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A Comparison of Local and Global Databases for the Environmental Impact of Residential Buildings

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Abstract

The construction sector significantly contributes to global greenhouse gas emissions, which is particularly relevant in emerging economies as Brazil. The Brazilian initiative of SIDAC (Construction Environmental Performance Information System) and the development of new tools aim to provide national data for assessing environmental impacts. A method that uses such data is the Whole Building Life Cycle Assessment (WBLCA), which is a systematic tool for evaluating a building's environmental impacts throughout its life cycle, including resource consumption, emissions, and waste generation. Due to the complexity of obtaining local data for WBLCA, the Ecoinvent database has been widely used due to its comprehensive dataset. However, its applicability to the Brazilian context can be limited due to regional variations in production processes. In this context, this study compares the performance of national (SIDAC) and international (Ecoinvent) databases using simplified WBLCA models for embodied carbon and single-point scores. The assessment focuses on phases A1 to A3, covering the embodied impacts from the extraction of materials to the construction. Three single-family residential buildings were assessed. The results highlight the differences between the databases. For instance, concrete has a much higher relevance using the SIDAC data and carbon emissions, while all other materials present less relevance in the overall impact. Also, one highlights the difference between carbon accounting, which uses carbon emissions in SIDAC and equivalent carbon emissions in Ecoinvent. However, one can conclude that SIDAC is a promising tool for Brazilian WBLCA, providing an easy way to calculate the building's impacts.

Keywords: Life cycle assessment, Climate change, Carbon emission, Residential building

1. Introduction

Climate change is a critical issue for humanity, necessitating immediate action and research to address its long-term impact on global weather patterns (Abbass et al., 2022). In such context, buildings play a significant role due to their negative impacts throughout the life cycle, from extracting raw materials to construction, operation, and even demolition (Chen et al., 2023). In addition, buildings are strongly impacted by climate change, leading to operation changes through users, leading to more impacts, such as increased energy consumption for cooling.

Life Cycle Assessment (LCA) stands out as the primary tool for understanding the possible environmental burdens among the sustainable practices one can apply to buildings. The Whole-Building Life Cycle Assessment (WBLCA) is an essential methodology for assessing the environmental impacts associated with all stages of a building's life cycle (Goretti & Setiawan, 2024). This approach identifies and quantifies greenhouse gas emissions, energy and natural resource consumption, and other environmental impacts, such as waste generation and pollution. The production of building materials, such as cement and steel releases large amounts of carbon dioxide (CO_2) into the atmosphere (Chen et al., 2024). In addition, the operation of buildings, which includes heating, cooling, lighting and other energy uses, accounts for a substantial share of global energy consumption and GHG emissions. LCA provides a holistic and detailed view of environmental impacts, assisting in making more sustainable decisions and implementing practices that minimise negative impacts throughout the entire life cycle of buildings (Pryshlakivsky & Searcy, 2021).

Recent global studies have reinforced the importance of contextualised data in WBLCA applications (Pauer et al., 2020; Teng et al., 2023), showing that different databases may change the impact estimation and decision outcomes. However, a clear gap remains in comparing newly developed national databases from emerging economies and well-established international ones, particularly in the Brazilian context. In Brazil, tools such as SIDAC and CeCArbon have been developed to support life cycle assessments in the construction sector. SIDAC (Construction Environmental Performance Information System, in Portuguese) enables the calculation of environmental performance indicators for construction products based on Brazilian data and LCA principles, promoting the reduction of embodied carbon and energy in buildings (Belizario-Silva et al., 2023). Similarly, CeCArbon estimates energy use and carbon emissions based on the life cycle of construction inputs (Sinduscon-SP, 2024).

Adopting appropriate methodological approaches is essential to achieve consistent and meaningful outcomes, particularly when addressing environmental objectives. This study compares the performance of national (SIDAC) and international (Ecoinvent) databases through simplified WBLCA models focused on embodied carbon, aiming to explore their differences and implications for design decision-making under future environmental constraints. The analysis is based on three single-family houses of varying construction standards, with assessments focused on life cycle phases A1 to A5.

2. Methodology

This research methodology was developed to compare Brazilian and international databases for carrying out LCA. It is therefore important to emphasise that the consolidated Brazilian data (SIDAC, specifically) inventories impact in terms of carbon emissions, disregarding other gases. It is, therefore, interesting to compare the carbon dioxide inventories obtained by both SIDAC and the Ecoinvent database. The following sections outline the main characteristics.

2.1 Object of Study

Three single-storey Brazilian houses made available by Caixa Economica Federal (CEF, a Brazilian financial institution responsible for promoting housing funding and social programmes) were selected, which designs followed NBR 12721:2006 (ABNT, 2006) directions. They are related to low, medium, and high standard categories, with different construction characteristics and floor-plan areas (Figure 1).

Materials that may be obtained in the international and local databases were selected. Table 1 shows the inventory of each building. The units refer to those available in the databases. For example, the embodied carbon of the clay brick is provided per block in the SIDAC database and kilogram in Ecoinvent. Wood is noted to have diverse representations within the SIDAC system, with twelve options available, classified into types and sources. The types include planed sawnwood, raw sawnwood and log, with the primary distinction being the level of finish and durability suited to specific applications. The sources include FSC-certified wood, wood from forests with management operations, wood from forests without management, and wood from pine plantations. Beyond these twelve options, eucalyptus logs are included, commonly employed as props or structural elements. In this study, the analyses prioritised using FSC-certified wood as the most sustainable option. Based on the inventory outlined above, the following section details the methodological framework adopted for LCA.

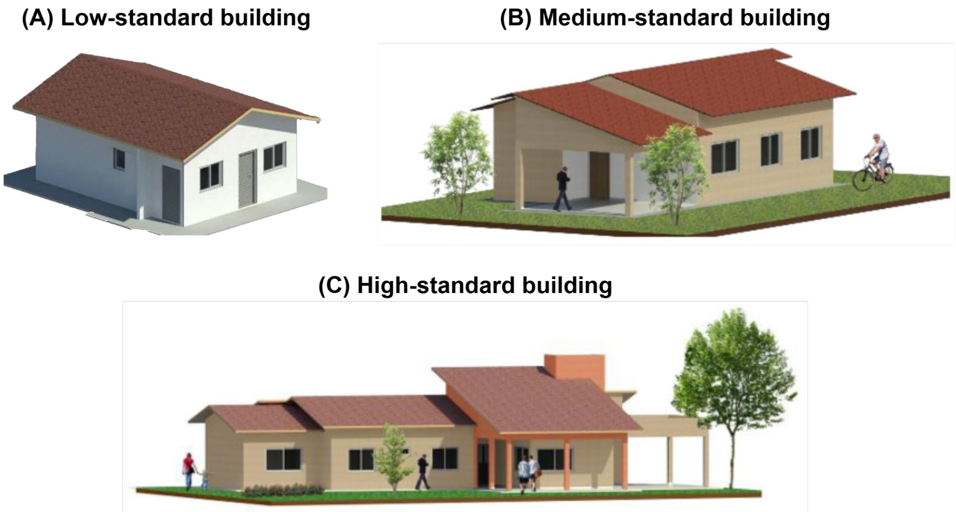

Figure 1. Building models considered in the study

Table 1. Inventory of material for each house

Material	Type	Unit	House standard		
			Low	Medium	High
Gravel	-	kg	2,610.00	8,226.00	14,589.00
Concrete	Lean	m^3	2.10	6.24	1.01
	20MPa	m^3	2.84	3.30	5.80
	25MPa	m^3	1.91	9.65	30.84
	30MPa	m^3	2.00	6.29	8.78
Wood	Sawlog and veneer log	m^3	63.38	99.02	209.61
	Raw sawnwood	m^3	2.45	6.02	27.44
	Planed sawnwood	m^3	0.15	2.15	2.47
Bricks (SIDAC)	Ceramic brick (9x19x19)	units	2,350.00	5,736.00	11,204.00
Bricks (Ecoinvent)		kg	4,935.00	12,045.60	23,528.40
Mortar (SIDAC)	1:4 ratio	m^3	2.09	4.55	12.02
	1:2:8 ratio	m^3	0.16	0.27	0.17
	1:2:9 ratio	m^3	6.75	13.84	11.75
	1:3 ratio	m^3	1.47	3.70	8.05
Mortar (Ecoinvent)	Cement mortar	kg	23,506.17	50,283.21	72,969.49
Roof tile (SIDAC)	Paulista	units	1,740.00	3,648.00	0.00
	French	units	0.00	0.00	4,308.00
Roof tile (Ecoinvent)	Paulista	kg	3,132.00	6,566.40	0.00
	French	kg	0.00	0.00	12,493.20
Structural steel	CA-50 and CA-60	kg	349.07	1,142.39	2,744.17

Source: Values based on the study of Vaz et al. (2024).

2.2 LCA Methodology and Databases

SIDAC is an LCA-based tool whose premise is to simplify the calculation by directly presenting the CO_2 impacts and primary energy demand for construction products. It only works with the cradle-to-gate stages and represents phases A1 to A3 of the building's life cycle (CEN, 2011). According to CEN (2011), life cycle phases A1 to A3 encompass the raw material supply, transport and manufacturing used in building construction. Therefore, the scope to be used with the Ecoinvent database follows a similar method, using the OpenLCA programme version 2.3 (Greendelta, 2024) and phases A1 to A3 with a similar WBLCA inventory. The Life Cycle Impact Assessment (LCIA) method chosen for the analysis is the Environmental Footprint (EF), version 3.1, with midpoint and endpoint characterisations. This way, the results can be compared for climate change ($kgCO_{2\text{-eq}}$) or final impact in a single score (normalised according to the method). For details of the SIDAC methodology, see Belizario-Silva et al. (2023). The cut-off Ecoinvent 3.8 database was used for the analysis.

Table 2 shows the processes chosen for the LCA, aiming to choose processes that were as similar as possible to those existing in SIDAC. Thus, one can discuss the differences between the results obtained by authors who use SIDAC or Ecoinvent as a reference for the processes. It is worth noting that SIDAC uses the $kgCO_2$ parameter for the impact on carbon emissions, and the EF method uses the $kgCO_{2\text{-eq}}$ parameter for the climate change indicator, a reference to the method proposed by the IPCC (Intergovernmental Panel on Climate Change) 2021.

Table 2. Ecoinvent processes used in OpenLCA

Material	Type	Process	Local
Gravel	-	gravel production, crushed	BR
Concrete	Lean	lean concrete production, with cement CEM II/A	RoW
	20Mpa	concrete production, 20MPa, ready-mix, with cement, pozzolana and fly ash 36-55%	RoW
	25Mpa	concrete production, 25MPa, ready-mix, with cement blast furnace slag 35-70%	BR
	30Mpa	concrete production, 30MPa, ready-mix, with cement blast furnace slag 35-70%	BR
Wood	Sawlog	hardwood forestry, eucalyptus ssp., sustainable forest management	RoW
	Raw sawnwood	board, softwood, raw, kiln drying to u=10%	RoW
	Planed sawnwood	planing, board, softwood, u=10%	RoW
Bricks	Ceramic block	clay brick production	RoW
Mortar	Cement mortar	cement mortar production, hand-mixed, on-site	RoW
Roof tile	French or Paulista	roof tile production	RoW
Structural steel	CA-50 and CA-60	reinforcing steel production	RoW
BR stands for Brazilian process, and RoW stands for Rest-of-World process in Ecoinvent.			

2.3 Functional Units

To address different perspectives of the WBLCA assessment, the following functional units were considered for discussion:

- Global building: impact of the entire building;
- Area: impact per m² of the building;
- Occupancy: impact per inhabitant of the building;
- Lifespan: impact per year of use;
- Lifespan and area: impact per m² of the building and year of use;
- Lifespan and density: impact per year of use and density (people per square meter).

The study of Souza et al. (2021) was used as a reference and one aimed at using multiple functional units, which provide an overview of the results. Recent works have acknowledged the differences among WBLCA and that a functional equivalent must be provided, not missing the deliveries provided by the system (Caldas et al., 2020; Evangelista et al., 2018; Saade et al., 2020). For example, the low-standard building accommodates three people, 43 m² floor-plan area and provides 14.3 m²/inhabitant; the medium accommodates four, has 100 m² and provides 25.0 m²/inhabitant, and the high accommodates six people, has 219 m² and provides 36.5 m²/inhabitant. The functional unit should account for these differences. It is also important to emphasise that these are standard projects for Brazil, and it is assumed that the design provides similar housing quality in terms of normative performance requirements. Following Brazilian studies, all the buildings were considered to have a 50-year lifespan (ABNT, 2021).

2.4 Interpretation and Limitations

Brazilian studies (Bianchi et al., 2021; Bueno et al., 2018; Carvalho et al., 2021; Domênico et al., 2021; Rezende et al., 2022) and the benchmarks of Lützkendorf et al. (2023) were used as a reference for comparison. Thought there are limitations of scope and comparison, the aim is to provide other insights from the results, such as if materials with divergent data require greater detail or less focus, according to their impact.

3. Results and Discussions

3.1 Total Embodied Carbon of the Buildings

Table 3 shows the carbon embodied in the materials considered for each building standard, and Figure 2 shows the contribution of each material to carbon emissions. The embodied carbon values increase with the size and standard of the building, as observed in the results from both databases. Compared to low-standard buildings, the embodied carbon in medium-standard buildings shows an increase of 142% using the SIDAC database and 129% using the Ecoinvent database. The embodied carbon impacts rise significantly for high-standard buildings relative to low-standard buildings, with an increase of 344% and 310%, according to the SIDAC and Ecoinvent datasets, respectively. These results highlight the hypothesis raised in this study: applying different evaluation methods, such as SIDAC and Ecoinvent, leads to different percentages of carbon embodied according to the building standard.

However, except for concrete, the values obtained from the Ecoinvent database are consistently higher than those derived from SIDAC (increases between 43% and 318% according to the material). Part of this discrepancy arises from the differing reporting frameworks. While SIDAC provides data specifically on CO_2 emissions, Ecoinvent reports in terms of CO_2-eq, which accounts for the global warming potential of greenhouse gases. Consequently, using Ecoinvent data inherently results in higher reported impact values. However, CO_2 emissions account for the largest share of the global warming potential, representing approximately 92% of the emissions reported as CO_2-eq by Ecoinvent. Consequently, variations in the production processes of materials across different databases are likely responsible for the significant discrepancies in embodied carbon values observed when comparing results based on SIDAC and Ecoinvent.

Table 3. Total embodied carbon of the buildings based on SIDAC and Ecoinvent databases.

Building	**Embodied carbon**	
	SIDAC (kgCO_2)	**Ecoinvent (kg$CO_{2\text{-eq}}$)**
Low-standard	7,212.0	11,189.9
Medium-standard	17,475.8	25,618.5
High-standard	31,993.8	45,902.4

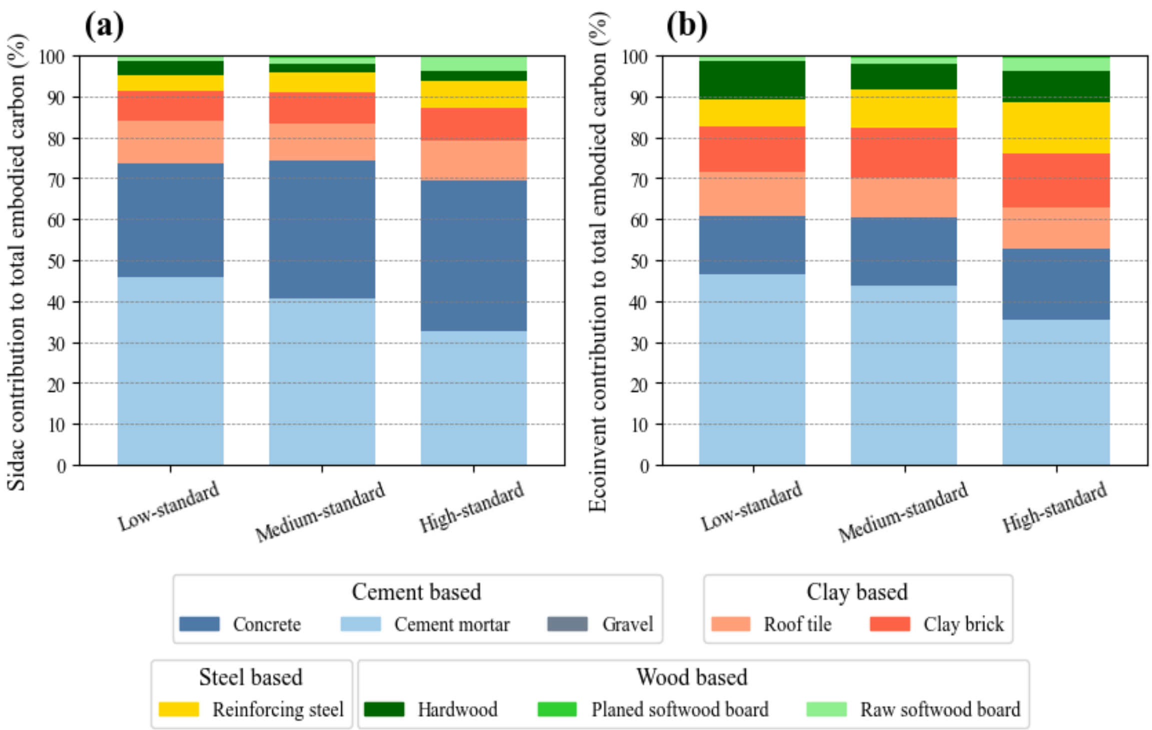

Figure 2. Embodied carbon per material based on (a) SIDAC and (b) Ecoinvent databases.

The materials with the most remarkable differences in impacts obtained from the databases were hardwood, reinforcing steel, clay brick and gravel. Concrete was the only material for which Ecoinvent reported lower impacts than SIDAC. A key distinction lies in Ecoinvent's broader scope, which accounts for upstream processes such as raw material extraction, manufacturing of inputs like fuels, and treatment of water used in the processes. Additionally, Ecoinvent incorporates elementary flows, including emissions to air and water, as outputs. Conversely, SIDAC's scope often begins with receiving materials at the factory, apparently omitting upstream impacts such as raw material extraction and water treatment. For example, in the case of hardwood, Ecoinvent provides a broader assessment by including upstream processes like fuel manufacturing. At the same time, SIDAC focuses only on direct processes such as fuel combustion impacts. Ecoinvent also accounts for a broader range of outputs, including emissions and waste, whereas SIDAC reports only biomass residues, leading to lower impact values.

Material-specific comparisons highlight further discrepancies. For reinforced steel, despite its limited process detail in Ecoinvent (including only steel manufacturing as input and steel as the output), this database results in higher impacts than SIDAC. For the ceramic blocks, Ecoinvent includes the extraction of clay, manufacturing of petroleum-derived fuels, natural gas extraction, water treatment, and the emission of pollutants during production. In contrast, SIDAC only accounts for the energy inputs used at the production site and outputs, such as steam and non-hazardous solid waste, without considering upstream emissions or water treatment processes. Ecoinvent includes quarrying, machinery manufacturing, equipment maintenance, and waste disposal for gravel production, while SIDAC limits its scope to extraction, crushing, and stockpiling processes.

Concerning concrete production, both databases consider cement blending and aggregate preparation. However, Ecoinvent goes further by incorporating the extraction of aggregates, diesel manufacturing, and waste generation during production. SIDAC, on the other hand, simplifies the process, focusing on market-representative cement blends and excluding waste generation due to data unavailability. These examples underline Ecoinvent's more extensive process coverage and elementary flow inclusion, which account for its higher reported impact values. This broader methodological approach makes Ecoinvent a more comprehensive tool for LCA, particularly for studies requiring global or multi-regional comparisons. SIDAC may align more with localised assessments where specific regional data and assumptions are prioritised.

Concerning the source of the processes considered by Ecoinvent, the database incorporates Brazilian-specific processes for materials such as gravel, 25 MPa concrete, and 30 MPa concrete. In contrast, other materials rely on the Rest of World (RoW) approach, representing a global average. However, using Brazilian processes in Ecoinvent did not result in fewer differences in impact values compared to SIDAC. No consistent relationship was observed between the geographic source of the processes (BR or RoW) in Ecoinvent and the magnitude of the differences in impact values between the two databases. This inconsistency suggests that the higher impact values reported by Ecoinvent are probably driven by its broader process inclusions and more detailed system boundaries rather than the geographical specificity of the data used. Future studies may analyse each process to understand possible differences.

Although the ranking of buildings based on embodied carbon remains similar across the different databases, the contribution of each material varies slightly depending on the reference used. In both databases, cementitious materials, such as concrete and cement mortar, are the predominant contributors to embodied carbon across all standards. Cementitious materials represent 69% to 74% of the carbon impacts using SIDAC and 53% to 61% using the Ecoinvent database. The range represents the variability between building standards. Ceramic materials, including clay bricks and roof tiles, consistently rank as the second most significant contributor to carbon emissions (up to 18% and 23% of the total carbon impact using the SIDAC and Ecoinvent databases, respectively). However, it was observed that the contribution of concrete based on Ecoinvent is smaller than in SIDAC, whereas ceramic materials have a larger share of embodied carbon impacts.

Contributions from other materials, i.e. wood, steel and gravel, account for approximately 9% to 13% of the total impact based on SIDAC among the three building standards assessed. On the other hand, these materials represent between 17% and 24% using Ecoinvent data. Hardwood, in particular, shows increased relevance in the Ecoinvent results, highlighting sensitivity to material-specific assumptions in this database. The results underscore the importance of database selection in life cycle assessment studies, as it significantly influences the relative contributions of materials to the impacts. These findings highlight the need to carefully consider database methodologies and limitations when interpreting results, particularly in comparative studies of construction materials and buildings.

The Ecoinvent database yields higher embodied carbon than SIDAC for all functional units and building standards. These discrepancies highlight the need for transparency in database methodologies to ensure robust and comparable assessments. Nevertheless, assessing the differences between the Brazilian and Ecoinvent databases is vital to understanding the main changes to higher or lower embodied carbon. Figure 3 shows the embodied carbon per material of the three buildings assessed.

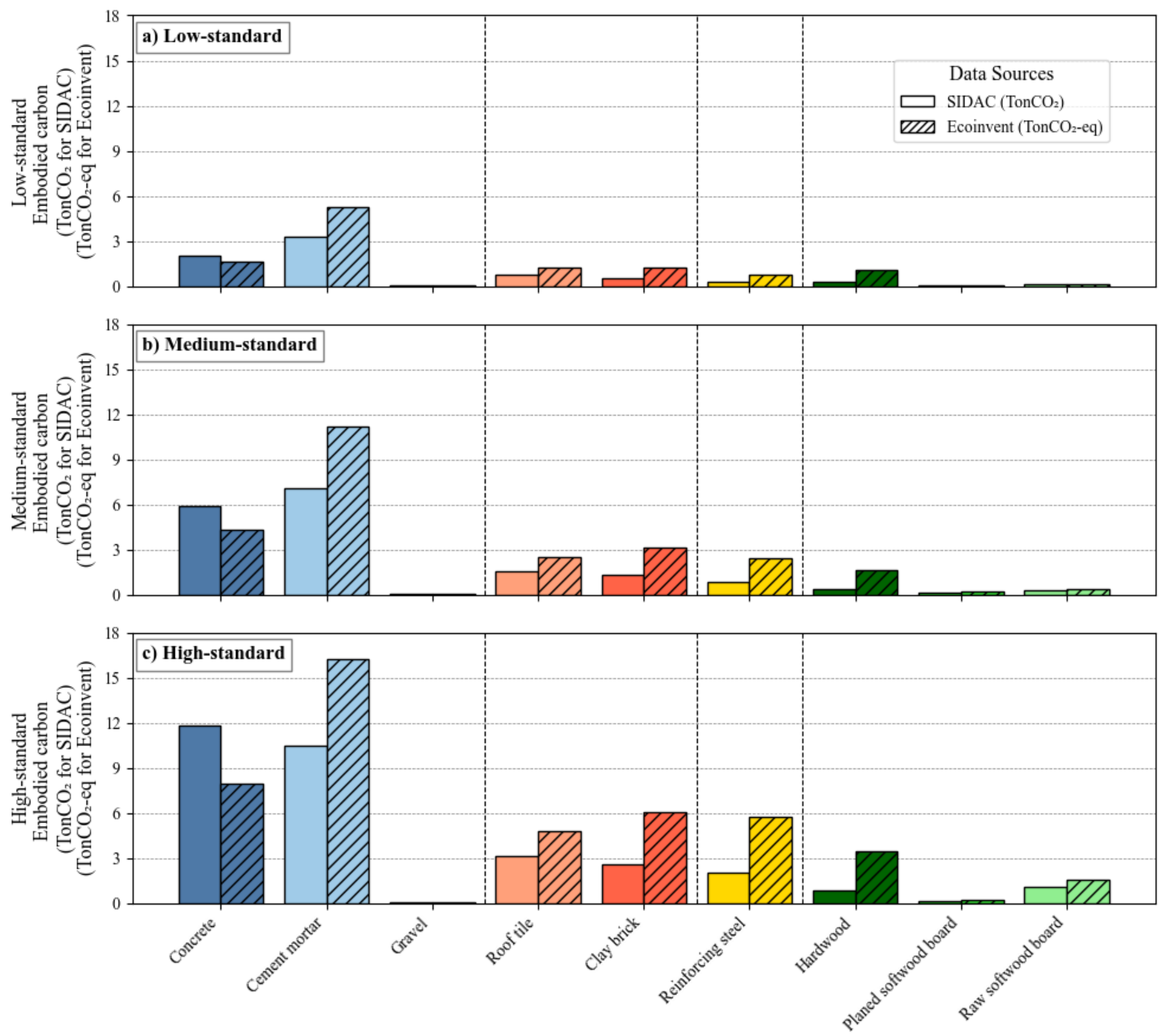

Figure 3. Embodied carbon per material according to SIDAC and Ecoinvent databases.

3.2 Embodied Carbon per Functional Unit

The comparison of carbon impacts between the different standards (low, medium and high) provides valuable insights for establishing benchmarks. However, it is essential to emphasise that these buildings differ in scope. For instance, medium and high-standard buildings typically feature larger floor areas and accommodate more inhabitants. Table 4 presents this context's embodied carbon per functional unit. The total embodied carbon of the buildings, i.e. the first functional unit, has been presented in Table 2 and discussed. However, it is presented in Table 3 to show how the functional unit impacts the comparison.

The results indicate a progressive increase in embodied carbon per inhabitant with the building standard. Therefore, switching from low-standard to medium-standard and high-standard buildings increases the embodied carbon per person. With SIDAC, the increase is 82% for medium-standard and 122% for high-standard buildings, compared to the low-standard. Using Ecoinvent, the increases are 72% for medium-standard and 105% for high-standard buildings. This trend reflects the larger floor-plan areas and higher resource intensity typically associated with higher-standard buildings, which accommodate a small number of inhabitants compared to their size. When the impacts are presented per area, the embodied carbon demonstrates a more balanced distribution across the building standards. Despite their higher embodied carbon, high-standard buildings may benefit from more efficient resource use per unit area. Compared to the low-standard building, the high-standard building reduces the embodied carbon per area by 13% considering SIDAC and 19% considering the Ecoinvent database, showing that both databases yielded similar results, even though they presented significant differences. The presentation of carbon impacts per inhabitant highlights the impact of user density, while the consideration per unit area provides information on the efficiency of material use.

Table 4. Embodied carbon per functional unit based on SIDAC and Ecoinvent database

Functional unit	**Database**	**Unit**	**High to low difference (%)**	**Standard**		
				Low	**Middle**	**High**
Global building	SIDAC	$kgCO_2$	344	7,212.0	17,475.8	31,993.8
	Ecoinvent	$kgCO_{2\text{-eq}}$	310	11,189.9	25,618.5	45,902.4
Per inhabitant	SIDAC	$kgCO_2$/people	122	2,404.0	4,369.0	5,332.3
	Ecoinvent	$kgCO_{2\text{-eq}}$/people	105	3,730.0	6,404.6	7,650.4
Per area	SIDAC	$kgCO_2/m^2$	-13	167.7	174.8	146.1
	Ecoinvent	$kgCO_{2\text{-eq}}/m^2$	-19	260.2	256.2	209.6
Per lifespan	SIDAC	$kgCO_2$/year	344	144.2	349.5	639.9
	Ecoinvent	$kgCO_{2\text{-eq}}$/year	310	223.8	512.4	918.0
Per lifespan and area	SIDAC	$kgCO_2/year/m^2$	-13	3.4	3.5	2.9
	Ecoinvent	$kgCO_{2\text{-eq}}/year/m^2$	-19	5.2	5.1	4.2
Per lifespan and density (people per area)	SIDAC	$kgCO_2$/year/ (people/m^2)	1030	2,067.4	8,737.9	23,355.5
	Ecoinvent	$kgCO_{2\text{-eq}}$/year/ (people/m^2)	344	3,207.8	12,809.3	33,508.8

3.3 Single-Score Assessment of the Buildings

The LCA may be presented more integratively through a single-score assessment of the reference buildings. Figure 4 shows a single-score indicator of the environmental impacts of each building for all functional units. The single-score methodology provides a valuable tool for understanding the relative significance of different environmental impacts, highlighting the areas where improvements could be made to reduce the overall environmental footprint of buildings. Climate change, particulate matter, land use and resource use fossils are the most significant contributors to the overall impact score, regardless of the standard or functional unit.

The results from the single-score analysis are consistent with the trends observed in embodied carbon assessments. Specifically, the building standard significantly influences environmental impacts, with higher-impact buildings showing higher effects when considering the impacts of the entire building or the impacts per inhabitant. Conversely, when the impacts are presented per area, the differences between the standards become less pronounced. In this case, the high-standard building showed lower impact.

In the context of this study, the simplified embodied carbon indicator - available in a Brazilian (SIDAC) and international (Ecoinvent) database - can be employed as a proxy for sustainability, as it provides a clear and direct correlation with the overall environmental impacts of the buildings. Given that the observed trend for both embodied carbon and single-score impacts is consistent, using carbon impacts as a representative metric is valid for this particular analysis. However, this may only hold in some cases. The single-score approach aggregates a broader spectrum of environmental categories, which could lead to a different ranking of impacts, mainly when non-carbon-related issues play a substantial role in the overall environmental footprint (EF3.1 method). The Environmental Footprint was the method selected to classify and characterise the impact pathways in a single score, with factors pre-established according to the method. Therefore, while CO_2 is a reasonable indicator, it may not always provide a comprehensive measure of sustainability across diverse building typologies or environmental impact categories.

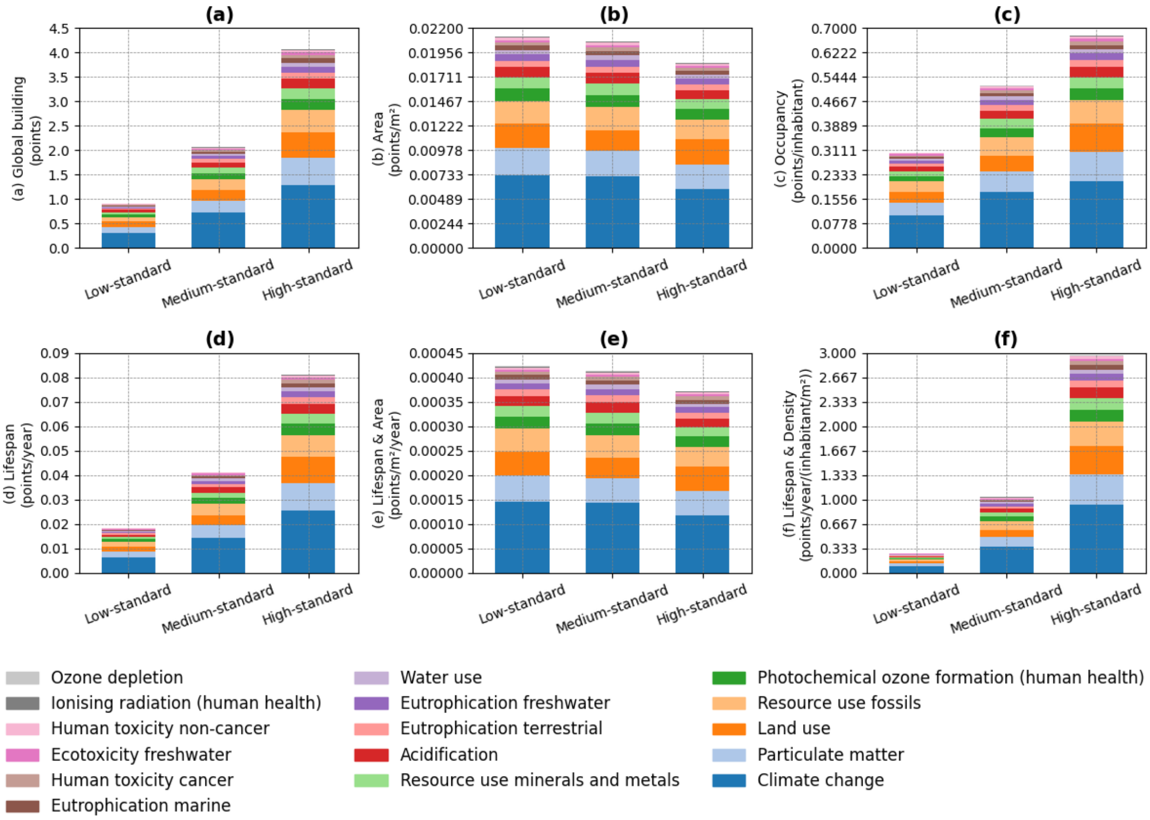

Figure 4. Environmental impacts in terms of single-point score values according to the EF3.1 method and functional unit: (a) total impact of the buildings, (b) impact per square meter, (c) impact per person, (d) impact per year, (e) impact per year and square meter, (f) impact per year and density.

3.4 Comparison to Brazilian and International Benchmarks

The final consideration in the study is comparing the results obtained regarding CO_2 and $CO_{2\text{-eq}}$ with the literature benchmarks. Lützkendorf et al. (2023) compiled benchmarked values for embodied carbon, ranging from 1.0 to 9.0 $kgCO_{2\text{-eq}}/m^2/year$ for residential buildings. All values obtained with the SIDAC and Ecoinvent databases fall into this range, even though SIDAC deals with only carbon emissions. Results were also similar to the ones obtained by Bianchi et al. (2021), with 246 and 418 $kgCO_{2\text{-eq}}/m^2$, and Bueno et al. (2018), with 179 $kgCO_{2\text{-eq}}/m^2$. Both works considered single-family houses with approximately 50 m², closer to the low standard in our study and 15 to 20 m² per person.

However, the results were slightly lower than the ones of Carvalho et al. (2021), with 10.9 $kgCO_{2\text{-eq}}/m^2/year$, and Domênico et al. (2021), with 8.2 $kgCO_{2\text{-eq}}/m^2/year$. Both studies considered single-family houses, although they presented different floor-plan areas. At last, Rezende et al. (2022) obtained a figure of approximately 150 $kgCO_{2-eq}/m^2$, which is also similar to the ones obtained in this study and the literature. Overall, benchmarks need to be better addressed, considering the peculiarities in the assessment and the different data used. However, one may confirm that the results of this study, both for Ecoinvent and SIDAC, fell into an established range of results, corroborating the legitimacy of the results.

4. Conclusions

This study highlights the critical role of database selection in assessing the environmental impacts of buildings, particularly in the context of embodied carbon. The analysis demonstrates how methodological differences can significantly influence the reported impacts by comparing national (SIDAC) and international (Ecoinvent) datasets. While the ranking of standards based on embodied carbon remains consistent across databases, the absolute values and material contributions differ, underscoring the importance of understanding the scope and limitations of each dataset.

These results significantly affect building design decision-making, particularly in light of increasing environmental constraints. Designers and policymakers must carefully select and interpret datasets to ensure accurate assessments, mainly when aiming for environmentally optimised construction. Adopting the SIDAC database can directly support designers and policymakers in Brazil by providing more contextually accurate environmental assessments at early design stages. This enhanced alignment with local construction practices can inform material choices, guide low-carbon procurement strategies, and foster regulatory frameworks that reflect Brazil's unique production conditions. Moreover, the insights provided by this study can inform the development of more robust and regionally adapted life cycle assessment frameworks, supporting the transition towards sustainable building practices.

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Data availability

Data are available upon reasonable request.

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