G20 Global Smart Cities Alliance

WORLD ECONOMIC FORUM

MODEL POLICY

Practitioners' Guide to Whole Life Carbon Assessments

Contents

Model policy

1 Introduction

1.1 Purpose of this guide

This guide explains how to prepare a whole life carbon assessment (WLCA) in alignment with the model policy created by the Taskforce on Sustainability and Smart Cities. It is framed to be used by practitioners who must comply with the policy.[1]

The guide explains what goes into submitting and complying with a WLCA. To stay impartial, the guide does not go into any one specific WLCA framework,[2] but highlights what is needed to create a successful assessment.

The document follows the compliance of the policy and thus uses the standard EN 15978 as published by the European Committee for Standardization (CEN) as referenced when needed. EN 15978 is widely used in the construction sector and is recommended by the World Green Building Council (WGBC).

1.2 What emissions does a WLCA cover?

Whole life carbon emissions are the total carbon emissions resulting from the construction and the use of a building over its entire life, including its demolition and disposal. They capture a building's operational carbon emissions from energy use, as well as its embodied carbon emissions. This includes emissions associated with: raw material extraction, the manufacture and transport of building materials and construction; maintenance, repair and replacement; and dismantling, demolition and eventual material disposal. WLCAs also include an assessment of the potential savings from the reuse or recycling of components after the end of a building's useful life as an alternative to disposal in a landfill/ incinerator/or other unsustainable waste outcomes. It provides an accurate picture of a building's carbon impact on the environment.

Major development planning applicants are required to calculate operational and embodied emissions, and demonstrate how they can be reduced as part of the WLCA. Planning applicants should continue to follow local, regional and international standards to assess and reduce operational and embodied emissions and insert the relevant information into the WLCA, as explained in this guide.

2 Implementing the Model Policy

2.1 When to submit a WLCA

Achieving the maximum whole life carbon reductions for a proposed building begins early in a development's design. Applicants should work closely with design teams at the earliest stages of project development to identify the priorities for the WLCA, and the opportunities and likely constraints in reducing whole life carbon emissions. These should be built into the project brief, and should be aligned with the principles outlined in the WLCA policy.

For planning applications that are referrable to a city's bureau of planning or other departments as locally appropriate, a WLCA should be submitted at the following stages:

Pre-application (where relevant)

The design and planning team should be involved with the WLCA. Most carbon savings are found in this stage and it sets the rest of the project on the right track. Additionally, the design phase is the most cost-effective stage to identify and implement savings; trying to fit them in after the fact can be difficult and costly.

Planning application submission

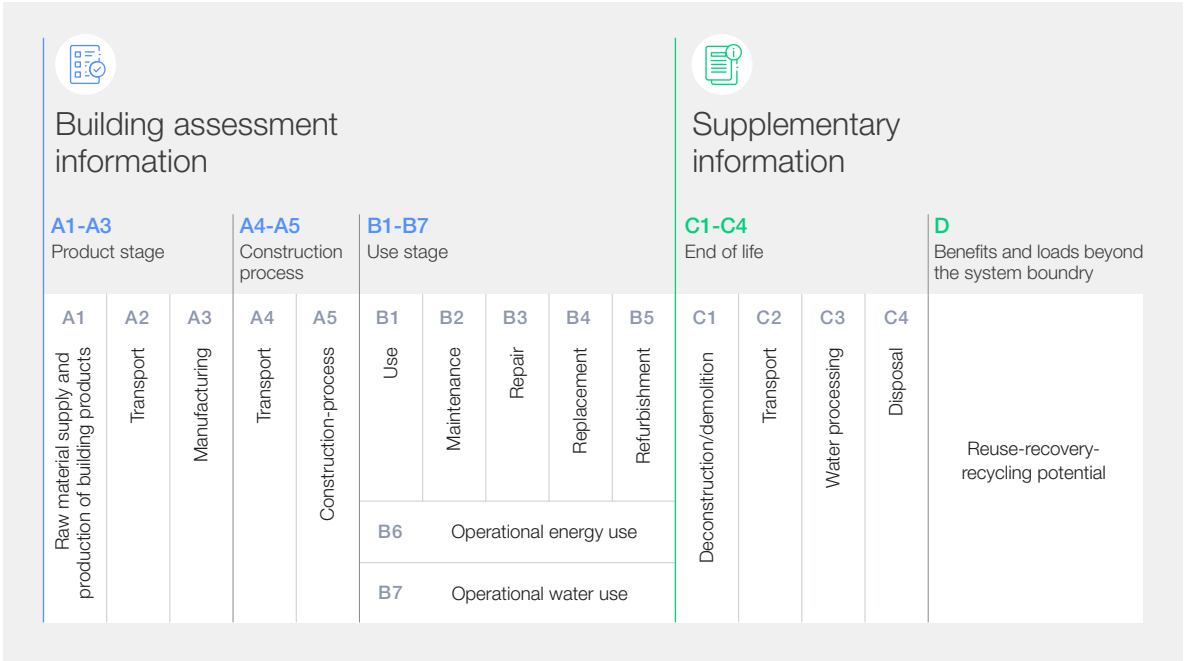
After the design stage is complete and all project teams are aligned, a detailed proposal should be submitted to show all potential savings.

Post-construction

Typically utilizing 12 months of operational data from the occupied development, this application should show the actual savings and plans to remedy any large discrepancies between planned and actual carbon savings. Twelve months of occupancy helps to ensure the accuracy of actual carbon savings.

A WLCA should be carried out using BS EN 15978: 2011 (sustainability of construction works – assessment of environmental performance of buildings – calculation method). It sets out the principles and calculation method for the whole life assessment of the environmental impacts of built projects.

As stated above, there are multiple frameworks and standards used globally for the practical implementation of BS EN 15978:2011. For example, RICS (England-specific) and draft ASHRAE/ICC 240p[4] (international when available) are assessment frameworks that specify the whole life carbon calculations based on life cycle assessments and other quantified environmental information. WGBC recommends EN 15978 with the minimum required reporting on modules A1-5, B1, B4, B5, B6, C1-4, and D (reported separately). Local- and regional-specific reporting standards may be appropriate and should be practiced accordingly.



3 Defining a System Boundary

3.1 Harmonizing and standardizing

The World Green Building Council (WGBC), the leading organization on what constitutes "green buildings" and how to measure and report their success, published a Whole Life Carbon Reporting and Targets Brief in March 2023.[5] This paper goes through the recommended reporting for the EN 15978 modules. This guide is in full support of their recommendations.

Harmonization and standardization are important to track carbon reduction success through all of the building's stakeholders, namely: the building sector, public authorities and financial institutions. Providing a common reporting framework and basis in the collection of data across all EN 15978 modules is a critical step in minimizing divergent reporting methodologies and results.

Please see WGBC's briefing on the minimum reporting requirements and justification of each module and for more information on harmonizing and standardizing.

4 Defining the Physical Scope

4.1 Building elements

The appropriate building elements are critical when calculating the whole life carbon of a building. The Level(s)[6] Framework methodology sets out a minimum physical scope that covers the building's shell, core and external works.[7,8]

The WLCA should cover all building elements that are applicable to the project and are to be included in the finished area of the completed project, including temporary works. This checklist can be found in Appendix A.

Appendix A: Scope of Building Elements has been taken from the Level(s) foundation in the hope of continued consistency across the globe.

5 Accessing Information on Materials and Products

5.1 Acceptable sources of carbon data for materials and products as highlighted in The London Plan 2021

The following are acceptable sources of carbon data for materials and products (or the latest available versions) in order of preference:

- Verified Type III EPDs in accordance with BS EN 15804 2012+A1:2013 or A2:2019
- Verified Type III EPDs in accordance with ISO 21930: 2017
- Verified Type III EPDs in accordance with ISO 21930: 2007
- Third-party (independently) verified, or peer-reviewed, carbon emissions to ISO 14067; EN 15804 or ISO 21930:2017 should be used as a CFP-PCR where relevant

– Verified Type III EPDs in accordance with ISO 14025

– Peer-reviewed life-cycle carbon assessment studies in accordance with ISO 14044

– Independently verified or peer-reviewed carbon emissions to PAS 2050:2011; EN 15804 should be used as the product sector-specific requirements where relevant

Applicants should use data from the manufacturer of the actual materials and products being used, following the order of preference above. If the manufacturer has not provided data or it is too early in the design process for the manufacturer to be known, then sector-level data (e.g. EPDs that use data covering several manufacturers) should be used.

5.2 Ensuring data quality

Applicants and developers should adopt third-party quality assurance mechanisms to ensure accuracy in their submissions. The mechanisms used should be reported at the planning application submission and post-construction stages using the template. Allocating the same person, team, or organization to oversee the WLCA process from design to post-construction, where possible, would provide consistency in reporting.

6 Developing Benchmarks

6.1 Setting targets

It is good practice to set targets for whole life carbon emissions reductions at the outset and to track progress against them throughout the project. The benchmarks created will help track the current progress of the policy effectiveness as well as help guide and develop future policies to be more effective. Benchmarks keep all parties accountable and transparent while measuring progress.

The estimated total whole life carbon emissions form the baseline for the development. All developments, regardless of their scope, are expected to compare their whole life carbon baseline against the most relevant benchmark. If the whole life carbon emissions of a development fall outside the range of the benchmarks (whether they are higher or lower), applicants must be able to explain why.

The Carbon Leadership Forum published in 2017 a study of embodied carbon[9] from over 1,000 building WLCA studies. The study was designed to guide practitioners trying to integrate carbon into a WLCA.[10] This study is a resource to aid in the creation of benchmarks and KPIs to be used to understand how to measure embodied carbon properly, where others are finding the most success in the reduction of embodied carbon, and as a comparable resource. The CLF study also includes the creation of the largest known database of building-embodied carbon.[11]

Appendix

A Building elements

For consistency, the building shall be defined in terms of a minimum scope of building parts and associated elements from which they are made up. These are set out in the table below.[12] Building Appliances that are procured and installed by building occupiers are excluded from the scope.

Building parts	Related building elements
Shell (substructure and superstructure)	
Load-bearing structural frame	Frame (beams, columns, and slabs) Upper walls External walls Balconies
Non-load bearing elements	Ground floor slab Internal walls, partitions, and doors Stairs and ramps
Facades	External wall systems, cladding and shading devices Facade opening (including windows and external doors) External paints, coatings and renders
Roof	Structure Weatherproofing
Parking facilities	Above ground and underground (within the curtilage of the buildings and servicing the building occupiers[13])
Core (fittings, furnishings and services)	
Fittings and furnishes	Sanitary fittings Cupboards, wardrobes, and worktops (where provided in residential property) Ceilings Wall and ceiling finishes Floor coverings and finishes
In-built lighting system	Light fittings Control systems and sensors
Energy system	Heating plant and distribution Cooling plant and distribution Electricity generation and distribution
Ventilation system	Air handling units Ductwork and distribution
Sanitary systems	Cold water distribution Hot water distribution Water treatment systems Drainage system
Other systems	Lift and escalators Firefighting installation Communication and security installations Telecoms and data installations

External works	
Utilities	Connections and diversions Substations and equipment
Landscaping	Paving and other hard surfaces Fencing, railings and walls Drainage systems

B Further Guidance on Specific Material Assessment Information

Further guidance on sourcing data for specific materials, products and life-cycle modules is provided from the London Plan Guidance on Whole Life-Cycle Carbon Assessments from March 2022. In this guide, "2.7 Materials and Products" section 2.7.2 details where to source particular data when EPDs or other direct material sources cannot be used. Section 2.7.2 is shown below:[14]

- **Structural elements:** Where EPDs are not available for structural elements (e.g. concrete), it is recommended that applicants use IStructE's guide on *How to calculate embodied carbon*[15] to source default values.

- **Mechanical, electrical and plumbing (MEP):** The embodied carbon emissions of MEP systems may be difficult to calculate in detail due to a lack of EPDs or other data sources. In these cases, it is recommended that applicants use the calculation methodology in CISBE TM65 Embodied carbon in building services, which guides the calculation at each life-cycle stage at product level: A1-A4, B1, B3, C1-C4. The "mid-level calculation" method should be used, but if there is not enough information available then the "basic calculation" method can be used instead. Applicants using the CIBSE TM65 methodology are also encouraged to report their results to CIBSE via their reporting form.[16] Applicants should use the default material carbon data in TM65 if product-specific carbon data is not available. For any materials that are not covered by TM65, applicants should use generic data sources that follow the EN15804 methodology (e.g. the ICE Database v3)[17]. If data following this methodology is not available, then other generic data sources should be used (e.g. older versions of the ICE Database v2). The final resort would be to use specific data from other manufacturers for similar products.

- **Module C3:** To calculate the carbon emissions for module C3 of materials and products (i.e. their end of life) relevant EPDs such as a manufacturer or sector EPD should be used in the first instance. If EPDs are not available, other relevant sources which follow EN15804 should be used.[18] The data provided by the software tool being used may also be appropriate, but applicants should check the end-of-life scenario assumed to ensure it is appropriate.

- **Furniture, fixtures and equipment (FFE):** For projects where FFE is included in the scope of the planning application (e.g. lockers, benches, desks, etc.), applicants can refer to the Furniture Industry Research Association's data if specific product information is not yet known.

- **Timber:** Sequestered carbon from the use of timber should be assessed in accordance with Clause 3.4.1 of the RICS PS. Sequestered carbon should be reported separately in the relevant part of the WLCA template.

Contributors

Lead author

Madeline O'Dwyer
Consultant, Sustainability and Design, Infosys

Co-leading members

André Aasrud
Senior Advisor, Clean Construction Program, C40 Cities

Anu Devi
Lead, G20 Global Smart Cities Alliance, World Economic Forum

Cécile Faraud
Head of Clean Construction, C40 Cities

Sarah Franklin
Lead, Net Zero Carbon Cities, World Economic Forum

Nidhi Gulati
Principal, Business Consultant, Sustainability and Design, Infosys

Joseph Upjohn
Consultant, Sustainability and Design, Infosys

Task force members

Juliet C. Anammah
Chief Sustainability Officer, Jumia Group

Lisa Brown
Executive Director, State and Federal Government Solutions, Johnson Controls

Alice Charles
Director, Cities, Planning and Design, Arup

Hubert Danso
Chief Executive Officer and Chairman, Africa Investor (Ai) Group

Corey Glickman
Advisor, Cradle 2 Commerce Program, Lawrence Berkeley National Laboratory

Noelia Jiménez Martínez
Head of Insights and Machine Learning, Nature Metrics

Jeff Kavanaugh
Chief Learner and Sharer, Infosys Knowledge Institute

Krishan Kumar
Former Chief Financial Officer, Durban Metro Council

Meghan Lewis
Senior Researcher, Carbon Leadership Forum

Swapnil Madhukar Joshi
Director, Sustainability and Design, Infosys

Vincent Martinez
President and Chief Operating Officer, Architecture 2030

Yame Nkgowe
Founder, Sustainable Cities Africa

Audrey Nugent
Director of Global Advocacy, World Green Building Council

Sam Ruben
Co-Founder, Mighty Buildings

Sanjay Sridhar
Policy and Strategy Advisor, Urban Movement Innovation Fund

About the G20 Global Smart Cities Alliance

The G20 Global Smart Cities Alliance accelerates the responsible adoption of technology for urban transformation goals. Established in June 2019, the alliance unites municipal, regional and national governments, private-sector partners and cities' residents around a shared set of principles for the responsible and ethical use of smart city technologies. The World Economic Forum, the International Organization for Public-Private Cooperation, serves as the secretariat for the alliance. Through the alliance, global experts from government, private- sector partners and civil society are compiling and analysing policies from around the world to identify model policies necessary for successful, ethical smart cities.

More model policies and details about the alliance can be found at: https://globalsmartcitiesalliance.org.

Endnotes

1. Practitioners are defined as individuals who will need to adhere to the policy in everyday practice with their operations. Examples include but are not limited to: construction managers, architects and designers, and building managers.

2. WLCA is a globally accepted method for evaluating and communicating the emissions, embodied and operational. Examples of guidance on WLCA for buildings have been developed by the European Committee for Standardization (CEN), Royal Institute of Chartered Surveyors (RICS), and ASHRAE, among others.

3. Major development is defined within the local context or as the total cost of the construction or renovation as a portion of the market value of the structure, or the number of occupants that will move in or must relocate while work is taking place. Any construction, retrofit, renovation, or refurbishment that requires planning approval is considered a major development.

4. The linked URL details the proposed plans of ASHRAE/ICC 240p; however, the document is not currently available.

5. Whole Life Carbon Policy Briefing—Page 1 (jpaper.io)

6. Level(s) Framework was developed to be used as a common European Union framework of core indicators and assessments of commercial and residential buildings. Level(s) has the ultimate goal of creating a common language and reporting objectives for WLC.

7. UM2_Setting_up_a_project_to_use_Level(s)_v1.1_26pp.pdf (europa.eu)

8. Omniclass Table 21, used by RICS, 240p, and other frameworks, is another good resource for defining building elements.

9. Simonen, K., Rodriguez, B., McDade, E,. Strain, L. (2017) Embodied Carbon Benchmark Study: LCA for Low Carbon Construction. Available at http://hdl.handle.net/1773/38017.

10. The Carbon Leadership Forum is currently working on a second version of the Whole Life Carbon WBLCA Benchmark Study scheduled to be published in 2024.

11. Simonen, K., Rodriguez, B., Barrera, S., Huang, M., (2017) CLF Embodied Carbon Benchmark Database, database. Available at http://hdl.handle.net/1773/38017.

12. Adapted from: CEN (2011), BCIS (2012), DGNB (2014) and BRE (2016).

13. If the share of underground car parking (usable area plus traffic area) accounts for more than 25% of the total useful floor area, the traffic area of the underground parking must be subtracted from the total useful floor area.

14. https://www.london.gov.uk/sites/default/files/lpg_-_wlca_guidance.pdf

15. https://www.istructe.org/IStructE/media/Public/Resources/istructe-how-to-calculate-embodied-carbon.pdf

16. https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q3Y00000IPZOhQAP

17. https://www.cibse.org/knowledge/knowledge-items/detail?id=a0q3Y00000IPZOhQAP

18. https://www.steelconstruction.info/End_of_life_LCA_and_embodied_carbon_data_for_common_framing_materials#Whole_life_embodied_CO2e_emissions_data

WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

The World Economic Forum, committed to improving the state of the world, is the International Organization for Public-Private Cooperation. The Forum engages the foremost political, business and other leaders of society to shape global, regional and industry agendas.

World Economic Forum
91–93 route de la Capite
CH-1223 Cologny/Geneva
Switzerland
Tel.: +41 (0) 22 869 1212
Fax: +41 (0) 22 786 2744
contact@weforum.org
www.weforum.org