**Joint response by climate policy experts from UCL and LSE to BEIS Call for Evidence: Towards a market for low emissions industrial products**

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The **UCL Institute for Sustainable Resources (UCL ISR)** generates knowledge that promotes the sustainable use of natural resources globally. Its multidisciplinary team produces innovative research across the topics of resource efficiency, circular economy, eco-innovation, and low carbon societies.
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**The Centre for Climate Change Economics and Policy (CCCEP)** was established in 2008 to advance public and private action on climate change through rigorous, innovative research. The Centre is hosted jointly by the University of Leeds and the London School of Economics and Political Science. It is funded by the UK Economic and Social Research Council. www.cccep.ac.uk

**The Grantham Research Institute on Climate Change and the Environment** was established in 2008 at the London School of Economics and Political Science. The Institute brings together international expertise on economics, as well as finance, geography, the environment, international development and political economy to establish a world-leading centre for policy-relevant research, teaching and training in climate change and the environment. It is funded by the Grantham Foundation for the Protection of the Environment, which also funds the Grantham Institute – Climate Change and Environment at Imperial College London. www.lse.ac.uk/grantham/

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# Response to Call for Evidence

## A. Executive summary

**A.1.** Carbon intensity standards for final products (e.g. buildings, cars) have a higher decarbonisation potential via inter-material substitution than intermediate product standards (e.g. cement). However, they are also more complex. Government can combine maximum carbon intensity standards for intermediate and final products to optimally accelerate decarbonisation towards net zero.

**A.2.** It does not make sense to calculate a building's whole lifecycle carbon emissions by assuming that the carbon intensity of heating will remain constant over the next 50-70 years while the electrification of heating is likely to rise and the carbon intensity of the grid to decline. Therefore, carbon intensity standards should align whole lifecycle carbon emissions assessments with plausible heating decarbonisation pathways rather than relying on present carbon emissions factors for heating.

**A.3.** There are many uncertainties associated with the use of benchmarks that presuppose CCS deployment at scale. Better avoid such potential bottlenecks for decarbonisation and opt for other definitions of maximum carbon intensity standards.

**A.4.** Most climate mitigation scenarios for sticking to the Paris targets assume the use of bioenergy with CCS (BECCS). Intermediate storage of sequestrated carbon via the use of biomass in buildings and infrastructure is preferrable to direct energy use. Therefore, government should use carbon intensity standards to incentivise the use of carbon sequestrating biomass in construction.

**A.5.** Certain carbon intensive building products are well recyclable and potentially reusable. However, the promise of future recyclability many decades ahead should not distract from the need to decarbonise in the present and near future.

**A.6.** Simplified estimates for maximum carbon intensity standards can be acceptable where the aim is tapping into the decarbonisation potential of inter-material substitution.

**A.7.** Government can use public sector procurement as the vanguard of lead market generation.

**A.8.** There is an excellent case for working towards the adoption of border carbon adjustment mechanisms and maximum carbon intensity standards in parallel rather than choosing between one or the other.

**A.9.** Maximum carbon intensity standards should be combined with targeted subsidies to create green lead markets and accelerate the transition to net zero.

## B. Responses to Call for Evidence

# Response to Chapter 1: Defining Low Emissions

*Setting definitions at a market, sector and/or product level*

Standards specifying maximum embodied or whole-lifecycle carbon emissions can be targeted at a range of product scopes. The following section addresses the potentials and drawbacks of different scopes and argues that their combination is the most promising approach.

## 1.1 Product versus sectoral versus market standards

The consultation document seems to use slightly overlapping terminology, when it differentiates between

a) intermediate and final products, and
b) market, sector or product level.

*Market-wide* definitions and assessment methodologies for low emissions ("this could be a single definition for all industrial products used for a specific purpose" (BEIS 2021, 18)) seem to conceptually overlap with *final* products while *sector* or *product* level seems to overlap with *intermediate products*. Insofar as this observation is correct, there is a danger that when we talk of 'product level' some people may also think of 'final products', and vice versa. Greater definitional clarity could be helpful with respect to the public consultation on policy design planned for autumn 2022 (BEIS 2021, 12).

## 1.2 Standards for intermediate products

In the United States state governments have begun to use Green Public Procurement to address embodied emissions in industrial materials. In October 2017 the Governor of California approved the Buy Clean California Act (BCCA), a measure against carbon leakage, foreseeing that the state should only procure a range of building materials if it can be shown by means of Environmental Product Declarations (EPDs) that they are within the levels of a maximum acceptable global warming potential (GWP) (Jordan and Bleischwitz 2020). The Californian government gave the procurement officers and tenderers time to adapt by phasing in the BCCA in various steps: in 2019 the state government requested bidders to submit EPDs with their tenders, setting 2020 as a deadline. Over the course of 2021 the maximum acceptable global warming potential limits were established and in July 2021 the awarding authorities started to refer to EPDs to gauge the GWP compliance of relevant materials (California State Government Department of General Services and Procurement Division 2021; Hasanbeigi and Shi 2021). In 2021 the State of Colorado (State of Colorado 2021) adopted its own Buy Clean legislation, the HB21-1303 *Concerning Measures To Limit The Global Warming Potential For Certain Materials Used in Public Projects* (Dunford, Niven, and Neidl 2021; Rempher and Olgyay 2021). Currently, the Biden administration is looking into adopting the approach at the federal level (Shepardson 2022). An adoption of a policy akin to the BCCA could eventually precipitate the ban of high carbon products on the market.

In December 2021 the Governor of New York signed the senate Bill S542A, which "requires the Office of General Services to establish guidelines concerning the procurement of low embodied carbon concrete" (Kinniburgh 2021; The New York State Senate 2021).

### 1.3 Standards for final products

Governments can set standards mandating outright maximum limits for embodied or overall lifecycle emissions of *final products*, such as buildings or cars. In 2018 the Dutch government introduced such a policy for all new homes and offices over 100 $m^2$ (C40 and Arup and University of Leeds 2019; UK Climate Change Committee 2020; Zizzo, Kyriazis, and Goodland 2017). France and Finland have announced similar policies, starting in 2022 and 2025 respectively, with mandatory lifecycle calculations preparing the way for the eventual introduction of emissions reduction targets (Aecom 2019; Freeman and Christie 2021; Kurmayer 2021; Ministère de la Transition écologique 2022).

As of 1 January 2022 in Sweden the *Act on Climate Declarations for Buildings under Construction* applies, which requires developers to measure and declare embodied emissions. There are no limit values for the climate impact but these may be introduced further in the future (Boverket 2021).

In 2021 Denmark introduced targets for whole life carbon in the building sector, effective from 2023. Buildings over 1,000 $m^2$ will need to limit emissions to 12 kg $CO_2e/m^2$/year, with a tightening of limit values every other year until 2029 (Birgisdóttir 2021; The Danish Housing and Planning Authority 2021).

The Dutch policy goes beyond carbon and comprises an environmental lifecycle assessment (LCA) for 11 impact categories, including embodied carbon. Each of the impact categories gets converted to Euros via a special procedure for weighting and converting impacts into currency value. The cap for overall environmental lifecycle impacts is also expressed in Euros-per-square-meter and set at €1 per $m^2$ per year (75 years for residential, 50 for offices). Under the policy embodied carbon is weighted at €50/ $tCO_2e$ (Pomponi et al. 2020; Teshnizi 2019; Varriale 2021).

Pioneering countries such as Denmark, the Netherlands, France and Finland are leading the charge while the European Commission is seeking to revise the Energy Performance of Buildings Directive (EPBD) to begin introducing mandatory calculation and disclosure of full lifecycle carbon emissions by 2027 (European Commission 2021b). The Industrial Deep Decarbonisation Initiative (IDDI) commitment to begin disclosing embodied carbon in public construction projects by 2025 could be an ideal focal point for both setting maximum levels of embodied carbon at the level of intermediate products and maximum whole lifecycle emissions at the level of buildings. However, to 'begin' in 2025 seems relatively late for the case of the UK, being only two years ahead of the EU, and the process should be accelerated as a matter of priority.

One could also use embodied or whole lifecycle emissions to define thresholds as a basis for specifying different taxation classes, analogously to the way many countries already use operational $CO_2$ emissions intensity to determine vehicle tax rates (European Political Strategy Centre 2016; Harvey 2013; Ürge-Vorsatz et al. 2020; World Green Building Council 2019).

### 1.4 Combining standards for intermediate and final products ***(Q10)***

Product specific benchmarks at the level of intermediate products score low in terms of technology neutrality (PA Consulting 2021, 6) and tend more towards the setting of incentives for incremental improvements within a product class. Product specific benchmarks inhibit inter-product competition for low carbon solutions and are thus in the way of innovative substitution processes (as advocated for by HM Government 2021a). For example, a specific benchmark for virgin steel, as stipulated under the heading of 'sector-level definitions' in the consultation document (BEIS 2021, 19), will not *directly* provide greater incentives for steel recycling. Nor will it *directly* provide incentives to substitute steel for cross-laminated timber. However, such incentives may arise indirectly due to potential increases in the price of remaining products, once more carbon intensive products are not eligible for procurement contracts or taken off the market.[5]

The more narrow benchmarks are, the less they induce competition for low carbon solutions between different materials or technologies. In contrast, they preserve the product category that is subject to benchmarking. For instance, a clinker benchmark has lower decarbonisation potential than a cement benchmark than a concrete benchmark than an entire buildings benchmark. The market opportunities for innovative low carbon concrete that manages to reduce the use of clinker will not be drastically improved by a relatively tight clinker benchmark.

This is not necessarily an argument against sector-level benchmarks but certainly against the sole reliance on those, without taking into account final products, such as vehicles or buildings. In contrast to intermediate product benchmarks, benchmarks at the level of finished products, such as vehicles or buildings, provide incentives for technology-neutral inter-material substitution and therefore harbour more potential for the inducement of radical innovation (*Industrial Decarbonisation Strategy Principle 5*). Market-wide assessment methodologies for final products are far more complex than sector level assessment methodologies for intermediate products, as a meaningful market-wide assessment of buildings or vehicles should also take into account operational emissions to arrive at whole lifecycle emissions, which requires much more data collection to understand the impact of building occupancy or real-world driving behaviour. However, the entire transitions agenda with their scenarios and pathway is of necessity future-oriented and the need for projections does add uncertainties. In this respect, the assessment of whole lifecycle emissions for vehicles and buildings should be aligned with plausible decarbonisation pathways for the electricity grid, rather than assuming that the carbon intensity of the grid is going to remain constant.

Combined benchmarks at intermediate and final product level have a higher joint potential for industrial decarbonisation and the inducement of radical innovations. Intermediate and final product standards should be combined to take the most polluting products within a category from the market and, at the same time, incentivise the innovative substitution between intermediate products at the level of final products, such as buildings or vehicles.

Learning from and seeking alignment with the policies of subnational actors such as US states, the Netherlands and Denmark could help to generate more dialogue with partners abroad and may lead to the increased development of joint approaches (*Industrial Decarbonisation Strategy Principle 7)*. The UK can catch up with California, and eventually align with the USA, by mirroring the BCA act and with Denmark by also adopting maximum whole life carbon emissions values at the building level. Government should consult with partners in in pioneering European countries to most effectively mirror policies that target the whole lifecycle emissions

[5] Thanks to Alastair McFarlane of PA Consulting for pointing out the potential price effect.

of buildings. At the same time, government should also consult with partners in California and with the U.S. federal government to optimally align the introduction of policies mirroring the Buy Clean policies at state and federal level. In this way, the UK could briskly move from its mid-field position to a leadership position in the design and deployment of embodied and whole lifecycle emissions standards and strengthens its policy broker role between the EU and the USA.

The combination of benchmarks at the level of intermediate products (such as cement and steel) and that of final products (such as cars or vehicles) could help make it easier to design low carbon final products and thus to ensure that they really stay below thresholds. For if benchmark standards for intermediate products ensure that such products do not pass a certain carbon intensity threshold, it is more likely that relatively low carbon products are indeed available on the market. Otherwise there might be the danger that a design for a building or vehicle assumes the availability of low carbon materials but if demand exceeds supply, this may not come true.

**Recommendations:**

- combine maximum carbon intensity standards for intermediate and final products to maximise decarbonisation potential (***Q9***), and
- align whole lifecycle carbon emissions assessments with plausible heating decarbonisation pathways rather than relying on present carbon emissions factors for heating (***Q32***).

## Response to Chapter 2: Sectoral and Product Scope

*Overarching approach to targeting policy: accounting for carbon sequestration*

*CCS*

The consultation document argues that "[s]tudies show that [a] transition [where policies lead to producers adopting low emissions technologies] should have a minimal impact on prices paid by end-consumers... using deep-decarbonised cement is estimated to increase the cost of a residential building by a maximum of 1%." (BEIS 2021). However, the consultation document refers to a study by Rootzén and Johnsson (2016)[6], of which the peer-reviewed version (Rootzén and Johnsson 2017) makes clear that it is based on the assumption that CCS will be a viable technology for achieving that at a certain price and notes explicitly that "appraisals of the costs associated with the introduction of CCS for industrial applications remain uncertain". Taking this uncertainty into account, it would be preferable to not bet everything on CCS but to also induce more cement-substituting innovation by benchmarking the whole-lifecycle emissions of buildings and infrastructure and supporting low carbon demonstration projects in parallel to support for CCS demonstration projects. As of September 2021 Perilli (2021) reports that there are no commercially viable CCS cement plants yet.

Similarly, the paper by Rootzén and Johnsson on steel decarbonisation cost pass-through also assumes CCS deployment: "..the costs associated with investing and operating new production units are to be regarded as tentative. In particular, this applies to the case in which CCS is assumed to be introduced .. since the suggested process ... has yet to be demonstrated on a commercial scale" (Rootzén and Johnsson 2016). Rootzén and Johnsson elaborated their CCS steel production cost estimates on i.a. Hooey et al. (2013) and IEAGHG (2013). Hooey et al.

[6] Managing the costs of CO2 abatement in the cement industry, 2016.

(2013, 7141) relied on computer modelling of $CO_2$ capture and IEAGHG (2013, 2) based their modelling on "existing technologies that *could* be deployed ... or technologies that are currently being developed ..." (emphasis added) rather than *real* costs from actually built CCS-equipped steel plants. Real costs could turn out to be much higher. It would also be important to consider the percentage of carbon emissions that could actually be sequestrated at a given cost. For example, IEAGHG (2013, 7) consider cases where only between 47% and 60% of $CO_2$ emissions are avoided, which is far from bringing emissions to zero. Furthermore, it has become questionable whether the CCS road for steel is still preferred as companies opt for the potentially green hydrogen route instead (S&P Global Platts 2021).

CCS-dependent benchmarks could turn out to be a bottleneck as they could only be applied once CCS can be commercially deployed at scale. Relying on CCS-dependent benchmarks for intermediate products risks opting for a narrow set of solutions that could fail to be plausible, to be zero carbon and to come at the lowest cost.

Any recognition of CCS in evaluating whether a product complies with a maximum carbon intensity standard requires an assessment of the quality and certainty of storage (Vinca, Emmerling, and Tavoni 2018). Any leakage risks should be taken into account when calculating the carbon intensity of a product.

**Recommendation:** avoid potential bottlenecks from uncertainties associated with CCS

*Biological carbon sequestration*

Carbon intensity standards should find ways to incentivise the use of carbon sequestrating biomass, that is, prioritise growing biomass for uses which sequester and store carbon out of the atmosphere for as long as possible, e.g. wood in construction. The deployment of bioenergy with CCS (BECCS) is part of most scenarios to keep global heating from escalating (Bellamy, Lezaun, and Palmer 2019). However, it is more in line with the vision of a circular economy to not directly use biomass for energy but first to use it in construction in the spirit of a 'cascading' use. Sequestrating carbon via the growth of biomass and then storing it in buildings and infrastructure before eventually burning it for energy use with carbon capture and storage (to prevent its release back to the atmosphere at a later date) is preferable over burning the biomass directly (see e.g. Keegan et al. 2013).

**Recommendation:** use carbon intensity standards to incentivise the use of carbon sequestrating biomass in construction

*Supporting decarbonisation across the manufacturing chain: incentivising extended use and circularity*

While, in principle, it is desirable to take into account a product's future recyclability into the assessment of its carbon content today, this remains highly speculative and runs the danger of not sufficiently taking into account the urgency with which we have to reduce emissions. For example, the steel industry argues that steel is (nearly) infinitely recyclable. However, if it remains locked up in a building for about 60 years, the recycled steel potentially available from it won't be available to substitute virgin steel for a long time. It is therefore important that the eventual benefits of potentially circular products more than half a century in the future do not keep us from reaching emissions targets over the next decades.

It should not only be new products that benefit from whole-life carbon assessments but it is also important to find ways of incentivising the continued use of existing buildings and vehicle parts through improvements and redesign (Allwood and Cullen 2011).

**Recommendation:** do not let the promise of future recyclability or re-use distract from the need to decarbonise in the present and near future

## Response to Chapter 3: Emissions Reporting and Verification

*Granularity: sectoral versus product-specific product carbon footprints (**Q23**)*

Sectoral initiatives can be important first mechanisms for creating EPDs and, as part of that, Product Carbon Footprints (Jordan 2021) but many producers of carbon intensive goods have by now already acquired such capacities in-house and can therefore produce individualised EPDs (Anderson 2022).

*Granularity: options for the simplification of emissions reporting*

When evaluating options for the simplification of emissions reporting (***Q20***) policy makers should take into account that the substitution between materials (e.g. timber vs concrete) or fundamental production technologies (e.g. conventional vs hydrogen steel) bear greater decarbonisation potential than the provision of incentives for more incremental improvements. Therefore, simplified estimates may be sufficient to induce inter-material substitution towards low or zero carbon solutions.

**Recommendation:** simplified estimates for maximum carbon intensity standards can be acceptable where the aim is tapping into the decarbonisation potential of inter-material substitution

*Stringency: role of voluntary labelling and standards (**Q13**)*

There is no convincing causal mechanisms to suggest that voluntary product labelling would be sufficient to move markets towards net zero goals. However, voluntary labelling initiatives can be valuable insofar as they can be precursors to mandatory labelling. Labelling can be a precursor to the setting of maximum carbon intensity standards.

It does not seem to make much sense for the government to set voluntary standards for low carbon products besides mandatory carbon labelling requirements. In particularly, it would not make much sense to label e.g. cement that performs relatively well compared to peers as 'low carbon cement', if it still - overall - a high carbon product or relies on the by-products of high carbon activities such as coal firing or conventional steel production.

In terms of voluntary standards, it makes sense to have consistently higher ambition levels in public procurement and thus making the public sector act a as a pioneer. In absence of mandatory standards across an industry, it makes sense to have ambitious standards for public procurement.

**Recommendation:** use public sector procurement as the vanguard of lead market generation (***Q29***)

## Response to Chapter 4: Policy implementation

*The interplay between maximum carbon intensity standards and carbon pricing*

Carbon pricing was supposed to create a market for low emissions industrial products. However, currently, emissions trading systems (ETS) tend to use the free allocation of emissions permits to producers of many industrial products as a way to counter the threat of carbon leakage. This severely diminishes the hoped-for decarbonisation effect of carbon pricing for such industrial products. In particular, current designs of free allocation inhibits the pass through of the carbon costs of basic industrial products throughout the value chains. We currently do not have an economy-wide carbon price due to the lack of carbon cost pass through to consumers. Restoring carbon prices in the value chain is a key part of creating markets for low carbon alternatives, and encouraging climate-neutral production processes. Pricing carbon is important for ensuring low carbon production can recover additional costs. This create incentives for efficient material use and choices (Neuhoff et al. 2021; Skelton, of, and 2017 2017).

In the context of restoring carbon pricing for imported goods, border carbon adjustments (BCAs), such as the Carbon Border Adjustment Mechanism (CBAM) proposed by the European Commission (European Commission 2021a), are a prominent way of addressing this, which at the same time counters carbon leakage, and would allow to phase out free allocation of emissions permits. However, as of yet, there is no full certainty as to their implementation, with corresponding doubts about the scope for alignment between the UK and the EU.

The use of mandatory standards for specifying maximum carbon intensity levels for different kinds of intermediate or final industrial products could serve several functions in relation to BCAs. They could be adopted

a) in preparation for the eventual phasing in of BCAs,
b) in lieu of BCAs or
c) as a complement to BCAs.

Mandatory carbon intensity standards can (a) provide incentives for the adoption of carbon labels in the form of Product Carbon Footprints and Environmental Product Declarations which would help to *prepare* industry to have the data ready to comply with BCAs (Bahn-Walkowiak et al. 2020).

Mandatory carbon intensity standards could (b) be an *alternative* measure to BCAs, which would apply at the point of putting a product on the market rather than at the border. Benchmarks for intermediate products are likely to partially duplicate the incentives already emanating from benchmark-based free allocation under emissions trading systems. However, in lieu of border carbon adjustments, they could partially address carbon leakage concerns. Even more, such benchmarks could help to induce more solid carbon certification and verification regimes, which would be a beneficial aspect to the technical viability of border carbon adjustments.

Mandatory carbon intensity standards could (c) *complement* BCAs by setting stronger incentives than a carbon price in selected sectors or product categories. Carbon pricing excels at inducing *incremental* change and can lead to substitution of materials when alternatives are *already* developed. However, targeted subsidies and standards have a track record of creating lead product markets by supporting innovation and the emergence of new industries (Grubb et al. 2021).

According to the European Commission's proposal, free allocation would be phased out by 2028 while the CBAM is phased in (European Commission 2021a). This could eventually take many years and face several uncertainties. Accordingly, carbon intensity standards would be a valuable instrument in almost any scenario. Regardless of the envisaged interplay between BCAs and mandatory carbon intensity standards, all of these options would help to create a more stable policy environment for steering industry towards net zero.

**Recommendation:** introduce both border carbon adjustment *and* maximum carbon intensity standards (***Q32***)

*Combine supply-side with demand-side measures*

Supply side measures in the form of subsidies like contracts for difference have been suggested to do some of the heavy lifting for getting hydrogen steel off the ground (HM Government 2021b), as even a relatively high carbon price would not suffice to set the incentives right. Vogl et al. suggest that "[o]nce viable technological alternatives to current fossil fuel-based production systems are feasible, a dedicated phase-out policy must ensure high emitters do not continue to operate alongside the low-carbon alternatives" (Vogl, Åhman, and Nilsson 2020). Maximum carbon intensity standards could be an excellent way to create incentives for entire sectors to phase out high carbon production and switch to hydrogen or other low or zero carbon technologies. However, they cannot be applied beyond niches such as public procurement before e.g. green hydrogen steel is actually available at sufficient scale, resulting in a hen-and-egg problem. However, combined with subsidies, one could define trigger points in terms of product availability at which procurement benchmarks would come into place, and eventually standards that only keep extremely low or zero carbon steel on the market place (***Q7/Q32***). One could draw inspiration from the Japanese top-runner approach to standard setting that famously has set targets for the future that could not yet be achieved at the time (Kimura 2010; Nordqvist 2006; Siderius and Nakagami 2013).

**Recommendation:** combine subsidies with maximum carbon intensity standards to create lead markets and accelerate the transition to net zero

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We would be pleased to speak further about our response. Please contact Dr Nino Jordan (nino.jordan@ucl.ac.uk).

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