

ACCOUNTING FOR EMBODIED CARBON

Costing Upfront Emissions in Green Infrastructure and the CMA's Strategic Role

Abstract

An asset carries a carbon history before it carries an operating history. Materials are produced and assembled long before a plant or building starts operating. This embodied carbon is separate from operational carbon released once running. This article explains embodied carbon, how it is measured, and what IFRS, Ind AS and Indian guidance say about carbon, identifying the gap that no financial reporting standard addresses embodied carbon. The article concludes by outlining what is missing and how CMAs can bridge the gap through carbon shadow pricing.

Introduction

Imagine a utility receives 1,000 emission allowances free from its regulator, buys 500 more from market at ₹60 each, emits 1,400 tonnes of CO₂ and surrenders 1,400 allowances. One carbon event is treated in four ways: free allowances as a grant under IAS 20, purchased allowances as an intangible asset under IAS 38, the surrender obligation as a provision under IAS 37, and, if held for trade, as inventory under IAS 2. Every one of these treatments is borrowed from a standard written for something else, applied by analogy because nothing more specific exists. If even traded carbon allowances need this much borrowing, then embodied carbon, the emissions locked into a new data centre or cooling plant before it ever switched on, sits in a total regulatory vacuum.

What Embodied Carbon Is

An asset enters a company's financial records after it has been purchased, built or commissioned, but its



CMA Rabi Kumar Sahu

Senior Manager (Finance)
NTPC Limited
Nava Raipur
cmarabi1985@gmail.com



CMA Kaushik Narayan

DGM (Finance)
NTPC Mining Limited
Ranchi
narainkaushik9@gmail.com

carbon footprint begins much earlier. Every physical asset has two separate carbon stories. Embodied Carbon is the greenhouse gas released in mining and processing the raw material, manufacturing its components, transporting and assembling them. Operational Carbon is released while the asset runs and depends on how efficiently it is used afterwards. A new data centre or transformer illustrates the difference clearly. The emissions from making its steel, copper and insulation are embodied carbon. The emissions associated with powering and cooling it once its live are operational carbon. The same applies to a building: emissions from producing construction materials are embodied carbon, while emissions associated with energy use

during occupation are operational carbon.

This distinction matters because the two are controlled by different people at different points in time. Operational carbon depends on how efficiently an asset is run once it exists, and it has been the main focus of energy efficiency and climate policy for two decades. Embodied carbon is decided much earlier, at the point a material, a supplier or a design is chosen, often years before the asset is built.

Why It Matters, and Why It Has Been Overlooked

Operational carbon shows up every month on an electricity bill and a meter reading. Embodied carbon shows up nowhere. It is scattered across a purchase order, a bill of materials and a supplier's own production records, and nobody's job has traditionally been to add it up. That gap, not a lack of importance, is why the topic has arrived later than operational carbon did.

The building and construction sector is estimated to account for about 39% of global energy-related carbon emissions split between 28% from operational and 11% embodied (World Green Building Council, 2019).. As operational carbon is steadily reduced through better insulation, efficient equipment and cleaner electricity, embodied carbon does not shrink at the same pace, because it is fixed the moment construction finishes. Its share of an asset's lifetime carbon footprint rises simply because the other half is falling.

Table 1 sets out who has a live reason to act today, without overstating where the legal obligation actually falls. The cost-pass-through mechanism it describes for CBAM is the same one this author's earlier article in this journal covered in detail for the steel and aluminium trade.

Table -1 : Legal and Compliance Pressures

Situation	Pressure today	Where the obligation actually sits
Exporting steel, aluminium, cement to the EU	Indirect, but immediate	EU importer surrenders CBAM certificates. Cost may flow back through pricing

Supplying materials or EPC into EU building projects	Indirect, building from 2028 to 2030	Developer bears disclosure/limits. Pressure flows to suppliers
Seeking green building certification in India	Direct, already in use	IGBC, GRIHA and similar rating criteria reward EPD disclosure directly
Everyone else, domestic focused, no certification	Voluntary	ESG score and its emerging link to the cost of capital

For companies with none of these pressures, the honest driver is capital rather than compliance. Larsen and Toubro closed a US\$ 700 Million sustainability-linked trade facility with Standard Chartered in 2025 priced against emission intensity targets, and other Indian companies have raised financing on similar terms. Global peers are already moving ahead under frameworks like the EU Corporate Sustainability Reporting Directive (CSRD) and ISSB IFRS S2. For example, Microsoft now integrates embodied carbon requirements into its data centre projects by tracking embedded emissions in steel and concrete, while BMW Group evaluates cradle-to-gate emissions when selecting manufacturing equipment. Sustainability reporting maturity is becoming a financial variable, and embodied carbon capability is a plausible, not yet proven, contributor to that maturity.

Step 1 : Measure (How Embodied Carbon Is Actually Measured?)

The measurement methodology rests on ISO 14040 and 14044 - the principles and detailed rules for life-cycle assessment (LCA), the practice of tracking a product's environmental impact from raw material to disposal - applied specifically to carbon by ISO 14067, with EN 15978 covering buildings. Table 2 summarises what each one actually does.

The GHG Protocol, the framework most widely used for corporate emissions accounting generally, places embodied carbon within Scope 3 of a company's emissions inventory, under Category 1 for purchased goods and services and Category

2 for capital goods. This is a useful way to classify the emissions for reporting purposes, but it is worth being precise that embodied carbon, a property of a physical product or asset, and Scope 3, a category in a company's own emissions reporting, are not identical ideas. A company can measure embodied carbon for internal decision making, such as comparing two suppliers, without that measurement ever needing to become part of a formal Scope 3 disclosure.

In practice, we need not calculate these life-cycle emissions from scratch by relying on Environmental Product Declarations (EPDs), which act as standardized 'nutrition labels' for materials and industry LCA databases to bring precise, verifiable physical emission factors into their cost sheets.

This is measurement work, not accounting work. It tells an organisation how much carbon is embedded in a wall or a slab. It does not tell finance how that number should sit in accounts.

Step 2 : Classify by Analogy (What IFRS, Ind AS and Other Guidelines Actually Say)

Before going further, it is important to distinguish what is already established from what this article proposes for internal management use. The life-cycle measurement methods discussed in Step 1, including ISO 14040, ISO 14044 and ISO 14067, are established standards for measuring environmental and carbon impacts, while the GHG Protocol provides an established framework for classifying emissions within corporate inventories. India also has the ICAI's 2012 Guidance Note on Accounting for Self Generated Certified Emission Reductions, although its scope is limited to a specific type of tradeable carbon credit. None of these frameworks requires companies to recognise embodied carbon in their financial statements as a separate accounting item. The classify-by-analogy approach discussed here, and the internal carbon pricing proposed in Step 3, are therefore management practices proposed for internal decision-making, not accounting requirements prescribed by IFRS, Ind AS or ICAI. They should operate alongside statutory financial reporting and should not be presented as a substitute for it.

No IFRS Accounting Standard, and no equivalent Ind AS, has ever been written specifically for

carbon, embodied or otherwise. The International Accounting Standards Board has said this plainly in its own educational material, acknowledging that its standards do not explicitly refer to climate related matters at all. Several attempts to draft a dedicated standard for emissions trading schemes have been opened and then quietly shelved.

In the absence of a specific standard, IAS 8, and its Ind AS equivalent, falls back on a general rule : apply judgement, guided by whichever existing standard deals with something similar. In practice, this has produced a patchwork behind the opening example rather than a single answer. A carbon credit or emission allowance a company intends to sell is generally treated as inventory under IAS 2 ; One it intends to use against its own future emissions is generally treated as an intangible asset under IAS 38; when government allowances are issued below fair value, the shortfall is treated as a grant under Ind AS 20. The obligation that builds up as the company emits is treated as a provision under Ind AS 37.

None of these allowances are amortised in the way a normal intangible asset would be, since they are not used up gradually. Over time, they are simply surrendered in full when the obligation falls due. Every part of this treatment is borrowed from a standard written for something other than carbon, applied by analogy because nothing more specific exists. The decision a CMA has to make, for embodied carbon exactly as for the allowance above, is which existing standards logic the item most resembles, and to apply it consistently.

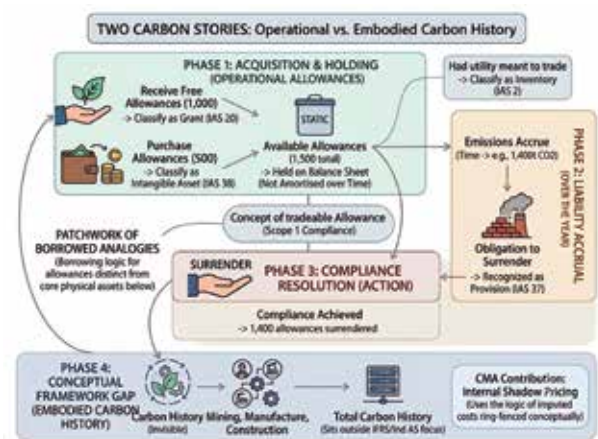


Figure 1: The Two Carbon Stories. Operational carbon compliance relies on a patchwork of

borrowed financial accounting standards (Phases 1–3), leaving a conceptual gap for embodied carbon (Phase 4) that is bridged by the CMA's internal shadow pricing.

India has one genuine exception. In 2012, the ICAI issued a Guidance Note on Accounting for Self Generated Certified Emission Reductions (CERs), addressing carbon credits earned under the Kyoto Protocol's Clean Development Mechanism. A credit becomes an asset only after UN confirmation. It is then valued as inventory under the Indian equivalent of IAS 2, at the lower of cost or net realisable value, with revenue recognised only when the credit is actually sold. But, its scope was deliberately focused. It covers one kind of tradeable carbon credit under one particular international mechanism. It says nothing about embodied carbon or internal carbon price. The gap remains outside its scope.

Table 2 sets out the wider set of guidelines a reader is likely to encounter, and what each one actually does, since the number of overlapping frameworks is itself part of why this area is confusing.

Table 2 : Guidance References

Guideline	Issued by	What it actually covers
ISO 14040 and 14044	ISO	The principles and detailed rules for life cycle assessment in general
ISO 14067	ISO	Applies life cycle assessment specifically to a product's carbon footprint
EN 15978	European standards body	Defines the life cycle stages of a building, from raw material to end of life
GHG Protocol, Scope 3	World Resources Institute and WBCSD	Classifies embodied carbon within a company's wider emissions inventory
IFRS S1 and S2	ISSB	Sustainability disclosure to investors, not financial accounting recognition
BRSR Core	SEBI	Assured disclosure of a defined set of ESG indicators for large listed companies

Guidance Note on CERs	ICAI, 2012	The one place Indian standard setters have actually written accounting rules for a carbon item
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Step 3 The CMA Solution (Internal Carbon Costing)

Classify-by-analogy answers the financial-accounting question as far as it can currently be answered. It does not stop a CMA from making an embodied-carbon figure useful for internal decisions today, without waiting for IFRS, Ind AS or ICAI to write a rule for it. Once measured through the life-cycle methods in Step 1, that figure can sit beside the ordinary cost sheet, a capital appraisal, a comparison between two suppliers as a second, separate number, clearly labelled as a management estimate rather than a financial-accounting entry. Cost Accounting Standard 4 already keeps imputed costs ring-fenced from the statutory cost of production in exactly this way; the same discipline extends cleanly to an embodied-carbon estimate. Ring-fencing it now, rather than waiting for a rule that may take years to arrive, leaves an organisation better placed for whichever accounting or disclosure standard eventually shows up.

For example, when evaluating tenders for an infrastructure project-such as a data center facility or substation civil works. Option A represents baseline Portland cement and structural steel, while Option B specifies low-clinker green concrete and recycled steel.

Table 3: Internal Shadow Carbon Appraisal for Infrastructure Capex

Parameter	Option A: Standard Build	Option B: Low-Carbon Build	Variance Analysis
Direct Capital Cost	₹ 1,200 Lakh	₹ 1,350 Lakh	+ ₹ 150 Lakh (+12.5% Capex premium)
Embodied Carbon	1,800 tCO ₂ e	1,100 tCO ₂ e	- 700 tCO ₂ e (-38.8% upfront carbon)

Internal Carbon Price	₹ 2,500 / tCO _{2e}	₹ 2,500 / tCO _{2e}	Illustrative Internal Management Price
Imputed Carbon Cost	₹ 45.0 Lakh	₹ 27.5 Lakh	- ₹ 17.5 Lakh avoided carbon risk
Total Evaluated Cost	₹ 1,245.0 Lakh	₹ 1,377.5 Lakh	Carbon-adjusted number for decisions

The ₹2,500/tCO_{2e} used in this analysis is illustrative rather than a prescribed or market-determined carbon price. It broadly reflects the range of disclosed internal carbon prices by Indian companies, including Mahindra & Mahindra (US\$10/tCO_{2e}), Essar Oil (US\$15/tCO_{2e}), and UltraTech Cement (US\$30/tCO_{2e} in its latest disclosure). The figure is therefore used only to demonstrate the mechanics of internal carbon costing and should not be interpreted as a universally appropriate carbon price.

Where carbon creates a current or anticipated economic or strategic exposure such as compliance costs, carbon-linked financing, customer requirements or a company's own transition targets, the measured embodied-carbon cost can be incorporated into capital appraisal and procurement. In a tender, it can be added to the quoted price as an internal decision metric, or included as one factor in a supplier scorecard alongside price, quality and delivery. Where no such exposure or management objective exists, the carbon-adjusted figure remains an informational rather than a financially determinative measure.

The academic accounting literature confirms this is a genuine, not imagined, gap. A systematic review of 117 papers published in accounting journals between 2005 and 2018 found the field of carbon accounting organising itself around disclosure, management, performance and assurance, with embodied carbon specifically remaining an underdeveloped corner even within that literature (He, Luo, Shamsuddin and Tang, 2022). Accounting research has, in other words, been asking largely the same questions as the standard setters and has not yet caught up to embodied carbon either.

Conclusion

Embodied carbon is a real and growing share of an asset's lifetime footprint, measurable today using established life cycle methods, and it sits almost entirely outside the reach of IFRS, Ind AS and India's own accounting guidance. That gap is not a reason to wait. It is the reason a management accounting response, built now on measurement and internal decision use rather than on a financial accounting rule that does not yet exist, is worth having and it is the CMA's craft to build it.

Limitations

The internal carbon price is a management assumption rather than a market-observed or universally comparable value. A price set too low may have little influence on decisions, while a price set too high may distort them. The imputed carbon cost is not itself a cash outflow or financial-accounting entry and carries no external assurance. Results also depend on reliable embodied-carbon data and consistent system boundaries; incomplete supplier data may lead to estimation errors or double counting. The example is illustrative, and actual treatment depends on the entity, transaction and jurisdiction. MA

References

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