BRANZ Carbon Tools

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Introduction to building life cycle assessment (LCA)

Jarred Butler, Building Environmental Scientist







Agenda





Climate change and the built environment



Building life cycle assessment fundamentals



Assessing results



Scope



Data

Climate change





New Zealand's climate change commitments

The Paris Agreement

- Limit global temperature rise to well below 2.0°C ideally no more than 1.5°C above pre-industrial levels
- Article 4.1 of the Agreement aims to achieve net-zero carbon emissions between 2050 and 2100
- New Zealand signed and ratified this agreement

UNFCCC on Paris Agreement

Climate Change Response (Zero Carbon) Amendment Act 2019

- Reduce GHG emissions to hold global warming to no more than 1.5°C above pre-industrial levels
 - Reduce all greenhouse gases (except biogenic methane) to net zero by 2050
 - Reduce emissions of biogenic methane within the range of 24–47% below 2017 levels by 2050, including to 10% below 2017 levels by 2030
- Establish an independent Climate Change Commission
- Establish emissions budgets as stepping stones
- Require government to develop and implement policies for adaption and mitigation

MFE on Zero Carbon Amendment Act





MBIE Building for Climate Change programme



- Programme aimed at helping the built environment meet the targets of the Zero Carbon Act
- Focuses on reducing operational and embodied emissions and improving climate resilience
- Will enact changes to raise minimum Building Code requirements
- LCA can be used to show you're meeting these targets

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Building life cycle assessment fundamentals





Building life cycle assessment is ...

CONSTRUCTION STREETION

USE STREE

END OF LIFE STREE

PRODUCT STREE

Building LCA is an analysis technique used to quantify and evaluate the environmental impact of a building throughout its entire life cycle

It's a holistic assessment, reducing the risk of decisions inadvertently transferring impacts from one stage of the life cycle or impact to another



Fundamentals	Assessing results	

Key standards

European (EN)	International (ISO)	Scope
EN 15978: 2011 Sustainability of construction works – Assessment of environmental performance of buildings – Calculation method	 ISO 21931 – 1: 2010 Sustainability in building construction – Framework for methods of assessment of the environmental performance of construction works – Part 1: Buildings 	Rules and guidance for applying LCA at the building level
EN 15804+A2: Sustainability of construction works – Environmental product declarations – Core rules for the product category of construction products	ISO 21930: 2017 Sustainability in buildings and civil engineering works – Core rules for environmental product declarations of construction products and services	Rules and guidance for applying LCA at the building product/service level
		Various standards dictating how to calculate impact of specific types of products

Fundamentals		

Life cycle stages

Based on international standards EN 15978 and ISO 21931





Fundamentals		

Environmental indicators

Common Name		Name		Units	
Climate change (100	year)	Global w	varming potential (total)		kg CO ₂ eq.
Ozone hole		Ozone de	epletion potential		kg CFC 11 eq.
Acid rain		Acidifica	tion potential		kg SO ₂ eq.
Algal blooms		Eutrophi	ication potential		kg PO ₄ ³⁻ eq.
Smog		Photoch	emical ozone creation po	kg C_2H_2 eq.	
Resource depletion		Depletio	on of mineral resource el	kg Sb eq.	
Fossil fuel depletion		Depletio	on of non-renewable foss	MJ (NCV)	
Greenhouse gas	Global wa potential (1	arming 00 year)		Greenhouse gas	Total GWP (100 year)
Carbon dioxide	arbon dioxide 1		→ 10 kg →	Carbon dioxide	10 * 1
Methane	/lethane 25		→ 10 kg →	Methane	10 * 25
Nitrous oxide 298		3 → 10 kg →		Nitrous oxide	10 * 298
			-	Total	3240 kgCO ₂ eq.



Information needed for LCA



Energy intensity

Water intensity

Schedule of quantities

- List of all the materials in your building
- Quantity of each material (e.g. kg, m², m³)

Annual energy use

- Ideally generated from an energy simulation

Annual water use

Materials database

- Impact of processes that occur during materials life cycle (e.g. manufacturing, landfilling)
- Activity data, determining how the material is used (e.g. service life, wastage rates)

Energy source intensities

- Impact of supplying building with energy while the building is occupied

Water source intensities

- Impact of supplying building with water while the building is occupied



Getting material quantities

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User-generated		Simple	Complex
Information Materials	Description	Tool includes pre-defined building elements (e.g. walls,	Generate schedule of quantities from BIM
Energy use		floors, roofs)	
Water use	Method	Select elements and enter areas	Export quantities from BIM and import into tool
External data			
sources	Situation	Best used on simple buildings	Best used on more complex buildings
Materials		such as houses	(e.g. apartments, commercial)
Intensities			
Activities	ΤοοΙ		
Energy intensity		Conf	CAR WEL
Water intensity		ಁಁಁಁೣಁಁಁಁಁಁಁ	· • AUU···

Fundamentals		

Typical building LCA workflow



Outputs											
Environmental	Life cycle stages										
Indicators	Product	Construction process	Use	End of life	D						
Climate change (100 year)											
Stratospheric ozone depletion											
Acidification											
Eutrophication											
Tropospheric ozone formation											
Mineral depletion											
Fossil fuel depletion											

Assessing results





	Assessing results	

Assessment methods

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Absolute approach – carbon budgets

• Compare assessed building to cap or target

• Starting to be done

• Can relate to objective targets

• In NZ, only available for climate change



	Assessing results	

Hotspot analysis













What is the scope of your LCA?

Three questions you need to answer:

- What life cycle stages are you considering?
- What indicators are you assessing?
- What parts of the building are you considering?

Ideally, you would answer 'All' to these questions, but this is very rarely practical and almost impossible at the start of a project

Scope is dependent on what information you have about your building and what external data is available

Scope will change over time as more information becomes available

Better to start LCA early with reduced scope, then increase scope throughout project

Don't wait until you have enough information – you'll never have enough







Scope throughout the project





BRANZ data





Environmental product declarations

Product stage		tage	Construction process stage			Use stage			Use stage End of life stage				Benefits and loads beyond the system boundary			
Raw material supply	Transport of raw materials	Manufacturing	Transport to customer	Construction / Installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction/Demolition	Transport to waste processing	Waste processing	Disposal	Reuse - Recovery- Recycling- potential
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Х	Х	Х	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND	MND

	Unit	1 kg of Pink® Batts® Insulation	
Environmental impact indicators			
Global warming potential (total)	kg CO ₂ -eq.	0.96	
Depletion potential of the stratospheric ozone layer	kg CFC11-eq.	1.60E-13	
Acidification potential of land and water	kg SO ₂ -eq.	0.00404	
Eutrophication potential	kg PO ₄ ³⁻ -eq.	8.39E-04	
Photochemical ozone creation potential	kg C ₂ H ₄ -eq.	3.32E-04	
Abiotic depletion potential - Elements	kg Sb-eq.	3.44E-07	
Abiotic depletion potential - Fossil fuels	MJ	14.5	

Source: Environmental product declaration for Tasman Insulation

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Generic data

- Where EPD data is not available, we use generic data from Ecoinvent
- Environmental impacts of various processes that occur throughout a materials life
- "New Zealandised" data
- Useful for stages of the life cycle beyond materials manufacture:
 - Transport by truck/ship
 - End-of-life processing/disposal
- As more EPD data becomes available, can use to replace generic data



Activity data

- Available as datasheets on BRANZ website (<u>www.branz.co.nz/buildinglca</u> (and select "Data"))
- Default scenario data for:
 - Transport distances to construction sites (by mode)
 - Construction waste and end-of-life routes
 - Maintenance and replacement of materials during building service life
 - Energy simulation
 - Water consumption
- Developed pre-2016 and could do with updating
- High level, e.g. don't differentiate end-of-life routes regionally



Climate change	Fundamentals	Assessing results	Scope	Data

Support for BRANZ Tools

Tools

https://www.branz.co.nz/low-carbon-resources/low-carbon-tools/

BRANZ offers free support for any of our tools

Email help facility

LCAQuick.help@branz.co.nz



Jarred Butler

Building Environmental Scientist jarred.butler@branz.co.nz

David Dowdell

Principal Scientist Sustainability david.dowdell@branz.co.nz