



Addressing Carbon Leakage:

Maximising Innovation and Minimising Competitiveness Impacts

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About Energy Systems Catapult

Energy Systems Catapult was set up to accelerate the transformation of the UK's energy system and ensure UK businesses and consumers capture the opportunities of clean growth. The Catapult is an independent, not-for-profit centre of excellence that bridges the gap between industry, Government, academia, and research. We take a whole systems view of the energy sector, helping us to identify and address innovation priorities and market barriers, in order to decarbonise the energy system at the lowest cost.

Net Zero Carbon Policy

Net Zero Carbon Policy is an Energy Systems Catapult thought leadership project, focusing on how the UK can develop an innovation-friendly, economy-wide policy framework for Net Zero. We are building on the insights from our Rethinking Decarbonisation Incentives project, to develop credible policy options for an efficient and socially beneficial transition.

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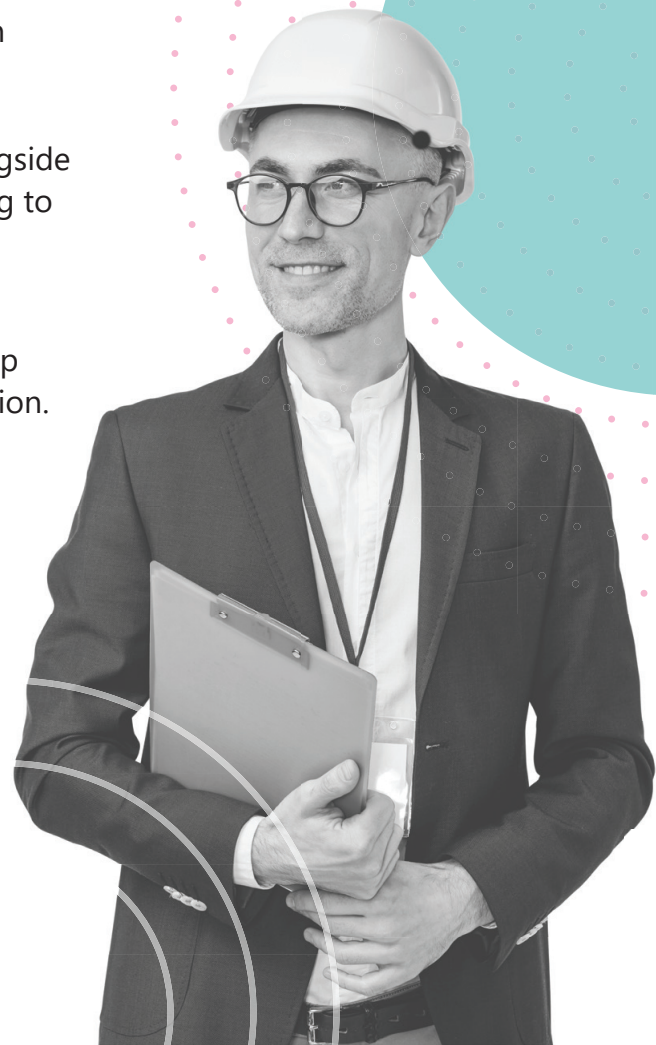
Summary

Carbon leakage can occur if the competitiveness impacts that arise from carbon policies lead to emissions reduction from domestic organisations combined with increases in emissions in other jurisdictions, where carbon policy is either less ambitious or does not exist. This can lead to a net increase in global emissions. Carbon Leakage will remain a risk while there is a disparity between the strength of domestic and international carbon policies.

For mitigating carbon leakage, until recently the focus has been on support mechanisms that subsidise, compensate, or exempt sectors from carbon pricing policies (e.g. free allowances under the UK Emissions Trading Scheme (ETS)). In recent years, the debate has shifted towards alternative options, such as a Carbon Border Adjustment Mechanism (CBAM). Steps by the European Union to implement a CBAM has moved this approach from policy theory to a viable solution. In the UK, there has also been a recognition that mandatory product standards can play an important role as part of a suite of measures, including a CBAM.

The UK government's consultation, 'Addressing carbon leakage risk to support decarbonisation',¹ is seeking views on these potential policy measures. Separately, a review of UK ETS free allowances will take place alongside considerations to ensure a clear transition from existing to future carbon leakage mitigation policies.

The emphasis on levelling the competitive playing field by applying policies at the border is a positive step towards both domestic and international decarbonisation. But carbon leakage is dynamic and affects sectors differently. This highlights the need for a policy framework for mitigating carbon leakage that does not rely on a single mechanism alone, and one that evolves with the requirements of industry and the wider carbon policy landscape.



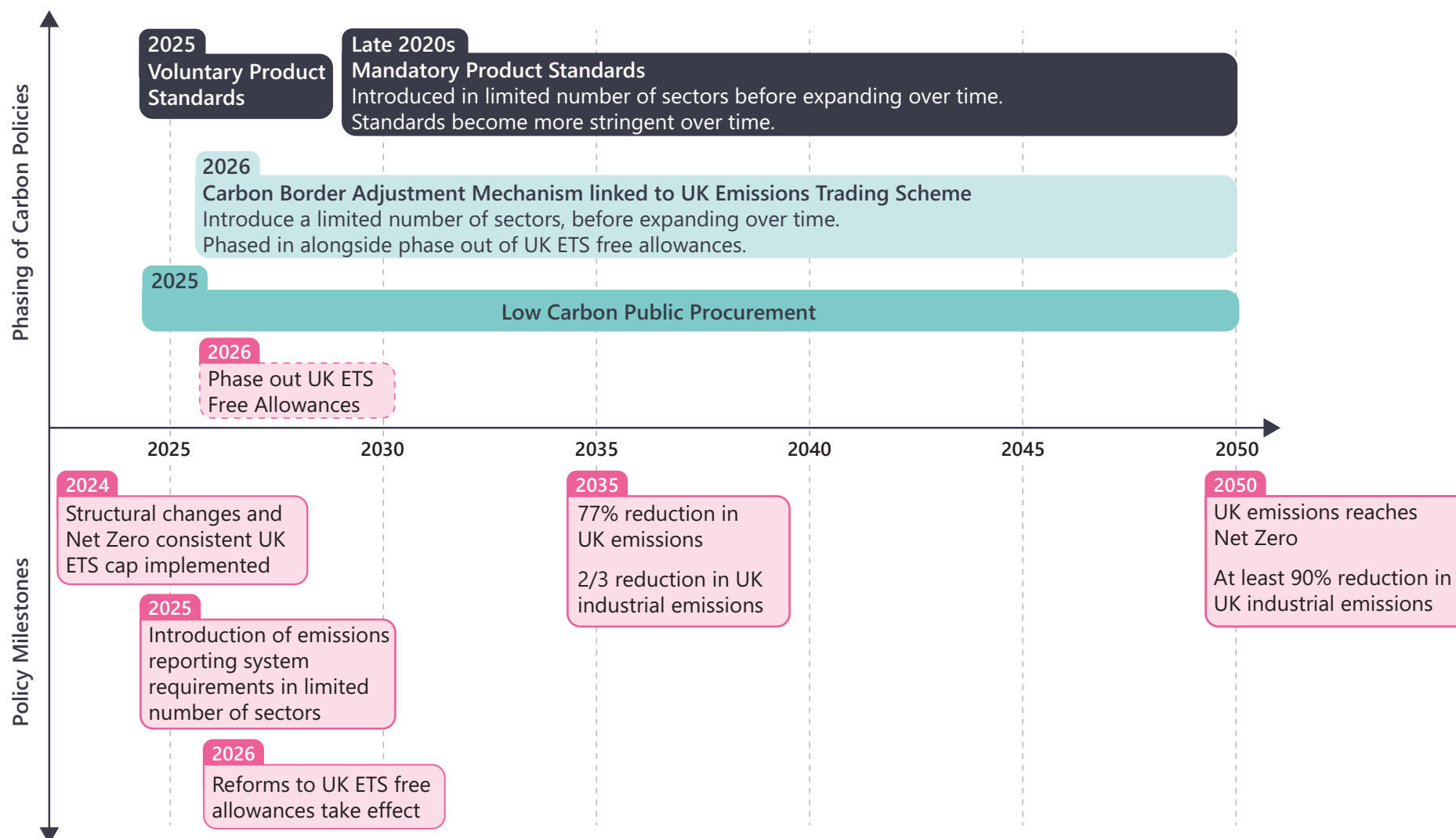
In this report, which also serves as our response to the government's consultation, we focus on three carbon policy approaches:

- **Pricing** – A CBAM that is applied to some sectors subject to the UK ETS and aligned with the proposed reduction of free allowances. It should be designed in a way that facilitates the smooth flow of trade and keeps the administrative burden to a minimum. The price applied by a CBAM should reflect the effective carbon price paid by domestic industry, calculated using the total amount arising from direct and indirect carbon policies less the value of relevant exemptions, compensation, and free allowances.
- **Standards** – Mandatory product standards could be implemented where there already exists voluntary efforts (for example, iron and steel, and cement and concrete). Determining their intended role alongside other carbon policies, including a potential CBAM, will be an important consideration. Engaging with the British Standards Institution (BSI) could enable improved industry buy-in, and a potential route to their international use through the International Standards Organisation (ISO).
- **Increasing demand** - Public procurement often constitutes a significant share of national markets for industry supplied goods. Although not sufficient by itself, procurement practices that include carbon requirements for products can support creating a market for low carbon goods.

We also cover the associated carbon accounting and reporting requirements necessary for their operation. A carbon accounting framework that provides an accurate and quantifiable picture of emissions across industry, including on imported goods, will be essential enablers for carbon leakage policy measures. Such a framework also has wider benefits, for example, revealing opportunities of low carbon innovation and growth.² Fundamental to this is the well-regulated – through a Carbon Regulator³ – monitoring, reporting, and verification (MRV) of emissions.

Timings and Phasing of Carbon Leakage Policy Measures

The specific application of carbon leakage policy measures will vary between industrial sectors, depending on their place in the value chain and the type of products they produce. The following should be seen as the broad direction of travel:



1 Introduction

The decarbonisation of industry is essential if the UK is to meet its Carbon Budgets and Net Zero target. But in their efforts to decarbonise, industry face two broad challenges:

- The necessary changes from high carbon to low carbon processes and products require significant capital investment, and in some instances, associated infrastructure (e.g. transport and storage solutions for carbon capture and storage (CCS)). As a result, emissions reduction does not happen gradually, but in steps.
- Some industry sectors are trade-exposed, where organisations compete on a global market. Where these sectors are also carbon- and energy-intensive, their ability to pass through costs (e.g. that result from carbon policy or energy prices) due to actual or potential competition is constrained.

This constraint can impact competitiveness without mitigating policies in place. Left unaddressed, it has the potential to result in carbon leakage.⁴ Carbon leakage can occur if the competitiveness impacts that arise from carbon policies lead to emissions reduction from domestic organisations combined with increases in emissions in other jurisdictions, where carbon policy is either less ambitious or does not exist. This can lead to a net increase in global emissions.

But carbon leakage is complex and can occur due to a multitude of factors that affect investment decisions beyond carbon policies, for example, exchange rates, labour, and capital costs. Carbon leakage can arise through four channels:⁵

- Short-term (output) competitiveness channel – whereby organisations that have to comply with carbon policies lose market share to those in sectors or jurisdictions covered by weaker or no carbon policies.
- Long-term (investment) competitiveness channel – whereby carbon policies alter investment decisions by organisations or investors (both domestically and internationally).
- Fossil fuel price channel – where carbon policies reduce the demand for fossil fuels by organisations, which can reduce the price of globally traded fossil fuels. This in turn, can increase demand by organisations not



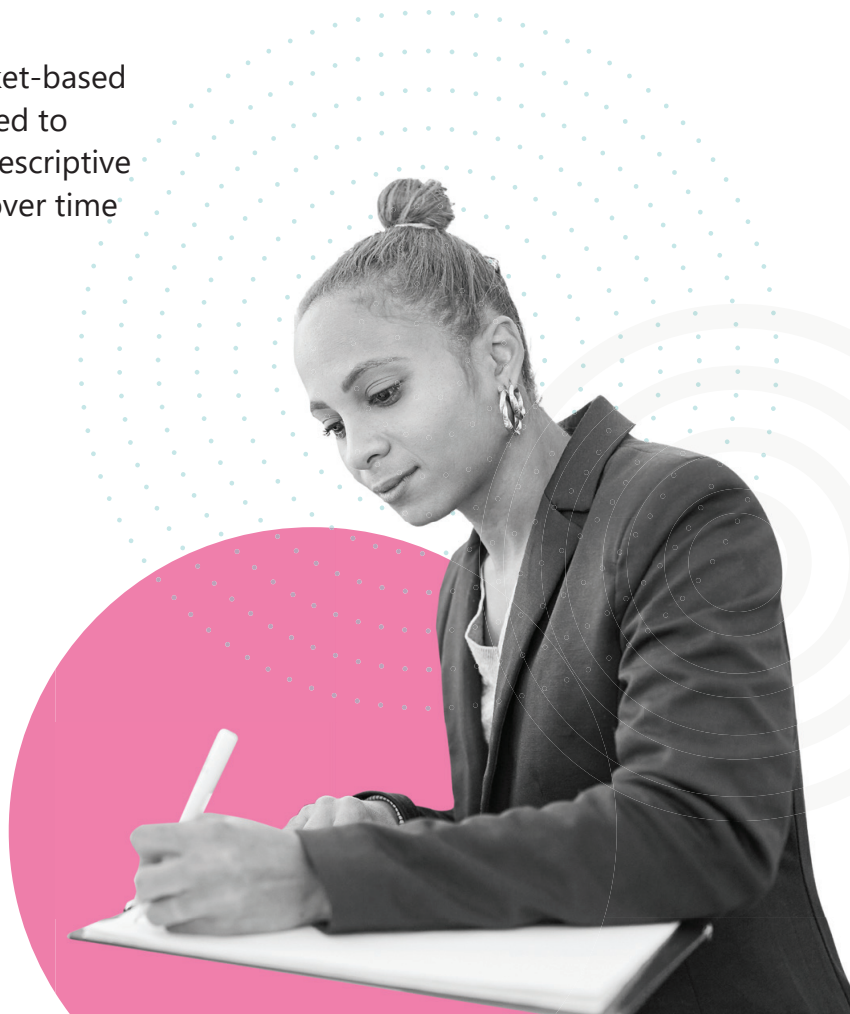
covered by carbon policies. It can also impact investment decisions surrounding fossil fuels. Reductions in UK demand, however, are unlikely to be of sufficient scale to influence global fossil fuel markets and pricing.

- Reverse leakage (technological spillovers) channel – the result of induced innovation by organisations covered by carbon policy that spill over to other organisations. This is similar to the Porter Hypothesis⁶, where carbon policy can induce innovation that is productivity enhancing.

The debate around the impact of carbon policy on carbon leakage tends to focus on the short and long-term competitiveness channels, but the reverse leakage channel – the upside innovation opportunity – should not be ignored. The reasons that may lead to reverse leakage include:

- Signalling organisations about their likely resource inefficiencies and the potential technological improvements they can make to reduce emissions.
- Raising corporate awareness, especially where policy is focused on data gathering or use of standards and benchmarks.
- Reducing the uncertainty that investments to reduce emissions will be valuable.
- Creates pressure that encourages organisations to innovate.

Carbon policies that are outcome and market-based are more likely to yield innovation compared to command-and-control approaches (e.g. prescriptive technology standards).⁷ Phasing in policy over time may also encourage innovation.



Government is considering policies for mitigating carbon leakage risk in the following sectors:

- Cement
- Chemicals
- Glass
- Iron and steel
- Non-ferrous metals
- Non-metallic minerals
- Paper and pulp
- Refining
- Fertiliser
- Power generation.

1.1 Existing Policies to Mitigate Carbon Leakage

There currently exists four policy measures specifically designed to mitigate against carbon leakage (see Table 1). These are all in effect support mechanisms that subsidise, compensate, or exempt sectors from carbon pricing policies.

This approach is not uncommon globally, but it is fundamentally different to policies applied at the border and policies aimed at increasing demand for low carbon products (i.e. those discussed in this report).

To level the playing field between domestic and international competitors, support mechanisms currently dull the incentive initially placed through carbon pricing. Whereas the policies discussed in this report seek to level the playing field by applying the same requirement on both domestic and international competitors.

Table 1 Overview of policies used in the UK to mitigate carbon leakage.

Support Policy	Carbon Policy	Coverage	Operation	Extent of Price Mitigation	Impact on Incentives
Climate Change Agreements⁸	Climate Change Levy (CCL)	Energy intensive sectors	Sector-specific voluntary agreements. Energy efficiency targets negotiated with the Environment Agency via sector associations. Energy use and emissions are reported over four two-year target periods.⁹	Discount on CCL:¹⁰ 92% for electricity 88% for natural gas and other fuels 77% for LPG	Incentivises investment in energy efficiency. Receiving a discount is conditional on meeting energy efficiency targets. If targets are missed, organisations can pay a buy-out fee (£18/tCO₂e) to remain in the scheme.¹¹
Energy Intensive Industries Exemption Scheme¹²	Costs of Renewables Obligation, Contracts for Difference, and Small-Scale Feed-in-Tariff	Businesses most at risk of carbon leakage ¹³	Individual business-specific. Certificate issued to successful applicants.	Level of exemption: Up to 85%	Incentive to reduce consumption.
Energy Intensive Industries Compensation Scheme¹⁴	Electricity cost increase due to UK ETS and Carbon Price Support (CPS)	Businesses most at risk of carbon leakage ¹⁵	Individual business-specific.	Level of compensation: Up to 75%	Incentives to improve energy efficiency is embedded in the compensation formula.
Free Allowances¹⁶	Direct cost of UK ETS allowances	UK ETS covered industry installations	Free allowance calculations: Historical Activity Level (HAL) x Benchmark x Carbon Leakage Exposure Factor (CLEF) The total number of free allowances was initially set at around 58 million in 2021 and will reduce annually by 1.6 million allowances.	Initial application of free allowances follows EU ETS Phase IV:¹⁷ 100% for sectors at a significant risk of carbon leakage - For less exposed sectors, it will be phased out after 2026 from 30% to 0% at the end of Phase I (2030)	Incentives to reduce emissions are embedded in ETS design through benchmarking as only the most efficient installations are able to get the maximum free allowances.

1.2 Policies in Other Jurisdictions

Where carbon policies exist in other jurisdictions, in many cases a similar approach to the UK has been taken to support industry. For example, free allowances are used in the New Zealand ETS, but with differences in the allocation methodology used when compared to the UK.

European Union Carbon Border Adjustment Mechanism

More recently, the European Council and the European Parliament reached a political agreement on the implementation of a Carbon Border Adjustment Mechanism (CBAM).¹⁸ The merits of a CBAM have been debated in literature for years, with the only example actively in place to date being in California. The California ETS uses a Border Carbon Adjustment (BCA) for electricity imports from other States, whereby importers must purchase allowances to cover embodied emissions.¹⁹

The EU's CBAM goes further than California's BCA in two important ways:

1. It applies to a range of carbon-intensive, trade-exposed sectors: cement, iron and steel, aluminium, fertilisers, electricity, and hydrogen.
2. It applies across international borders.

The EU CBAM will enter force in its transitional phase from 1st October 2023. During this initial phase, importers of goods in scope will have to report the embodied emissions of their imports. From 1st January 2026, importers will need to declare the quantity of goods imported into the EU in the preceding year and the associated embodied emissions. Importers will then surrender the corresponding number of CBAM certifications, which will be calculated using the weekly average auction price of EU ETS allowances in €/tCO₂. Alongside phasing in of the CBAM, free allowances under the EU ETS will phase out, during the period 2026-2034 (see Table 2).



Table 2 Phasing in CBAM and phasing out free allowances by 2034.²⁰

	2026	2027	2028	2029	2030	2031	2032	2033	2034
CBAM (%)	2.5	5	10	22.5	48.5	61	73.5	86	100
Free Allowance (%)	97.5	95	90	77.5	51.5	39	26.5	14	0

While the EU claims that their CBAM complies with World Trade Organisation (WTO) rules, it still remains an untested area of trade policy. For example, China recently asked the EU to justify its incoming CBAM at the WTO²¹ and India plans to file a complaint to the WTO.²² Compliance with WTO rules sits outside of the scope of this report, which is covered widely in the literature.²³

United States Inflation Reduction Act

The Inflation Reduction Act (IRA) takes a different approach to the EU CBAM, instead of applying a carbon price on imports, it seeks to subsidise decarbonisation. The IRA directs \$250.6 billion in federal funding to clean energy and \$47.7 billion to decarbonising manufacturing, delivered through a mix of tax incentives, grants, and loan guarantees.²⁴



The Inflation Reduction Act directs \$250.6 billion in federal funding to clean energy and \$47.7 billion to decarbonising manufacturing.

1.3 Policies for the UK

For the UK, the government's consultation, *Addressing carbon leakage risk to support decarbonisation*,²⁵ shows its intent that the EU's approach is where policymakers' preference lies. But it goes beyond the implementation of a CBAM to also potentially include mandatory product standards and measures to grow the low carbon market.

Separately, a review of UK ETS free allowances will take place alongside considerations to ensure a clear transition from existing to future carbon leakage mitigation policies.

The emphasis on levelling the competitive playing field by applying policies at the border is a positive steps towards both domestic and international decarbonisation.

In this report, which also serves as our response to the government's consultation, we focus on these three carbon policy approaches – pricing, standards, and increasing demand – and the associated carbon accounting and reporting requirements necessary for their operation.

2 A Policy Framework for Carbon Leakage²⁶

Carbon leakage will remain a risk while there is a disparity between domestic and international carbon policies and emissions reduction ambition. But carbon leakage is dynamic and affects sectors differently. This highlights the need for a policy framework for mitigating carbon leakage that does not rely on a single mechanism alone, and one that evolves with the requirements of industry and the wider carbon policy landscape.

Fundamentally, the risk of carbon leakage results from the ability of an organisation to remain competitive, either by gaining and or maintaining a profitable and sustainable market share relative to its competitors.

Determining the inherent risk of carbon leakage is not straightforward, however. Vivid Economics, with support from Energy Systems Catapult, developed a framework to assess the competitiveness of UK sectors and provide an understanding of the role of carbon pricing for the Department for Business, Energy & Industrial Strategy.²⁷ Establishing carbon leakage risk for individual sectors or organisations is outside the scope of this report.

As the UK's efforts to decarbonise domestic industry in line with climate targets grows, the relative strength of carbon policies when compared to other jurisdictions may have an increasing impact on competitiveness.

This impact is not limited to direct carbon pricing, as experienced through the UK ETS, but includes the indirect impact from wider carbon policies. For example, the current relative price between electricity and gas use in the UK does not enable the electrification of industry where appropriate.²⁸ Access to affordable, low carbon energy is essential for enabling the technological transition necessary for carbon intensive industry.

Government has an important role in mitigating future carbon leakage risk. This is not just limited to developing the appropriate domestic measures, but should also include working alongside international partners.

“Fundamentally, the risk of carbon leakage results from the ability of an organisation to remain competitive, either by gaining and or maintaining a profitable and sustainable market share relative to its competitors.”

2.1 Policy Measures

In this section of the report, we assess three policy measures that can be used to mitigate carbon leakage:

- Carbon border adjustment mechanism.
- Mandatory product standards.
- Low carbon public procurement.

This analysis uses and builds on a report Energy Systems Catapult delivered to the Climate Change Committee in 2020, ahead of their Sixth Carbon Budget advice to government.²⁹

2.1.1 Carbon Border Adjustment Mechanism

A Carbon border adjustment mechanism (CBAM) can be used by a country (or trading bloc) to address asymmetric carbon policies between jurisdictions. A domestic carbon price is applied on producers (e.g. via a carbon tax or resulting from an emissions trading scheme), which is also levied on products imported from countries that do not adopt equivalently stringent carbon policies. In addition, exports may be eligible for rebates.



Table 3 Advantages and disadvantages of a carbon border adjustment mechanism.

Criteria	Advantages	Disadvantages
Technical Feasibility (including Measurability)		The policy would be administratively complex, especially in establishing the carbon content of equivalent products from other jurisdictions, with a reliance on international data. Complexity compounded by the need for agility in responding to market distortions that might emerge, e.g. impacts on supply chains.
Political and Legal Challenges		Highly politically challenging, especially in the current global trade environment, because it could be seen as a form of protectionism. This could be alleviated with careful compliance with WTO rules, but this may raise legal challenges.
Achieving Net Zero	Assuming the effective carbon price is consistent with Net Zero, there is a strong incentives to reduce emissions in line with Net Zero due to maintaining entire carbon price for domestic industry, including for exports (depending on design).	
Consumption-Based Emissions	Strong incentive to reduce consumption-based emissions with implementation at the border.	
Carbon Leakage and Competitiveness Impacts	Strong protection against carbon leakage due to creating a level playing field for industry, including on imported products.	Some risks that state support from major competing markets (e.g. China and United States of America) could outweigh the impact of a CBAM, which would result in competitiveness impacts regardless.

Sector Coverage³⁰

The extent to which industrial sectors are covered by a future CBAM will be a design choice, but it requires consideration of the entire carbon policy landscape. In its initial implementation, it would be sensible for it to apply to sectors subject to the UK ETS – the largest component of the effective carbon price that industry currently sees. Seeking to replicate the EU's CBAM as far as possible would smooth the transition with the UK's largest trading partner.

A CBAM may not be appropriate for all sectors subject to the UK ETS. There is a need for a package of measures designed to balance deliverability, administrative burden, emissions reduction, and mitigating carbon leakage. For example, providing data on embodied emissions at a product level will be simpler for some sectors (e.g. steel production), but infeasible for other sectors where a product's manufacture involves a complex supply chain (e.g. automotive manufacturing).

The UK cannot directly place a carbon price or reporting requirements on installations based abroad. It would then be necessary for the liability of a CBAM to be applied on importers of products.

Over time, a CBAM could expand to cover other sectors and products. Like the role of mandatory products standards (discussed in the next section), policies applied at the border on imported goods will continue to evolve. In part, this will be informed by the early phases of a CBAM, as well as the wider carbon policy landscape, including mandatory product standards and policies implemented in other jurisdictions.

Emissions Monitoring, Reporting, and Verification³¹

Importers should be required to meet the same level of emissions monitoring, reporting, and verification (MRV) as domestic industry under the UK ETS for which a CBAM is used to address the carbon leakage risk.

Where independent verification of data cannot be achieved to an equivalent level of rigour, the use of default values for the carbon content of imported products could be used. Such values will need to strike a balance to prevent significantly over- or under-estimating carbon content to maintain compatibility with measured values.



Seeking to replicate the EU's CBAM as far as possible would smooth the transition with the UK's largest trading partner.

This approach will retain the incentive to provide verified emissions with the potential for a lower CBAM liability. However, it may also result in unintended consequences, whereby high carbon products use default values to avoid a potentially higher CBAM liability. To prevent this, a requirement to provide all available data could be used and default values should be under constant review, with appropriate adjustments made on a rolling basis.

There is an opportunity that MRV requirements are aligned and agreed across jurisdictions (e.g. through trade deals) that can help minimise the overall administrative burden on organisations, including importers, while encouraging the broader proliferation of carbon policies globally.

Emissions Coverage³²

Emission scopes are defined as:

- **Scope 1 Emissions** – Direct emissions from operations owned or controlled by the reporting company.
- **Scope 2 Emissions** – Emissions from the generation of purchased electricity, steam, heating, or cooling for use in direct operations.
- **Scope 3 Emissions** – All indirect emissions (not included in Scope 2) that occur in the value chain of the reporting organisation and where organisations might consider themselves to have influential control over.

As a minimum, a CBAM should apply to all Scope 1 emissions embodied in imported products to replicate the type of emissions directly covered by the UK ETS. Under the UK ETS, Scope 2 emissions are indirectly priced as a result of covering at source electricity generation. In other jurisdictions, Scope 2 emissions will vary based on the carbon intensity of electricity. Applying a CBAM to Scope 2 emissions on imported products would seek to replicate the impact that the UK ETS has on domestic industry. There is publicly available data on the carbon intensity of electricity generation in most countries, and therefore, it should be straightforward to calculate imported Scope 2 emissions with a reasonable degree of accuracy.

In a similar way, Scope 3 emissions, in part, are also indirectly covered by the UK ETS. For example, downstream aviation operators in the UK are obligated to surrender allowances, and upstream, Scope 1 emissions from some UK manufacturers are covered as described above. A CBAM should apply to Scope 3 emissions to replicate the type of emissions that are indirectly covered as a result of the UK ETS. The challenge, however, is ensuring Scope 3 emissions in other jurisdictions are reported and verified accurately. We discuss addressing this further in Section 3.3.

There is significant overlap with the reporting and verification of emissions required for mandatory product standards (see next section). Carbon accounting and reporting is covered in more detail in Section 3.

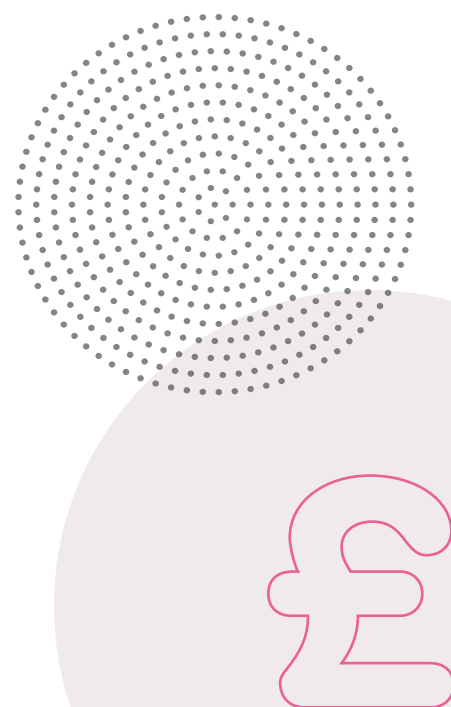
Calculating Effective Carbon Price³³

Energy Systems Catapult has previously developed a methodology for calculating the effective carbon price for emitting sectors and activities across the economy, including for industry.³⁴ This approach could be applied both domestically and for other jurisdictions.

A CBAM by its nature is a measure used to mitigate the impacts of a base carbon policy, which in most cases is carbon pricing. In the UK, industry at risk of carbon leakage sees its an effective carbon price arising from a range of carbon policies, including directly from the UK ETS and Climate Change Levy (CCL) and indirectly from the Carbon Price Support (CPS), Contracts for Difference (CfD), Feed-in-Tariffs (FiTs), and Renewables Obligations (ROs). Currently, UK industry also receives various exemptions, compensation, and free allowances from these policies (see Table 1).

The price applied by a CBAM should reflect the effective carbon price paid by domestic industry, calculated using the total amount arising from direct and indirect carbon policies less the value of relevant exemptions, compensation, and free allowances. The final effective carbon price will a) differ depending on the sector, and b) will vary over time.

Variations over time will predominately be a result of the prevailing UK ETS market price. To ensure that imported products are treated no less favourably than domestic products, a link between a CBAM price and UK ETS price will need to be established. The price applied by a CBAM could



be calculated by reference to the domestic carbon price on a regular basis by either using:

- Regular averages of the ETS secondary market price, or
- Using the fortnightly UK ETS auction clearing price.

Given the intended purposes of a CBAM is to level the playing field between domestic and international industry, then it would be appropriate to use the fortnightly UK ETS auction clearing price for the purposes of setting a CBAM price.

Effective Carbon Price in Other Jurisdictions³⁵

A similar approach for calculating domestic effective carbon prices should be applied for other jurisdictions. The final CBAM price applied would then be the difference between the effective carbon price in the UK and the jurisdiction where the good was produced (see Figure 1).

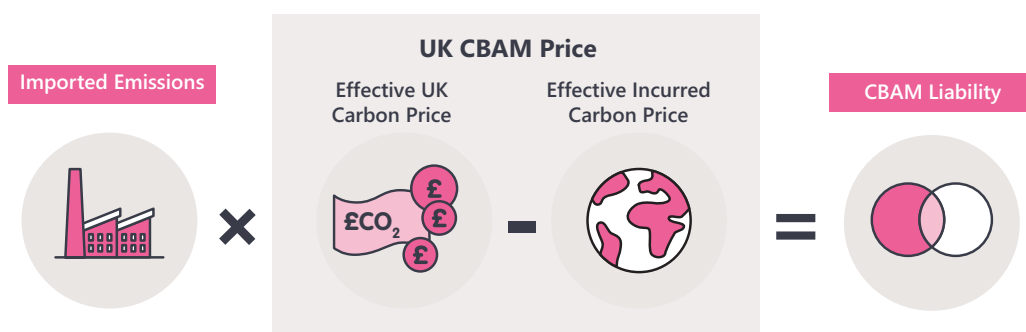


Figure 1 Calculation to determine the UK CBAM liability.³⁶

The responsibility for calculating the effective carbon price domestically and in other jurisdictions should be with the government. In the initial phases, it may be impracticable for importers to provide this information. The option could be made available for importers, should they have access to such information, to provide verified data so that a more accurate final CBAM price can be levied.

Challenges in calculating effective carbon prices in other jurisdictions will vary depending on the complexity of the carbon policy landscape. For example, accounting for support provided by other jurisdictions to equivalent industry could require significant resource to maintain accuracy over time. As a result, there is potentially a substantial administrative cost for government if it wants to implement a CBAM.

There may also be pushback from other jurisdictions, where their effective carbon price is low and where standards and regulation are more often used as a policy incentive. Determining the CBAM liability that result from standards and regulation would not be straightforward and is open to interpretation. Due consideration on how such policies would be handled as part of implementing of a CBAM is necessary.

Implementation³⁷

A CBAM would have to be designed in a way that facilitates the smooth flow of trade, ensuring that the administrative burden introduced on organisations is kept to a minimum, and that is aligns as far as possible with other domestic priorities at the border.

There are three points to consider:

- **The point of emitting** – when the embodied emissions are imported and enters the UK.
- **The point of payment** – when the importer would pay the UK effective carbon price per tonne of carbon dioxide equivalent.
- **The point of compliance** – when the importer would be required to reconcile the embodied emissions that have entered the UK, against the emissions they have paid for, and the carbon price in the jurisdiction of origin.

While a CBAM will be a separate and distinct policy measure from the UK ETS, there should be alignment as far as possible. Achieving simplicity in a CBAM's implementation and application is encouraged, but it must be balanced with achieving the underlying goal. For example:

- **Price** - excise duties are set and fixed on an annual basis, but a CBAM would align more appropriately with the UK ETS with a dynamic price. This will require new reporting and compliance requirements that importers would need to engage with. There could be a transition period, whereby a CBAM price is fixed annually in the initial phase. Once importers are familiar with the process, pricing could become dynamic and better aligned with the UK ETS. Equally, the process could be automated, and additional administrative burden for the importers kept to a minimum.



- **Payment** – the UK ETS allows emissions to be paid for at a separate point to the release of products into free circulation, this should be replicated by a CBAM to ensure the free flow of products into the market.
- **International alignment** – the UK should seek to align with the EU CBAM as far as possible. The EU remains the UK's largest trading partner. And while it is unlikely to result in direct costs arising from the requirements to purchase EU ETS allowances, there is a risk of increased administrative burden and indirect costs on both sides, resulting from differing, additional reporting requirements.

Timings³⁸

The implementation of a CBAM should align with the proposed reduction of free allowances for industry under the UK ETS in 2026. In this way, a CBAM can seek to replace free allowances as the main measure for mitigating carbon leakage; a similar approach is proposed by the EU (see Table 2).

The design of a CBAM will affect implementation timelines, and initial decisions should bear the 2026 changes to free allowances as part of that.



2.1.2 Mandatory Product Standards

Product standards can be used to ensure that certain products or industry outputs comply with minimum requirements related to its carbon emissions. Product standards can be voluntary or mandatory in their application.

Table 4 Advantages and disadvantages of mandatory product standards.

Criteria	Advantages	Disadvantages
Technical Feasibility (including Measurability)		High administrative complexity to establish standards and MRV methodologies. Relies upon life cycle assessment that is verified and comparable across different products.
Political and Legal Challenges	Imposing a standard at the border may be more politically appealing than other measures. Opportunity to propagate through the International Standards Organisation.	Imposing a standard at the border on imports could face legal challenge.
Achieving Net Zero	Strong incentive to reduce emissions intensity in line with Net Zero. However, prescriptive standards based on the performance of individual products can yield unintended consequences. Using a framework that is outcome-based can prevent this.	Careful design required to address emissions intensity of exports.
Consumption-Based Emissions	Strong incentive to reduce consumption-based emissions with implementation at the border.	
Carbon Leakage and Competitiveness Impacts	Strong protection against carbon leakage due to creating a level playing field for industry, including on imported products.	Requires careful consideration of the impact on upstream/downstream markets where the primary product is just a part of the value chain. For example, it may create carbon leakage risk for other producers, if they themselves are at risk of carbon leakage.

In the initial phase of mandatory product standards, the following criteria should be used to determine scope coverage:

- **Exposure to carbon leakage risk** – it may be appropriate to align this with the methodology used for free allowances under the UK ETS as a starting point. Eventually, a more comprehensive approach, which considers the wider carbon policy landscape (i.e. beyond the UK ETS), could be applied to ensure the carbon leakage risk is accurately calculated.

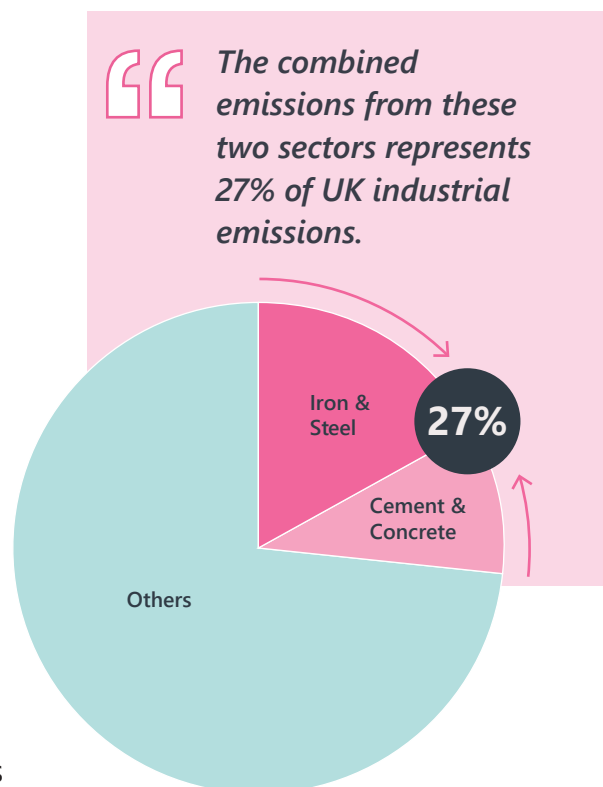
- **Impact on industrial decarbonation and Net Zero** – quantifying the potential impact mandatory product standards might have on overall emissions reductions.
- **Role in wider carbon policy landscape** – understanding the role that mandatory product standards will play alongside other carbon policies (including a potential CBAM) and initiatives will be crucial for efficient policy design and ensuring the right signals are received by industry.
- **Deliverability** – this is critical in the initial phase, where industry buy-in and overall operation could determine the longevity and success of the policy.
- **International alignment** – this will be particularly important for long-term success, as well as providing an opportunity for the UK to be a leader in this space.

Sector Coverage³⁹

Initially, a sensible approach would be targeting sectors where there are existing voluntary efforts. The iron and steel, and cement and concrete sectors would be suitable, for example. The combined emissions from these two sectors represents 27% of UK industrial emissions⁴⁰ and both are already part of international initiatives underway. For example, the Industrial Deep Decarbonisation Initiative (IDDI), with goals to 1) encourage governments and the private sector to buy low carbon steel and cement, and 2) source and share data for common standards and targets.⁴¹ In addition, there also exists the Responsible Steel standards and certification programme⁴² and Low Carbon Concrete Group's Routemap.⁴³

Building on international initiatives, and existing domestic carbon policies, such as the UK ETS, would act as a foundation for additional sectors to be included in later phases. For example, the chemicals sector, which represents 16% emissions, but is more complex in terms of product variability and is currently lacking equivalent international initiatives.

The use of mandatory product standards and their coverage should be designed to work in concert with coverage of a CBAM, if introduced.



Emissions Coverage⁴⁴

As a minimum, the monitoring, reporting, and verification (MRV) of emissions for mandatory product standards should include Scope 1 and Scope 2. It may be appropriate to include upstream Scope 3 emissions, but this requirement will vary between products based on the overall impact that upstream emissions has on the total amount of emissions for a given product. If relatively low, the additional administrative burden required, and potential variations in accuracy, may outweigh the benefits.

This is particularly relevant if early phases of mandatory product standards are applied to foundational industry products, which is already midstream (i.e. process of raw materials into relatively simple intermediate products) in the value chain by their nature.

It is recognised that excluding downstream Scope 3 emissions in the early phases may result in unintended consequences (e.g. incentivising the manufacture and use of products, which are less emissions intensive to manufacture, but that have a greater environmental impact over their whole lifespan), but these should be addressed with separate, complimentary policies (e.g. labelling on final products).

Intended Role⁴⁵

Determining the intended role that mandatory product standards will play alongside other carbon policies will be an important consideration for their design and placement in the value chain. This will vary between sectors.

With a policy approach as potentially complex as mandatory product standards, it would be sensible to begin by focussing on a narrow range of sectors, covering midstream in the value chain. This approach seeks to address criteria listed above and should align as far as possible with existing carbon policy reporting requirements (e.g. the UK ETS and Streamlined Energy and Carbon Reporting (SECR)).



The proposal of including Scope 1 and 2, with some upstream Scope 3 emissions, in iron and steel, and in the cement and concrete sectors is conducive with including a narrow range of products sold to specific downstream sectors (e.g. steel products used in construction, but not those manufactured for use in the automotive sector only). The final choice of intermediary, product, and component manufacture will also need testing against the criteria listed above.

Additional benefits could arise from data collection that could be applied to final products, which could inform separate policies that address the unintended consequences discussed above (e.g. through labelling). This may also inform voluntary product standards on downstream products, before later extending to mandatory if deemed appropriate.

Point of Obligation⁴⁶

The point of obligation should be aligned as far as possible to complement other carbon policy obligations placed on industry. For example, at the point of production aligns with where the UK ETS obligation sits and already includes sectors proposed for the initial phase (iron and steel; cement and concrete). If designed appropriately, this approach could minimise additional administrative burdens by using the same data across reporting purposes.

It may be deemed that a CBAM could fulfil mitigating carbon leakage for these sectors, in which case, mandatory product standards could be used elsewhere in the value chain. Where multiple policies are applied at various stages of the value chain, there is an increased risk of double counting emissions. Preventing double counting will be essential to ensuring the appropriate incentives are passed down the value chain.

To prevent inducing carbon leakage with the introduction of mandatory product standards, the same standards should apply on imported goods. In this case, it may be more appropriate to place the obligation on the point of sale, to align with existing customs approaches and to ensure all products brought into the UK comply with regulations before entering the market. It would then become the responsibility of the importer based in the UK.

Setting Thresholds⁴⁷

Is it essential that, in the initial phase, setting thresholds for standards balances deliverability and emissions reduction. Increasing stringency over time in subsequent phases would be necessary to ensure standards continue to achieve both of these goals.

In their consultation document, the Department for Energy Security and Net Zero and HM Treasury propose the following set of principles:⁴⁸

- Thresholds should be set at a level tailored for each sector. Exceptions may be made for some sectors where a heterogeneity of products makes this approach impractical.
- Thresholds for mandatory product standards should be set at an ambitious, but achievable level reflecting engagement with industry experts.
- Industry should be provided with advance notice of any planned increase in stringency and consulted as appropriate.
- Thresholds for voluntary standards should be set at a range of more ambitious levels, up to Net Zero or near zero.
- The increasing stringency of mandatory product standards thresholds should be linked to the UK's Net Zero target and Carbon Budgets to ensure that emissions reductions levels in line with government targets (as a minimum) will be incentivised.
- The increasing stringency of thresholds would need to account for the step-change nature of industrial decarbonisation and may need to be reassessed in response to technological advances. Gradual, but frequent, increases in stringency could be needed in the short-term, with bigger and less frequent increases required once deep decarbonisation technologies have been widely deployed.
- The government should be clear about the review process for a threshold, either specifying the circumstances which would trigger one, or setting a regular review process.



These principles are sensible and should form the basis for setting thresholds, and will need to sit alongside wider interactions with industry stakeholders before finalising. For example, engaging with the British Standards Institution (BSI) could enable improved industry buy-in, and a potential route to their international use through the International Standards Organisation (ISO).

Timing⁴⁹

The development and implementation of mandatory product standards should be phased. Phasing in over time, potentially by beginning with a phase of voluntary product standards, followed by mandatory product standards that increase in stringency over time is likely to see a higher success of deliverability. The voluntary phase could be used to ensure the emissions reporting obligation and data systems are fully operational, before entering mandatory operation in the mid-to-late 2020s.

The understanding developed in these early phases will also determine the pace at which a broader scope and increased stringency is introduced.



The voluntary phase could be used to ensure the emissions reporting obligation and data systems are fully operational, before entering mandatory operation in the mid-to-late 2020s.

2.1.3 Low Carbon Public Procurement

Public procurement often constitutes a significant share of national markets for industry supplied goods. Although not sufficient by itself, procurement practices that include carbon requirements for products can support creating a market for low carbon goods. It is a potentially important instrument for creating lead markets in low carbon outputs and more broadly as an instrument to promote innovation. Public procurement can also be used as a test case for the development of broader mandatory product standards where the role of embodied carbon brings associated complexities, e.g. life cycle assessment.

Public procurement is not a focus of the government's consultation on addressing carbon leakage and is not explored in detail in this report.

Table 5 Advantages and disadvantages of low carbon public procurement

Criteria	Advantages	Disadvantages
Technical Feasibility (including Measurability)		High administrative complexity to establish standards and MRV methodologies. Relies upon life cycle assessment that is verified and comparable across different products.
Political and Legal Challenges	Highly politically supported.	Risk of picking winners, which can be prevented with careful design, e.g. avoid using prescriptive standards that determines the type of product, instead use outcome-based standards based on embodied carbon.
Achieving Net Zero	Provides incentives to reduce emissions.	
Consumption-Based Emissions	Design of policy can incentivise a reduction in consumption-based emissions.	
Carbon Leakage and Competitiveness Impacts	It can help create a level playing field for affected industry by setting a minimum requirement for products. This in itself can provide protection against carbon leakage, but it requires careful design.	

2.2 Cross-Cutting Issues

In a framework where different carbon leakage policy measures are implemented, there will be cross-cutting issues, including the measurement of carbon intensity; risk of circumvention and resource shuffling; potential downstream impacts; exports; and carbon credit and offsetting.

Estimating Product Level Emissions Intensities⁵⁰

Simplifying the process for estimating product level emissions intensities will be particularly important in the early phases of any policy measure. Currently, emissions tend to be attributed at the site level, rather than on individual products. Estimating product level emissions intensities will require taking site level data and disaggregating into individual products. The guidance for this will have to be clear and simple to ensure consistency and comparability of data, and to minimise the administrative burden for both the data generator and data consumer (see Figure 1 for examples of these).

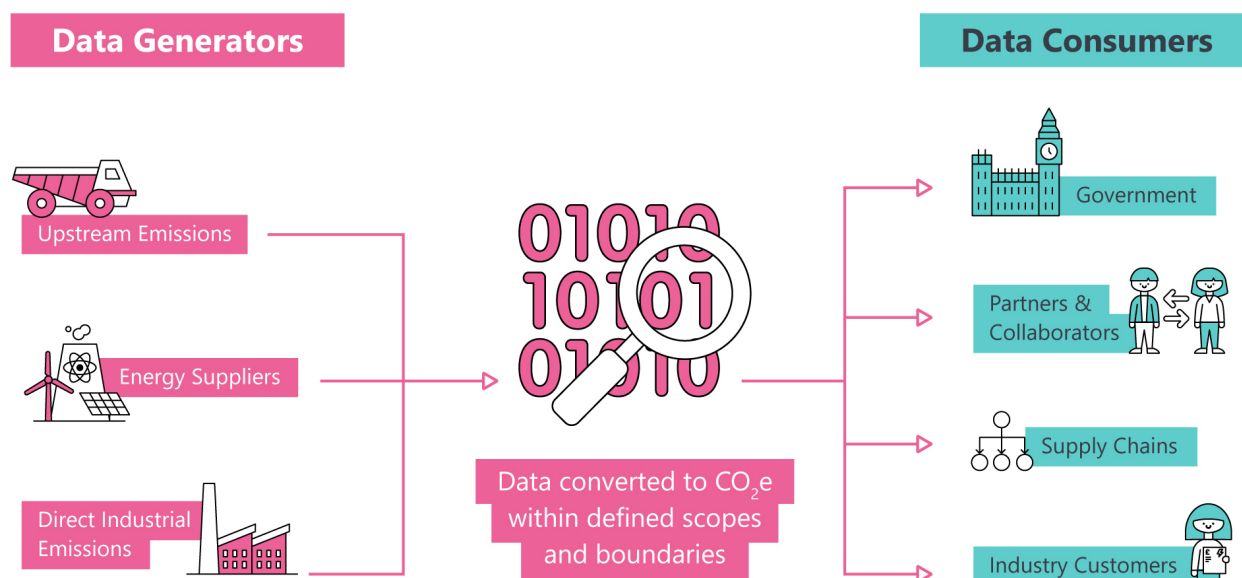


Figure 2 Emissions data generators and consumers.⁵¹

The underlying metric by which product-level emissions intensities are estimated will impact the overall integrity of the process. This is likely to differ between product types and sectors, but it is essential to use the most appropriate metric. For example, an emissions intensity tied to weight could be simple, yet accurate enough for steel products, but insufficient for chemicals.

There is a fine balance between the administrative burden that policies can introduce and ensuring the level of accuracy is appropriate to achieve the aims of the policy itself. Carbon leakage mitigation policies are about levelling the playing field between domestic and international competitors when it comes to carbon policies. The aim is preventing a global rise in industrial emissions by ensuring UK industry does not offshore. The required accuracy of data should reflect this aim.

Risk of Circumvention and Resource Shuffling⁵²

The circumvention of carbon leakage policy measures can occur if products that would otherwise be covered by the measures are altered to fall outside of the scope. There is an increased risk of circumvention in the early phases, where the initial scope may be narrow. This is particularly the case where the carbon leakage policy measures do not fully reflect domestic policy in terms of overall scope. For example, if UK industry is able to circumvent domestic

carbon policies in a similar manner to imported goods, then it is the underlying policy that needs addressing, rather than the carbon leakage policy measure. But if UK industry is unable to do so, then this suggests the scope of the carbon leakage measure is not sufficiently wide enough.

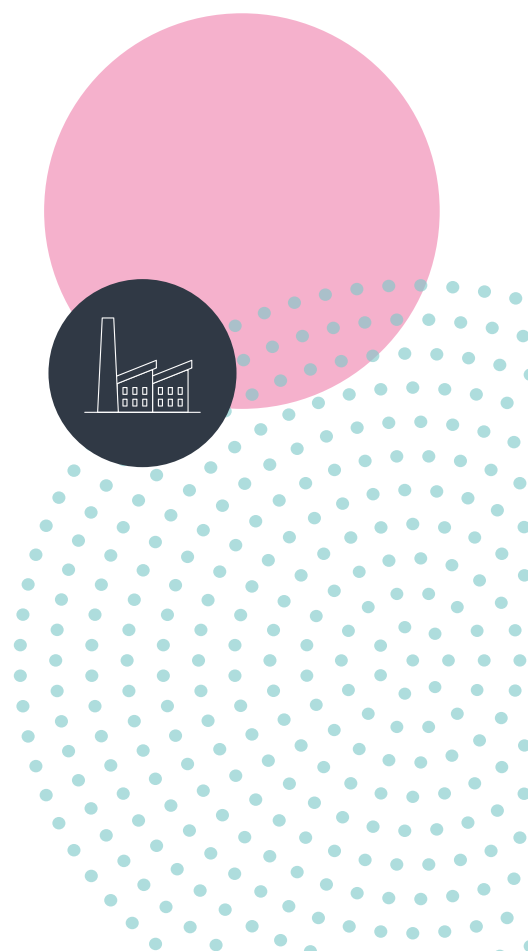
Addressing circumvention will require a balance between phasing in a scope that is achievable in the near-term, but is adapted and expanded over time to deal with unintended consequences.

Resource shuffling is where an organisation diverts its most carbon-intensive products to markets with less stringent regulation, and its lower emissions goods to the UK market. This technically achieves the goal of mitigating carbon leakage, and should be addressed by alternative approaches (e.g. international cooperation).

Potential Downstream Impacts⁵³

There are potential downstream impacts arising from carbon leakage policy measures, including cost impacts, for example:

- Where the UK is a net importer of a particular product, and domestic prices are affected by the price of imports, carbon leakage policy measures could increase the price of both imported and comparable domestically produced products. This in itself may increase the risk of carbon leakage in some cases.
- The cost of intermediate inputs could increase and result in an increase in price of final products. Where these products compete against imports from countries with less ambitious carbon policies affecting intermediate inputs, it could lead to a reduction in demand for low carbon products produced domestically, while increasing the demand for higher carbon imports.
- Cost increases might be absorbed by businesses through reduced profit margins, which could affect investment decisions and lead to a reduction in domestic production.
- Changes to prices resulting from a CBAM or mandatory product standards could decrease certainty over expected costs for importers.



Seeking to address the potential downstream impacts should be an ongoing exercise, balancing the impact on price and administrative complexity. In the near-term, it might be sensible to do nothing for final products where the level of relevant intermediate inputs is below a defined threshold.

Where above the threshold, applying an 'implied' carbon price or product standard to imports where UK production is most effected could best balance the potential impacts. Attempts to calculate the number of intermediate inputs that are embedded in imported processed products would in effect result in a significant expansion of carbon leakage policy measures, which in the near-term is unlikely to be achievable or even desirable.

Over time, as more data is collected and the wider impacts of carbon leakage policy measures are better understood, decisions can be made about how to better address downstream impacts.

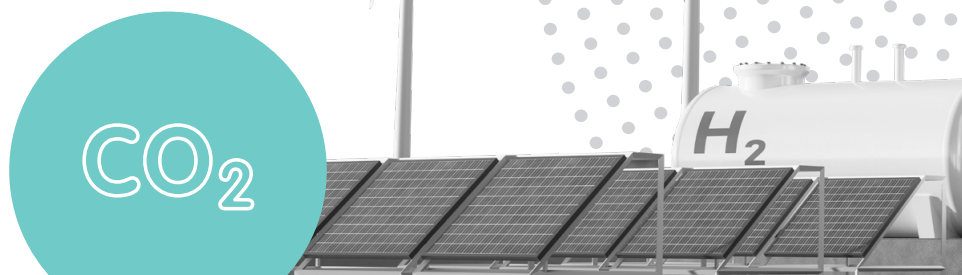
Exports⁵⁴

Domestically produced products for export also face carbon leakage risks. The approaches taken to mitigate carbon leakage in export markets will depend on the underlying policy mechanism it is seeking to address. For example, if it is a carbon price arising from the UK ETS, then a rebate on exported products may be appropriate, subject to WTO rules.⁵⁵

There is a risk that if rebates are applied, it could create incentives for producers of high carbon products to increase exports, undermining the effectiveness and credibility of domestic carbon policies.⁵⁶ For product standards, it may be that a voluntary scheme is required in the initial phases to understand the impacts of mandatory product standards.

Carbon Credits and Offsetting⁵⁷

There is a potential role for carbon credits purchased through voluntary carbon markets as part of wider decarbonisation efforts. However, carbon credits to offset emissions should not be considered within the assessment of a product, especially if this is currently prohibited in the domestic policies that the carbon leakage policy measures are implemented to address (e.g. the UK ETS).



2.3 Timings and Phasing of Carbon Leakage Policy Measures

The timing and phasing of carbon leakage policy measures are crucial for mitigating carbon leakage and must account for:

- The existing framework of carbon policies, especially where additional measures may increase the administrative burden for organisations. Every effort should be made to simplify existing carbon policies or phase measures to minimise impacts.
- Each industrial sector will continue to decarbonise at different rates, and variations will occur regionally, including between industrial clusters and dispersed sites.
- The dynamic variation in trade exposure of different sectors over time.

The specific application of carbon leakage policy measures will vary between industrial sectors, depending on their place in the value chain and the type of products they produce.

It is out of scope of this report to propose sector specific timelines, and the following should be seen as the broad direction of travel. Figure 2 highlights the proposed timings, including their alignment with policy milestones:

- In 2024, structural changes to the UK ETS will be implemented, including changes to the cap to align with Net Zero.
- In 2025, the introduction of emissions reporting system requirements in a limited number of sectors will allow for voluntary product standards and low carbon public procurement to be implemented. This provides an opportunity to test requirements and collect data ahead of implementing mandatory product standards.
- From 2026, reforms to UK ETS free allowances take effect, which sees the beginning of their phasing out. Alongside this sits the introduction of a CBAM, linked to the UK ETS, in a limited number of sectors. The CBAM should expand over time and fully phase in as free allowances completely phase out.
- Late 2020s, product standards become mandatory in a limited number of sectors, before expanding over time. Standards also become more stringent over time.



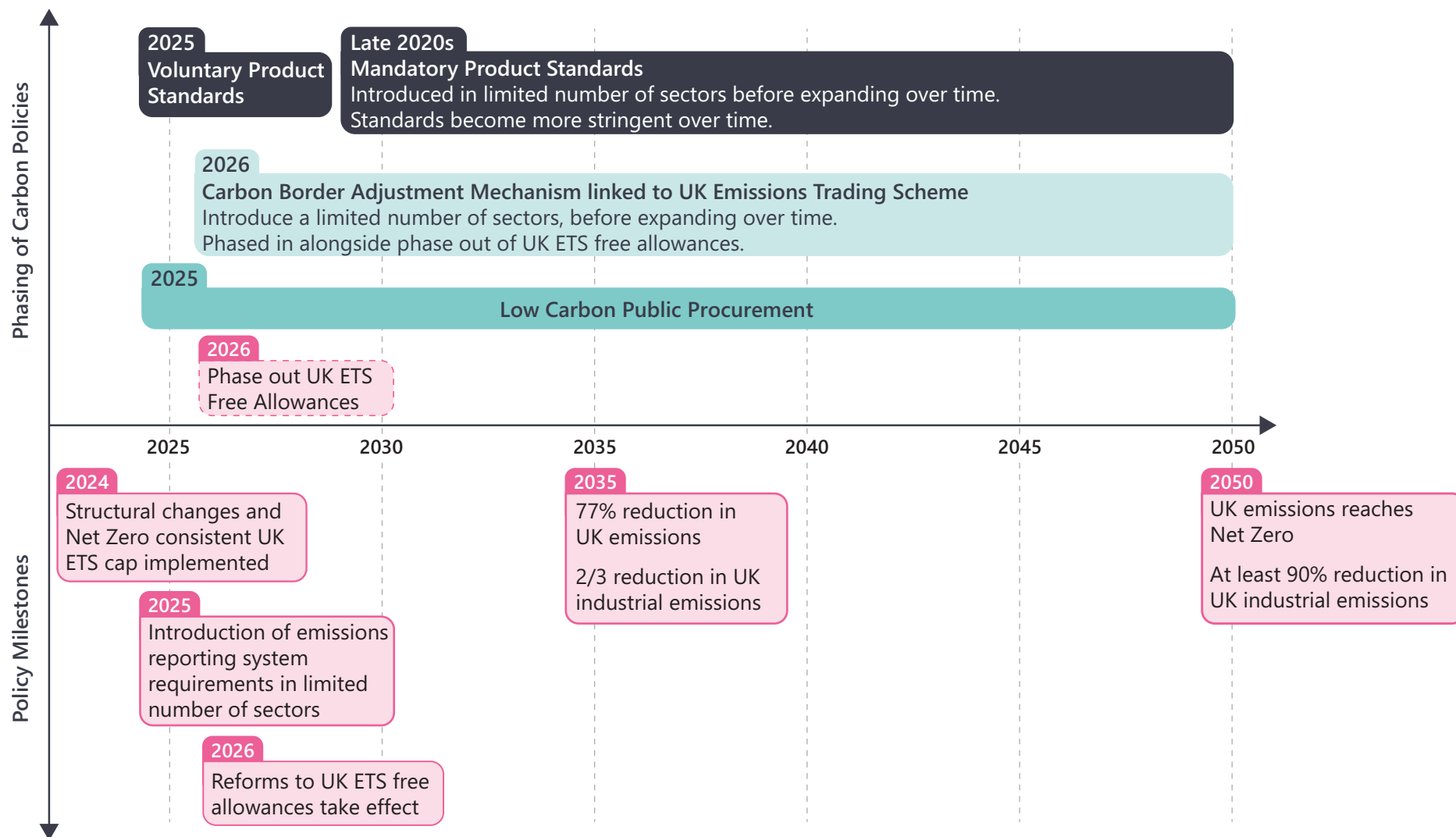


Figure 3 Proposed timeline for policy milestones and phasing of carbon leakage policy measures and policy milestones.

3 Carbon Accounting and Reporting

3.1 Accounting and Reporting Framework⁵⁸

A carbon accounting framework that provides an accurate and quantifiable picture of emissions across industry, including on imported goods, will be essential for the successful implementation of carbon leakage policy measures. Such a framework also has wider benefits, for example, revealing opportunities of low carbon innovation and growth.⁵⁹ Fundamental to this is the well-regulated monitoring, reporting, and verification (MRV) of emissions.

The current carbon accounting ecosystem is complex and limited in coordination between existing practices. There is also an absence of regulatory oversight to provide consistent emissions disclosures across approaches. Addressing both is crucial for ensuring the carbon accounting ecosystem matures to the scale, and at the pace, required for both industrial decarbonisation and mitigating carbon leakage.

The existing carbon accounting landscape does not reveal a transparent picture of global emissions or the traceability of emissions moving between international boundaries. The UK could play a leading role in improving the global transparency of emissions, demonstrating best practice through the adoption of a streamlined and standardised carbon accounting framework. Doing so would also give greater confidence that CBAMs and mandatory product standards are calculated and applied accurately.

Reporting Embodied Emissions⁶⁰

Energy Systems Catapult has previously proposed a standardised approach to emissions reporting that is independent of individual policy mechanisms or schemes, which we describe as a decoupled approach.⁶¹ To reduce the administrative burden placed on industry, the design of an emissions reporting framework should be adaptable to meet future requirements of emissions data.



The UK could play a leading role in improving the global transparency of emissions, demonstrating best practice through the adoption of a streamlined and standardised carbon accounting framework

As part of this, we advocate for a 'disclose once' principle, establishing a single source of truth for emissions data. This approach means emissions data generated by industry could support the multiple accounting needs of data consumers (e.g. government and industry customers, see Figure 1) to reduce the overall administrative burden on industry.

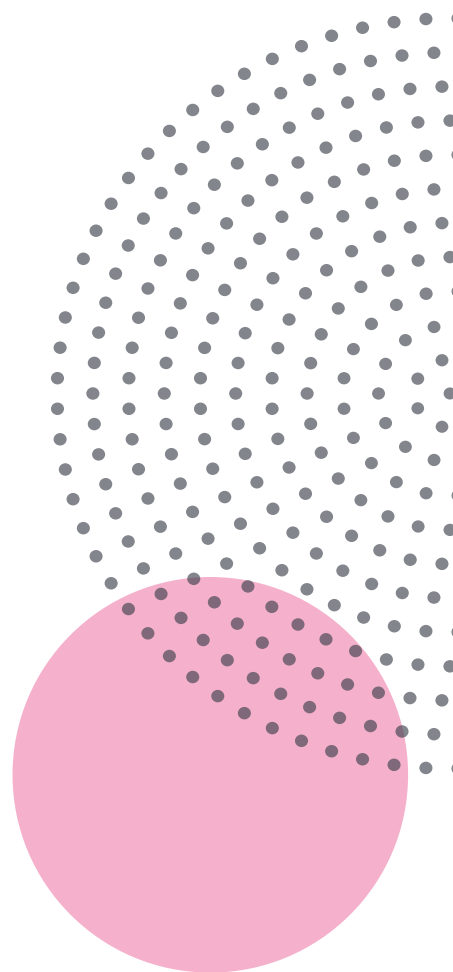
To enable industry to disclose once, a carbon accounting framework must be supported by a coordinated digital systems architecture, with standards applied to facilitate the interoperability and comparability of emissions data (see Section 3.3).

A well-coordinated emissions reporting framework, with a single point of emissions disclosure for industry, should also support different carbon leakage policy measures without creating additional administrative burden. Improving the completeness and consistency of emissions reporting through standardisation provides the necessary foundations for comparability across different accounting practices and adaptability to future requirements.

The reporting of installation level emissions is more adaptable to future requirements of emissions data and aligns to existing requirements of industry to report their installation level emissions (e.g. to comply with the UK ETS and similar international schemes). Through the coordinated digitalisation of emissions MRV, installation level emissions could support multiple requirements to attribute emissions through different measures (e.g. expanding coverage of carbon leakage policy measures).

Balancing Administrative Burden and Accuracy⁶²

There is no one size fits all approach that will give a complete and accurate picture of emissions. Accuracy is dependent not just on the quality of data obtained, but on the artificial boundaries set to attribute emissions at different operational levels and geographical areas. Government should not strive for accuracy above all else. Instead it should be taking pragmatic steps to identify the level of granularity needed from reported emissions data to meet multiple requirements of that data, without increasing the administrative burden on industry.



There may be multiple products or materials produced at one site and, in this case, installation level emissions reporting may not provide the granularity of emissions data required for product specific insights. In this instance, default values could be used for specific products or proxy measurements calculated from inputs and outputs for a specific industrial process at a site. Provided standards used ensure comparability and default values are regularly reviewed to accommodate innovation, installation level reporting remains a pragmatic first step towards a streamlined carbon accounting framework.

Emissions Factors⁶³

Multiple conversion factors do not facilitate the comparability of emissions data. We recommend the UK ETS as an anchoring policy to promote the alignment of accounting methodologies where possible. This would mean aligning conversion factors to the GHG Inventory factors used by the UK ETS for the calculation of embodied emissions of imported goods.

Ensuring the accuracy and credibility of conversion calculations internationally will be important for monitoring emissions across international supply chains. Emissions factors may be location-specific (e.g. emissions associated with local electricity supply) and should not be used to calculate conversions beyond their defined geographical coverage. Conversions for different locations will need to be designed in a way that is comparable with domestic production and will improve in robustness over time (e.g. in sectors where there are known issues, such as land use).

International coordination will also be required to produce emission factors that can align to international requirements of UK industry (e.g. through the EU CBAM).

3.2 Designing the Mechanism

Methodology for Measuring Embodied Emissions of Products⁶⁴

While it will be important to consider the complete lifecycle of a product and promote circular economy principles to fully decarbonise industry, existing life cycle assessment (LCA) (e.g. Environmental Product Declarations) are resource intensive to produce. Due to their bespoke nature, they do not provide comparable data for different products

that may achieve the same overall function. This can limit opportunities for innovation (e.g. such as in the reuse of waste materials), but also create significant challenges for the assessment of complex international supply chains with regards to imported goods.

Installation level emissions reporting, facilitated by interoperable digital systems, could provide the emissions data needed to track and trace emissions through supply chains to support a variety of applications, including LCAs. With advances in digital reporting, innovation within supply chains could be rewarded closer to real time, without relying on lengthy cyclical and administratively intensive assessments.

Existing LCAs provide an aggregated assessment of emissions associated with a product and have been designed to support sector specific business cases. Effectively designed, a reporting framework with installation level data could provide far richer insights to target innovation, identify cross-sector collaboration and decarbonise complex supply chains. Such a framework could support a wider range of policy mechanisms, adapting to the needs of industry and government.

To achieve Net Zero at the global scale required, it will be important to understand the embodied emissions of a product, including where imported. Upstream emissions must be considered beyond the final exported country to account for complex international supply chains, where products may move through several jurisdictions before reaching the UK.

Greater transparency of upstream emissions sources and associated emissions (e.g. transportation of products) will be important to facilitate international collaboration, but it will also be essential to accurately calculate the net benefits of domestic supply of certain goods and materials.

We have previously recommended government fund feasibility studies to understand sector specific requirements for the exchange and processing of emissions data.⁶⁵ This can support different carbon accounting practices through an effectively coordinated and digitalised carbon accounting framework that enables industry to disclose once. Feasibility studies could include considerations for how existing sector led LCAs could be supported and new LCAs introduced over time, including the incorporation of data from international supply chains.



To achieve Net Zero at the global scale required, it will be important to understand the embodied emissions of a product, including where imported.

Reporting Metric⁶⁶

Currently, CO₂e/mass represents the most suitable conversion metric to facilitate comparable carbon policies internationally. Through a distributed digital systems architecture, industry could make additional data available for relevant activities that could allow for additional performance metrics to be incorporated into targeted policies in the future. Given the rapid pace of change in carbon policies internationally, designing a system with scope for adaptability would be advantageous.

Emissions Data Collection Period⁶⁷

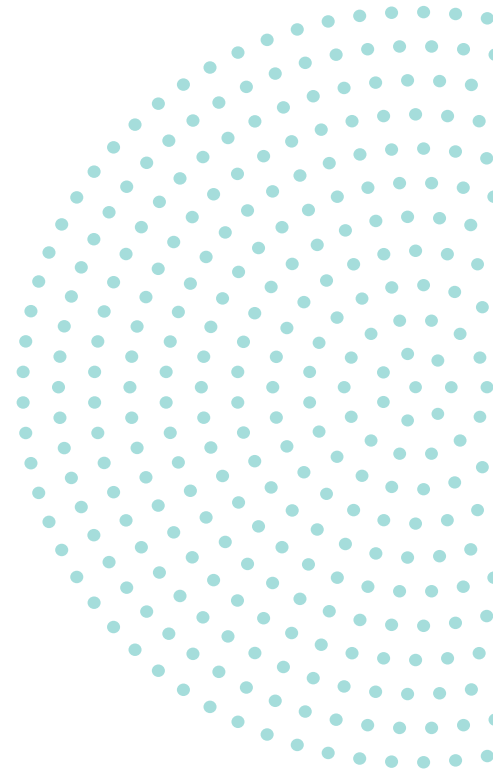
An incremental and phased approach to policy implementation gives industry time to adapt to new measures and promote international alignment among their supply chains (see Figure 2). With more accurate emissions data, policymakers can have greater confidence that policies at the border will have a material effect on emissions reduction globally before full implementation.

In addition to a phased period of data collection, government should also invest in digital and carbon skills, with training and guidance to empower industry to select the most appropriate digital tools and accounting practices to support their data collection.

Sectoral Coverage of Emissions Reporting⁶⁸

Industrial sectors currently covered by UK ETS should see initial data collection requirements for carbon leakage policy measures. We recommend an incremental, sector led approach to carbon policy design that eventually leads to consistent oversight of emissions across all sectors.

The use of thresholds and the impact this has on the coverage of SMEs remains an area that requires further investigation. For example, the scale of SMEs currently below the reporting threshold for the UK ETS is unknown. Understanding the extent of emissions not currently reported through the ETS due to the 20 MWth per installation threshold will be essential for future reporting requirements.



Emissions Scope⁶⁹

Emissions scope relevant to a CBAM and product standards is covered in Section 2.1. More broadly, the consideration of indirect upstream and downstream emissions encourages organisations to consider the wider impacts of their business activities and coordinate decarbonisation efforts with supply chains. For example, if all sectors of the economy were required to report their Scope 1 emissions, including internationally, government would have a relatively complete picture of emissions as products pass through supply chains and are eventually processed at their end of life.

With effective coordination of digital systems, industry and industry customers could also use Scope 1 reported emissions to make their own assessments of emissions relating to their activities, including their Scope 2 and 3 emissions. For example, for Scope 2, energy data in the UK is settled on a half hourly basis and can be used to support this level of analysis (e.g. using National Grid ESO's carbon intensity API⁷⁰ in conjunction with metering data).

For imported goods, international coordination would be required to encourage the wide scale reporting of Scope 1, 2, and 3 emissions. Interim default values may need to be used where there are gaps in reporting, these default values could be designed to incentivise sites and sectors to report Scope 1 emissions to the desired standardised format.

3.3 Digitalisation

The ability to exchange, compare, track and trace emissions data through complex and international supply chains will be fundamental to the UK's future low carbon economy. We have previously highlighted opportunities for digital technologies to simplify emissions reporting⁷¹, in which we propose data exchange could be facilitated through the effective coordination of a distributed digital systems architecture.

A distributed approach to the digitalisation of emissions MRV and carbon accounting could accommodate and adapt to a range of policy use cases, including policies targeting carbon leakage, without creating additional requirements for industry to disclose emissions to multiple systems.



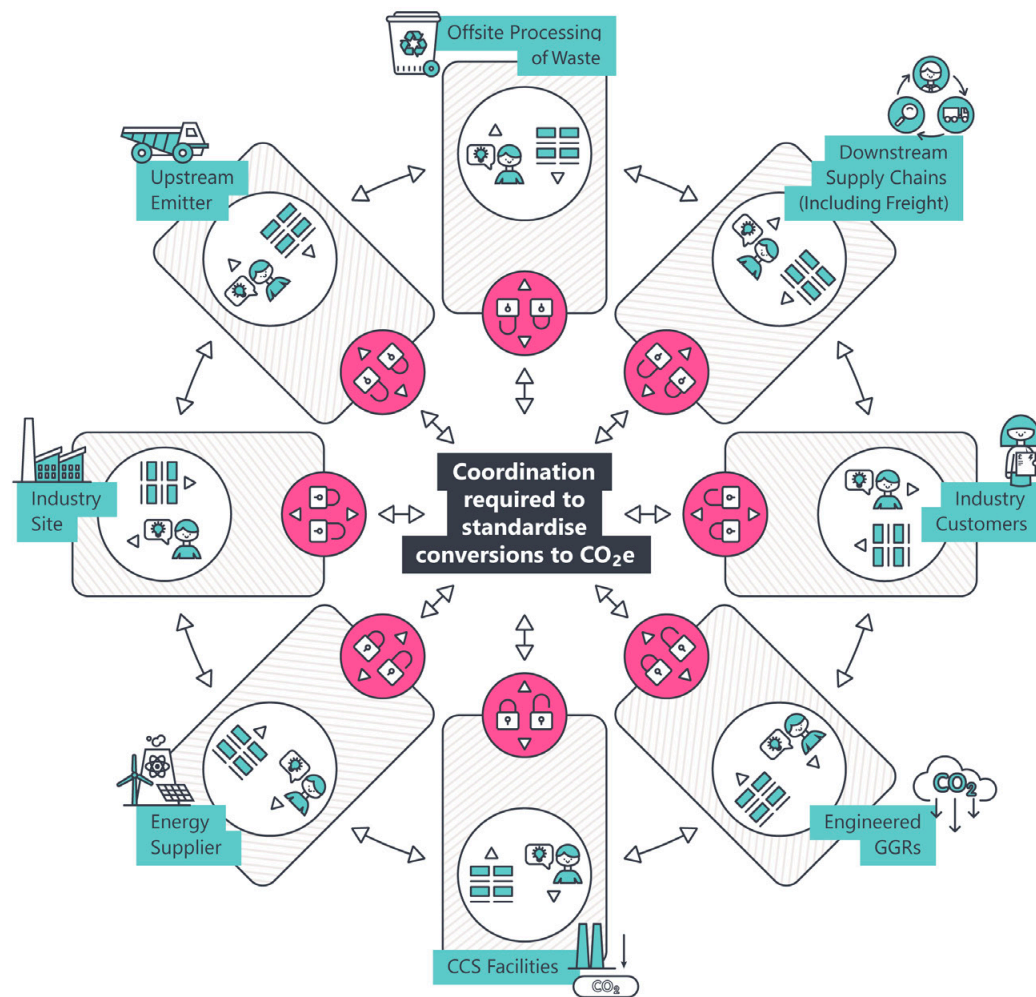


Figure 4 Demonstration of emissions data being exchanged through a distributed digital systems architecture. This approach could facilitate LCAs for industry customers in addition to government requirements of data, all from a single point of disclosure from industry.⁷²

IT System⁷³

The requirements on industry to report emissions will evolve over time with emerging stakeholder needs and new government policies. Existing static reporting tools, such as Microsoft Excel spreadsheets, do not support the incorporation of more data sources and more frequent data updates, nor are they easily adaptable to new reporting requirements. It is also unlikely that a single digital platform can be designed and managed to accommodate all future scenarios, and there are already digital platforms in development to support different use cases.

We propose the following high-level digital infrastructure principles required to facilitate emissions data exchange:

- **Distributed hosting** – emissions data that relates to the fundamental activities of an organisation should be maintained by the organisation and made available for onward consumption by any authorised parties. This ensures that a single source of truth is maintained and propagated.
- **‘Pull’ not ‘push’** – data consumers (e.g. government and industry customers) should pull data from all relevant sources at the point of need rather than prescribing routine submissions of bespoke data. This ensures that data consumers are able to implement their own processing techniques and enables a ‘one-to-many’ relationship between data generators and data consumers.
- **Coordinated governance** – Data requirements need to be streamlined and broken down to the lowest common denominators to minimise the burden on data generators. Our previously proposed Carbon Regulator⁷⁴ would be well placed to provide the effective coordination needed to ensure the interoperability of emissions data from distributed reporting systems and establish the standards required for the development of digital carbon accounting platforms.

A distributed thin layer of IT infrastructure (a node) that standardises and transmits data to government can be supported by a platform with the primary function to make pull requests to receive the reporting data from industry to meet reporting obligation. By developing thin layers of digital infrastructure in an open source first approach that prioritises interoperability between market participants. This lowers costs to deployment and makes systems easier to use and integrate.

The approach of a small, open source software package distributed across industry that then provides standardised data to government would reduce the administrative burden faced by industry and reduce data cleansing and manual monitoring by government. Within energy, the digital spine feasibility study is taking this type of approach to data sharing and standardisation.⁷⁵



Frequency of Reporting⁷⁶

Frequency of reporting is largely determined to accommodate the administrative burden it places on industry. Initially, the frequency of emissions reporting should align to the UK ETS annual reporting requirements. As a digital systems architecture is developed, there may be an opportunity to enable more real time tracking of emissions related activities, pulling data from approved interoperable systems without placing additional administrative burdens on industry.

For Scope 1 emissions, providing a product ID, a geographical location for its production, and time stamps for when it was produced could be part of future reporting requirements. Data on other factors, such as contributions from additional manufacturing processes, can be incorporated as a series of data points associated with that product ID.

For imported emissions, reporting should seek to achieve a similar level of granularity, but it is recognised that in many cases this will not be possible. Where verified data is provided at a higher level of granularity, it may be provided within the scope of the node as a data transformation step.

Verification of Emissions Data⁷⁷

We have previously proposed the introduction of a Carbon Regulator to have economy-wide oversight over emissions MRV, and to ensure that carbon accounting approaches are coherent and consistent across the economy.⁷⁸

We propose the following responsibilities for a Carbon Regulator to promote the standardisation of MRV practices:⁷⁹

- Coordinating reporting requirements for emissions disclosures required to deliver and support carbon policies, which are currently disparate.
- Introducing mandatory emissions disclosures, using the UK ETS as an anchoring policy for the standardisation of emissions disclosures.⁸⁰
- Oversight of the digital architecture required to ensure the interoperability of emissions data from distributed reporting systems. This will likely involve setting standards and principles for the development of distributed digital systems used to support MRV and carbon accounting to meet different stakeholder needs.

- Certification of third-party verifiers required to ensure compliance with MRV standards and use of distributed digital systems.

A Carbon Regulator could also be responsible for verifying imported emissions to the same level of rigour as data reported by UK organisations.

We will soon begin to develop options for operationalising a Carbon Regulator, including its potential roles and responsibilities, and to propose steps towards its implementation.

Disclosure of Emissions Data⁸¹

Where possible, embodied emissions data for products should be made publicly available. There may be reasons that data cannot be shared publicly (e.g. to protect intellectual property), in such instances, clear justification should be made.

As a general rule, open data promotes collaboration, co-creation, innovation, and a more equitable distribution of technological resources. This can in turn help inform policymakers working on cross-cutting policy challenges like Net Zero and empower innovators developing low carbon technologies.

We recognise industry stakeholders' concerns surrounding the increased transparency of emissions data. But with effectively coordinated policies and regulatory oversight, transparent data could help stimulate the competition and investment required to decarbonise industrial processes and supply chains in the UK and internationally.



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13. In order to be eligible, businesses must show that electricity costs amount to 20% or more of their GVA, and be within a sector that has a trade intensity of at least 4% and an electricity intensity of at least 7%.
14. BEIS (2022). Review of the schemes to compensate certain energy intensive industries for indirect emission costs in electricity prices. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1071917/eii-compensation-schemes-government-response.pdf
15. In order to be eligible, businesses must show that their indirect carbon costs (the combined effect of the UK ETS and CPS) will amount to 5% or more of their GVA, and be within a sector where the trade intensity is greater than 45% or an indirect emissions intensity greater than 0.8 kgCO₂/£GVA.
16. HMG (2020). The Future of UK Carbon Pricing – UK Government and Devolved Administrations' Response. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/889037/Government_Response_to_Consultation_on_Future_of_UK_Carbon_Pricing.pdf
17. European Commission. Revision for Phase 4 (2021-2030). https://ec.europa.eu/clima/policies/ets/revision_en
18. European Commission. Carbon Border Adjustment Mechanism. https://taxation-customs.ec.europa.eu/green-taxation-0/carbon-border-adjustment-mechanism_en

19. Ember (2020). The Path of Least Resistance. <https://ember-climate.org/app/uploads/2022/02/Ember-Path-of-least-resistance-2020.pdf>
20. European Parliament (2022). Climate change: Deal on a more ambitious Emissions Trade System (ETS). <https://www.europarl.europa.eu/news/en/press-room/20221212IPR64527/climate-change-deal-on-a-more-ambitious-emissions-trading-system-ets>
21. Carbon Herald (2023). China asks EU to provide justification for upcoming carbon border tax. <https://carbonherald.com/china-asks-eu-to-provide-justification-for-upcoming-carbon-border-tax/>
22. Reuters (2023). India plans to challenge EU carbon tax at WTO. <https://www.reuters.com/world/india/india-plans-challenge-eu-carbon-tax-wto-sources-2023-05-16/>
23. CATO Institute (2021). Legal Issues with the European Carbon Border Adjustment Mechanism. <https://www.cato.org/briefing-paper/legal-issues-european-carbon-border-adjustment-mechanism>
24. McKinsey & Company (2022). The Inflation Reduction Act: Here's what's in it. <https://www.mckinsey.com/industries/public-and-social-sector/our-insights/the-inflation-reduction-act-heres-whats-in-it>
25. DESNZ and HMT (2023). Address Carbon Leakage Risk to Support Decarbonisation. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147347/30_MARCH_2022_CONSULTATION_ON_ADDRESSING_CARBON_LEAKAGE_RISK_TO_SUPPORT_DECARBONISATION.pdf
26. This section corresponds to consultation questions:
 - 1.1) Do you believe that the risk of carbon leakage in the UK is likely to?
 - 1.2) What factors contribute to the risk of future carbon leakage that government should be looking at and that government should address?
 - 1.3) How should the government act to mitigate future carbon leakage risk?
27. Vivid Economics and ESC (2020). UK Competitiveness and the Role of Carbon Pricing. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/911247/UK_Business_Competitiveness_and_the_Role_of_Carbon_Pricing_report.pdf
28. Energy Systems Catapult (2018). Rethinking Decarbonisations Incentives: Current Economic Signals for Decarbonisation in the UK. <https://es.catapult.org.uk/report/rethinking-decarbonisation-incentives-current-economic-signals-for-decarbonisation-in-the-uk/>
29. Energy Systems Catapult (2020). Industrial Decarbonisation: Net Zero Carbon Policies to Mitigate Carbon Leakage and Competitiveness Impacts. <https://es.catapult.org.uk/report/industrial-decarbonisation-and-carbon-leakage/>
30. This section corresponds to consultation questions:
 - 2.1) Should a CBAM only apply to products in sectors that are subject to the UK ETS?
 - 2.3) If the scope of a CBAM is initially limited, should it be designed to potentially cover other products in future?
 - 2.4) Should the importer of products covered by a CBAM be responsible for meeting all CBAM requirements? If not the importer, who?
31. This section corresponds to consultation questions:
 - 2.5) Should importers be required to provide accurate, independently verified emissions data for the products they import where available?
 - 2.6) Should there also be an option for importers to use default values, where they do not or cannot provide accurate emissions data are?
 - 2.7) Are there any factors not presented in this chapter which government should consider for the calculation of default values?
 - 2.8) Are there any additional challenges or opportunities around the monitoring, reporting and verification of emissions that have not been considered?

32. This section corresponds to consultation questions:

- 2.9) What data could UK importers provide for Scope 1 emissions embodied within imported products on a product basis?
- 2.10) What alternative data sources would government need to consider when determining Scope 1 imported emissions on a product basis if these data cannot be provided by an importer?
- 2.11) Do you agree or disagree a CBAM should be applied to Scope 2 emissions embodied within imported products?
- 2.12) What data could UK importers provide for Scope 2 emissions embodied within imported products on a product basis?
- 2.13) What alternative data sources would government need to consider to determine Scope 2 imported emissions on a product basis if these data cannot be provided by an importer?
- 2.14) Should the government consider the use of product level electricity 'content' benchmarks and country level averages to calculate Scope 2 emissions from purchased electricity?
- 2.15) If yes, how should country level Scope 2 average emissions be calculated?
- 2.16) Should a CBAM be applied to the Scope 3 emissions embodied within imported products that are also indirectly covered by the UK ETS?
- 2.17) What data could UK importers provide for Scope 3 emissions embodied within imported products on a product basis?
- 2.18) What alternative data sources would government need to consider to determine Scope 3 imported emissions on a product basis if these data cannot be provided by an importer?
- 2.19) Do you have further comments on the inclusion and measurement of emissions embodied in imported products as part of a CBAM?

33. This section corresponds to consultation questions:

- 2.20) Should the price applied by a CBAM be comparable to the effective domestic carbon price paid, including accounting for any discounts available through free allowances or compensation?
- 2.21) Should the price applied by a CBAM track the prevailing UK ETS price throughout the year, as opposed to being set at a fixed annual rate?

34. Energy Systems Catapult (2018). Rethinking Decarbonisation Incentives: Current Economic Signals for Decarbonisation in the UK. <https://es.catapult.org.uk/report/rethinking-decarbonisation-incentives-current-economic-signals-for-decarbonisation-in-the-uk/>

35. This section corresponds to consultation questions:

- 2.22) Should the price applied by a CBAM to imported products be based on the value of the effective carbon price differential between the UK and the country where that good was produced?
- 2.23) Would it be practicable for importers to provide information on the effective carbon price already paid on products in the originating country?
- 2.24) What issues might arise in taking into account a carbon price already paid in another country when calculating the price applied by a CBAM?

36. DESNZ and HMT (2023). Address Carbon Leakage Risk to Support Decarbonisation.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147347/30_MARCH_2022_CONSULTATION_ON_ADDRESSING_CARBON_LEAKAGE_RISK_TO_SUPPORT_DECARBONISATION.pdf

37. This section corresponds to consultation questions:

- 2.25) Do you have any views on how a CBAM could be designed to ensure maximum simplicity? For example, by following the mechanism for other border charges such as tariffs and excise duties.
- 2.26) Should government prioritise reflecting the flexibility offered by the UK ETS in a CBAM? For example, by allowing emissions to be paid for at a separate point to the release of products into free circulation.
- 2.27) Are there further actions government could take to design a CBAM in a way that facilitates the smooth flow of trade?
- 2.28) Are there further interactions with the customs and/ or border systems which government should take into account for the development of a CBAM?

38. This section corresponds to consultation questions:

- 2.29) Are there further policy interactions that government should consider regarding potential implementation timelines for a CBAM?

39. This section corresponds to consultation questions:

- 3.1) Were mandatory product standards introduced, should the above criteria be used to decide on its initial sectoral scope? Are there other criteria that should be considered?
- 3.2) Which option, if any, would be most appropriate for the initial sectoral targeting of a mandatory product standard? Are there other/additional sectors which should be considered for early targeting, for example to address the risk of substitution?

40. Iron and Steel 17%, Cement and Concrete 9.9%: BEIS (2022). Final UK Greenhouse Gas Emissions National Statistics: 1990 to 2020. <https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2020>

41. Clean Energy Ministerial. Industrial Deep Decarbonisation Initiative. <https://www.cleanenergyministerial.org/initiatives-campaigns/industrial-deep-decarbonisation-initiative/>

42. Responsible Steel. <https://www.responsiblesteel.org/>

43. ICE (2022). Low Carbon Concrete Routemap. <https://www.ice.org.uk/engineering-resources/briefing-sheets/low-carbon-concrete-routemap>

44. This section corresponds to consultation questions:

- 3.3) Which option, if any, would be most appropriate for emissions scope of a mandatory product standard?

45. This section corresponds to consultation questions:

- 3.4) Which value chain option, if any, would be most appropriate to target with a mandatory product standard?

46. This section corresponds to consultation questions:

- 3.5) Which option, if any, would be most appropriate for targeting the point of obligation for a mandatory product standard for domestically produced goods?
- 3.6) What considerations should government consider when targeting the point of obligation for imported goods?
- 3.7) Do you agree or disagree that any mandatory product standard should apply to imports?

47. This section corresponds to consultation questions:

- 3.8) Do you agree or disagree with the proposed principles for setting thresholds and increasing the stringency of mandatory product standards over time?

48. DESNZ and HMT (2023). Address Carbon Leakage Risk to Support Decarbonisation.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1147347/30_MARCH_2022_CONSULTATION_ON_ADDRESSING_CARBON_LEAKAGE_RISK_TO_SUPPORT_DECARBONISATION.pdf

49. This section corresponds to consultation questions:
- 3.9) Should mandatory product standards be delivered in stages, broadly moving from a less stringent, relatively focussed application in the late 2020s to a more stringent and potentially broader application during the 2030s?
50. This section corresponds to consultation questions:
- 4.3) What is your view on the importance of finding ways to simplify the process for estimating product level emissions intensities?
 - 4.4) What are the different options for simplifying the process for estimating product level emissions intensities without compromising on the integrity of the estimates?
 - 4.5) Do you have any views or empirical data on the trade-offs between reductions in administrative costs in the generation of product level data, and the accuracy of such data?
51. Energy Systems Catapult (2023). Carbon Accounting and Standards in Industry: A Framework for Innovation and Growth. <https://es.catapult.org.uk/report/carbon-accounting-and-standards-in-industry-a-framework-for-innovation-and-growth>
52. This section corresponds to consultation questions:
- 4.7) How can carbon leakage measures be best designed to limit risk of circumvention?
 - 4.9) How can carbon leakage mitigation measures be best designed to limit risk of resource shuffling?
53. This section corresponds to consultation questions:
- 4.12) What are your views on the relative merits of the potential options presented above for addressing potential downstream impacts of carbon leakage measures? Are there alternative options for addressing this issue?
 - 4.14) How should the government strike the right balance between the need to address material downstream effects and the implications for both administrative complexity and consumer impacts?
54. This section corresponds to consultation questions:
- 4.17) For UK sectors affected by carbon leakage risk in export markets described in 4.1 above, what approaches would you propose for the mitigation of carbon leakage risk?
55. Giulia Claudia Leonelli (2022). Border Tax Adjustments and the WTO Law Compatibility of ETS/CBAM Export Rebates: Aut Simul Stabunt, Aut Simul Cadent. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4169897
56. Green Alliance, E3G, Clean Trade, and Friends of the Earth (2023). Joint Briefing – Leveraging trade policy and carbon border mechanisms to tackle consumption emissions and carbon leakage. <https://green-alliance.org.uk/wp-content/uploads/2023/04/Consumption-emissions-and-carbon-leakage-joint-briefing.pdf>
57. This section corresponds to consultation questions:
- 4.19) Should the use of carbon credits to offset emissions be considered within the assessment of a product?
58. This section corresponds to consultation questions:
- 6.1) Should the government introduce a new framework to enable the reporting and collection of product level emissions?
59. Energy Systems Catapult (2023). Carbon Accounting and Standards in Industry: A Framework for Innovation and Growth. <https://es.catapult.org.uk/report/carbon-accounting-and-standards-in-industry-a-framework-for-innovation-and-growth>
60. This section corresponds to consultation questions:
- 6.4) If you answered yes above, do you prefer (1) Attributing installation level data to products with default values or (2) Product life cycle assessments with default values, or another option?
 - 6.5) Would you prefer a single emissions reporting framework for all carbon leakage policy measures?

61. Energy Systems Catapult (2022). Carbon Accounting in Industry: Learning from the South Wales Industrial Cluster to Develop a Consistent and Coherent National Framework. <https://es.catapult.org.uk/report/carbon-accounting-in-industry/>
62. This section corresponds to consultation questions:
- 6.6) What are your views on balancing the administrative burden of product emissions reporting against the accuracy of results?
63. This section corresponds to consultation questions:
- 6.7) Which emissions factors should be used for the calculation of embodied emissions of products if emissions reporting requirements were introduced? What are the advantages or disadvantages of the options?
64. This section corresponds to consultation questions:
- 7.1) Should government pursue a Life Cycle Assessment-based approach?
 - 7.2) What is your preference for the type of Life Cycle Assessment methodology framework that should be adopted?
65. Energy Systems Catapult (2023). Carbon Accounting and Standards in Industry: A Framework for Innovation and Growth. <https://es.catapult.org.uk/report/carbon-accounting-and-standards-in-industry-a-framework-for-innovation-and-growth>
66. This section corresponds to consultation questions:
- 7.3) Should CO₂e/mass (including performance metric where relevant) be used as the metric for embodied emissions reporting and form the basis of any subsequent policy? If you disagree, please explain why and suggest an alternative metric.
67. This section corresponds to consultation questions:
- 7.5) Should the government introduce a data collection period before the full implementation of carbon leakage policy measures?
68. This section corresponds to consultation questions:
- 7.7) Should only those businesses in scope of current or upcoming policies be required report information about the emissions of products?
69. This section corresponds to consultation questions:
- 7.9) Should the scope of any new embodied emissions reporting be limited to that which is required by carbon leakage policy measures, if introduced?
70. This section corresponds to consultation questions:
- 7.9) Should the scope of any new embodied emissions reporting be limited to that which is required by carbon leakage policy measures, if introduced?
71. Energy Systems Catapult (2023). Carbon Accounting and Standards in Industry: A Framework for Innovation and Growth. <https://es.catapult.org.uk/report/carbon-accounting-and-standards-in-industry-a-framework-for-innovation-and-growth>
72. Energy Systems Catapult (2023). Carbon Accounting and Standards in Industry: A Framework for Innovation and Growth. <https://es.catapult.org.uk/report/carbon-accounting-and-standards-in-industry-a-framework-for-innovation-and-growth>
73. This section corresponds to consultation questions:
- 8.3) Do you have a preference for how frequently emissions data should be reported?
74. Energy Systems Catapult (2021). The Case for an Economy-Wide Carbon Regulator. <https://es.catapult.org.uk/report/the-case-for-an-economy-wide-carbon-regulator/>
75. BEIS (2022) Energy System 'digital spine' feasibility study. <https://www.gov.uk/government/publications/energy-system-digital-spine-feasibility-study>

76. This section corresponds to consultation questions:

- 8.3) Do you have a preference for how frequently emissions data should be reported?

77. This section corresponds to consultation questions:

- 8.5) What are your views on how product embodied emissions data should be verified? What are the advantages or disadvantages of the different options?

78. Energy Systems Catapult (2021). The Case for an Economy-Wide Carbon Regulator.

<https://es.catapult.org.uk/report/the-case-for-an-economy-wide-carbon-regulator/>

79. Energy Systems Catapult (2023). Carbon Accounting and Standards in Industry: A Framework for Innovation and Growth. <https://es.catapult.org.uk/report/carbon-accounting-and-standards-in-industry-a-framework-for-innovation-and-growth>

80. Energy Systems Catapult (2022). Carbon Accounting in Industry: Learning from the South Wales Industrial Cluster to Develop a Consistent and Coherent National Framework.

<https://es.catapult.org.uk/report/carbon-accounting-in-industry/>

81. This section corresponds to consultation questions:

- 8.6) Should embodied emissions data for products be made publicly available through either labelling, a publicly accessible database, both, or neither?



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