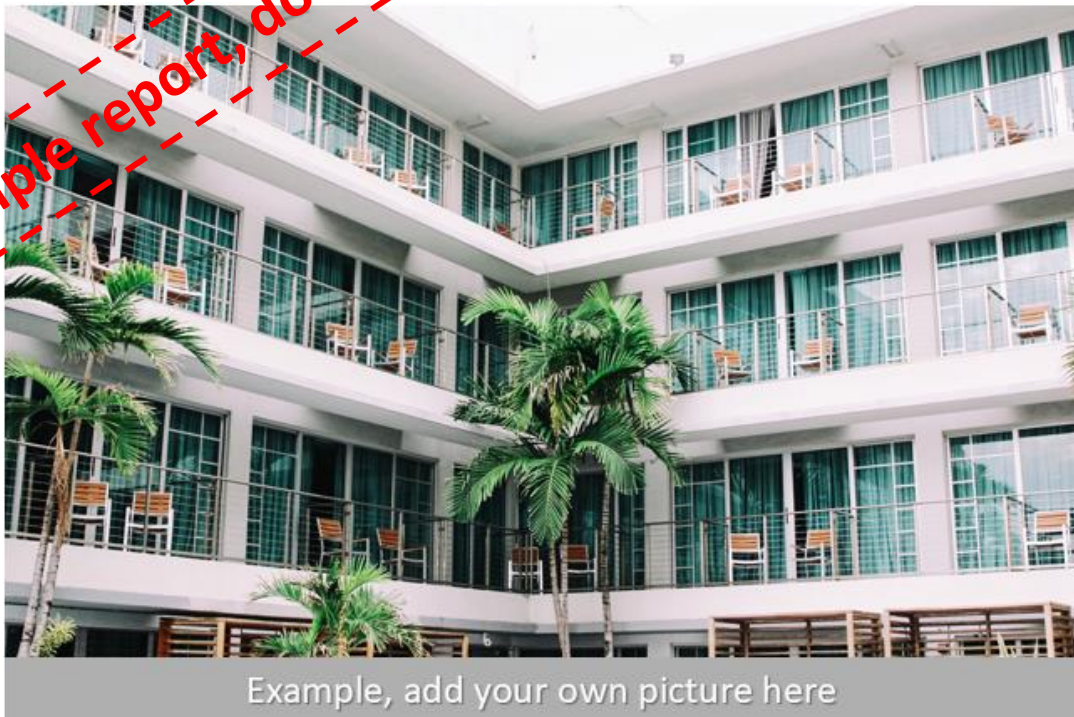One Click LCA

One Click LCA® – Result reporting template for LEED v4 MRc1 Building Life-Cycle Impact Reduction, Option 4

Life cycle assessment results for achieving credits for LEED v4 MRc1 Building Life-cycle Impact reduction credit and its option 4 whole building impact assessment.

Example, add your own picture here

LEED v4 Platinum Holiday Apartments

Address: Palm Street, Los Angeles

Author: Tytti Bruce-Hyrkäs

Date: 4th November 2017

Contents

1. Life cycle impact assessment result summary

The life cycle assessment was calculated using One Click LCA. The results are summarized in following table. The results represent the total life cycle impact during 60 year service life.

Impact category	Unit	Baseline result	Proposed design result	Reduction, %
Global warming potential (greenhouse gases)	$kgCO_2$ eq	1,96E6	3,89E2	-21
Depletion of the stratospheric ozone layer	kgCFC-11 eq	6,35E0	5,51E0	-13
Acidification of land and water sources	$kgSO_2$ eq	1,6E4	1,46E4	-8,6
Eutrophication	N eq	1,33E3	1,19E3	-11
Formation of tropospheric ozone(photochemical oxidant formation)	NO_xeq	1,87E5	1,74E5	-6,6
Depletion of non-renewable energy resources	MJ	1,85E7	1,61E7	-13

Number of environmental impact categories with more than 10 % reduction:
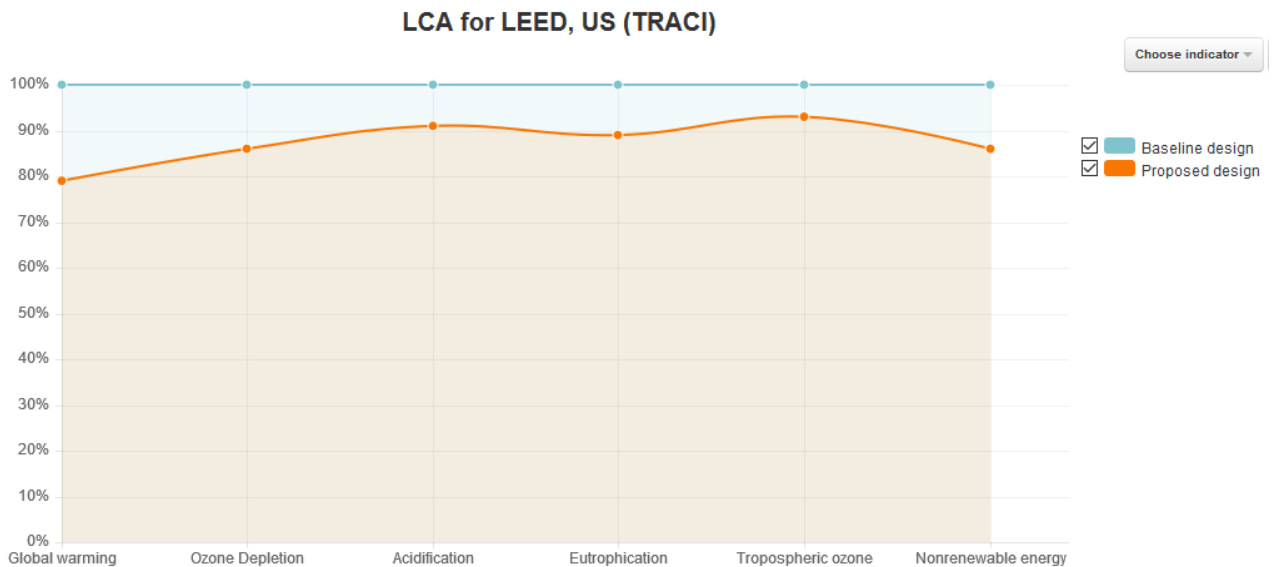
2. The life cycle assessment scope and service life

One Click LCA tool was used to model both baseline and proposed building.

In the assessment following life cycle stages according to EN 15804 (2012) were included:

- A1-A3 Construction Materials
- A4 Transportation to site
- B1-B5 Maintenance and material replacements
- C1-C4 Deconstruction

Building service life was estimated to be 60 years which is fixed in the tool settings.

3. Description of the datasets

One Click LCA calculation tool was used for the analysis. All of the datasets in the tool follow ISO14044 standard.

The One Click LCA tool LEED LCA tool for North America was used in the assessment. The tool uses US/Canadian data and supports TRACI 2.1 and all required impact categories.

Special note for TRACI: Formation of tropospheric ozone (for TRACI 2.1.) in the Full Reference Guide LCA text refers erroneously to unit "NOxeq" whereas TRACI 2.1. uses O3eq (Ozone-equivalent). See United States Environmental Protection Agency: Tool for the Reduction and Assessment of Chemical and other Environmental Impacts (TRACI), TRACI version 2.1, Documentation Nr S-10637-CP-2–0. When submitting the credits using the LEED v4's dynamic PDF forms the user is suggested to choose "NOx".

Also, for depletion of nonrenewable energy, the Full Reference Guide LCA text states that for the purposes of complying with this credit, depletion means "the amount used".

4. Analysis material scope

The material scope in was the same in both baseline and proposed design. The LCA analysis included following building elements:

Element	Included	Comment (mark if something is not relevant)
Standard foundations	Yes	
Special foundations	Yes	
Slab on Grade	Yes	
Basement excavation	No	
Basement Walls	Yes	
Columns	Yes	
Beams	Yes	
Floor Construction	Yes	
Floor / Ceiling Finishes	No	Excluded as optional
Roof Construction	Yes	
Exterior and Semi-exterior Walls from cladding to finishing	Yes	Semi-exterior elements attic elements included
Exterior Windows	Yes	
Exterior Doors	Yes	
Roof Coverings	Yes	
Roof Openings	Yes	
Load-Bearing partitions	Yes	
Other Partitions	No	Excluded as optional
Interior Doors	No	Excluded as optional
Fittings	No	
Stair Construction	Yes	
Stair Finishes	No	Excluded as optional
Wall finishes	Yes	Calculated for included walls (exterior and interior load-bearing) only
Parking structures	Yes	
Parking lots	No	

As per LEED v4 specification following elements were excluded from the analysis: electrical and mechanical equipment and controls, plumbing fixtures, fire detection and alarm system fixtures, elevators, and conveying systems, excavation and other site development, parking lots.

5. Description of Baseline building and explanation of equivalence

The baseline was created based on the proposed building design to ensure the equivalence of the proposed design and baseline in all required aspects including same area, location, function, energy performance, and directional exposure. The baseline building was created by changing the material definitions within One Click LCA tool.

The equivalence in energy performance and exposure conditions was ensured by following aspects:

- All alternative enclosure roof, wall and slab materials were modelled with similar R-value / U-value / F-Factor to ensure similar energy loss through the structure
- The size and location of the windows and skylights were kept similar in both models to ensure similar energy loss through the structure
- Structural elements were modelled with required load bearing capacity

Differences between the baseline and proposed building and the evidence in the equivalence in performance are explained in the table below.

Baseline material / construction	Proposed material / construction	Equivalence in performance
External wall concrete, cast-in-place, 3001-4000 psi, average (National ready mix concrete association).	External wall concrete, cast-in-place, 3001-4000 psi, 20% ash, 30% slag (National Ready Mixed Concrete Association)	Same load bearing capacity (4000 psi 5strength), no impact on energy performance, service life is estimated to be as long as building for both baseline and proposed building. Transport distance was also estimated to be the same.
Floor slab, concrete, cast-in-place, 4001-5000 psi, average (National ready mix concrete association).	Floor slab, cast-in-place, concrete, 4001-5000 psi, 20% ash, 30% slag (National Ready Mixed Concrete Association)	Same load bearing capacity (4000 psi strength), no impact on energy performance, service life is estimated to be as long as building for both baseline and proposed building. Transport distance was also estimated to be the same.
Mineral wool insulation batt, R22 (Knauf insulation)	Cellulosic fiberboard insulation (American Wood Council)	The thickness of both insulation options was calculated using the same R-value requirement. Service life was estimated to be the same. The transport distance was estimated to be average for the baseline and 12 ml for the proposed design based on material provider.
Reinforcement steel bars, manufacturer North America average	Reinforcement steel bar, McMinnville mill (Cascade Steel)	Same steel strength requirement was ensured in both cases. Service life was estimated to be the same. The transport distance was estimated to be average for the baseline and 150 ml for the proposed design based on material provider.

6. Description of Proposed building

The proposed building was calculated in One Click LCA based on design data from architectural model which was prepared using Revit. Surface materials were added in the tool based on construction plans. The quality of the input data was estimated to be good.

7. The detailed assessment results

As both proposed design and the proposed design were calculated separately the result tables for both of them are added here separately. Additionally a comparison table of all of the results is shown

Results for the baseline design

Whole-building Life Cycle Assessment, ISO 14040 & ISO 14044 (TRACI 2.1.)

	Sector	Global warming kg CO2e	Ozone Depletion kg CFC11e	Acidification kg SO2e	Eutrophication kg Ne	Formation of tropospheric ozone kg O3e	Depletion of nonrenewable energy MJ
A1-A3	Construction Materials	1,76E6	6,3E0	1,55E4	1,13E3	1,77E5	1,57E7
A4	Transportation to site	1,09E5	2,45E-2	1,5E2	7,5E1	1,35E3	1,56E6
B1-B5	Maintenance and material replacement	1,51E3	1,35E-7	8,12E0	1,76E-1	7,08E1	1,74E4
C1-C4	Deconstruction	9,48E4	1,91E-2	3,59E2	1,23E2	8,32E3	1,27E6
	Total	**1,96E6**	**6,35E0**	**1,6E4**	**1,33E3**	**1,87E5**	**1,85E7**
		Show graph	Show graph	Show graph	Show graph	Show graph	Show graph
	Results per denominator						
	Gross Internal Floor Area (ASHRAE), sqft 4000.0	4,91E2	1,59E-3	4E0	3,33E-1	4,67E1	4,63E3

Results for the baseline design

Whole-building Life Cycle Assessment, ISO 14040 & ISO 14044 (TRACI 2.1.)

	Sector	Global warming kg CO2e	Ozone Depletion kg CFC11e	Acidification kg SO2e	Eutrophication kg Ne	Formation of tropospheric ozone kg O3e	Depletion of nonrenewable energy MJ
A1-A3	Construction Materials	1,35E6	5,46E0	1,41E4	9,91E2	1,65E5	1,32E7
A4	Transportation to site	1,09E5	2,45E-2	1,5E2	7,5E1	1,35E3	1,56E6
B1-B5	Maintenance and material replacement	1,51E3	1,35E-7	8,12E0	1,76E-1	7,08E1	1,74E4
C1-C4	Deconstruction	9,48E4	1,91E-2	3,59E2	1,23E2	8,32E3	1,27E6
	Total	**1,55E6**	**5,51E0**	**1,46E4**	**1,19E3**	**1,74E5**	**1,61E7**
		Show graph	Show graph	Show graph	Show graph	Show graph	Show graph
	Results per denominator						
	Gross Internal Floor Area (ASHRAE), sqft 4000.0	3,89E2	1,38E-3	3,66E0	2,97E-1	4,36E1	4,02E3

Results for the proposed design and comparison

Whole-building Life Cycle Assessment, ISO 14040 & ISO 14044 (TRACI 2.1.)

	Sector	Global warming kg CO2e	Ozone Depletion kg CFC11e	Acidification kg SO2e	Eutrophication kg Ne	Formation of tropospheric ozone kg O3e	Depletion of nonrenewable energy MJ
A1-A3	Construction Materials	1,35E6 | -23 %	5,46E0 | -13 %	1,41E4 | -8,9 %	9,91E2 | -13 %	1,65E5 | -7 %	1,32E7 | -16 %
A4	Transportation to site	1,09E5 | -0 %	2,45E-2 | -0 %	1,5E2 | -0 %	7,5E1 | -0 %	1,35E3 | -0 %	1,56E6 | -0 %
B1-B5	Maintenance and material replacement	1,51E3 | 0 %	1,35E-7 | 0 %	8,12E0 | 0 %	1,76E-1 | 0 %	7,08E1 | 0 %	1,74E4 | 0 %
C1-C4	Deconstruction	9,48E4 | 0 %	1,91E-2 | 0 %	3,59E2 | -0 %	1,23E2 | 0 %	8,32E3 | 0 %	1,27E6 | 0 %
	Total	**1,55E6**	**5,51E0**	**1,46E4**	**1,19E3**	**1,74E5**	**1,61E7**
	Comparing total results with: Baseline design						
	Baseline design Total	1,96E6	6,35E0	1,6E4	1,33E3	1,87E5	1,85E7
	Proposed design compared with Baseline design	-21 %	-13 %	-8,6 %	-11 %	-6,6 %	-13 %
		Show graph	Show graph	Show graph	Show graph	Show graph	Show graph
	Results per denominator						
	Gross Internal Floor Area (ASHRAE), sqft 4000.0	3,89E2	1,38E-3	3,66E0	2,97E-1	4,36E1	4,02E3

8.   Description of One Click LCA calculation tool

The calculations were performed with One Click LCA calculation tool. The software is fully compliant with LEED v4 BD+C manual and "Full Reference Guide LCA text". One Click LCA has been third party verified by ITB for compliancy with the following LCA standards: EN 15978, ISO 21931–1 and ISO 21929, and data requirements of ISO 14040 and EN 15804. You can find the official letters of compliancy here: https://www.oneclicklca.com/wp-content/uploads/2016/11/360optimi-verification-ITB-Certificate-scanned-1.pdf.

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standards: ISO 9001, ISO/IEC 27001, ISO/IEC 17025, EN 45011, and ISO/IEC 17021.