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Improving the market benefits for lower-carbon industrial production in Scotland

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1 Executive summary

This report was commissioned on behalf of the Scottish Government to investigate the potential for demand-side policy interventions to incentivise the decarbonisation of Scotland's energy-intensive industries (EIIs). It provides an overview of the evidence relating to the design of demand-side policies to influence EII emissions. It aims to: identify and categorise the products currently manufactured by Scottish EIIs; understand the size and nature of these markets; summarise the main influences governing buyer decision-making in these markets; and identify relevant and impactful demand-side policy interventions for Scotland. In doing so, it addresses four broad policy questions:

- What demand-side policies do other jurisdictions use to decarbonise EIIs?
- Which of these types of policies could be implemented in Scotland?
- How effectively could these policies influence purchasing decisions?
- Which EII sectors and products should demand-side policies prioritise?

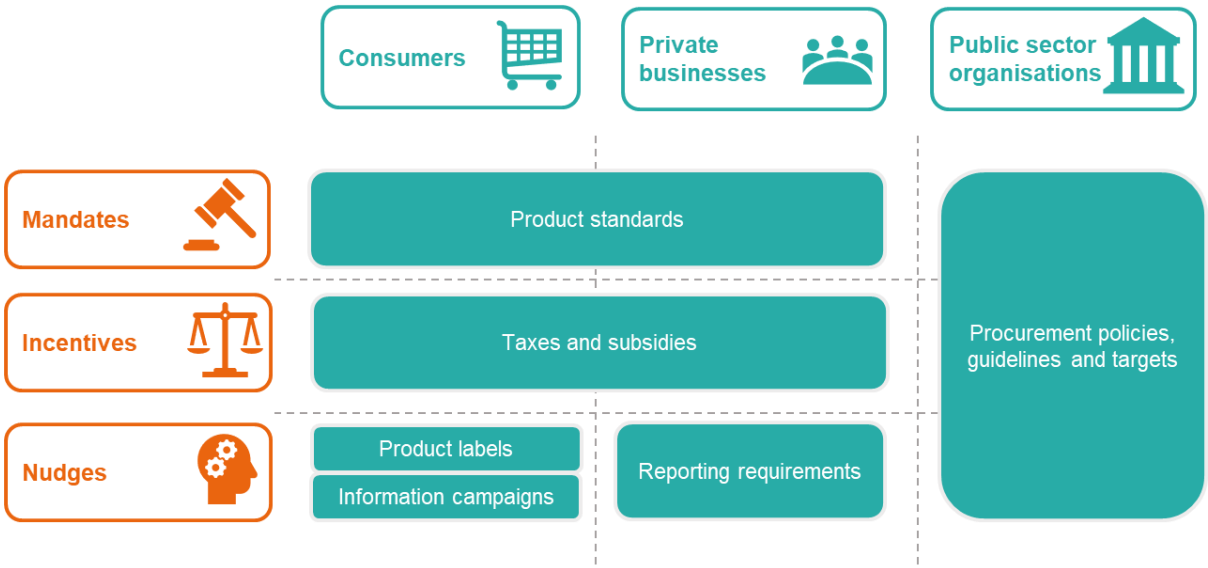
This evidence, along with evidence gathered through two in-depth case studies of emissions measurement and benchmarking, is then drawn on to assess alternative policy interventions against a set of criteria and to provide recommendations on the next steps for policymakers to pursue in Scotland.

EIIs are a significant contributor to both Scotland's economy and its environmental footprint, accounting for approximately 4% of economic output and 15% of greenhouse gas (GHG) emissions. Reducing emissions from these sectors will be a necessary condition for Scotland to meet its decarbonisation objectives.

Demand-side policy interventions – measures that influence the purchasing decisions of public sector organisations, private businesses and consumers to reduce their demand for emissions-intensive products – can play a key role in supporting the decarbonisation of EIIs. Such policies have the potential to influence purchasing decisions and help increase the competitiveness of Scottish businesses.

Demand-side policy interventions can be categorised into three approaches – mandates, incentives and nudges (see Figure 1). While other jurisdictions have implemented, or plan to implement, a range of demand-side interventions, the focus has generally been on public sector procurement: for example, the Buy Clean California Act and the Netherlands' CO_2 Performance Ladder. There are fewer examples of policies targeting businesses or consumers directly. Importantly, policymakers can draw on a range of inputs to support this process, notably existing product labels and environmental product declarations.

Figure 1: Policy intervention framework



There are two constraints which affect the ability of the Scottish Government to implement such demand-side policy interventions: reserved matters which the UK Government has not devolved to the Scottish Government and international trade law. Demand-side policies affecting consumers and private businesses are generally not devolved to the Scottish Government, although there are exceptions for food & drink and consumer advocacy. International trade law is unlikely to constrain demand-side policy interventions, so long as these do not explicitly discriminate against international sellers. The Scottish Government is therefore likely to have the most discretion with policies targeting devolved public sector procurement, although it can also influence UK-level policies targeting consumers and businesses, such as product standards and labelling rules.

The drivers of purchasing decisions vary by buyer type. While some private businesses do account for environmental considerations in their purchasing decisions, this is generally understood to reflect stakeholder preferences or concerns over future profitability. Conversely, there is evidence that consumers account for environmental considerations when making purchasing decisions, and that providing them with clear information can be a powerful tool for driving consumption towards green products. This suggests that nudges are likely to be more effective where they target consumers rather than businesses, although reporting requirements for businesses can magnify their effects.

Public sector organisations in Scotland are already encouraged to account for environmental considerations in their procurement processes. However, there are few explicit mandates or incentives. While this suggests that mandates or incentives could potentially have an impact, such policies would need to balance other procurement or policy priorities such as accessibility and quality.

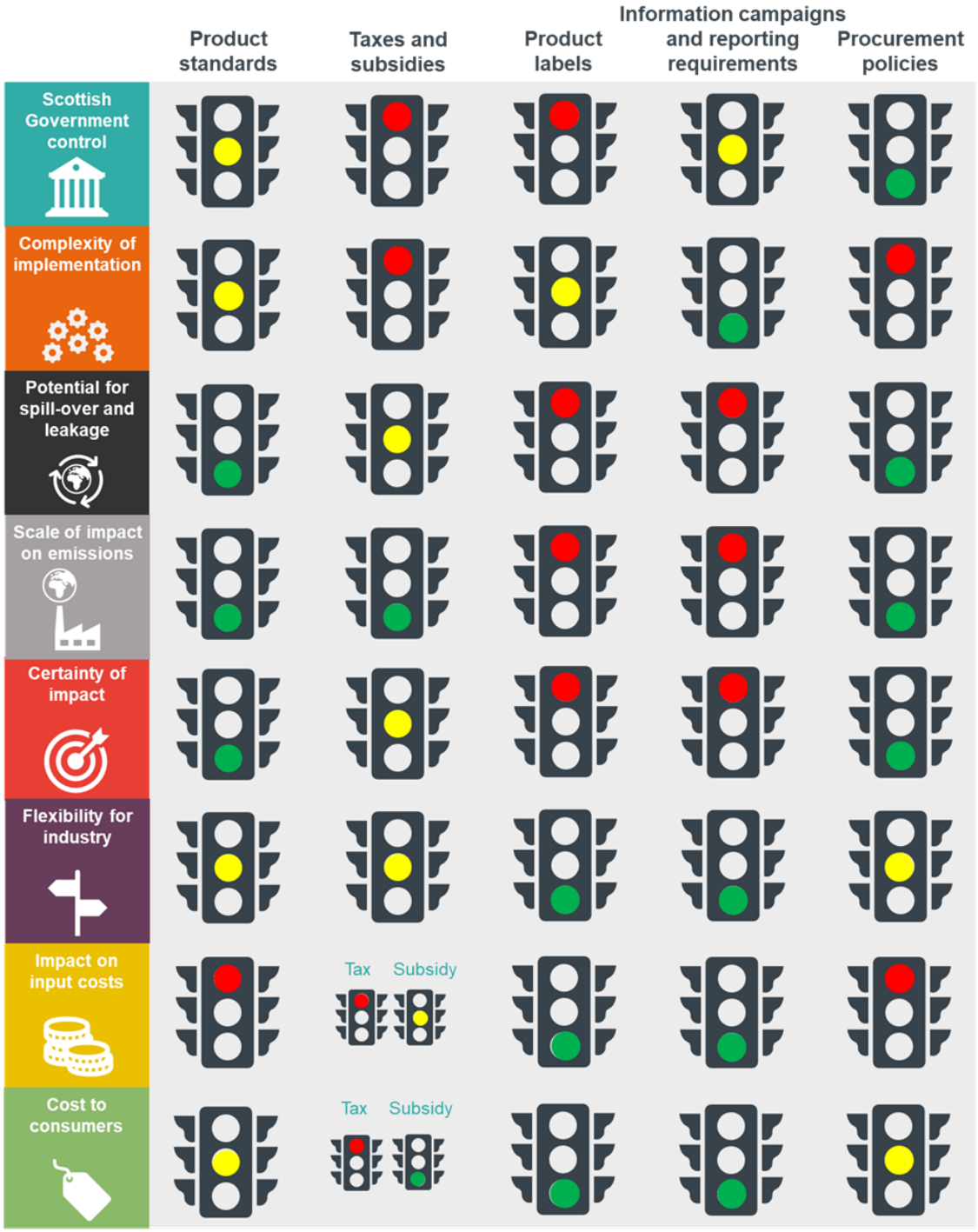
Demand-side policies are more likely to be effective if they target those EII sectors with the largest emissions-reduction potential and the largest share of domestic consumption as these policies primarily target domestic buyers. While over 70% of EII emissions come from the chemicals & pharmaceuticals and oil & gas refining sectors, it is estimated that over 85% of this output is exported. Exports in the cement and food & drink sectors, also large emitters, are proportionally much lower.[1] Once technically viable emissions reductions and domestic consumption are accounted for, the sectors where demand-side policy interventions have the greatest potential to drive significant emissions reductions are cement, followed by chemicals & pharmaceuticals, oil & gas refining and food & drink.

Policymakers should account for a range of considerations when determining which policies to prioritise in the Scottish context. This includes whether or not the Scottish Government can pursue a policy within its devolved powers, the complexity of implementing the policy, the potential for spill-over effects, the scale and certainty of a policy's impact on emissions, potential costs to industry and consumers, and the flexibility industry has in responding to a policy signal.

Five broad policy categories are assessed against these criteria in Figure 2, where green, amber and red ratings indicate the relative strengths of policy categories. No single policy is likely to be superior to another in all circumstances or for all sectors. For example, information campaigns are likely to be better suited to consumer-facing industries such as food & drink, while mandates such as product standards are best suited to sectors where demand largely comes from domestic consumption.

[1] This has been estimated using sector emissions and potential (technically viable) emissions reductions from the report on Deep Decarbonisation Pathways for Scottish Industries (published December 2020) and estimates of the proportion of domestic demand for each sector based on Scottish- and UK-level export and business statistics data.

Figure 2: Summary of policy assessments



Evidencing lower-carbon production is important regardless of the demand-side policy. Consistently measuring, benchmarking and validating emissions intensity across products informs purchasing decisions and allows policymakers to understand how emissions have changed over time. This supports the design and implementation of demand-side policies and allows carbon intensity information to be transmitted to various buyers to create market benefits for lower-carbon products. However, there is currently a deficit of information and tools on product-level carbon intensity.

Two case studies examined the measurement, benchmarking and validation of key products produced by Scottish EIIs: cement and whisky. These case studies highlighted that, for the selected products, there is good evidence of best-practice emissions intensity measurement. Furthermore, stakeholders indicated that they were generally able to measure their emissions more precisely, even where they were not currently doing so. However, case study participants also emphasised that benchmarking emissions needs to be done with caution, as simplistic comparisons can be misleading. Policymakers should, therefore, consult with industry to ensure that planned emissions measurements are consistent and comparable across products.

Recommendations for policymakers

These recommendations propose the key policies and next steps which should be prioritised in order to influence market conditions and create benefits for lower-carbon industrial production in Scotland.

Introduce basic reporting requirements and encourage voluntary emissions reporting for consumer-facing industries.

Basic emissions reporting requirements can be used to shift demand towards lower-carbon products and improve the information available to policymakers. This is likely to be particularly impactful for consumer-facing industries such as food & drink, where end-consumers have a relatively direct relationship with and understanding of the EII products in question. While some reporting requirements exist today under systems such as the UK Emissions Trading Scheme (ETS), these do not capture all sites or all emissions. More consistent reporting across manufacturers can help influence demand and communicate where Scottish producers are more environmentally friendly than international competitors, potentially helping to create a market for green Scottish products.

Review building regulations to ensure that lower-carbon products are used in construction.

Building regulations can help create markets for lower-carbon construction products such as cement and steel. Discussions with the cement sector highlighted that building designers and engineers are often unaware of lower-carbon product options available in construction today. Changes to building regulations can therefore be used to ensure that building designers and engineers are aware of, and encouraged to use, lower-carbon product options for appropriate applications, driving uptake of lower-carbon alternatives. When making any such changes, the whole life cycle of the building should be taken into account in order to avoid unintended consequences, and it will be important to engage affected industrial sectors and the construction industry early in the process.

Explore potential for an incentive-based scoring system in public procurement.

Public procurement policy is a devolved power and an important potential tool in driving shifts in demand due to the Scottish public sector's position as a large buyer of certain emissions-intensive products. In particular, the public sector in Scotland is a significant procurer of construction services which make use of a number of products manufactured by EIIs. Within procurement policy, interventions which create incentives for businesses to decarbonise without

barring them from participating in a tender process are preferred due to the flexibility they provide to producers. More flexible policies are less likely to impose significant costs on producers or the public sector, which makes them relatively low risk and low regret while still promoting demand for green products.

Further investigate consumer behaviour and consumer preferences for lower-carbon products produced by energy-intensive industries.

Understanding drivers of consumer behaviour and preferences for individual products is crucial to creating markets for low-carbon products. However, current evidence on demand for lower-carbon versions of individual products is limited, and this lack of information creates a barrier for policymakers in enacting effective policy. Further investigation of consumer preferences for key products, including a focus on a revealed-preferences approach to eliciting buyer responses in order to contend with the intention-action gap resulting from consumers stating one preference when their actual purchasing decisions reveal another, would be beneficial.

Influence and coordinate with other governments, particularly in areas where powers are not devolved.

While not all policy interventions are devolved to the Scottish Government, Scotland can still exercise significant influence over the UK Government to enact demand-side policies such as product labels. Furthermore, coordinating with other governments within the UK and abroad can be a way of enhancing the impact of a given policy. As noted in the UK's Industrial Decarbonisation Strategy, effective policy should be suited to a joint approach between the UK and other countries pursuing similar goals.

When designing and implementing any policies, a number of design and implementation principles should be taken into account. These include early engagement with industry and policy experts, reviewing policies often to ensure they are having the intended effect, and designing policies that are flexible and avoid unintended consequences.

Contents

2 Introduction

This report was commissioned on behalf of the Scottish Government to investigate the potential for demand-side policy interventions to incentivise the decarbonisation of Scotland's energy-intensive industries (EIIs).

EIIs comprise: cement; chemicals & pharmaceuticals; glass; food & drink; iron, steel & aluminium; oil & gas refining; and paper & pulp. They are significant contributors to both Scotland's economy and its environmental footprint, accounting for approximately 4% of economic output and 15% of greenhouse gas (GHG) emissions.[2] Reducing emissions from these manufacturing sub-sectors will be a necessary condition for meeting Scotland's decarbonisation objectives: reaching net zero by 2045 and reducing all industrial emissions by 43% on 2018 levels by 2032.[3]

Engagement with EII representatives in Scotland has highlighted a desire to see low-carbon products given greater credit in purchasing decisions by the public sector, consumers and businesses.[4] The Climate Change Committee (CCC) has also called for a stronger policy approach to decarbonisation which could in the longer term involve demand-side policy measures, including procurement and product standards that drive demand towards low-carbon products.[5] Creating market benefits for low-carbon products is particularly important due to the potential for carbon leakage in some sectors from market-based measures such as carbon prices. The creation of a market for low-carbon goods can help decarbonise industry without leading to offshoring of emissions by creating a price premium for those low-carbon goods.[6]

Demand-side policy interventions – measures that influence the purchasing decisions of public sector organisations, private businesses and consumers to reduce the demand for emissions-intensive products – can therefore play a key role in supporting the decarbonisation of EIIs. For the purposes of this study, demand-side policies are distinct from supply-side policies, which use subsidies, grants, subsidised financing, tax breaks or regulations to encourage EII sectors to reduce the emissions intensity of their products. Likewise, they are distinct from market-based measures, which use economy-wide taxes or trading schemes to influence both demand and supply decisions.

At a high level, demand-side policy interventions have three potential consequences:

- First, demand-side policies can affect purchasing decisions, encouraging consumers, businesses and the public sector to buy fewer emissions-intensive products, or to prefer less emissions-intensive substitutes.
- Second, they encourage EIIs, including EIIs in other jurisdictions that export to Scotland, to reduce the emissions intensity of their products. In this respect, demand-side policies have an advantage over supply-side policies and market-based measures in that they have an effect on non-Scottish producers. Moreover, by ensuring a level playing field, such policies are less likely to lead to 'carbon leakage', which would likely occur if Scottish producers were regulated and taxed more than international competitors.

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2 Paper 6/1 – Industry background information, from the Just Transition Commission Scotland. Scottish EIIs contributed approximately £6 billion in gross value added (GVA) in 2018 (4% of total Scottish GVA).

3 Securing a green recovery on a path to net zero: climate change plan 2018–2032 – update, published in December 2020.

4 For more information, see Decarbonising Scotland's Industrial Sectors and Sites: A Paper for Discussion with Scottish Energy Intensive Industries, published in April 2019 by the Scottish Government.

5 Net Zero: The UK's contribution to stopping global warming, published by the CCC in May 2019.

6 Ibid.

- Third, insofar as Scottish EIIs have a lower emissions intensity than competitors in other jurisdictions, demand-side policies will help increase the competitiveness of Scottish businesses.

This report provides an overview of the evidence relating to the design of demand-side policies to influence EII emissions. It aims to identify and categorise the products currently manufactured by Scottish EIIs, understand the size and nature of these markets, summarise the main influences governing buyer decision-making in these markets, and identify relevant and impactful demand-side policy interventions for Scotland. In doing so, it addresses four broad policy questions:

- What demand-side policies do other jurisdictions use to decarbonise EIIs?
- Which of these types of policies could be implemented in Scotland?
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This evidence, along with evidence gathered through two in-depth case studies of emissions measurement and benchmarking, is then drawn on to assess alternative policy interventions against a set of criteria and provide recommendations on the next steps for policymakers to pursue in Scotland.

The remainder of this report proceeds as follows:

Section 0 reviews the range of demand-side policy interventions that aim to influence purchasing decisions in other jurisdictions and the 'policy inputs' that help facilitate their implementation.

Section 0 discusses which of these policy interventions might be feasibly implemented by the Scottish Government, considering devolved powers and international trade law.

Section 0 discusses how consumers, businesses and public sector organisations currently account for environmental considerations when making purchasing decisions.

Section 0 draws on the evidence above to assess key policies across a range of relevant dimensions.

Section 0 summarises evidence gathered on emissions measurement, benchmarking and validation gathered through case studies of the Scottish cement and Scotch Whisky sectors.

Section 0 provides concise recommendations and next steps focused on policies for prioritisation, key design principles and key implementation principles.

Section 0 draws the evidence base together and concludes.

Annex A presents an overview of Scottish EIIs, including their emissions footprint and abatement potential and the ability of demand-side policy to accelerate this abatement. The underlying data and calculations used in this section are included in an accompanying **Scottish EII Emissions Dashboard**, held by the Scottish Government for internal reference.

Annex B explores high level considerations and recommendations for designing a basket of goods approach to help inform policymakers' decisions and consumer behaviour.

3 International evidence on demand-side policy interventions

This section reviews the range of demand-side policy interventions that aim to influence the emissions of EIIs in other jurisdictions.

Sub-section 0 presents a framework for categorising interventions by buyer type and intervention approach. **Sub-section 0** reviews examples of demand-side policy interventions and discusses their relative strengths and weaknesses at a high level in order to provide real-world examples of the applicable policy frameworks. **Sub-section 0** reviews the 'policy inputs' that can facilitate the implementation of demand-side policy interventions.

3.1 Policy framework

Demand-side policy interventions can influence the decisions of three types of **buyers**:

- **consumers;**
- **private businesses;** and
- **public sector organisations**.

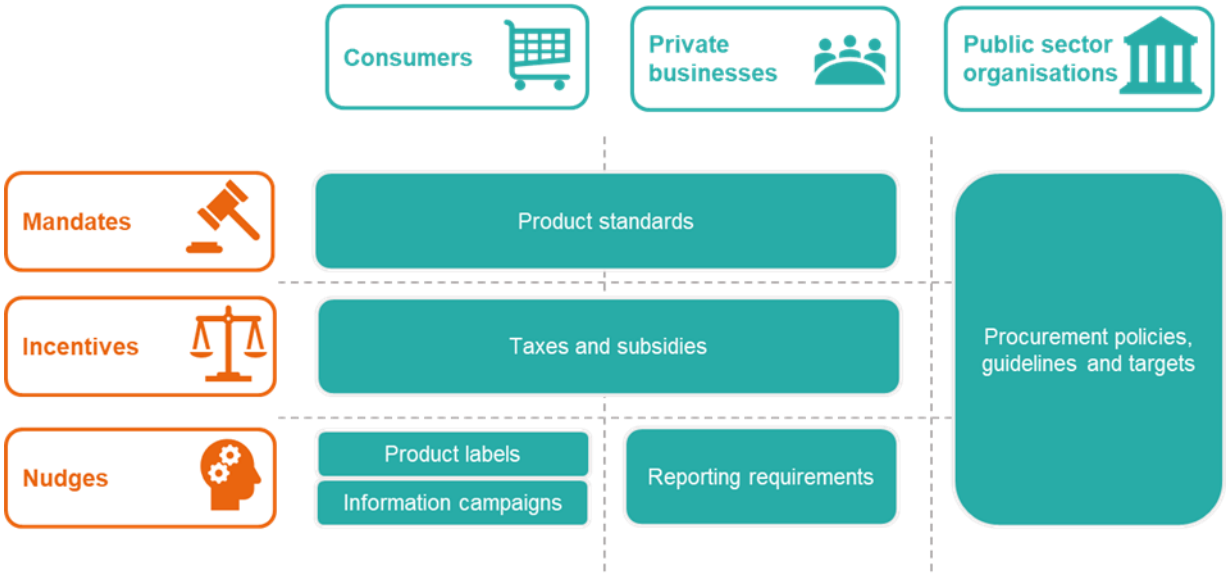
An individual policy intervention may target one of these buyer types or work more widely to address a range of buyer types. Further detail about dependencies between their respective purchasing decisions in the context of Scottish EIIs is presented in Section 0.

Demand-side policy interventions can be categorised into three **approaches**, which vary in how prescriptive they are:

1. **Mandates:** Policies that ban the purchase of products which fail to meet a particular standard. Examples include mandatory product standards that limit which products can be purchased or which products can be purchased by a particular buyer (e.g. a business or public sector organisation).
2. **Incentives**: Policies which provide measurable and specified (e.g. financial) benefits to encourage the purchase of certain products and/or discourage the purchase of others. These include product-specific taxes and subsidies, and quality criteria in government procurement that reward certain products.
3. **Nudges:** Behavioural interventions designed to encourage buyers to prefer certain products without explicitly changing their incentives. These include product labels, public information campaigns and reporting requirements for businesses and public sector organisations.

Figure 3 provides an overview of this policy framework and example policy interventions that apply to each buyer type and approach.

Figure 3: Policy intervention framework



3.2 Examples of policy interventions

A range of demand-side environmental policy interventions have been implemented in other jurisdictions, many of which directly or indirectly support the decarbonisation of EIIs.

This section presents key examples of such policy interventions, grouped in accordance with the policy framework discussed in Sub-section 0.

These examples are not exhaustive but cover the most notable policies that are relevant for EII decarbonisation in Scotland. Importantly, while individual demand-side policies are presented as standalone interventions, these often form part of wider environmental policy interventions.

Mandates

One approach to supporting the decarbonisation of EIIs is the introduction of mandates. Mandates are policies that ban the purchase of products which do not meet certain criteria, and they can apply across the three buyer types: consumers, businesses and public sector organisations.

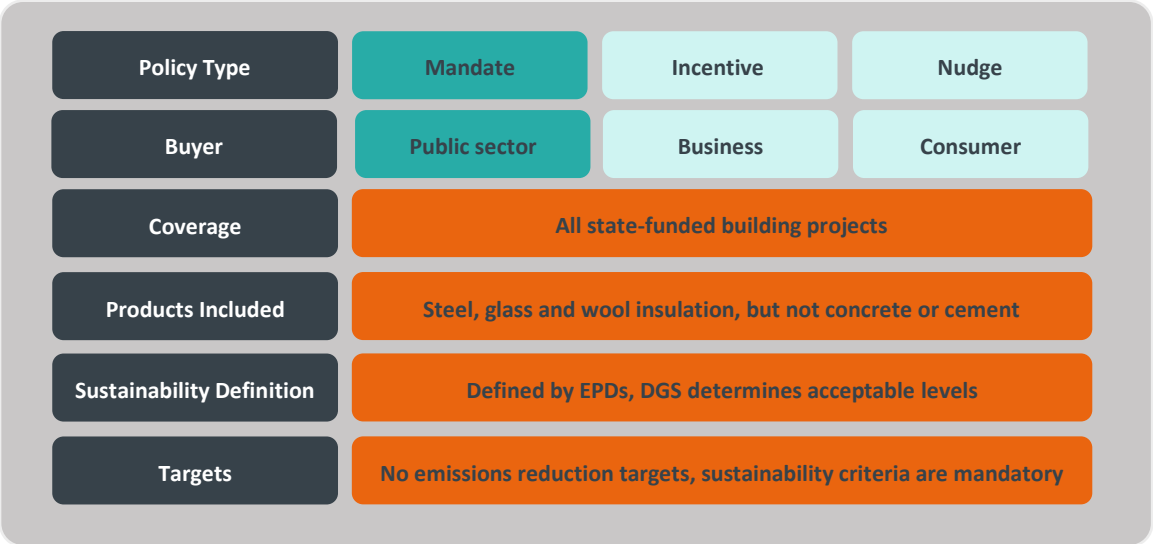
For public sector buyers, demand-side mandates include the introduction of binding procurement requirements in public sector tenders. Examples include requiring that public sector organisations can only purchase products that are able to demonstrate a threshold level of environmental performance or banning the purchase of a specific product – e.g. the Buy Clean California Act, the Rijkswaterstaat[7] Environmental Cost Indicator thresholds in the Netherlands and the Government Buying Standards in the UK.

Demand-side mandates targeted at businesses and consumers take the form of mandatory product standards which explicitly define the types of products that businesses and consumers are legally able to purchase. This may involve banning products directly or banning products that fail to demonstrate a certain environmental requirement – for example, Norway's aviation fuel blending mandate or the bans on single use plastic products implemented in India, Canada and some Australian and

[7] The Rijkswaterstaat is part of the Ministry of Infrastructure and Water Management of the Netherlands.

American states. Importantly, these policies are unlikely to support improved environmental performance by energy-intensive industries, but rather encourage businesses and consumers to substitute alternative products with a lower environmental footprint.

The Buy Clean California Act (California)



Passed in October 2017, the Buy Clean California Act (Assembly Bill No. 262)[8] requires state-funded building projects in California to account for the effects of certain construction materials on global warming and establishes a threshold level of environmental performance for these products.

The California Department for General Services (DGS) will define a 'maximum acceptable' level of global warming potential (GWP) for the construction materials that are covered by the Act. GWP standards were published in January 2021 and will be reviewed every three years. GWP is measured using a full life-cycle cost accounting method and represents the manufacturers' GWP of the eligible material's production life cycle.[9]

Successful bidders for a public works project must submit environmental product declarations (EPDs) which demonstrate that they are compliant with these requirements to the public sector organisation responsible for awarding the contract. EPDs are International Standards Organisation (ISO) type III declarations which communicate the life-cycle impacts of products and can be used for all goods and services (see Sub-section 0 for further detail). The EPDs must be 'facility-specific'. That is, they must be specific to the production methods used at the plant where the product was made, rather than being an average for the manufacturer.

The materials included in the Act are structural steel, concrete-reinforcing steel, flat glass and mineral wool insulation. Carbon-intensive materials such as concrete and cement are not included.

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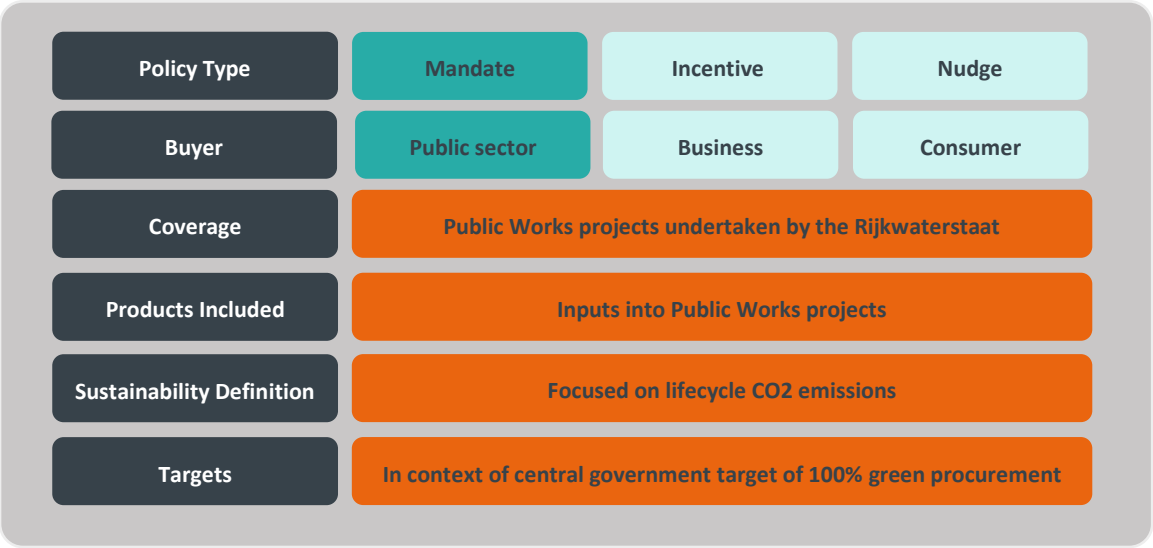
8 See https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201720180AB262 for legislation.

9 https://www.dgs.ca.gov/PD/Resources/Page-Content/Procurement-Division-Resources-List-Folder/Buy-Clean-California-Act

A key strength of the Act is that it sets a fixed, clear requirement, explicitly banning products which do not meet an acceptable level of environmental performance. Proponents of the Act also point to its potential to have a positive impact on local industry, by helping 'heavily regulated California steel mills that compete with unregulated or under-regulated mills in China, India and elsewhere'.[10]

A limitation of the Act is the small number of products that it applies to. In particular, concrete, cement and aluminium are all excluded. This may be attributable to 'significant opposition' from the cement and concrete industries.[11] However, there is scope for additional products to be introduced into the Buy Clean California Act in future.

Environmental cost indicators (Netherlands)



Environmental cost indicators are one of the tools used by the Rijkwaterstaat (the Department of Public Works of the Ministry of Infrastructure and the Environment) to facilitate green public sector procurement for infrastructure projects in the Netherlands. Procuring agencies set a maximum environmental cost indicator (ECI) for a procurement process, and do not consider tenders that exceed this value.[12]

The approach relies on DuboCalc, a bespoke software package developed by the Rijkswaterstaat. DuboCalc calculates the life-cycle (cradle-to-grave) environmental impacts of products used in a particular tender, according to ISO standard 14040 and the NEN-EN 15804 Environmental Assessment Method – Buildings and Construction.[13] DuboCalc is free for bidders to use and can be obtained simply by registering at the DuboCalc website. Bidders have responded enthusiastically to being asked to use DuboCalc and have highlighted that in some cases it has helped them achieve better designs.[14] The Rijkwaterstaat also uses DuboCalc to incentivise environmental

[10] https://www.rics.org/north-america/news-insight/future-of-surveying/sustainability/the-buy-clean-california-act---what-can-we-learn-from-it/

[11] https://www.atlastube.com/atlas-observer/the-new-buy-clean-california-act-good-intentions-with-unintended-consequences/

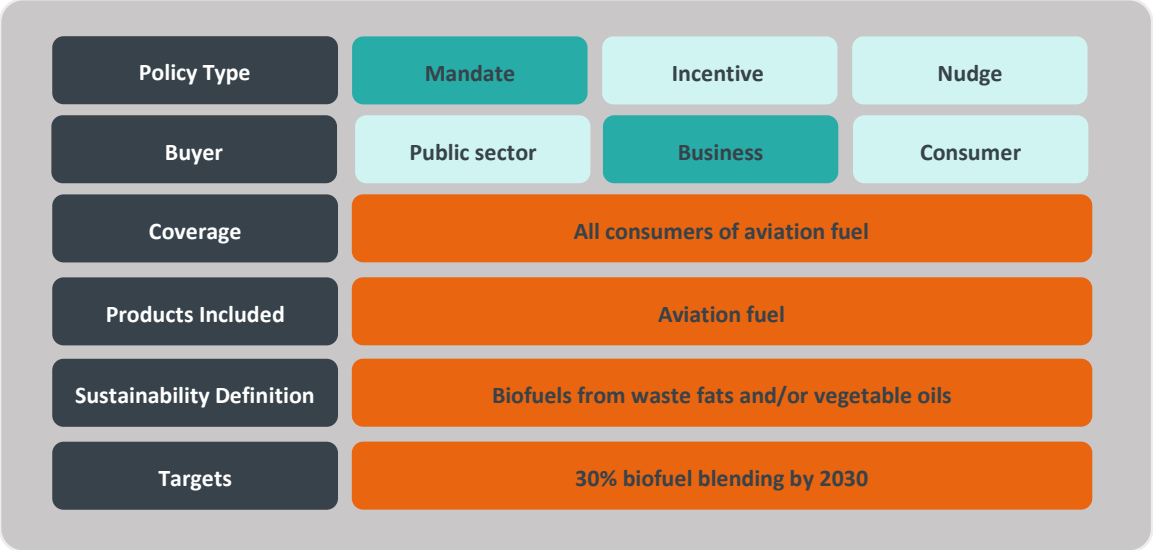
[12] https://ec.europa.eu/environment/gpp/pdf/news_alert/Issue36_Case_Study78_Rijkswaterstaat.pdf

[13] https://www.dubocalc.nl/en/what-is-dubocalc/

[14] https://ec.europa.eu/environment/gpp/pdf/news_alert/Issue36_Case_Study78_Rijkswaterstaat.pdf

performance above a mandated minimum threshold by subtracting the monetised benefits of an ECI from the quoted price (see discussion on incentives below).

Advanced Aviation Biofuel Mandate (Norway)



In 2018, the Norwegian government announced a mandate which required all jet fuel sold from 2020 to include a minimum of 0.5% advanced biofuel. This policy intervention supports the government's target of a 30% biofuel share in aviation by 2030 and aims to create a market for alternative aviation fuels which facilitates the required technological and industrial development.[15]

Because of the nature of the air transport sector, domestic biofuel blending mandates have the potential to lead to emissions leakage. For example, consumers may substitute away from leisure travel to Norway, in favour of a destination where air travel is relatively cheaper. As a result, some Norwegian airlines have expressed their preference for international mandates to 'ensure a level playing field'.[16]

Incentives

As an alternative approach to establishing mandates, policymakers can instead introduce policies which incentivise buyers to account for the environmental impact of the products they purchase.

The nature of incentive-based policy interventions will vary depending on the buyer type they target. For public sector buyers, incentives can be built into procurement contracts by explicitly incorporating a supplier's climate impact into the cost or quality scores used to determine purchase decisions. The CO_2 Performance Ladder utilised by the Rijkwaterstaat in the Netherlands is an example of this type of policy.

Policies designed to influence the incentives for businesses and consumers include taxes and subsidies. A number of 'environmental' taxes exist globally, though few

[15] https://www.globenewswire.com/news-release/2020/09/21/2096569/0/en/Sweden-and-Norway-Target-Increased-Use-of-Sustainable-Aviation-Fuel.html

[16] https://www.euractiv.com/section/aviation/news/airlines-get-ready-for-jet-biofuel-take-off-in-norway/

address EIIs. One exception is Carbon Border Adjustment Mechanisms which have been proposed by a number of jurisdictions, including the European Union.

CO_2 Performance Ladder (Netherlands)

The CO_2 Performance Ladder is another of the tools used by the Rijkwaterstaat to facilitate green public sector procurement for infrastructure projects.[17] The policy incentivises public sector organisations undertaking infrastructure projects to select suppliers committed to ambitious levels of CO_2 reduction by artificially lowering their tender price.

There is evidence that the scheme is effective, with a 2016 comparative study finding that organisations with a certificate on the CO_2 Performance Ladders have an annual CO_2 reduction of 3.2% and reduce their GHG emissions twice as fast as the average Dutch company.[18] This has made it an attractive potential policy for other governments as well. A 2018 feasibility study which looked at adapting the CO_2 Performance Ladder to local governments in Victoria, Australia found that the policy was relatively low risk and judged it to be the most appropriate low-carbon procurement scheme for these governments.[19]

Alongside a tender response, suppliers can voluntarily apply for and submit a CO_2 Performance Ladder certificate which will commit them to meeting the requirements of one of five 'rungs' of the ladder. The lowest rung commits the supplier to measuring its own CO_2 emissions; higher rungs commit suppliers to establishing and achieving

17 https://gpp2020.eu/fileadmin/files/Training_materials/Training_reports_photos_etc/6_Presentation_Riga_blue_version_PP.pdf

18 Rietbergen, Martijn & Opstelten, Ivo & Blok, Kornelius. 2017. Improving energy and carbon management in construction and civil engineering companies—evaluating the impacts of the CO2 Performance Ladder. *Energy Efficiency, 10*.

19 https://www.localgovernment.vic.gov.au/__data/assets/pdf_file/0026/166643/CO2-Performance-Ladder-Feasibility-Study-PDF,-879KB.pdf

emissions-reduction goals across the entire supply chain.[20] Each rung reduces the price by 1%, up to a maximum of 5%, effectively increasing the likelihood that tenders with lower climate impacts will be selected.[21] These rungs cover Scope 1, 2 and 3 emissions to varying degrees – on rungs 1 to 3, suppliers commit to reducing Scope 1 and 2 emissions, while, on rungs 4 and 5, suppliers commit to reducing Scope 3 emissions.[22] Contractors demonstrate they have delivered the level of performance required by their bids by achieving a CO_2 Awareness Certificate issued by certified authorities approved by the Council of Accreditation.[23] To dissuade suppliers from unrealistic bids, suppliers which do not achieve agreed reductions can be subject to sanctions equal to one and a half times the benefit the supplier received from the emissions reductions in the bid.[24]

A noticeable benefit of this policy is its simplicity. The policy design is easy to understand, with clear measurable incentives attached to improved environmental performance. It also allows for flexibility in the level of environmental performance sufficient to achieve rewards. The policy therefore incentivises suppliers which may not currently be able to achieve the most ambitious CO_2 reductions to still work towards improved environmental performance, particularly when compared to binary 'pass/fail' criteria. Likewise, it can be more effective than a minimum standard in encouraging environmentally efficient producers to further improve their efficiency.[25]

Carbon Border Adjustment Mechanisms (Proposed, EU)

Policy Type	Mandate	Incentive	Nudge
Buyer	Public sector	Business	Consumer
Coverage	Importers and exporters of products		
Products Included	To be determined: likely limited to emissions intensive products		
Sustainability Definition	CO_2 content		
Targets	EU Net Zero 2050 target		

20 https://gpp2020.eu/fileadmin/files/Training_materials/Training_reports_photos_etc/6_Presentation_Riga_blue_version_PP.pdf

21 http://www.oecd.org/gov/ethics/gpp-procurement-Netherlands.pdf

22 https://gpp2020.eu/fileadmin/files/Training_materials/Training_reports_photos_etc/6_Presentation_Riga_blue_version_PP.pdf

23 https://ec.europa.eu/environment/gpp/pdf/news_alert/Issue36_Case_Study78_Rijkswaterstaat.pdf

24 https://www.rijkswaterstaat.nl/zakelijk/zakendoen-met-rijkswaterstaat/inkoopbeleid/duurzaam-inkopen/co2-prestatieladder.aspx

25 https://www.climateworks.org/wp-content/uploads/2019/09/Green-Public-Procurement-Final-28Aug2019.pdf

The European Commission is currently consulting on a potential Carbon Border Adjustment Mechanism (CBAM) which would require importers of certain products to pay a tax equivalent to the cost of the EU Emissions Trading Scheme (ETS) allowances that would have been required had the product been produced domestically. Depending on the eventual design, the CBAM may also compensate EU exporters for emissions allowances purchased.

The CBAM aims to prevent carbon leakage, which occurs as a result of companies transferring production to countries outside the EU that are less strict about emissions intensities.[26] It can, therefore, protect low-emissions domestic EIIs from competition with high-emissions international competitors, and can have the secondary effect of encouraging international EIIs to decarbonise.[27]

A key disadvantage of the proposed CBAM is the implementation complexity associated with measuring and validating the embedded carbon in a wide range of imports. Likewise, the CBAM has the potential to introduce distortions, particularly if some types of imports are excluded. For example, if the CBAM were to apply to the import of steel but not of finished products with significant steel content (e.g. wind turbines), it could incentivise the import of finished products at the expense of domestic industry.

Nudges

A third set of demand-side policy interventions also aims to 'nudge' buyers to consider environmental impact in their purchasing decisions, without imposing explicit incentives or standards.

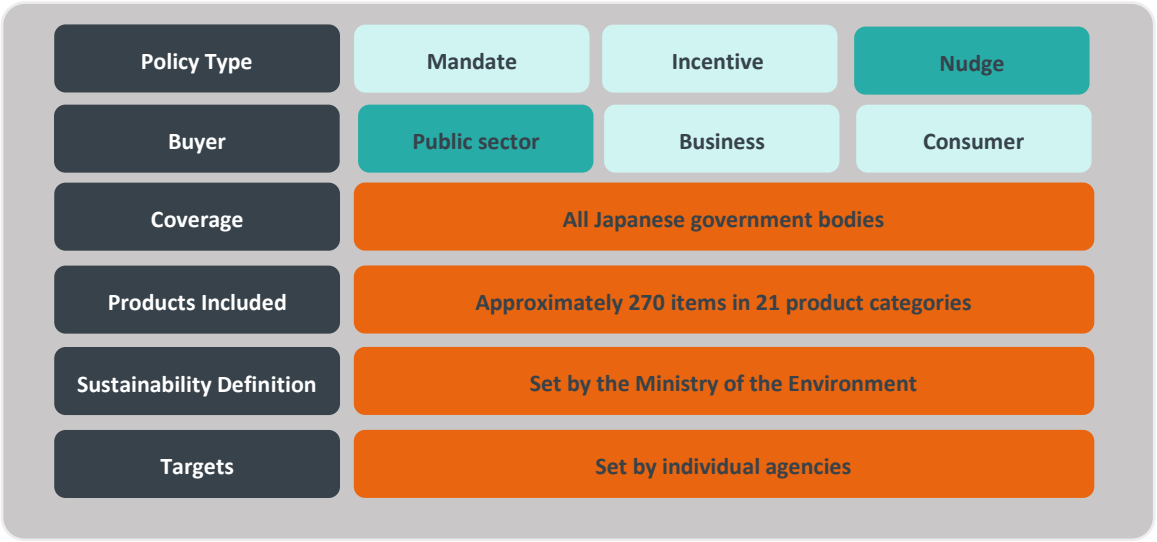
For governments and businesses, policy nudges can take the form of voluntary procurement guidelines or reporting requirements: for example, the Japanese Act on Promoting Green Purchasing and the EU Green Public Procurement guidelines which help buyers to develop procurement policies that account for environmental performance.

For consumers, the most prominent nudge policies involve product labelling and support public information campaigns. Government could introduce its own labelling scheme, such as the Eco Mark in Japan, or require certain products to carry an existing environmental label. Both approaches nudge consumers to change their purchasing decisions.

[26] https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12228-Carbon-Border-Adjustment-Mechanism

[27] https://www.frontier-economics.com/uk/en/news-and-articles/articles/article-i7771-carbon-border-taxes-help-or-harm-to-european-industry/

Act on Promoting Green Purchasing (Japan)



Japan's Act on Promoting Green Purchasing (2001)[28] is one example of a policy nudge. Instead of legally requiring green procurement for public agencies, the central government sets out a number of criteria for purchases to be considered 'green'.

The Act covers approximately 270 items, including vehicles, public works projects and smaller products like paper and office equipment.[29]

Central government does not set a requirement for the level of green procurement for government agencies, but it does require that agencies design their own green procurement policies and regularly report on their performance to the Minister for the Environment. This encourages green purchasing decisions without explicitly imposing criteria or mandates.

The Act is supported by a number of other demand-side policies, including the Green Contracting Law which defines recommended contracting methods for six types of contracts (electricity, vehicles, ships, energy service company projects, architectural design and industrial waste management).[30] The law uses three methods for prioritising green procurement:

- The 'bottom-cut' method involves setting an environmental minimum standard on tenders, and then selecting the winner on the basis of non-environmental considerations. This method is used for the procurement of electricity, small watercraft and industrial waste contracts.
- The 'comprehensive' evaluation method evaluates tenders on criteria which include both environmental and non-environmental criteria. This method is used for the procurement of automobiles.
- The 'proposal' method also evaluates tenders on both environmental and non-environmental criteria but puts the onus on the tenderer to demonstrate that their

[28] Act No. 100 of May 31, 2000, which entered into effect in 2001. See http://www.env.go.jp/en/laws/policy/green/

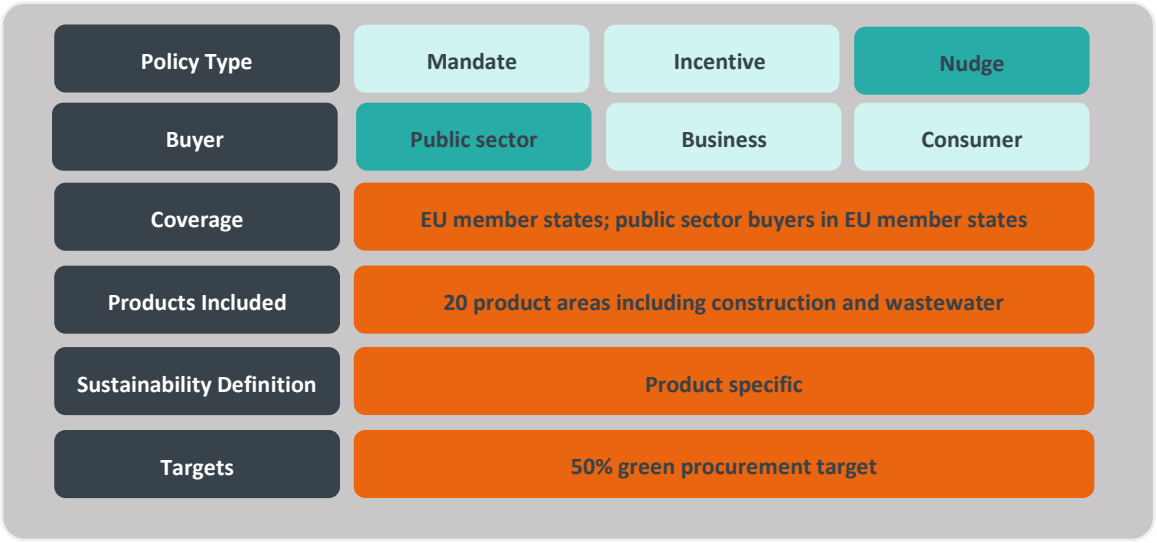
[29] https://www.env.go.jp/en/policy/economy/pdf/gpp_pamphlet.pdf

[30] https://www.env.go.jp/en/policy/economy/pdf/gpp_pamphlet.pdf

proposal meets the procurer's requirements. This method is used for the procurement of ships and buildings.

Note that these methods are treated as nudges rather than incentives or mandates because they are recommended rather than required by central government.

Green Public Procurement guidelines (EU)



The EU developed its Green Public Procurement (GPP) criteria to encourage green procurement amongst its member states.[31] For a number of product categories, they set out voluntary evaluation criteria and green procurement targets which can be incorporated into procurement contracts to reduce the environmental impact. The criteria cover two levels: 'core' criteria focus on key aspects of environmental performance, while 'comprehensive' criteria consider additional aspects.

In total, EU GPP criteria are available for over 20 product areas including road and office building design, construction and management, and wastewater infrastructure.

Member states are also encouraged to draw up their own National Action Plans for Green Public Procurement, which can utilise the GPP criteria.[32] The EU has set a voluntary target of at least 50% procurement as green, where 'green' means tendering procedures must comply with the 'core' GPP criteria.[33]

In practice, the GPP criteria act as a supporting framework to guide implementation of green procurement and provide recommendations as to which levels of green procurement should be considered sufficient. The criteria are not binding, and thus they are a nudge targeted at governments in EU member states. However, public bodies of EU member states can incorporate the GPP criteria into their own procurement policies in a more prescriptive way, for example as the basis for a mandate or incentive policy.

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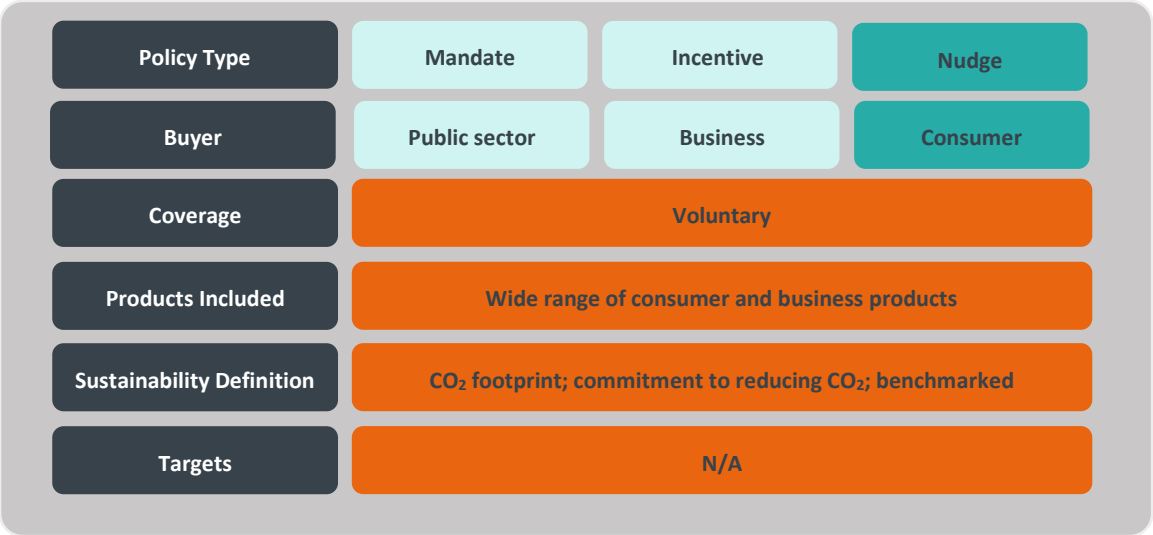
[31] GPP is a voluntary instrument with sector and product dependent criteria which can be found at https://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm. Public procurement in the EU is also subject to Directive 2014/24/EU and Directive 2014/25/EU.

[32] https://ec.europa.eu/environment/gpp/action_plan_en.htm

[33] https://ec.europa.eu/environment/gpp/gpp_policy_en.htm

For example, the UK has set out sustainable procurement mandates in the Government Buying Standards (GBS), which stipulate minimum environmental (including energy efficiency) standards for a range of products including electrical goods, furniture and catering services.[34]

Carbon Trust Carbon Footprint labelling scheme (international)



The Carbon Trust Carbon Footprint labelling scheme primarily serves as a nudge to influence consumer purchasing decisions, although it also has applications for businesses and government purchasing (see discussion on 'policy inputs' in Section 0). It is a voluntary label on commercial products, aimed at enabling consumers to purchase products which have the lowest carbon emissions impact over their life cycle.

The Carbon Trust verifies organisation and product carbon footprint, and then provides the Carbon Trust 'badges' to demonstrate that certain standards have been met. It uses a life-cycle assessment of the product: cradle-to-gate or cradle-to-grave depending on the circumstances. The information and methodological requirements vary depending on the type of label the product is being evaluated for.[35] These labels have been applied to a range of products and industries, including Cemex cement[36] and Walkers crisps.[37]

There are four main labels:

- CO_2 measured: indicates that the carbon footprint of the product has been measured;
- Reducing CO_2: indicates a commitment to reduction of CO_2, not including offsets, over two years;
- Carbon neutral: indicates that the product is carbon neutral; and

[34] https://www.gov.uk/government/collections/sustainable-procurement-the-government-buying-standards-gbs

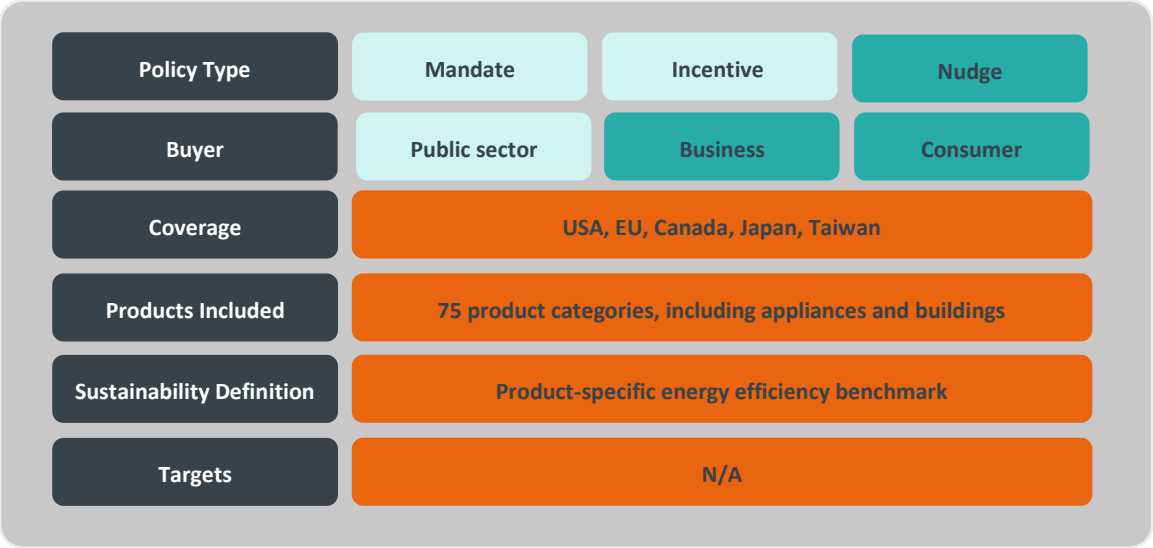
[35] https://www.carbontrust.com/what-we-do/assurance-and-certification/product-carbon-footprint-label

[36] https://www.worldcement.com/europe-cis/08042010/cemex_launches_carbon_labelled_cement/

[37] https://www.carbontrust.com/news-and-events/news/the-carbon-trust-launches-worlds-first-carbon-footprinting-gallery

- Lower CO_2: indicates that the life-cycle carbon footprint of a product is significantly lower than the life-cycle carbon footprint of the market-dominant product in its category.

Energy Star label programme (USA)



The Energy Star label is a programme run by the US Department of Energy which provides information on the energy consumption of products.[38] The Energy Star product label is found on 75 different product categories, including homes, commercial buildings and industrial plants. It was established by the United States Environmental Protection Agency in 1992 and has since been partly adopted in the EU, Canada, Japan and Taiwan.[39] The Energy Star label applies to consumer purchases (e.g. appliances) as well as to business purchases (e.g. commercial property).

A number of state and local governments in the United States use the Energy Star Portfolio Manager® tool to inform their energy benchmarking and transparency policies.[40]

Section 0 discusses how labels such as the Carbon Trust Carbon Footprint label and Energy Star label can be used to inform or support policy interventions.

Summary

There are a range of policy interventions planned or implemented in other jurisdictions that aim to influence purchasing decisions in order to encourage higher levels of supplier environmental performance. Some of these specifically target EII products, but the majority have broader environmental objectives.

These policies can be categorised into a policy framework with three broad types of buyers (consumers, businesses and public sector organisations), and three broad policy approaches (mandates, incentives and nudges), see Figure 4.

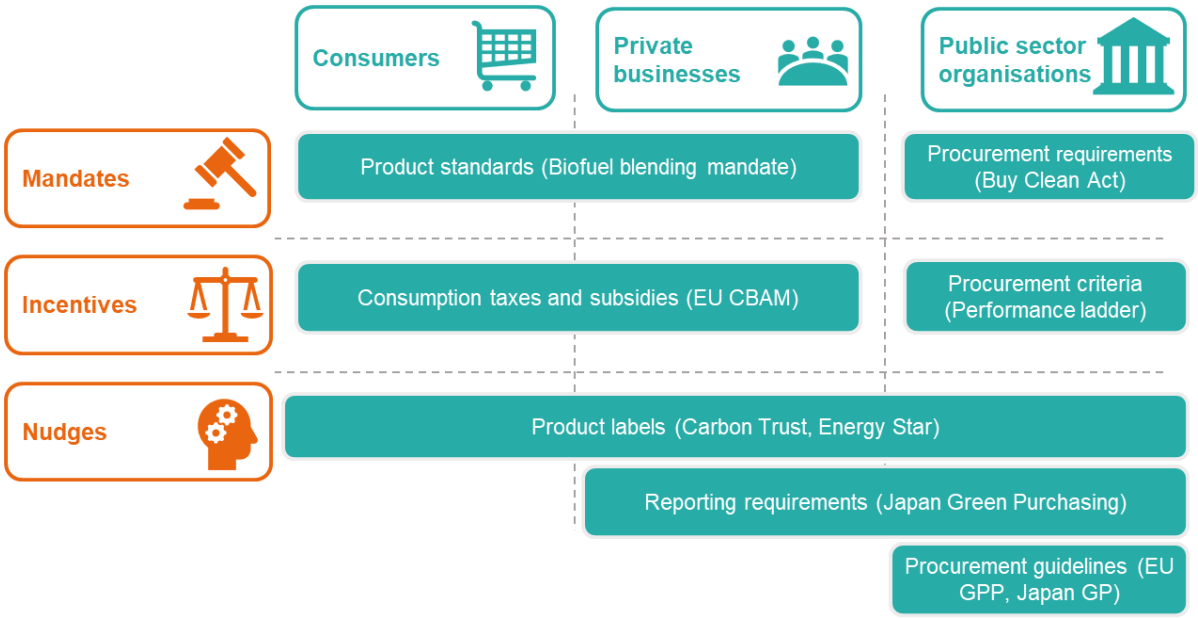
[38] https://www.energystar.gov/about

[39] https://www.energystar.gov/partner_resources/international_partners

[40] https://www.energystar.gov/about/energy_star_program_influence_refrigerators

The most common policy interventions targeting EII emissions tend to influence public sector procurement, but a wider range of environmental performance policies influence consumer and business decisions.

Figure 4: Policy framework, with examples from other jurisdictions



3.3 Policy design

Demand-side policies that encourage the decarbonisation of EIIs generally comprise four elements:

1. **Measure**: A measure of environmental performance: for example, tonnes of CO_2e per product or whether a particular production process is used.
2. **Benchmark**: A method for using this measure to assess the environmental performance of products. Products can be assessed in absolute terms: for example, as having less than a threshold amount of CO_2 per product. Alternatively, they can be assessed in relative terms, by comparing their performance to other products in their sector or jurisdiction: for example, as having a lower CO_2 content than the market-dominant product or being in the 10% lowest emissions products in their category.
3. **Validate**: An approach to verifying that a product achieves a certain benchmark. Validation approaches can be self-reported, relying on the supplier to self-assess whether they meet a benchmark, or they can be independently validated, usually by a third party not involved in the transaction.
4. **Implement**: An approach to combine measurements, benchmarks and validation processes to form a policy intervention.

Policymakers can design measures, benchmarks and validation processes specifically to support particular demand-side policy interventions. In practice, however, they generally rely on one or more 'policy inputs' to support policy design.

The two main categories of policy inputs are

- product labels; and
- environmental product declarations (EPDs).

Product labels

Environmental product labels can be awarded to a product or supplier to indicate that it meets a certain level of environmental performance. These are referred to as Type I Environmental Labels by the ISO.[41] Labels generally combine measurement, benchmarking and validation.

There are a wide range of different environmental product labels, some of which are country-specific and some of which are used globally. Different labels address different measures of environmental performance and vary in the benchmark they require for a product or supplier to be awarded a label. For example, the Carbon Trust's Carbon Footprint label focuses mainly on the CO_2 emissions associated with a product, while other labels consider wider definitions of environmental sustainability and efficiency.

As an **input to policy** interventions, environmental product labels can be used as a necessary or sufficient condition for verifying that a supplier meets the required procurement criteria or to inform the design of criteria.

- **Sufficient condition.** Policymakers can give suppliers the option of demonstrating compliance with product standards or procurement criteria by showing that they have obtained one or more appropriate product labels (a sufficient condition). For example, the level of environmental performance necessary to qualify for the Japanese Environment Association's Eco Mark label is a sufficient condition to demonstrate compliance with the Japanese Government's Act on Promoting Green Purchasing.
- **Necessary condition.** Policymakers can require that suppliers demonstrate compliance by showing they have obtained a particular product label (a necessary condition). For example, most major appliances sold or rented in the EU must display an EU Energy Label which provides a grade rating of the product's energy consumption.[42]
- **Design input.** The criteria used to award existing environmental product labels can be used to guide the definition of 'green' products when designing procurement standards. These approaches use the 'measure' and/or the 'benchmark' elements of a given label, but not its approach to 'validation'.

Environmental labels can also act as a policy intervention in their own right, 'nudging' purchasers to choose more environmentally friendly products. Such labels can be effective in the absence of policy interventions, but governments can reinforce their effectiveness with information campaigns.

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[41] ISO 14024 Environmental Labels and Declarations. Type I environmental labels are used where there are clearly defined criteria for products; Type II self-declared environmental claims are used for products or services where clearly defined criteria and labelling scheme are not present; Type III environmental declarations are used for specific aspects of products using a life-cycle approach.

[42] For more information on the EU Energy Label see Regulation (EU) 2017/1369.

Environmental product declarations (EPDs)

EPDs are documents which describe the environmental impact of a particular product. They can provide a key input to the benchmarking and validation elements of a policy intervention. EPDs are an ISO 14025 Type III environmental declaration.

The core component of an EPD is a life-cycle assessment of the product's environmental impacts, along with other impacts such as those on human health. Life-cycle assessments, as specified in ISO 14040, address the environmental aspects throughout a product's life cycle from raw material acquisition through production, use, end-of-life treatment, recycling and final disposal.[43]

EPDs are distinct from product labels in that they do not generally seek to establish a product as meeting a particular benchmark but detail a measure or level of its environmental impact. Likewise, EPDs are not always validated by an independent third party, although this may be a requirement for certain buyers.

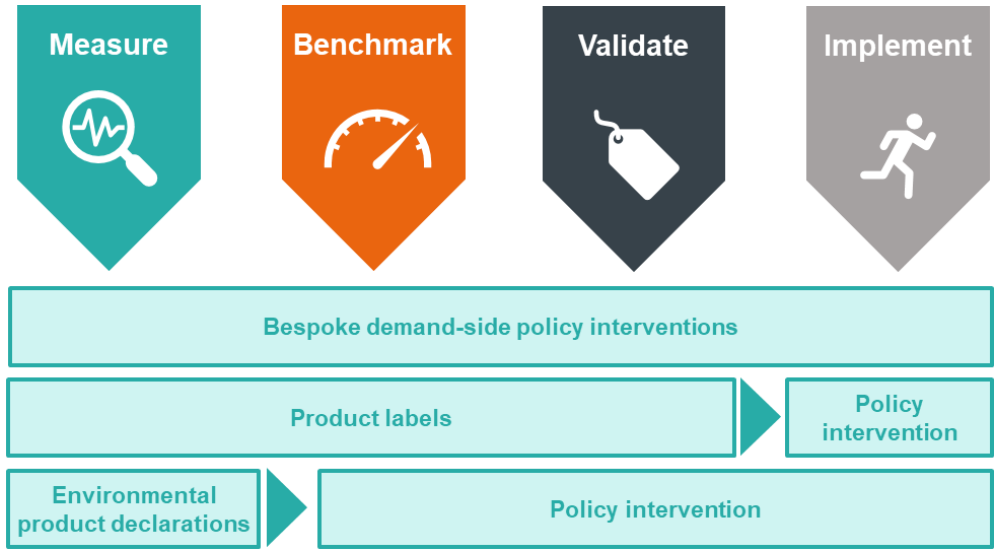
The measure of environmental impact detailed in an EPD can be evaluated against product standards or procurement criteria. For example, The Buy Clean California Act requires the bidder to submit 'facility-specific' EPDs (specific to product, manufacturer and plant). These EPDs are then evaluated against the maximum acceptable level of global warming potential set out by the state government.

Summary

Demand-side policy interventions that encourage the decarbonisation of EIIs should, in general, specify an approach to measuring, benchmarking and validating environmental impact, as well as a mechanism for combining these approaches into a particular mandate, incentive scheme or nudge (see Figure 5).

Policymakers can draw on a range of inputs to support this process, notably existing product labels and EPDs.

Figure 5: Elements of demand-side policy design



[43] ISO 14040:2006, Environmental management — Life cycle assessment — Principles and framework, https://www.iso.org/obp/ui#iso:std:iso:14040:ed-2:v1:en

4 Policy interventions available to the Scottish Government

Not all of the policy interventions used by other jurisdictions can be implemented by the Scottish Government. There are two main constraints:

- reserved matters which the UK Government has not devolved to the Scottish Government; and
- international trade law.

This section provides an overview of the policy interventions over which the Scottish Government is likely to have more or less control. The purpose of this section is to provide an indication of likely policy priorities, and it is not a legal opinion on specific policies.

4.1 UK-Scotland devolution

The Scotland Act (1998) and subsequent revisions (2012, 2016) set out which matters are devolved to the Scottish Government and which matters are reserved by the UK Government. The implications of the Act for public sector procurement and the three policy approaches are outlined below.

The Scottish Government controls the rules governing procurement by public sector organisations. Reserved powers are unlikely to constrain the implementation of such demand-side policies in Scotland.

Product standards and consumer protection policy is generally reserved by the UK Government. There are exceptions for food products and packaging. The Scottish Government has control over some EII products, such as those related to the manufacture and distribution of gas, but it is not clear that this infers control over demand-side policies related to such products. The Scottish Government also has control over building regulations, which can be used to influence demand for EII products used in construction.

The Scottish Government has control over some taxes, notably income tax bands and rates, but most indirect taxes that could influence purchasing decisions are reserved by the UK Government. Some exceptions include taxes charged on the carriage of passengers by air from airports in Scotland, taxes charged on aggregate (an input for concrete) and landfill taxes, all of which are devolved to the Scottish Government.

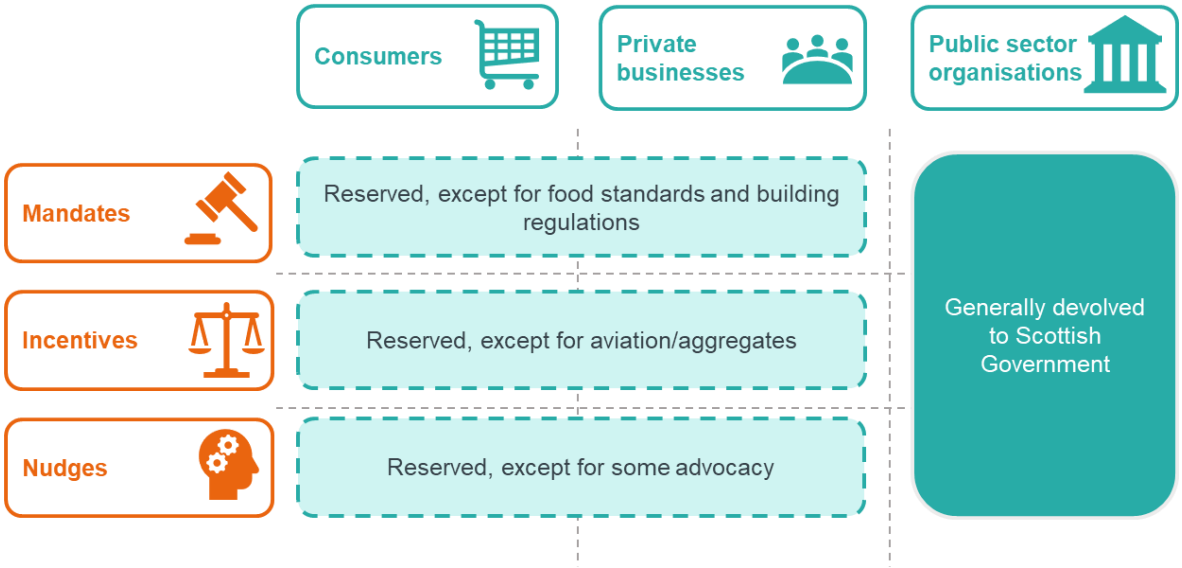
Labelling policy is generally reserved by the UK Government and is overseen by the National Measurements Office. The Scottish Government does have control over consumer advocacy and advice, and it may therefore be

able to conduct public information campaigns to increase awareness of existing labels or encourage businesses to adopt voluntary targets.

Even where control is reserved, the Scottish Government may still have the opportunity to influence buyer decisions. For example, it can lobby the UK Government to impose mandates, incentives or nudges that support the decarbonisation of Scottish EIIs.

The range of policy interventions that are likely to be devolved or reserved is summarised in Figure .

Figure 6: Policy interventions under Scottish Government control



4.2 International trade law

The main constraints on UK and Scottish demand-side policy making from an international trade law perspective are those that arise from the commitments the UK has entered into as a member of World Trade Organisation (WTO) and as a party to the WTO's plurilateral agreements. These aim to ensure that entities such as the UK and Scotland do not discriminate between trade partners, and that any non-tariff measure undertaken is not a disguised restriction on trade or an unjustifiable or arbitrary form of discrimination against trade partners. The implications of international trade law for each of the three buyer types, along with incentive policy approaches, are outlined below.

Public sector organisations

Since the UK left the European Union, the Scottish Government is no longer required to comply with the EU Procurement Directives.[44] However, it must still comply with the Government Procurement Agreement (GPA)[45] of the WTO. On 1 January 2021, the UK became a member of the revised GPA in its own right.

[44] https://www.gov.scot/publications/changes-to-procurement-legislation-at-the-end-of-the-eu-exit-transition-period-sppn-11-2020/

[45] https://www.wto.org/english/tratop_e/gproc_e/gp_gpa_e.htm

The GPA aims to ensure fair, transparent and non-discriminatory conditions of competition for public sector procurement. Broadly, compliance with the GPA requires the Scottish Government to avoid discriminating between international and domestic sellers on the grounds of nationality.[46]

GPA obligations are limited to 'covered' entities purchasing 'listed' goods, services or construction services of a value exceeding a specified threshold.[47] This includes most public sector buyers in Scotland for purchases exceeding £140,000, with higher minimum thresholds for sub-central government buyers and construction services contracts.

In practice, the GPA is unlikely to constrain public sector procurement rules or guidelines which aim to encourage the decarbonisation of EIIs, so long as those policies do not discriminate explicitly against international sellers.

WTO rules allow countries to undertake measures that are necessary for legitimate public policy objectives. These measures include standards and labels that regulate product characteristics. Whether, in so doing, countries can regulate the process and production methods through which products are made is less clear and has been a subject of international disagreement. Recent WTO jurisprudence suggests that product labelling that regulates products on the basis of their production history (e.g. their carbon intensity) can come under the scope of measures allowed for by WTO rules.[48] However, this remains an evolving area of law.

For standards and labelling policy interventions to comply with WTO rules, they must be shown:

- to be no more restrictive of trade than is necessary; and
- to fulfil a legitimate regulatory objective (and not be a disguised restriction on trade or an unjustifiable form of discrimination, either between foreign and domestic suppliers or between different foreign suppliers).

Measures that are based on international standards or 'policy inputs' are more likely to comply with WTO rules.

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[46] Specifically, sellers in the 48 WTO members who are signatories of the GPA.

[47] Construction services as defined in the GPA are based on Division 51 of the United Nations Provisional Central Product Classification (CPC), and therefore include construction works (and not just associated services). In general, construction works are included in the scope of construction services for the definition of construction services used throughout this report.

[48] https://www.wto.org/english/tratop_e/envir_e/labelling_e.htm

Member states are able to apply measures at a subnational level, provided they are proportionate and conform with WTO rules (e.g. Scotland could adopt a stricter measure if there was evidence demonstrating its necessity).

In practice, WTO rules are unlikely to constrain policy interventions that set product standards or labels to encourage the decarbonisation of EIIs as long as they do not create unnecessary obstacles to international trade.

Incentives

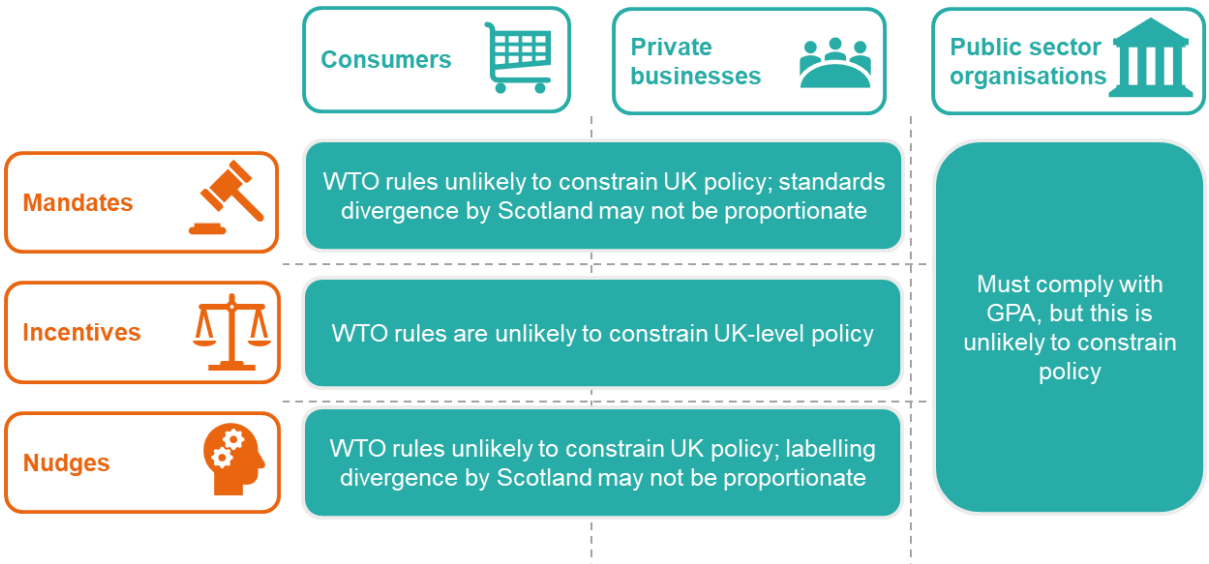
Finally, WTO rules may constrain some non-procurement incentive policy interventions, particularly those that provide **subsidies** rather than levying taxes. Subsidies are measures that involve a financial contribution (e.g. grants, foregone taxes, concessional financing, etc.) by a government or public body that confers a benefit to the recipient. Environmental subsidies are usually paid to suppliers but, in principle, they can be paid to buyers (e.g. payment to private businesses that commit to purchasing environmentally friendly inputs).

Subsidies are prohibited by WTO rules if they are specific to a particular industry, firm or region and have adverse effects on trading partners. Services are excluded. For example, a subsidy for a vehicle manufacturer which is conditional on it using inputs that are only available in Scotland is likely to contravene WTO rules.

In practice, WTO subsidy rules are unlikely to meaningfully constrain most demand-side policies, including subsidies for buyers of lower-carbon inputs, as long as these subsidies do not unfairly privilege Scottish suppliers of these inputs.

The range of policy interventions that are likely to be allowed under existing international trade law are summarised in Figure 7.

Figure 7: Policy interventions under Scottish Government control



5 Summary of the key drivers of buyer decision-making

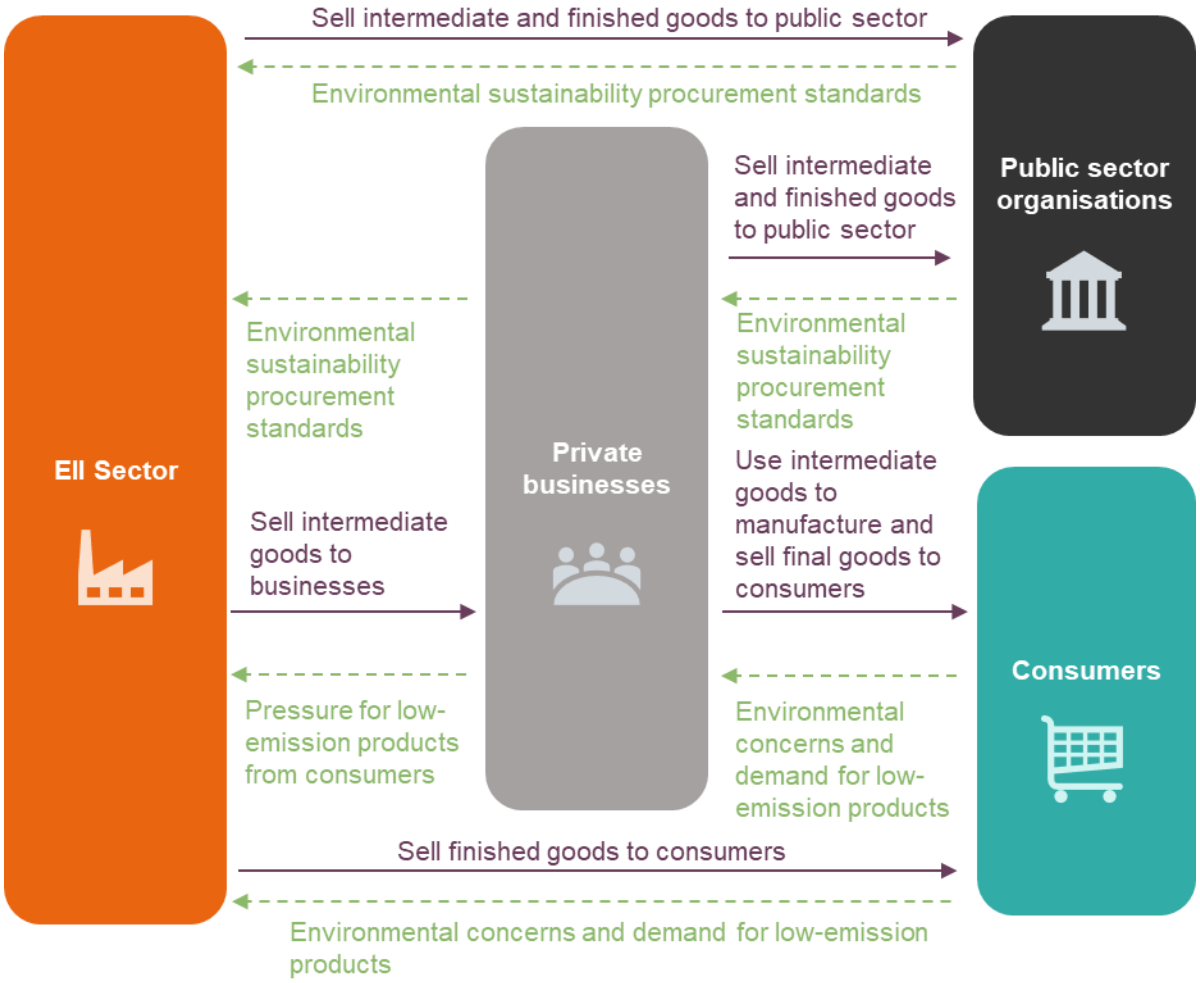
To understand which demand-side policy interventions would be most effective in reducing EII emissions, it is necessary to understand what drives demand for EII products.

As described in Section 3, there are three types of purchasers of EII products:

- **Private businesses,** which purchase goods produced by EII companies to manufacture finished products for consumers and the public sector. For example, a construction firm might purchase steel to build a hospital for a National Health Service (NHS) Scotland Health Board, or a distillery might purchase glass with which to bottle whisky.
- **Public sector organisations**, which procure goods either directly from EII companies or from private businesses that use EII products as inputs. For example, a local authority might hire a private contractor to build roads, with this contractor in turn purchasing cement from an EII company.
- **Consumers**, who purchase final goods made with EII products. In some cases consumers may also purchase goods produced directly by EII companies, such as food & drink products. In most cases, however, purchased goods will be produced by private businesses that use EII products as inputs in their production processes.

A summary of how these buyers interact with the EII sector and each other is illustrated in Figure 8.

Figure 8: Demand for EII products



This section explores each of these buyer types in turn, in order to understand how emissions and carbon intensity-related concerns factor into their respective decision-making processes.

5.1 Business demand

Business decision-making is often characterised as being mostly or wholly a function of profit motive. However, there is evidence that some businesses do take emissions and other environmental concerns into consideration when making purchasing decisions for both profit-related and ethical reasons.

A growing number of companies use internal carbon prices which allow them to place a monetary value on GHG emissions and factor this as a cost into business and investment decisions. More than 1,200 companies worldwide had either implemented or

were planning to implement an internal carbon price by 2016, a 23% increase over the previous year.[49] Internal carbon prices usually take one of three forms:[50]

- **An internal carbon fee,** which places a monetary value on each tonne of carbon emissions.
- **A shadow price**, which is similar to an internal carbon fee but is treated more theoretically and used for long-term planning. Most companies using this approach apply a shadow price which is higher than the current government carbon price.
- **An implicit price**, based on the cost of reducing GHG emissions or complying with government regulations. As an example, this could be the cost of complying with fuel economy standards.

The decision to implement an internal carbon price can be consistent with profit maximisation, particularly where the business expects future changes in policy.[51] For example, BP uses an internal shadow price per metric ton of carbon to prepare for expected regulation involving higher carbon prices.[52]

Businesses can also implement internal carbon prices for ethical reasons. However these are difficult to disentangle from stakeholder pressure (including from employees, consumers and shareholders) to be more environmentally sustainable.[53] Businesses will transmit pressure from stakeholders through to their suppliers, for example by adjusting their supply chains to reduce emissions and provide customers with lower-carbon products. There is evidence that customer requests to reduce GHG emissions are a significant driver of carbon reductions in business supply chains.[54]

Overall, the evidence suggests that businesses generally target emissions reductions because of concerns about future profitability or to accommodate the preferences of stakeholders rather than because of internal motivation. As a result, the focus of this report remains on the public sector organisations and consumers which buy from businesses and can exert significant influence over business decisions.

5.2 Public sector procurement

The Scottish public sector spends a significant amount on goods and services (£12.5 billion in the 2018/19 financial year).[55] This spend is spread across hundreds of

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[49] Center for Climate and Energy Solutions. 2017. The business of pricing carbon: how companies are pricing carbon to mitigate risks and prepare for a low-carbon future. https://www.c2es.org/site/assets/uploads/2017/09/business-pricing-carbon.pdf

[50] Center for Climate and Energy Solutions, https://www.c2es.org/content/internal-carbon-pricing/#:~:text=The%20observed%20price%20range%20for,and%20prepare%20for%20future%20regulation.

[51] Center for Climate and Energy Solutions. 2017. The business of pricing carbon: how companies are pricing carbon to mitigate risks and prepare for a low-carbon future. https://www.c2es.org/site/assets/uploads/2017/09/business-pricing-carbon.pdf

[52] Center for Climate and Energy Solutions. 2017. The business of pricing carbon: how companies are pricing carbon to mitigate risks and prepare for a low-carbon future. https://www.c2es.org/site/assets/uploads/2017/09/business-pricing-carbon.pdf

[53] Orlitzky, Marc, & Siegel, Donald, & Waldman, David. 2011. Strategic Corporate Social Responsibility and Environmental Sustainability. *Business & Society, 50(1)*.

[54] Damert, Matthias, & Feng, Yunting, & Zhu, Qinghua. 2018. Motivating low-carbon initiatives among suppliers: The role of risk and opportunity perception. *Resources, Conservation and Recycling, 136.*

[55] Based on procurement spending data provided by the Scottish Government for this report.

organisations which are influenced by a variety of stakeholders including budget holders and policy leads. Understanding the public procurement process is therefore central to the design of demand-side policy interventions to support decarbonisation as changes to the procurement process can have a direct impact on the emissions associated with a significant volume of goods and services.

Public sector procurement decisions can be influenced through mandates, incentives or nudges.

A direct approach for influencing public procurement demand is through explicit product standards. By specifying that they will only procure products which meet a certain standard, public sector organisations can directly affect the carbon content of their purchases. For example, public sector organisations could mandate that they will only procure construction contracts which make use of 'green' steel based on a provided and internationally recognised definition of 'green'. Such a mandate could be used in conjunction with the existing push for lower-carbon construction in Scottish Building Standards.[56] Any such mandates would still need to comply with existing quality and safety standards in Scotland and should be used to complement (and not conflict with) related standards.

Another approach is to implement explicit incentives into the public procurement process. An example is scoring, which gives greater weights to low emission products. If a bidder's score is directly affected by the emissions stemming from their bid, it will be incentivised to make use of lower-carbon inputs.

Nudges can also be used to affect public sector procurement. Rather than mandating the purchases of certain types of products or incorporating emission standards explicitly into the scoring, public sector organisations can be encouraged to develop green policies or take account of emission standards more generally. This can translate into pressure on businesses to reduce emissions, without explicitly setting out standards that all procurers must use or all bidders must meet.

Overall, while public sector organisations in Scotland are encouraged to take account of environmental considerations when procuring goods and services, there are currently no explicit standards mandated in the procurement process. Any mandates or incentives introduced would have to be carefully designed so as to not to interfere with other procurement or policy priorities, such as accessibility to small and medium-sized enterprises (SMEs) or construction quality objectives. These other priorities may in some cases conflict with emissions-reduction objectives.

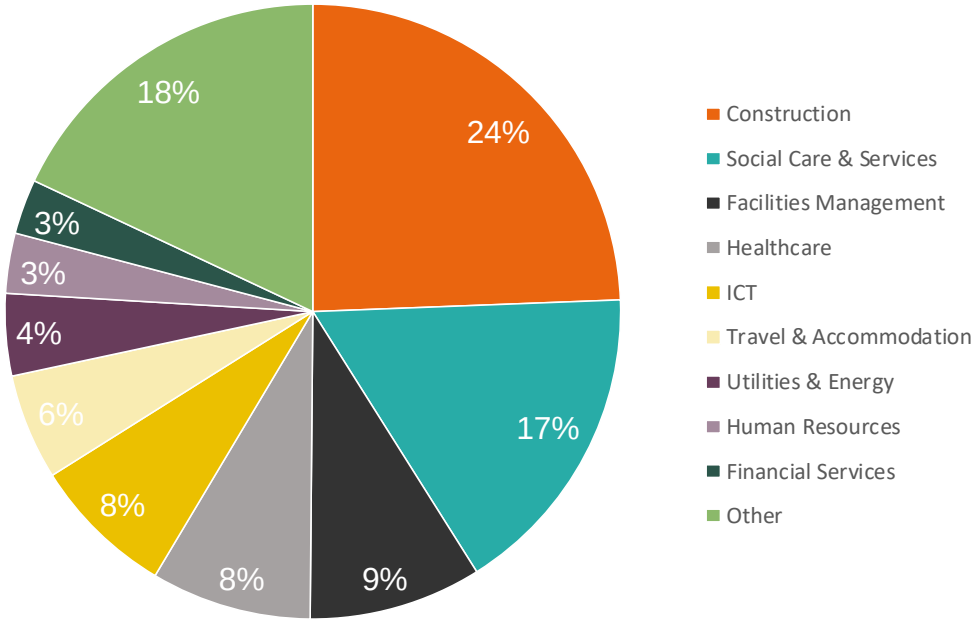
To assess where mandates, nudges and incentives can be introduced, it is necessary to understand the nature of public sector procurement in Scotland and the drivers of procurement demand.

[56] See, for example, https://www.gov.scot/publications/building-standards-technical-handbook-2019-non-domestic/6-energy/6-0-introduction/.

The nature of public sector procurement in Scotland

Public organisations in Scotland purchase a wide variety of goods and services. Construction is the single most important category of public procurement in Scotland, with public sector organisations procuring more than £3 billion worth of goods and services from construction companies in 2018/19 – nearly a quarter of all public procurement spending in Scotland.[57] Construction spending is particularly relevant for EII decarbonisation as EII products such as cement, glass and steel are all key inputs into construction. Other relevant categories of procurement include utilities & energy (which represented more than £540 million of procurement spending in 2018/19), vehicles (which represented more than £230 million of procurement spending in 2018/19), and food & drink[58] (which represented more than £180 million of procurement spending in 2018/19).[59] Public procurement spending by category of supplier is illustrated in Figure 9.

Figure 9: Public procurement spending by category of supplier, 2018/19



Note: This figure is based on procurement spending data provided by the Scottish Government

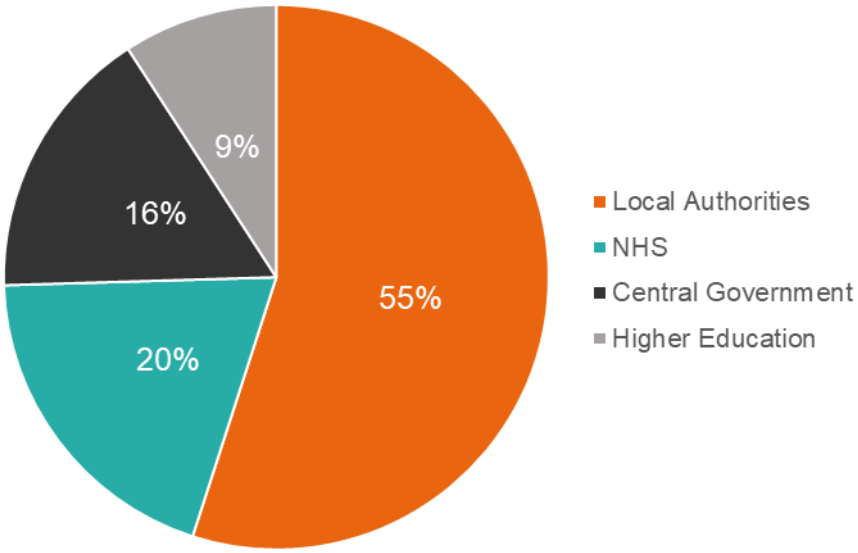
Most public procurement spending is conducted by local authorities (55%), with the remainder split between NHS Scotland health boards (20%), Scottish Government departments (16%) and higher education providers (9%) (see Figure 10).

[57] Based on procurement spending data provided by the Scottish Government for this report.

[58] Including catering.

[59] Based on procurement spending data provided by Scottish Government for this report.

Figure 10: Public procurement spending by type of public organisation, 2018/19



Note: This figure is based on procurement spending data provided by the Scottish Government

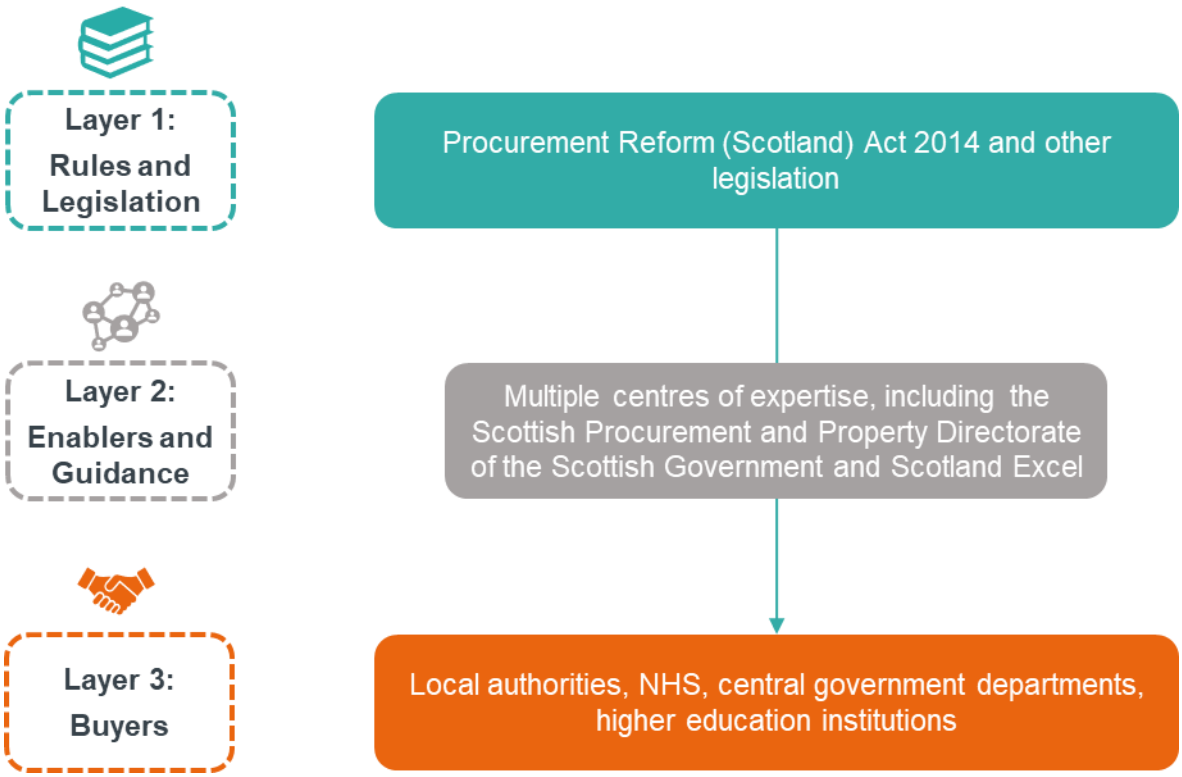
While public spending is split amongst a large number of organisations, there are still central rules and guidelines which these organisations must follow. These central procurement rules have a bearing over all public sector procurement in Scotland and represent a powerful tool for influencing the purchasing decisions of these organisations.

Drivers of public procurement demand – three layers

Broadly, there are three layers in the public procurement decision-making process in Scotland. These are summarised in

Figure 11 below. Understanding these layers is key to understanding how mandates, incentives and nudges can be implemented, and where it is appropriate to do so.

Figure 11: Layers of procurement demand drivers in Scottish public procurement

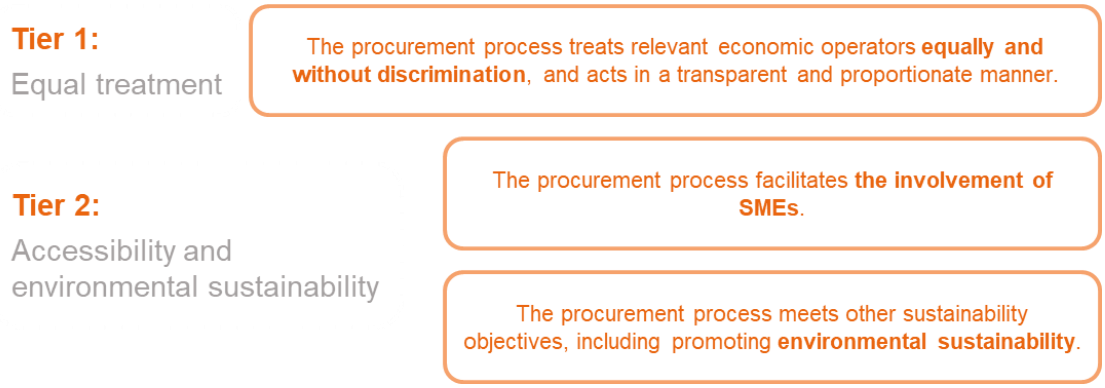


The first layer of procurement drivers comprises the **rules and legislation**, including the Procurement Reform (Scotland) Act 2014, and other industry-specific legislation such as building standards and regulations. These set the rules by which all buyers must abide. The second layer comprises **organisational enablers**, in particular the Scottish Procurement and Property Directorate of the Scottish Government and Scotland Excel, as well as centres such as Advanced Procurement for Universities and Colleges and National Services Scotland (NSS) National Procurement (for the NHS). These bodies publish frameworks and guidelines which are widely used by public organisations in Scotland. The third layer comprises the **buyers** or contracting authorities which make purchasing decisions. All procuring organisations have a range of objectives which they must meet, balancing legislative requirements alongside broader policy goals and their own procurement requirements.

The core of the principles which determine public procurement demand are set out in the Procurement Reform (Scotland) Act 2014. All public contracts valued at more than £50,000 and public works contracts valued at more than £2 million are subject to this Act, with limited exceptions. The Act sets out the Sustainable Procurement Duty, which requires that a contracting authority considers how its purchasing decisions can improve the social, environmental and economic wellbeing of the area in which it operates.[60] The Act also requires the contracting authority to consider how it can reduce inequality and facilitate the involvement of SMEs.

Overall, while the Sustainable Procurement Duty establishes the importance of considering environmental concerns, this needs to be balanced against other considerations (see Figure 22).

Figure 22: Importance of different requirements in sustainable procurement



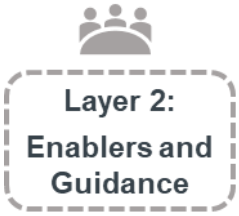
The contracting authority is only able to comply with the Sustainable Procurement Duty insofar as it does not interfere with its ability to:

i) treat relevant economic operators equally and without discrimination; and
ii) act in a transparent and proportionate manner.[61]

[60] Procurement Reform (Scotland) Act 2014, para 9.1.a.i.

[61] Procurement Reform (Scotland) Act 2014, para 8.

There are also competing priorities within the Sustainable Procurement Duty itself – in particular, the need to facilitate the involvement of SMEs. Discussions with procurement policy experts in the Scottish Government emphasised that ensuring that a wide range of suppliers (especially mid-sized and smaller suppliers) are able to participate in the public procurement process is critical. Therefore, any environmental guidelines or standards adopted in the procurement process must not be so burdensome as to prevent smaller suppliers from being able to bid.



To assist public sector organisations in running their procurement process, the Scottish Government has made a range of resources available to contracting authorities. One such example is a published series of handbooks to assist public sector clients in managing and procuring construction projects.[62] The centres of expertise function as enablers in this process and assist public sector organisations in the procurement process. They publish frameworks and guidance covering a wide range of procurement categories, from corporate and human resources services to national utilities procurement. While non-binding and available for use at the procurers' discretion, they are nonetheless used by nearly all public sector organisations to inform their procurement decisions. These frameworks were developed through significant engagement with procurers, suppliers and the broader market. The frameworks are for use by public sector organisations and charities only and cannot be used by the private sector.

These frameworks vary heavily depending on the category of goods and services being procured, although they are all underpinned by the principles set out in the Procurement Reform (Scotland) Act 2014. They generally do not set out particular environmental standards (beyond those established in EU directives) or mandates, in part because this could interfere with the ability of smaller suppliers to participate in the procurement process. However, this is not always the case, and some products are subject to explicit standards. For example, the ICT hardware procurement framework stipulates that all products should meet or exceed energy efficiency standards based on Energy Star ratings and meet or exceed Electronic Product Environmental Assessment Tool Gold compliance.[63]

A number of tools are available to public sector organisations to assist in complying with the Sustainable Procurement Duty. These include a prioritisation tool and a sustainability test, as well as guidance on how the procurer might want to consider the life-cycle impact of materials and goods purchased in evaluating their environmental impacts.[64] For example, the sustainability tools available to public sector procurers include example questions they may wish to include in the tender, such as 'detail your understanding, experience and achievements in minimising the overall embodied carbon for a similar project'. However, these are recommendations rather than mandates, and the tools emphasise that any environmental or emissions requirements should be proportionate to the market and the scope of services required. In general, the guidance steers buyers

[62] This series of handbooks, is being updated to take account of changes to Scottish procurement legislation resulting from the UK's Transition Period on exiting the EU coming to an end on 31 December 2020.

[63] https://www.gov.scot/publications/desktop-client-devices-framework-sp-19-016/

[64] See https://sustainableprocurementtools.scot/ for more information.

away from asking for specific standards,[65] and it is not up to procurement guidance organisations to specify material standards. Instead, standards are set by legislative or regulatory bodies, such as by building standards for construction, and then carried through to procurement.[66]

Layer 3: Buyers

The final layer is those contracting authorities that actually procure goods and services. These include local authorities, NHS Scotland health boards, central government bodies and higher education institutions. Their demand is driven by their operational needs and policy objectives as well as by the rules and legislation by which they must abide. These buyers procure a wide variety of goods and services with a view to meeting their needs and objectives. Notably, they procure a significant amount of construction services, which is of particular relevance for this report due to the construction industry making substantial use of EII products such as cement, glass and steel. Local authorities account for the majority of construction procurement spending, representing 63% of construction procurement in 2018/19.[67]

Buyers of construction services are influenced by policy objectives such as those set out in the Procurement Reform (Scotland) Act 2014 and other related legislation and industry best practice. Building standards are of particular relevance. Construction buyers are bound by these building standards, and concerns around building quality are particularly important in construction procurement. There are also large numbers of smaller bidders in the Scottish construction procurement market, including SMEs, and buyers frequently purchase services from these SMEs. As with procurement in general, accessibility to these SMEs is a key part of the construction procurement process in Scotland.

Summary

Overall, environmental concerns are important in public procurement and are considered by public sector buyers. However, these must be balanced against the requirement that a procurement process must be accessible to smaller bidders and other concerns such as quality. While the available evidence suggests that, today, the primary driver of procurement decisions is accessibility, there is scope to increase the importance of GHG emissions and other environmental concerns through changes to, or clarifications of, legislation or guidance. These can be translated into mandates, incentives or nudges.

Any such changes will feed directly into buyers' decision-making processes. These changes would need to be carefully designed to ensure that they do not impose too large a burden on buyers and sellers, that they can feasibly be implemented alongside other requirements and that they align with existing and planned guidance.

5.3 Consumer demand

Consumer demand exerts a powerful influence on the decisions of EII companies and intermediary businesses. If consumers prefer lower-carbon end-products, and have the information to support this choice, then suppliers will have an incentive to meet this

[65] See https://sustainableprocurementtools.scot/index.cfm/guidance/climate-change/carbon-in-production/supplier-selection/

[66] Scottish building standards are underpinned by the Building (Scotland) Act 2003. For more detail see https://www.gov.scot/policies/building-standards/.

[67] Based on procurement spending data provided by the Scottish Government for this report.

demand. As a result, consumer preferences for final products have significant implications for EIIs.

Like public sector organisations and private businesses, consumer purchasing decisions can be influenced through mandates, incentives or nudges.

A direct approach for influencing consumer demand is through product standards. By making the purchase of certain products illegal, such standards can eliminate their consumption.

Another approach is through taxes or subsidies which affect the final price of the product paid by consumers. All else being equal, if the price of a product increases, demand for that product decreases, with the scale of the decrease being dependent on the elasticity of demand for the product. Introducing a tax on high-carbon products is therefore a clear way to increase demand for lower-carbon alternatives.

There is also evidence that consumers increasingly account for the carbon content of products when making their purchasing decisions, independent of environmental taxes. Insofar as consumers already prefer green products, giving them the information they need to inform their purchasing decisions can drive demand for lower-carbon products without having to introduce a tax. How consumers account for such information is less straightforward than for mandates and incentives and is therefore the focus of the rest of this section.

Consumer demand for green products

Consumer demand for green products is becoming increasingly significant. A 2019 YouGov study of more than 9,000 consumers across North America and Western Europe found that two-thirds of consumers supported the idea of a recognisable carbon label on products to demonstrate that the products in question had been made with a commitment to measuring and reducing their carbon footprint.[68] More generally, climate change is increasingly an important consideration for consumers: survey results have highlighted consumers' growing preferences for environmentally friendly products[69] and a 2019 Ipsos MORI survey found that the level of concern about climate change was higher in the UK in 2019 than it was in any of its previous 29 years of surveys.[70] Green products, once considered a niche market,[71] are increasingly becoming a key segment of consumer demand.

However, consumer attitudes do not always translate into action, and there is a gap between what consumers say and what they do. This is commonly referred to as the 'intention-action gap'. One recent survey found that, while 65% of consumers said they wanted to buy environmentally sustainable products, only 26% actually followed through and did so.[72] Demand-side policies aimed at consumers need to be cognisant of this and

[68] https://www.carbontrust.com/news-and-events/news/research-reveals-consumer-demand-for-climate-change-labelling

[69] https://ssir.org/articles/entry/cultivating_the_green_consumer#

[70] https://www.ipsos.com/ipsos-mori/en-uk/climate-change-important-consumers

[71] https://ssir.org/articles/entry/cultivating_the_green_consumer#

[72] https://hbr.org/2019/07/the-elusive-green-consumer

designed in such a way as to maximise effectiveness and ensure consumers' stated attitudes about green products are actually translated into purchasing decisions.

Impact of environmental product labels on consumer demand

Product labels, in particular, can be a powerful tool for influencing consumer behaviour. Not only can they help reduce carbon emissions in a market and drive the transition to a zero-carbon economy, but they also offer important additional benefits to consumer welfare by enabling consumers to choose products which they prefer. The economic theory behind product labelling is relatively simple. Some consumers prefer lower-carbon products and these goods are underprovided – a market failure arising from 'information asymmetry'. Product labels help address this under-provision by giving consumers more information and increasing demand for lower-carbon products.

A number of academic studies have shown the effectiveness of product labelling across a range of different goods. Li et al. (2018) performed a field experiment involving sustainable oysters graded with medium-, low- or high-sustainability labels, combined with an econometric model to control for other factors, to assess the impact of green product labels on consumer demand. They found that customers were willing to pay more for products that were more environmentally friendly and that this impact on willingness to pay was even greater when the labels explicitly differentiated the level of environmental sustainability or contained brief information on the basis for the labels.[73] Moreover, they found that the baseline (or reference point) was important. In the case where they evaluated low- and medium-graded green products against a product with no specified grade, consumer demand was actually significantly higher for the ungraded product. This may indicate that consumers can be strongly influenced by 'negative' labels indicating moderate or low levels of environmental sustainability, just as they can be influenced by 'positive' labels indicating high levels of sustainability. More generally, it highlights that there could be distortionary effects from labelling if it is not comprehensive or clear due to what consumers internalise as their reference point for a green product.

In general, the evidence supports the effectiveness of product labels across a range of label types and industries. Sammer and Wüstenhagen (2006) assessed the impact of EU energy labels on consumer demand for lightbulbs and washing machines.[74] They found that the level of meaningful information in the label was an important determinant of consumer demand and that products with greener energy labels significantly increased consumer willingness to pay for the product beyond the difference which could be attributed to the underlying electricity cost. Other examples include:

- Golan et al. (2001), who found that providing consumers with positive information on green products significantly increased willingness to pay for those products.[75]
- Blend and Van Ravenswaay (1999), who found that consumers were willing to pay considerably more for apples with an eco-label compared to unlabelled apples.[76]

[73] Li, Tongzhe, & Kecinski, Maik, & Messer, Kent. 2018. Behavioural responses to science-based eco-labelling: gold, silver, or bronze. *Applied Economics*, *50 (39)*.

[74] Sammer, Katharina, & Wüstenhagen, Rolf. 2006. The influence of eco-labelling on consumer behaviour – results of a discrete choice analysis for washing machines. *Business Strategy and the Environment, 15(3)*.

[75] Golan, Elise, & Kuchler, Fred, & Mitchell, Lorraine, & Greene, Cathy, & and Jessup, Amber. 2001. Economics of Food Labelling. *Journal of Consumer Policy, 24 (2)*.

[76] Blend, Jeffrey, & van Ravenswaay, Eileen. 1999. Measuring Consumer Demand for Ecolabeled Apples. *American Journal of Agricultural Economics*, *81(5)*.

- Asche and Bronnmann (2017), who found that eco-labels increased willingness to pay for fish, although this varied by species of fish.[77]

Based on the existing evidence, it is clear that some consumers prefer green products, and product labels can be a powerful tool for enabling them to purchase the green products which they prefer.

Factors determining effectiveness of 'green' labels

Simply putting a label on a product is unlikely to be sufficient – these labels need to be appropriately designed in order to ensure the desired effect. The available literature and broader evidence from behavioural economics suggest a few key characteristics that could be prioritised to increase effectiveness. In particular, labels should:

i. be clear and contain an appropriate amount of information; and
ii. leverage social influence and behavioural insights.

Perhaps the most important feature that is highlighted across the academic evidence is the importance of label clarity. A number of studies have found that consumers tend to ignore label information when it is too complicated.[78] The label needs to be informative, without providing so much information that consumers become confused and ignore it.

Social influence can also be a powerful tool. Put simply, people tend to do what others are doing, and so telling a customer that other customers are purchasing lower-carbon products can substantially increase their likelihood of following suit. For example, one study found that telling online shoppers that other customers were buying environmentally friendly products led to a 65% increase in these shoppers making at least one sustainable purchase,[79] while another study found that telling university students that other commuters were taking more sustainable methods of transportation made those students five times more likely to take sustainable transport themselves.[80]

Summary

Consumers are showing increasing concern about carbon emissions and environmental sustainability, and providing them with better information to inform their purchasing decisions can be a powerful tool for driving consumption towards greener products. This is even more effective when the information is clear and concise, and when it leverages social pressures to ensure individuals know other consumers are also making sustainable purchases. However, the Scottish Government has limited ability to enact labelling policies in practice (see Sub-section 0), and these policies would likely only be applicable to a smaller sub-set of EII products even in the case where their implementation was feasible.

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[77] Asche, Frank, & Bronnmann, Julia. 2017. Price premiums for ecolabelled seafood: MSC certification in Germany. *Australian Journal of Agricultural Resource Economics, 61 (4)*.

[78] See for example McCluskey, Jill, & Swinnen, Johan. 2004. Political Economy of the Media and Consumer Perceptions of Biotechnology. *American Journal of Agricultural Economics, 86 (5)*; and Lusk, Jayson, & Marette, Stephen. 2012. Can Labelling and Information Policies Harm Consumers?. *Journal of Agricultural & Food Industrial Organization, 10 (1*).

[79] https://hbr.org/2019/07/the-elusive-green-consumer

[80] Ibid.

6 Assessment of potential policy options

As explored in Section 0 of this report, there are a wide range of potential demand-side policy interventions available to assist in creating market benefits for lower-carbon products, with a sub-set of these available to the Scottish Government through its devolved powers (see Section 0). Assessing the potential benefits and risks of these policies is important for understanding which types of policies are most appropriate for Scotland and which EII sectors and products they are best suited for.

This section evaluates the potential policy options available in the context of demand-side industrial decarbonisation policy in Scotland, drawing on the evidence set out in the remainder of this report and expert economic judgement. The policy assessment is informed by the international evidence on demand-side policy interventions set out in Section 0, the evidence on policy interventions available to the Scottish Government in Section 0, evidence on key drivers of buyer decision-making explored in Section 0, and the overviews of each energy-intensive industry provided in Annex A.

These assessments are then used to inform the recommendations and next steps in Section 0.

6.1 Criteria for assessing policy options

These policy interventions have strengths and weaknesses which should be considered to inform an assessment of which may be most appropriate in the Scottish context. In its recent Industrial Decarbonisation Strategy published in March 2021, the UK Government set out a number of design principles for demand-side measures.[81] In particular, the Industrial Decarbonisation Strategy suggests that demand-side measures should:

- support industry to share the cost of decarbonisation with consumers;
- create incentives for emissions reductions which are balanced across industry;
- apply equally to domestically produced and imported products to ensure a level playing field;
- be adaptable according to the needs of different sectors;
- be technology neutral to allow for the possibility of future innovation;
- work in harmony with other policies, such as carbon pricing, energy efficiency and business models for low-carbon technologies; and
- be suited to a joint approach between the UK and other countries pursuing similar goals.

These are important guiding principles which inform the criteria used to assess policies in this section as well as the design principles set out in Sub-section 0. In line with best practice, this report considers that effective evaluation criteria of demand-side policy should be:

- **Relevant.** Each criterion should represent a key objective that is relevant for the implementation of demand-side decarbonisation policy in Scotland.
- **Informative.** Each criterion should support meaningful comparison by distinguishing between policies that effectively satisfy objectives and those that do not.
- **Mutually exclusive**. The criteria should not overlap with each other.
- **Exhaustive**. The portfolio of criteria should cover all key objectives that are relevant for demand-side decarbonisation policy in Scotland.

[81] See the UK's Industrial Decarbonisation Strategy (March 2021), pages 38-39.

Based on these guiding principles, this section proposes eight criteria against which the different policy options should be assessed, summarised in Figure below.

Figure 13: Demand-side EII policy evaluation criteria for Scotland

Subsequent sub-sections evaluate each policy against each criterion using a red, amber or green rating in order to explore their relative strengths and weaknesses and develop recommendations for next steps. The key features of each criteria and the relevant scoring thresholds are summarised in

Figure 14.

Figure 14: Summary of key features and scoring thresholds for policy evaluation criteria

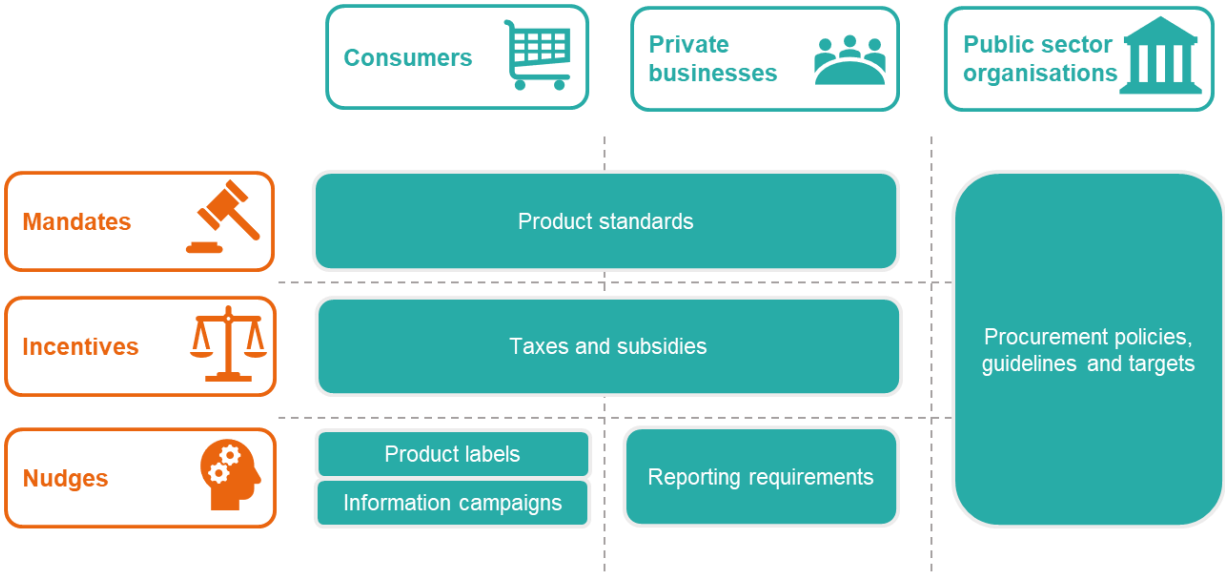
Criteria	Key features	Scoring thresholds
Scottish Government control	Can the policy be implemented within the scope of the devolved powers?	A 'green' rating indicates that the policy is possible under devolution, a 'yellow' rating indicates it may be possible for some industries or products but not others, while a 'red' rating indicates the necessary powers are not devolved.
Complexity of implementation	How complex is the policy design for policymakers to implement and administer, and how much of a burden does this impose upon manufacturers and other actors in the supply chain such as businesses and consumers?	A 'green' rating indicates a relatively straightforward process and little action required on the part of key actors such as manufacturers, a 'yellow' rating indicates a moderately complicated process with some notable actions required, while a 'red' rating entails significant actions for policymakers, manufacturers and other key actors.

Criteria	Key features	Scoring thresholds
Potential for spill-over and leakage	What are the potential indirect effects of these policies, in particular, internationally? For example, implementing stricter carbon standards in Scotland may lead international manufacturers which export to Scotland to reduce their emissions. Similarly, Scottish manufacturers may reduce emissions for their exports alongside their domestically consumed products. Products outside the direct scope of the policies may also be affected both domestically and internationally in cases where customers are able to substitute to other types of products.	A 'green' rating indicates possible significant positive effects in the form of positive spill-overs internationally, a 'yellow' rating indicates some potential for positive spill-over effects, while a 'red' rating indicates limited to no prospect of positive spill-overs or the potential for negative effects from carbon leakage.
Scale of impact on emissions	How significant is the impact of the policy likely to be? The scale of the impact evaluates the extent to which the policy can drive emissions reductions for a given product or industry, assuming that the product or industry is affected by the policy in question.	A 'green' rating indicates a potentially significant decrease in carbon intensity and emissions, a 'yellow' rating indicates a moderate decrease, while a 'red' rating indicates that the policy may have more limited impact on Scottish EIIs.
Certainty of impact	How certain is the impact of the policy, and to what extent can it be driven by the policymaker as opposed to relying on uncertain reaction from consumers and businesses?	A 'green' rating indicates the impact of the policy is fairly certain, a 'yellow' rating indicates there is a degree of uncertainty stemming from business and consumer reactions, and a 'red' rating indicates significant uncertainty in reactions to the policy and its resulting impact.
Flexibility for industry	How much choice in emissions mitigation methods do manufacturers have under the policy? This is important to consider as more rigid policies which dictate exactly what to do are likely to have higher marginal mitigation costs. Furthermore, a flexible policy is more likely to be adaptable to the needs of different sectors and be technology neutral.	A 'green' rating indicates a large degree of choice on the part of the manufacturer, a 'yellow' rating indicates some freedom of choice in terms of action but with certain fixed stipulations, while a 'red' policy indicates little to no flexibility for industry with the emissions intensity reduction methods firmly dictated by the policy.
Impact on input costs	How significant a cost will the policy impose on manufacturers to meet the required standard? Ideally, policies should share the cost of decarbonisation with consumers, and not impose too strong a burden on one or the other.	A 'green' rating indicates the policy will have little to no impact on input costs in and of itself (although it may still impose additional administrative burden), a 'yellow' rating indicates a moderate impact on costs, while a 'red' rating indicates the policy could significantly affect input costs for exposed companies.
Cost to consumers	How significant will this policy change the costs faced by consumers? Costs include monetary burden placed upon consumers, and include impacts on non-monetary factors such as choice, safety and fairness.	A 'green' rating indicates the policy will have little to no impact on consumer costs, a 'yellow' rating indicates a moderate potential impact on costs, and a 'red' rating indicates the policy could have a potentially notable effect on the costs faced by consumers.

In the following sub-sections, we use these criteria to assess the key types of policies summarised in Figure 15. For the purpose of assessment, we combine information campaigns with reporting requirements, as information campaigns are effectively a consumer-facing version of reporting requirements in terms of likely effects and so their assessments are very similar. In particular, we assess:

1. product standards;
2. taxes and subsidies;
3. product labels;
4. information campaigns and reporting requirements; and
5. procurement policies.

Figure 15: Policy intervention framework



As explored in Section 0**,** the Scottish Government's ability to enact some of these policies within its devolved powers is limited. For example, most indirect taxes and subsidies are reserved by the UK Government, with some exceptions for taxes such as taxes on carriage of passengers by air. However, in all cases, the Scottish Government has a degree of control over these policies in some areas relevant to EII products and can extend its influence by working with the UK Government to implement policies which are reserved. As a result, all of the policy categories in Figure 15 are evaluated here, even where the Scottish Government's ability to implement them directly may be limited.

For more information on these types of policies and the policy framework, see Section 0.

6.2 Product standards

Product standards, a form of mandate, can have a significant and direct effect on emissions intensity for affected products. Product standards benefit from the potentially significant scale of their impact. Their impact is relatively certain – a given product standard can be translated directly into a reduction in emissions. For example, as set out in Sub-section 0, to obtain a Carbon Trust Carbon Footprint label of 'Lower CO_2', a product's life-cycle carbon footprint needs to be significantly lower than the market-dominant product in its category. More generally, these labels can be used to stipulate a strict standard which products must meet. Furthermore, manufacturers may choose or need to make equivalent emissions intensity reductions for products they sell outside of

Scotland as well, leading to positive spill-overs. These policies also apply equally to all products, which limits the possibility of carbon leakage. However, they do not eliminate leakage entirely, as product standards could still lead to substitution for products unaffected by the product standards, and these policies must therefore be carefully designed.

While not as complex as some other policy options from the perspective of policymakers, product standards nonetheless may require some significant adaptations from manufacturers in order to meet them. As these policies directly require a change in production methods to lower emissions intensity if firms are currently non-compliant with the standard, they can also have potentially significant impacts on input costs and raise the marginal costs of production.[82] Depending on the ability of companies to pass on these costs to consumers, this may also translate into higher end-user prices.

Overall, these policies can be a powerful but somewhat blunt and inflexible policy instrument for reducing emissions intensity. As a result, they should be implemented carefully. While they are generally unavailable as a policy instrument for the Scottish Government, the Scottish Government does have a degree of control over food standards and building regulations.[83] Building regulations are important for a number of EII products used in construction. As set out in Annex A, a significant portion of demand for products, such as cement and steel, in Scotland is driven by purchases for the domestic construction sector. Construction in Scotland must abide by existing building regulations around factors such as building energy usage and sustainability[84] and, while building regulations currently focus on the performance of the constructed building, these regulations can still be used to impact demand for products such as cement and steel used in construction. Product standards may therefore be useful policy levers for use by the Scottish Government where they are available. Figure 16 sets out a high level assessment of the main criteria for product standard policies.

[82] In particular, switching to low-carbon energy may represent a significant additional cost, as set out in the Scottish Government's Deep Decarbonisation Pathways for Scottish Industries report (December 2020). The additional cost from this fuel switching is estimated to cost Scottish EIIs over £6 billion by 2045.

[83] While building regulations are often considered distinct from product standards by policymakers as they apply to buildings in general as opposed to individual products used in construction, in practice, their impacts are similar and they can be viewed as a form of product standard

[84] For more information, see in particular sections 6 and 7 of the building standards technical handbooks available at https://www.gov.scot/policies/building-standards/monitoring-improving-building-regulations/

Figure 16: Assessment of product standards policy

6.3 Taxes and subsidies

Taxes and subsidies are policies which incentivise buyers to account for the environmental impact of goods and services by reflecting the carbon cost more explicitly in the purchase price. Taxes raise the price of carbon-intensive goods for buyers, while demand-side subsidies lower the effective price of relatively lower-carbon products. The main advantage of taxes and subsidies is that the scale of their impact on demand (and

therefore emissions) can be significant.[85] The precise scale depends on two main factors. The first is (intuitively) the specific rate of tax or subsidy chosen, with the impact on the cost of the product, and therefore demand for the low-carbon products, increasing with the size of the tax or subsidy. The second is how sensitive buyers are to changes in price, with impact increasing with buyer responsiveness. When appropriately formulated, taxes and subsidies can shift product demand in meaningful ways, which can have significant implications for product emissions. They also allow a degree of flexibility for industry, as suppliers have a choice in how specifically to react to these taxes and subsidies.

One challenge of taxes and subsidies is that they are a more indirect measure when compared to policy mandates and can lead to unexpected distortions in demand and therefore in production. For example, an increase in the price faced by consumers for one product as a result of a tax increase can shift demand to a substitute unaffected by this tax increase (and which has therefore experienced a decrease in relative price). As a result, the actual effect may deviate from the intended effect and lead to unexpected shifts in demand for other products. Implementing new taxes and demand-side subsidies is also potentially complex and may require a longer implementation timeline for policymakers than other policy options. They may also be more complex to implement for businesses and manufacturers than some other measures, depending on the impacts on their supply chains. On top of this, taxes can impose substantial costs on industry and consumers.

However, with a few exceptions (notably for air transport), tax policies are not generally devolved to the Scottish Government and are therefore not appropriate policy mechanisms in Scotland. This is summarised in Figure 17.

[85] See, for example, the existing literature on the impact of tobacco taxation on cigarette demand. The available literature largely found that raising cigarette prices through taxation led to a significant reduction in demand for cigarettes by youth and young adults. Some of this literature is summarised in Bader, Pearl & Boisclair, David & Ferrence, Roberta. 2011. Effects of tobacco taxation and pricing on smoking behaviour in high risk populations: a knowledge synthesis. *International Journal of Environmental Research and Public Health*, available at https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3228562/.

Figure 17: Assessment of taxes and subsidies

6.4 Product labels

As explored in Section 0, product labels attempt to nudge consumers and businesses towards purchasing lower-carbon products by increasing transparency around products' emissions footprints and (in some cases) wider environmental impacts. Product labels are primarily targeted at reducing information asymmetries by improving the information available to consumers when making purchasing decisions. This provides a benefit to consumers as they are able to better direct their demand towards products that they prefer. Product labels are also relatively low cost: although they may impose an administrative burden on producers and suppliers in the form of compliance and more

differentiated branding,[86] they do not necessarily imply a meaningful direct cost for manufacturers. Input costs may still increase if manufacturers switch to a more expensive but lower-carbon production method in response to a shift in demand, but they have flexibility in choosing if (and how) to do so.

Product labels are a flexible policy, but their impact on demand and emissions intensity can be uncertain and potentially limited. As set out in Section 50**,** product labels can be a meaningful driver of consumer demand, with the evidence across a range of products showing that consumers are willing to pay more for 'greener' products. However, this same evidence shows that they need to be carefully designed to clearly convey an appropriate amount of information and to leverage other factors such as social influence where possible. Furthermore, the Competition and Markets Authority has found that a substantial proportion of firms' green claims (including claims around product labels) are misleading, which may affect consumer faith in product labels.[87] All of this limits the certainty of the impact of these labels.

Even when appropriately implemented, their impact may be lower than incentive policies such as taxes which directly affect the price of goods for consumers. As explored in Sub-section 0, the evidence points to consumers largely being willing to pay more for 'green' products. However, the premium they are willing to pay depends on the consumer and the product. As a result, the impact of a product label on the demand for a product may be lower than that of a tax or subsidy which directly affects the price for the buyer.

Overall, product labels benefit from their flexibility and low cost, and can meaningfully affect consumer demand when appropriately designed. These policies may not be appropriate in Scotland, however, as labelling policy is generally reserved by the UK Government and is unavailable under Scotland's devolved powers. This is summarised in Figure 18 below.

[86] For more information, see https://www.oecd.org/env/policy-persectives-environmental-labelling-and-information-schemes.pdf and Iraldo, Fabio, & Griesshammer, Rainer, & Kahlenborn, Walter. 2020. The future of ecolabels. *The International Journal of Life Cycle Assessment, 25*. Environmental labelling can increase administrative costs through factors such as auditing and certification, with these barriers likely to be more significant for SMEs.

[87] https://www.gov.uk/government/news/global-sweep-finds-40-of-firms-green-claims-could-be-misleading

Figure 18: Assessment of product labelling policy

6.5 Information campaigns and reporting requirements

Information campaigns and reporting requirements can also be used to nudge consumers and businesses towards lower emissions intensity products. Reporting requirements can involve organisations measuring and reporting their emissions or environmental performance, as well as reporting on what measures they are taking to

reduce emissions and improve other environmental indicators.[88] Information campaigns go further than this by transmitting this information to consumers in order to effect behavioural change through raised awareness and increased understanding of factors such as product emissions. Information campaigns can extend to a wide variety of products and issues – for example, anti-smoking campaigns raise awareness of the harms of smoking, while there is an ongoing information campaign to raise awareness of COVID-19 and encourage vaccination.[89] In practice, product labels can also form a part of information campaigns.

Information campaigns and reporting requirements are similar to product labels across the criteria assessed but are potentially less complex to implement and more likely to be available to the Scottish Government as a policy option. The key distinction between reporting requirements and information campaigns is that reporting requirements are slightly more removed from the final consumer and may therefore be less visible and lower impact. Information campaigns, on the other hand, are designed to be visible, as this is the method through which they drive behavioural change. Overall, visibility is key to these policies' effectiveness. For them to be effective in driving demand, buyers of these goods need to be aware of the information and reports, and be able to understand what it means for the products they are purchasing.[90]

In general, information campaigns and reporting requirements can encourage a shift to lower-carbon products by improving the information available to consumers and by improving the comparability of emissions intensities between manufacturers and across jurisdictions. However, these policies may still have lower impact than stricter policies which involve mandates or strong incentives. Evidence from public health information campaigns shows mixed results, with some campaigns such as those on tobacco harms having a material impact on consumer behaviour, while others on issues such as reducing illicit-drugs behaviours appear to have been ineffective.[91] While evidence of impacts on information campaigns specifically targeted at emissions and other environmental factors is more limited, there is nothing to suggest they would be systematically more effective than information campaigns and reporting requirements targeted at issues such as public health.

Overall, information campaigns and reporting requirements are a low-cost and flexible measure which can help drive demand towards lower emissions intensity products, although they may be relatively low impact. The Scottish Government also has control over consumer advocacy and advice and may therefore be able to conduct information campaigns or encourage businesses to adopt voluntary targets. This is summarised in Figure 19 below.

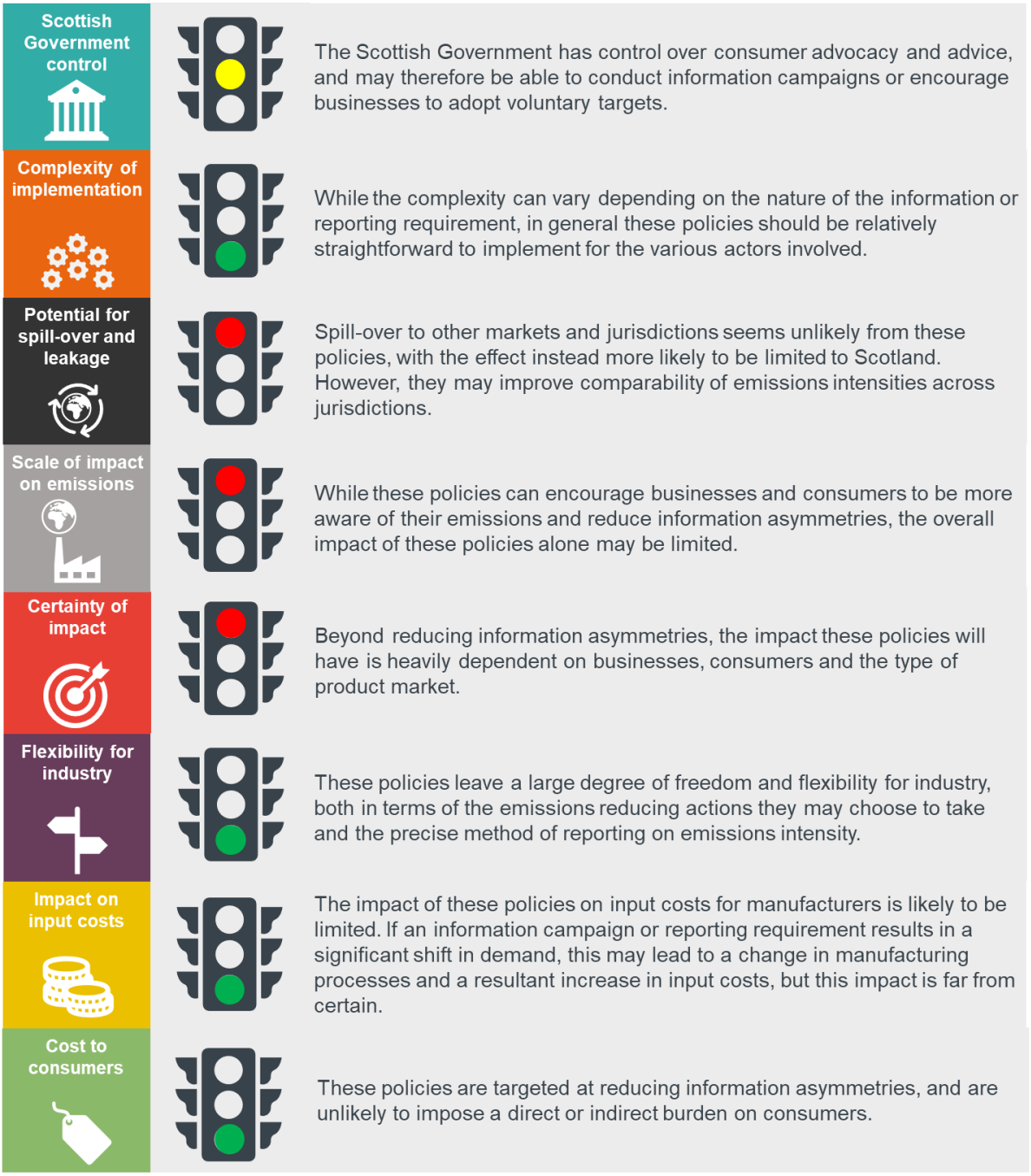
[88] See, for example, HM Government's 'Environmental Reporting Guidelines: Including streamlined energy and carbon reporting guidance' from March 2019, which provides guidance on reporting environmental impacts for relevant companies in the UK.

[89] See, for example, https://campaignresources.phe.gov.uk/resources/campaigns/29-stop-smoking.

[90] For more information on public information campaign design, see Weiss, Janet. 1994. Public information campaigns as policy instruments. *Journal of Policy Analysis and Management, 13(1*).

[91] Stead, Martine, & Angus, Kathryn, & Langley, Tessa, & Katikireddi, Srinivasa Vittal, & Hinds, Kate, & Hilton, Shona, et al. 2019. Mass media to communicate public health messages in six health topic areas: a systematic review and other reviews of the evidence. *Public Health Research*, 7(8).

Figure 19: Assessment of information campaigns and reporting requirements



6.6 Procurement policies

Procurement policies can include nudges, incentives and mandates. While implementing changes to procurement policies is potentially complex and adjusting to these changes may be costly for businesses, procurement policy could be a significant driver of reductions in emissions intensity for products procured by public sector entities such as the central government and local authorities.

As a result of the Scottish public sector's role as a large buyer of goods and services in key product markets, procurement policies can have a significant impact on emissions.

As set out in Sub-section 0, not all goods that the public sector procures in Scotland are carbon-intensive; however, the public sector is a major procurer of construction, which includes a number of carbon-intensive inputs. The impact of procurement policies is also relatively direct, which reduces uncertainty around their potential effects (although this does depend on the degree to which the policies are comprised of nudges, incentives or mandates). They are also comprehensive in that they apply to all suppliers equally (although they do not necessarily impact all suppliers equally) and can therefore be used to reduce the emissions intensities of imported products as well as domestically manufactured goods. They may also drive reductions in emissions intensities for some Scottish exports, as manufacturers that reduce emissions intensities in response to a significant shift in domestic demand may need to reduce emissions for both their exported and domestically consumed goods.[92]

Some procurement policies can be inflexible for businesses and impose larger costs on some manufacturers than others. A strict carbon intensity requirement in procurement imposes larger burdens and constraints on businesses when compared to more flexible policies such as the CO_2 Performance Ladder used in the Netherlands, which adjusts the score received in the procurement process when certain requirements are met.[93] As a result, these policies should be carefully designed to manage the burden on businesses while still incentivising them to reduce emissions intensities.

Overall, procurement policies are readily available to the Scottish Government and can leverage the various public procurers' buyer power to incentivise manufacturers to reduce emissions intensities. However, they are potentially complex to implement, and need to be carefully designed to maintain a degree of flexibility for suppliers where possible and reduce the cost burden imposed upon manufacturers, intermediary businesses and the public procurers in Scotland. Any changes to procurement policy also need to be balanced against wider objectives such as enabling SMEs to participate in public procurement. Figure 20 sets out the evaluation of the main criteria for procurement policies.

[92] This is a result of the fact that it may not be possible to decarbonise only a portion of production, and as a result reducing emissions intensity for goods sold domestically may necessarily involve doing the same for those exported internationally.

[93] https://gpp2020.eu/fileadmin/files/Training_materials/Training_reports_photos_etc/6_Presentation_Riga_blue_version_PP.pdf

Figure 20: Assessment of procurement policies

6.7 Summary of policy assessments

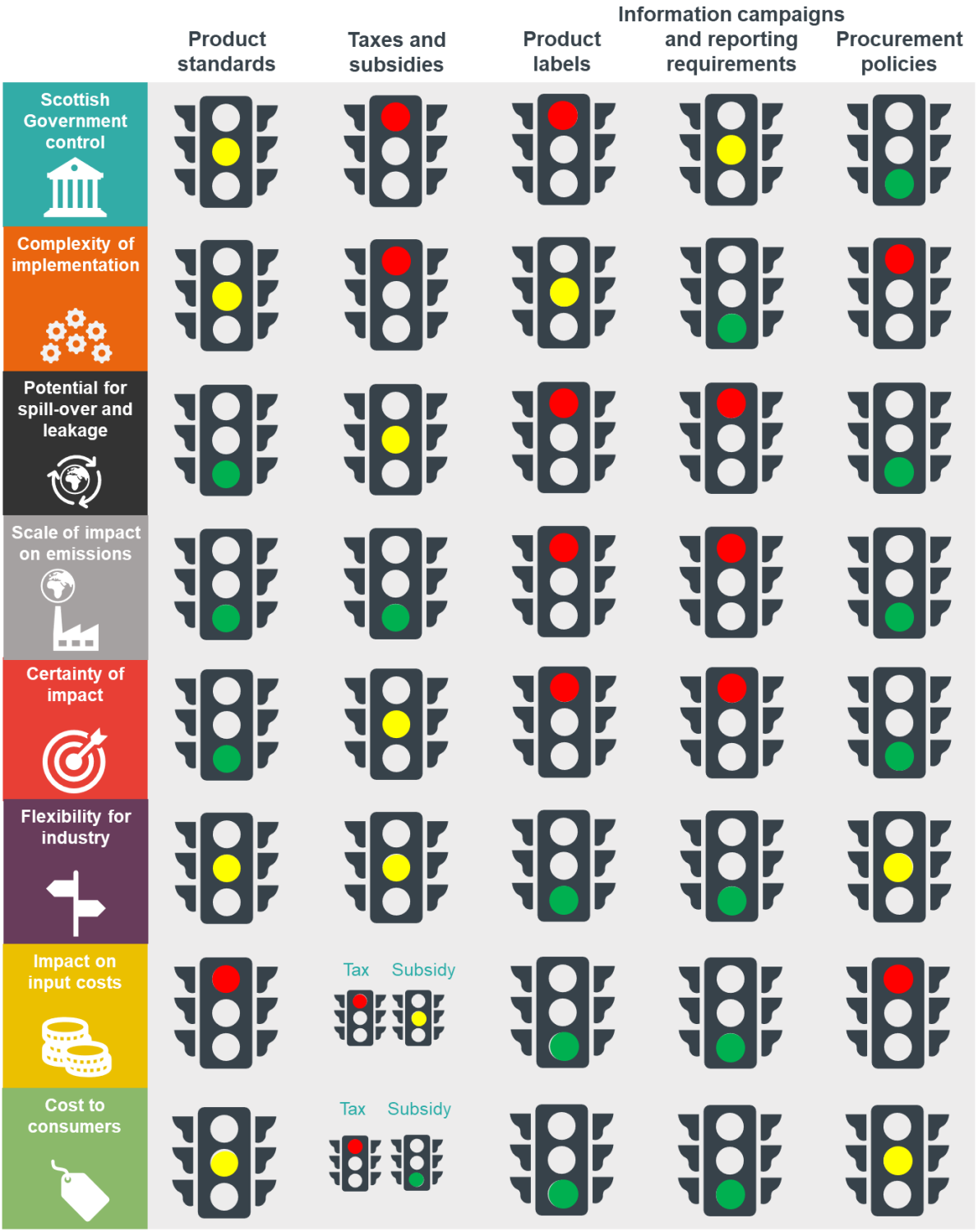
The assessments for the individual policies considered in this section are summarised in Figure 21 below.

As has been noted throughout this section, these policies all have positive and negative aspects. The policies should not be simply ranked based on the number of green and amber ratings they received, as not all of these ratings are equal and their effectiveness will depend on the overall objective and product in question. For example, information campaigns and reporting requirements have more green ratings than product standards,

but this does not mean they are superior policies in every instance and they may still be better suited for certain products and objectives.

Overall, there is likely to be no single best policy, and the ideal policy to apply depends on the situation and sector. The fact that there are 'red lights' in these policy assessments does not mean the policy should not be pursued. Instead, when implementing any of these policies, it is necessary to work through these negative aspects, develop solutions to them where possible and, more generally, be aware of the limitations or risks they entail. Where there are red lights with respect to Scottish Government control due to powers not being devolved, these policies may still be pursued through collaboration with the UK Government. This is explored further in Section 0**.**

Figure 21: Summary of policy assessments



6.8 Scope of impact on emissions

The evaluation of the policy options above has been focused on assessing their benefits and limitations for Scottish EIIs as a whole. The purpose of this study is to undertake initial analysis across a range of policy options in order to identify those that

policymakers should prioritise for further investigation and development, but it does not evaluate every policy against each applicable EII sub-sector. However, it is important to consider the scope of the impact on emissions for particular sub-sectors when undertaking this further, more-granular analysis and ahead of implementing any policy.

The scope of impact is distinct from the scale of impact included in the assessment criteria and differs across sectors. The scale of impact indicates how significantly the policy can drive emissions reductions for a given product or industry, assuming that the product or industry is affected by the policy in question. By contrast, the scope of the impact depends instead on the proportion of products and emissions in the sector that are affected by the policy in question. This is largely driven by:

1. the proportion of demand which is domestic and the potential emissions reductions for these products; and
2. the range of products which are affected and their importance for emissions in the sector.

In general, demand-side policies are more likely to be effective if they target those EII sectors with the largest emissions-reduction potential and the largest share of domestic consumption. As explored in more detail in Annex A, the largest sectors in terms of emissions are not necessarily those sectors with the largest potential emissions reductions from demand-side policy. To determine the potential reductions from demand-side policy, it is necessary to consider:

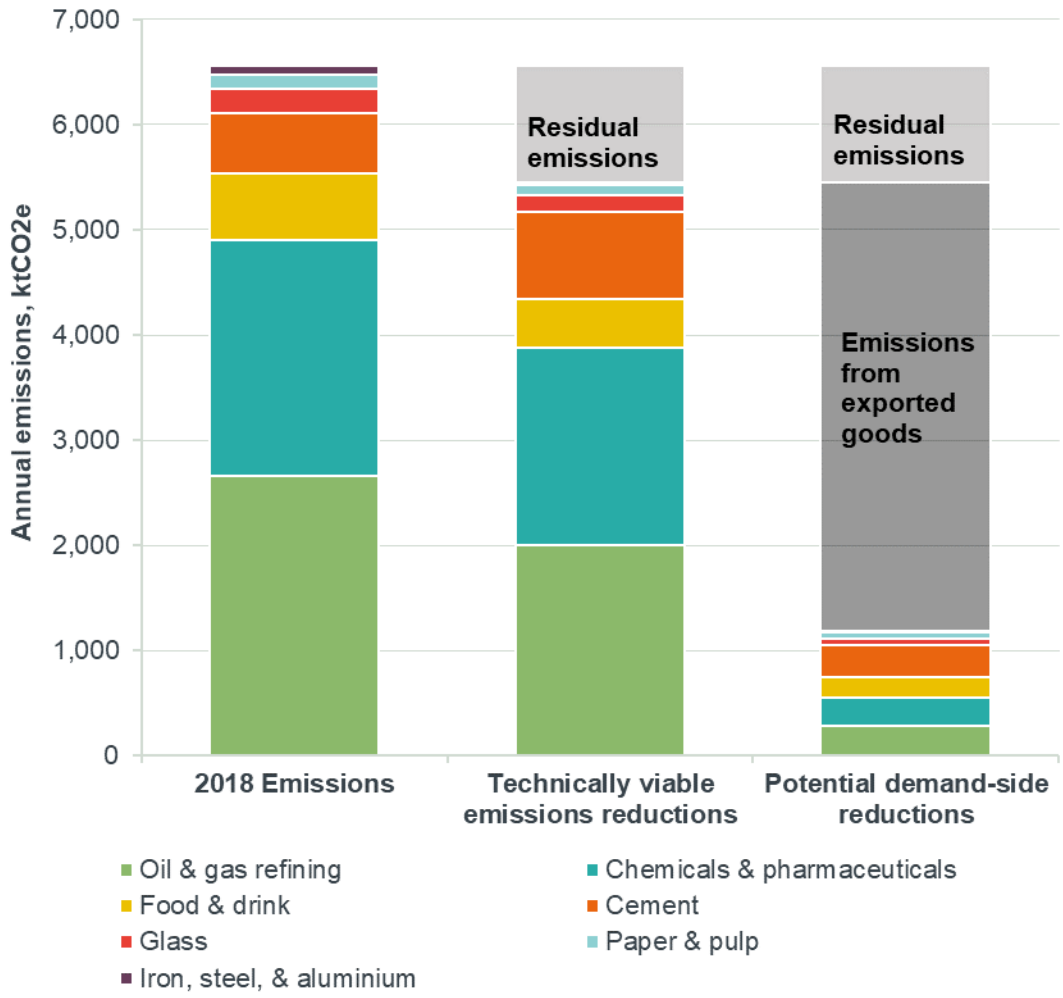
i. the level of emissions from the EII sector;
ii. what percentage of these emissions can be eliminated; and
iii. what proportion of these emissions are driven by domestic demand.

Scotland's EII sectors face unique constraints, challenges and opportunities for decarbonisation. The potential gains from increased efficiency and electrification (or replacement of fossil fuels with hydrogen) vary by sector, with some EII sectors having greater scope for reductions than others. For example, the cement sector may be able to completely eliminate all carbon emissions through increased efficiency, electrification, and the use of carbon capture and storage, while the iron, steel & aluminium sector may only be able to reduce its emissions by a maximum of 31% at current production levels.[94] Similarly, the proportion of exports varies significantly by sector. While over 70% of EII emissions come from the chemicals & pharmaceuticals and oil & gas refining sectors, an estimated 85% of this output is exported, whereas the proportion of exports in the cement and food & drink sectors is much lower. The importance of technically viable emissions reductions and domestic consumption in estimating overall potential domestic emissions reductions from demand-side policy is illustrated in Figure .[95]

[94] For greater detail on potential reductions in these sectors, see https://www.gov.scot/publications/deep-decarbonisation-pathways-scottish-industries/

[95] For more detail on how the estimates in this figure were calculated, see Annex A.

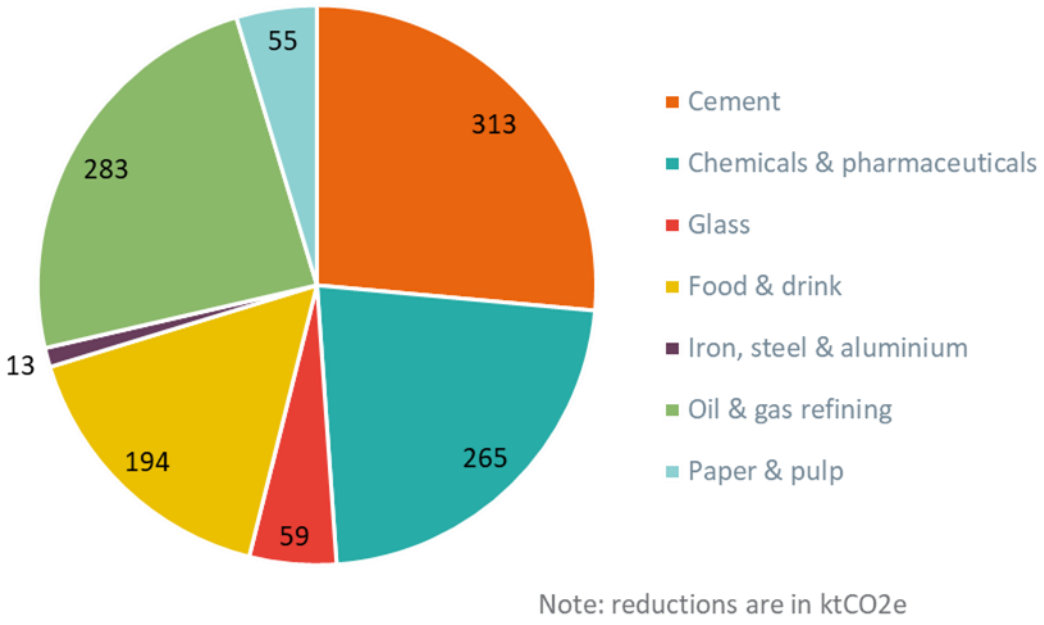
Figure 22: Potential levels of annual domestic emissions reductions by EII sector



After accounting for technically viable emissions reductions and domestic consumption, the sectors where demand-side policy interventions have the greatest potential to drive significant emissions reductions are cement, followed by chemicals & pharmaceuticals, oil & gas refining and food & drink. This is illustrated in Figure 23.[96] While there are smaller reductions possible in the glass and paper & pulp sectors, there is limited scope to create substantial emissions reductions in iron, steel & aluminium using demand-side mechanisms. Note that global emissions reductions could exceed domestic reductions if demand-side policies in Scotland influence foreign EIIs or Scottish exporters.

[96] This figure presents an estimate of potential annual domestic emissions reductions that could be targeted by demand-side policies. This estimate is based on the proportion of technically viable scope 1 emissions reductions accounted for by domestic consumption of Scottish-produced EII products. It does not include potential scope 1 emissions reductions associated with exported EII products (e.g. if they are decarbonised alongside the manufacture of products for domestic consumption), nor does it include other positive spill-over effects of demand-side policies (e.g. decarbonisation of imported EII products).

Figure 23: Potential domestic demand-side policy emissions reductions by sector (annual, $ktCO_2e$)



Demand-side policies also have a greater scope and are more likely to be effective if they affect a range of products within a sector, as opposed to targeting one specific niche product. For example, introducing reporting requirements for the oil & gas refining sector has a much larger policy scope than changes to public procurement of gas products, which only affects a relatively small sub-set of products in the market. The types of products produced by each sector are set out in greater detail in Annex A.

Assessments of the likely scope of impact are set out in Figure 24 below for a sub-set of products and policies, focused on EII sub-sectors for which there is significant potential for emissions reductions. These assessments are informed by analysis of the proportion of demand for each sector which is domestic, and what types of products are produced in each sector, as well as by Scotland's devolved powers as set out in the policy assessments in this section. For example, while production emissions (and potential reductions) from Scotland's oil & gas refining sub-sector are high, an air passenger fuel tax (one of the tax mechanisms devolved to the Scottish Government) is likely to be of limited impact as most oil & gas products are exported and airplane fuel is one product of many. As a result, this policy would affect only a small part of the oil & gas refining market.

Figure 24: Assessment of scope of impact for a sub-set of policies and EII sub-sectors

	Similar policies in other jurisdictions	Domestic demand	Products affected
Procurement policies - cement	CO_2 Performance Ladder (Netherlands); Buy Clean Act (California)	Significant proportion of demand is domestic	Affects major buyers and all products
Product labels - food & drink	Carbon Trust Carbon Footprint label (International)	Significant proportion of demand is domestic	Affects all buyers, but to be effective drink needs to be in scope
Reporting requirements - general	Act on Promoting Green Purchasing (Japan)	Varies across sectors	Affects all products, but in a more indirect way
Procurement policies - oil & gas	CO_2 Performance Ladder (Netherlands); Buy Clean Act (California)	Domestic demand represents small share of total	Only affects a relatively small sub-set of products/market
Taxes and subsidies - air passenger fuel tax	Advanced Aviation Biofuel Mandate (Norway)	Domestic demand represents small share of total	Only affects a relatively small sub-set of products/market

Note: A green impact rating indicates a high scope of impact, a yellow rating indicates a moderate scope of impact, while a red rating indicates a limited scope of impact.

Overall, when assessing which policies to implement, it is important to keep in mind the extent to which the policy is capable of affecting demand across the sector, which will depend on the specific sector and policy in question. A policy with an extensive scope of impact within an industry and a large scale of impact on the products affected will lead to more significant impacts on total emissions.

6.9 Assessing the impact on competitiveness

A second common factor across all these demand-side policies is that they need to be carefully implemented in order to preserve or enhance the competitiveness of Scottish industry and avoid carbon leakage and adverse economic effects. While policy nudges appear unlikely to have a noticeable impact on competitiveness due to their flexibility and overall relatively low burden on manufacturers, mandates and incentive policies may have an effect on competitiveness. Despite the potential risks of some of these policies, if implemented carefully they can enhance, rather than hinder, the competitiveness of Scottish industry while also assisting it with decarbonisation.

As noted in Annex A, EII sectors are important contributors to the Scottish economy. If Scottish EII producers were to have lower emissions intensity than their international competitors, demand-side policies could support these sectors by incentivising the purchase of lower-carbon goods and shifting demand towards Scottish EIIs.

An analysis of the relative emissions intensity of Scottish EII products is beyond the scope of this report. However, it should not be assumed that all Scottish EII sectors will necessarily be more efficient than international competitors. CE Delft (2018) found that the UK as a whole ranked 16th of 25 countries in terms of oil & gas refining production emissions efficiency in 2011, producing only 40% as many kilograms of oil & gas

products per tonne of CO_2e as market leader Japan.[97] Likewise, the study found that the UK ranked 12th of 13 countries in terms of steel production emissions efficiency in 2009, producing 22% as much steel (in value) per tonne of emissions as market leader Italy.

There is, however, some evidence that the relative emissions intensity of Scottish EIIs is improving, with increasing attention being directed towards decarbonisation and the required investment planning. An October 2020 report by UK Concrete highlighted that the UK concrete and cement sector has decarbonised faster than the UK economy as a whole.[98] It also set out a detailed roadmap to reducing cement sector emissions beyond net zero, which suggests that Scottish cement may grow more competitive from an emissions intensity perspective.[99] Similarly, the Food & Drink Federation in the UK published a report in 2019 exploring what the sector can do to achieve carbon neutrality by 2050, with a focus on decarbonising heat in the sector.[100] It found that the food & drink sub-sectors studied in the report could reduce emissions from heat by 64-100% by 2050 when compared to 2012 levels, depending on the level of grid decarbonisation and availability of decarbonised gas.

In addition, Scotland does appear to have potential advantages. Scotland was on track to deliver 100% of its own electricity needs from renewables by 2020 as of the end of 2019, highlighting the high level of decarbonisation of the energy grid.[101] Scottish manufacturers have also invested in innovation to reduce emissions and the Scottish Government has affirmed its commitment to reducing carbon emissions as part of the COVID-19 recovery and ensuring this recovery supports Scotland's net-zero carbon goals.[102] All of this indicates that emissions intensity in Scottish EIIs is likely to continue to fall and there is strong support to meet the major potential emissions reductions highlighted in the recently published report on Deep Decarbonisation Pathways for Scottish Industries.[103]

In general, the competitive position of Scottish EIIs with respect to emissions intensity and potential future reductions is an important policy consideration, as any advantages will be amplified by demand-side policies. However, even in cases where Scottish industries are relatively emissions intensive compared to international competitors, there may still be benefits for Scottish industry from introducing demand-side policies. Namely, Scottish demand is likely to be more important for Scottish EII producers than it will be for individual international competitors. As a result, international competitors may be less likely to reduce emissions in order to continue supplying Scottish consumers than Scottish EIIs would be, creating an additional incentive for Scottish EII to decarbonise and ultimately affording them an advantage over those international competitors.

Overall, where Scottish EII sectors are more efficient from an emissions perspective than their international competitors, demand-side policy will have the additional benefit of supporting these businesses. This in turn could provide economic benefits to these sectors and to the Scottish economy as a whole.

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97 CE Delft. 2018. Carbon intensities of energy intensive industries, https://www.cedelft.eu/en/publications/2200/carbon-intensities-of-energy-intensive-industries.

98 https://www.thisisukconcrete.co.uk/TIC/media/root/Perspectives/MPA-UKC-Roadmap-to-Beyond-Net-Zero_October-2020.pdf

99 Ibid.

100 https://www.fdf.org.uk/globalassets/resources/publications/fdf-slr-report-decarbonising-heat-to-net-zero.pdf

101 https://neweconomics.org/uploads/files/NEF_Re-energising-manufacturing_Nov.pdf

102 https://www.gov.scot/news/advisory-group-on-economic-recovery/

103 https://www.gov.scot/publications/deep-decarbonisation-pathways-scottish-industries/

7 Case studies on emissions measurement, benchmarking and validation

The ability to evidence lower-carbon production is important for all of the policies assessed in Section 0. Consistently measuring emissions intensity across products is necessary for implementing many of these policy interventions, as it allows policymakers, businesses and consumers to understand the emissions intensity of products and how this has changed over time. Furthermore, benchmarking these emissions measurements can inform purchasing decisions for end-consumers, businesses and the public sector by revealing which products are relatively low carbon. It is also important that these measures and benchmarks are validated in order to ensure that they are accurate and consistent across suppliers. Outside of informing buyer decisions, information on emissions intensities is also an important tool for policymakers for understanding which sectors and products to prioritise with respect to policy development. Overall, understanding how emissions intensity can be measured and reported is key to supporting implementation of various policies and conveying carbon intensity information to various buyers.

There is currently a deficit of information and tools available to inform buyers of the carbon intensity of products and support the design and implementation of the various available policy levers. As a result, we undertook two case studies examining key products produced by Scottish EII. The case studies considered:

- **How emissions intensity is currently defined and measured**, whether on a voluntary or mandatory basis, and a brief assessment of the strengths and limitations of these methods;
- **Where emissions intensity is measured**, how it is benchmarked and validated; and
- **Where emissions intensity is not currently measured or reported**, a summary and brief assessment of available approaches that could usefully be adopted.

Emissions measurements can include Scope 1, 2 and 3 emissions. For clarity, these emissions are defined briefly below:

- **Scope 1** emissions are direct emissions from sources owned or controlled by the manufacturer. These include process emissions and other direct emissions such as those from vehicles;
- **Scope 2** emissions are indirect emissions from the generation of purchased electricity; and
- **Scope 3** emissions include indirect emissions (excluding electricity) that occur in the value chain, both upstream and downstream.

These case studies are focused on understanding emissions intensity measurement and benchmarking for different products and are not policy implementation studies. As a result, they are not specifically related to any particular policy, but instead can be used to inform a range of policy options by setting out the feasibility of comparing emissions intensities across manufacturers for specific products, and the related strengths and weaknesses of these measures.

Through a combination of desk review and stakeholder interviews, the following section of the report examines two case studies:

1. **Cement** production at the Dunbar Cement works; and
2. **Whisky** production in Scotland, with a particular focus on Diageo.

These case study products were chosen for three reasons.

- First, a relatively high proportion of demand in the cement and food & drink sectors is domestic rather than international and the potential emissions reductions in these sectors are substantial, as set out in Annex A.
- Second, the Scottish Government also has access to policy levers which can be used to affect these products (such as procurement policies for cement and information campaigns for whisky).
- Third, they offer insight across products aimed at different market/buyer segments – cement is a product primarily purchased by businesses (such as construction companies), while whisky is a consumer-facing good.

However, the selection of these products for case study investigation does not imply that these are the two most important products with respect to demand-side policies in Scotland.

7.1 Case study 1: Cement

Background on cement production at Dunbar

The Dunbar limestone quarry and cement plant (Dunbar) is the only integrated cement manufacturing operation in Scotland.[104] The Dunbar plant has been operating since 1963 and employs approximately 140 people. It is owned by Tarmac and is one of three cement plants managed by the company which operate as a supply network across the UK. The main use of cement is as a constituent of concrete products. Tarmac is a vertically integrated business and operates a large number of downstream processes that use cement as a constituent, including ready-mixed concrete, concrete blocks, mortars and screeds. Approximately half of the cement produced at Dunbar is exported to England, and approximately half is used in Scotland.

Cement plants are energy intensive and involve several process stages. The main operations and how they relate to carbon emissions are described below.

1. The process begins with extracting limestone from a quarry (via drilling, blasting) and transport from the quarry to the processing plant.
2. The limestone is combined with other raw materials, including sources of iron, silica and alumina, to give the exact chemistry needed for cement manufacture. The raw materials are then crushed and ground. This involves electricity consumption.
3. The finely ground raw materials then undergo chemical processing at 1450^{o}C in the cement kiln, which includes preheater, calciner and rotary kiln stages. Process emissions (CO_2) from the decarbonation of limestone (calcium carbonate) to lime (calcium oxide) are the main contributor to CO_2 emissions, followed by CO_2 from fuel consumption to provide the heat. Electricity is also consumed.
4. This produces ‘clinker’, which is cooled and stored in silos. The clinker is then ground with gypsum and other additions to produce a range of finished cements. This involves further electricity consumption.

[104] DNV held an informative one-hour videoconference meeting with several Tarmac representatives on the 22 April 2021 to obtain much of the information presented.

5. The cement is sold in bulk or is packed. It is transported offsite via rail and road, which involves transport emissions.

Throughout the process described above, there are also embodied carbon emissions and transport emissions associated with the raw materials that are purchased (e.g. iron, silica, alumina). Dunbar purchases some of these materials, while others are sourced from within its quarry.

General good practice at Dunbar

Emissions reduction has been a focus in the cement industry for many years, and emissions from the sector have reduced by 53% since 1990.[105] Dunbar cement plant considers that it has already adopted many of the technical and financially viable options available to it. Overall, Tarmac has reduced emissions per tonne across its business by 23.5% since 1990 and has a target to achieve net zero by 2050.

Examples of good practices at Dunbar include:

- Clinker replacement with cementitious additions (for example, including limestone, ground granulated blast-furnace slag (GGBS) or fly-ash) to reduce the clinker-cement ratio and reduce carbon intensity, which can be undertaken at the cement plant or at the concrete plant.
- 40-45% of fuels used at Dunbar are waste-derived fuels such as used tyres (part biomass), solid recovered fuel (which was previously landfilled and is part biomass), and processed sewage pellets (100% biomass). This reduces reliance on fossil fuels and the biomass fraction of the waste-derived fuels is carbon neutral, helping to reduce CO_2 emissions.
- 100% of electricity used is purchased from renewable sources (wind and solar), supported by Renewable Energy Guarantees of Origin certificates. Some of the electricity supplied to the site is sourced from landfill gas generated by a nearby landfill site.
- Tarmac believes that as cement is an energy-intensive operation, market competitiveness is dependent on energy efficiency. Dunbar has implemented energy efficiency measures onsite, such as a new efficient cement mill which reduces the electricity needed for cement milling by 50%. Additionally, Dunbar is certified to ISO 50001 Energy Management Standard and ISO 14001 Environmental Management Standard.
- Tarmac has invested significantly in rail capacity at the Dunbar site and in cement depots to improve distribution efficiency and reduce CO_2 emissions from transport.
- Tarmac is involved in research into plasma energy and hydrogen to reduce carbon emissions and is also a participant in Low Emissions Intensity Lime and Cement (LEILAC), an EU Horizon 2020 project aimed at enabling a breakthrough in technology to dramatically reduce carbon emissions. Tarmac is a member of NECCUS, an alliance of industry, government and experts focused on enabling carbon emissions from industrial sources in Scotland and beyond.

[105] See, for example, the 'Beyond Net Zero' roadmap for the UK cement and concrete sector published by UK Concrete in October 2020.

Emissions measurement

Dunbar currently measures Scope 1, 2 and 3 emissions based on international standards of best practice.

To measure Scope 1 and Scope 2 emissions, Dunbar uses a calculation methodology, the Cement CO_2 Protocol,[106] and a template developed by the Global Cement and Concrete Association. The template was developed based on the GHG protocol which is the most widely used GHG accounting standard.[107] The methodology is considered good practice. The vast majority of the facility Scope 1 emissions (i.e. the kiln/clinker process) are also captured under the UK ETS, using the prescribed approach for calculating, reporting and independent verification of emissions.

Dunbar calculates its Scope 3 GHG emissions using the GHG protocol. Dunbar's Scope 3 emissions are relatively small and include purchased goods and materials (embodied carbon), employee commuting, business travel, and third-party contracted transport of incoming materials and outgoing cement products. Dunbar accounts for all the main Scope 3 emissions and increasingly requires its main suppliers to provide it with emissions data.

Dunbar measures the carbon emissions intensity of cement in various forms. In particular, it measures it in terms of:

- CO_2/tonne clinker produced (both gross and net intensity);[108]
- CO_2/tonne of cement produced (both gross and net intensity); and
- CO_2/tonne of Portland cement equivalent produced (both gross and net intensity). Clinker is the most carbon-intensive component of cement but in any particular year the amount of clinker produced and turned into cement will vary. To adjust for stock impacts, Portland cement equivalent is a normalising factor used to calculate the amount of cement products that can be produced from the clinker that is actually produced in that year. It uses the average clinker-cement ratio for the year to enable 'like-for-like' comparison across cement products.

In addition to measuring carbon emissions intensity, Dunbar also measures energy intensity, as that can also help to identify and benchmark performance.

The broader Tarmac group also conducts life-cycle assessments of its UK cement products. Tarmac conducts in-house EPD life-cycle assessment (LCA) of its UK cement products. These assessments are not currently publicly available for cement but are available for concrete. EPDs for concrete extend the measurement of emissions to include the production, use and disposal of concrete, and not just the emissions up to the point of delivery of cement to the customer. Cement EPDs are available at UK sector level. Tarmac also conducts carbon footprint assessments for all products according to PAS 2050 Method for Assessing the Life Cycle Greenhouse Gas Emissions of Goods and Services.

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[106] In 2016 the Cement CO_2 protocol became a British and European Standard BS EN 19694-3:2016 Stationary source emissions. determination of greenhouse gas emissions in energy-intensive industries; cement industry. It is in the final stages of becoming an ISO International Standard.

[107] ghgprotocol.org

[108] Gross emissions account for all CO_2 emissions, while net emissions can incorporate a discount to account for emissions from the combustion of alternative waste-derived fuels such as Solid Recovered Fuel SRF (which otherwise would go to landfill or incineration, and ultimately produce CO_2). Biomass sources recognised by the EU ETS as carbon neutral are not included in the gross or net calculations. This is in line with the Cement CO_2 Protocol and EN 19694-3:2016.

Tarmac indicated that it is important when comparing LCAs between different products (such as concrete versus alternative materials) that comparisons are made only at the full scale of the building or infrastructure asset and are based on whole-life performance. For example, concrete buildings can last significantly longer than alternatives and reduce the energy needed for heating and cooling compared to other materials through application of concrete's thermal mass benefits, and, over its lifetime, concrete reabsorbs a substantial proportion of CO_2 emitted during its manufacture. As a result, Tarmac indicated that simplistic comparisons based on embodied carbon at point of construction may lead to sub-optimal design and specification choices as well as higher running or maintenance costs, along with potentially increased carbon emissions during operational use.

Emissions at Dunbar and Tarmac UK

The site-specific Scope 1, 2 and 3 GHG emissions at Dunbar are commercially confidential, and only the Dunbar GHG emission data regulated under the UK Emissions Trading Scheme (ETS) are publicly available. In 2018, the Dunbar plant emitted 574,000 tonnes of CO_2e. This represents the vast majority of the Scope 1 emissions from the site and includes emissions from fuel consumption and from process decarbonation, the main contributors to overall emissions. Dunbar stated that its Scope 2 emissions (electricity) are less than 10% of overall site emissions and 100% of electricity is from renewable sources.

Publicly available (aggregated) data are available for Tarmac UK-wide operations and include Dunbar. The figure below shows most emissions to be Scope 1. Based on the publicly available data, the majority of Scope 1 emissions are process emissions, while the remainder are made up of fuel consumption (mainly coal, waste derived fuel, natural gas and oil).

Tarmac UK Emissions

	1000's tCO_2e	% of total emissions
Scope 1 (process)	1,383	45%
Scope 1 (fuel)	960	32%
Scope 2*	128	4%
Scope 3	572	19%
Total	3,043	100%

Source: 2019 Annual Sustainability report, https://sustainability-report.tarmac.com/planet/climate-change/

*Note that while Scope 2 electricity is reported here on a location-based method using national grid factors, since all electricity is from renewable sources it is reported as zero when using a market-based method as permitted by the Greenhouse Gas Protocol.

Emissions benchmarking

Carbon emissions intensity is benchmarked in various ways at Dunbar. In particular, emissions intensity is benchmarked:

- internally, against other Tarmac cement plants; and
- externally, against other cement manufacturers.

Care is required when benchmarking, and simplistic comparisons can be flawed. As a result, benchmarking should only be performed by informed parties owing to a number of complexities, including those outlined below:

- There are 27 different types of 'common' cement in Europe, depending on the cement constituents, as well as a number of 'specialist' cement types, with emissions not directly comparable across them. As a result of this variation, care needs to be taken when comparing one cement plant with another. This variation in grade of cement is why Dunbar calculates the carbon intensity (CO_2/tonne) of Portland cement equivalent produced.
- Carbon-reducing cementitious additions (e.g. fly-ash and slag) are made at the cement plant in some jurisdictions and at the concrete plant in others. In the UK, bulk cement is made into concrete downstream of the cement plant, when various quantities of cementitious additions can be added to help reduce the clinker-cement ratio and thus the carbon intensity (this results in a large number of variations of concrete types in compliance with British and European concrete standards). In the UK, cementitious additions are mainly made at the concrete plant. In the EU, such additions typically occur at the cement plant. This means that emissions intensities are not directly comparable between the UK and EU at the cement plant level. This needs to be taken into account when comparing UK cement plants with EU cement plants.
- Some countries produce a coarser cement than in the EU, which can have an apparently lower-carbon intensity per tonne, but a larger quantity of cement may be needed for the end application. Again, these differing cements are not directly comparable, and this should be accounted for when benchmarking emissions intensities.

Validation of measurement and benchmarks

As well as Scope 1, 2 and 3 emissions data undergoing internal assurance processes within Dunbar and Tarmac, the vast majority of Scope 1 emissions (i.e. the main operational emissions) are independently verified by a third party, as required by the UK ETS. The Dunbar cement plant has also undergone annual assurance of GHG emissions by independent consultants several times.

Demand-side considerations in cement

Demand for lower-carbon cement products is growing. Tarmac is receiving an increasing number of requests from its customers for 'carbon footprint' assessments of its concrete products. Similarly, local authorities and other clients are increasingly requesting carbon performance data across a project that demonstrate carbon reduction. Such requirements are beginning to be included in contractual documents.

It is important to note that the carbon intensity of cement and concrete is to a large extent dependent on its intended application. Tarmac must provide cement and concrete to the standard required by end-users and building standards, and therefore the carbon intensity of its products is a function of application and building/asset design. Introducing policies to support use of lower-carbon cement and concrete products is an area that Tarmac believes can incentivise decarbonisation. Tarmac is supporting proposals to change product standards to allow a greater range and proportion of clinker

replacements to be used in cement and concrete which would reduce the emissions intensity of cement and concrete products. Tarmac indicated that the lowest-carbon concrete type available and appropriate for a specific application is not always specified by the designer or engineer. As higher clinker products have a higher-carbon intensity, using a lower-carbon concrete formulation could significantly reduce the emissions intensity of the cement and concrete products purchased.

Tarmac is supporting the work by the Construction Leadership Council's Green Construction Board (a joint industry-government initiative), which has a task group developing a route map for adoption by the industry to assist designers, engineers, clients and the wider construction sector to reduce the carbon impact of construction activities. The intent is to encourage greater uptake of the lower-carbon options available today for specific applications and those that will be available in the future as product standards change.

Furthermore, while Tarmac is supportive of measures to reduce carbon, it has concerns about 'carbon leakage' and the impact of potential additional costs incurred at Dunbar as a result of new demand-side policies. A significant proportion of cement used in the UK is imported, so anything that incurs additional cost to Dunbar but does not have an equivalent effect on international competitors will disadvantage Dunbar. While carbon leakage from demand-side policies is generally lower than supply-side policies, this is a nuanced issue that can still occur and should be kept in mind when implementing any new policy.

In general, Tarmac considers that there needs to be a close link between demand-side measures that encourage lower-carbon procurement and the policies needed to facilitate decarbonising cement manufacture, including addressing the availability of enabling infrastructure (e.g. CO_2 transport and storage), international competitiveness and decarbonisation costs. The fragmented and complex nature of the construction supply chain make this particularly challenging and requires careful design.

Summary

In summary, Dunbar cement plant is a mature energy-intensive industry. It has calculated CO_2 emissions for decades. Its knowledge of its carbon emissions and intensity appears robust. It confirmed its use of an appropriate calculation methodology and considers an appropriate breadth and scope of emissions.

Although Tarmac considers the site-specific GHG emission and intensity data at Dunbar to be commercially confidential, it is open to the possibility of sharing more information with the Scottish Government. Care is required when benchmarking and simplistic comparisons can be flawed, so any future decisions to incentivise decarbonisation should be taken in consultation with the cement industry.

7.2 Case study 2: Whisky

Background on whisky production in Scotland

Scotland has more than 130 malt and grain whisky distilleries. This is the greatest concentration of whisky production in the world,[109] and whisky is a major product within Scotland's important food & drink industry. In this case study, we liaised with both the

[109] https://www.scotch-whisky.org.uk/discover/distillery-map/

Scotch Whisky Association (SWA) – a trade body which represents more than 90% of Scotch Whisky operations – and with Diageo, which operates nearly 30 Scotch Whisky distilleries.[110]

Whisky production involves a number of process stages. The main stages of production, and how they relate to carbon emissions, are described briefly below:

1. Malting operations occur before whisky distilling. In the malting process, barley and water are mixed so that germination occurs. Kiln drying then halts germination. The kiln drying process involves energy consumption which produces CO_2.
2. Following the malting operations, the whisky distillery operations begin with the mashing stage. In the mashing stage, hot water is added to the mixture, again involving energy consumption. This produces a liquid known as wort.
3. Yeast is then added to the wort to enable fermentation. This creates a low-alcohol liquor known as wash. Fermentation releases CO_2, but these are biogenic, short-cycle carbon emissions and not part of any Scope 1, 2 or 3 reporting.
4. The wash is then distilled, involving more energy consumption.
5. The new-make spirit produced is then poured into casks to enable maturation to begin.
6. Once maturation is complete (after a minimum of three years) the whisky can be bottled (which involves electricity consumption) and transported for sale (which involves fuel consumption).

Throughout the stages described above, there are also embedded emissions and transport emissions associated with the raw materials that are purchased (e.g. cereals, yeast).

General good practice in the Scotch Whisky sector

The Scotch Whisky sector has been calculating GHG emissions for a number of years and has made some progress since 2008. By 2018, absolute GHG emissions had reduced by 34%, and the use of non-fossil fuels had increased from 3% to 28%.

Examples of good practices include the introduction of biomass boilers at some distilleries and the purchase of green electricity. Energy efficiency measures have also been implemented, driven by the Climate Change Agreement for the spirits sector. This agreement sets energy efficiency targets and in return companies are eligible to claim discounted rates of the Climate Change Levy. Diageo finds that external energy efficiency audits such as the Energy Savings Opportunity Scheme can be more valuable to achieve improved energy efficiency than, for example, ISO50001 (Energy Management) or ISO14001 (Environmental Management Systems).

In 2020, the SWA published a pathway report on how the sector might reach net-zero Scope 1 and 2 emissions by 2045.[111] This was used to inform the development of the

[110] DNV held informative one-hour videoconference meetings with SWA on 20 April 2021, and with Diageo on 23 April 2021 to obtain much of the information presented below. Where relevant and appropriate, information is provided separately for the SWA and Diageo.

[111] https://www.scotch-whisky.org.uk/media/1733/scotch-whisky-net-zero-report.pdf

SWA Sustainability Strategy which was launched in 2020 and sets a sector-wide ambition to achieve net zero by 2040 with an interim target of a 40% reduction by 2030, measured against 2018 emissions.[112] It aims to achieve this via a combination of measures, including improved energy efficiency, the application of multiple technologies (such as anaerobic digestion, biomass, hydrogen, high-temperature heat pumps), the reduced GHG emissions intensity of electricity generation and by offsetting. Hydrogen has a central role in the net-zero scenario, and the strategic uncertainties related to hydrogen production, supply and distribution are major barriers. Additionally, technologies such as high temperature heat pumps for industrial use will need further research and development.

Diageo has been ranked by the CDP (previously Carbon Disclosure Project) as the best-performing beverage company in the world for climate change strategy, emissions disclosure and performance. Diageo has improved energy efficiency, generated and sourced renewable/low-carbon energy, partnered with the supply chain to help reduce emissions and opened a new state-of-the-art Innovation and Research Centre in Scotland to support sustainable growth of the distilling industry. By 2030, Diageo aims (globally) to:

- have become net-zero carbon in direct operations (Scope 1 and 2);
- have reduced supply-chain (Scope 3) carbon emissions by 50%; and
- be using 100% renewable electricity across direct operations. Diageo has already achieved this target in Scotland and is a signatory to RE100.

Emissions measurement

The SWA currently measures its members' Scope 1 and 2 emissions based on international standards of best practice. Diageo also measures Scope 1 and 2 emissions and attempts to go further and capture most Scope 3 emissions.

- **Scotch Whisky Association**

The SWA confirmed that it follows the UK's carbon-reporting guidance (which is broadly in line with the GHG protocol) to calculate its members' Scope 1 and 2 GHG emissions. This approach is generally considered good practice. The Scope 1 emissions captured currently focus mainly on production operations and do not capture 100% of Scope 1 direct transport emissions. However, the SWA understands that these direct transport emissions which are not captured are likely to represent only a small proportion of Scope 1 emissions. The SWA collects and collates these reported emissions.

The SWA does not currently collect Scope 3 GHG emissions data from its members, although this may change in the future. However, while these data are not centrally collected, some whisky producers do calculate their own Scope 3 emissions. According to the SWA, the LCA of whisky indicates that Scope 3 emissions (e.g. from production of cereals, bottling facilities and export of whisky) are larger than direct Scope 1 and 2 production emissions. This suggests that measuring Scope 3 emissions is an important part of calculating whisky products' emissions intensities.

In general, most GHG emissions in the whisky sector are calculated voluntarily. This is because only a small proportion of the distilleries consume enough energy to be

[112] https://www.scotch-whisky.org.uk/insights/sustainability/

captured under the UK ETS, a mandatory scheme with its own specific requirements for calculating, reporting and verification.

Although it has the necessary data to calculate carbon emissions intensity (i.e. emissions per unit product), the SWA currently does not calculate it as it finds tracking energy efficiency to be more effective for its purposes.

Emissions from SWA members

Publicly available aggregated emissions data are available from the SWA. These data cover 127 sites in Scotland, including 70 malt distilleries, 5 grain distilleries and 11 packaging sites.

The emissions baseline was 528,792 tonnes CO_2e/year in 2018, and fossil fuels dominate the emissions inventory as shown in the table below. Only approximately 5% of emissions are from Scope 2 electricity use.

SWA aggregated baseline GHG emissions contributions by fuel (2018)

Fuel	%
Scope 1 - Natural Gas	63%
Scope 1 - Fossil Oils	31%
Scope 1 - CNG/LPG	1%
Scope 2 - Electricity	5%

Source: https://www.scotch-whisky.org.uk/media/1733/scotch-whisky-net-zero-report.pdf

- **Diageo**

Diageo uses the GHG protocol to calculate its Scope 1, Scope 2 and Scope 3 GHG emissions. Diageo considers its calculations for Scope 1 and Scope 2 emissions to be relatively mature and well established.

Scope 3 emissions are the most difficult to calculate, although Diageo attempts to capture most contributors. This difficulty arises from the fact that Diageo does not have direct control over Scope 3 emissions. Some suppliers in its value chain are also not in Scotland, further complicating the calculation of Scope 3 emissions.

As of 2021, Diageo is further developing its Scope 3 emissions data and has indicated its aim to be an exemplar company in this area. Diageo estimates its Scope 3 emissions mostly via its own calculations (which include embodied carbon within its calculations), which are supported by questionnaires filled in by suppliers.

Diageo has the necessary data to calculate carbon emissions intensity. However, as was the case with the SWA, it indicated that it currently does not calculate emissions intensity. Diageo focuses on energy intensity (measured as kWhr/litre pure alcohol produced) and absolute CO_2 emissions from all energy use. It estimates absolute emissions from all direct energy use regardless of the source.

Diageo emissions data

Site-specific detailed GHG emissions are commercially confidential. Diageo produces publicly available aggregated data of its global CO_2 emissions, but, because it is a large multinational company, these emissions data include emissions from a number of different beverages (not just whisky). Similarly, Diageo reports emissions data in accordance with the new Streamlined Energy & Carbon Reporting requirements (the UK Government's national disclosure requirement for large companies), but these only provide one GHG emission figure for the whole of UK operations, and again include production of all beverages, not just whisky.

For this study, the most relevant publicly available Diageo emissions data are the direct emissions from its largest Scottish distilleries as captured under the UK ETS, as presented below. Diageo operates nearly 30 Scotch Whisky distilleries, so these represent just some of their emissions.

GHG ETS emissions from Diageo sites under ETS (2018)

Site	CO_2 Emissions (t)
Leven	6,394
Glenlossie Distillery	7,747
Cameronbridge Distillery	25,963

Emissions benchmarking

Both the SWA and Diageo perform some energy efficiency benchmarking, although they note that this needs to be done carefully as simplistic comparisons can be flawed. As noted above, while the SWA and Diageo do have the ability to calculate carbon emissions intensity, they do not do so as they believe this measure could mask energy inefficiencies.

- **Scotch Whisky Association**

The SWA produces an anonymised energy intensity benchmark (measured as kWhr/litre pure alcohol produced) which compares Scottish distilleries against one another. It is commercially confidential and not publicly available.

The SWA noted that care is required when benchmarking distilleries, which should only be done by informed parties owing to the complexities outlined below:

- There are inherent differences in the distillation process for malt whisky (batch (pot) distillation) and blended whisky (continuous distillation). Batch distillation is less efficient than continuous distillation; and
- Furthermore, some distilleries have additional processing (e.g. by-product processing).

- **Diageo**

Diageo benchmarks its whisky distilleries internally against each other, with these benchmarks being commercially confidential. While Diageo does publicly produce an overall energy intensity single annual figure for its products, as it is a large multinational company and produces a number of different beverages, its value for benchmarking whisky energy intensity is limited.

Like the SWA, Diageo also highlighted that care needs to be taken when comparing the performance of different distilleries, as simplistic comparisons can produce flawed conclusions due to factors such as differences in site size and the character of the whisky produced.

Validation of measurements and benchmarks

GHG emissions data undergo internal quality assurance processes within individual companies and are then reviewed again by the SWA as it collates the data. In addition to this, Scope 1 operational emissions at the biggest distilleries (~10% of Scottish distilleries) are independently verified by a third party as required by the UK ETS. Some companies also voluntarily engage independent consultants to provide third-party assurance of annual GHG emissions.

Demand-side considerations in whisky

Over 90% of Scotch Whisky is exported, and consumers in different countries are likely to have different preferences and demands with respect to the carbon content of products and other factors. Neither the SWA nor Diageo is aware of any current consumer pressure for eco-labelling of whisky, and both noted that in practice labelling would be difficult (especially for blended whisky). Diageo mentioned that the current focus of some major buyers such as supermarkets is on improving packaging.

Despite this lack of immediate pressure from buyers, Diageo has been working on a series of assessments to help consumers better understand the environmental footprint of some of its most popular brands, such as Johnnie Walker whisky. The assessments summarise the carbon and water impact and how the product compares against other drinks, and it provides details of how Diageo is working to address impacts. Figure 25 below illustrates that production accounts for less than one-third of emissions for Johnnie Walker whisky.

Figure 25: Johnnie Walker carbon footprint by stage of production and sale[113]

	% Carbon Footprint
Raw ingredients	29%
Packaging	24%
Production	32%
Transport	4%
Retail & consumer	11%

Summary

The Scotch Whisky industry has been calculating GHG emissions for a number of years, and some good practices have been implemented already across the industry. These include biomass boilers, renewable electricity and energy efficiency measures. In 2020, the SWA published a report on pathways to net-zero Scope 1 and 2 emissions by 2045.[114] Some companies go further – by 2030 Diageo aims globally to become a net-zero Scope 1 and 2 emitter, reduce Scope 3 emissions by 50% and have 100% renewable electricity across direct operations.

The SWA trade body represents more than 90% of Scotch Whisky operations. Its knowledge of carbon emissions is robust, and the UK Government guidance on carbon reporting is used to calculate its members Scope 1 and Scope 2 GHG emissions.

Scope 3 GHG emissions represent a significant proportion of overall emissions, and the SWA does not currently collect Scope 3 from its members, although this may change in the future. Some companies, such as Diageo, do calculate their Scope 3 emissions.

The SWA and Diageo have the necessary data to calculate carbon emissions intensity, although they do not currently calculate it and instead use energy intensity benchmarks to compare distilleries.

The SWA and Diageo highlighted that care is required when benchmarking and simplistic comparisons can be misleading. As a result, benchmarking should be performed by informed parties who are able to adjust for factors such as differences between malt and blended whisky production.

7.3 Key takeaways from the case studies

These case studies highlighted that, for the selected products, there is good evidence of best practice with respect to emissions intensity measurement already happening in Scotland. Furthermore, the stakeholders engaged indicated that they broadly have the ability to measure their emissions intensity, even where they are not currently doing so.

However, the case study participants also consistently emphasised that benchmarking emissions needs to be done with caution, as simplistic comparisons can be misleading.

[113] See https://www.diageo.com/PR1346/aws/media/3961/diageo_knowing_our_footprint_johnnie_walker.pdf

[114] https://www.scotch-whisky.org.uk/media/1733/scotch-whisky-net-zero-report.pdf

This is an important policy consideration – while the products selected for these case studies should not be assumed to be representative of all products and industries, in general, it does appear that direct comparisons of emissions intensities across products and manufacturers may lead to inaccurate conclusions. As a result, when implementing demand-side policies, policymakers should be careful to ensure that emissions measurements are consistent and comparable across products within a given category. Doing so will likely require consultation with industry.

Policymakers may also wish to use emissions intensity measurements to create additional indicators which monitor emissions intensity and decarbonisation progress for EII products more generally. One such approach is proposed in Annex B, which explores high level considerations and recommendations for designing a 'basket of goods' approach to track changes in carbon intensity for Scottish EIIs.

8 Overall recommendations and next steps

This report investigated the demand-side policies available to the Scottish Government to support industrial decarbonisation, international examples of these policies, drivers of demand, and case studies of emissions measurement and benchmarking in cement and whisky.

Demand-side policies can be used to create a market for lower-carbon products and to encourage manufacturers to decarbonise while remaining competitive. If implemented correctly, they benefit from having a low risk of carbon leakage when compared to supply-side policies, as they expose domestic and foreign manufacturers to the same constraints and carbon costs when selling products in Scotland. There is unlikely to be a singular demand-side policy which will lead to a substantial shift in decarbonisation, but a well-designed portfolio of demand-side policies can be an important part of encouraging this transition to net zero. These policies should be viewed as complementary and can work together with supply-side policies to encourage a shift to lower-carbon consumption.

Drawing on the evidence and information in the preceding sections of this report, we now set out overall recommendations and next steps that can be taken forward by the Scottish Government. These recommendations are broadly split into three sub-sections:

- **Policies for prioritisation.** Within the context of Scotland's devolved powers, which policies appear to be most promising for driving emissions reductions and creating a market for lower-carbon products in Scotland.
- **Design principles.** These recommendations cover factors which should be taken into account when designing any demand-side policy.
- **Implementation principles.** When implementing policies, these principles set out the key steps which should be taken to maximise their effectiveness and limit unintended consequences.

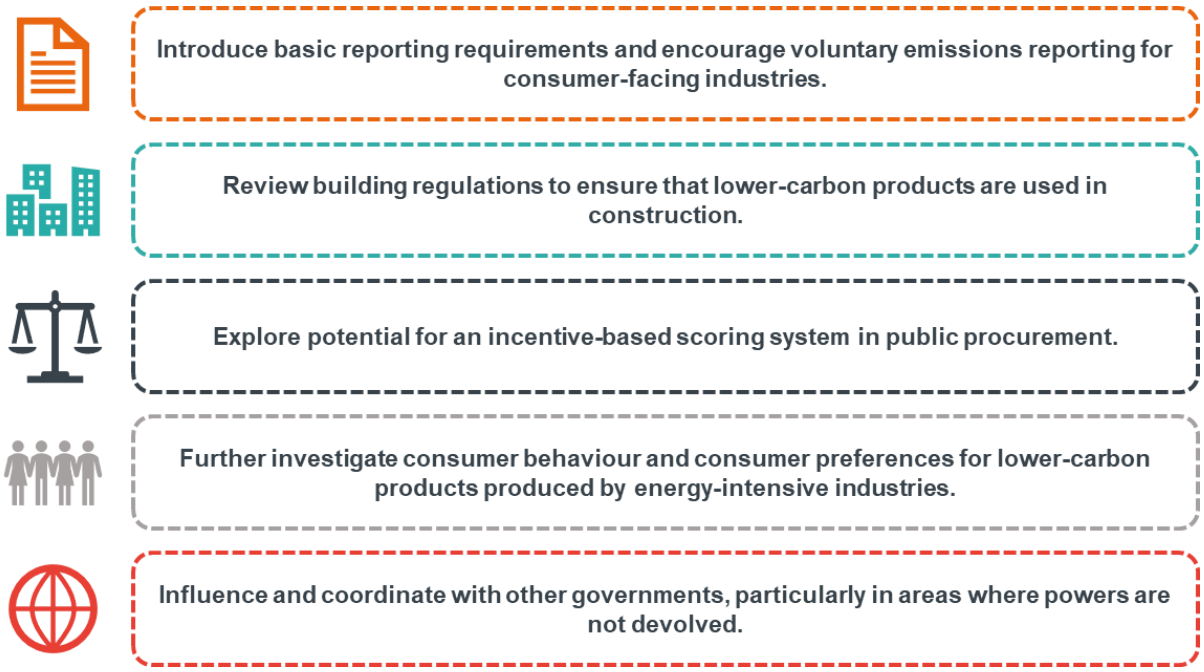
8.1 Main recommendations

As set out in Section 0, the main policies available to the Scottish Government are product standards (primarily food standards and building regulations), information campaigns, voluntary reporting requirements and procurement policies.

Based on our assessment of the different policy options set out in Section 0, the additional evidence gathered through desk review in Sections 0 and 0, and the case study discussions in Section 0, we identified five main recommendations, as set out in

Figure 26. These recommendations propose the key policies and next steps which should be prioritised in order to influence market conditions and create benefits for lower-carbon industrial production in Scotland.

Figure 26: Main recommendations and next steps



These recommendations are explored in more detail below. When designing and implementing any of the policies recommended, the design principles in Sub-section 0 and the implementation principles in Sub-section 0 should also be considered.

Recommendation 1: Introduce basic reporting requirements and encourage voluntary emissions reporting for consumer-facing industries.

As set out in Sub-section 0, there is evidence that consumer demand is increasingly being driven by concerns about products' environmental impacts. For some products, this demand may still be limited today; for example, as mentioned in Section 0, whisky producers have indicated that they are not aware of any current consumer pressure for eco-labelling. Despite this, companies such as Diageo are producing consumer-facing reports which convey the emissions from their products,[115] which suggests that they may believe this demand will become more significant in the future in line with the general trend supported by the literature. Furthermore, industries such as cement and whisky are able to track the emissions and energy intensity of their products.

Some production sites already report a portion of their emissions under systems such as the UK ETS, but these existing reporting requirements do not cover all sites or all emissions. As explored in the case studies, some manufacturers are able to measure emissions beyond the scope of the UK ETS, capturing a larger portion of their Scope 1, 2 and 3 emissions. Extending the reporting requirements to all sites and encouraging reporting of a wider scope of emissions could be a meaningful way to increase transparency and inform buyer and policymaker decisions.

[115] See https://www.diageo.com/PR1346/aws/media/3961/diageo_knowing_our_footprint_johnnie_walker.pdf

This reported information could then be used in a variety of ways, including through information campaigns, to make emissions from products more transparent to consumers. Reporting targeted at increasing the information available to consumers should select a unit which is easily understandable to maximise the clarity of this information, as clearer and more understandable information leads to more significant impacts (as explored in Sub-section 0). For example, consumers are likely to have a better understanding of what a measure such as CO_2 emissions per bottle of alcohol means for their consumption behaviour when compared to aggregate emissions at a production site reported under the UK ETS. Ensuring that information is reported consistently across manufacturers, and in a way that is clear and interpretable for consumers, businesses, policymakers, and other key actors, could be a meaningful way of improving purchasing decisions.

Encouraging the reporting and dissemination of this information is a low-cost, low-regret intervention, particularly where companies are already gathering the required data. For consumer-facing industries, this can help influence demand and communicate where Scottish producers are more environmentally friendly than international competitors, potentially helping to create a market for green Scottish products. Even for less consumer-facing industries, such as chemicals, encouraging this reporting helps to improve transparency across industry, making it easier for policymakers to evaluate the emissions intensities of Scottish producers. It can also assist in disseminating information abroad and send signals to foreign manufacturers, leading to positive spill-overs and encouraging further decarbonisation.

As a next step, the Scottish Government should select key consumer-facing industries such as food & drink and engage with manufacturers to establish how emissions can be consistently measured across products in a way that is clear for businesses and consumers. This is the first step in determining which specific reporting requirements can be introduced or determined. The Scottish Government should also engage with the UK Government as, while the Scottish Government can encourage voluntary reporting, mandatory reporting requirements are a reserved matter.

Recommendation 2: Review building regulations to ensure that lower-carbon products are used in construction.

The Building (Scotland) Act 2003 allows Scottish Ministers to introduce building regulations which support sustainability. In current building regulations, carbon emissions are largely considered as a function of energy efficiency, and there are no specific regulations related to embodied carbon or life-cycle carbon.[116] While usually considered distinct from product standards in a policy context, building regulations are similar to product standards in practice, in that they stipulate standards that a product (a building) must meet. Moreover, building regulations are devolved, and appear to be a meaningful tool to drive emissions reductions in sectors such as cement without imposing a significant additional burden on manufacturers.

Case study discussions with Tarmac highlighted that the carbon intensity of its products is dependent on the intended application of the concrete and that buyers of cement products do not always use the lower-carbon options which are available and appropriate for the required application. Structural integrity and safety are key considerations in construction. However, there are benefits to buyers who specify the lowest-carbon requirement needed for the application.

[116] See in particular Section 6 and 7 of domestic and non-domestic building regulations, available at https://www.gov.scot/policies/building-standards/monitoring-improving-building-regulations/

Ensuring that designers and engineers are both aware of and encouraged to use lower-carbon options for appropriate applications could significantly drive demand for products such as lower-carbon cement and steel. There are existing initiatives which are seeking to drive the use of embodied carbon and carbon life-cycle standards in construction, including those put forward by the Net Zero Public Sector Buildings Standard in Scotland[117] as well as the Green Construction Board and the UK Green Building Council.[118] In general, it is important to consider the whole life carbon of a building, including its energy efficiency, the embodied carbon of the materials used to construct it and factors such as the life of the building. As a result, changes to building regulations could include incorporating embodied carbon assessments but should, if possible, go beyond this to consider the whole life cycle of the building and thereby avoid unintended consequences. A policy which incorporates a requirement to use lower-carbon products in building regulations could take several forms, ranging from (for example) a requirement to assess the whole carbon life cycle of a building and ensure this meets certain standards, to limiting the use of the 10-20% most carbon-intensive products for a given purpose. The Scottish Government will, however, need to be careful about setting embodied carbon standards for individual products such as cement, as this could be viewed as setting product standards in reserved areas via changes to building regulations.

Overall, while other considerations such as safety needs should be considered, encouraging building designers to use the lowest-carbon construction product options could help reduce the carbon intensity of products such as cement and steel without imposing an additional burden on manufacturers.

As a next step, opportunities to include additional carbon standards in building regulations should be explored further with the Scottish Government's Building Standards Division, bodies such as Zero Waste Scotland which have been exploring embodied carbon standards in detail, as well as affected industrial and construction sectors in Scotland. These discussions should also involve the wider UK Government to coordinate in areas where similar initiatives are being taken and to ensure that changes to building regulations are not viewed as a means of circumventing Scotland's devolved powers.

Recommendation 3: Explore the potential for an incentive-based scoring system in public procurement.

Public procurement policy is a devolved power and is an important potential tool in driving shifts in demand due to the Scottish public sector's position as a large buyer of certain emissions-intensive products (as explored in Sub-section 0). Procurement policies directly affect the sub-set of the market which is driven by public sector demand. Moreover, they can also have a significant indirect effect on emissions due to the signals they send to businesses and manufacturers. These direct and indirect effects can help to incentivise manufacturers to decarbonise their products in general, and the overall impact is not necessarily limited to the proportion of products which is procured by the public sector. In Scotland, procurement policy is likely to be particularly relevant for products such as cement and steel which are used in construction due to the proportion of construction demand which the Scottish public sector accounts for.

Within changes to procurement policy, policies which create incentives for businesses to decarbonise without barring them from participating in a tender process are particularly attractive due to the flexibility they allow in terms of manufacturer response. A policy like the CO_2 Performance Ladder used by the Rijkwaterstaat has significant potential, as it

[117] https://www.scottishfuturestrust.org.uk/page/net-zero-public-sector-buildings-standard

[118] https://www.ukgbc.org/ukgbc-work/advancing-net-zero/

creates incentives for meeting certain requirements without imposing the burden of a strict mandate on manufacturers. While there is an existing duty to consider environmental effects and emissions under Scotland's Sustainable Procurement Duty and public bodies must also comply with climate change annual reporting duties,[119] an incentive-based system would go further than this and may provide a stronger incentive for businesses to decarbonise.

Implementing a 'shadow price' for carbon in procurement may also be an effective way of incentivising emissions intensity reductions. This type of policy increases the price (for the purpose of scoring) for higher emissions intensity products, thereby creating an incentive to decarbonise. This would provide a flexible, continuous incentive for incremental decarbonisation while avoiding strict cut-offs for procurement eligibility.

In general, more flexible policies such as those suggested above are less likely to impose significant costs on manufacturers or the public sector, which makes them relatively low risk and low regret while still promoting demand for green products.

This type of incentive-based policy should be explored further with procurement policy experts within the Scottish Government (including the Construction Procurement Policy Unit) to evaluate what role and form it could take in the Scottish context and identify other actors who should be involved in its exploration and potential implementation.

Recommendation 4: Further investigate consumer behaviour and preferences for lower-carbon products manufactured by Scottish EIIs.

As explored in more detail in Sub-section 0, consumer demand for green products in general is becoming increasingly significant. However, these consumer preferences do not always translate into action, and the drivers of demand are often complex. This is consistent with the evidence provided in the case studies in Section 0, which highlighted that while demand for lower-carbon products appears to be growing in some areas (such as cement), in others (such as whisky) demand for lower-carbon products today is limited, in the view of manufacturers.

Evidence on demand for lower-carbon versions of individual EII products is limited, and this lack of information creates a barrier for policymakers in enacting effective policy. To support implementation of demand-side policies and the development of markets for lower-carbon products, policymakers should further investigate consumer behaviour and preferences for key products which can be the targets of demand-side policy.

If possible, this type of investigation should focus on a revealed-preferences approach to eliciting buyer responses in order to contend with the intention-action gap.[120] As discussed in Sub-section 0, consumers will often state one preference, while their actual purchasing decisions reveal another. Empirical experiments can be used to overcome this, looking at (for example) buyer responses to a change in relative price between products or an unexpected demand-side shock. However, further investigation could also take the form of consumer surveys of stated preferences or further detailed case studies with industry focused on product demand. All of these approaches should be done in collaboration with industry in order to ensure that the intricacies of the market are captured.

[119] https://www.gov.scot/publications/taking-account-of-climate-and-circular-economy-considerations-in-public-procurement-sppn-1-2021/

[120] Revealed preference approaches use observational or experimental data to test how consumers behave in practice, rather than relying on stated preferences elicited through surveys, workshops or other primary evidence-gathering activities.

Recommendation 5: Influence and coordinate with other governments, particularly in areas where powers are not devolved.

While not all policies are available to the Scottish Government within their devolved powers, the Scottish Government can still exercise significant influence over the UK Government to enact demand-side policies such as product labels. Furthermore, coordinating with other governments within the UK and abroad can be a way of enhancing the impact of a given policy. As noted in the UK's Industrial Decarbonisation Strategy, effective policy should be suited to a joint approach between the UK and other countries pursuing similar goals.[121] Other governments can be encouraged to adopt policies implemented in Scotland, increasing the international scope of their impact, driving the development of an international market for low-carbon Scottish products, and providing an even stronger signal for export-heavy Scottish industries to decarbonise. This is even more important in the context of the ongoing debate on the implications of the UK Internal Market Bill and the implications of this Bill for Scotland's devolved powers.[122]

8.2 Design principles

There are a number of design principles which should be taken into account when designing any policy, including those recommended in Sub-section 8.1. Policies which are designed using these principles will be better suited to working within the broader policy environment, ensuring businesses have flexibility to respond, ensuring a level playing field with imported products and avoiding the risk of carbon leakage.

Five key design principles should be considered. These are summarised in Figure below.

Figure 27: Design principles for demand-side policies

Design principle	Description
Treat domestic and foreign products comparably	Policies should be designed to ensure that emissions intensities for domestic and imported products are treated comparably.
Account for substitution effects	Policies should acknowledge that demand for Scottish goods is not static and take account of potential substitution effects.
Be flexible	Policies should be designed to be flexible.
Avoid unintended consequences	Policies should seek to avoid unintended consequences, including for end-users of the affected products.
Account for the broader context	Policies should account for broader economic trends and the wider policy environment.

These principles are explained in more detail below. If all these principles are taken into account, demand-side polices can provide additional benefits to Scottish EII sectors that are more efficient from an emissions perspective than their international competitors and limit the impact on EII sectors that are currently less efficient while they catch up.

[121] See Industrial Decarbonisation Strategy (March 2021), pages 38-39.

[122] https://www.gov.scot/publications/statement-internal-market-bill/

Policies should be designed to ensure that emissions intensities for domestic and imported products are treated comparably.

First and foremost, policies should be designed to ensure that emissions intensities for domestic and imported products are treated comparably, and that imported products are subject to the same policies and costs as domestically produced products.

This includes, where possible, using a consistent measure of life-cycle emissions to assess emissions intensity. As was emphasised in the case studies, emissions may be recorded at different stages of the production process for different countries, and products are not always homogeneous. For example, in the cement industry some additions are made at the concrete plant level in the UK but at the cement works in the EU, while some countries such as India produce a coarser cement product. The SWA and Diageo also highlighted that simple comparisons of energy or carbon intensity can be misleading for whisky products due to differences in production methods for different types of whisky (such as malt and blended).

Accounting for such differences across products and countries is an important part of ensuring a level playing field for domestic and imported products and is a key design principle of the UK's Industrial Decarbonisation Strategy.[123]

Policies should be designed to be flexible.

Allowing flexibility in business response reduces the burden on businesses and the marginal cost of abatement. A more flexible policy is also more adaptable to the needs of different sectors, more likely to be technology neutral and more likely to encourage future innovation – two key principles set out in the UK's Industrial Decarbonisation Strategy.[124] While some types of policies are naturally more flexible than others, every policy should be designed to maximise the flexibility that manufacturers have in how to respond.

For example, the CO_2 Performance Ladder used by the Rijkwaterstaat in the Netherlands is a good example of a flexible policy. The CO_2 Performance Ladder rewards meeting certain procurement standards with a reduction in the price of the bid (for the purposes of scoring), which provides incentives for manufacturers to reduce their emissions without excluding them from the procurement process or stipulating precisely what changes to production they must make. This is much more flexible than the environmental cost indicators also used by the Rijkwaterstaat, which exclude bidders that exceed a maximum threshold. It is also more flexible than the Buy Clean California Act, which explicitly bans products which do not meet an acceptable level of environmental performance.

Policies need to acknowledge that demand for Scottish products is not static.

Demand for Scottish products is not static, and policies should also encompass possible substitute products where appropriate in order to avoid unintended shifts in demand.

A demand-side policy might encourage substitution to another, more emissions-intensive product that is outside the scope of the policy. For example, building designers may replace cement in construction with an alternate building material which is not subject to the same demand-side policies. As a result, policies should consider the potential substitution effects for current and future consumption and production.

[123] See the UK's Industrial Decarbonisation Strategy (March 2021), pages 38-39.

[124] Ibid.

Policies should be designed to avoid unintended consequences, including for end-users of the affected products.

An important part of achieving this is ensuring that policies treat domestic and imported goods fairly, are flexible and take account of possible substitution effects. However, unintended consequences could also arise if (for example) manufacturers are unable to adapt to policy changes due to a lack of infrastructure, technology or time.

For example, further decarbonisation for some industries may rely on the availability of carbon capture and storage or hydrogen. If this key infrastructure is not available, the policy may reduce demand for their products or raise their costs without enabling them to have a chance to respond to this signal.

There may also be unintended consequences which affect end-users of these products, for example if a change in production method impacts the safety of a product. While impacts on consumers were included as an assessment criteria in Section 0, broad impacts on end-users of given products should be consistently kept in mind while designing a policy to avoid unintended consequences.

Policies should account for broader economic trends and the wider policy environment.

These policies do not exist in isolation and will interact with macroeconomic trends and other existing policies. In order to maximise policy effectiveness and avoid harming the competitiveness of Scottish industry, it is important to be aware of these interactions.

For example, the impacts of COVID-19 are likely to continue to affect demand across a number of industries, including for Scottish EII products such as aviation fuel. Enacting additional demand-side policies which affect these products may impose an additional burden upon an industry already facing a demand shock, which makes policies targeted at those products less attractive.

Furthermore, it is important to ensure these policies work in harmony with other policies, as emphasised in the UK's Industrial Decarbonisation Strategy.[125] For example, some manufacturers are already faced with a reduction in UK ETS-free allowances, which may make it more difficult for them to invest in decarbonisation. Policymakers need to be aware of these constraints when designing any additional policies.

8.3 Implementation principles

Following the selection and design of demand-side policies, they still need to be implemented. Policies need to be carefully implemented in order to ensure they have the intended effect and enable businesses to respond appropriately. These are summarised in

Figure 28.

[125] See the UK's Industrial Decarbonisation Strategy (March 2021), pages 38-39.

Figure 28: Implementation principles for demand-side policies

Implementation principle	Description
Start with homogeneous products	Start with more homogeneous products and industries.
Target direct relationships	Target buyers that have a direct relationship with energy-intensive industries.
Confer with industry early	Confer with affected industry early in the process to avoid unintended consequences.
Consult experts	Consult experts within different parts of government and the wider public sector to maximise policy effectiveness.
Give adequate notice	Give adequate notice for businesses to respond.
Review policies regularly	Review policies regularly to evaluate their effectiveness in light of shifting market conditions.

These key implementation principles are outlined in greater detail below.

Start with more homogeneous products and industries.

Demand-side policies are likely to be much easier to implement in industries that are more homogeneous,[126] as industries with highly differentiated products will necessarily require more in-depth study to account for complexities and avoid unintended consequences. These industries may be consumer facing or produce intermediate products for use by businesses. Once these have been addressed, policymakers will still need to quickly move on to the more difficult and differentiated industries.

Target buyers that have a direct relationship with energy-intensive industries.

Demand-side policies are likely to be most effective when they influence buyers that purchase products relatively directly from EIIs. EII products that form a small part of the finished product which is ultimately sold to a buyer via numerous intermediaries may experience more muted effects from demand-side policies due to the additional steps between the end-consumer and the manufacturer. For example, consumers have a relatively direct relationship with food & drink products such as whisky but are likely to have a much more limited understanding of chemical products such as acrylics which are a component of a range of downstream products.

As highlighted in Sub-section 0, consumers are showing increasing concern about carbon emissions and environmental sustainability, and providing them with better information to inform their purchasing decision can be a powerful tool for driving consumption towards greener products. This information is most effective when the information is clear and concise, and when it leverages social pressures to ensure individuals know that other consumers are also making sustainable purchases. This is likely to be easiest for products which consumers have a good understanding of and a direct relationship with.

[126] For more detail, see the analysis set out in Annex A. For example, the number of products and their uses is more limited in a sector such as cement than in one such as chemicals & pharmaceuticals which produces a range of products for a wide variety of end-uses.

Confer with affected industry early in the process to avoid unintended consequences.

As highlighted in Section 0, there are potential complexities in measuring and comparing emissions intensities across products, and drivers of demand may be complex. It is important to understand potential unexpected substitution effects from an action, as well as whether infrastructure or supply constraints will prevent industry from reacting to the policy signal. Consulting manufacturers and industry experts early on and throughout the policy implementation process can help reduce risks of unintended policy consequences.

Consult experts within different parts of government to maximise policy effectiveness.

There are a number of existing experts within government who should be engaged with when implementing policy changes in order to maximise their effectiveness and ensure they complement the existing policy environment. For example, for changes to public procurement standards it is important to confer with Scottish public procurement experts to ensure these policies sit well within the rest of the policy environment and can be communicated effectively to buyers. Similarly, consulting Building Standards experts is an important part of implementing any changes to building regulations and ensuring they do not conflict with other priorities. Overall, engaging with the relevant experts within government is a key step in ensuring that new policies enhance, rather than conflict with, existing ones.

Give adequate notice for businesses to respond.

Uncertainty is a major barrier to investment and changes to business models, and limiting this uncertainty should be a key consideration in any policy implementation. This is particularly important where the necessary technology or infrastructure required to decarbonise may not be available today. Policies need to take account of the constraints on businesses and be implemented in such a way that businesses have adequate time to respond to the signal.

Review policies regularly to evaluate their effectiveness in light of shifting market conditions.

Markets for Scottish products are not static, and the policy environment is rapidly changing as governments aim to meet their net-zero targets. As a result, any policy implemented needs to be regularly reviewed (for example, every one to three years) to ensure it is still having the intended effect and is sending the correct signal to manufacturers, businesses and consumers.

9 Conclusion

Demand-side policy interventions that aim to reduce EII emissions by influencing the purchasing decisions of consumers, private businesses or public sector organisations can be categorised into one of three approaches – mandates, incentives and nudges.

While other jurisdictions have implemented or plan to implement a range of such demand-side interventions, the focus has generally been on public sector procurement: for example, the Buy Clean California Act and the Netherlands' CO_2 Performance Ladder. Fewer examples target businesses or consumers directly. Importantly, policymakers can draw on a range of inputs, notably existing environmental product labels and EPDs, to support this process.

There are two constraints which affect the ability of the Scottish Government to implement such demand-side policy interventions: reserved matters which the UK Government has not devolved to the Scottish Government and international trade law. Demand-side policies affecting consumers and private businesses are generally not devolved to the Scottish Government, although there are exceptions for food & drink, building regulations, and consumer advocacy. International trade law is unlikely to constrain demand-side policy interventions, so long as these do not explicitly discriminate against international sellers.

The Scottish Government is therefore likely to have the most discretion with policies targeting public sector procurement and building regulations, although it can also influence UK-level policies targeting consumers and business such as product standards and labelling rules. The Scottish Government can also introduce or encourage additional reporting requirements for businesses.

The drivers of purchasing decisions vary by buyer type. While some private businesses do account for environmental considerations in their purchasing decisions, these are generally understood to reflect concerns over future profitability or to accommodate the preferences of consumers and other stakeholders. Conversely, there is evidence that consumers do account for environmental considerations when making purchasing decisions and that providing them with clear information can be a powerful tool for driving consumption towards green products. This suggests that nudges are likely to be more effective where they target consumer purchasing decisions rather than businesses, although reporting requirements for businesses can magnify their effects.

Public sector organisations in Scotland are encouraged to take account of environmental considerations in their procurement processes. However, there are currently few explicit requirements or incentives. While this suggests that mandates or incentives could potentially have an impact, such policies would need to be designed so as not to interfere with other procurement or policy priorities, such as accessibility and quality.

Demand-side policies are more likely to be effective if they target those EII sectors with the largest emissions-reduction potential and the largest share of domestic consumption. While over 70% of EII emissions come from the chemicals & pharmaceuticals and oil & gas refining sectors, over 85% of this output is exported, whereas exports in cement and food & drink are much lower. Once technically viable emissions reductions and domestic consumption are accounted for, the sectors where demand-side policy interventions are likely to be most effective at reducing emissions are cement, followed by chemicals & pharmaceuticals, oil & gas refining and food & drink.

Based on our assessment of the different types of demand-side policy options available as well as the additional evidence gathered throughout this report, we identified five main recommendations and next steps for policymakers to pursue with respect to demand-side policy in Scotland. These recommendations are targeted at those key policies and the next steps which should be developed in order to influence market conditions and create benefits for lower-carbon industrial production in Scotland. This includes a recommendation to further investigate consumer behaviour and preferences for lower-carbon products, due to the limited information currently available on this. In particular, policymakers should:

1. introduce basic reporting requirements and encourage voluntary emissions reporting for consumer-facing industries;
2. review building regulations to ensure that lower-carbon products are used in construction;
3. explore the potential for an incentive-based scoring system in public procurement;

4. further investigate consumer behaviour and preferences for lower-carbon products manufactured by Scottish EIIs; and
5. influence and coordinate with other governments, particularly in areas where powers are not devolved.

When designing or implementing any of these policies, it is important to take account of a number of principles. These include engaging with policy experts early on, reviewing policies often to ensure they are having the intended effect and designing policies to be flexible and avoid unintended consequences. Case study participants also highlighted the importance of caution when comparing emissions across different products and, in general, industry should be engaged with early on to avoid unintended policy consequences or distortions.

10 Annexes

Annex A - Overview of energy-intensive industries in Scotland

EIIs are a significant share of the Scottish economy and form a key part of the overall manufacturing sector, which accounts for more than half of Scotland's exports.[127] Scottish EIIs contribute approximately £6 billion in gross value added (GVA) every year (4% of total GVA) and employ approximately 70,000 people (4% of total employment).[128] Jobs in manufacturing pay slightly more than the Scottish average, with the median full-time manufacturing job paying approximately £30k per year in 2019.[129]

EIIs are one of the major drivers of GHG emissions, responsible for approximately 15% of all Scottish emissions, with this overwhelmingly driven by emissions from the chemicals & pharmaceuticals and oil & gas refining sectors.[130] However, the largest sectors in terms of emissions are not necessarily those sectors with the largest potential emissions reductions from demand-side policy. To determine the potential reductions from demand-side policy, it is necessary to consider:

i. the level of emissions from the EII sector;
ii. what percentage of these emissions can be eliminated; and
iii. what proportion of these emissions are driven by domestic demand.

Once these factors are accounted for, policymakers can identify the sectors and products where demand-side interventions are likely to have the biggest impact. While the potential reductions in chemicals & pharmaceuticals and oil & gas refining remain significant, cement and food & drink emerge as important sectors from a demand-side policy perspective despite their smaller total emissions footprints (see Figure 29).

There are additional potential emissions impacts which are not explicitly included in the estimates set out in Figure 29. For example, voluntary product labels can affect international demand in the same way that they can affect domestic demand if the labelling is carried through for foreign purchasers. Likewise, Scottish producers might

[127] Paper 6/1 – Industry background information, from the Just Transition Commission Scotland.

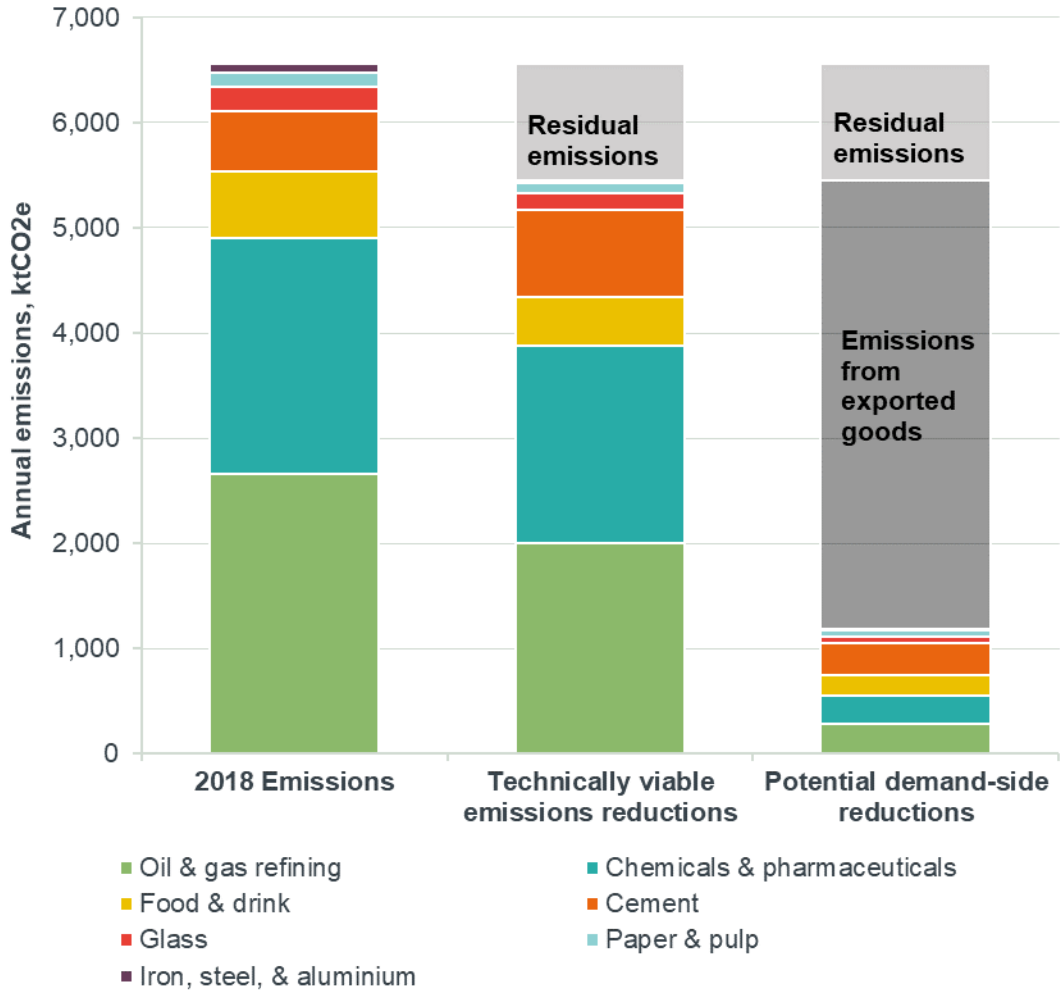
[128] Ibid.

[129] Based on the Annual survey of hours and earnings (2019), which found that median full-time weekly earnings were £579.10 in Scottish manufacturing, compared to a Scotland-wide average of £576.70.

[130] Paper 6/1 – Industry background information, from the Just Transition Commission Scotland.

export more low-emissions products to international markets. These are not explicitly modelled as doing so would require a detailed mapping of export flows at the product level.

Figure 29: Potential levels of annual domestic emissions reductions by EII sector



Full details of the economic and emissions footprint of Scottish EIIs are presented in the **Scottish EII Emissions Dashboard** held by the Scottish Government for internal reference. The remainder of this section summarises key insights from these data:

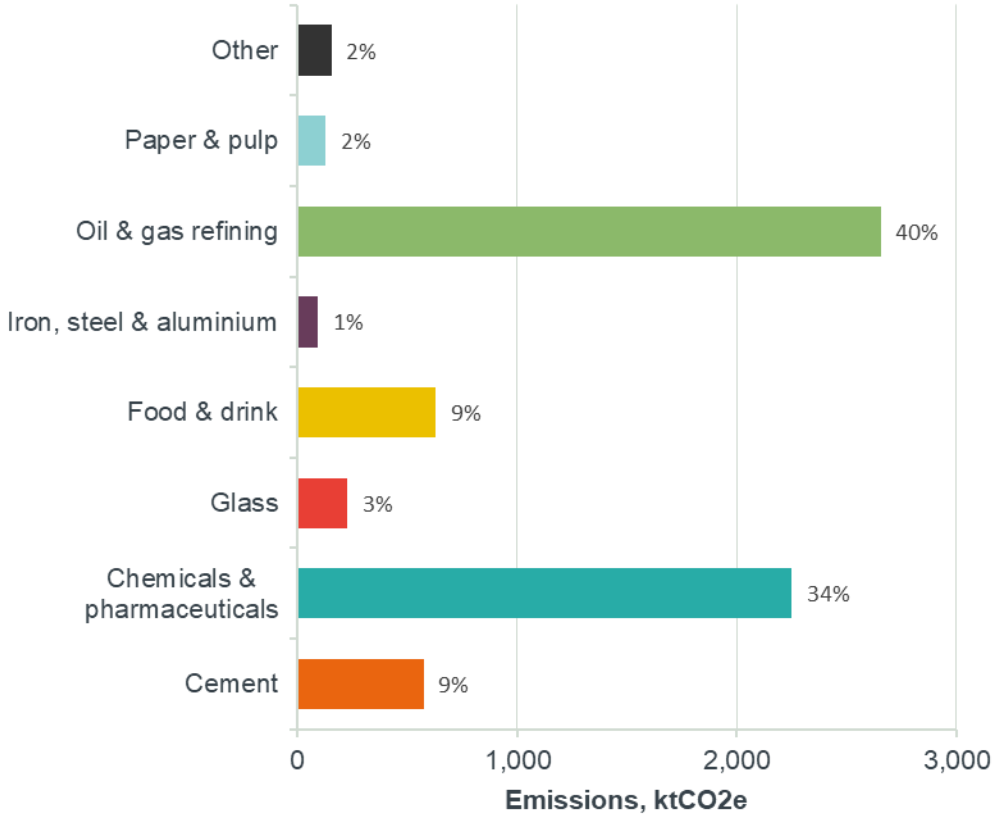
- **Section A1** sets out **emissions and potential reductions** in each sector.
- **Section A2** sets out the **economic importance** of each sector, in terms of GVA, employment and exports.
- **Section A3** describes the **main products and customers** in each sector.
- **Section A4** concludes.

A1 Emissions and potential reductions

Of the seven EII sectors which are the focus of this report, the significant majority of emissions come from two sectors: chemicals & pharmaceuticals, and oil & gas refining. These two sectors accounted for over 70% of all EII emissions in 2018, equal to nearly 5,000 $ktCO_2e$. The next largest sector in terms of emissions was food & drink, emitting an estimated 629 $ktCO_2e$ (or approximately 9% of total EII emissions). Cement also

made up a notable portion of EII emissions, emitting an estimated 574 ktCo2e in 2018 and representing nearly 9% of EII emissions. The remaining EII sectors collectively accounted for less than 10% of total emissions.[131] This is illustrated in Figure 30.

Figure 30: Emissions by sector, 2018



However, the sectors with the largest emissions footprint are not necessarily those where the largest emissions reductions from demand-side policy can be made. There are three factors which need to be considered when determining the potential reductions from demand-side policy:

- **The level of emissions from the EII sector**. This is intuitive, as sectors with larger emissions footprints have larger reduction potential.
- **What percentage of these emissions can be eliminated.** Scotland's EII sectors each face unique constraints, challenges and opportunities for decarbonisation. The potential gains from increased efficiency and electrification (or replacement of fossil fuels with hydrogen) vary by sector, with some EII sectors having greater room for reductions than others. For example, the cement sector may be able to completely eliminate all carbon emissions through increased efficiency, electrification and the use of carbon capture and storage, while the iron, steel & aluminium sector may only be able to reduce its emissions by a maximum of 31% at current production levels. These reductions are based on the assumption that the maximum efficiency gains, electrification and carbon

[131] See the Deep Decarbonisation Pathways for Scottish Industry report, https://www.gov.scot/publications/deep-decarbonisation-pathways-scottish-industries/

capture and storage levels which are possible by 2045 are achieved, noting that, in practice, the cost of reaching these levels is likely to vary by sector.[132]

- **What proportion of these emissions are driven by domestic demand.** Demand-side policy interventions are aimed at affecting purchases made by Scottish consumers, businesses and public sector organisations. Therefore, if a sector's outputs are overwhelmingly exported to foreign buyers, demand-side policy interventions are likely to have a more limited effect on reducing emissions.[133]

Once technically viable emissions reductions and domestic consumption are accounted for, a different picture emerges. Despite representing only 9% of total EII emissions, cement is the sector with the largest possible emissions reductions from demand-side policy. This is because of two factors:

- First, the possible emissions reductions in the cement sector are significant, largely as a result of the potential for carbon capture, utilisation and storage technology (CCUS) in this sector as well as greater use of bioenergy. This technology, along with greater electrification of industrial processes and some minimal efficiency improvements, could see emissions in this sector fall from 574 $ktCO_2e$ in 2018 to minus 257 $ktCO_2e$ in 2045, such that the cement sector becomes a net negative emitter.[134] Even other sectors where significant reductions in emissions can be made do not approach the degree of reduction seen in cement – the next most significant reductions in percentage terms occur in the chemicals & pharmaceuticals sector, where it is estimated that ca. 85% of emissions could be eliminated from 2018 levels by 2045.
- Second, a significant amount of Scottish cement is purchased by Scottish buyers, particularly when compared to sectors like chemicals & pharmaceuticals and oil & gas refining where nearly all goods produced are exported.[135]

Food & drink also becomes disproportionately important from a demand-side policy perspective when compared to its aggregate level of emissions. As with cement, this is a combination of the potential room for emissions reductions and the relatively high proportion of food & drink products consumed in Scotland. Conversely, some sectors offer nearly no possibilities for demand-side policy-driven emissions reductions. In particular, the potential room for reductions in iron, steel & aluminium is very small, and there is some evidence that the emissions reductions that are possible may happen regardless in the 'business-as-usual' case without the need for further policy action.[136]

Consistently estimating pre-2018 emissions is difficult due to changes in how emissions data are recorded and changes in the estimation methods in the emissions data over time. Trends in emissions data should therefore be interpreted with caution. Based on

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[132] For greater detail on potential reductions in these sectors, see https://www.gov.scot/publications/deep-decarbonisation-pathways-scottish-industries/

[133] It is worth noting that these demand figures include some products that are produced by Scottish businesses using EII products and then exported. Demand-side policies can affect these emissions as the first layer of demand is domestic, but it may be more difficult to do so when compared to products which are purchased by Scottish businesses and consumed domestically.

[134] See Deep Decarbonisation Pathways for Scottish Industries for more detail. Emission reduction figures are summarised in Figure 15.

[135] Based on Export Statistics Scotland (2018) and Export Performance Monitor Scotland data.

[136] See Zero Waste Scotland's report 'Industrial Decarbonisation and Energy Efficiency Roadmap: A Scottish Assessment'.

the best estimate of historical emissions,[137] absolute emissions in some EII sectors appear to have fallen over time, while in others emission levels appear to have remained relatively flat or increased:

- Emissions in the paper & pulp sector have declined noticeably since 2012, while GVA from the sector has remained relatively steady.
- Emissions in iron, steel & aluminium also appear to have decreased since 2012, although by a smaller degree than paper & pulp.
- Emissions trends in chemicals & pharmaceuticals and oil & gas refining data are particularly subject to fluctuations due to changes in how the data are recorded and the method of isolating emissions for petrochemicals from emissions in oil & gas refining. However, combined emissions for the two sectors appear to have been trending downwards in recent years, with a decrease in recorded oil & gas refining emissions and a relatively flat trend in chemicals & pharmaceuticals emissions since 2012.
- Food & drink and glass emissions have remained relatively consistent since 2012, while emissions in cement appear to have increased slightly in the period from 2012 to 2018.

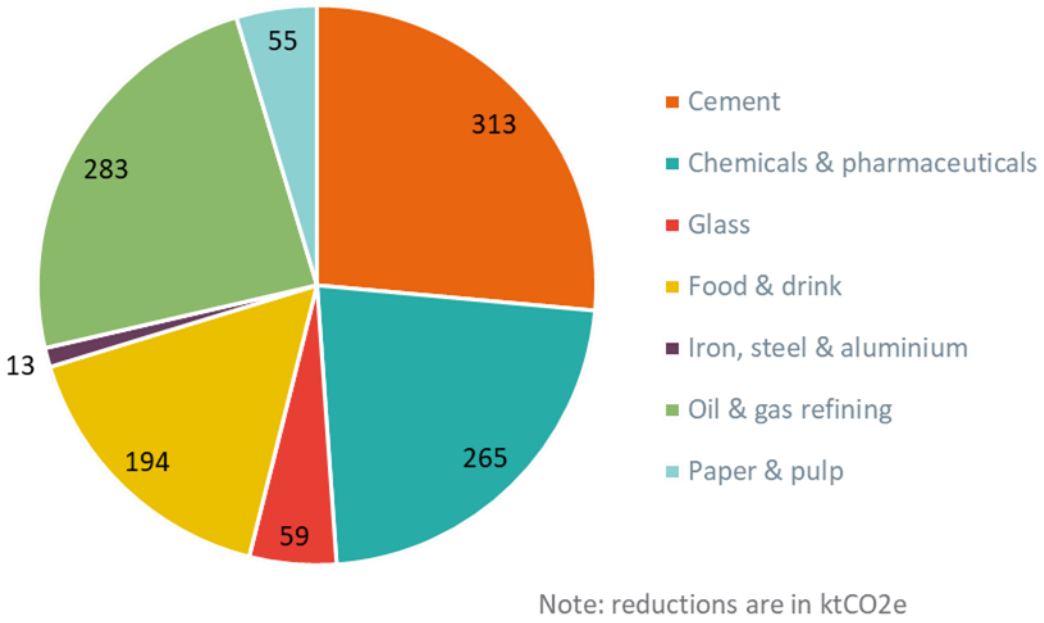
More information on these trends is contained in the **Scottish EII Emissions Dashboard**.

Overall, the most important sectors to focus on from a demand-side policy perspective appear to be cement, chemicals & pharmaceuticals, oil & gas refining, and food & drink (see Figure 31).[138] While there are smaller reductions possible in the glass and paper & pulp sectors, there is limited scope to create substantial emissions reductions in iron, steel & aluminium using demand-side mechanisms. Note that global emissions reductions could exceed domestic reductions if demand-side policies in Scotland influence foreign EIIs or Scottish exporters.

[137] Estimated using the Scottish Pollutant Release Inventory (SPRI) and Scotland Greenhouse Gas (GHG) inventory.

[138] This figure presents an estimate of potential annual domestic emissions reductions that could be targeted by demand-side policies. This estimate is based on the proportion of technically viable scope 1 emissions reductions accounted for by domestic consumption of Scottish-produced EII products. It does not include potential scope 1 emissions reductions associated with exported EII products (e.g. if they are decarbonised alongside the manufacture of products for domestic consumption), nor does it include other positive spill-over effects of demand-side policies (e.g. decarbonisation of imported EII products).

Figure 31: Potential domestic demand-side policy emissions reductions by sector (annual, $ktCO_2e$)



A2 Economic importance

It is also important to understand the overall contribution of each EII sector to the Scottish economy with respect to GVA, employment and exports. The economic importance of these sectors is very different to their respective carbon footprints (see Figure 32 and Figure 33).[139]

The food & drink sector alone accounted for approximately 70% of EII GVA and employment, generating nearly £4 billion in GVA and employing over 46,000 people in 2018.

The next largest sector was chemicals & pharmaceuticals, contributing approximately 21% of EII GVA (£1.2 billion) and 15% of employment (10,000 people).

The economic contribution of the remaining sectors in 2018 was significantly smaller:

- Oil & gas refining, despite accounting for 37% of EII emissions, only contributed approximately 3% of EII GVA (£190 million) and 2% of employment (1,000 people).
- Conversely, despite accounting for only approximately 2% of EII emissions, the paper & pulp sector contributed approximately 4% of EII GVA (£249 million) and 7% of employment (4,400 people).
- Iron, steel & aluminium contributed approximately 1% of EII GVA (£50 million) and 3% of employment (2,100 people).
- Cement had a very limited economic footprint, contributing less than 1% of EII GVA and employment (£7 million; 130 people). There is only one cement site in Scotland (in Dunbar).

[139] The figures and statistics on GVA and employment cited below were estimated using Scotland's Annual Business Statistics.

Figure 32: GVA in Scotland from each EII sector

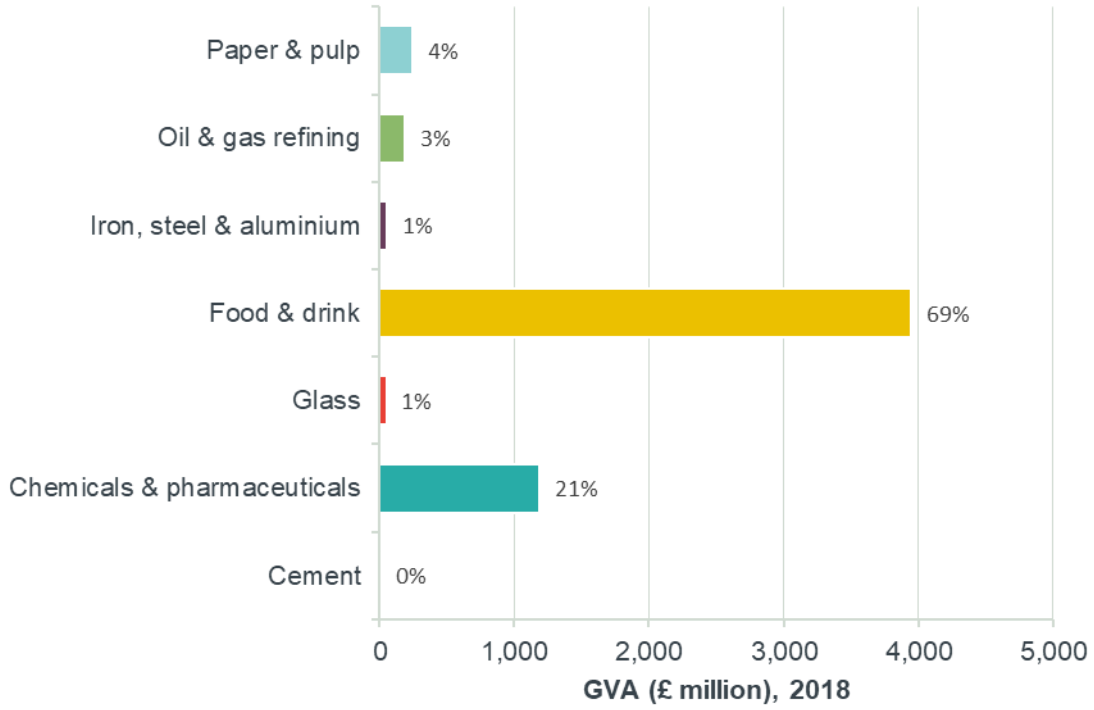
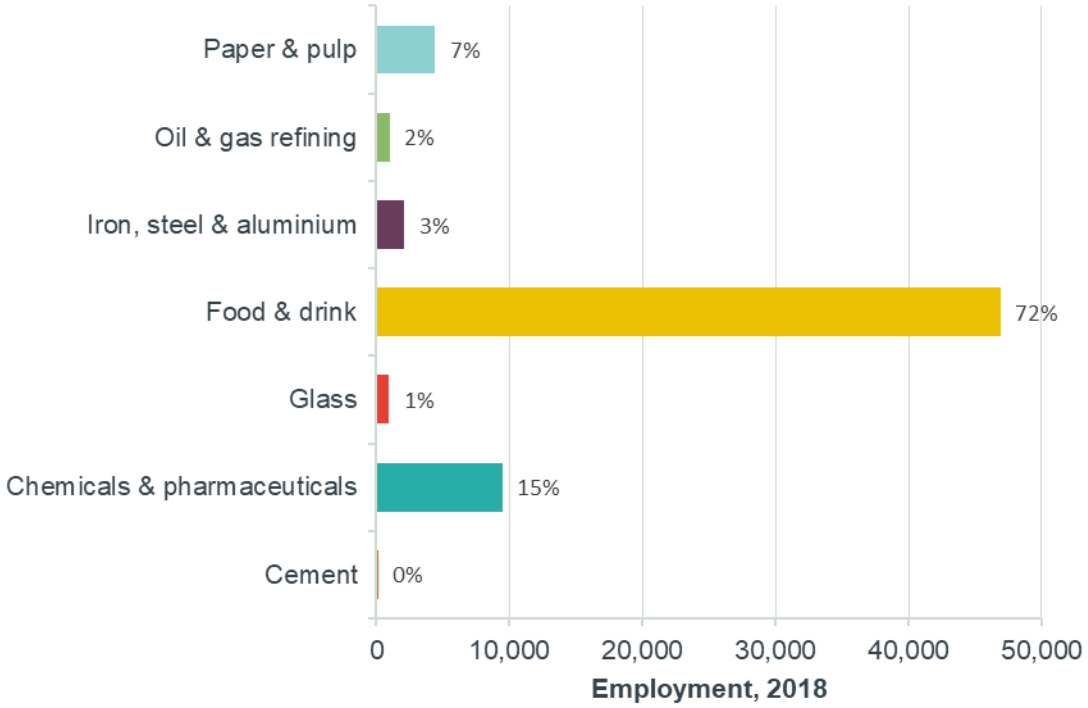


Figure 33: Employment in Scotland from each EII sector

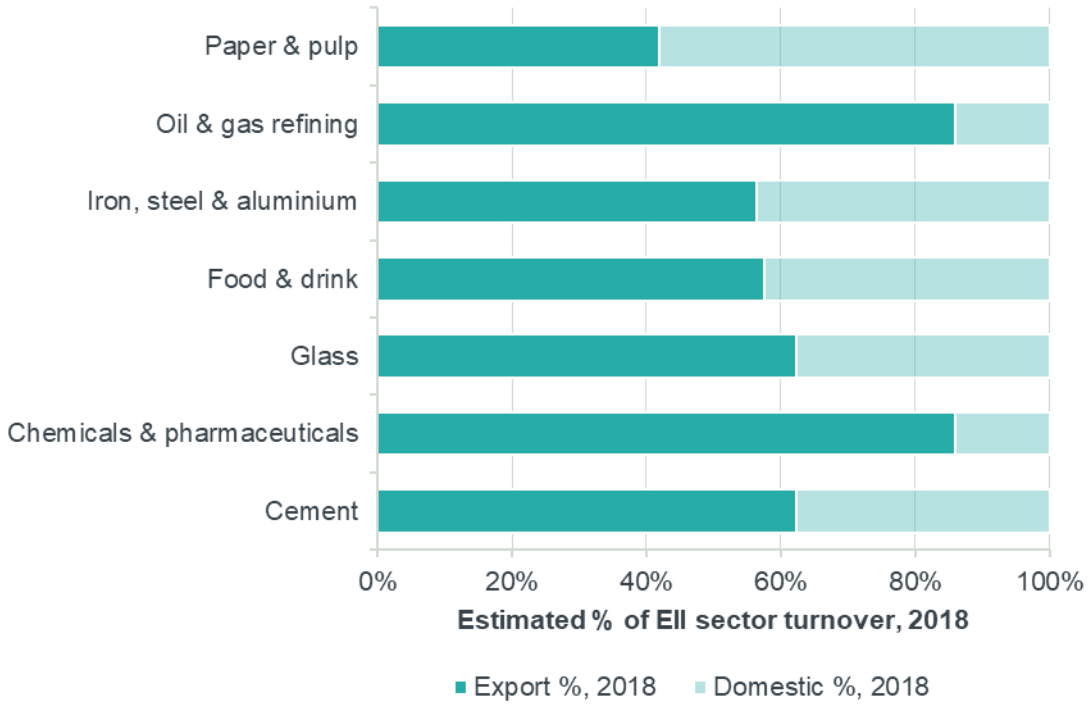


Along with being an important consideration when it comes to assessing the potential impact of demand-side emissions-reduction policies, exports are also a key measure of

economic importance.[140] While export data are aggregated at a level which makes it difficult to identify exports attributed to individual sectors, the proportion of exports for each EII sector are estimated and summarised in Figure 34. Overall, exports are an important source of demand in every EII sector, with over half of the total value of products in six of the seven sectors estimated to be exported to the rest of the UK or internationally.

Exports are particularly important for the chemicals & pharmaceuticals and oil & gas refining sectors, with even conservative estimates showing that over 85% of the goods produced in these sectors are exported. Those sectors with a significant amount of local demand, such as cement (used extensively in Scottish construction) and food & drink, still export a significant share of output. This illustrates how competitive Scottish goods are internationally, with demand for Scottish goods across a range of sectors coming from all around the world. However, it also mutes the effectiveness of local demand policy, as changes in Scottish demand-side measures do not directly influence foreign purchasing decisions.[141]

Figure 34: Local and international demand for Scottish EII products



Note: Exports include sales to other UK nations

A3 Main products and customers

Scottish EIIs produce a wide range of goods. These include finished goods consumed by end-customers, along with a variety of intermediate goods used by other businesses in the production of their products (see Figure 35).

[140] Exports were estimated using Export Statistics Scotland (2018) and Export Performance Monitor Scotland data.

[141] The exception is where intermediate goods are produced by Scottish businesses before being exported. In these cases, some demand-side policy interventions may influence decisions.

Figure 35: Product and customer types by EII sector

The information set out below is not exhaustive but presents the main products and customers for each sector. This can help identify which demand-side policy interventions are likely to be most effective in each sector, as this varies by product and customer type.

- **Cement – primarily intermediate goods used by businesses.** The Scottish cement sector produces both bulk and packed cement.[142] This cement is mainly used in the construction industry, with cement being a key input into both building and transport infrastructure construction. Demand from the Scottish public sector is particularly important for the cement sector. Public sector spending represents ca. 16% of the construction industry's turnover.[143] As the construction industry is the primary purchaser of cement, this means that the Scottish public sector is indirectly a major customer for the cement sector.
- **Chemicals & pharmaceuticals – primarily intermediate goods used by businesses.** Basic chemicals are used in a wide variety of products, in everything from food products to aerospace products. Scotland's EII sector is particularly focused on petrochemicals such as synthetic ethanol, ethylene, propylene, polyethylene and polypropelene.[144] However, Scotland's chemicals &

[142] See https://dunbar.tarmac.com/materials/ for specific cement brands produced at the Dunbar cement plant.

[143] Based on procurement spending data provided by the Scottish Government for this report.

[144] https://www.ineos.com/sites/grangemouth/about/

pharmaceuticals sector also produces a range of additional goods such as elastomers (synthetic rubber)[145] and antibiotics.[146] The main customers for Scottish chemicals & pharmaceuticals are the petrochemical and pharmaceutical industries, with other customers including the food & drink industry (for use in food packaging).[147]

- **Glass – primarily intermediate goods used by businesses.** Scottish glass manufacturers produce a variety of clear and green glass spirit bottles (20cl–2l), often using recycled materials, as well as other types of glass bottles and glass mineral wool insulation. The primary customers of these goods are drinks manufacturers. Glass mineral wool insulation is also used in construction.[148]
- **Food & drink – primarily finished goods used by end-customers.** A large part of the food & drink sector's turnover is comprised of whisky sales.[149] Major products of the Scottish food & drink sector also include vodkas, gins,[150] cheddar cheese[151] and biscuits.[152] These are finished goods ultimately purchased by end-customers, both domestically and abroad.
- **Iron, steel & aluminium – primarily intermediate goods used by businesses.** Scottish basic metals manufacturers' main products are heavy steel plate[153] and semi-finished aluminium,[154] as well as forged products such as engine components and seamless pipes.[155] These are largely intermediate goods used by businesses, particularly in construction (where steel plate is used to construct buildings and bridges) but also in marine, shipbuilding[156] and off-shore energy industries.[157]
- **Oil & gas refining – primarily intermediate goods used by businesses.** The Petroineos oil refinery in Scotland produces a range of fuels which includes liquified petroleum gas, gasoline, jet fuel, kerosene, gas oil and fuel oil.[158] These are largely purchased by businesses, including Scotland's major airports and the Rolls-Royce engine testing facility in Derby.[159] Ineos Olefins & Polymers and Ineos Forties Pipeline System also supply the Fife Ethylene Plant with Ethane[160] and the Avanti Gas Road Loading Terminal. The Fife Natural Gas Liquids plant

[145] https://www.versalis.eni.com/

[146] https://www.sdi.co.uk/news-features/success-stories/gsk

[147] https://www.ineos.com/sites/grangemouth/about/

[148] See, for example, https://www.heraldscotland.com/news/17068617.scotlands-glass-industry-still-thriving-300-years/; https://www.o-i.com/; https://www.ardaghgroup.com/news-centre/facility-focus-irvine-scotland; and https://www.superglass.co.uk/.

[149] https://www.scotch-whisky.org.uk/newsroom/scotch-whisky-economic-impact-report-2018/

[150] https://www.sdi.co.uk/key-sectors/food-and-drink

[151] https://www.lactalis.co.uk/our-brands/galloway/

[152] https://mcvities.co.uk/about

[153] https://libertysteelgroup.com/uk/our-locations/liberty-steel-dalzell/

[154] https://alvancealuminiumgroup.com/news/expansion-plans-fort-william/

[155] https://www.wyman.com/locations/wyman-gordon-livingston.html

[156] https://libertysteelgroup.com/uk/our-locations/liberty-steel-dalzell/

[157] https://www.wyman.com/locations/wyman-gordon-livingston.html

[158] https://www.petroineos.com/refining/grangemouth/

[159] https://www.ineos.com/sites/grangemouth/about/

[160] Ibid.

produces propane, butane and gasoline, with a significant amount of these products exported via the Braefoot Bay Terminal.[161]

- **Paper & pulp – mix of intermediate goods used by businesses and finished goods used by end-customers.** Scottish paper & pulp products include both intermediate goods purchased by businesses and finished products purchased by end-customers. Products include fine and custom papers,[162] lightweight coated paper used in magazines,[163] toilet rolls, hand towels, face tissues and other disposable paper products.[164]
- **Other – mix of intermediate goods used by businesses and finished goods used by end-customers.** Other products produced by EII manufacturers in Scotland include additional wood products such as chipboard, forged metal products made from a variety of alloys, electronics products such as semiconductor wafers, and ceramics. These are purchased by both businesses and end-customers, depending on the specific product.

A4 Summary

EIIs contribute approximately 4% of Scottish GVA and employment, and over one-quarter of exports. Of this, food & drink is the largest single sector, accounting for approximately 70% of EIIs' economic footprint, with chemicals & pharmaceuticals accounting for most of the residual.

EIIs are responsible for approximately 15% of all Scottish CO_2e emissions, with more than 70% of these coming from the chemicals & pharmaceuticals and oil & gas refining sectors. However, in deciding on the focus of demand-side policies, policymakers should also account for the share of these emissions that can be eliminated and the share of sector output that is consumed domestically. Of note, more than 85% of chemicals & pharmaceuticals and oil & gas refining output is exported and some sectors such as iron, steel & aluminium have low abatement potential.

Overall, the sectors where demand-side policy interventions are likely to be most effective at reducing emissions are cement, followed by chemicals & pharmaceuticals, oil & gas refining and food & drink. The effects on the remaining sectors are likely to be small.

Annex B – A basket of goods approach for carbon intensity

This Annex explores high level considerations and recommendations for designing a basket of goods approach to help inform policymakers' decisions and consumer behaviour. Overall, such an approach could be a useful tool for both policymakers and consumers. The proposed approach draws on product emissions intensity for a small number of representative EII products, weighted by the relative share of Scottish consumption emissions, in order to create an overall index which can be used to track

[161] https://www.shell.co.uk/about-us/what-we-do/shell-fife-ngl/about-fife.html

[162] https://arjowigginscreativepapers.com/en/

[163] https://www.upmpaper.com/about-us/our-locations/our-paper-mills/upm-caledonian-paper/

[164] https://www.fourstonespapermill.co.uk/our-products/

changes in emissions intensity over time and compare the overall emissions intensity of Scottish products to imports.

B1 Developing a basket of goods

A basket of goods approach can be a useful tool for informing behaviours and decision-making. A good example of this is the Consumer Prices Index (CPI), which uses a representative shopping basket for consumers to estimate a measure of inflation,[165] an important reference for policy makers, businesses and consumers. Here, we propose an index of carbon intensity for a representative basket of Scottish EII goods. This index is informed by best practice suggested by the CPI approach and by the evidence gathered from case study interviews and desk research.

There are three key components to developing a basket of goods and calculating an indicator or index based on this:

Figure 36: Developing a basket of goods approach

- **Measure of emissions**. What measure of emissions should be used? In particular, should the measure focus on aggregate emissions from Scottish consumption (which includes demand effects as an increase or decrease in demand will affect aggregate emissions even if product emissions intensity has remained constant), or instead measure product emissions intensity for a fixed basket of goods?
- **Products in basket.** Which products should be included in the basket? These products should be representative of the sector or sectors the basket of goods is designed to encompass. The method for selecting products for a typical CPI basket of goods could serve as a guide here, as the CPI basket design attempts to consider average consumer patterns.
- **Weighting of products in basket**. How should the products in the basket be weighted with respect to their contribution to the overall index of carbon intensity? There are a number of factors which could be used to weight the basket, but the overall goal is for the weighting to provide a representative picture of consumption.

There are necessary trade-offs with any approach. An approach which is more informative for policymakers may be less informative for consumers, and vice versa. We set out a recommended approach for developing a basket of goods approach below, taking account of these trade-offs and other relevant factors.

[165] See Office for National Statistics (ONS) website for more information on calculation and use of CPI.

B2 Measure of emissions

We suggest using **product emissions intensity** as a measure of emissions, as opposed to aggregate emissions from Scottish consumption. A change in emissions intensity shows the extent to which the emissions 'price' of consumption has increased or decreased, analogous to the inflation or deflation estimated using the CPI. If absolute emissions were used instead, this would introduce demand effects into the basket, as a change in basket emissions could come from either a change in emissions intensity or a change in demand for these products.

There is a necessary trade-off here, and a basket which shows emissions intensity for a fixed amount of consumption may be less informative for driving some types of consumer behaviour (as a reduction in consumption would not translate to a reduction in emissions in the basket). However, it is likely to be a much more useful policy tool as it illustrates how emissions for a fixed level of consumption have changed over time, similar to what the CPI does for changes in price. The main distinction with respect to the CPI is that, while prices increase over time in the UK, emissions intensity will hopefully consistently decrease.

Comparing emissions intensity across different products requires care and expertise. For example, as explored in Section 0, simplistic comparisons of the emissions intensity of cement products may lead to an inaccurate picture due to factors such as clinker content and coarseness of different cement products. Similarly, care is needed when comparing the energy or emissions intensity of whisky products, due to factors such as differences in distillation processes for different types of whisky (such as malt and blended).

While it appears that such comparisons can be made, they need to be made by experts even within what might appear to be a relatively homogeneous product. This suggests that additional care needs to be taken when combining or comparing emissions intensities for products produced by entirely different sectors, to ensure that they are comparable. This includes ensuring that the scope of emissions measured is consistent across measurements. Ideally, all emissions intensity measurements would include Scope 1, 2 and 3 emissions and reflect a life-cycle approach to carbon intensity, in line with the best practice suggested by the EU Consumer Footprint calculation.[166] However, as noted in the case studies, consistently measuring Scope 3 emissions across products and industries may not be feasible. If this is the case, the measure of emissions intensity will need to be limited to Scope 1 and 2 emissions to ensure a consistent measure across products. Overall, this suggests that these comparisons will be very challenging and require significant resources to perform in practice.

The final complication is the choice of denominator for the emissions intensity measures. Creating an indicator of overall emissions intensity across different types of products requires the units of these products to be comparable, and it is not clear how (for example) one tonne of cement compares to one litre of whisky. One option is to only aggregate products that are measured in the same way (such as tonnes of Portland cement equivalent or litres of blended whisky). Even without aggregating and normalising units across different products, the index can still be informative, as it can be used to measure the change in the weighted average of emissions intensity over time (e.g. showing that emissions for the basket have fallen 3% between year A and year B). The only thing that is lost by not having a consistent denominator across products is having a singular, static measure of emissions intensity (e.g. x tonnes of carbon per kg

[166] https://eplca.jrc.ec.europa.eu/uploads/LCIND2_Finalreport.pdf

of product). Attempting to develop this singular, static measure would require careful consideration as well as industry engagement.

B3 Product selection

Due to the complexity of consistently estimating and comparing emissions intensities across products, we suggest limiting the number of products in the basket to one or two representative products from each EII sector and **limiting the total number of products in the basket to 5-10** to start with (which can be expanded further in future iterations if necessary).

This is a substantially reduced number when compared to the basket of goods used to calculate measures such as the CPI and the EU Consumer Footprint, with these measures including more than 700[167] and more than 150 products respectively.[168] However, given the potential difficulty of consistently measuring and combining measures of emissions intensities across products, it is advisable to limit the total number of products in the basket to be no more than strictly necessary. These products need to be broadly representative of average emissions intensities in the sector and capture the general trend in emissions. For example, if the entire sector is decarbonising at a similar pace and all different types of products have fairly similar average emissions intensities, then one product will be enough to represent the sector. However, if a sector produces two very different types of products and one of these is decarbonising faster than the other, then representative products for both these types will be necessary. In general, this means that sectors such as cement may only need one representative product in the basket, while sectors such as food & drink and chemicals & pharmaceuticals are likely to require more.

For a given product, an average will still need to be taken of emissions intensity for that product – for example, an average emissions intensity for whisky in the basket as opposed to attempting to include emissions intensity for every brand of whisky individually. To ensure comparability across years, the products should be kept constant for a few years at a time, as opposed to being updated and re-selected every year to be perfectly representative of that year's consumption.

B4 Product weighting

The choice of weighting for the products in the basket is important. We propose using **the relative share of Scottish consumption emissions as the weighting**. For example, if total emissions from a sector make up 50% of EII emissions from Scottish consumption, then that sector should receive a 50% weighting overall within the basket, with products within that sector also weighted based on their relative emissions importance to that sector. As an example, consider a basket which only includes the iron, steel & aluminium and chemicals & pharmaceuticals sectors, and that emissions are 50% steel and 50% chemicals. In this hypothetical basket, there are one hypothetical steel product and two hypothetical chemicals products, with chemical A representing 20% of the chemicals sector and chemical B representing the remaining 80%. This means that the overall product weightings in the basket are 50% for the one steel product, 10% for chemical A, and 40% for chemical B.

To illustrate the implications of this choice of weighting for the movement of the overall index over time, suppose that a sector had a 20% share of emissions in the baseline

[167] See Office for National Statistics (ONS) website for more information on calculation and use of CPI.

[168] https://eplca.jrc.ec.europa.eu/uploads/LCIND2_Finalreport.pdf

basket and that emissions intensities for this sector's products declined by 25% while the emissions intensity of all other products in the basket remained constant. This would mean that overall emissions intensity for the basket would decline by 4%, effectively showing that the emissions 'price' for consumers had deflated by 4% for a given basket of consumption.

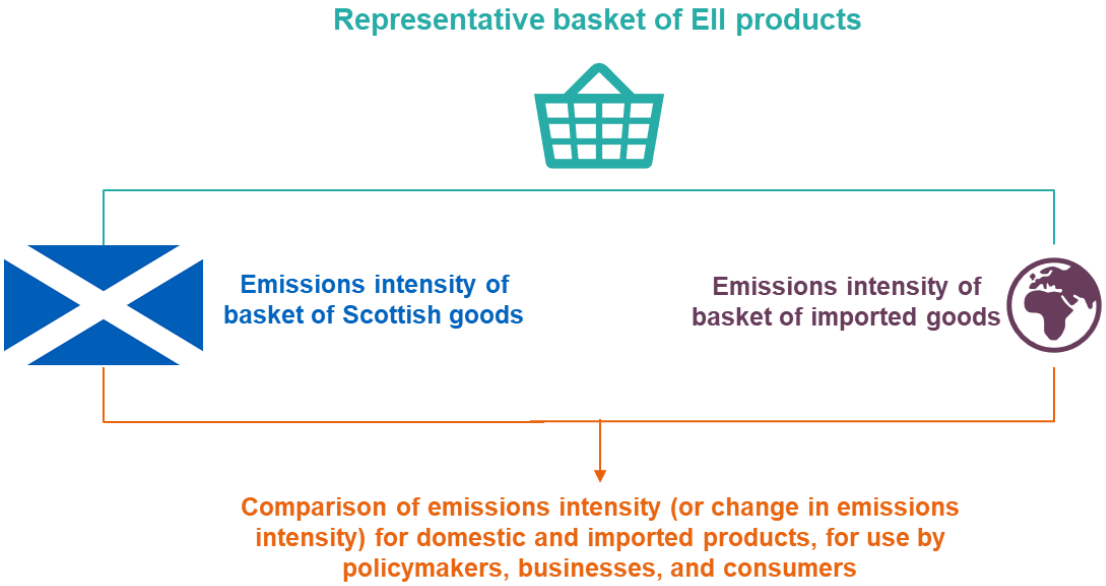
To ensure comparability across years, the product weightings should be kept constant for a number of years at a time, rather than being updated and re-selected every year to be perfectly representative of that year's consumption. A sensible approach might be to base the product weighting based on the average consumption over the past 3-5 years, to avoid distortions from annual variation and reduce administrative burden.

B5 Interpreting the basket

This basket will communicate the 'price' of a representative basket of EII products and how this changes over time. This makes it a useful tool for policymakers, as it can help to track how quickly, on average, the EII sector is decarbonising. However, in and of itself it may be of limited use to consumers – while it can enable them to better understand the emissions from the products they consume, it may be difficult for them to understand how they could adjust their behaviour to consume less carbon. Variations in this approach can make it more informative to consumers. Providing an intuitive breakdown of what is driving overall emissions intensity in the basket can help consumers understand which sectors and products are contributing more to emissions and how quickly they are decarbonising.

To assist with interpreting the carbon intensity of a basket of Scottish EII goods, policymakers could provide a separate indicator for imported EII products to illustrate how Scottish goods compare. This would illustrate the difference in emissions between an equivalent basket of goods produced in Scotland or imported from abroad, as illustrated in Figure 37 below. When calculating a basket of goods emissions indicator for Scotland separately from imported goods, the same products and product weightings should be used, with the difference between the baskets being the average emissions intensities of the products. It is particularly important for this comparison that emissions intensities capture Scope 3 emissions due to the potential transport emissions for some products transported from abroad. This comparison can also be used to illustrate the rate at which emissions intensity is falling for Scottish products compared to imported products, a potentially useful policy tool.

Figure 37: Using a basket of goods to compare domestic production to imports



B6 Summary and suggested next steps

Overall, the basket of goods approach proposed is characterised by:

- **using product emissions intensity** as the relevant measure of emissions for the index of carbon intensity;
- **limiting the number of products in the basket to 5-10 products**, with no more than two products selected per EII sector to start with; and
- **weighting each product's emissions intensity based on the relative share of Scottish consumption emissions** to establish the relative importance of each product's emissions intensity in the overall index.

This approach could be a useful tool for informing policymaker and consumer decisions and for supporting Scotland's industrial decarbonisation goals. This approach could also be explored in the wider UK context as a tool to support the UK Government's stated ambition to increase demand for low-carbon products.[169]

To pursue this approach further, policymakers in Scotland should:

- identify 5-10 representative products which can be used to form the basket of goods;
- engage with relevant producers of these products to determine how the emissions intensity can be consistently measured and how comparable these measures are; and
- coordinate with the UK Government to identify where a collaborative approach can be taken given the relevance of this type of index of carbon intensity to the UK's Industrial Decarbonisation Strategy objectives.

[169] For more information, see the UK's Industrial Decarbonisation Strategy, published in March 2021.

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