chosen approach to carbon pricing, we need regulation and supporting policy measures to drive demand for low-carbon technologies. The evidence presented in this report highlights the need to rebalance energy prices as part of a comprehensive policy framework. Regulation will inevitably need to play a stronger role to overcome the structural barriers to rapid decarbonisation. We present options available to EU policymakers that could ensure more regulatory focus is placed on building decarbonisation at Member State level. Minimum energy performance

Principles for EU carbon pricing in the buildings sector

1. **A cog in the machine.** Carbon pricing cannot deliver building decarbonisation on its own. It is not even the most important element of the comprehensive policy framework needed to deliver on the EU's sectoral goals. As part of that framework, it can support efforts by better aligning incentives and generating revenues for decarbonisation programmes.
2. **Fit for 55.** Carbon pricing should be nested within a climate target architecture aligned with the 55% EU-wide emissions reduction target by 2030. Increased Effort Sharing Regulation (ESR) targets would allow carbon pricing to play a supporting role in decarbonising the buildings sector. Reliance on emissions trading to meet the 55% goal would place the risk of rising compliance costs on end users.
3. **100% revenues recycled.** Support programmes for renovation of homes occupied by low-income groups and early adopters of deep decarbonisation projects are essential to sustainably mitigate the negative distributional impacts and can save many more tonnes of carbon than the impact of carbon pricing alone.
4. **A just transition.** Carbon pricing will introduce additional costs to the use of fossil fuels for heating. These costs will be felt most keenly by fossil energy users with the lowest incomes. Carbon pricing must be introduced in a way that enables households to adapt *before* being burdened by the price, through attention to timing, price control, targeted energy efficiency and renovation programmes and broader socioeconomic and housing policy.

standards for existing buildings can provide building owners with a clear trajectory for long-term renovation requirements to 2050 and drive action before 2030 in the worst performing buildings. An obligation on Member States to replace fossil fuel heating systems would provide the missing link in the EU's building decarbonisation strategy. Member States could then choose to implement this obligation by introducing tradable clean heat standards for fossil fuel heating suppliers. Such a solution would engage the private sector in heat decarbonisation and stimulate the market for heating system replacements.

Chapter 1

An introduction to the EU policy context and the structure of this report

The EU has set itself an objective to be climate neutral by 2050.[2] Reaching this goal requires boosting the 2030 climate target, currently set at a 40% reduction in GHG emissions compared to 1990 levels. In 2020, the European Commission presented the 2030 Climate Target Plan, which demonstrates how the EU could cut net GHG emissions by at least 55% net by 2030.[3] The European Council endorsed the 55% target,[4] which was enshrined in the Climate Law.[5]

Reaching a more ambitious climate target would require significant additional policy action. The Commission has reviewed options in the 2030 Climate Target Plan, preparing for the broad overhaul of climate and energy policies that it will propose in July 2021 — the Fit for 55 package. The 2030 Climate Target Plan places particular emphasis on enhancing the use of carbon pricing in some of the options.

Since the creation of the EU emission trading system (EU ETS) in 2005, the EU and its Member States have gained experience with carbon pricing. The EU ETS is part of a legal framework that aims at securing the achievement of the EU's 2020 and 2030 GHG targets:

- The EU will reduce its emissions from the sectors covered by the ETS[6] by 43% from 2005 levels by 2030. This covers large point emission sources (mainly power sector and industry) and aviation, representing around 40% of the EU's GHG emissions.
- The emissions, which are not regulated by the ETS and represent around 60% of the EU's emissions, are under the responsibility of Member States. The Effort Sharing Regulation (ESR)[7] provides that each Member State will reduce its

---

[2] Croatian Presidency of the Council of the European Union. (2020). *Long-term low greenhouse gas emission development strategy of the European Union and its Member States*. https://unfccc.int/sites/default/files/resource/HR-03-06-2020%20EU%20Submission%20on%20Long%20term%20strategy.pdf

[3] European Commission. (2020a). *Stepping up Europe's 2030 climate ambition – Investing in a climate-neutral future for the benefit of our people*. COM(2020) 562 final. https://ec.europa.eu/clima/sites/clima/files/eu-climate-action/docs/com_2030_ctp_en.pdf

[4] European Council, Council of the European Union. (2020). *European Council conclusions, 10-11 December 2020*. https://www.consilium.europa.eu/en/press/press-releases/2020/12/11/european-council-conclusions-10-11-december-2020

[5] European Council, Council of the European Union. (2021, April 21). *European climate law: Council and Parliament reach provisional agreement* [Press release].

https://www.consilium.europa.eu/en/press/press-releases/2021/05/05/european-climate-law-council-and-parliament-reach-provisional-agreement/

[6] European Commission, EU Emissions Trading System (EU ETS), https://ec.europa.eu/clima/policies/ets_en#tab-0-1

[7] European Commission, Effort sharing: Member States' emission targets, https://ec.europa.eu/clima/policies/effort_en#tab-0-1

emissions from non-ETS sectors from 2005 levels by 2030 by a certain percentage ranging from 0% to 40%. These national targets are called the effort sharing targets (ESR targets). Together, they will reduce emissions in these sectors by 30% by 2030, compared to 2005 levels.

The EU ETS currently covers 30% of total building emissions. These are direct emissions from larger fossil fuel district heating system installations included in the EU ETS (>20MW) and indirect emissions from electricity use in appliances, heating and cooling equipment and lighting amongst other end users.[8] Member States have the responsibility for the other building emissions, including those of most commercial and residential fossil fuel heating systems.

Member States are free to put a carbon price on these emissions or to roll out other measures to remain within the limits set by their national ESR targets.

The Commission is considering the introduction of emissions trading for additional emissions sources, including fossil fuel combustion of road transport and building heating, where carbon pricing at the national level is 'often absent or limited.'[9] Amongst the options analysed in the Commission's Impact Assessment (see Annex 1), the extension of EU ETS to new sectors before 2030 is unlikely. The risks to power sector decarbonisation from an extension would be too great.[10] Changes to the EU ETS will need to bed down before adding additional uncertainty with the introduction of new sectors.[11] Commission senior staff recently stated their preference for setting a separate system for the new sectors subject to emission trading.[12] However, the broadening of the coverage of the EU ETS remains an option for the future. This report examines alternatives to the extension of the EU ETS as a way of driving the pace and scale of decarbonisation needed in the buildings sector.

The EU wishes the 2020s to be the decade of building decarbonisation. To meet the goal of reducing greenhouse gas emissions by at least 55% net in 2030 (relative to 1990 levels), emissions from buildings are expected to fall by 60% relative to 2015.[13] That means a massive increase in the energy saved through renovation and the swapping out of tens of millions of fossil fuel heating systems, replaced by sustainable renewable alternatives.[14]

Change of this scale is unprecedented and at this pace requires the mobilisation of society's resources. Public and private investment needs to be driven by clear and

---

8 European Commission. (2020b). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: Stepping up Europe's 2030 climate ambition; Investing in a climate-neutral future for the benefit of our people*. Commission staff working document, impact assessment. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020SC0176

9 European Commission. (2020c). *Climate change — updating the EU emissions trading system (ETS).* https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12660-Updating-the-EU-Emissions-Trading-System/public-consultation

10 Graichen, V, Graichen, J., & Healy, S. (2019). *The role of the EU ETS in increasing EU climate ambition: Assessment of policy options.* Sitra Studies 161. https://media.sitra.fi/2019/10/07112628/the-role-of-the-eu-ets-in-increasing-eu-climate-ambition.pdf

11 Sandbag. (2020, December). *Times of change for the EU ETS: Sandbag's feedback on the upcoming revision*. https://sandbag.be/index.php/2020/12/03/times-of-change-for-the-eu-ets-sandbags-feedback-on-the-upcoming-revision/

12 Polish Electricity Association (PKEE). (2021, April 20). *The coming shakeup of the EU Emissions Trading System* [Presentation]. Politico Live. https://www.politico.eu/event/the-coming-shakeup-of-the-eu-emissions-trading-system/

13 European Commission, 2020b.

14 European Commission, 2020b.

ambitious policy towards the achievement of the decarbonisation goal. The energy transition in buildings must be just, with a fair distribution of costs and benefits.

Our report explores the task ahead, focusing on the role of carbon pricing in delivering on building decarbonisation. It makes the case for a gradual and measured introduction of carbon pricing to rebalance energy prices and raise the revenues needed to support buildings renovation and heating system replacements, particularly amongst those households least able to react to higher prices through investment in low-carbon technologies. It does not place carbon pricing as the primary decarbonisation policy instrument in the buildings sector. Instead, it sees it as one or a number of important regulatory, pricing and supporting policy measures. It emphasises the point that carbon pricing is necessary but nowhere near sufficient.

In Chapter 2 we explain the need for a step change in policy ambition to drive up the renovation rate and the substitution of fossil fuel heating systems with cleaner alternatives.

Chapter 3 examines the role of carbon pricing in the buildings sector, both in aligning incentives with the decarbonisation goal and raising the revenue needed to fund the supporting policies needed to effect real change.

In Chapter 4 we assess the distributional impacts of carbon pricing and explain how to design carbon pricing measures and spend revenues to make the pricing mechanism fairer.

In Chapter 5 we assess the different ways in which carbon pricing could be introduced through the EU policy framework. We examine the following options:

- Do nothing, with the expectation that Member States will institute their own carbon pricing measures.
- Adopt minimum carbon taxes through the Energy Taxation Directive.
- Obligate Member States to reduce carbon emissions through heating system replacements, through either Clean Heat Standards on heating fuel suppliers or alternative measures. Clean Heat Standards would impose a carbon price by proxy, as the costs of meeting it would be passed through on fossil fuel heating prices.
- Introduce a separate ETS for buildings (and road transport), with and without a price corridor.

Finally, in Chapter 6 we place carbon pricing within the broader building decarbonisation policy framework, setting out how regulatory and supporting policy measures interact with carbon pricing.

Chapter 2

The scale of the buildings sector decarbonisation challenge and the need for urgent action

This chapter sets out the challenge ahead for the buildings sector in the 2020s, explaining the need for a step change in policy ambition to drive up the renovation rate and the substitution of fossil fuel heating systems with sustainable renewable alternatives. This challenge is also an opportunity. A comprehensive policy framework aimed at achieving an equitable transition in the EU's buildings stock would have multiple benefits beyond the climate goal. It would reduce energy poverty, improve local air quality and reduce reliance on fuel imports.

The European Union aims to put itself on a balanced pathway to climate neutrality by 2050. That pathway would see the EU reduce its emissions by at least 55% net by 2030, compared to 1990 levels.[15] To meet the 55% goal, the European Commission estimates that buildings sector emissions will need to fall by 60% by 2030, compared to 2015 levels, with emissions in the residential sector falling by 61%-65% and in the services sector by 54%-61%.[16] This represents a massive transformation in the pace of change and is broadly aligned with the Buildings Performance Institute Europe (BPIE)'s Responsible Policy Scenario.[17]

The change of pace needed is represented in Figure 1. Emissions fell from 690 to 570 million tonnes of carbon dioxide equivalent (CO_2e) between 2005 and 2017, a reduction of 18% over 12 years.[18] The hatched line, however, illustrates the significant cut in emissions that will be required to meet the 2030 goal. If emissions from the sector are to be limited to 220 million tonnes CO_2e in 2030, they will need to fall at almost three times the rate we have seen since 2005.

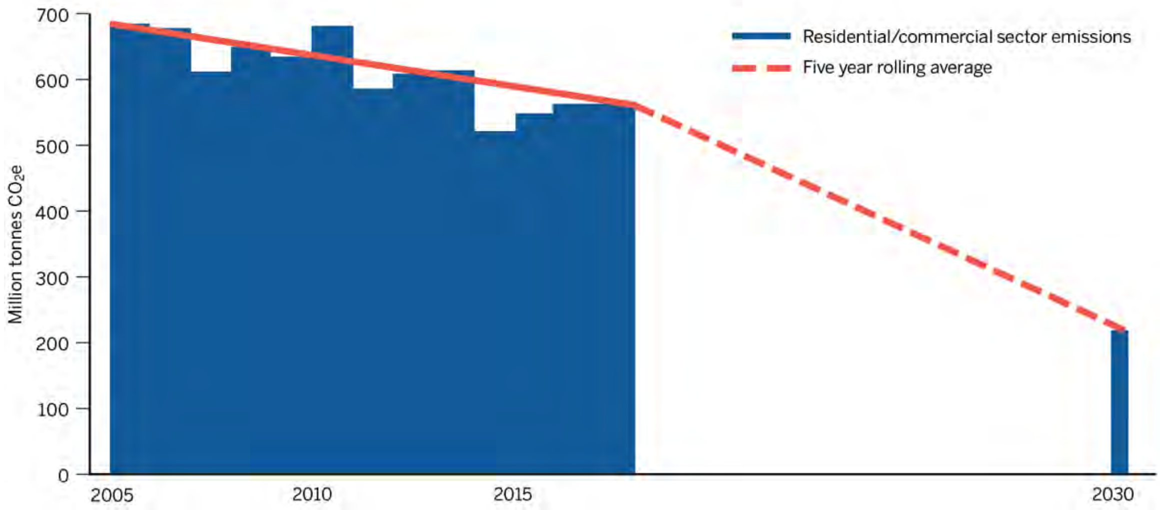
[15] European Commission. (2020d). *State of the Union: Commission raises climate ambition and proposes 55% cut in emissions by 2030.* https://ec.europa.eu/commission/presscorner/detail/en/IP_20_1599

[16] European Commission, 2020b.

[17] Buildings Performance Institute Europe. (2020). *On the way to a climate-neutral Europe.* https://www.bpie.eu/wp-content/uploads/2020/12/On-the-way-to-a-climate-neutral-Europe-_Final.pdf

[18] European Environment Agency. (2019). *Greenhouse gas emissions by aggregated sector.* https://www.eea.europa.eu/data-and-maps/daviz/ghg-emissions-by-aggregated-sector-5#tab-dashboard-02

Figure 1. Residential/tertiary sector greenhouse gas emissions (million tonnes CO_2e)



Source: European Environment Agency. (2019). *Greenhouse gas emissions by aggregated sector*

What will need to change to reduce building emissions by 60%?

Reducing building emissions requires both reductions in final energy consumption and the switching of heating fuels from fossil fuels, such as gas, oil and coal, to electricity and the direct use of renewable sources.

The European Commission Impact Assessment foresees energy demand in the residential sector falling by 14%-18% and in the services sector by 8%-9% by 2030, relative to 2005. The bulk of these reductions (12% and 7% respectively) are already baked into the baseline, that is, they are expected to occur without additional effort beyond what is already planned by Member States.[19] This is optimistic given the reduction in the rate of decline in buildings energy demand during the last decade,[20] the shallow nature of 70%-80% of energy renovations[21] and concerns raised about the reliability of energy savings from policy measures reported by Member States.[22] The baseline scenario used by the Commission assumes that the EU's 32.5% energy efficiency target for the year 2030 is met. At the same time, the Commission recognises that Member States' energy efficiency contributions are insufficient to reach the EU's energy efficiency target.[23] Achieving the required reductions in energy consumption by

[19] European Commission, 2020b.

[20] Thomas, S., & Rosenow, J. (2019). *Energy consumption in Europe: Why is it increasing and what are the policy implications?* European Council for an Energy Efficient Economy (ECEEE) Summer Study paper. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2019/3-policy-and-governance/energy-consumption-in-europe-why-is-it-increasing-and-what-are-the-policy-implications/

[21] IPSOS/Navigant. (2019). *Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU.* https://ec.europa.eu/energy/sites/ener/files/documents/1.final_report.pdf

[22] Forster, D., Kaar, A., Rosenow, J., Leguijt, C. & Pato, Z. (2016). *Study evaluating progress in the implementation of Article 7 of the Energy Efficiency Directive*. Ricardo Energy & Environment, report for DG Energy. https://ec.europa.eu/energy/sites/ener/files/documents/final_report_evaluation_on_implementation_art._7_eed.pdf

[23] European Commission. (2020e). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions: An EU-wide assessment of national energy and climate plans; Driving forward the green transition and promoting economic recovery through integrated energy and climate planning*. COM(2020) 564 final. https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1600339004657&uri=COM:2020:564:FIN

2030 will require both more ambitious policy action and more effective delivery of energy savings through existing policy measures.

The quantity and quality of building fabric renovations must increase

Energy consumption used for heating will need to decarbonise at a faster rate than overall buildings energy consumption. Coal, oil and natural gas accounted for just under half of all final energy consumption in buildings in 2015[24] and three-quarters of the energy used for space heating.[25] To bring down space heating energy consumption and create better conditions for the installation of renewable heating systems, which require lower flow temperatures,[26] the EU Commission anticipates that the Type 1 weighted energy renovation rate (improvements in the thermal integrity of buildings' shells) will need to rise from its current rate of 1.0% per year in the residential sector to between 1.4% and 2.4% in the second half of the 2020s. In the services sector, the increase is from 0.6% to between 1.0% and 1.5%, depending on the assumed mix of policy levers adopted. The Renovation Wave, launched by the EU Commission in 2020, aims to at least double the rate of residential and nonresidential renovations by 2030, driven by policy measures targeted at the market failures and barriers affecting the sector.[27]

A step change in the rate of deep renovations will be needed during the 2020s. According to the EU Commission's Impact Assessment, the average Type 1 renovation will have to reduce a building's energy consumption by between 52% and 66% in the residential sector and by over 40% in the services sector. Contrast this with the current situation. The average energy savings achieved by all energy renovations were only 9% in residential and 17% in commercial buildings from 2012 to 2016. Deep renovations that save more than 60% of primary energy were only carried out in 0.2% to 0.3% of the stock each year.[28] In the Commission's Impact Assessment, the rate of deep renovations increases by more than 400% in scenarios that balance regulatory measures and carbon pricing (MIX and ALLBNK).[29]

Fossil fuel heating systems must be replaced

To reduce building emissions by 60% by 2030, final energy consumption reductions will need to be accompanied by changes to the fuels we use for heating. In the Commission's Impact Assessment scenarios, the share of coal, oil and fossil gas in residential buildings final energy consumption is halved by 2030, with coal all but

---

[24] European Commission, 2020b.

[25] Hall, S. (2020). *EC wants EU buildings: Energy use cut 14% by 2030 through renovation*. S&P Global Platts. (https://www.spglobal.com/platts/en/market-insights/latest-news/electric-power/101420-ec-wants-eu-buildings-energy-use-cut-14-by-2030-through-renovation

[26] Rosenow, J., & Lowes, R. (2020). *Heating without the hot air: Principles for smart heat electrification*. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/heating-without-hot-air-principles-smart-heat-electrification/

[27] European Commission. (2020f). *Questions and answers on the renovation wave*. https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_1836

[28] European Commission. (2019a). *Comprehensive study of building energy renovation activities and the uptake of nearly zero-energy buildings in the EU.* https://ec.europa.eu/energy/sites/ener/files/documents/1.final_report.pdf

[29] European Commission, 2020b.

disappearing from the mix, oil consumption falling by 80%-84% and fossil gas by 37%-48%.[30]

In the Commission's Impact Assessment, the fossil fuels used in residential buildings are displaced by energy savings, electricity use and ambient heat, transferred from ground, air and water sources using heat pumps. Electricity use in buildings is expected to rise markedly, driven by both the electrification of heat and the increasing number and use of appliances. By 2030, electricity consumption in residential buildings is expected to rise by 23%-29%, while the share of ambient heat ('other RES' in the Commission's modelling) more than quintuples, climbing from 2% in 2015 to between 10% and 15% in 2030. The shares of bioenergy (other than ambient heat) and distributed heat increase only very slightly.[31]

Options for heat decarbonisation

Not many technologies can produce zero-carbon heat. Scaling up the installation of electrically powered heat pumps is the key technological solution for the next decade and beyond. Heat pumps are more than three times as efficient as gas and oil boilers and can be installed in individual buildings or on an industrial scale as part of heat networks. As the electricity grid decarbonises, the carbon footprint of buildings will further decline. Deep geothermal technologies have the potential to work alongside heat pumps in decarbonising and expanding district heating networks.[32] Solar thermal technologies can also play a key role in the provision of zero-carbon hot water, reducing the draw of buildings on energy networks, both as a stand-alone technology and in combination with other decarbonisation technologies.

Sustainable bioenergy sources also have a limited role to play. They can be combusted as biomass, biogas or hydrogen, but their use in the production of low temperature heat in a zero-carbon future is limited by their availability and their impacts on local air quality through fine particulate emissions. Hydrogen's role in providing heat to buildings is also likely to be limited to its use in power generation to meet peak demand on cold, windless, dark winter days,[33] given the relative costs of producing it using zero-carbon electricity. There are many other competing applications for zero-carbon hydrogen with even fewer available options, for example, feedstock for industrial processes, high temperature industrial heat and long-distance travel.[34]

To achieve the reductions in fossil heat and the increase in ambient renewable heat envisaged by 2030, heating system replacements will need to focus on installing heat pumps (and solar thermal) and avoiding fossil fuel boilers. In addition, the stock of heating systems will need to turn over more quickly than in the past. The Commission's Impact Assessment scenarios foresee rates of heating system replacement running at more than 4% per year during the period 2026-2030.[35] This means that close to one in four of all buildings in the EU are expected to have their heating systems replaced

[30] European Commission, 2020b.

[31] European Commission, 2020b.

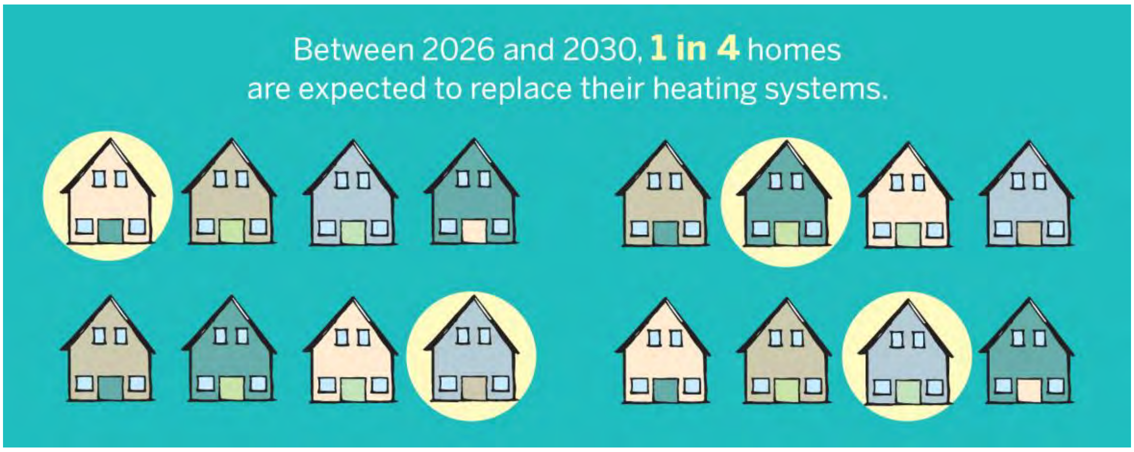
[32] Dumas, P., & Bartosik, A. (2014). *Geothermal DH potential in Europe*. GeoDH. http://geodh.eu/wp-content/uploads/2014/11/GeoDH-Report-D-2.2-final.pdf

[33] Borwn, T., Schlachtberger, D., Kies, A., Schramm, S., & Greiner, M. (2018). *Synergies of sector coupling and transmission reinforcement in a cost-optimised, highly renewable European energy system*. Energy. https://arxiv.org/pdf/1801.05290.pdf

[34] Rosenow & Lowes, 2020.

[35] Type 2 Renovation (heating system replacements only) rate of 4% per year and Type 3 Renovation (fabric improvements and heating system replacements) rate of 0.3%-0.6% per year, based on EU Commission, 2020b.

during the last five years of the 2020s. Policy measures will be needed to ensure that this strong driver of building decarbonisation happens.



Getting up to speed as quickly as possible

This scale and pace of change emphasises the importance of:

- Immediately increasing the rate of building renovation through targeted supporting policy measures.
- Putting in place the broader policy framework to drive sufficient demand, enable investment and ensure the supply chain can deliver as the rate of decarbonisation gathers pace over the course of the decade.

Delaying action would not only risk the achievement of 2030 targets. It would have very real costs in at least three dimensions:

1. Greenhouse gas impacts. Climate science tells us that early action is ever more important. The sooner we decarbonise our building stock, the fewer greenhouse gas emissions will accumulate in the atmosphere.
2. Supply chain optimisation. Ramping up the rate at which we decarbonise our buildings now will mean that fewer buildings will need to be treated at the peak of the renovation wave in the 2030s. Flattening the renovation curve means that fewer people need to be trained up to work as installers and assessors and that renovation businesses can plan for a smoother pattern of delivery over a longer period.
3. Optimal balance between fabric improvements and heating system replacements. The more orderly the process, the more likely it is that, in any given building, the most cost-effective mix of fabric and heating system changes can be made. Making fabric improvements first enables cheaper heating systems with lower capacities to be installed and operate more effectively.

The scale of the challenge means that we need policy instruments to kick-start the renovation wave now and ensure that action grows throughout the 2020s and beyond. The next chapter explores the role of carbon pricing in that policy framework.

Chapter 3

Necessary but far from sufficient: Carbon pricing is just one piece of the buildings sector decarbonisation jigsaw

This chapter makes the case for carbon pricing as part of a comprehensive policy framework. It highlights the limited application in EU Member States of carbon prices on the fossil fuels directly combusted in buildings, contrasting this with the policy costs (EU ETS costs and other levies) faced by electricity users. With the electrification of many of the EU's heating systems being a key technological trend in all the Commission's 2030 scenarios, rebalancing the prices of fossil fuels and electricity will be a key element of the decarbonisation policy package.

Reflecting the environmental costs of carbon emissions in retail energy prices serves two key purposes as part of a comprehensive policy framework. First, it sends the right price signal to end users and the supply chain, raising the cost of using carbon-rich fuels relative to low-carbon alternatives and improving the payback to both fabric efficiency improvements and heating system replacements. This directionally positive change would reinforce the effectiveness of other policy measures aimed at boosting building. Investment subsidies would need to be less generous to achieve equivalent results, and the lifetime costs to households and businesses of compliance with regulations aimed at reducing emissions (e.g., ecodesign) would be lower — the investment costs of buying more efficient equipment would be offset by more valuable energy savings.

Second, carbon pricing provides revenues that can be used to fund the targeted investment support programmes needed as part of the policy mix. While such programmes should be justifiable based on their cost effectiveness in meeting policy objectives, independent of their funding source, the use of carbon pricing revenues to fund carbon abatement investment can help to make carbon pricing more politically acceptable. Raising carbon prices in the buildings sector has regressive impacts that can be tackled through the recycling of revenues (see Chapter 4).

Carbon pricing alone would be insufficient to drive the uptake of the cost-effective carbon abatement actions needed in the buildings sector. Many market failures and barriers in addition to weak price signals affect the willingness and ability of building owners to invest in building fabric improvements and sustainable renewable heating systems (see the 'Barriers to building decarbonisation' sidebar). These issues are well understood by policymakers, including the EU Commission, which noted in its Carbon Plan Impact Assessment that to 'reduce the risk of excessively high carbon prices with an extension of ETS scope, any expansion of ETS into the buildings and road transport could benefit from a strong complementary regulatory framework that delivers more energy efficiency, renewables and transport decarbonisation.'[36]

[36] European Commission, 2020b.

Barriers to building decarbonisation

A building decarbonisation strategy needs to address the following barriers:

- **Financial:** high up-front cost, limited public funds, split incentives, weak price signals, lack of clear property value differential, transaction costs.
- **Consumer:** knowledge, time and hassle factors, inertia, perceived risk, attachment to incumbent technologies, high discount rates.
- **Communication:** lack of well-communicated decarbonisation trajectory, lack of technical and practical support.
- **Supply chain:** lack of low-carbon renovation skills and capacity in renovation sector, lack of quality assurance for complex renovation.
- **Building complexity:** multiple ownership, mixed use, commercial lease barriers.

Adapted from: EmBuild, 2017.[37]

Rebalancing price incentives in line with the carbon goal

Carbon pricing can be introduced directly through energy taxation, or indirectly through regulations that cap emissions and permit allowances to emit to be traded, such as the EU Emissions Trading System (see Chapter 5 for a discussion of carbon pricing options).

The price of carbon in the EU is unevenly distributed across fuels used in buildings. Figure 2 shows that heating fuels used for combustion in buildings, such as fossil gas, coal and oil, are subject to carbon taxes of 114 euros per tonne in Sweden, 62 euros in Finland, 45 euros in France, 34 euros in Ireland, 25 euros in Germany,[38] 23 euros in Denmark and Portugal, 20 euros in Luxembourg, 17 euros in Slovenia and zero elsewhere in the EU.[39, 40, 41, 42] However, in most EU Member States, no such carbon price is in place. Electricity, which is used for many different end-uses in buildings, including heating, is covered by the EU Emissions Trading System, as are some installations providing heat to district heating systems. The EU ETS price has risen from 32 euros per tonne to more than 50 euros during the course of the first five months of 2021.[43]

The price of carbon on combustible heating fuels is set to rise during the 2020s in some countries. Luxembourg's carbon tax is planned to rise to 30 euros in 2023 and

---

[37] EmBuild. (2017). *Barriers that hinder deep renovation in the building sector.* http://embuild.eu/site/assets/files/1316/d4_1_embuild_final_report-1.pdf

[38] The carbon price in Germany is set by the federal government but will be allowed to vary in a price corridor as part of a hybrid cap-and-trade mechanism from 2026. See Hansen, H. (2019). Germany to raise carbon price to 25 euros in 2021 after pressure. *Reuters*. https://www.reuters.com/article/us-germany-climate-idUSKBN1YK0IF

[39] Exchange rate as of 21 March 2021 is 1 SEK = 0.099 euros. Government Offices of Sweden. (2021). *Sweden's carbon tax*. https://www.government.se/government-policy/taxes-and-tariffs/swedens-carbon-tax/

[40] Schulz, F. (2020, May). German cabinet agrees CO2 price of €25 from January 2021. *Euractiv*. https://www.euractiv.com/section/energy-environment/news/german-cabinet-agrees-to-a-co2-price-of-e25-from-january-2021/

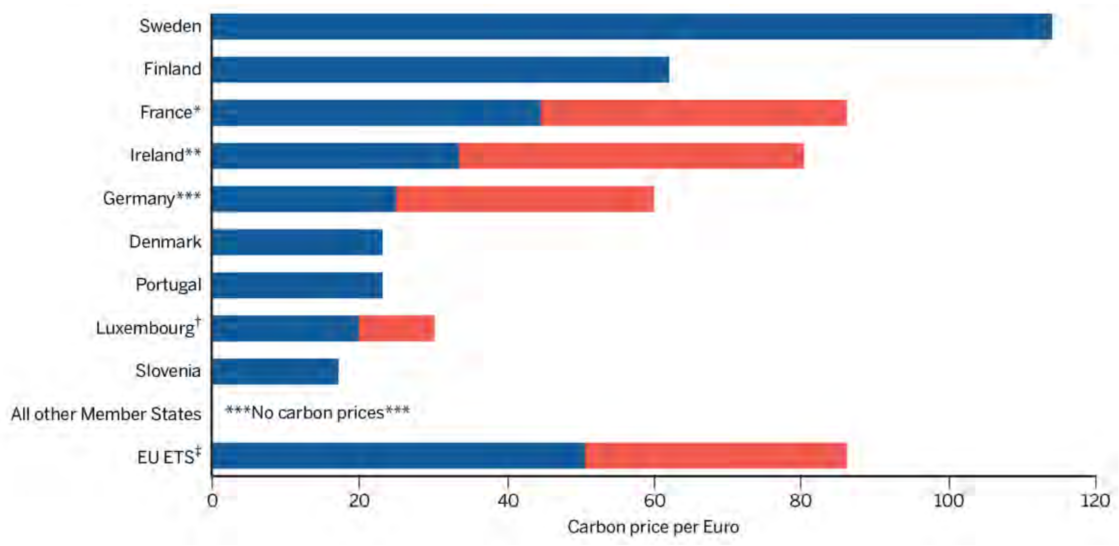
[41] World Bank Group. (2020). *State and trends of carbon pricing 2020.* https://openknowledge.worldbank.org/bitstream/handle/10986/33809/9781464815867.pdf?sequence=4&isAllowed=y

[42] JCA. (2020). STATEC expects CO2 tax to reduce emissions but not enough to meet climate objectives. *Luxembourg Chronicle.* https://chronicle.lu/category/environment/34736-statec-expects-co2-tax-to-reduce-emissions-but-not-enough-to-meet-climate-objectives

[43] Ember. (2021, December). Daily EU ETS carbon market price (euros). https://ember-climate.org/data/carbon-price-viewer/

Germany's carbon price trajectory is scheduled to reach 55-65 euros in 2026.[44, 45] Ireland's Climate Action Committee has recommended that its carbon tax rise to 80 euros in 2030.[46] France's carbon tax was expected to rise each year to 86.20 euros by 2022, but has been kept at 2018 levels in the face of public protests by the *gilets jaunes*.[47] The Commission's Impact Assessment scenarios see EU ETS prices of between 32 and 65 euros over the period to 2030.[48] The average of independent forecasts, polled in April 2021, put the EU ETS allowance price at 58 euros in 2025 and 86 euros in 2030.[49]

Figure 2. Range of carbon prices on fossil fuels combusted in buildings (national measures) and used in electricity generation (EU ETS) in 2021 and, where expectations are available, in future years



* Price announced for 2022 but now unlikely following freeze of carbon price at 2018 level. ** Price recommended by Irish Climate Action Committee for 2030. *** Middle of price corridor (euro 55-65) announced for 2026. †Price announced for 2023. ‡EU ETS allowance market price 24 May 2021; average 2030 price amongst range of independent experts, April 2021.[50] Note: Sweden and Denmark have been converted from national currencies to euros.

Only in Finland and Sweden does the carbon tax on fossil fuels used for heating exceed the EU allowance price passed through on electricity prices. This imbalance in the application of carbon prices across competing fuels distorts the market for heating services in an unhelpful way. Correcting this distortion is essential to improve the economics of building renovation and fuel switching in particular.

---

44 Ember, 2021.

45 Hansen, 2019.

46 O'Sullivan, K. (2019). CO2 and you: The carbon tax explained. *Irish Times*. https://www.irishtimes.com/news/environment/co2-and-you-the-carbon-tax-explained-1.3839345

47 Savolainen, A. (2020). A low ineffective French carbon tax lies frozen at 2018 level. *Climate Scorecard*. https://www.climatescorecard.org/2020/03/the-dysfunctional-french-carbon-tax-is-frozen-at-2018-level/

48 See Table 38 in EU Commission, 2020b.

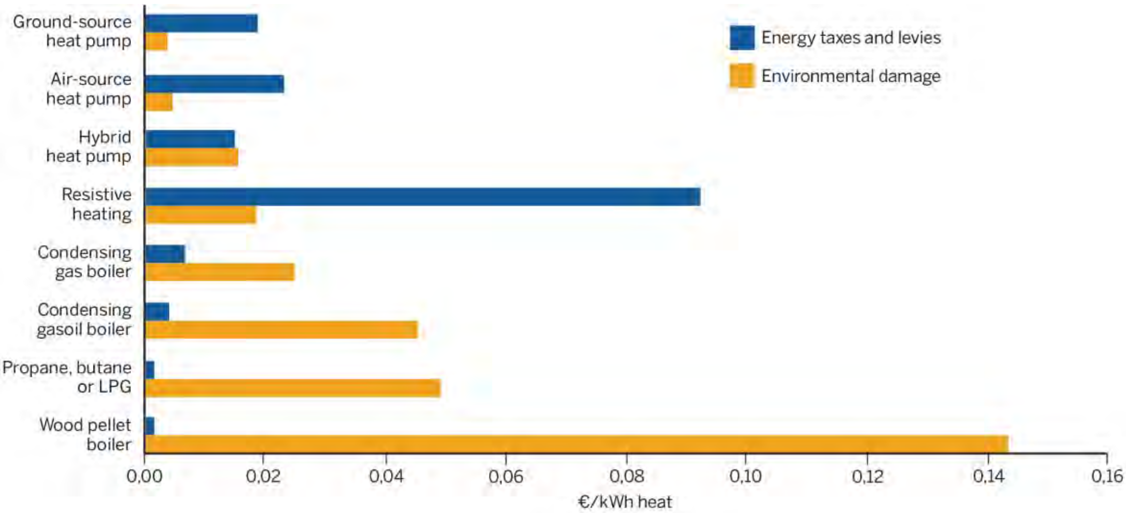
49 Carbon Pulse. (2021). *Poll: Big boost for EU carbon price forecasts as several analysts see EUAs topping €100 this decade*. https://carbon-pulse.com/125815/

50 EEX. (2021). Spot market. https://www.eex.com/en/market-data/environmental-markets/spot-market; Carbon Pulse, 2021.

Even in those countries in which fossil fuels are most highly taxed, the relative prices of fossil gas and electricity currently work against fuel switching, with electricity being more expensive across the EU. Nowhere in the EU is electricity cheaper than fossil gas.[51] One of the main reasons for this is the levies that have been predominantly added to electricity prices as a way of funding electricity decarbonisation policies, such as feed-in tariffs for renewable energy. Belgium has the most marked disparity between the prices of fossil gas and electricity, with electricity almost six times as expensive per unit of energy consumed.[52]

Comparing the levies and taxes in Belgium with estimates of the environmental damage costs for each unit of heat consumed under different space heating technologies reveals a problematic picture. Figure 3[53, 54] shows that, in the Belgian case, fossil fuel and wood burning technologies consume energy with the smallest additional financial cost while inflicting on society the largest environmental cost. Heating using electricity and ambient heat transfer through heat pumps produces the least environmental harm and is subject to higher policy costs.

Figure 3. Comparison of energy taxes and levies and environmental damage per unit of heat, Belgium



Source: Baetens, R. (2020). *Carbon Taxes: The curious case of Belgium's counterproductive household energy taxes.* CE Delft. (2019). *Milieuschadekosten van verschillende technologieën voor woningverwarming (Environmental damage costs of different home heating technologies)*

[51] European Commission. (2020g). *Energy prices and costs in Europe.* https://ec.europa.eu/energy/data-analysis/energy-prices-and-costs_en

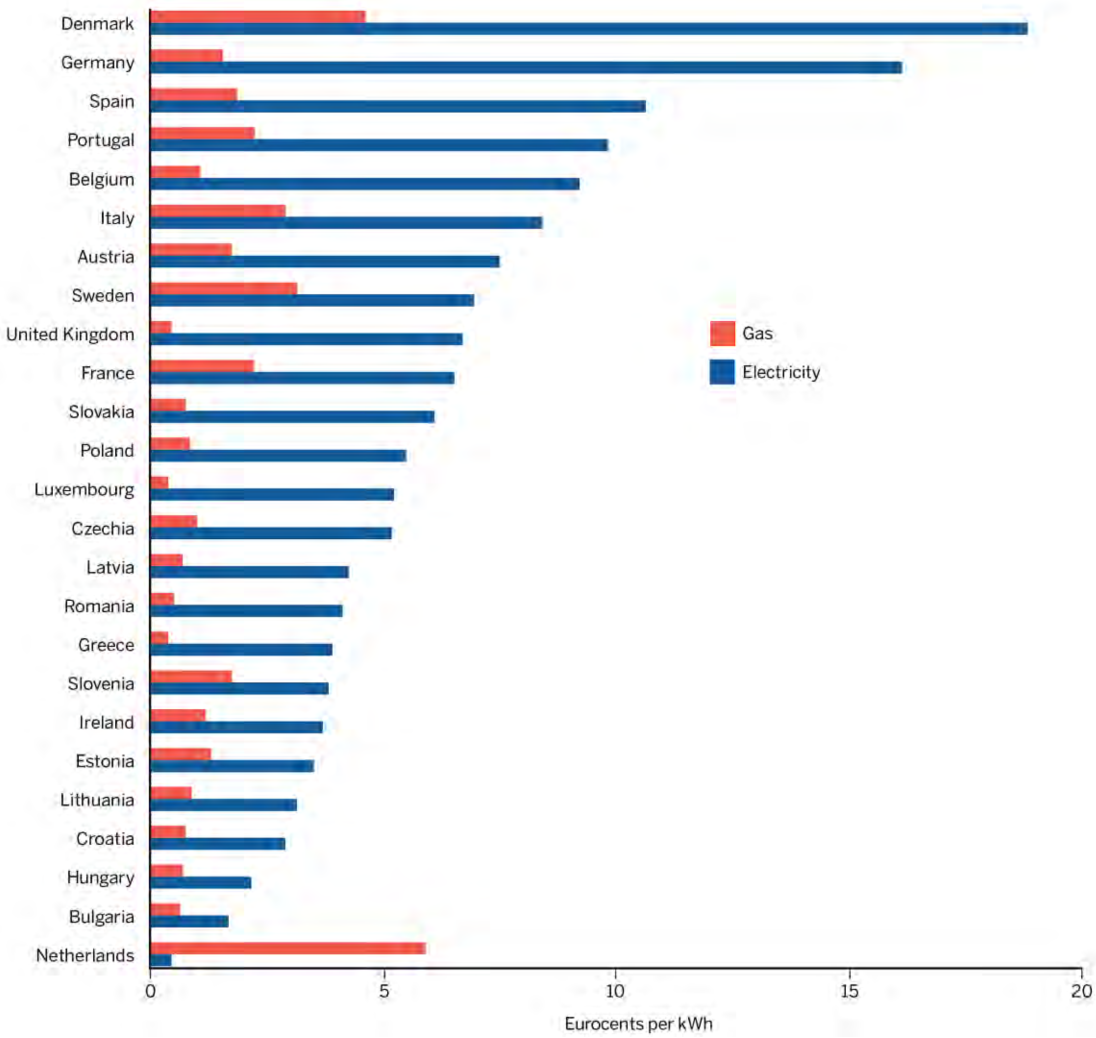
[52] Rosenow, J. (2021, May 3). Unlocking electrification through rebalancing levies and taxes. *Euractiv*. https://www.euractiv.com/section/electricity/opinion/unlocking-electrification-through-rebalancing-levies-and-taxes/

[53] Baetens, R. (2021, February 15). Twitter post. https://twitter.com/RubenBaetens/status/1361279689768251394?s=20, based on Baetens, R. (2020, November 28). *Carbon Taxes: The curious case of Belgium's counterproductive household energy taxes*. Ruben Baetens blog. https://rubenbaetens.medium.com/carbon-taxes-3e4ffa3db059; and CE Delft. (2019). *Milieuschadekosten van verschillende technologieën voor woningverwarming (Environmental damage costs of different home heating technologies)*. https://www.vmm.be/publicaties/milieuschadekosten-van-verschillende-technologieen-voor-woningverwarming#

[54] The high wood pellet burning external cost is mainly due to particulate matter emissions and associated health impacts. The climate cost of biomass is associated with direct CO_2 emissions. No lifecycle compensation taken into account in the graph shown. The CE Delft study (referenced above) from which the data are taken notes that, if partial compensation of CO_2 emissions by regrowth of forests is taken into account, this lowers the total environmental damage costs of wood pellet burning by 25%.

The combination of taxes and levies on electricity fundamentally skews the economics of space heating away from electrification at the very time that we would like people to invest in electrically powered heating technologies. Figure 4[55] illustrates the disparities between fossil gas and electricity taxes and levies across Europe in 2020. In Denmark and Germany, electricity was subject to taxes and levies that are more than 14 euro cents per kWh higher than those on fossil gas. The ratio was highest in the United Kingdom, where electricity was subject to taxes and levies that are 15 times those placed on fossil gas; in Luxembourg the ratio is 12, and in Germany, it is 10. Across Europe, only the Netherlands placed a smaller tax and levy burden on electricity than on fossil gas.

Figure 4. Levies and taxes (including VAT) on residential gas and electricity prices (euro cents per kWh), average in 2020



European Commission. (2020). *Energy prices and costs in Europe*

Rebalancing prices is not a silver bullet

On its own, rebalancing pricing would send the right market signals to end users and the supply chain but not lead to sufficient energy efficiency improvements. The other

55 Based on EU Commission, 2020g.

market failures and barriers affecting the buildings sector would remain unaddressed without regulatory measures and investment support. These constraints on the ability of markets to deliver effectively are reflected in empirical estimates of the responsiveness of energy consumption to changes in its price (the price elasticity of demand). Buildings' energy consumption is very price inelastic (see section below: 'The responsiveness of heating fuel demand to changes in prices'), both in the short run (behavioural responses to changes in prices are small as space heating is a necessity) and the long run (investment is constrained by many factors).

The responsiveness of heating fuel demand to changes in prices

Estimates of the price elasticity of demand represent the factor by which the demand for a good or service changes in response to a 1% change in its price. Price inelastic goods have a price elasticity between minus one and zero, with goods being classified as more inelastic the closer their elasticity estimate is to zero. A price elasticity of minus 0.50 implies that a 1% increase in price leads to a 0.5% decrease in consumption.

Empirical estimates of the short-run price elasticity of demand for heating fuels in Europe range from -0.025 to -0.26, with long-run estimates ranging from -0.05 to -0.32 for fossil gas and -0.025 to -0.50 for electricity.[56] The larger estimates in the long run reflect the longer time consumers have to react to changes in price, including making investment decisions in building renovation and fuel switching to lower carbon alternatives. The smaller estimates in the short run capture both reductions in energy waste (as consumers pay more attention to their energy use) and welfare-reducing reductions in indoor temperatures (as energy-poor households ration their energy consumption in response to higher prices). Applying these price elasticities to the average price of fossil gas in the EU (6.8 euro cents/kWh in 2018) would suggest that a 25 euro carbon price will increase gas prices by 7%-8% and reduce gas consumption by 0.4% in the short run and 2.4% in the long run. To achieve significant reductions in energy consumption, Cambridge Econometrics estimated a 180 euro carbon price would be needed to meet carbon goals without additional complementary policy measures. A large carbon price such as this would increase gas retail prices by 53%. Applying the same price elasticity estimates to this change leads to a decrease in consumption of 2.7% in the short run and 17% in the long run.[57] The application of price elasticity of demand estimates to carbon price changes can be seen in Figure 5.

Figure 5. Link between carbon price and energy consumption

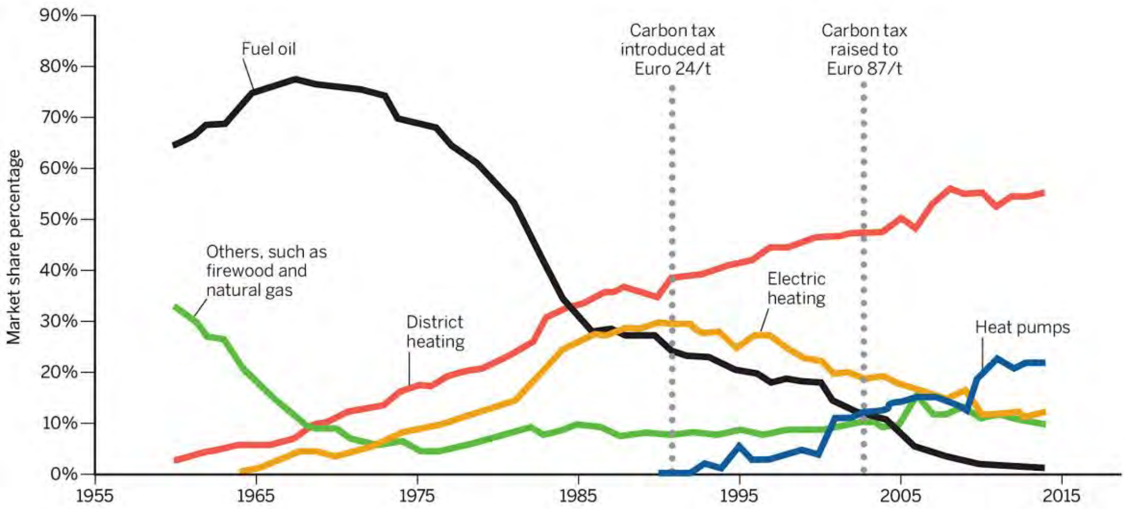
While caution should be used in the application of elasticities of demand to nonmarginal changes in price, the fact that empirical estimates are so small highlights the importance of combining policy measures in the buildings sector to enable the market for decarbonisation technologies to be more responsive to policy-driven changes in energy prices.

[56] Europe Economics. (2016). *Evaluation of fiscal measures in the national policies and methodologies to implement Article 7 of the Energy Efficiency Directive*. https://ec.europa.eu/energy/sites/ener/files/documents/final_report_on_fiscal_measures_used_under_article_7_eed_0.pdf

[57] European Commission, 2020g.

Over time, policy measures addressing the barriers to investment should make the market more responsive to changes in energy prices, meaning that estimates of the price elasticity of demand should become more elastic. This emphasises the synergies between carbon pricing and broader policy measures aimed at decarbonising buildings. Figure 6[58, 59] shows how the introduction of moderate and subsequently high rates of carbon taxation in Sweden followed the earlier use of broader public policy instruments to replace the use of heating oil with electricity and district heating.

Figure 6. Evolution of heat delivered to buildings in Sweden



Source: Adapted from Werner, S. (2017). *District heating and cooling in Sweden*; Government Offices of Sweden. (2021). *Sweden's carbon tax*

The carbon tax was introduced in 1991 at a rate equivalent to 24 euros per tonne after the market share of fossil fuel oil had fallen to 25%, less than the shares of electricity and district heating. The increases in the shares of district heating and electric heating were in part driven by the rapid expansion of the Swedish building stock during the 1960s and 1970s. During the 1990s, heat pumps emerged as the only growing competitor to district heating networks. The carbon tax rate was ramped up to 87 euros per tonne in 2004 at the point at which the share of fossil fuel oil had fallen to around 10% and the share of heat pumps had risen to a similar level. Since 2004, the rate has continued to rise to 114 euros per tonne, along with the shares of heat pumps and district heating. The share of electric resistive heating has declined with the uptake of heat pumps, although some modern buildings use direct electricity to heat coils in underfloor heating systems.[60]

The European heat pump market has been growing at a rate of 12% per year and reached 1.3 million sales in 2018; however, the majority of units are sold in Southern Europe, primarily to meet cooling demand.[61] The largest national heat pump market in

[58] Adapted from Werner, S. (2017). District heating and cooling in Sweden. *Energy, 126.* https://www.researchgate.net/publication/315303036_District_heating_and_cooling_in_Sweden

[59] Government Offices of Sweden, 2021.

[60] Swedish Energy Agency. (2015). *Electric heating*. https://www.energimyndigheten.se/en/sustainability/households/heating-your-home/heat-distribution-and-control-systems/electric-heating/

[61] European Commission. (2020h). *Clean energy transition — technologies and innovations, accompanying the document: Report from*

Europe is France, which has both a carbon tax and a set of support programmes in place to drive demand, including a focused approach towards renovating low-income housing. The impact of subsidy programmes can be observed when looking at the German market. A new subsidy scheme aimed at encouraging the replacement of fossil heaters with heat pumps coincided with a 40% increase in sales in 2020. The introduction of a CO_2 price (25€/t) at the beginning of 2021 is expected to drive market development further.[62]

While the heating system replacement market may respond to the combination of economic incentives through subsidies and carbon pricing, the building renovation market has yet to grow significantly. In Sweden, despite the relatively high carbon price, the IEA Energy Policy Review in Sweden (2019) found that energy use in buildings remains significant, with the energy intensity of residential energy consumption per dwelling and space heating per floor area remaining fairly constant since 2010. The IEA (International Energy Agency) recommended that the government consider adapting its tax deduction policy to focus funding on energy renovations.[63]

The relative unresponsiveness of buildings energy consumption to energy prices reflects the essential nature of the energy services being consumed, particularly space heating, and the barriers to investment in the sector. These factors weigh most heavily on those households with the lowest incomes, which can often only respond to higher energy prices by reducing their heating demand or reducing consumption of other essential goods, such as food. These distributional effects are assessed in more detail in the next chapter.

Chapter 4

Addressing distributional impacts

This chapter assesses the distributional impacts of adding a carbon price to heating fuels. It makes the case for bringing forward and ring-fencing carbon revenues to mitigate the negative distributional implications, primarily through supporting households to decarbonise.

Adding a carbon price to heating fuels raises the cost of heating for many building users. Policies that mitigate the negative impacts on those least able to afford extra costs and unable to invest in decarbonisation technologies in response to the price signals must be part of any carbon pricing policy. A carbon pricing policy should be preceded by significant support and outreach to target households, enabling them to reduce heating fuel use and decarbonise heating before the price has an impact on bills.

Adding to the costs of heating fuels affects consumers in different ways. The *absolute* cost of heating homes adequately increases the most for users of fossil energy with the highest emissions intensities, living in the largest and least efficient homes. The *relative* burden is greater for households with lower incomes because the impact of any

the Commission to the European Parliament and the Council on progress of clean energy competitiveness. COM(2020) 953, final Part 3/5. https://eur-lex.europa.eu/resource.html?uri=cellar:871975a1-0e05-11eb-bc07-01aa75ed71a1.0001.02/DOC_3&format=PDF

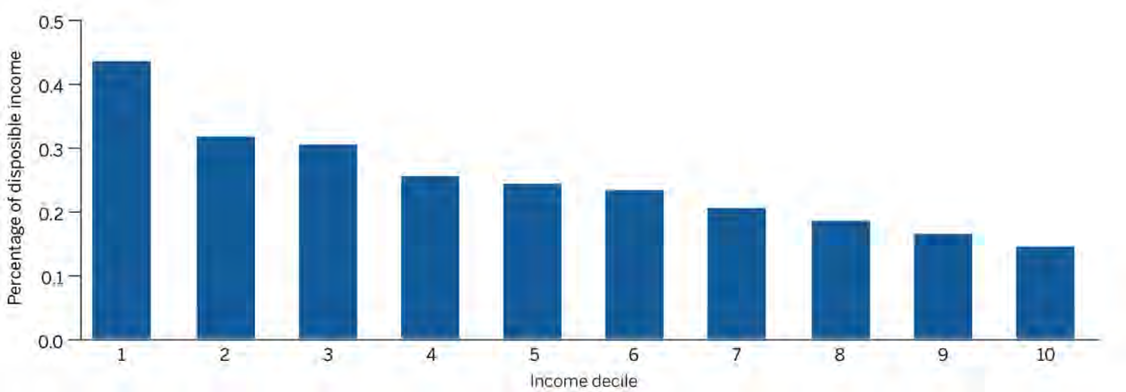
[62] Conversation with Thomas Nowak and Martin Sabel on 30 April 2021, drawing on data from stats.ehpa.org.

[63] International Energy Agency. (2019). *Energy policies of IEA countries: Sweden 2019 review.* https://www.iea.org/reports/energy-policies-of-iea-countries-sweden-2019-review

price increase of an essential good, such as energy for heating, affects a larger proportion of the expenditure of those with less money to spend.

This distributional impact of pricing the carbon used in heating and transport is illustrated in Figure 7[64] , which shows how a carbon tax of just over €30 per tonne accounts for a much greater share of a lower income household's disposable income than a higher income household. The share of the carbon tax in disposable income is more than twice as large amongst the 10% of households with the lowest incomes than it is for those in the top half of the income distribution. Therefore, policies that increase the cost of energy are regressive, unless the benefits created by the policy are geared to favour lower income households.[65]

Figure 7. Carbon tax as a share of households' disposable income, by income decile in France (€30.50/tCO_2)



Data source: Berry, A. (2019). *The distributional effects of a carbon tax and its impact on fuel poverty: A microsimulation study in the French context*

Fuel pricing policies are amongst the most regressive of climate policy options.[66] Raising the price of heating fuels is more regressive than raising the price of transport fuel, given the relative proportions of household income spent on heating and transport across income deciles.[67]

The burdens fall more heavily on household users than commercial or industrial users as households feel the full weight of the price whereas commercial and industrial users may be able to pass the increases of price on to customers. It is also expected that retailers of heating fuels pass through the increased costs in full to end users.[68]

[64] Berry, A. (2019, January). The distributional effects of a carbon tax and its impact on fuel poverty: A microsimulation study in the French context. *Energy Policy, 124.* http://tankona.free.fr/audreyberry2019.pdf

[65] For example, see: Zachmann, G., Fredriksson, G., & Claeys, G. (2018). *The distributional effects of climate policies*. Bruegel Blueprint Series 28. https://bruegel.org/2018/11/ distributional-effects-of-climate-policies; Guidehouse & Cambridge Econometrics. (2020). *E-quality: Shaping an inclusive energy transition.* Eurelectric. https://www.eurelectric.org/e-quality/; Pollitt, M., & Dolphin, G. (2020). *Feasibility and impacts of EU ETS scope extension: Road transport and buildings.* Centre on Regulation in Europe. https://cerre.eu/publications/feasibility-impacts-eu-emissions-trading-system-ets-extension/; and Burke, J., Fankhauser, S., Kazaglis, A., Kessler, L., Khandelwal, N. B., O'Boyle, P., & Owen, A. (2020). *Distributional impacts of a carbon tax in the UK: Report 2 — Analysis by income decile.* Grantham Research Institute on Climate Change and the Environment and Centre for Climate Change Economics and Policy. London School of Economics and Political Science and Vivid Economics. https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2020/03/Distributional-impacts-of-a-UK-carbon-tax_Report-2_analysis-by-income-decile.pdf

[66] Guidehouse & Cambridge Econometrics, 2020.

[67] Pollitt & Dolphin, 2020; Zachmann et al., 2018; Burke et al., 2020.

[68] Pollitt & Dolphin, 2020.

For those households not using electricity for heating, heating fuels makes up a greater part of the household bill than electricity. Two-thirds of energy consumption in the residential sector is for space heating, a further 15% for water heating.[69] Therefore, a carbon price on heating fuels has the potential to have a more significant impact than the current ETS on overall energy cost and the household budget.

Of key concern is where absolute or relative burdens fall on those who are least able to bear them and/or who have the least ability to make changes to avoid the burden. *Given the level of energy poverty and energy inequity in Europe, policies or combinations of policies in the energy transition must aim to improve energy equity not simply avoid regressive effects.*

Assessing distributional impacts

To design an appropriate policy mix, decision-makers should examine the distributional impacts of adding a carbon price to heating fuels. This impact can be considered through three lenses: the geographical, the vertical and the horizontal.

Lens 1: Geographical impacts

First, the geographical lens throws light onto which member states would have the most national emissions brought into a European pricing mechanism. Carbon emissions from heating vary significantly amongst Member States. Both the amount of energy used for heating, which is a product of climate and building stock efficiency, and the carbon content of fuel used for heating influence national emissions from heating.

Climate conditions and building stock efficiency differ amongst countries influencing energy demand for heating. Heating degree days (HDDs), a measure of the extent to which outside air temperatures are lower than 15.5 degrees Celsius, vary significantly amongst European Member States. There is a natural trend for higher degree days in northern countries and lower degree days in southern countries and subregions thereof.[70] Alongside local climate, the condition of the building stock affects the amount of heating fuels used in any location or country. Very cold countries with efficient building stocks use less heating than relatively warmer countries with poorer quality stocks. Although data on energy performance of the European building stock is incomplete, age of the building stock is often used as a proxy for efficiency.[71] Self-reported data on the presence of defects in dwellings, a measure of building quality, illustrates that 30% of households reported defects in Cyprus and more than 20% did so in Latvia — a country with a relatively cold climate — while less than 5% reported faults in Finland.[72] The state of repair of the building stock also provides an indicator of the scale of investment needed to reduce heating fuel use and fossil fuel reliance.

---

[69] Kruit, K., Vendrik, J., van Berkel, P., van der Poll, F., Rooijers, F., Jossen, Q., & de Meulemeester, H. (2020). *Zero Carbon Buildings 2050.* CE Delft. https://www.cedelft.eu/en/publications/2474/net-zero-buildings-2050%20

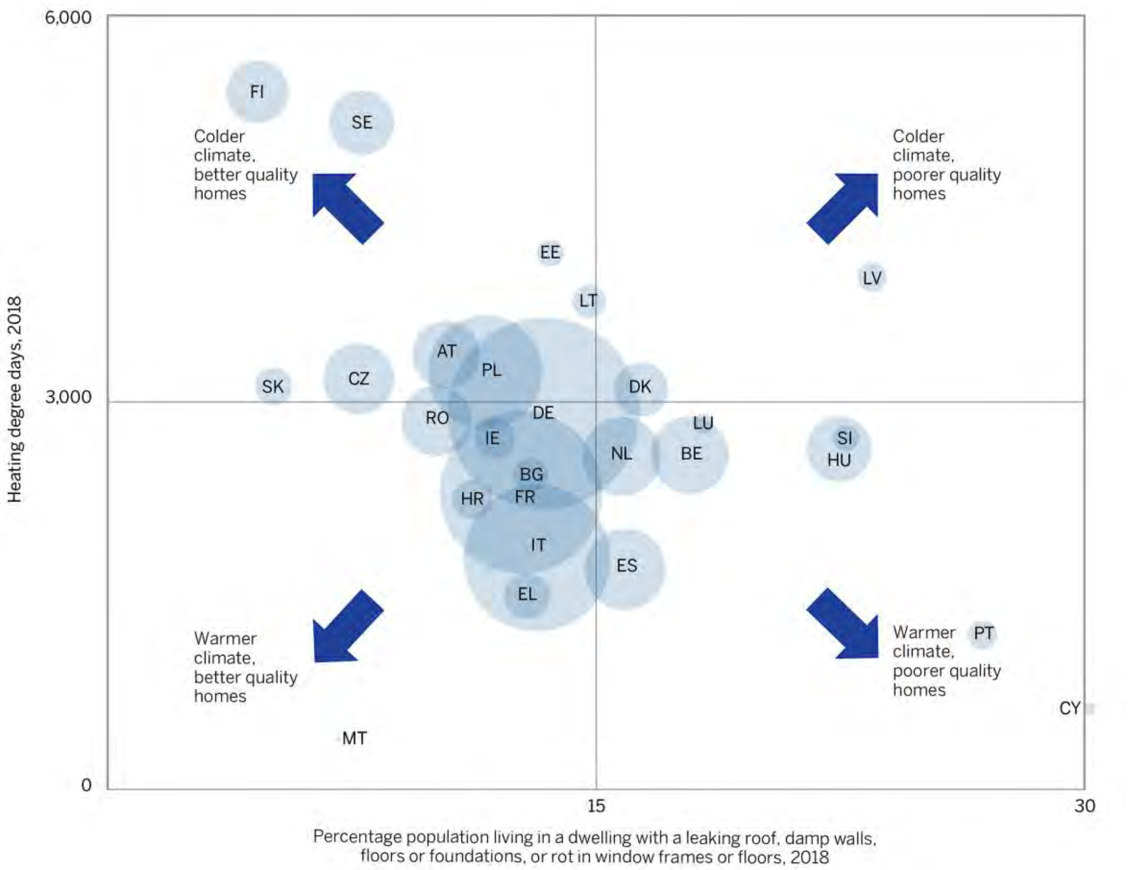
[70] For a breakdown of heating degree days for Member States, see Table 2 in Kruit et al., 2020.

[71] Filippidou, F., & Jimenez Navarro, J. *Achieving the cost-effective energy transformation of Europe`s buildings.* EUR 29906 EN, Publications Office of the European Union. https://ec.europa.eu/jrc/en/publication/achieving-cost-effective-energy-transformation-europes-buildings

[72] Eurostat. (2018). *Total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor. EU-SILC survey*. https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ilc_mdho01&lang=en

In Figure 8,[73,74] EU Member States are plotted along two axes with heating degree days on the *y* axis and the level of building defects on the *x* axis. The sizes of the circles represent estimates of the amount of energy used to satisfy heating demand in each country. In the top left quadrant, we find cold countries with high numbers of heating degree days and relatively efficient buildings (Finland and Sweden). In the bottom left quadrant are warmer countries with poorer quality building stock. Amongst the countries with more than 20% of their populations living in dwellings with defects, Latvia, Slovenia and Hungary give rise to particular concern given the cold winter temperatures, as measured by the number of heating degree days.

Figure 8. Climate and building quality



Sources: Eurostat. (2018). *Total population living in a dwelling with a leaking roof, damp walls, floors or foundation, or rot in window frames or floor.* EU-SILC survey; Eurostat. (2021). Disaggregated final energy consumption in households — quantities; and Kruit et al. (2020). *Zero Carbon Buildings 2050*

The emissions intensity of the fuels used to meet heating service demand is the other key determinant of the additional burden created by a carbon price on heating. Around two-thirds of energy for residential heating, cooling and hot water in Europe comes

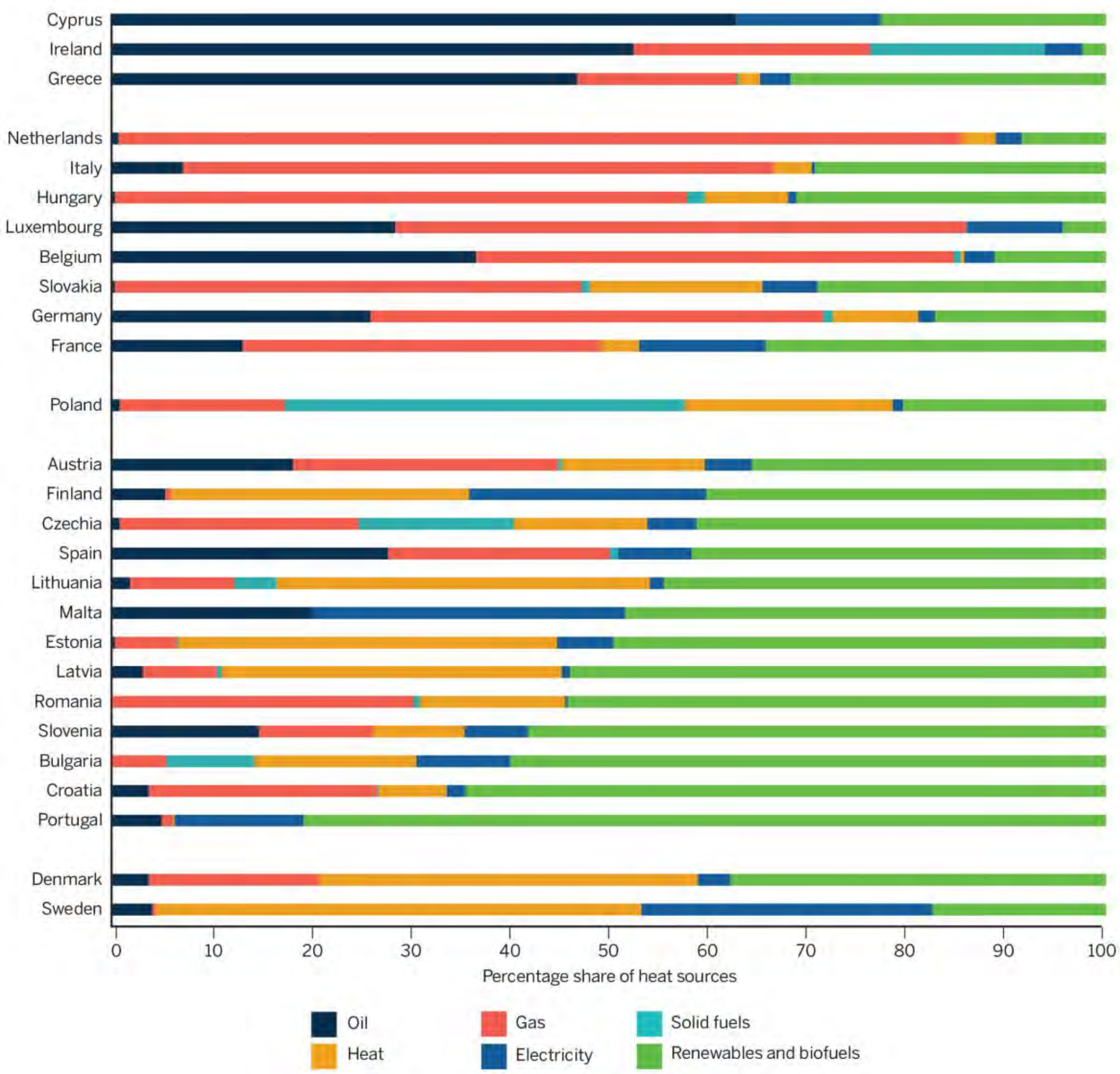
[73] Eurostat, 2018.

[74] Eurostat. (2021). Disaggregated final energy consumption in households — quantities. https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nrg_d_hhq&lang=en

from fossil fuels.[75] The most commonly used fossil fuel for heating is fossil gas followed by oil and petroleum products and coal products.

Once again, this average hides significant variation amongst countries. Figure 9[76] shows the share of fuels in final energy consumption for residential space heating, with those countries with high shares of direct fossil fuel use in their mix of heat sources on the left and those with higher shares of electricity, derived heat and renewables on the right.

Figure 9. Final energy consumption for residential space heating (2019), countries grouped by dominant source



Source: Eurostat. (2021). *Disaggregated final energy consumption in households — quantities*

In a carbon pricing regime, all fossil fuels will be subject to the carbon price, but the cost impact will be higher for those fuel sources with the greatest emissions intensities,

[75] European Commission, 2020f.

[76] Eurostat, 2021.

shown in Table 1.[77] Coal has by far the greatest emissions intensity of commonly used fuels.

Table 1. Emissions intensity of heating fuels

Fossil fuel for heating	Emissions intensity (tCO_2/MWh)
Gas	0.202
Heating oil	0.267
Coal	0.341-0.354

Broadly, the countries illustrated in Figure 9 can be grouped as follows:

- Countries in which oil and petroleum products have the highest share in their heat fuel mix include Cyprus, Ireland and Greece. In Spain, Belgium, Luxembourg and Germany, heating oil also accounts for more than 20% of residential space heating energy consumption, while France, Italy and Austria are also major consumers.
- Countries in which fossil gas is the dominant fuel include the Netherlands, Italy, Hungary, Luxembourg, Belgium, Slovakia, Germany and France. In all of these countries except France, gas comprises 45% or more of fuel use. In the Netherlands, the share is as high as 85%. Other countries with significant gas consumption include Spain, Austria, Czechia, Greece, Ireland, Denmark, Poland, Romania, Croatia and Lithuania.
- In Poland heating fuel consumption is dominated by solid fuels, notably coal. 72% of all solid fuel use for space heating in the EU is in Poland. Elsewhere in the EU, Czechia has the second largest consumption (12% of EU solid fuel consumption) and Germany the third (5%). Ireland is the other major consumer of solid fuels for space heating (5% of EU consumption), mostly peat and peat products, which account for around 20% of Ireland's space heating energy consumption.
- In Sweden district heat accounts for 49% of all space heating energy consumption, while in Denmark the share is 38%. All other Nordic, Baltic and Eastern European countries (except Balkan countries) also have relatively high shares of district heat compared to the rest of the EU (10% or higher).
- Many other countries use renewables and biofuels more than any other fuel, although the mix amongst renewable fuels is difficult to ascertain owing to gaps in the data. In Portugal over 80% of space heating is provided from renewables and biofuels. In Slovakia, Bulgaria, Romania, Slovenia and Croatia, more than 50% comes from this source. In the other countries in this group the dominance of renewables and biofuels is less clear, as they account for between 35% and 50%.

Citizens of those countries that have the greatest reliance on high emissions fossil fuels and have higher heating needs due to a colder climate — including Poland, Ireland,

---

[77] Koffi, B., Cerutti, A., Duerr, M., Iancu, A., Kona, A., & Janssens-Maenhout, G. (2017). *CoM default emission factors for the Member States of the European Union.* EU Commission. https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&ved=2ahUKEwicto2EoNPwAhVF4YUKHXziAbAQFjAAegQIBRAD&url=https%3A%2F%2Fwww.covenantofmayors.eu%2Findex.php%3Foption%3Dcom_attachments%26task%3Ddownload%26id%3D326&usg=AOvVaw0hAv1GkF5aYN00rdXDIAm-

Luxembourg, the Netherlands, Belgium, Germany, Slovakia, Hungary and Austria — can expect to be affected most by the carbon price. In addition, individual households in warmer countries that rely on carbon intensive fuels for heating, particularly where the building stock is inefficient, will also feel the impact of the price — including Cyprus, Greece, Spain and Italy.

As emissions from electricity and some district heating sources are already covered by the existing ETS, countries with a high share of heating from these sources will have a lower additional burden created by the introduction of a pricing mechanism on heating fuels.

Lens 2: Vertical impacts

Vertical inequalities arise from the impact of carbon pricing on different income deciles.[78] Both vertical and horizontal lenses apply to commercial building owners and households; however, the focus of this section is on household energy users as commercial energy users have some potential to pass through the costs of the carbon price to customers where households do not,[79] and the evidence focuses on the impacts on households.

An increase in energy cost places a greater burden on those with smaller incomes,[80] creating vertical inequities, as seen in Figure 7. The increase in energy cost is a larger part of the household income and reduces already limited expendable income available for other essentials and therefore can cause poor welfare outcomes.

Households that were already facing energy difficulties are therefore expected to be amongst the most affected by carbon pricing. A study of the impact of the French carbon tax on housing and transport fuels assessed that, without redistribution of the revenues and with no price elasticity, the tax at current levels of €30.5/tCO_2 would increase energy poverty by 6.4% and at the €100/tCO_2 price in 2030 would increase energy poverty by 25%.[81]

Low-income households most impacted by the price have the least ability to replace equipment before end of life, and at end of life, they are less likely to be able to afford low-carbon options when more expensive. Similarly, investment in renovation to improve thermal quality is either unaffordable or outside their control, as low-income households are more likely to be tenants in countries that have significant quantities of rented housing.[82] Therefore, any price responsiveness is likely to be achieved through

---

[78] Cronin, J. A., Fullerton, D., & Sexton, S. E. (2017). *Vertical and horizontal redistributions from a carbon tax and rebate*. (Working Paper No. 23250). National Bureau of Economic Research. https://www.nber.org/system/files/working_papers/w23250/w23250.pdf; and Sommer, S., Mattauch, L., & Pahle, M. (2020). *Supporting carbon taxes: The role of fairness*. (Working Paper No. 2020-23). Institute for New Economic Thinking. https://www.inet.ox.ac.uk/publications/no-2020-23-supporting-carbon-taxes-the-role-of-fairness/

[79] Pollitt, M., & Dolphin, G. (2020). *Feasibility and impacts of EU ETS scope extension: road transport and buildings*. Centre on Regulation in Europe. https://cerre.eu/publications/feasibility-impacts-eu-emissions-trading-system-ets-extension/

[80] Zachmann et al., 2018.

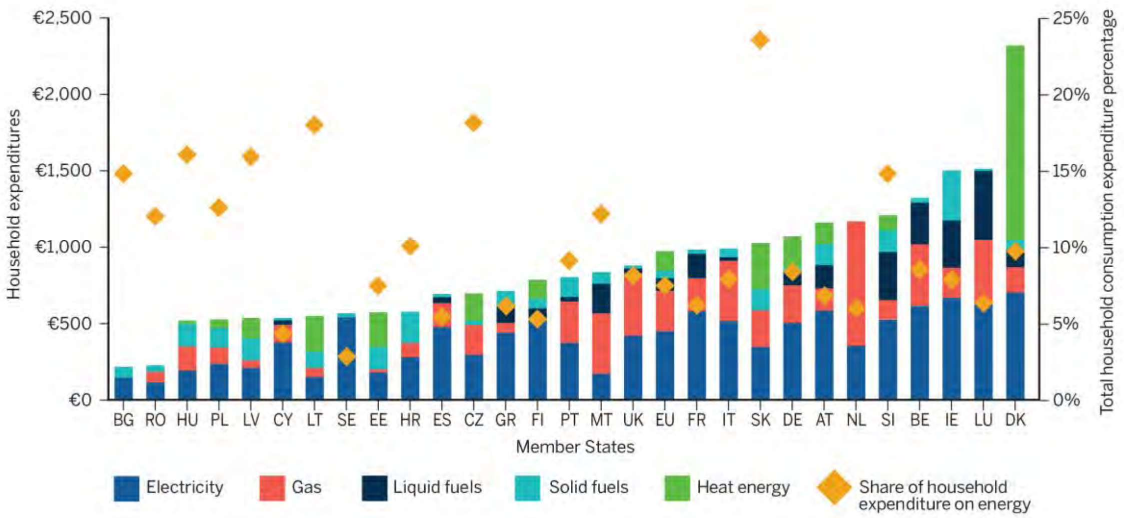
[81] Berry, 2019.

[82] See, for example, OECD. (2021). *HM1.3 housing tenures.* OECD Affordable Housing Database. https://www.oecd.org/els/family/HM1-3-Housing-tenures.pdf

(further) energy rationing, which can cause damage to physical and mental health, educational attainment and well-being.[83]

Energy price burden and heating fuel use, for the lowest income households, vary significantly amongst Member States as is illustrated in Figure 10.[84, 85] It shows how much the share of household expenditure on energy for the lowest income households ranges, from 23% in Slovakia to just 3% in Sweden.

Figure 10. Expenditure on home energy for EU households in the lowest income decile



Sources: Sunderland et al. (2020). *Equity in the energy transition: Who pays and who benefits?*; European Commission. (2020g). *Energy prices and costs in Europe*

Lens 3: Vertical impacts

Notwithstanding the clear trend of increasing energy burden for lower income deciles, there can be huge variation within income groups.[86, 87] For this reason it is important to also consider horizontal inequities. Households in the same income decile use different of types and quantities of heating fuels and vary in their ability to respond to the carbon price, which influences how pricing impacts them. Clearly, households that use fossil fuels for heating will be hardest hit. Other factors that contribute to horizontal inequalities by affecting heating fuel demand include dwelling size and efficiency, household composition, age, health and vulnerability, working situation, location and local climate. Factors that contribute to horizontal inequities by affecting the ability of the household to respond to the price include owner or tenant status and availability of alternative heating fuels or district heating. These horizontal inequities are arguably

[83] Marmot, M., Allen, J., Goldblatt, P., Boyce, T., McNeish, D., Grady, M., & Geddes, I. (2010). *Fair society healthy lives: The Marmott review.* Institute of Health Inequality. http://www.instituteofhealthequity.org/resources-reports/fair-society-healthy-lives-the-marmot-review

[84] Sunderland, L., Jahn, A., Hogan, M., Rosenow, J., & Cowart, R. (2020). *Equity in the energy transition: Who pays and who benefits?* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/equity-in-energy-transition-who-pays-who-benefits/

[85] European Commission, 2020g.

[86] Fawcett, T. (2016). *Policy and extreme energy consumption.* DEMAND Centre Conference. https://ora.ox.ac.uk/objects/uuid:89e0fe2a-b90f-4fb9-9847-94b2e30efd3b

[87] White, V., Roberts, S., & Preston, I. (2012). *"Beyond average consumption": Development of a framework for assessing impacts of policy proposals on different consumer groups.* Final report to Ofgem. Centre for Sustainable Energy. https://www.ofgem.gov.uk/ofgem-publications/75556/beyond-average-consumption.pdf

more difficult to assess and address than vertical inequities associated with income.[88] In response, an archetype approach has been proposed to better address the distributional impacts of carbon pricing.[89]

Table 2 is adapted from a study[90] of the combined impact of a carbon tax on both heating and transport fuels on German households. It shows the impact on net monthly income of a carbon price of €50 per tonne of CO_2 on different household types. The original study calculated the combined impact of a carbon price on both heating and transport fuels and after redistribution and rebalancing measures. For this table, the impact of the carbon price on heating fuels alone has been illustrated.

Table 2. Illustrative impact of a €50/ tonne CO_2 price on heating fuel on different households

Household	Property size and heat consumption	Income[91]	Additional expenses for heat (€ per year)	Impact on net monthly household income
Couple, at least one employed, oil heating, rural	109m2 High heat consumption	€3,657 net. €2,438 net equivalised 70th percentile (High income)	€221	-0.5% net income -0.76% net equivalised income
Single person, employed, above average income, urban	70m2 Average heat consumption	€2,662 net. €2,662 net equivalised 75th percentile (High income)	€76	-0.24% net income -0.24% net equivalised income
Single parent, at least one child, employed, not renovated, below average income, rural or urban	84m2 High heat consumption	€2,192 net €1,438 net equivalised 25th percentile (Low income)	€213	-0.81% net income -1.23% net equivalised income

[88] Sommer et al., 2020.

[89] White et al., 2012.

[90] Agora Verkehrswende & Agora Energiewende. (2019). *Klimaschutz auf Kurs bringen: Wie eine CO2-Bepreisung sozial ausgewogen wirkt.* https://static.agora-energiewende.de/fileadmin/Projekte/2017/Abgaben_Umlagen/CO2-Rueckverteilungsstudie/Agora-Verkehrswende_Agora-Energiewende_CO2-Bepreisung_WEB.pdf

[91] Income includes: 1) Monthly net household income (net income of tax and social security contributions; 2) Monthly net equivalised household income (equivalised for household size); and 3) Percentile net household income.

Couple, at least one employed, not renovated, tenants, urban	81 m2 High heat consumption	€3,774 net €2,516 net equivalised 71st (High income)	€126	-0.28% net income -0.42% net equivalised income
Single person, retired, low-income, rural	77m2 Average heat consumption	€981 net €981 net equivalised 13th percentile (very low income)	€93	-0.79% net income -0.79% net equivalised income
Retired couple, urban	102 m2 Average heat consumption	2,083 net 1,389 net equivalised 32nd percentile (low income)	€130	-0.52% net income -0.78% net equivalised income
Family, at least one child, not renovated, below average income	97m2 High heat consumption	3,081 net 1,342 net equivalised 29th percentile (low income)	€244	-0.66% net income -1.52% net equivalised income
Family, at least one child, at least one employed, urban	115m2 High heat consumption	4,957 net 2,182 net equivalised 64th percentile (above average income)	€118	-0.2% net income -0.45% net equivalised income

Source: Agora Verkehrswende & Agora Energiewende. (2019). Klimaschutz auf Kurs bringen: Wie eine CO2-Bepreisung sozial ausgewogen wirkt.

In this analysis, the carbon price on heating fuels of €50 a tonne added more than €200 to the heating bills of the low-income households with high heat consumption.

The final focus in a distributional assessment is that of agency: how easy or difficult it is to change fossil fuel use in heating energy. Both vertical and horizontal inequities dictate the ability of the household to make changes to respond to the price. But in addition, the national or local framework of support for decarbonisation of heating can either enable or disable decarbonisation choices and their affordability. Policies, subsidies, finance and practical assistance can ensure that households are able to decarbonise either in response to price rises or in advance of them. Lack of availability, suitability and accessibility of these programmes to households of different types contributes to the inequitable impact of the carbon price. Unfortunately, most heating decarbonisation programmes require a significant level of upfront cost contribution by the household, meaning that lower income households cannot benefit.

The geographical, vertical, horizontal and agency inequalities that result from the imposition of a carbon price on heating fuels stack on top of one another. To weigh the full impact of these inequalities, they need to be considered holistically in the context of other mounting burdens and inequalities. Closely connected to the proposed extension of the ETS to heating fuels is the parallel extension of the pricing mechanism to transport fuels. These additional carbon prices would be introduced in some countries with an already heavy burden of carbon pricing, which may or may not be reduced or adjusted. More generally, the trend of rising energy expenditure as a proportion of income is expected to continue into this decade.[92] Outside the energy sector, income-based inequities exist in access to and price paid for a range of essential goods and services. Poorer households have been found to pay considerably more for access to, for example, utilities finance and insurance.[93] The introduction of a carbon price on heating fuels must be considered within the context of other burdens and more general increases in the wealth divide.

Addressing distributional impacts and promoting faster decarbonisation

It is clear from this description that an introduction of any carbon price must be accompanied by measures to address the distributional impacts, whether between countries, geographical communities or end users, *and* to promote swifter decarbonisation by addressing the multiple additional barriers. Measures that can promote both of these aims simultaneously must be prioritised.

Solidarity and fairness amongst Member States

Addressing the different burdens that a carbon price would place on Member States and recognising the different stages European countries are at on their decarbonisation pathways are central to the European Union objective of economic and social cohesion. There is a range of established mechanisms to promote these aims, including cohesion policy and funding and structural and investment funds.

Within the existing EU ETS, 90% of Phase 4 allowances (from 2021) are allocated based on their share of verified emissions with 10% distributed amongst certain

---

92 European Commission. (2020i). *Commission recommendation of 14.10.2020 on energy poverty.* SWD(2020) 960 final. https://ec.europa.eu/energy/sites/ener/files/recommendation_on_energy_poverty_c2020_9600.pdf

93 See: Fair By Design. (n.d.) *Everything comes at a price*. https://fairbydesign.com; Davies, S., Finney, A., & Hartfree, Y. (2016). *The poverty premium — When low-income households pay more for essential goods and services*. University of Bristol School of Geographic Studies. http://www.bristol.ac.uk/geography/research/pfrc/themes/finexc/poverty-premium/; Westlake, A. (2010). *The UK poverty rip off: The poverty premium 2010*. Save the Children UK. https://resourcecentre.savethechildren.net/ node/13400/pdf/uk-poverty-rip-off-poverty-premium.pdf; and Corfe, S., & Keohane, N. (2018). *Measuring the poverty premium.* Social Marketing Foundation. http://www.smf.co.uk/wp-content/uploads/2018/03/Measuring-the-Poverty-Premium.pdf

Member States for the purposes of solidarity, growth and interconnections.[94] Further, the Modernisation Fund is funded by auctioning 2% of the allowances 2021-2030 and is explicitly targeted at the 10 lowest income Member States for projects that modernise energy systems and improve energy efficiency. There is a live discussion on whether the existing method of allocation of both allowances and of targets under the ESR is appropriate, but this is not within the scope of this paper.[95]

Designing a pricing mechanism to deliver equitable decarbonisation

The role of carbon pricing is not limited to creating price signals. The revenues created, either from a tax or through the sale of allowances in a trading system, are an indivisible part of the climate policy, and their use can be more impactful than the price alone. Given the scale of the challenge to both mitigate catastrophic climate change and to ensure low-income and otherwise burdened households are protected and assisted to decarbonise, *100% of the revenues generated must be securely ring-fenced to mitigate the distributional impacts and enable households to decarbonise. These revenues must not only be ringfenced but brought forward in time.*

The impact of a carbon price will be felt by households and other users of heating fuels immediately on its introduction. Measures are therefore needed to soften any price shocks and to enable households to reduce their exposure to the price through renovation and fuel switching. To mitigate price shocks, a carbon tax is often introduced on an escalator to gradually increase the price over time. Within a cap-and-trade system, the price and therefore additional cost to households is unknown, adding risk. In response, the volume of allowances can be gradually reduced using supply to manage the price. Using these mechanisms, the risk of very high prices can be mitigated, and time and space can be opened up to allow for investment into energy efficiency and sustainable renewable heating systems. To make use of this time and space for investment, support to decarbonise must be available before the price takes effect. Future revenues can support the immediate scale up of heating decarbonisation as a source of securitisation for a bond raising funds to pre-seed investment. Examples in both the London and Milan congestion charges, which have been used to raise capital for transport investment ahead of revenues, provide clear precedent.

Three priorities guide the use of revenues:

- First to support low-income households to benefit from energy efficiency and heat decarbonisation.
- Second to mitigate the short-term impact of the carbon price through bill support or social support for target households.
- Third to invest available revenues and other additional funding into cost effective carbon savings.

---

[94] EU Commission. (2020j). *Commission Decision (EU) 2020/2166 on the determination of the Member States' auction shares during the period 2021-2030 of the EU Emissions Trading System*. EUR-Lex. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:32020D2166

[95] See Ecologic (https://www.ecologic.eu/17817) and Öko-Institut & Agora Energievende. (2020). *How to raise Europe's climate ambitions for 2030: Implementing a -55% target in EU policy architecture.* https://static.agora-energiewende.de/fileadmin2/Projekte/2020/2020_07_Raising-EU-Ambition/185_A-AW-EU_Ambition_WEB.pdf

Priority 1

Revenues should be spent on large-scale, targeted support for low-income and otherwise heavily burdened households — for example, those using coal or oil for heating — to improve the efficiency of their homes and switch to sustainable renewable heating fuels. The long-term solution to sustainably mitigate distributional impacts, reduce energy bills long term, permanently alleviate energy poverty and ensure that those on low incomes can benefit from the energy transition is to provide heavily or fully subsidised efficiency and heat decarbonisation support. This practical and financial support for efficiency and fuel switching must be combined with effective outreach and targeting to ensure that eligible, hard-to-reach households can benefit.

Relying only on the redistribution of revenues via lump sum payment, social support or reduction of other income or consumption taxes fails to address the horizontal and agency inequities or to address the root causes of energy inequities and energy poverty. A study based on the French carbon tax specifically compared the impact of lump sum payments with energy efficiency subsidies for the lowest income households and found that subsidies achieve greater savings and are more likely than direct financial transfers to reduce the proportion of people suffering from fuel poverty.[96] Financial payments need to be made in perpetuity and increase with an escalation of the price, simply to balance the household budget. This approach is akin to filling the bath without the plug in. Whilst financial support is needed in the short term to address immediate impacts (see priority 2), energy efficiency improvements provide long-term sustainable solutions that accelerate the energy transition and reduce the need for ongoing financial support.

Priority 2

The second, but equally important, priority is short- to medium-term bill support or other forms of redistribution for target households. This is necessary to mitigate the immediate impact of the carbon price on those who are least able to bear the burden or make low-carbon choices. Although not an optimal long-term solution, this measure is important to mitigate the risk of energy rationing before decarbonised heat and energy efficiency measures can be rolled out for all target households. Targeted transfers enable the regressivity of the tax to be addressed using a smaller percentage of the future revenues, leaving part of the budget to be allocated to heating decarbonisation. A further study on the French carbon tax found that 59% of the revenues is needed when using a flat rate transfer to all households to make the carbon tax progressive but only 18% when the bottom three income deciles are targeted.[97]

Priority 3

The third priority is for the use of revenues alongside other funding and financial mechanisms to support cost-effective carbon savings or low-carbon innovation. The revenues created by the carbon price are far more powerful in their potential to save carbon than the price itself. A study based on UK household electricity prices compared the carbon-saving impact of a price increase with the carbon-saving impact of investing the revenues into an effective efficiency programme. It found that

[96] Giraudet, L.-G., Bourgeois, C., & Quirion, P. (2019). *Social-environmental-economic trade-offs associated with carbon-tax revenue recycling*. European Council for an Energy Efficient Economy. https://www.eceee.org/library/conference_proceedings/eceee_Summer_Studies/2019/7-make-buildings-policies-great-again/social-environmental-economic-trade-offs-associated-with-carbon-tax-revenue-recycling/

[97] Berry, 2019.

reinvestment of the revenues generated up to nine times more carbon savings than the price alone.[98]

Les gilets jaunes

In October 2018, *les gilets jaunes* (the yellow vests) first took to the streets to protest — initially — against high fuel prices. The protests came to focus on a carbon price, specifically the escalation of the Contribution climat énergie (CCE), a surcharge to existing energy taxes on fossil fuels that households and companies pay on the purchase of diesel, petrol, heating oil, gas or coal, based on their carbon content. Soon after the initial protests, an analysis of the causes and dynamics of the protests was carried out by Agora Energiewende.[99] It found that, although the French population generally supports climate protection, a number of flaws in the design of the carbon taxation regime, broader governmental reforms and the lack of overall transparency and communication of the reforms were at the root of the protests. The assessment concluded:

1. Ring-fencing revenues for redistributive and carbon-saving purposes, thereby making the mechanism revenue neutral, is central to the acceptance of carbon pricing as a climate protection measure.
2. Effective and transparent communication regarding how revenues will be invested is essential.
3. Exemptions and compensation must not privilege businesses over households
4. Part of the revenues should be redistributed to low-income households to combat regressive impacts.
5. Revenues should enable those affected to protect themselves from rising costs, for example, by providing support for access to lower-carbon options for home heating and transport.

The use of revenues to accelerate the decarbonisation of heat — as part of the suite of building renovation and sustainable, renewable heating policies within which the pricing mechanism sits — will reduce emissions in the sector and bring down the overall price of carbon within the trading scheme. Therefore, these complementary polices are an important part of reducing the regressive effects of the tax.

A gradual increase in carbon prices would enable distributional issues to be mitigated to some extent through efficiency and heat decarbonisation if this support is delivered at scale from well before the introduction of the price.

Chapter 5

Assessing the options for the introduction of carbon pricing to the EU buildings sector

In this chapter we assess different options for introducing carbon prices on heating fuels, either at the EU level or by encouraging Member States to do so.

Carbon pricing can be put in place in two main ways:

---

98 Cowart, R., Bayer, E., Keay-Bright, S., & Lees, E. (2015). *Carbon caps and efficiency resources: Launching a "Virtuous Circle" for Europe*. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/carbon-caps-and-efficiency-resources-launching-a-virtuous-circle-for-europe/

99 Gagnebin, M., Graichen, P., & Lenck, T. (2019). *The French CO2 pricing policy: Learning from the yellow vests protests*. Agora Energiewende. https://static.agora-energiewende.de/fileadmin/Projekte/2018/CO2-Steuer_FR-DE_Paper/Agora-Energiewende_Paper_CO2_Steuer_EN.pdf

1. Carbon taxes put an explicit price on carbon emissions and can be introduced relatively straightforwardly through existing systems of energy taxation. They provide a clear and predictable price signal, although announcements on future tax rates can be relatively easily reversed through annual budget processes. They do not guarantee an emissions outcome. The amount of emissions depends on the strength of the carbon price signal and the broader policy framework as a whole.
2. Cap-and-trade mechanisms regulate the amount of carbon that can be emitted. The trading of allowances to emit reveals the carbon price, which varies with the demand and supply of allowances. Quantity-based regulations, such as the ETS, guarantee a level of emissions, as long as high (or low) prices are politically acceptable. The carbon price depends on the strength of the policy framework as a whole.

Hybrid systems are possible that combine elements of the two main options. A hybrid system could see the price in an ETS controlled through withdrawals and injections of allowances into the market, creating a price corridor within which it is allowed to vary. This type of hybrid has the advantage of being more predictable and limiting the distributional impacts of carbon pricing. However, it could not be relied upon to both guarantee meeting the 2030 carbon target and keep prices below the price ceiling. To ensure the price does not breach its upper limit, allowances would need to be allowed to be injected into the system, increasing the amount of carbon emitted. This means that such systems cannot be used as part of the climate target architecture if the price is not eventually allowed to rise to the point at which the total cap on emissions over the lifetime of the system is respected.

It is possible to put proxy carbon prices in place through other types of regulations that put an implicit price on carbon. An example, discussed below, would add an additional cost to fossil fuel bills by obligating fossil heat providers to deliver carbon emission reductions through switches to sustainable renewable heat or the purchase of credits from others who have made switches. In effect, the cost of credits would be the carbon price. Excise duties on fuels also serve as a proxy for carbon taxes, particularly in the transport sector.

Options 1 to 4 assessed in this chapter assume that ESR targets are raised in line with the Fit for 55 goal. This would allow carbon pricing to be introduced in a managed way, providing the opportunity to address energy equity concerns through the targeted spending of carbon revenues and other resources. Option 5 assumes that ESR targets are not aligned with the carbon goal. This would require the introduction of emissions trading. The carbon price could not be managed, as the emissions cap would act as part of the climate target architecture.

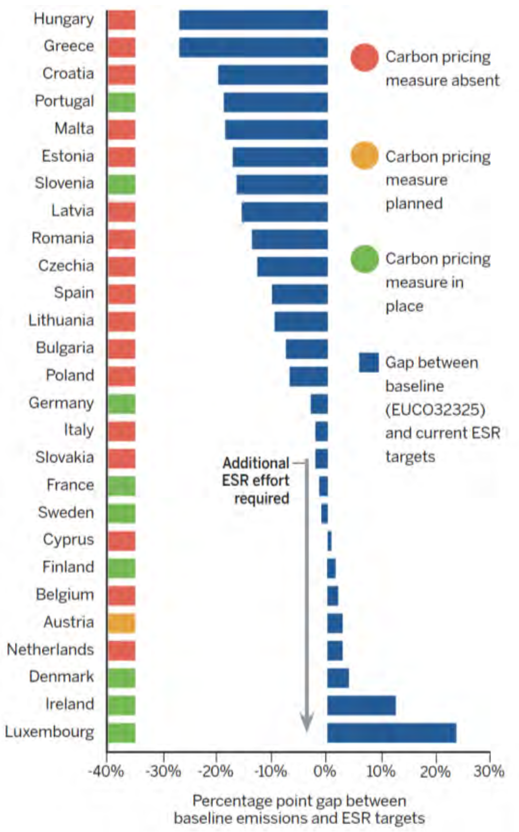
1. Allow Member States to choose whether or not to introduce a carbon pricing mechanism — higher ESR targets would be likely to lead to more national carbon pricing.
2. Increase minimum energy tax levels based on carbon content for non-EU ETS fuels, through a revision of the Energy Taxation Directive.
3. Introduce a separate hybrid EU ETS with a price corridor for ESR emissions from buildings (and transport).

4. Regulate fuel suppliers to achieve a clean heat standard — an alternative to explicit carbon pricing. Member States could be obligated to make carbon emissions reductions through heating system replacements, with the option to regulate fuel suppliers or use alternative measures.
5. Introduce a separate EU ETS without a price cap in order to use the carbon pricing instrument as part of the climate target architecture.

1. Allow Member States to choose whether or not to introduce carbon pricing measures

Higher ESR targets would most likely lead to Member States taking action to impose carbon prices on fuels used in buildings without a requirement from the EU. Figure 11 illustrates the correlation between the strength of ESR targets and the likelihood of carbon pricing. The blue bars show the amount of effort required by Member States to meet their current ESR targets in 2030. The countries on the left-hand side of the chart do not need to expend additional effort to meet their current targets, relative to baseline emissions as calculated by the PRIMES model (EUCO3232.5 scenario), used by the EU in its energy and climate modelling exercises.[100] The red, amber and green tabs show the current status of carbon pricing on the direct combustion of fossil fuels used for heating in each Member State.

Figure 11. Effort required to meet existing ESR targets and status of carbon pricing measures for building emissions



100 European Commission. (2019b). *Technical note: Results of the EUCO3232.5 scenario on Member States.* https://ec.europa.eu/energy/sites/default/files/technical_note_on_the_euco3232_final_14062019.pdf

Luxembourg, the EU Member State with the most challenging current ESR target, announced in its National Energy and Climate Plan (NECP) that it will introduce a carbon tax of 20 euros per tonne in 2021 on non-ETS fuels, rising to 25 euros in 2022 and 30 euros per tonne in 2023. This will add around 80 euros to the average annual fuel bill of oil-heated homes. Half the revenues will be used to support decarbonisation measures in poorer households.[101]

Ireland introduced a carbon tax in 2010, which covers heating fuels. It has the second most stringent ESR target amongst Member States. The Irish tax was increased by 30% in both 2020 and 2021, from 20 euros in 2019 to 26 euros in 2020 and 33.50 euros per tonne in 2021.[102] 100% of the revenues from the increases in the tax rates in 2020 and 2021 have been ring-fenced for emissions reduction projects, including energy poverty efficiency upgrades, protecting vulnerable households through fuel allowances and projects aimed at ensuring a just transition.[103] The Irish government has committed to incremental increases to 80 euros per tonne by 2030.[104]

Denmark has the third toughest ESR target and its own target of reducing emissions by 70% by 2030. Denmark already has a carbon tax of 177 Danish kroner (24 euros) per tonne and the Danish Council on Climate Change recommends sharply increasing the carbon price in order to meet targets.[105] Successive green tax reforms have seen environmental taxes, including the carbon tax, replace pay-roll and income taxes. Some revenues were used to subsidise energy efficient technologies, and households received a 'green check' based on income level.[106]

Finland (62 euros), France (44.60 euros) and Sweden (114 euros) have the highest carbon tax rates on heating fuels in the EU and also have ESR targets that are amongst the 10 most challenging. Finland and Sweden have used increases in environment and energy taxes to offset reductions in taxes on labour and entrepreneurship. The most recent increases in Sweden in carbon taxes have flowed to the general budget. In France, the 2014 tax reform saw the 'climate energy contribution' redistributed to companies through a tax credit for competitiveness and employment (75% or revenues), a VAT reduction on thermal building renovation (18%) and a 'green check' for households on low incomes (8%).[107]

Amongst the other 10 Member States with the most challenging ESR targets, Austria has announced its intention to put some form of carbon pricing in place, potentially

---

[101] Government of Luxembourg. (2018). *Luxembourg's integrated national energy and climate plan for 2021-2030.* https://ec.europa.eu/energy/sites/ener/files/documents/lu_final_necp_main_en.pdf

[102] Irish Citizens Assembly (2018), *How the State can make Ireland a leader in tackling climate change*. https://2016-2018.citizensassembly.ie/en/How-the-State-can-make-Ireland-a-leader-in-tackling-climate-change/

[103] Government of Ireland. (2021). *Budget 2021: The use of carbon tax funds 2021.* http://budget.gov.ie/Budgets/2021/Documents/Budget/Carbon%20tax%20document.pdf

[104] Government of Ireland. (2019). *Climate Action Plan 2019 to tackle climate breakdown.* https://assets.gov.ie/10206/d042e174c1654c6ca14f39242fb07d22.pdf

[105] Agence France Presse. (2020). Denmark readies increased carbon tax to promote energy transition. *Barron's.* https://www.barrons.com/news/denmark-readies-increased-carbon-tax-to-promote-energy-transition-01592830806

[106] Marten, M., & van Dender, K. (2019). *The use of revenues from carbon pricing.* (Working Paper No. 43). OECD Taxation. https://doi.org/10.1787/3cb265e4-en.

[107] Rocamora, A. R. (2017). *The rise of carbon taxation in France: From environmental protection to low-carbon transition*. IGES (Institute for Global Environmental Strategies). https://www.iges.or.jp/en/publication_documents/pub/workingpaper/en/5983/The_Rise_of_Carbon_Taxation_in_France_Rocamora_May_2017.pdf

mirroring the system in Germany,[108] which has a national ETS for heating and transport fuels. The Netherlands does not have a carbon tax in place but has begun rebalancing taxes away from electricity and towards fossil gas in order to encourage households to opt more often for electrical heat options such as heat pumps. Tax rates are increasing over time for gas and decreasing for electricity.[109] Only Belgium and Cyprus do not impose a carbon price on heating fuels, although there is an ongoing discussion on carbon pricing in Belgium.

Amongst the other 18 Member States with less challenging ESR targets, only Germany, Portugal and Slovenia have an explicit carbon price on heating fuels. In all three countries, the carbon price is relatively low (25 euros per tonne or less), although the price will rise in Germany to 55-65 euros in 2026. The 2021 Constitutional Court ruling in Germany requiring the updating of its climate law, may lead to higher carbon prices.[110]

If ESR targets are raised, more Member States would be likely to develop their own carbon pricing policy measures. Member States wishing to introduce a carbon pricing measure could choose a carbon tax (as in many Member States), adapt energy taxes to encourage electrification (as in the Netherlands), put in place an emissions trading system (or hybrid system, as in Germany) or choose a regulatory measure with an implicit carbon price, although no Member State has chosen this option thus far (see discussion of the Clean Heat Standard later in this chapter).

2. EU-wide minimum energy taxation levels based on carbon content

Member States' national carbon pricing measures could be underpinned by EU-wide minimum carbon tax rates. This would force Member States without carbon taxes to adjust their energy taxes to reflect the carbon content of heating fuels and go some way to ensuring that Member States without carbon taxes do not benefit from the movement of economic activity from high to low carbon tax countries.

How would it work?

- The Energy Taxation Directive would be amended to ensure that all fuel consumption outside the EU ETS is subject to a carbon tax.
- The existing excise system would be used for the purpose of the carbon tax.
- The level of the carbon tax would be increased gradually with the aim of reaching a balance between the tax and the EU ETS price.
- Tax credits for emissions from heat in industry sectors exposed to the risk of carbon leakage could be made available if no border adjustment mechanism is in place.

---

108 Asen, E. (2020). *Carbon taxes in Europe*. Tax Foundation. https://taxfoundation.org/carbon-taxes-in-europe-2020/

109 National Government for the Netherlands. (2021). *Tabellen tarieven milieubelastingen (Tables of environmental tax rates)*. https://www.belastingdienst.nl/wps/wcm/connect/bldcontentnl/belastingdienst/zakelijk/overige_belastingen/belastingen_op_milieugrondslag/tarieven_milieubelastingen/tabellen_tarieven_milieubelastingen?projectid=6750bae7%2D383b%2D4c97%2Dbc7a%2D802790bd1110

110 Reuters. (2021). Germany sets tougher CO2 emission reduction targets after top court ruling. https://www.reuters.com/business/environment/germany-raise-2030-co2-emissions-reduction-target-65-spiegel-2021-05-05/

Assessment: A sensible idea that's politically undeliverable?

The introduction of an EU-wide carbon tax alongside a strengthening of ESR targets could align with the EU's climate goals. The tax could be introduced gradually, allowing targeted decarbonisation programmes to decarbonise the homes of those most vulnerable to increases in energy prices first. A clear trajectory for carbon prices, alongside other market transformation policy measures, would help the market for building renovation and heating system replacements to develop. Revenues would be available to Member States to fund decarbonisation support programmes at their discretion. Some Member States might choose to use the revenues to reduce other taxes, redistribute as lump sum transfers or pay down national debt.

An EU-wide carbon tax has many merits in theory. In practice, however, taxation policy is a national competence, requiring unanimity amongst Member States before proposals can be adopted. A proposal by the Commission in 2011 to reform the Energy Taxation Directive to bring it more closely in line with the EU's energy and climate policy objectives failed to be adopted and was withdrawn in 2015, following unsuccessful negotiations amongst Member States in the Council.[111]

The experience of this failure, and indeed the outcome of the earlier debate around whether to reach an EU-wide agreement on carbon taxation on electricity and industry or to set up the EU ETS, suggest that it may be difficult to successfully pursue this option. However, the Commission's ambition to move to qualified majority voting for energy taxation matters and the Council's commitments to updating the ETD's legal framework may be able to pave the way for meaningful reform. Article 192(2) of the Treaty on the Functioning of the European Union contains a *passerelle clause* that would enable the switch from unanimous voting for taxes in the environmental field, providing a potential route to the setting of energy taxes based on carbon content and in line with climate goals.[112]

3. A separate hybrid EU ETS for buildings (and transport)

With ESR targets increased, an EU-wide ETS covering the buildings sector could be set up with a price floor and price ceiling — a price corridor. The obligation to meet targets would remain at Member State level until at least 2030, through the ESR, allowing the ETS mechanism to be introduced gradually with a clear trajectory for prices. A decision could be made at a later date on whether to merge the system with the existing EU ETS on electricity and industry.

How would it work?

- Upstream heating (and transport) fuel providers (e.g., fuel suppliers) would be obligated to comply with a new ETS provision, requiring them to surrender allowances covering all their emissions in the separate ETS.
- Upstream fuel providers supplying both regular ETS installations and installations covered by the new ETS would need to differentiate their supplies when reporting emissions through the monitoring, reporting and verification (MRV) framework.

---

111 European Commission. (2011). *Excise duties: Energy tax proposal.* https://ec.europa.eu/taxation_customs/business/excise-duties-alcohol-tobacco-energy/excise-duties-energy/excise-duties-energy-tax-proposal_en

112 Transport & Environment. (2020). *The Energy Taxation Directive: T&E's feedback on the Inception Impact Assessment.* https://www.transportenvironment.org/sites/te/files/publications/2020_04_TransportEnvironment-feedback-EnergyTaxationDirective-IIA-2020.pdf

- The trajectory of the separate ETS cap would be aligned with the sectors' shares of the 2030 and 2050 targets, but the hybrid nature of the system would mean that, at least initially, these would not be binding (see next bullet).
- A tight price corridor (lower and upper limits to price) with an upward trajectory would provide price stability. Allowances could be added to or withdrawn from the market to ensure price stability.
- Allowances would be auctioned, with at least some revenues available for allocation across Member States to address distributional policy issues.

Assessment: A carbon tax in all but name with options for future amalgamation with the regular EU ETS

The introduction of an EU ETS for buildings (and transport) with a tight price corridor would have a similar effect on end-user energy prices as a carbon tax. With a clear trajectory for the cap and a price fluctuating within a tight range, a hybrid ETS would also support market transformation policies in a similar way to a carbon tax. This hybrid policy mechanism could not be relied upon to ensure integrity with the 2030 climate goals, making increases in ESR targets essential.

End users would be insulated from the risk of very high prices by the upper limit of the price corridor. This risk would be taken by national governments with obligations to meet ESR targets. If emissions from buildings (and transport) do not fall sufficiently quickly, the ETS price would rise until it hit its upper limit. An ETS price sitting at the top of its price corridor would at least indicate to governments the need to ramp up action on buildings policy measures or to find other emissions reductions to compensate for the failure to decarbonise buildings quickly enough, such as in the other, much smaller sectors covered by the ESR (e.g., the land use, land-use change and forestry [LULUCF] sectors) or by retiring allowances in the regular EU ETS.

A separate ETS, with or without a price cap, would have ramifications for the strategies of those Member States that have already put carbon taxes in place. Some Member States have noted that such a development would disrupt plans for a particular trajectory for carbon prices, already agreed and communicated, as well as potentially affecting their recycling of carbon revenues.[113]

4. An obligation to decarbonise heating systems: Clean heat standards for fuel suppliers

How would it work?

- Member States would be obligated to make non-ETS carbon emission savings from substituting fossil fuels with clean heating fuel and making heating system replacements, in much the same way as Member States are obligated to make final energy savings under Article 7 of the Energy Efficiency Directive (EED).[114]
- The sum of Member States' required emissions reductions would be aligned with the 2030 goal.

---

[113] See, for example, this tweet from the Minister of Environment in Luxembourg, Turmes, C. (2021) https://twitter.com/claudeturmes/status/1372194347848962050?lang=en

[114] European Parliament. (2018). *Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency*. EUR-Lex. http://data.europa.eu/eli/dir/2018/2002/oj

- Member States would be free to put in place a clean heat standard on heating fuel suppliers or use alternative measures to meet their obligations.
- Under the clean heat standard option, upstream fossil fuel heat providers would be obligated to deliver a minimum share of low-carbon fuel across their sales of heating fuels not covered by the ETS.
- The low-carbon share would increase each year, based on historic sales in a baseline period.
- Credits would be awarded for carbon emission savings from clean heating fuels and heating system conversions.
- Obligated fuel providers could deliver fossil fuel reductions through
    - Upstream actions (e.g., biofuels injection or replacement of district heating system plants).
    - The delivery of heating system replacements (e.g., installing heat pumps or wood-burning stoves).
    - The purchase of credits (from other obligated parties and potentially from accredited third parties).
- Decarbonisation-readiness actions, for example, making boilers hydrogen ready, would not be allowed — only actual decarbonisation actions would count towards meeting obligations.
- Strict rules on the sustainability of bioenergy actions would need to be put in place.
- The costs of meeting the clean heat standard would be passed through to end users through prices of the fossil fuels supplied.

Assessment

A clean heat standard for heat suppliers would be a multifaceted policy instrument. It would both drive decarbonisation directly, through the requirement to undertake accredited decarbonisation actions, and impose a carbon price on fossil fuel heat consumption through the mechanism of cost pass-through to end users. The closest analogy to this policy measure would be the energy efficiency obligation schemes (EEOSs) in operation in 14 Member States. Article 7 of the EED requires Member States to put in place EEOSs or alternative measures to meet their end-use energy savings obligations during the period 2021-2030. EEOSs place an obligation on energy utilities to deliver energy savings through accredited energy efficiency actions, such as insulation, efficient lighting and products and behavioural measures. An obligation on heat suppliers would require them to deliver carbon savings through accredited heat decarbonisation actions.

The rate at which fuel suppliers would be required to decarbonise could be aligned with the achievement of heating fuel switching's share of the Fit for 55 climate goal. This would place the ultimate responsibility on fuel suppliers to deliver the required decarbonisation effort. Just as with an ETS, the marginal cost of meeting the target would be passed on to end users, who would ultimately shoulder the risk of underdelivery through higher prices. Heating system replacements undertaken by accredited third parties could generate credits to sell to obligated fuel suppliers. These would be analogous to the White Certificates, which can be generated by third parties in some EEOSs (see the sidebar on White Certificates). Annex 2 contains more detailed analysis of this option, including its potential interaction with broader energy efficiency policy.

The likelihood of this approach being adopted at the EU level — for example, through an addition to the Renewable Energy Directive (RED), similar to Article 7 EED — is small at the moment, given that no Member State has put a decarbonisation obligation on heating fuel suppliers (clean heat standard) to date. It is more likely that some Member States might choose to pilot this option, with wider adoption at the EU level possible at a later date. The revision of the RED to include a mandatory renewable heating and cooling target could act as a trigger for such schemes.

White Certificates

The EEOSs in France, Italy and Poland (and some Australian states) allow obligated parties to meet their obligations through the purchase of credits (White Certificates) from third parties. These credits can be purchased through bilateral trades or open market operations, which create a visible price for the delivery of certified energy savings.

White Certificates provide obligated parties with more routes to target achievement and transparent market access for third parties. The visible price acts as a signal for market actors to engage in energy saving actions, increasing competition. At the same time, the larger number of market players and the trading of certificates increases the costs of scheme administration. In determining whether or not to introduce White Certificates into their EEOSs, scheme designers need to weigh up the additional administrative costs against the likely programme cost savings from the increased competition amongst energy efficiency service providers.

5. A separate ETS without a price corridor

If ESR targets are not raised, some form of ETS with a binding cap would be required. That implies either an extension of the current ETS to buildings (and some other emissions covered by the current ESR targets) or a separate ETS for these new sectors. A set of options to allow some fungibility between the two ETSs would also be possible.

Without Fit for 55 proof ESR targets, the carbon pricing measure's primary function would be to act as an essential piece of the climate target architecture. ETS caps would need to ensure climate integrity, with the prices in the systems reflecting progress towards the goal and expectations about future efforts.

In the 2030 Climate Target plan impact assessment, the Commission highlights the potential benefits of creating a single carbon price to drive emission reductions where they are most cost efficient; provide a level playing field between domestic fossil fuel heating systems, district heating and electric heating; and ensure high quality monitoring, reporting and verification of emissions.[115] However, the same arguments for not extending the current ETS to new sectors discussed in Chapter 1 would remain. Changes to the current ETS, such as those proposed by Sandbag, will need to bed down before adding additional uncertainty with the introduction of new sectors.[116] In addition, several studies[117] highlight that, because of the buildings sector's lack of responsiveness to carbon prices, a single extended ETS cap would delay action in this sector and put additional pressure on companies currently covered by the ETS. Furthermore, the reassurance of a cap on the majority of the EU's energy-related carbon emissions could allow policymakers to go slower on the regulatory and supporting policy measures needed to overcome non-price barriers to building decarbonisation, delaying cost-effective action in the buildings sector and making real the price risks facing EU industries.

How would it work?

- Upstream heating (and transport) fuel providers would be obligated to comply with a new ETS provision, requiring them to surrender allowances covering all their emissions in the separate ETS.
- Upstream fuel providers supplying both regular ETS installations and installations covered by the new ETS would need to supply evidence of fuel being supplied to entities with compliance obligations in the regular ETS.
- The trajectory of the separate ETS cap would be aligned with the sector shares of the 2030 and 2050 targets.
- Allowances would be auctioned, some by Member States and others by the European Union to allow for redistribution of revenues.

Assessment: A means of ensuring that climate targets are met with implications for the wider EU climate and energy policy framework

A separate ETS for buildings (and transport) with a Fit for 55 trajectory and no price ceiling would generate a carbon price specific to these sectors, although options for some fungibility with the main ETS would need to be explored to avoid extremely high prices for users of fossil fuels in the buildings and transport sectors. This is a significant risk if investment in low-carbon technologies does not respond quickly enough to the package of policy measures put in place.

The impact of a separate ETS on investment, independent of the impact of other policy measures, is difficult to predict. Compared to a carbon tax or a hybrid ETS with a price corridor, an ETS with a freely floating price would create a less certain and less easily communicated price signal, potentially undermining the impact on investment.[118] On

---

[115] European Commission, 2020b.

[116] Sandbag, 2020.

[117] See for example: Stenning, J., Bui, H., & Pavelka, A. (2020, June). *Decarbonising European transport and heating fuels — Is the EU ETS the right tool? Cambridge Economics.* European Climate Foundation. https://europeanclimate.org/wp-content/uploads/2020/06/01-07-2020-decarbonising-european-transport-and-heating-fuels-full-report.pdf; Burger, A., Gibis, C., Knoche, G., Lünenbürger, B., & Weiß, J. (2020, October). *Raising the EU 2030 GHG emission reduction target. Implications for ETS and non-ETS sectoral targets.* Umwelt Bundesamt. https://www.umweltbundesamt.de/publikationen/raising-the-eu-2030-ghg-emission-reduction-target; and Öko-Institut & Agora Energiewende, 2020.

[118] Kaufman, N., Obeiter, M., & Krause, E. (2016). *Putting a price on carbon: Reducing emissions.* World Resources Institute. https://www.wri.org/publication/putting-price-carbon-reducing-emissions

the other hand, the possibility of very high prices might spur more investment to avoid this risk.

More importantly, neither an extended ETS nor a separate ETS would eliminate the need for the implementation of the policy measures described in Chapter 6, which would still remain key components of the comprehensive policy framework needed to decarbonise the buildings sector. By making the carbon pricing instrument the means by which the 55% climate goal is reached, the introduction of an ETS in the buildings sector could reduce some Member States' efforts to develop suitably ambitious policy measures to deal with non-price barriers, a risk that would magnify if ESR targets were to be scrapped altogether.[119] The effect of weaker efforts to tackle broader market failures and barriers would be higher carbon prices, which, while driving some countervailing reductions in carbon emissions, would have significant implications on the fairness of the transition. Many of those emissions savings would be from underheating in low-income, energy-poor or vulnerable households. 6.9% of the EU's population said that they could not afford to heat their homes at current prices.[120]

The risk that policy focus might be diverted from the development of regulatory and supporting policy measures could play out differently in different Member States. A lack of progress in one country would lead to higher consumer prices across all Member States. This risk to consumers from inaction in other countries could be mitigated through stronger drivers of action at the EU level. This was the case during the first 15 years of the ETS on electricity and industry, with binding renewable energy targets driving power sector decarbonisation alongside the cap on emissions. In the buildings sector, binding energy efficiency and renewable heat targets could perform a similar role. Member States' energy saving obligations under Article 7 of the Energy Efficiency Directive could be increased to ensure that the ambition of supporting measures matched the carbon goal.[121] A similar driver to encourage switching away from fossil fuel heating could be provided by a clean heat obligation on Member States (the next option assessed), which could be introduced instead of, or in addition to, a carbon tax or ETS.

The Commission stresses the need for additional policy measures in the buildings sector to mitigate the risks associated with a high carbon price. It argues that having the buildings sector covered by both the ETS and ESR targets (double coverage) can ensure that Member States continue addressing important non-price-sensitive abatement potentials.[122] The Commission notes that a double coverage by ETS and ESR caps could lead to a situation where the sectors newly covered by the ETS would reduce more than what is required to achieve the ESR targets, allowing sectors that are not covered by the ETS to do less.[123]

---

[119] European Environment Bureau. (2021). *A carbon pricing blueprint for the EU*. https://mk0eeborgicuypctuf7e.kinstacdn.com/wp-content/uploads/2021/03/A-Carbon-Pricing-Blueprint-for-the-EU2.pdf

[120] Eurostat. (2019). *Population unable to keep home adequately warm by poverty status*. https://ec.europa.eu/eurostat/web/products-datasets/-/sdg_07_60

[121] Santini, M., & Thomas, S. (2020). *Article 7 of the Energy Efficiency Directive 3.0: How to maximise the energy efficiency opportunity for climate neutrality.* Regulatory Assistance Project. https://www.raponline.org/knowledge-center/article-7-energy-efficiency-directive-3-0-how-maximise-energy-efficiency-opportunity-climate-neutrality/

[122] European Commission, 2020b.

[123] The Commission also mentions that the risk could also be limited by specific ambitious EU measures in these other sectors through, for example, the F-gas regulation or agriculture policy. EU Commission, 2020b.

The Commission highlights the role of EU policy in intensifying the policy effort. It lists options to reinforce the ESR, including the Energy Efficiency Directive (EED), the Energy Performance of Buildings Directive (EPBD), the Renewable Energy Directive (RED) and the Energy Taxation Directive (ETD). The next chapter takes a helicopter view of the broader building decarbonisation policy framework and how carbon pricing measures fit within it.

Chapter 6

The interaction of carbon pricing with the rest of the building decarbonisation policy framework

This report describes how carbon pricing is directionally positive but will only deliver the required pace and scale of building decarbonisation if other policy measures are reinforced. Indeed, these other policy measures are instrumental to drive emission cuts and keep carbon prices at a reasonable level. The chapter assesses the interactions between carbon pricing and other elements of the policy mix, identifying actions that the EU could take to reinforce building decarbonisation efforts.

Designing a suitable policy mix

The current building policy mix is insufficiently ambitious. The level of emission cuts needed in the buildings sector is unprecedented, calling for both a reinforcement of existing policy tools and the creation of new tools, at EU, national and local levels.[124] A recent study by Buildings Performance Institute Europe (BPIE) found that Member States' Long Term Renovation Strategies are not on a path towards the total decarbonisation of the building stock by 2050.[125]

The level of investment needed to perform the transition in the buildings sector is significant and requires an adequate mobilisation of private and public funding sources. Aligning price incentives with the climate goal is part of the solution, alongside instruments to support private investments, through improving access to finance, and direct public investment where it is needed most. At the same time, policies are needed to address nonfinancial barriers, such as split incentives, lack of information and behavioural barriers,[126] as well as the rapid expansion and upskilling of the supply chain. Planning can also help with the transition. The Netherlands has, for example, chosen to implement a district-oriented approach through heat zoning plans. The government sees the district as 'the easiest scale at which to implement alternatives to natural gas step-by-step at natural junctures and limit the costs.' Test beds for natural-gas-free districts were started in 2018.[127]

---

[124] See Chapter 2; and Santini & Thomas, 2020.

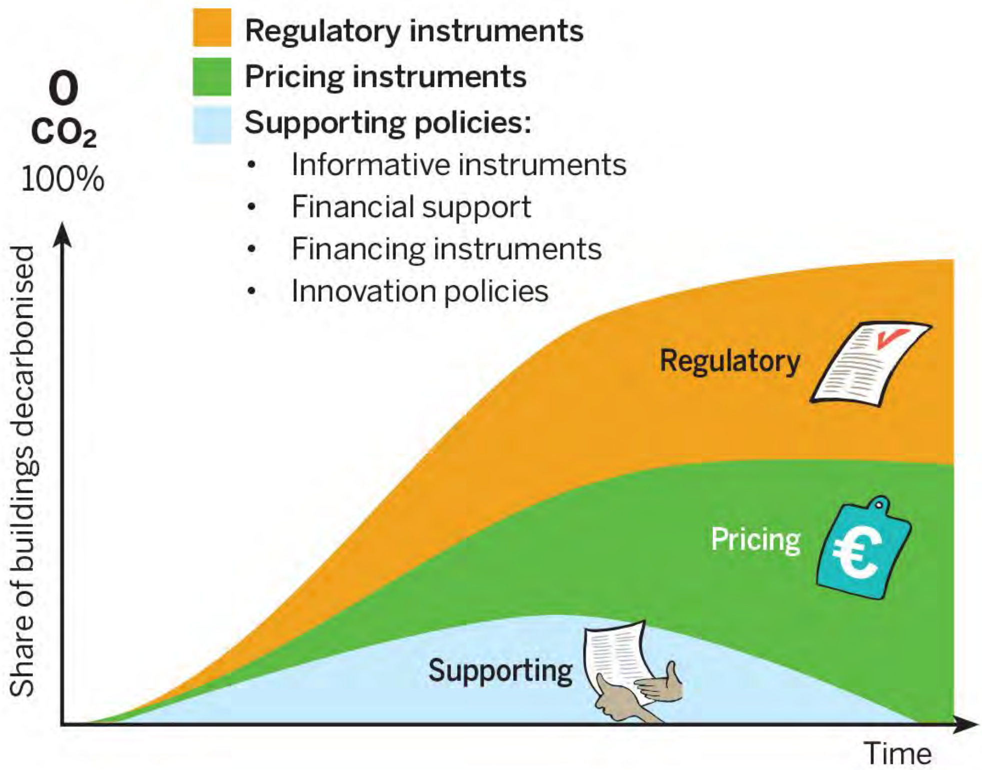
[125] BPIE. (2021). *The road to climate neutrality: Are national long-term renovation strategies fit for 205?* https://www.bpie.eu/publication/the-road-to-climate-neutrality-are-national-long-term-renovation-strategies-fit-for-2050/

[126] Gillingham, K., Newell, R., & Palmer, K. (2009). Energy efficiency economics and policy. *Annual Review of Resource Economics, 1*(1), 597-620. https://www.annualreviews.org/doi/pdf/10.1146/annurev.resource.102308.124234

[127] Netherlands Enterprise Agency. (2020). *Heating and cooling potential analysis: An assessment of the potential for an efficient heating and cooling supply in the Netherlands*. https://ec.europa.eu/energy/sites/default/files/nl_ca_2020_en.pdf

The combination of regulation, pricing and supporting policy instruments can be mutually reinforcing if introduced in a coherent manner.[128] Pricing makes supporting measures more affordable, by generating revenues to spend on renovation programmes and bill support for energy-poor, low-income and vulnerable households. It also makes those renovation programmes go further, by improving the economics of low-carbon investments and reducing the subsidies required to overcome behavioural barriers to investment (e.g., high discount rates). The same is true of regulations. If prices and supporting measures are aligned with the carbon goal, compliance with complementary regulations will be easier to achieve as illustrated in Figure 12.[129] Without a coherent approach to carbon pricing, it will be difficult to expect willing compliance with regulations to decarbonise buildings. How can we expect people to switch to low-carbon fuel sources if they are taxed more heavily than the fossil fuel alternatives?

Figure 12. Decarbonising the buildings sector through regulation, pricing and supporting measures



Source: van de Poll, et al. (2020). *Zero carbon buildings 2050*. CE Delft. Background report. Note: Schematic of comprehensive policy package to reach full decarbonisation of the residential buildings sector.

The strength of each element of the policy mix should change over time. Supporting measures should dominate in the short term, as the supply chain ramps up and financial support is required to mitigate the impacts of pricing measures on energy poverty. However, the regulatory and pricing frameworks are also present early on to

[128] Rosenow, J., Fawcett, T., Eyre, N., & Oikonomou, V. (2016). Energy efficiency and the policy mix. *Building Research & Information, 44*(5-6), 562-574.

[129] van de Poll, F., Rooijers, F., Vendrik, J., Kruit, K., & van Berkel, P. (2020). *Zero carbon buildings* 2050. CE Delft. Background report. https://www.cedelft.eu/en/publications/2474/net-zero-buildings-2050

provide clear direction to building owners and the supply chain and to generate the revenues needed to support investments and tackle energy poverty.

EU power sector decarbonisation: A successful combination of regulation, pricing and supporting measures

Between 2005 and 2019, the EU power sector decarbonised by 29%;[130] renewable generation jumped to 34%, rising from just 7.4 TWh in 2008 to 125.7 TWh in 2019;[131] and coal generation has fallen by 48% in the last five years alone.[132]

Behind this success has been a mixture of carbon pricing, regulation and supporting policy measures. The EU ETS has put a price on carbon, albeit a very low price for much of the last 15 years, incentivising low-carbon investments, but has only been one driver of action.

Supporting subsidies for renewable energy in many Member States, in the main through feed-in tariffs funded by levies on electricity prices, have been the central driver behind the growth in wind and solar generation. As the markets for these technologies have developed, the support provided for new investments has subsided, although the impacts on consumers' electricity bills continue to be felt. Underpinning those supporting policy measures were the mandatory renewable energy targets imposed through the Renewable Energy Directive. Regulation has played a key role, too, in phasing out coal in some Member States.

This example shows that carbon pricing does not preclude the introduction of strong regulatory and supporting measures, particularly if mandated through a coherent package at the EU level.

Regulatory measures

Demand for building renovation and heating system replacements has remained stubbornly low over the last decade, despite the many subsidy programmes available across Member States. Regulatory measures can provide clear direction to the sector, and this is needed if the required pace of change is to be realised. Demand needs to be driven.

The EU is well placed to regulate certain aspects of the buildings policy framework (e.g., ecodesign) and to provide guidance to Member States on how to regulate to meet EU Directives in other cases (e.g., minimum energy performance standards for existing buildings).

Product and equipment regulations

Direct regulation of appliances, products and equipment used in buildings is under direct EU control through the Ecodesign Directive, as these are bought and sold throughout the EU. Ecodesign can further contribute to decrease emissions across all sectors of the economy, and the Commission should publish the next work plan, which was already due in 2020. Ecodesign regulations should be aligned with the climate goal. A study by ECOS suggests that a ban on the sale of new fossil fuel heaters would be required by 2025 to prevent consumers from investing in heating systems that will

---

130 European Environment Agency. (2020). *Greenhouse gas emission intensity of electricity generation in Europe.* https://www.eea.europa.eu/data-and-maps/indicators/overview-of-the-electricity-production-3/assessment

131 Eurostat. (2020). *Renewable energy statistics*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics

132 Ember. (2020). *EU power sector in 2020.* https://ember-climate.org/project/eu-power-sector-2020/

become stranded assets.[133] This could be achieved though national policies or at the EU level. One option highlighted by the Commission is to promote higher minimum standards even if, for certain product categories, it implies *de facto* phasing out certain fossil fuel options.[134] Standards should also mandate 'smartness' functions for appliances, increasing the possibility for the end users to provide flexibility services for the grid.

The direct regulation of products and equipment acts to edit the choices available to consumers once they have made the decision to invest. Carbon pricing would act to improve the total cost of ownership of less polluting products, making the regulations easier to bring forward. Supporting measures can be used to encourage consumers to purchase or lease the most efficient technologies and to speed up the replacement of the most polluting equipment. Regulations on buildings can also act to speed up the investment rate in cleaner products.

Regulations on existing buildings

Regulations creating deadlines have a very important role to play, for example by creating a point beyond which buildings must reach a certain performance level. This is the case with minimum energy performance standards (MEPS) for existing buildings. These standards for existing buildings have already been adopted in some European countries,[135] and the Commission has committed to propose a framework for MEPS for Europe as part of the current revision of the EPBD. By providing clear dates by which buildings must comply with standards, the demand for renovation would increase, both as deadlines approach and around trigger points, such as building sale.[136]

Carbon pricing would make higher standards more cost effective to achieve, as the lifetime costs and benefits of taking action would improve. Supporting measures would be needed to ensure that building owners were aware of short- and long-term obligations and to provide the funding and financial products to support investment for households of all income levels. Social safeguards for housing affordability, particularly for tenants, will also be needed.[137] With the right supporting framework in place, these measures could have an impact well before their deadline, as shown in the illustrative graph in Figure 12.

Regulations on new buildings and major renovations

Building codes are already in place across the EU. Similar to standards for new products, building codes influence the technologies deployed in obligated buildings, that is, buildings, new or older, undergoing a major renovation. The EPBD requires all

[133] Zill, M., Olesen, G. B., & Toulouse, E. (2020). *Five years left: How ecodesign and energy labelling can decarbonize heat.* ECOS. https://ecostandard.org/wp-content/uploads/2020/12/Five-Years-Left-How-ecodesign-and-energy-labelling-Coolproducts-report.pdf

[134] European Commission, 2020b.

[135] France, the Netherlands and two regions of Belgium have introduced MEPS. Sunderland, L., & Santini, M. (2020a). *Case studies: Minimum energy performance standards for European buildings*. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/case-studies-minimum-energy-performance-standards-for-european-buildings/

[136] Sunderland, L., & Santini, M. (2020b). *Filling the policy gap: Minimum energy performance standards for European buildings*. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/filling-the-policy-gap-minimum-energy-performance-standards-for-european-buildings/

[137] Sunderland, L. & Santini, M. (2021). *Next steps for MEPS: Designing minimum energy performance standards for European buildings*. Regulatory Assistance Project. https://www.raponline.org/knowledge-center/next-steps-for-meps-designing-minimum-energy-performance-standards-for-european-buildings/

new buildings from 2021 to be nearly zero-energy buildings (NZEB). At the trigger point of major renovations, the EPBD requires building elements to be upgraded to a minimum, cost-optimal, energy performance level. These provisions require transposition by Member States. Building standards do not aim to bring buildings in line with the climate neutrality objective and should be aligned to ensure the phase out of fossil fuel equipment. Smartness requirements should be reinforced to enable building users to participate in flexibility markets.

Energy efficiency regulations on utilities

Energy efficiency obligation schemes (EEOSs) are operating in 14 Member States. These require energy suppliers or distributors to make end-use energy savings from energy efficiency actions. The requirement for obligated parties to deliver a set quantity of energy savings serves to drive action, while the placing of the obligation on private sector actors fosters cost effectiveness and market competition. Article 7 of the EED requires Member States to meet an energy savings obligation which can be achieved through an EEOS and/or alternative measures. It allows energy savings to be delivered across all sectors of the economy, not just buildings, although in practice, the majority of savings have been delivered in the buildings sector or through cross-cutting instruments, such as EEOSs, which include buildings. Some EEOSs include sub-targets for energy savings in buildings and/or for low-income, vulnerable or energy-poor households.[138] Article 7 EED should be reinforced to (1) deliver more savings through a higher target; (2) prevent the support of fossil fuel technologies; (3) improve measurement, verification and evaluation practice; and (4) guarantee a minimum level of support for low-income households.[139]

Carbon pricing would improve the economics of building renovation and other energy efficiency measures, thereby making it easier for Member States to meet their energy savings obligation and obligated utilities to meet their targets. Increases to minimum energy taxation levels through the ETD would also reduce the scope for Member States to make eligible energy savings through national pricing measures.[140] Supporting policies can be used to combine public and private financial measures and to help obligated parties find target households if required.

Clean heat regulations on utilities

In much the same way as the EED imposes an energy savings obligation on Member States, which can be passed on to utilities through EEOSs, the Renewable Energy Directive (RED) could put in place a clean heat obligation on Member States, which could be implemented through clean heat standards, as described in Chapter 5. Just as with the improvements recommended for Article 7 EED above, a clean heat obligation would need to be aligned with the 2030 climate goal by being (1) suitably ambitious, delivering the amount of heating system replacements envisaged in the Commission

---

138 European Commission. (2020k). *2020 assessment of the progress made by Member States towards the implementation of the Energy Efficiency Directive 2012/27/EU and towards the deployment of nearly zero- energy buildings and cost-optimal minimum energy performance requirements in the EU in accordance with the Energy Performance of Buildings Directive 2010/31/EU*. https://ec.europa.eu/energy/sites/ener/files/progress_report_towards_the_implementation_of_the_energy_efficiency_directive_com2020954.pdf

139 Santini & Thomas, 2020.

140 Santini & Thomas, 2020.

Impact Assessment,[141] and (2) avoid perverse climate outcomes by ensuring that the use of unsustainable bioenergy in space heating did not increase. The Joint Research Centre (JRC) recently pointed to the large increase in forest harvesting in the EU,[142] driven in the main by the use of wood in the energy system.[143] The risk of further unsustainable reductions in the EU's carbon sinks suggests that forest-based bioenergy should not be an eligible clean heat action for compliance with an obligation on Member States. This risk should also be reflected in Member States renewable heat targets, which should be differentiated by feedstock coupled to sustainability criteria, that is, excluding wood that comes directly from forests, as opposed to secondary biomass, which is a by-product from an industrial process.

Carbon pricing could act in tandem with a clean heat obligation, just as the EU ETS operates alongside EEOSs and feed-in tariffs for renewable electricity in the power sector. The carbon price would act to make it easier for obligated heating fuel suppliers to meet their obligations. Supporting policy measures could provide additional financial support, information campaigns and targeting support. Subnational governmental organisations could team up with obligated fuel suppliers or accredited third parties to deliver area-based clean heat solutions, supporting the achievement of obligations.

Supporting policy measures

Supporting policy measures include direct financial support measures (e.g., grants and subsidies), financial instruments to support investments (e.g., green mortgages, pay-as-you-save), informative instruments (e.g., energy performance certificates, energy labels, building renovation passports), practical support to building owners (e.g., through one-stop shops) and innovation support (e.g., RD&D spending, supply chain training). The majority of these measures are undertaken at the national or local level, but the EU can facilitate the rollout of supporting measures.

All of these supporting measures will ease compliance with regulations and, if an ETS is introduced, lower the carbon price. However, perhaps the most important supporting measure the EU can take is through direct financial support for building renovation. An EU Renovation Fund, drawing on future carbon pricing revenues, could provide the core funding for the renovation of the homes of those most burdened and least able to adapt to the introduction of carbon pricing. The Modernisation Fund, which draws on a percentage of existing EU ETS revenues to support the lower income member states to modernise and decarbonise their energy systems, and the Just Transition Fund, which is available to coal and carbon intensive regions, provide precedents and models for allocation of a proportion of the revenues.

The allocation of revenues should follow the priorities set out in Chapter 4: Large-scale, targeted support for low-income and otherwise heavily burdened households to improve the efficiency of their homes and switch to sustainable renewable heating fuels and short-term financial support to target households in the time before they can access renovation support and investment in carbon-saving and low-carbon innovation

---

141 European Commission. 2020b.

142 Ceccerni, G., Duveiller, G., Grassi, G., Lemoine, G., Avitabile, V., Pilli, R., & Cescatti, A. (2020). Abrupt increase in harvested forest area over Europe after 2015. *Nature*. https://www.nature.com/articles/s41586-020-2438-y

143 Jonsson, K., Cazzaniga, N., Camia, A., & Mubareka, S. (2021). *Analysis of wood resource balance gaps for the EU.* EU Commission. https://ec.europa.eu/jrc/en/publication/analysis-wood-resource-balance-gaps-eu

projects. 100% of the revenues should be securely ring-fenced for these purposes. Distribution mechanisms should be designed to channel funds as quickly as possible to the pipeline of renovation projects at the local level, ease sticking points in these renovation pipelines and support the establishment of new renovation programmes. Funds should be designed to generate maximum long-term impact in achieving both equity and decarbonisation, and the impact must be verified.

By bringing forward carbon revenues — for example, through raising a climate bond, targeting public expenditure where it is most needed and putting in place the regulatory levers and other supporting measures required to drive demand — the ambitious climate goals for 2030 can be reached. Without all of the above, emissions will not fall quickly enough, and if an EU ETS is in place, the most vulnerable households in Europe will suffer. Only a comprehensive and ambitious buildings policy framework will deliver on Europe's climate and energy goals.

Annex 1

The main scenarios and policy options in the Carbon Plan Impact Assessment

In the impact assessment accompanying the Climate Target Plan, the Commission developed GHG reduction scenarios. It has constructed these scenarios around a set of policies that either focus on carbon pricing (e.g., through inclusion of new sectors in the ETS) or focus on regulatory measures (e.g., renovation requirements) or combine the two.[144] The Commission notes the limits of the modelling exercise, 'notably in terms of detailed representation of specific policies, differentiated impacts on economic actors as well as specific challenges that will be encountered in the implementation of these polices.'[145] The Commission will publish more detailed analyses together with the legislative proposals in July 2021.

The Commission presented the following main scenarios as compatible with a -55% GHG target:[146]

- REG, a regulatory-based measures scenario assuming a high increase of the ambition of energy efficiency, renewables and transport policies, while keeping the EU ETS scope unchanged.
- CPRICE, a carbon-pricing-based scenario assuming a strengthening and further expanding of carbon pricing, be it via EU ETS or other carbon pricing instruments, to the transport and buildings sectors. This is combined with low intensification of transport policies and no intensification of energy efficiency and renewables policies.
- MIX, a combined approach of REG and CPRICE. It expands carbon pricing and moderately increase the ambition of policies, but to a lesser extent than in REG.
- ALLBNK, a scenario based on MIX. It further intensifies fuel mandates for aviation and maritime sectors.

[144] European Commission, 2020b.

[145] European Commission, 2020b.

[146] European Commission, 2020b.

These scenarios integrate four policy options related to carbon pricing, which we describe below.[147]

ETS 1: Status quo

This option does not foresee an extension of emission trading beyond the current ETS scope. The EU achieves increased climate ambition by adapting the ETS and the ESR caps in their current scope.[148] REG, the policy scenario that relies the most on regulatory measures to achieve a 55% climate target, uses this option. REG assumes high ambition in energy efficiency, renewable energy, transport and non-CO_2 policies. This includes, for example, rolling out mandatory minimum energy performance standards for worst-performing buildings.[149] REG requires a larger policy effort than the other scenarios to compensate for the status quo in carbon pricing coverage.

ETS 2: Extension of EU ETS to new sectors

This option foresees an extension of the ETS to additional sectors, including to emissions from buildings that are not yet covered by the ETS. Most of the policy scenarios reaching a 55% GHG cut include this option (MIX, CPRICE, ALLBNK, MIX-non-CO_2). In these scenarios, the extension of the ETS to additional sectors will deliver some emission cuts and require a smaller policy effort than in the REG scenario. The Commission presents two suboptions:

- ETS_2.1 removes the emissions newly included in the ETS from the scope of Member States' ESR targets. The scenario that models a maximised role for carbon pricing (CPRICE) uses this suboption. CPRICE does not foresee an intensification of energy efficiency and renewable energy policies.[150] It results in a relatively high carbon due to the price inelasticity of demand in the sectors newly placed under the EU ETS (see analysis in Chapter 3).
- ETS_2.2 maintains the emissions newly included in the ETS in the scope of Member States' ESR targets (double coverage). The introduction of carbon pricing in these sectors supports the achievement of Member States' targets. The scenarios opting for this option combine it with an intensification of other policies. MIX, for example, combines it with intensified policies on energy efficiency and renewable energy. The Commission highlights the role played by these policies to limit increases in carbon prices.

ETS 3: Separate emission trading schemes

This option foresees the creation of a separate EU-wide emissions trading system, next to the existing EU ETS. This separate ETS would cover emissions from new sectors 'at least transitionally.'[151] The option maintains these emissions in the scope of Member States' ESR targets (double coverage). In the 2030 climate target plan, no policy scenario selected this option, and the Commission notes that it can be 'approximated'

[147] These options are outlined in European Commission, 2020b.

[148] Compared to the baseline scenario, additional emission cuts are expected in both the ETS and ESR sectors. European Commission, 2020b.

[149] European Commission, 2020b.

[150] European Commission, 2020b.

[151] This would be leading to two ETS systems of roughly similar size in 2030, each close to 35% of total emissions. European Commission, 2020b

by the results of the MIX scenario.[152] One can expect the European Commission to present further analysis related to this option when it presents the ETS proposals in July 2021.

ETS 4: National action

The fourth option foresees the introduction of an obligation on Member States to create a national trading mechanism independent from the EU ETS to support national targets. The Commission presents other variants: national carbon taxes or minimum carbon content elements of excise duties in the revised ETD. This option maintains the current policy architecture. No policy scenario has selected this option, and the Commission notes that it can be 'approximated' by the results of the MIX scenario.[153]

Annex 2

Analysis of the potential for Clean Heat Standards to drive the decarbonisation of space heating

A clean heat standard would require careful policy design. All fossil fuel bill payers would bear the costs of meeting the standard, but credited actions would take place in buildings where obligated parties would find it most cost effective to act, that is, the buildings where they have to contribute the least amount of resources per unit of carbon saved. This would most likely favour larger buildings with motivated owners with access to investment capital. To ensure an equitable distribution of effort, some restrictions on the freedom of obligated fuel suppliers to choose buildings in which to act and complementary policy measures would be needed. In combination, programme design and complementary policy measures could mitigate partially the distributional impacts of the increase in fossil heating fuel costs, for example through:

- Minimum targets for delivery in the residential sector.
    - Minimum targets for delivery in hard-to-reach areas (e.g., remote rural).
    - Minimum targets for delivery in buildings with energy-poor, low-income and vulnerable households.
- Complementary policy measures to identify and help target energy-poor, low-income and vulnerable households.
- Complementary policy measures to co-fund investments by households without access to capital.

A clean heat standard would need to be firmly embedded within a comprehensive policy framework for building decarbonisation to drive demand for uptake across all market segments, including the private rented sector, and to ensure that the activities of obligated parties aligned with broader initiatives, such as area-based fuel-switching approaches.

Compared to an ETS, a clean heat standard would both drive more decarbonisation action and require more administrative effort to measure and verify compliance. To measure compliance, estimates of the avoided fossil fuel consumption would need to

[152] EU Commission, 2020b.

[153] EU Commission, 2020b.

be made, ideally based on historic meter readings (for fossil gas) and delivery receipts for heating oil and coal. Verification of actions would need to take place on a statistically significant and representative sample of action, and fuel supplier audits would need to be carried out to match overall sales with the expected sales, given decarbonisation actions.

Compared to an Energy Efficiency Obligation Scheme (EEOS), however, the costs of measurement and verification might be expected to be relatively modest. There are relatively few actions that can be taken to decarbonise heat, and only the historic fuel consumption needs to be known to estimate the extent of decarbonisation. In an EEOS, estimates need to be made of both the consumption before and after the energy efficiency intervention. Estimates of the administrative costs of EEOSs range between 4 euro/MWh and 11 euro/MWh.[154]

One potential issue with a clean heat standard lies in its interaction with energy efficiency improvements to the fabric of buildings that reduce the fuel required to deliver and maintain a comfortable temperature. Care would need to be taken in policy design to ensure that making fabric improvements in line with the efficiency first principle was not disincentivised. This could be problematic if heat standard credits were sized to the capacity of the replacement heating equipment, meaning that bigger heating systems would attract higher subsidies for building owners. This is an issue endemic to any policy measure providing financial incentives to install heating systems.

A partial solution to the issue of oversizing would be to link credits for decarbonisation to historic energy consumption. This would avoid incentives for additional capacity. However, to ensure a level playing field for energy efficiency and heating system replacements, the additional benefits to society of energy efficiency (see 'The societal benefits of energy efficiency in low-carbon buildings' below) would need to be factored into policy design. This could be done by requiring that a minimum level of building performance is reached before allowing replacement heating systems to be accredited and ensuring that the low-carbon heating obligation was linked with other supporting policy mechanisms for energy efficiency, for example, energy efficiency obligations. In the United Kingdom, the Renewable Heat Incentive requires a minimum level of insulation to be installed before applying for a renewable heat subsidy, if it is recommended on the building's Energy Performance Certificate.[155]

In those countries with existing EEOSs, the interactions between the Clean Heat Standard and EEOSs would need to be assessed. In many EEOSs, the installation of heat pumps is an eligible option for obligated parties. The EEOSs could either be redesigned to make a strict demarcation between eligible actions in the two schemes, or a certain amount of overlap could be allowed, if the installation of efficient and clean heating systems was to be prioritized. Minimum efficiency standards could be required to be met, before clean heating systems could be eligible to claim credits. This would make synergies between the two scheme types, potentially leading to more demand for

---

[154] Rosenow, J., & Bayer, E. (2017). *Costs and benefits of energy efficiency obligations: A review of European programs.* Regulatory Assistance Project. https://www.raponline.org/wp-content/uploads/2017/04/rap-rosenow-bayer-costs-benefits-energy-efficiency-obligations-2017-may.pdf

[155] Ofgem. (2021) *Domestic Renewable Heat Incentive Guidance*. https://www.ofgem.gov.uk/system/files/docs/2021/03/drhi_essentialguide_forapplicants_mar2021_v7.pdf

energy efficiency measures and reducing the costs to EEOS obligated parties of meeting their targets.

The societal benefits of energy efficiency in low-carbon buildings

Even if the electricity grid was decarbonised, the price of zero carbon electricity reflected the true marginal cost to society of delivering energy to buildings and bill payers had perfect foresight on future electricity system costs, other market failures and barriers would prevent an optimal amount of energy efficiency investment. For example, split incentives between building owners and tenants would still remain. Faced with an obligation or incentive to decarbonise, building owners would most likely prefer to minimise investment, regardless of the costs of future energy bills. Without energy efficiency investment, energy poverty would continue, accompanied by welfare losses from underheating and poor indoor air quality and associated health care costs.

The future costs of electricity systems are unknown, and what estimates exist are not reflected in buildings investment decisions. As electricity systems decarbonise and end-uses electrify, the provision of flexibility services will have more value. Buildings with more efficient thermal properties have greater option value in that they can preheat or precool prior to expected peak events without significant impacts on comfort levels.

Energy efficiency is labour intensive. In Member States with slack labour markets, improving the thermal properties of buildings can boost employment. This may be particularly important in countries that have to adapt to more significant structural changes to their economies in the energy transition, for example, countries with significant coal, fossil gas or oil sectors.

RAP® Energy Solutions for a Changing World

Regulatory Assistance Project (RAP)®
Belgium · China · Germany · India · United States

Rue de la Science 23
B – 1040 Brussels
Belgium

+32 2-789-3012
info@raponline.org
raponline.org