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Research Article

Embodied emissions policies—design options and political mobilization potential

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Abstract

The topic of greenhouse gas emissions embodied in products is gaining in prominence and the possibilities for measuring and verifying them are improving. This provides fertile ground for those who demand that climate policy should address such embodied emissions. There are different design options for policies targeting embodied emissions. Such differences affect which groups can be mobilized in their favour. This paper shows that procurement standards which target intermediate products can mobilize the support of relatively low carbon producers of high carbon materials, while product standards which target final products can mobilize the support of producers of relatively low carbon materials and knowledge-intensive service providers.

Keywords: environmental product declaration; product carbon footprint; carbon leakage; public procurement; policy coalitions; lobbying

Introduction

The question of how to generate support for ambitious climate policy is crucial for limiting global temperature rise in line with internationally agreed targets. The failure to implement carbon pricing at the US federal level, the violent *gilets jaunes* protests in France against rising fuel taxes [1], protests against the removal of fuel subsidies in Nigeria [2], and the political backlash against the phase-out of fossil fuel heating in Germany [3] are prominent cases underlining the need to move political feasibility to the centre of attention when considering solutions to climate change. There is a well-established academic debate on the political economy and feasibility of regulatory standards versus carbon pricing [4, 5]. However, most of that debate does not yet consider the inclusion of 'embodied', often transnational, supply chain emissions in policy instruments. Where it does, it is largely limited to the political economy of including cross-border emissions into pricing mechanisms and does not provide a thorough analysis of alternatives, complements or potential precursors to pricing, such as public procurement and regulatory standards targeted at the carbon footprint of products [6]. The objective of the present paper is to respond to this gap by developing a comparative political economy account that specifies how different embodied emissions policy instruments vary with respect to which business coalitions they can mobilize in their favour.

The potential of new policy instruments targeting the greenhouse gas emissions embodied in products has led to the emergence of new lobbying coalitions. Transcending prior, more disparate, framings of the environmental qualities of their goods and services, businesses can now rally behind the common framing of 'low embodied emissions'. This paper first develops a theory explaining how different policy designs affect which actors can be mobilized in support of embodied emissions policies and then tests it on the basis of a network analysis.

As long as greenhouse gas emissions embodied in goods are not sufficiently addressed, ambitious climate policy is more likely to result in competitive disadvantages. In the case of carbon pricing, *carbon leakage* describes a situation where the existence of a domestic carbon price leads to a competitive advantage for producers from abroad, who do not face the carbon price. As a result, domestic industries may relocate abroad and/or foreign producers may become more competitive, leading to income and employment losses in the domestic setting. The most tragic aspect of the carbon leakage scenario is that the domestic consumption of the good in question continues, making the policy largely ineffectual for reducing GHG emissions [7].[1] Addressing embodied emissions would be an important step towards alleviating carbon leakage. Similarly, the adoption of energy efficiency measures and the use of renewable energy should become more attractive for producers if the emissions embodied in products were to become criteria for purchasing decisions, for instance through pricing, standards or procurement.

The European Union has started to address carbon leakage through the introduction of the Border Carbon Adjustment Mechanism (CBAM). It plans to phase-out the free allocation of emission permits to industry and to phase-in requirements for importers to surrender emission permits. While this is an important step forward for addressing carbon leakage, other instruments targeted at the emissions 'embodied' in products are

[1] To what extent this is the case for different industries and carbon price levels is a politically charged matter of contestation.

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relevant as alternatives, complements or as part of well-sequenced dynamic policy instrument mixes [6, 8–11].

Environmental Product Declarations (EPDs) have emerged as a promising way to make the carbon content of products transparent, and to serve as the informational basis for further climate policy [12, 13]. EPDs have been proposed as the basis for policies targeted at different points in the value chain: at the level of intermediate commodities, such as steel or cement, and at the level of final products, such as cars or buildings.

In 2018 the Netherlands introduced maximum thresholds for the overall embodied impacts of buildings across a number of environmental categories. In 2022 France introduced upper limits for the embodied carbon lifecycle emissions of buildings. In 2023 Denmark introduced mandatory maximum whole life carbon thresholds for buildings, addressing both operational and embodied emissions. At the same time Sweden and Finland were working on similar regulations [14]. Since March 2023 the German government has made the disbursement of the most subsidized loans for the construction of buildings conditional upon low greenhouse gas emissions along the whole life cycle [15, 16]. There are discussions about a potential inclusion of embodied emissions into the European Commission's Energy Performance of Buildings Directive (EPBD) [17]. In the run-up to these developments, in Germany, the UK and at the European level various organizations had already been advocating for the inclusion of embodied emissions performance in mandatory building standards.[2]

The Buy Clean California Act (BCCA) is a measure against carbon leakage, requiring the Californian state to only procure certain building products if their carbon footprint is below a certain threshold. The BCCA applies to carbon steel rebar, flat glass, mineral wool board insulation, and structural steel [12, 18–20].[3] This marked the first instance of a US state actively working to mitigate embodied emissions from imported products [21].[4] Since July 2022 authorities check compliance with the BCCA by demanding to see EPDs for the goods in question [24]. The BCCA has inspired the take-up of similar policies by other US states and at the Federal level [25–28]. The 2022 US Inflation Reduction Act provides for considerable investment into EPD development, product labelling and public procurement of low carbon materials [29]. In 2023 Canada, Germany, the UK and the USA jointly pledged to buy low-emission steel, cement and concrete, and/or to adopt lifecycle assessment and set emissions reduction targets for public buildings and/or infrastructure. A US representative explicitly linked this development to the US Federal Buy Clean Initiative [30].

Given their potential to address significant gaps in climate policy [10], it is crucial to enhance our understanding of the political economy behind policies dealing with embodied emissions. Who can be mobilized in their support? How do variations in policy design affect who can be mobilized as supporters?

This article, for the first time, puts forward an explicit theory of how businesses re-align from prior sustainability framings to coalesce behind demands for embodied emissions policies and specifies *who lobbies for what*, i.e. which industries lobby for what types of embodied emissions policies. The propositions are then tested through an analysis of major parts of the transnational network of organizations advocating for different embodied emissions policies or producing technical guidelines for these. To this end, the article presents the first network dataset dedicated to organizations advocating for embodied emissions policies. Through recursively mapping the relevant organizations' sponsors and member organizations, and, in turn, their members and sponsors, the dataset covers more than 2000 organizations.

The next section presents the theoretical framework and the hypotheses arising from it, section 3 describes materials and methods, section 4 and 5 present and discuss the results.

Theory and hypotheses

Support from business interest groups is often key for environmental legislation to be passed. Due to the powerful role of business in environmental politics, it is of particular interest how specific policies can mobilize particular business interests in their support [31–34]. Corporate support for or resistance to environmental policies can be largely explained by their differential effects on businesses [35, 36]. For example, Vogel [37] suggests that domestic producers may be more willing to support stricter regulations when they anticipate that their international competitors will bear a disproportionately greater share of the burdens of compliance.

Many authors suggest that product standards or subsidies [4, 37, 38] can successfully mobilize business support in their favour. The expansion of feed-in tariffs for renewable energy has spawned its own lobby and has thus ushered in a self-reenforcing dynamic [39]. There is a clear constituency for energy efficiency standards and targets [40]. In both cases, concentrated groups can reap large benefits. In contrast, critics have pointed to carbon pricing's failure to muster industry support for ratcheting up [4, 5].[5]

At each stage of value or supply chains there are specific constellations of relevant actors and differences in the interests they pursue [35, 41, 42]. For analysts, advocates and policy-makers it is crucial to know more more about the differences in the political dynamics associated with interventions at different points in the value chain. Accordingly, this study focuses on the different business coalitions that can be mobilized in support of policies targeting intermediate (building materials) and final products (buildings).

The presence of benefits for the different coalition members is a key factor for coalition building, which, in turn, is a crucial determinant of policy adoption. Public choice literature suggests it is easier to mobilize actors in the pursuit of concentrated benefits or in resisting to concentrated losses rather than diffuse ones [43]. Increasingly, environmental struggles and controversies are located on the terrain of the *informational* [44]. More information enables new environmental policies [45]. Information on life cycle environmental impacts makes different products commensurable in terms of environmental impacts, enabling new types of environmental policy. A transformation of information on production-based emissions into product qualities can enable the emergence of product standards. As these have more clearly defined and concentrated beneficiaries [4, 37, 38], this should also make them a more attractive proposition for carbon efficient businesses to rally behind them in support.

Commensuration – "the transformation of different qualities into a common metric" [46]—can be an important aspect in the dynamics of *coalition-building*. Espeland and Stevens [46] suggest

[2] Supplementary Table S2 provides an overview of actors advocating for a greater role for embodied emissions.

[3] Originally, concrete was also part of the draft proposal.

[4] Between 2009 and 2015 Chinese steel exports rose by 400% [22]. By 2017 China was producing about half of the annual global steel output [23].

[5] However, to what extent this is an innate feature of carbon pricing or simply due to the failure to address emissions embodied in trade, and the resulting threat of carbon leakage, is an open question.

that, as commensuration establishes new interpretative frameworks, it can have political effects. As such, "it is not a neutral or merely technical process". Carbon has become a central unit of account for the evaluation of production and consumption practices in climate politics [47]. It is the unit of account by which different processes are made commensurable across time and space. By creating an equivalence between different activities and identities, an overarching frame such as 'low-carbon' can unite different actors under one banner.

As E. E. Schattschneider already argued in the first half of the 20th century: "new policies create a new politics" [48]. Through redistributive as well as cognitive, or interpretive, effects, policies can shape interest groups, just as interest groups shape policies [48]. On the one hand, institutions enable and constrain individual choice and strategies. But beyond that, they also "affect the articulation of interests, and particularly the articulation of *collective* interests" (author's own emphasis) [49]. As a result, institutional configurations play a role in facilitating the organization of certain groups and contributing to the disarticulation of others. Institutions contribute to the emergence and decline of groups not only by affecting coalition formation but also by influencing the "capacities … to recognize shared interests in the first place" [49].

Shared interests, however, may only manifest themselves once specific policies, which benefit one set of actors at the expense of another, become technically feasible. Thus, initiatives that contribute towards *capacity-building*, by helping to make the greenhouse gas emissions of different products commensurable, can have ripple effects on the conditions for *coalition building* [50].

In order to work out how information might affect political divisions one needs to be attentive to how it can affect the feasibility of regulation, i.e. how the feasibility of regulation mediates the effect of information on political divisions. The availability of information can affect the ability to craft policy in more universalist, rather than particularist, terms. Policies that can be justified with reference to universal higher normative principles enjoy greater and wider legitimacy than policies that only serve particular interests.

Whether a policy is designed in more particular or more universalist terms impinges on the identity of interest groups. Where a higher level concept is used, a broader group may correspond to the scope of the policy. For example, 'support for renewable energy' has a broader policy scope than 'support for wind energy' and support for 'low or zero carbon energy' is even broader.[6] Information-providing institutions can be an antecedent condition for the emergence of coalitions that are held together by an alignment of their particular interests with a more universal, collective, interest [49, 51].

Embodied environmental impacts can complement or supersede existing sustainability criteria, which tend to be far less information intensive, but also less precise. For instance, rather than relying on scientific measurements of the environmental impacts of building materials, the 2009 version of the dominant green building certification scheme in the USA, LEED, still relied on non-measurement proxies for the environmental impacts of building materials, such as materials that were *reused*, *regional*, *recycled*, or *renewable* [52]. A 2014 version of the British green building certification scheme BREEAM also allowed the provision of credits for the use of *recycled* or *re-used* materials [53]. Where

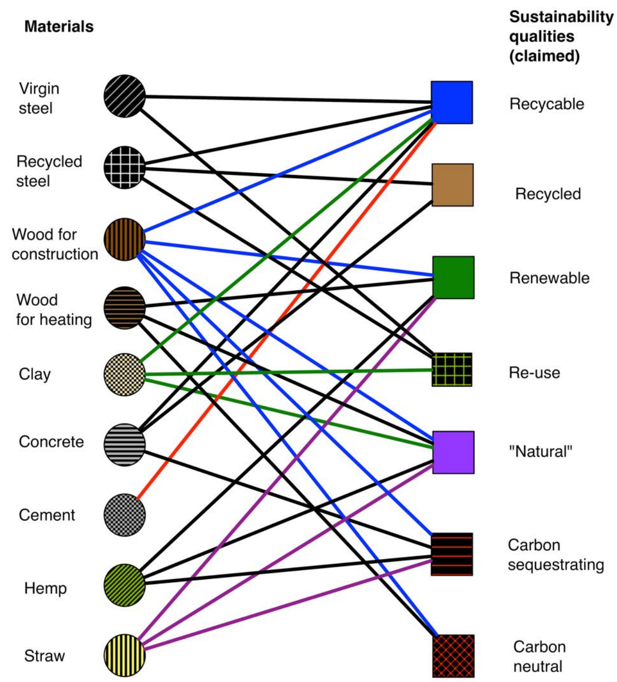

Figure 1. Sustainability framings of materials.

LCA is available, one could instead emphasize the criterium of *embodied emissions*.[7] By making different materials comparable, renewable materials such as wood, and recycled ones, such as low carbon cement, can unite behind the common banner of embodied emissions, rather than behind separate framings, where, for example, steel and conventional concrete would also be able to rally behind the banner of recyclability.

Prior framings of the environmental advantage of the different materials would have been 'renewable' in the case of wood, 'natural' in the case of clay, 'recyclable' and 're-use' in the case of steel, and 'recycled' in the case of low carbon cements and concrete. However, 'recyclable' and 'recycled' are also potentially attributes of higher carbon concrete and steel, 'natural' and 'renewable' are attributes of wood pellets for heating. Figure 1 shows examples of sustainability qualities that have been claimed for different materials.[8]

As embodied emissions become measurable and comparable, a new embodied emissions framing allows actors hitherto fragmented into different camps of environmental framings to rally behind one banner—it enables a *re-aggregation* of interest group identities. Different actors who, in the past, have emphasized different framings, such as support for wood or renewable materials or 'natural materials', now lobby jointly for the regulation of embodied emissions in the buildings sector. This not only includes material suppliers but also experts in sustainable construction and businesses specializing in enabling carbon commensurability, such as database and software providers. This shows that information-based commensuration processes can enable the articulation of new coalitions.

By making the environmental impacts of different products commensurable—be it at the level of the building material, the element or the building itself—policies based on life cycle assessment can transcend specific materials or technologies and, therefore, garner the support of heterogenous coalitions of

6 This example already shows that a broader scope should not necessarily be equated with a higher degree of universal legitimacy, as low rather than zero carbon energy may be seen as insufficient for reaching long-term climate goals.

7 Or embodied environmental impacts more generally, which, however, would be less commensurable.

8 Supplementary Table 1 provides the sources of these claims.

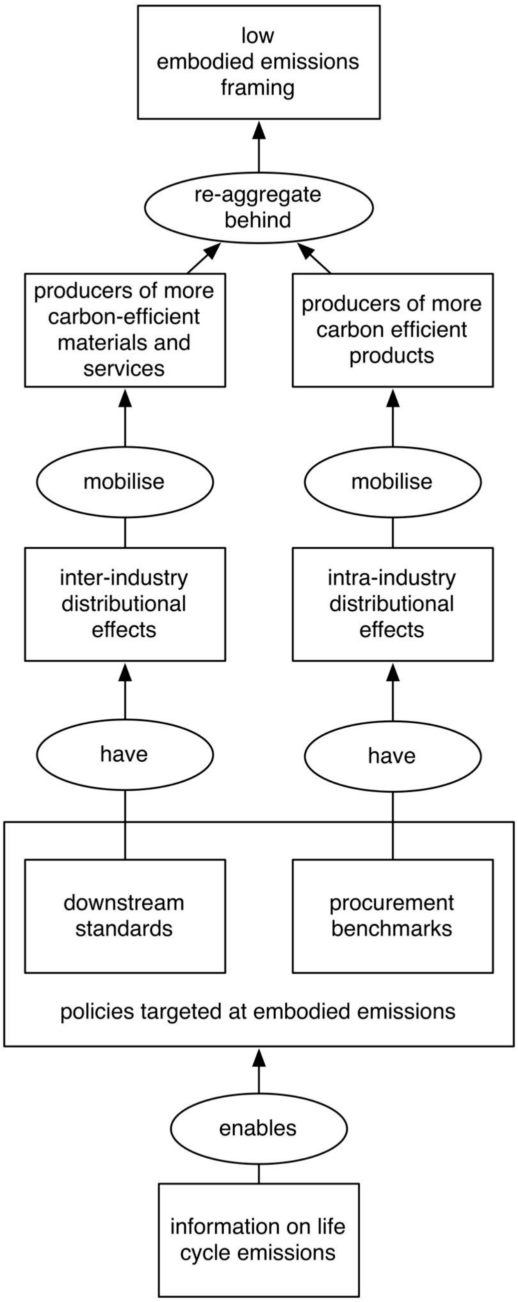

Figure 2. Sequences of propositions on coalition shaping effects of product level life cycle emissions information.

product and service providers, who would, in the absence of such a more universal policy, fend for more particular interests.

Framing the qualities of products or services in terms of embodied emissions can provide an alternative to other sustainability framings and thus allows for the re-aggregation of interest groups behind a common framing. The way in which such a re-aggregation occurs depends on the specific characteristics of the policy advocated. Some policies will lead to *inter*-sectoral and others to *intra*-sectoral competition over which product has lower embodied emissions.

While the Californian approach promotes intra-material competition over better carbon performance, the whole building approach can also promote inter-material competition. From this, two interrelated hypotheses can be deduced: policies that have intra-sectoral competitive benefits to producers of goods that are relatively low carbon compared to other products within the same materials category can mobilize the support of producers of relatively low carbon *products*. In contrast, policies that have inter-sectoral competitive benefits will tend to mobilize the support of producers of *materials* that are relatively low carbon, or that, at least, have a greater decarbonization potential than rival materials.

Figure 2 locates these hypotheses within more extended sequences of propositions on the coalition shaping effects of product level life cycle emissions information.

Materials and methods

An in-depth study[9] of the *embodied emissions in buildings* policy field in Germany, the UK, and the USA yielded key umbrella organizations advocating for a greater role for embodied emissions in policy-making. An analysis of organizational affiliations with these umbrella organizations formed the basis for a network analysis testing the hypotheses specifying how variations in the inter- and intra-sectoral distributive effects of embodied emissions policy proposals correspond to differences in the composition of lobbying coalitions.

The focus is on embodied emission policies in the form of regulatory standards for the built environment and public procurement specifications setting upper limits for embodied emissions of intermediate products. Carbon border adjustments or tariff walls targeting embodied carbon contents can also be considered embodied emissions policies but are not included in the analysis.

Table 1 shows the entities that were classified as 'targets' in the embodied emissions network, i.e. the umbrella organizations whose member- and sponsorships were to be analysed. The target classification consists of two layers. On the one hand, those entities that are directly associated with advocacy or technical guidelines for the consideration of embodied emissions (first order). On the other hand, some of the organizations that are affiliated with the first, for example as sponsors or members (second order).

Where the network nodes were associations, their member organizations and other associates, such as sponsors, were collected by analysing information on their affiliations from their websites in 2017 and 2018. The data on network nodes and edges was cleaned and standardized with OpenRefine [54] and turned into a network graph via various *R* packages, in particular *igraph* [55–62]. This resulted in a directed network with 2171 nodes and 2249 edges. The removal of nodes with fewer than two links/edges enabled a concentrated focus on key actors, facilitating a clearer visualization of the network in Fig. 3. Consequently, 89 nodes and 167 edges were left.

The Walktrap algorithm served to cluster the network into different communities, as indicated by the different colours in Fig. 3. The communities are the results of random walks with four steps. Such short random walks tend to stay within densely connected subgraphs [57, 63–67].

Network connections are "realist", i.e. based on declared affiliations between organizations. This is objective, in so far as actors self-identify their associations [68]. However, the selection of the original set of organizations and the extent to which one includes additional links is somewhat subjective. Such additional links can be an organization's members, the organizations it is itself a member of, or sponsor or partner organizations. Whenever an organization's affiliations were included in the analysis, *all* of the

[9] In the Supplementary Section S2 provides more information on building materials and Section 3 on embodied emissions advocacy networks.

Table 1. Entities as targets in embodied emissions network.

Entities	Order
Alliance for Sustainable Building Products (ASBP)	1
Arbeitsgemeinschaft der Rohholzverbraucher e. V.	2
ASBP BREEAM Consultation	1
Athena Sustainable Materials Institute	2
Building Alliance (GA)	1
Bundesverband der Säge- und Holzindustrie e. V.	2
Buy Clean California Campaign (BCC)	1
Carbon Leadership Forum (CLF)	1
Deutscher Holzwirtschaftsrat (DHWR)	1
Deutscher Massivholz- und Blockhausverbandes e. V.	2
Embodied Carbon Task Force (ECTF)	1
German Sustainable Building Council (DGNB)	1
Gesamtverband Deutscher Holzhandel e. V.	2
GLA Guidance	1
Green Construction Board (GCB)	1
Hauptverband der Deutschen Holzindustrie und Kunststoffe verarbeitenden Industrie und verwandter Industrie- und Wirtschaftszweige e. V.	2
Innovation and Growth Team (IGT)	1
natureplus	1
Polaris Materials	2
RICS Methodology	1
Silicon Valley Leadership Group	2
Sustainable Silicon Valley	2
Timber Accord	1
U.S. Concrete	2
Verband der Deutschen Holzwerkstoffindustrie	2
Verband Deutscher Papierfabriken e. V.	2
Verband Österreichischer Ziegelwerke	2
Wood for Good	1
Zero Carbon Non Domestic Task Group (ZCNDTG)	1

self-declared affiliations were included. However, not all the affiliations of all the affiliated organizations were included. Sometimes, it appeared, meaningful connections could not be identified without including more connections, while at other times the inclusion of more organizations would unduly dilute the network and make it useless for the purposes of analysis. Supplementary Section S3 provides detailed qualitative information on these networks, as well as reasons for the inclusion or exclusion of specific actors.

For each case study region, one organization was chosen as the most pure, typical, representative of an advocate for the embodied emissions policy prevalently proposed in that region.[10] By analysing in detail with respect to which materials the membership of these three main organizations have commercial interest, as reflected by their websites, it became possible to identify the materials suppliers associated with advocacy for specific embodied emissions policies. The focus was on commonly recurring building products instead of exhaustively covering the entire universe of different building products.

Results

Figure 3 shows the joint network of embodied emissions advocates across Germany, the UK and the USA. There are several links between the "British-Germanophone wood interests" and "British sustainable building" communities and also a link between the "German-Nordic wood" and "European-Germanophone sustainable building" communities. However, there are no corresponding links between wood interests and the US-based "Carbon Leadership Forum" and "Buy Clean California campaign" communities. Note that the nodes in the "British sustainable building" community are more densely concentrated. This is a consequence of the research having yielded a higher number of entities that are directly associated with advocacy or technical guidelines for the consideration of embodied emissions. However, this should not be taken to infer greater support for embodied emissions policies in the UK.

When delving further into the makeup of three key umbrella organizations advocating for embodied emissions in the respective countries, it becomes apparent that in the US the Buy Clean California coalition shows the presence of concrete and steel[11] interests, including trade unions, and the absence of wood, hemp and clay interests. In the UK and German-speaking countries, on the other hand, wood, hemp, and clay interests dominate the Alliance for Sustainable Building Products and the *natureplus* association (see Supplementary Tables S4–S6).

While explicitly not speaking in the name of their companies, experts from large multinational developers and engineering consultancies like *Skanska* and *Arup* have participated in initiatives advocating for a greater role of embodied emissions in construction. As the conceptual and planning branch of construction, they are not bound to specific building materials and any policy drivers for more innovation in the construction industry may increase the value of their technical and organizational capabilities. If these expert statements can be interpret as 'lobbying', this would imply that not only low-carbon materials suppliers have an interest in the embodied emissions narrative but also service providers.

Table 2 shows that property developers and consultancies are very prominent among the actors with most outgoing links (Outdegrees) in the network. It also highlights the role of wood interests.

Discussion

There is a difference in the mobilization logics between the European and Californian approaches. The strategy of specifying minimum carbon intensities for intermediate materials has allowed the emergence of a coalition of businesses representing incumbent materials (if relatively carbon efficient products), labour unions and environmental groups to push for the legislation. This would be improbable with a generalized LCA building standard—whereas efficiency standards at the level of building *products* can pitch domestic against foreign interests (or state against nationwide ones), *building-level* LCAs also pitch materials against each other.

Embodied emissions standards for final products can be neutral with respect to the technologies and materials used. This allows the forging of novel alliances among suppliers of different materials and also between suppliers and service providers, as these do not need to be aligned via a preference for a certain material or type of construction but simply in terms of a preference for the incorporation of embodied emissions into standards.

Embodied emissions, enabled by information provision, is a new banner behind which different groups, such as low-carbon cement, renewable building materials suppliers, building consultants and progressive developers, can rally. In doing so, other group identities can weaken: in Germany, organizations

[10] See Supplementary Section S3 for a detailed rationale for choosing the different representatives.

[11] The overall higher carbon efficiency of US steel, due to higher recycling rates (see Supplementary Section 2), helps to explain why parts of the US steel industry and unions could be mobilized in favour of carbon benchmarks for procurement.

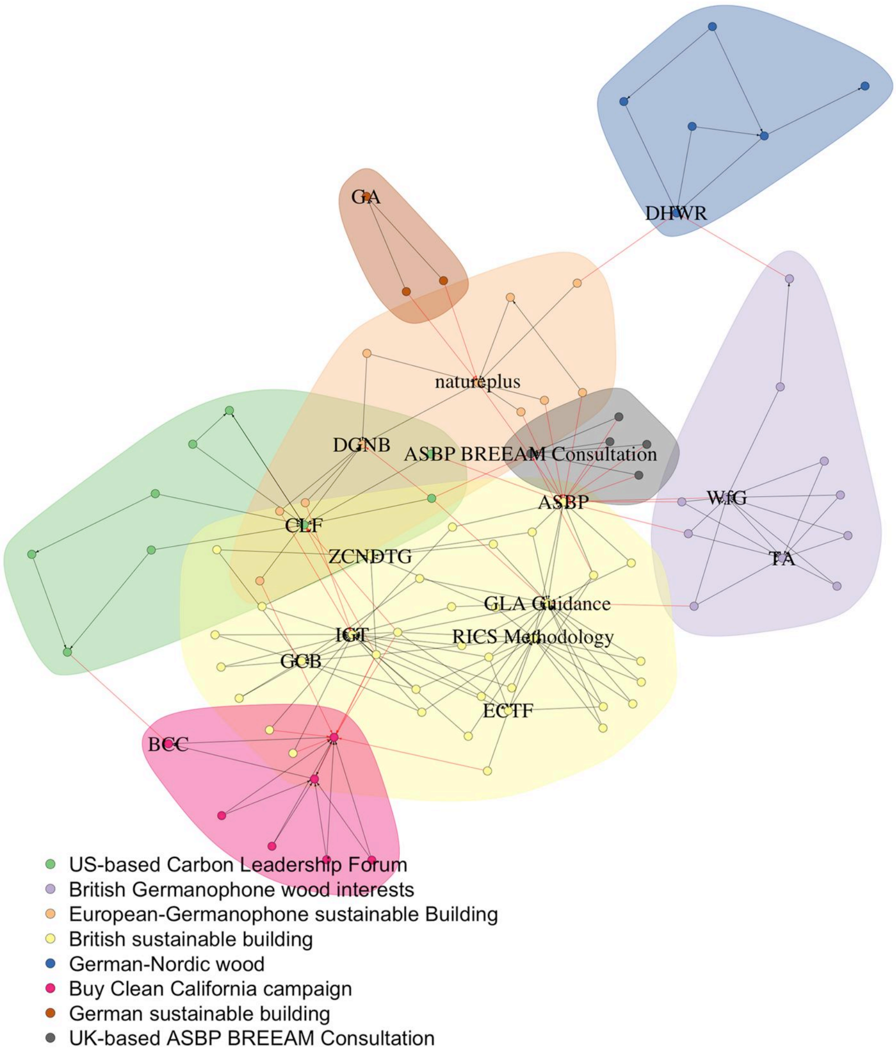

Figure 3. Major part of the transatlantic embodied emissions advocacy network.

Table 2. Actors with most outgoing links (Outdegrees) in network.

Name	Outdegrees
Arup	8
Skanska	7
Circular Ecology	4
thinkstep	4
British Woodworking Federation	3
UCL	3
Atkins	3
Davis Langdon/AECOM	3
Timber Trade Federation	3
Timber Research and Development Association	3
Laing O'Rourke	3
UKGBC	3

representing construction wood and wood-as-fuel, both 'renewables', eventually parted ways over the question of life-cycle carbon emissions [69].[12]

While the EPD-based policies most prominently advocated for in the USA and Europe have profoundly different implications for inter- and intrasectoral competition, the additional push for the diffusion of EPDs that can be expected as a result of successful implementation would improve the basis for any one of these policies. Mandatory regulation or public procurement specifications drawing on EPDs are likely more exigent than purely voluntary processes and could thus help to improve the reliability of the underlying data. In addition, a proliferation of EPDs and quality enhancements would also improve the informational basis for the adoption of border carbon adjustments. Importantly, these policies, while being backed by partly very different constituencies, are not mutually exclusive, and could thus be combined. Yet the differences between the Californian and European policy proposals mean that support for one of the policies does not imply support for the other.

The proliferation of EPDs improves the data on the environmental performance of individual producers and allows comparisons between them. Insofar as it allows producers to better anticipate the competitive effects of potential procurement

[12] Various actors subscribe to the idea that the cascading use of wood, which implies that it is only burned for its energy-use after at least one other 'higher value' use-stage, increases it contributions to a low carbon economy, as it thus can help to provide alternative construction materials, thereby avoiding the embodied emissions associated with conventional materials [70, 71]. Crucially, support for the argument that wood can help to cut emissions by substituting high carbon materials (such as cement, steel and plastics) benefits the construction wood sector over the wood-as-fuel sector, in the political-economic competition between the use of biomass as an energy carrier and as a material [72, 73, for more information on this competition].

specifications or regulations, it may have *cognitive* effects on coalition formation. Further research may wish to investigate such potential effects through qualitative interviews, historical analyses and game-theoretical modelling taking into account conditions of imperfect information.

It is worthwhile to engage in more political comparative political economy analysis of different embodied emissions policies. For instance, steel sector lobbying for the BCCA was mirrored by the European steel trade association Eurofer's support for a carbon inclusion mechanism requiring importers into the European market to purchase EU ETS permits [74] and steel giant ArcelorMittal's intervention in favour of a European carbon border tax [75]. It may also be possible to extend lessons learnt from a political economy analysis of public procurement to eventual mandatory limits to the lifecycle emissions of industrial products, such as steel and cement [76], which could be adopted by carbon clubs [77].

The empirical results of this paper are valid for a particular time and place. More empirical research for other time frames and other places would be desirable. Future research may usefully apply artificial intelligence to data from the Internet Archive to extract dynamic, large-scale network representations of organizational memberships in coalitions supporting or opposing specific types of embodied emissions policies.

A more recent analysis of the Carbon Leadership Forum website reveals that wood interests now have joined as sponsors.[13] Unlike the Buy Clean California campaign, the Carbon Leadership Forum has never been purely focused on thresholds for intermediate products, so this development does not go against the grain of the analysis presented here. More speculatively, there might be a correspondence between the chance of whole life carbon building regulations actually being implemented and the engagement of wood interests with advocacy efforts towards such aims.

From 2024 onwards California's building code addresses embodied emissions for commercial buildings and schools of a certain size. Interestingly, of the three compliance paths offered, one is based on the use of products below certain embodied emissions thresholds, within specific materials categories, and another one on whole building life cycle assessment analysis [79]. The regulation thus incorporates a compromise solution, allowing to choose between downstream standards and thresholds/benchmarks for intermediate products. The work presented in this paper could be usefully complemented by an analysis of the coalitions behind these code changes.

The building of greater capabilities for EPD creation in the building sector could also help to introduce embodied emissions policies in other sectors, such as automotives [80] or food [81, 82]. Further research may examine the coalition dynamics in those sectors.

Conclusion

This paper contributes a unique dataset of the early advocacy network for embodied emissions policies in the form of regulatory building requirements and procurement specifications. It develops the first theory of how businesses re-align from prior sustainability framings to that of embodied emissions and comes up with testable propositions on which businesses come out in support of what specific embodied emissions policy. The network analysis empirically corroborates the propositions.

A wide range of different building material suppliers and service providers can rally behind the banner of a greater role for embodied emissions. Commensurability enables technology- and material-open policies that have the potential to re-aggregate interest groups behind common demands, instead of each advocating for material-specific privileges. Embodied emissions policies that can legitimately rest on quantifiable metrics allow actors to transcend merely qualitative sustainability framings and to re-aggregate behind a novel common frame for policy demands.

Different embodied emissions policy designs mobilize different constituents. Whereas the BCCA can muster support from the same trade unions that supported steel tariffs under the Trump administration [83–86], building standards that incorporate embodied emissions criteria are better suited to garner support from alternative low carbon providers and sophisticated planners and service providers, who are not bound by specific materials and who can benefit from novel challenges in construction.

The non-exclusive nature of different embodied emissions policies means that correspondingly different coalitions can be fostered either simultaneously or sequentially, with synergetic spillover effects in the form of forced diffusion of EPDs, which serve as the informational foundation of such policies.

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Author's contributions

Nino David Jordan (Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Validation, Visualization, Writing—original draft, Writing—review & editing)

Non-author's contributions

Raimund Bleischwitz (primary PhD supervisor), David Coen and Colin Provost (secondary PhD supervisors).

Conflict of interest

The author is on the core committee of the Whole Life Carbon Policy Coalition (WLCP.Co), a sub-working group of the UNEP-hosted Global Alliance for Buildings and Construction (Global ABC). The authors main academic affiliation, the UCL Institute for Sustainable Resources (ISR), is listed as founding member of the ASBP, one of the organizations under examination in this article. The author was not involved in the founding of the ASBP, any preceding discussions, or any subsequent collaboration. He only became aware of it during the course of his research and is not aware of any conflict of interest.

[13] eg Softwood Lumber Board (SLB) and Weyerhaeuser [78].

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Data availability

The data and code underlying this article are available in the UCL Research Data Repository, at https://doi.org/10.5522/04/c.7033433.

Supplementary data

Supplementary data are available at *Oxford Open Climate Change* online.

Ethics declaration

This project is covered by the UCL Data Protection Registration, reference No Z6364106/2015/03/136, section 19, research.

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