Policy insight
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green alliance...

What is carbon pricing and does the UK need it?

Summary

Climate change costs are forecast to rise to

3.3%

of GDP by 2050

Climate change imposes huge costs on society. These include health impacts, droughts and flooding, reduced agricultural productivity and biodiversity loss. Already in the UK, which is relatively well protected from the worst effects, climate change is costing the equivalent of 1.1 per cent of GDP, forecast to rise to 3.3 per cent by 2050 and 7.4 per cent by 2100.[1]

These costs are borne by those who directly suffer the effects and by society at large. Polluters are often not paying a fair price for the costs they impose. This stands in direct contradiction to the 'polluter pays' principle, recently enshrined through the UK's Environment Act, which states that the costs of pollution "should be borne by those causing it, rather than the person who suffers the effects of the resulting environmental damage, or the wider community".[2]

Putting a price on carbon has long been seen as a way of rectifying this imbalance in relation to climate change and encouraging a move away from a high carbon economy. In some instances, polluters have been made to pay for at least some of the cost of their greenhouse gas emissions, largely through emissions trading schemes and carbon taxes.

Globally, carbon pricing instruments cover around 23 per cent of the world's greenhouse gas emissions and this proportion is increasing.[3]

However, there are limits to the extent that carbon pricing can be used, and it is difficult to apply it to all of the world's emissions and truly embed the polluter pays approach.

> **“The government should set out a renewed vision for carbon pricing.”**

Here, we examine the track record of carbon pricing in the UK, its future potential and limitations and the role it should play alongside other policy measures to drive a low carbon, nature rich economy.

We conclude that the government should:

— **Improve the current carbon pricing system.** This includes: ensuring both domestic and imported goods pay a fair carbon price; addressing price disparities between electricity, which has the potential to be low carbon, and natural gas, which does not; and improving the UK emissions trading scheme (ETS) by expanding its scope and exploring links with the EU market.

— **Set out a renewed vision for carbon pricing.** This should give businesses long term certainty to spur investment, as well as determining where revenue should be fairly directed and how to avoid exacerbating the cost of living crisis. Carbon pricing should complement existing sector specific pricing mechanisms and decarbonisation pathways.

— **Use carbon pricing as part of a new, broader industrial strategy.** This should drive down emissions through a range of policy levers that stimulate low carbon markets.

Demystifying the language around carbon pricing

Carbon price	A catch-all term for the price put on greenhouse gas emissions, usually through taxation or an emissions trading scheme.
Carbon tax	A fixed price per tonne of fossil fuel emitted.
Emissions trading scheme (ETS)	A market based mechanism where a collective emissions goal is set and permits are distributed to stay within its limit, which can be traded between emitters.
Carbon leakage	The relocation of production to countries with less strict carbon pricing or other climate policies, to avoid incurring extra cost, which has the effect of moving, rather than reducing overall global emissions.
Free allowances	Emission permits distributed free within an emissions trading scheme, often with the aim of protecting domestic industries from the risk of carbon leakage.
Carbon border adjustment mechanism (CBAM)	A scheme that applies a carbon price to imported goods to match that paid by domestic industries, to ensure higher carbon products do not enjoy an unfair financial advantage.

Why we need carbon pricing

> **“Emitting carbon into the atmosphere is often free to the polluter, but the costs of its impacts fall on everyone.”**

Emitting carbon into the atmosphere is often free to the polluter, but the costs of its impacts fall on everyone, including those not yet born. This is a market failure. Carbon pricing tries to address this by making emitters pay now for the true cost of their pollution, and by encouraging decarbonisation. The incentive is stronger when future prices are signalled in advance, allowing businesses time to invest in low carbon technologies and to change their practices.

Revenue generated through carbon pricing can be used to manage any effect it has on poorer households and further invest in decarbonisation, among other options.

Carbon pricing is typically delivered either through taxation or by creating a market for emissions reductions through an emissions trading scheme (ETS). These schemes usually operate on a ‘cap and trade’ basis, where a collective emissions goal is set and only enough permits (also known as allowances) to pollute are distributed to stay within the limit. Permits can either be auctioned or distributed free, and emitters who then have a surplus can sell them to those who require more.

Taxes, by contrast, are often simpler, with fixed prices ideally rising over time, but there is no guarantee the desired emissions goals will be met. Tax rate setting may also be subject to political pressure, as has been seen with fuel duty in the UK. This has been frozen since 2011, with estimated revenue losses of £13.9 billion in 2022-23 alone and carbon emissions five per cent higher than they would have been if the tax had risen in line with inflation as originally intended.[4]

It is difficult to quantify the extent to which carbon prices deliver carbon reductions because they do not operate in isolation, but there are some indicators that they lead to positive changes:

Emissions reduction

Although some suggest the EU ETS, in which the UK participated for 15 years, has had limited impact on overall emissions, one study found it directly resulted in 11.5 per cent emissions reductions from participating sectors from 2008 to 2016. As only some sectors are included, this equated to 3.8 per cent of the bloc's total emissions and saved the equivalent of over one billion tonnes of carbon dioxide.[5,6] While carbon pricing is never the only factor driving reductions, its impact does seem particularly strong in decarbonising electricity generation: a 2018 study by Ofgem found that carbon pricing led to more emissions savings than other policy interventions in the UK power sector.[7]

Using carbon pricing could reduce the cost of climate change mitigation by

32%

by 2030

Support for environmental and social projects

Globally, carbon pricing raised $84 billion in revenue in 2021, half of which was then spent on environmental or development projects.[8]

Economic benefits

The OECD found that carbon pricing can stimulate green growth and create new markets for low carbon technologies.[9] A market-based approach can also be cost effective, as participants aim to deliver emissions reductions at the lowest possible price. The World Bank suggests that using carbon pricing on a large scale could reduce the cost of climate change mitigation by 32 per cent by 2030.[10]

Public support

There is widespread public support for the polluter pays principle. Previous polling for Green Alliance found that 75 per cent of those surveyed supported taxing polluters, including when polluters are individuals rather than businesses. This compared to just 12 per cent who think the costs of pollution should be evenly shared by society.[11]

A brief history of carbon pricing in the UK

> **“There is no consistent price for atmospheric carbon pollution across the economy.”**

There are very few environmental taxes in the UK, and those that exist only contributed 5.3 per cent of total tax revenue in 2022, or £47.4 billion.[12] This fell from 7.7 per cent in 2002 and is nearly one per cent lower than the EU average.[13] Of those that do exist, none are direct carbon taxes in that they are not tied to emission levels, but they often act as implicit carbon taxes as they are based on polluting activities, such as fuel use.

Fuel duty and energy taxes make up around 75 per cent of the environmental tax take, while other transport taxes (eg vehicle registration tax) and non-carbon related pollution taxes (such as landfill tax or fishing licences) make up the rest.[14]

The UK ETS is largely focused on emissions from heavy industry, power generation and regional aviation (domestic flights and flights to the European Economic Area), raising £6.1 billion in the 2022-23 financial year.[15] The Office for Budget Responsibility suggests that around three quarters of the UK’s territorial emissions are directly or indirectly priced through implicit carbon taxes and the ETS.[16]

The variety of different, and often implicit, carbon charges in the UK means that there is no clear or consistent price for atmospheric carbon pollution across the economy. When the UK left the EU ETS, many organisations and economists saw it as an opportunity to implement a more uniform, explicit carbon tax. The government opted to pursue an independent UK ETS instead, which has evolved over time.

The future scope of carbon pricing in the UK is in question but, in the near to medium term, it will largely be oriented around the UK ETS. The scheme is waiting for a net zero aligned cap, a potentially broadened remit and there is a possibility of linkage to the EU ETS in future.

Emissions trading timeline

1997	Emissions trading was one of the three main market mechanisms introduced to help industrialised countries limit national emissions under the Kyoto Protocol.[17] On the back of the agreement, the UK government commissioned a review into the use of economic instruments in tackling greenhouse gas emissions, which initially resulted in the Climate Change Levy on business energy use.[18]
2002	The UK developed its first ETS, ahead of joining the EU's when it began, in 2005. The EU ETS initially included power generation and energy intensive industries (eg oil refining, cement and steel works), and later added aviation. It now covers around 40 per cent of the bloc's emissions.[19]
2008-09	The EU scheme was set up to allow the market to dictate the price, but a price crash during the recession induced a focus on price stability.[20] Prices remained low for the first 15 years, ranging from €5-25 per tonne of CO_2.[21]
2013	To complement the EU ETS, the UK set a carbon price floor for the power sector of £16.[22] This was due to rise to £30 by 2020, but became a top up charge rather than a floor and was frozen at £18.08 from 2016 to 2021.[23]
2013	Aviation joined the EU ETS and the emissions cap peaked at two billion permits.[24] The annual rate at which the cap falls was 1.74 per cent between 2013 and 2020 and is currently 2.2 per cent, but there are plans to move to a 4.4 per cent per year reduction by 2030.[25]
2021	The UK ETS was implemented in January 2021 following the UK's exit from the EU, with a cap five per cent lower than the UK's previous national share in the EU ETS.[26] It covers the same sectors as the EU ETS and an auction reserve price (ie the minimum price) was pegged at £22 to prevent instability. However, prices were initially volatile, with UK firms paying around ten per cent more for emissions compared to their EU counterparts in the first year of the scheme.[27] Many have called for the UK and EU ETS to be linked to address potential problems with liquidity arising from the smaller UK market. There has been no visible progress on this so far, despite signs that the government is open to the idea.
2022	The government ran a consultation on developing the UK ETS to align it to the net zero target and expand it to cover some additional sectors, as well as signalling an intention to remove the auction reserve price.[28] A full response is yet to be released.
2023	In March 2023, the government issued a further consultation on carbon leakage, outlining approaches to carbon border adjustment mechanisms (CBAMs, see page 15).[29] This follows plans by the EU to begin implementing CBAMs from October 2023.[30] As of June 2023, the price of carbon in the EU ETS is around €93 (£79) per tonne, and the UK's market price currently sits at around £59 per tonne, with both schemes experiencing unprecedented price increases since 2021.[31] These dwarf the low prices seen in the first 15 years of emissions trading and are more on par with the rates called for by the High Level Commission on Carbon Prices, a voluntary initiative of international governments, business, civil society and academia, launched at the 2015 Paris climate summit.[32]

Implementation challenges

Free allowances resulted in an effective subsidy of

£72m

for aviation

A number of challenges have limited the use and impact of carbon pricing in the UK. They include:

Fears of carbon leakage

When the UK and EU introduced emissions trading schemes the expectation was that it would become a global approach and this is still something advocated for by a range of organisations, from the International Monetary Fund to the Citizens' Climate Lobby. In the absence of a co-ordinated approach, businesses subject to carbon prices could be at risk of being undercut by competitors based in countries with fewer environmental regulations and could be tempted to move production abroad, an effect known as carbon leakage.

It is hard to estimate the likelihood of leakage as business competitiveness rests on many factors. But organisations such as the Zero Carbon Campaign and the Climate Change Committee have suggested the threat is often exaggerated.[33]

Fears of carbon leakage have led to the allocation of free allowances in both the UK and the EU emissions trading schemes, which dilutes the incentive for energy efficiency and decarbonisation, and leaves emissions undercharged or, in some cases, even subsidised. In 2022, around a third of total allowances within the UK ETS were issued free.[34] Transport & Environment reports that, in 2021, the aviation industry received more free allowances than it was required to submit to cover emissions. The sale of excess allowances on the secondary market resulted in an effective subsidy of £72 million for aviation, subverting the polluter pays principle.[35]

A limited price signal to consumers

Firms can decide how much of the cost to pass onto their customers, so incentives to change consumer behaviour are weakened if costs are absorbed upstream. The costs passed on are difficult to determine, but research has found that, other than the electricity sector, industries included in the EU ETS do not pass on significant costs with their final product.[36] This can partly be explained by concerns around competitiveness. But other factors influence these decisions like maximising market share.

Passing on carbon prices and other related costs could also have a relatively small impact as labour costs and taxes often play a larger role in determining product price.[37]

In other instances, consumers do not have the agency to switch to low carbon alternatives, limiting the effectiveness of any potential price signal. In rental properties, tenants are not able to install energy efficiency measures to lower their bills and improve environmental performance. Landlords, meanwhile, would bear the upfront cost without necessarily reaping the reward. Cost benefit incentives are therefore misaligned, restricting behaviour change.

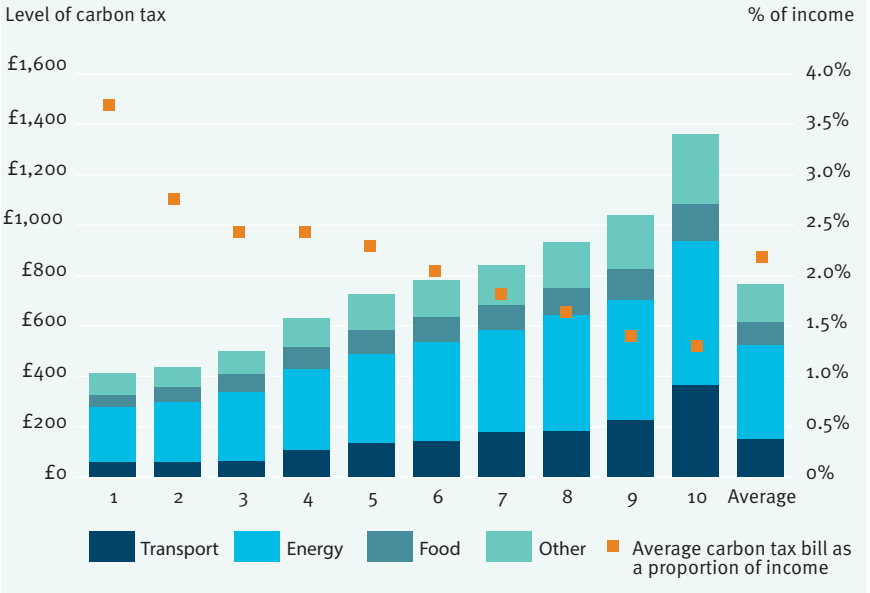
> “Adverse social impacts can be reduced by using revenue gained to compensate vulnerable households.”

Carbon pricing could be regressive

If not carefully designed, carbon pricing could hit lower income households harder, because spending on carbon intensive goods such as heating and transport is a larger proportion of their outgoings. They may be unable to afford the upfront investment in lower carbon alternatives, like home insulation or electric vehicles.[38]

The Grantham Research Institute at the London School of Economics modelled the impacts of a carbon tax at £75 per tCO_2 in 2030 and found the lowest three income deciles proportionately spend twice as much (two to four per cent of their income) compared to the top three deciles (one to two per cent).[39] The impacts of carbon taxes also differ geographically, with households in colder environments and rural areas spending more on heat and transport respectively. Adverse social impacts of carbon taxes can be reduced by using revenue gained to compensate vulnerable households, which could in turn increase public support for them.[40]

Without intervention, raising carbon prices could leave lower income households worse off



Adapted from a graph produced by Grantham Research Institute on Climate Change and the Environment, et al[41]

Electricity is charged as much as

£200

more per tonne of CO_2 emissions than gas

Sometimes the most expensive investments should come first

Classic carbon pricing theory says that each additional investment to reduce emissions should be more expensive than previous investments.[42] As a carbon price rises steadily, cheaper options are exhausted first, theoretically allowing the market to deliver decarbonisation at 'least cost'.

However, this ignores often significant transition costs and the risk of infrastructure lock in. When climate change mitigation involves long lived assets, such as power plants or transport infrastructure, investing in more expensive options early may make more sense, to avoid becoming locked in long term to a high carbon emitting pathway or risking future stranded assets.

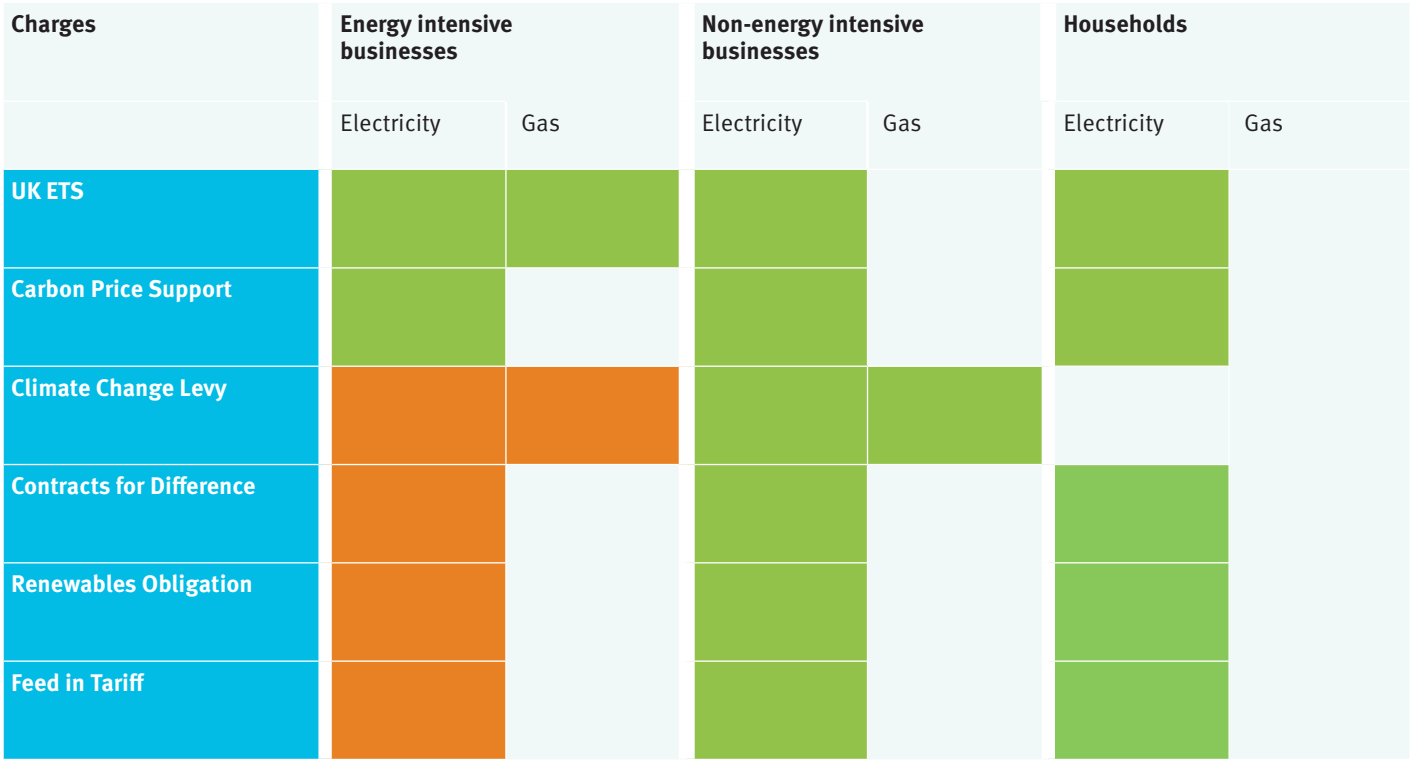
This is further complicated by uncertainty over long term carbon price trajectories which discourage investments with high upfront costs and long payback periods.

Carbon prices are inconsistent

The lack of an explicit, streamlined carbon tax means overlapping instruments can result in overcharging for emissions in some areas and undercharging elsewhere. For example, there is a price disparity between electricity and gas, as electricity generation is subject to higher levies than gas.

This means that, overall, electricity is charged as much as £200 more per tonne of CO_2 emissions than gas (based on 2021-22 prices).[43] In March 2023, the government promised to "rebalance" electricity and gas prices "to make it easier for consumers to make the switch to green products", but this will need to be done carefully and complemented by other energy efficiency policies to be effective.[44]

Overlapping charges mean electricity is subject to higher carbon prices than gas



Policy effectively places carbon price

Policy results in a discount

Adapted from a graph produced by the Institute for Fiscal Studies[45]

Carbon pricing across sectors

> **“Carbon pricing will be more effective if it is accompanied by complementary policies.”**

Despite the benefits it could bring, it is hard to create a consistent cross economy approach to carbon pricing, as different sectors require tailored approaches and, in some instances, are starting from very different regulatory and tax positions. For example, the transport sector faces a host of environmental taxes and only partially participates in the ETS, resulting in skewed pricing across aviation, surface transport, rail and shipping. Meanwhile, sectors such as land use and agriculture have no environmental taxes and so have limited regulation of their emissions.

Carbon pricing will be more effective if it is accompanied by complementary policies. For example, robust carbon measurement needs to be developed in land use and agriculture to account for the sector’s complex emissions cycles, to enable fair carbon pricing.

While some of these problems are not easily overcome just by expanding the UK ETS, careful expansion in some areas could ensure greater fairness, with more sectors paying an adequate carbon price for their emissions. This could include adding in new sectors entirely (such as waste incineration), as well as broadening the scope of others (such as adding shipping emissions, currently omitted from the transport sector’s carbon pricing). For the transport sector, our report *Reforming transport taxes: a fair share package* sets out additional fiscal changes needed for the sector to pay a fair carbon price.[46]

See the annex on page 18 for more detail on the current state of carbon pricing and its potential in different UK sectors.

Spending the revenue well and fairly

Revenue from the UK ETS is expected to top

£5bn

a year to 2030

Some of the challenges we have outlined can be addressed by using the revenue generated from carbon pricing in a targeted way. Revenue from the UK ETS is expected to top £5 billion a year to 2030, following a peak of £6.6 billion in 2023.[47] The money raised could be directed towards multiple goals, but at least some of it should be recycled to support the low carbon transition, which the Climate Change Committee predicts will require investments of £50 billion a year from 2030.[48] This is largely expected to come from private funding, but the government will need to contribute as well. There is great potential to use carbon pricing revenue for this. For the 2022-23 financial year, the government allocated £5.5 billion to its core net zero spending, which was less than the amount raised by the UK ETS in the same period.[49]

On the following page we explore the options for using carbon pricing revenue.

Potential uses for carbon pricing revenue

Purpose	Summary	Advantages	Disadvantages
Central government spending	Revenue for spending on health, education, defence, reducing the national debt, etc	Strong public support[50] Improves economic resourcing and could allow tax cuts in other areas	Lack of clear returns as money is pooled as general revenue
Support for households	The disproportionate financial impact of carbon pricing on vulnerable households could be addressed through redistribution, with targeted dividends being more progressive than flat rate rebates.[51,52] Targeted revenue recycling could leave most poorer households better off, while ensuring that higher income, higher polluting households pay more for their greater climate impact.[53]	Reduces inequity	Technically difficult
Stimulating green investment	Several market failures have led to underinvestment on research and development in low carbon industries, which revenue from carbon pricing could rectify. Ringfencing funds could also help to commercialise new technologies and make the switch to low carbon alternatives easier, creating elasticity in the system.	Very strong public support[54] Speeds up the pace of decarbonisation	It is a challenge to pick winners accurately and remain within state aid rules Expenditure may not match the revenue raised
Reconfiguring the tax system	Revenue could be used to overhaul the tax system, shifting to taxing 'bads' (ie polluting activities) instead of 'goods' (ie labour and income). This could initially render carbon pricing revenue neutral. Pre-existing distortions in the tax system would need to be carefully considered when designing adjustments based on carbon pricing and further changes would be necessary as carbon emissions fall.	Could improve the efficiency of the tax system Promotes employment[55]	Politically and technically challenging Revenues will fall over time Effectiveness could be compromised if revenue generation is prioritised
Support for global decarbonisation and climate aid	Revenue, particularly from CBAMs (see page 15), could be directed towards supporting global climate action, particularly in poorer nations. Global decarbonisation is mutually beneficial, and such support reduces the risk of some countries being locked out of low carbon markets. Revenue could also be channelled into the loss and damage fund agreed at the 2021 Glasgow climate conference to assist countries most vulnerable to and affected by climate change.	Improves global fairness Speeds up the global green transition	Low public support in the UK[56] Politically challenging

Trade measures

> **“Regulatory alignment is critical to mitigate the risk of carbon leakage.”**

While an international approach to tackling carbon leakage and greenhouse gas emissions across the entire supply chains would be best, it will not happen overnight and any effective multilateral solution is likely to be a long way off.

The EU will be introducing a carbon border adjustment mechanism (CBAM) imminently, which essentially extends domestic carbon pricing to imported products. This aims to ensure that imports produced to lower climate standards are priced at the same level as products produced to higher standards domestically. The EU CBAM transition period will begin in October 2023 and full implementation is expected in 2026. It has been designed to link directly with the EU ETS and will initially apply to carbon intensive imports deemed to be at the most risk of carbon leakage, ie cement, iron and steel, aluminium, fertiliser, electricity and hydrogen.

The UK is pursuing a similar approach in the absence of wider international collaboration, but it is lagging behind the EU. It has only just launched a consultation on addressing carbon leakage through a CBAM, mandatory product standards or measures that would expand the market for low carbon products.[57] Consequently, these are not likely to apply before the mid-2020s at the earliest.[58]

Regulatory alignment is critical to mitigate the risk of carbon leakage, both by discouraging ‘dumping’ of high carbon products on markets with lower pricing and to reduce administrative burdens. In practice, this would ideally include linking the EU ETS, the UK ETS and the CBAM scheme together.

The UK has not explicitly set out its intention to link with the EU ETS. At the moment, the two schemes are nearly identical, the UK having retained many aspects of the EU ETS following withdrawal from the EU. This makes linking highly feasible, and there have been suggestions that the government is open to this approach. The main short term hurdle could be the UK’s desire to become the first country with a net zero consistent ETS, which would increase differences between the two schemes. This follows the UK’s decision to lower the cap to five per cent below its previous national share in the EU scheme.[59]

Any carbon border mechanism also needs to be thoughtfully designed to avoid detrimental impacts on developing economies which produce goods subject to the new carbon charges. They should be involved in the policy design in a meaningful way.

Our recommendations

> **“It is difficult to envisage an efficient and fair climate policy programme where the polluter is not made to pay in some way.”**

It is difficult to envisage an efficient and fair climate policy programme where the polluter is not made to pay in some way. Carbon pricing should be used as a signalling device across the economy, as well as a source of revenue to support the low carbon transition.

The case for carbon pricing should be restated, and it should sit within broader fiscal reforms that will be needed for the tax system to drive and support a low carbon economy.[60]

Immediate priorities for the government should be:

1. Improve the current carbon pricing system

The government should address the existing shortcomings in carbon pricing and make simple improvements that would accelerate decarbonisation across the economy. Priorities include:

- An approach to CBAMs that addresses carbon leakage fears while protecting developing economies.
- Reducing and eventually eliminating the free allowances that skew the polluter pays principle.
- Certainty around the auction reserve or ‘floor’ price, introduced for all participants from when the UK ETS was first created. The government has committed to remove it and has consulted on replacing it, but has yet to respond, and the resulting lack of clarity is damaging the business case for investment.
- Linking the UK ETS with the EU ETS to resolve liquidity issues and improve the impact of a CBAM, without jeopardising the UK’s net zero trajectory.
- Expanding the UK ETS, in the first instance to include waste incineration and shipping.

2. Set out a renewed vision for carbon pricing

The tax system needs to be reframed for a low carbon economy, so the government should increase its ambition to ensure the cost of carbon is fairly borne across the ETS and any other carbon pricing mechanisms.[61] A clear, ambitious price signal would increase business confidence in low carbon investment.

> “Carbon pricing can play an important role, but only if underpinned by a strong green industrial policy.”

In the near term, the vision should address the specific challenges of carbon leakage and an effective carbon price for each industry, particularly those presently not well covered or difficult to decarbonise. Sector based strategies should eliminate pricing inconsistency within sectors like transport and, as a priority, rebalance the price disparity between gas and electricity, without raising energy bills. It should also consider the purpose of the revenue gained, with at least some being used to stimulate further green investment and protect lower income households from rising costs.[62]

The vision should also be long term and outline the purpose of carbon pricing within the wider context of the net zero goal. This should include identifying its limitations, including establishing where significant transition costs and the risks of locking in high carbon infrastructure mean other measures are necessary for early systemic change. The long term vision should also address the impact of declining revenues as the economy decarbonises.

It should carefully consider the inclusion of greenhouse gas removals in carbon pricing, which may be an appropriate option for scaling up some schemes, provided they are only used to offset residual emissions that cannot easily be reduced. Deciding the level of acceptable residual emissions across different sectors over time will require political decisions to weigh up technical feasibility and social value. Setting out this vision would enable enough time for thorough planning and to put regulatory measures in place.

3. Use carbon pricing as part of a new, broader industrial strategy

Carbon pricing alone will not trigger timely, cost effective decarbonisation across industry. It can play an important role, but only if underpinned by a strong green industrial policy. Such a policy should be mission oriented and consistent, with enough scope to flex to meet the country’s varied needs. Similar to the US Inflation Reduction Act, the hallmark of a strong industrial policy is not just its monetary commitment, but also a medium to long term timeline and the breadth of sectors covered.

Within a green industrial framework, the government can employ tools that work across the economy, as well as those tailored to specific sectors. Cross economy mechanisms include attention to the workforce (addressing skills and migration), infrastructure and innovation, while sector specific levers involve regulation and subsidies on both the demand and supply side, as well as procurement interventions.[63]

Public and private investment should be used alongside carbon pricing to stimulate low carbon innovation and markets. Together, these would provide certainty to enable the UK to contribute its share of global action to limit the devastating impacts of climate change.

Annex
Sector carbon pricing summarised

Sector	What is the state of carbon pricing?	What's covered by the UK ETS?	What needs to change to make carbon pricing more effective?	Complementary policies
Transport	Road transport is primarily taxed through fuel duty and vehicle excise duty, which respectively raised £53 billion and £7 billion in the 2019-20 tax year. Aviation is taxed to a lesser extent, with air passenger duty raising just £4 billion in 2019-20. Non-carbon greenhouse gases are excluded, despite causing two thirds of aviation's warming impact. Shipping is a big emitter and remains minimally taxed.	Departing flights to the European Economic Area (EEA) (incoming EEA flights are covered by the EU ETS). The government has consulted on broadening the scope to include flights from the UK to Switzerland and the considerable non-CO_2 impacts of aviation. It also proposes to include domestic maritime emissions from large vessels by the mid-2020s.	Free allowances for aviation should be phased out by 2026 as the EU is doing and the UK ETS should expand to capture the non-carbon atmospheric warming impacts of aviation.[64] Ensure shipping pays a fair carbon price, either by implementing a shipping fuel levy or, ideally, by including smaller vessels and half of international emissions when included in the ETS. For surface transport, implement an emissions based purchase tax to promote low or zero emission vehicles.[65]	Ambitious targets to encourage the use of sustainable fuels in aviation and shipping.[66] For surface transport, which should not be included in the ETS due to the undesirable cost placed on consumers and the low likelihood of significant emissions reduction, an ambitious zero emissions vehicle (ZEV) mandate is needed instead.[67] This should be complemented by road pricing to address the non-CO_2 social and economic burdens of car travel.[68]
Land use and agriculture	No explicit environmental taxes.	Nothing, but the government called for early views on the monitoring, reporting and verification of emissions in land use and agriculture as part of the *Developing the UK ETS* consultation. More recently, Defra published a Nature Markets Framework, containing a commitment to develop a harmonised carbon footprint methodology for farmers.[69]	Carbon pricing would be difficult to implement in land use and agriculture, due to complex emissions cycles and issues of permanence and traceability. Robust and accurate emissions measurement needs to be developed for carbon pricing to be implemented. If selected emissions sources (eg ruminant livestock and fertiliser) are targeted for a carbon tax, it is likely border measures will be needed.	Funding for farmers to manage land for nature. This could build on voluntary pricing schemes such as the Woodland Carbon Code and the Peatland Code.

Sector	What is the state of carbon pricing?	What's covered by the UK ETS?	What needs to change to make carbon pricing more effective?	Complementary policies
Energy (heating and electricity)	There are numerous overlapping levies which create a price disparity between electricity and gas. The effective carbon price for electricity in households was £137 per tCO_2e, compared to -£25 per tCO_2e for gas. Overcharging electricity compared to gas locks consumers in to a higher carbon and more inefficient solutions. Heating is relatively inelastic, meaning its use is not affected by changes in prices, so the lack of government compensation risks putting more costs onto vulnerable households who are unable to make the switch to cheaper clean energy.	Power generation	The price disparity between domestic heating and electricity needs to be addressed fairly. This could be done by a parallel scheme for heating, as well as power generation, as the EU has recently implemented. Other measures are needed to address disparities for industrial consumers.	Strengthened energy efficiency incentives and support for vulnerable households to ensure that carbon pricing is not regressive.
Industry	Heavy industry receives free allowances for most of its emissions, reducing the effectiveness of industrial carbon pricing. Outdated industry 'best practice' benchmarks mean carbon intensive practices can be priced more favourably than lower carbon production methods.	Energy intensive industries (oil refining, production of iron and steel, aluminium, metals, cement, lime, glass, ceramics, pulp, paper, cardboard, acids and bulk organic chemicals).	Free allowances should be reduced and better targeted towards industries at genuine risk of carbon leakage. CBAMs should be introduced in line with the EU's approach with an aim of eliminating free allowances entirely.	Sector specific policies and investments to promote energy and resource efficiency, electrification and the uptake of deep decarbonisation technologies, particularly where there considerable upfront capital expenditure is required. Procurement and product standards would provide certainty needed for low carbon technologies to commercialise.
Waste	Landfill tax has been effective at reducing methane emissions but has resulted in most waste materials going to incineration instead, and there are increasing concerns over the carbon impact of this.	Nothing, but the government has consulted on including waste incineration and energy from waste from the mid to late 2020s.	The UK ETS needs to include incineration and energy from waste, including biogenic emissions, as soon as possible. A direct carbon tax on different forms of waste management should be considered.	Circular economy incentives, including a resource reduction target, to prevent waste arising in the first place.

Endnotes

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6 P Bayer and M Aklin, 2020, 'The European Union emissions trading system reduced CO_2 emissions despite low prices', *PNAS*, vol 117

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What is carbon pricing and does the UK need it?

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Green Alliance
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