

Green Mark 2021

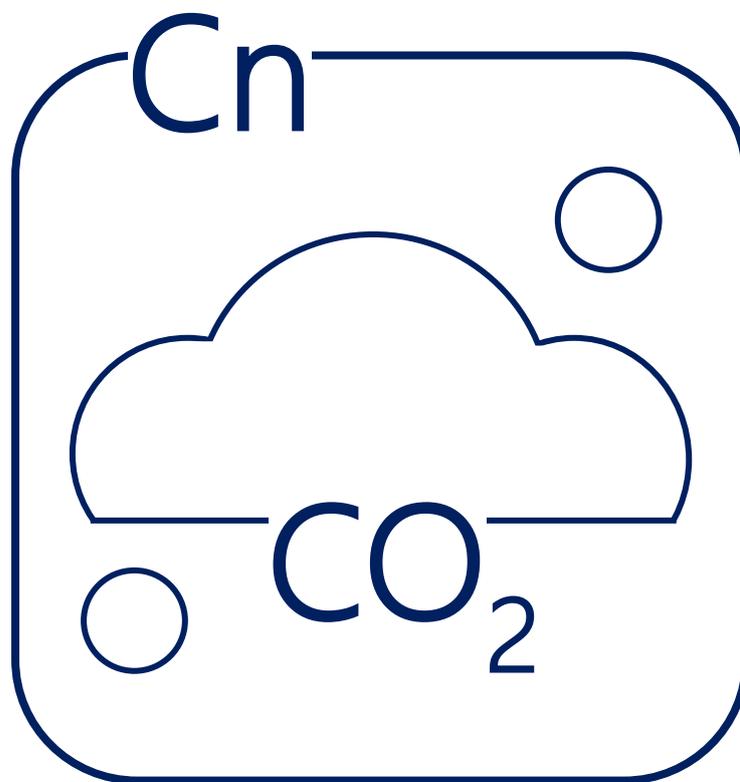
**Cn**

Whole Life Carbon

The Whole life Carbon section looks at the projects carbon footprint, with a focus on embodied carbon, the use of sustainable construction or retrofit materials and methods, as well as the role of tenants and their fit outs. The section will also evaluate building owners on their transition towards carbon neutrality at the asset level, translating the corporate objectives into tangible outcomes, as well as their support for tenants to do the same.

The GM 2021 Whole life Carbon section (Cn) has been created leveraging leading international movements such as the World Green Building Council's Net Zero Carbon Buildings commitment, and professional standards such as the RICS Whole life carbon assessments for the built environment.

The section has been refined through a collaborative approach with the Singapore Green Building Council, the National Environment Agency, the JTC corporation and the Public Utilities Board.



Helps projects meet targets under the following SDGs



# WHOLE LIFE CARBON

WHOLE LIFE CARBON																
CN1 CARBON	Green Mark Points															
CN1.1 Whole Life Carbon	New	Existing														
<p><b>CN1.1 Whole Life Carbon (WLC) Assessment</b></p> <p>Whole Life carbon assessment consistent with EN 15978 and EN 15804.</p> <p>Useful references: <a href="https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf">https://www.rics.org/globalassets/rics-website/media/news/whole-life-carbon-assessment-for-the--built-environment-november-2017.pdf</a></p> <p><a href="https://www.architecture.com/-/media/GatherContent/Whole-life-carbon-assessment-for-architects/Additional-Documents/11241WholeLifeCarbonGuidancev7pdf.pdf">https://www.architecture.com/-/media/GatherContent/Whole-life-carbon-assessment-for-architects/Additional-Documents/11241WholeLifeCarbonGuidancev7pdf.pdf</a></p> <p><b>(i) Minimum Scope Requirement of WLC Assessment</b></p> <table border="1" style="width: 100%; border-collapse: collapse; margin-bottom: 10px;"> <thead> <tr style="background-color: #d9e1f2;"> <th colspan="2" style="padding: 5px;">Minimum Scope of WLC assessment</th> </tr> </thead> <tbody> <tr> <td style="width: 30%; padding: 5px;">Building elements to be included</td> <td style="padding: 5px;">1. Substructure 2. Superstructure</td> </tr> <tr> <td style="padding: 5px;">Lifecycle stages to be included</td> <td style="padding: 5px;">1. Product stage [A1-A3] 2. Construction Stage [A4-A5] 3. Maintenance Stage [B2] Façade 4. Replacement Stage [B4] ACMV 5. Operational Energy [B6]</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li><i>New building projects that conduct the <b>full scope</b> of WLC assessment will score up to additional 2 points under the <b>Innovation section</b>.</i></li> <li><i>New building projects scoring under CN1.1(i) will be excluded from scoring under CN 1.1(ii)(a)</i></li> </ul> <p><b>(ii) Embodied Carbon Computation</b></p> <p>a) Calculation of embodied carbon of the development Using the BCA Embodied Carbon calculator <u>or</u> embodied carbon software tools which are linked to robust carbon data sets such as the Inventory of Carbon and Energy (ICE) database, the RICS Building Carbon Database, etc.</p> <p>b) &gt;10% Reduction from the reference embodied carbon (for Concrete, Glass and Steel)</p> <p>c) &gt;30% Reduction from the reference embodied carbon (for Concrete, Glass and Steel)</p> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 10px;"> <thead> <tr style="background-color: #d9e1f2;"> <th style="width: 30%;"></th> <th style="text-align: center;">Reference values (kgCO<sub>2</sub>e/m<sup>2</sup>)</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>Non-Residential</b></td> <td style="text-align: center;"><b>1000</b></td> </tr> <tr> <td style="text-align: center;"><b>Residential</b></td> <td style="text-align: center;"><b>1500</b></td> </tr> <tr> <td style="text-align: center;"><b>Industrial</b></td> <td style="text-align: center;"><b>2500</b></td> </tr> </tbody> </table> <p><i>(Reference values based on A1-A4 emissions for superstructure)</i></p>	Minimum Scope of WLC assessment		Building elements to be included	1. Substructure 2. Superstructure	Lifecycle stages to be included	1. Product stage [A1-A3] 2. Construction Stage [A4-A5] 3. Maintenance Stage [B2] Façade 4. Replacement Stage [B4] ACMV 5. Operational Energy [B6]		Reference values (kgCO <sub>2</sub> e/m <sup>2</sup> )	<b>Non-Residential</b>	<b>1000</b>	<b>Residential</b>	<b>1500</b>	<b>Industrial</b>	<b>2500</b>	<p style="text-align: center;"><b>(i)</b></p> <p style="text-align: center;"><b><u>Non Residential:</u></b></p> <p style="text-align: center;">3 points</p> <p style="text-align: center;"><b><u>Residential:</u></b></p> <p style="text-align: center;">3 points</p> <p style="text-align: center;"><b>(ii)</b></p> <p style="text-align: center;"><b><u>Non Residential:</u></b></p> <p style="text-align: center;">0.5 point for (a) 1 point for (b) OR 2 points for (c)</p> <p style="text-align: center;"><b><u>Residential:</u></b></p> <p style="text-align: center;">0.5 point for (a); 1 point for (b) OR 2 points for (c)</p>	<p style="text-align: center;"><b>(i)</b></p> <p style="text-align: center;"><b><u>Non Residential:</u></b></p> <p style="text-align: center;">N.A</p> <p style="text-align: center;"><b><u>Residential:</u></b></p> <p style="text-align: center;">N.A</p> <p style="text-align: center;"><b>(ii)</b></p> <p style="text-align: center;"><b><u>Non Residential:</u></b></p> <p style="text-align: center;">1 point for (a) N.A for (b) OR N.A for (c)</p> <p style="text-align: center;"><b><u>Residential:</u></b></p> <p style="text-align: center;">1 point for (a) N.A for (b) OR N.A for (c)</p> <p><i>(ii) is applicable only to Existing Buildings with Addition and Alteration (A&amp;A) works involving additional gross floor area (GFA) with new construction, addition of floors with independent substructures</i></p>
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CN1.2 2030 Transition Plan	New	Existing
<p>Carbon and Energy transition plan - delineates steps to deliver a net zero carbon building from 2030 for the asset under assessment, based on scope 1 and 2 emissions.</p> <p><i>Timelines and strategies shall be clearly articulated with tracking mechanisms, covers the areas under the building owner's control. See WGBC Net zero Carbon commitment <a href="https://www.worldgbc.org/thecommitment">https://www.worldgbc.org/thecommitment</a></i></p>	<p><b><u>Non Residential:</u></b></p> <p>1 point</p> <p><b><u>Residential:</u></b></p> <p>1 point</p>	<p><b><u>Non Residential:</u></b></p> <p>5 points</p> <p><b><u>Residential:</u></b></p> <p>1 point</p>
<b>CN1 Carbon</b>	<b>5 Points total</b>	

# WHOLE LIFE CARBON

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CN2 Construction	Green Mark Points																			
CN2.1 Sustainable Construction	New	Existing Buildings																		
<p>Use of sustainable construction materials and methods to reduce environmental impacts of the construction phase.</p> <p>(i) Design with Low CUI</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr style="background-color: #d9e1f2;"> <th style="width: 30%;">Building Type</th> <th style="width: 70%;">CUI</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>Non Residential</b></td> <td style="text-align: center;">≤ 0.35</td> </tr> <tr> <td style="text-align: center;"><b>Residential</b></td> <td style="text-align: center;">≤ 0.45</td> </tr> <tr> <td style="text-align: center;"><b>Industrial</b></td> <td style="text-align: center;">≤ 0.45</td> </tr> </tbody> </table> <p>(ii) Adoption of sustainable building systems and Design for Manufacturing and Assembly (DfMA) that minimise resource use and waste, with a view to a greater integration of components and systems. The following can be considered jointly and severally based on % coverage over constructed floor area (CFA).</p> <p>a) Advanced precast concrete system (APCS)</p> <p>b) Structural Steel</p> <p>c) Mass Engineered Timber (MET)</p> <p>d) Prefabricated Prefinished Volumetric Construction (PPVC)</p> <p>e) Hybrid structural system of:</p> <p style="margin-left: 20px;">i) Structural Steel and Precast Concrete; or</p> <p style="margin-left: 20px;">ii) MET and Structural Steel/ Precast Concrete</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr style="background-color: #d9e1f2;"> <th style="width: 30%;">Building Type</th> <th style="width: 70%;">Adoption of Sustainable Building System</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><b>Non-Residential</b></td> <td style="text-align: center;">≥ 50% of CFA</td> </tr> <tr> <td style="text-align: center;"><b>Residential</b></td> <td style="text-align: center;">≥ 55% of CFA</td> </tr> </tbody> </table> <p>(iii) Use of Low Carbon Concrete certified by SGBC or equivalent local certification bodies (using CEM II – V cements under SS EN 197-1) for ≥ 80% of applicable superstructure works by volume</p> <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"> <thead> <tr style="background-color: #d9e1f2;"> <th style="width: 70%;">Concrete categories</th> <th style="width: 30%;">Points</th> </tr> </thead> <tbody> <tr> <td>Concrete products that achieve at least SGBP 2 ticks or equivalent administered by local certification bodies</td> <td style="text-align: center;">0.5</td> </tr> </tbody> </table>	Building Type	CUI	<b>Non Residential</b>	≤ 0.35	<b>Residential</b>	≤ 0.45	<b>Industrial</b>	≤ 0.45	Building Type	Adoption of Sustainable Building System	<b>Non-Residential</b>	≥ 50% of CFA	<b>Residential</b>	≥ 55% of CFA	Concrete categories	Points	Concrete products that achieve at least SGBP 2 ticks or equivalent administered by local certification bodies	0.5	<p style="text-align: center;"><b>Non Residential:</b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p>0.5/0.75/1 point for (iii)</p> <p>0.5point for fine/coarse agg. replacement; 1point for both coarse and fine agg. replacement for (iv)</p> <p style="text-align: center;"><b>Residential:</b></p> <p>2 points for (i)</p> <p>1 point for (ii),</p> <p>0.5/0.75/1 point for (iii)</p> <p>0.5point for fine/coarse agg. replacement; 1point for both coarse and fine agg. replacement for (iv)</p>	<p style="text-align: center;"><b>Non Residential:</b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p>0.5/0.75/1 point for (iii)</p> <p>0.5point for fine/coarse agg. replacement; 1point for both coarse and fine agg. replacement for (iv)</p> <p style="text-align: center;"><b>Residential:</b></p> <p>2 points for (i)</p> <p>1 point for (ii),</p> <p>0.5/0.75/1 point for (iii)</p> <p>0.5point for fine/coarse agg. replacement; 1point for both coarse and fine agg. replacement for (iv)</p>
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<p>(iv) Replacement of coarse and fine aggregates for structural concrete applications [by mass of RCA, WCS, granite fines (GF)] must meet both minimum requirements in terms of <u>extent of usage</u> and <u>replacement levels</u> as shown in the table below:</p> <table border="1"> <thead> <tr> <th>Minimum Requirement</th> <th>RCA</th> <th>WCS</th> <th>GF</th> </tr> </thead> <tbody> <tr> <td>Extent of usage</td> <td>≥ 1.5% x GFA</td> <td>≥ 0.75% x GFA</td> <td>≥ 1.5% x GFA</td> </tr> <tr> <td>Replacement amount (%)</td> <td>≥ 20%</td> <td>≤ 10%</td> <td>≥ 50%</td> </tr> </tbody> </table>				Minimum Requirement	RCA	WCS	GF	Extent of usage	≥ 1.5% x GFA	≥ 0.75% x GFA	≥ 1.5% x GFA	Replacement amount (%)	≥ 20%	≤ 10%	≥ 50%
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<p><b>CN2.2 Sustainable Products &amp; Finishes</b></p>															
<p>(i) <b>≥ 60%* (by cost) or ≥ 80%* (by areas)</b> of the Architectural and applicable landscaping works are at least SGBP 2 ticks or equivalent administered by local certification bodies</p> <p>(ii) <b>≥ 60%* (by cost)</b> of Mechanical, Electrical and Plumbing (MEP) systems are SGBP certified or equivalent administered by local certification bodies</p> <p>* The coverage of ≥ 60% (by cost) or 80% (by areas) should include minimally <b>at least 3 building Products/Finishes</b>.</p>	<p><b>Non Residential:</b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p><b>Residential:</b></p> <p>2 point for (i)</p> <p>1 point for (ii)</p>	<p><i>(Applicable to existing buildings with retrofitting works or change of MEP systems)</i></p> <p><b>Non Residential:</b></p> <p>2 points for (i)</p> <p>3 points for (ii)</p> <p><b>Residential:</b></p> <p>2 points for (i)</p> <p>3 points for (ii)</p>													
<p><b>CN2.3 Conservation, Resource Recovery and Waste Management</b></p>															
<p>(i) To encourage conservation of existing building structure, recovery of demolished building materials for reuse and/or recycling and waste management. Existing structures are conserved and not demolished.</p>		<p><i>(Applicable to existing buildings undergoing major retrofitting work and &gt; 30 years old)</i></p>													

<p>(ii) Existing structures are demolished with an enhanced demolition protocol, where a recovery rate of <math>\geq 40\%</math> crushed concrete waste from the demolished building is sent to approved recyclers with proper facilities.</p> <p>(iii) Appointment of environmental specialists during construction stage – The main builder is a BCA Green and Gracious Builder with Merit or above rating and has ISO14001 certification.</p>	<p><b><u>Non Residential:</u></b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p>1 point for (iii)</p> <p><b><u>Residential:</u></b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p>1 point for (iii)</p>	<p><b><u>Non Residential:</u></b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p>1 point for (iii)</p> <p><b><u>Residential:</u></b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p>1 point for (iii)</p>
<p><b>CN2 Construction</b></p>	<p><b>5 Points total</b></p>	

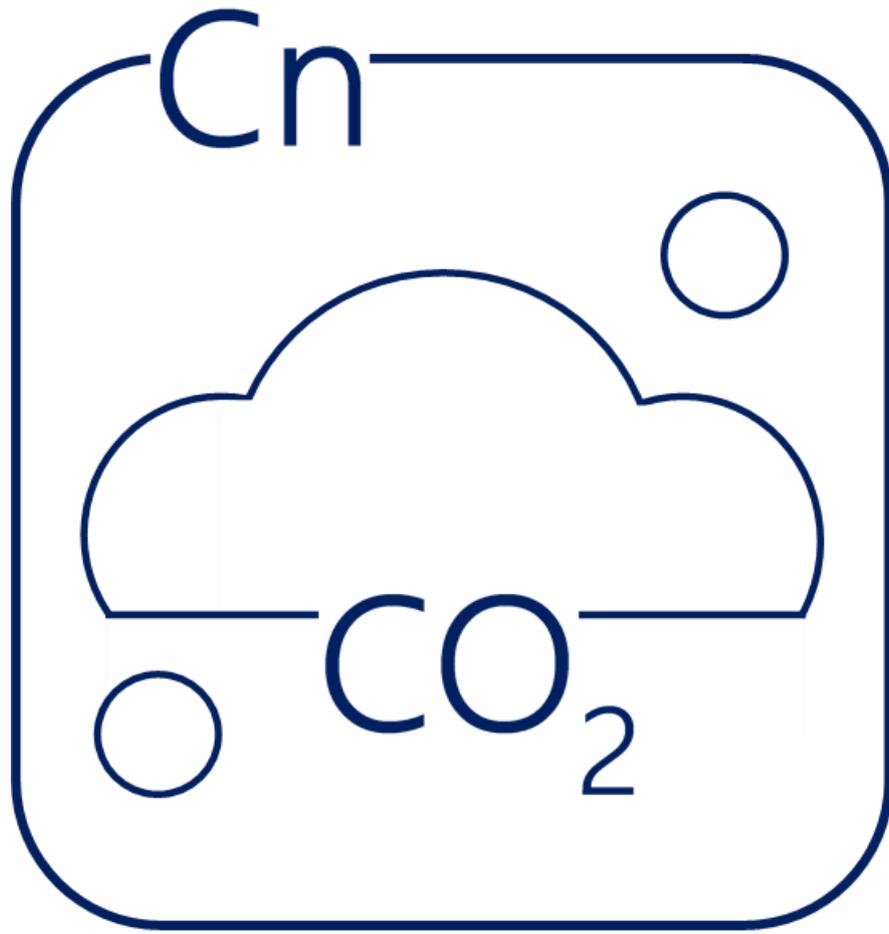
## WHOLE LIFE CARBON

CN3 Fit Out	Green Mark Points	
CN3.1 Green Lease	New	Existing
<p>A comprehensive Green Lease* (or equivalent) to be incorporated into the tenancy agreement, that establishes agreed levels of environmental performance between the landlord and the tenant for</p> <ul style="list-style-type: none"> <li>(i) ≥ 50% of the net lettable area</li> <li>(ii) ≥ 70% of the net lettable area</li> <li>(iii) Every tenant</li> </ul> <p><i>*The Green Lease should include at a minimum: principles relating to energy, water, waste, environmental management and procurement including materials, fit-out as well as facility management practices.</i></p> <p><i>Example template is available:</i></p> <p><i>BCA Green Lease Toolkit: Office/Retail/Industrial Green Schedule: <a href="https://www1.bca.gov.sg/docs/default-source/docs-corp-buildsg/sustainability/green-lease-toolkit.docx?sfvrsn=3c597a12_4">https://www1.bca.gov.sg/docs/default-source/docs-corp-buildsg/sustainability/green-lease-toolkit.docx?sfvrsn=3c597a12_4</a></i></p>	<p><b><u>Non Residential:</u></b></p> <p>1 point for (i)</p> <p>2 points for (ii)</p> <p>3 points for (iii)</p> <p><b><u>Residential:</u></b></p> <p>N.A</p>	<p><b><u>Non Residential:</u></b></p> <p>1 point for (i)</p> <p>2 points for (ii)</p> <p>3 points for (iii)</p> <p><b><u>Residential:</u></b></p> <p>N.A</p>
CN3.2 Fit Out Products		
<ul style="list-style-type: none"> <li>(i) ≥ 80% (by cost or area) of the fit-out materials used (construction and finishes) for <b>common areas</b> (i.e. non-tenanted spaces) shall be at least SGBP 2 ticks or equivalent administered by local certification bodies</li> <li>(ii) ≥ 80% (by cost or area) of the fit-out materials used (construction and finishes) for <b>tenanted spaces/ dwelling units</b> shall be conserved or at least SGBP 2 ticks or equivalent administered by local certification bodies</li> </ul> <p><i>Fit out products with EPD certification can score additional points at Innovation section</i></p>	<p><b><u>Non Residential:</u></b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p><b><u>Residential:</u></b></p> <p>1 point for (i)</p> <p>2 points for (ii)</p>	<p><b><u>Non Residential:</u></b></p> <p>1 point for (i)</p> <p>1 point for (ii)</p> <p><b><u>Residential:</u></b></p> <p>2 points for (i)</p> <p>N.A for (ii)</p>



## CN - INNOVATION

	Green Mark Points	
	New	Existing
<p>Where projects can demonstrate substantial performance to a specific Carbon indicator or outcome innovation points can be awarded on a case by case basis. Points shall be awarded based on the strength of evidence of benefits and potential impact.</p> <p><u>Process:</u></p> <p><b>At Design / Pre-retrofit stage</b> The project team is to submit a concise summary that articulates:</p> <ul style="list-style-type: none"> <li>• The nature of the environmental benefit of their intervention</li> <li>• Justify the impact of the intervention through detailed calculations and comparisons with industry norms</li> <li>• Substantiate the calculations and comparisons with evidence and data.</li> </ul> <p><b>At Verification (As Built/ In Operation):</b> Details of the implemented intervention including measurements and monitoring of the environmental performance including lessons learnt if the intervention does not perform as expected.</p> <p><i>Examples:</i></p> <ul style="list-style-type: none"> <li>• <i>Full scope of Whole Life Carbon (WLC) Assessment</i></li> <li>• <i>Use of NEWSand in non-structural applications</i></li> <li>• <i>Use of carbon mineralisation technologies</i></li> <li>• <i>Use of 100% granite fines as aggregate replacement</i></li> <li>• <i>Recognising products with EPDs</i></li> <li>• <i>Recognising design for Disassembly/Future adaptability - to facilitate future changes and dismantlement (in part or whole) for recovery of systems, components and materials.</i></li> </ul>	Up to 2 points	Up to 2 points
<b>CN INNOVATION</b>	<b>2 Points total</b>	



Developed by:



In collaboration with:

