EcoCalculator Assembly Definitions & Assumptions

The ATHENA® EcoCalculator results reflect the assumptions inherent within the ATHENA® Impact estimator for buildings. However, the Impact Estimator offers additional options for many of the assemblies and the basic approach to developing EcoCalculator results was to select assumptions that would be fair in term so assembly comparisons. These essential underlying assumptions are described below. Users wishing to explore other supported options can do so using the Impact Estimator.
http://www.athenasmi.ca/tools/impactEstimator/index.html

Global Assumptions

- The Impact Estimator requires a definition of building type, whether rental or owner occupied and expected life. This affects the maintenance schedule and repair/replacement of certain building assemblies. For the purposes of the commercial EcoCalculator, we assumed an “owner occupied office” building type, either high-rise or low-rise, with a 60-year life, and for the residential EcoCalculator we assumed a “single family residential” building type with a 60- year life
- An assumption was made that all assemblies would be installed in either low- or high-rise office or residential buildings using components and loadings typical for central areas of the United States but with differentiations between locations for the purposes of properly defining assemblies in terms of thermal performance and related code requirements.
- The life cycle stages included in the LCA results include resource extraction, resource transportation, building product manufacturing and component manufacturing (components incorporate two or more building products), transportation from manufacturing plant to building site by various modes, on-site construction, maintenance and replacement of components over a 60-year period, end of life (demolition) effects and transportation to landfill of those materials currently landfilled.
- Commercial buildings’ exterior walls were assumed to have 40% windows by area and residential 20% windows by area.
- All windows were assumed to be inoperable in commercial buildings and operable in residential buildings.
- All window glazing was assumed to be double-glazing with low-E silver coating and argon filled cavity. Viewable curtainwall was assumed to be two panes of 6 mm glazing.
- All concrete (except floor topping) was assumed to be 4000 psi (30 MPa) in commercial buildings and 3000 psi (20MPa) in residential buildings.

- All cast-in-place concrete was assumed to contain 25% flyash in place of Portland cement; although this is not necessarily typical, it was considered more appropriate to use an environmentally beneficial formulation.
- All concrete masonry was assumed to contain 0% flyash, while precast concrete was assumed to contain 10% silica fume in place of Portland cement.
- All gypsum board was assumed to be 5/8" thick regular gypsum board in commercial buildings and 1/2" thick regular gypsum board in residential buildings, taped and finished with two coats of latex paint.
- In commercial buildings, all wood structural panels (WSP) used data for softwood plywood, and in residential buildings plywood and OSB are available as decking and sheathing choices.
- All vapor barriers were assumed to be 6 mil polyethylene.
- All air barriers are assumed to be 1.8 oz/yd^2 polypropolene.
- Rigid insulation used data from closed-cell extruded polystyrene.
- Batt insulation used data from fiberglass batt.

Column and Beam Assumptions

- Live load for structural systems was assumed to be 75 psf/3.6 kPa for commercial buildings and 50 psf/2.4 kPa for residential buildings.
- Commercial bay sizes were set at 30'x30' and residential at 10'x15' for the purpose of assessing columns and beams.
- Commercial column heights were set at 10' and residential at 8'.
- Glulam beams assumed 24F grade (2400 psi allowable bending stress) beams.
- HSS steel columns assumed 5"x5" steel tube, ¼" tube thickness.
- Softwood columns assumed 6"x6" (nominal) built-up columns.

Intermediate Floor and Roof Assumptions

- The live load for roofs was set at 45 psf (2.4 kPa).
- The live load for intermediate floors was set at 75 psf (3.6 kPa) for commercial buildings and 50 psf (2.4 kPa) for residential buildings
- Glulam beams were assumed to be at 24F glulam 4'/1200 mm spacing, supporting 2"x (nominal)/38 mm S/P/F tongue-and-groove decking.
- Wood trusses were assumed to be 2"x4" or 2"x6" (nominal)/38 x 89 mm or 38 x 140 mm solid lumber fastened with galvanized steel nail plates. Trusses were assumed to be spaced at 24"/600 mm o.c. and bridging included at 6'-6"/2000 mm o.c.
- Open web steel joists were assumed to be 4'/1200 mm o.c.
- Precast double-T assemblies were assumed to be 8'/2400 mm wide.
- Steel joists were assumed to be light gauge steel "C" joists, intended for residential use only.

- Composite wood and steel joists (TJM, TJL, TJW and TJH type) were assumed to be 4'/1200 mm o.c. Joist chords were assumed to consist of one or two 2"x4" (nominal)/38 mm x 89 mm wood members with tubular steel webs. Nails and other steel connectors except bridging are included.
- Wood I-joists were assumed to be ½" OSB web with either 2"x3" (nominal) LVL flanges for commercial buildings or 2"x2" (nominal) MSR flanges for residential buildings..
- Solid wood joists were assumed to be 2"x (nominal)/38 mm wood joists (SPF #2 grade) at 16"/400 mm o.c. and include solid lumber bridging at 6'-6"/2000 mm o.c.
- Steel decking was assumed to be 22 ga. 1.56"/39 mm metal deck.
- Concrete topping assumed 3 ½"/89 mm thick concrete reinforced with 6"x6"/150 mm x 150 mm no. 10 metal mesh.
- EPDM roofing membrane assumed ethylene-propylene-diene monomer used as roofing membrane application density of 4.5 kg/m^2 or 92 lbs/square (100 sq.ft.).
- Modified bitumen roofing membrane assumes 2-ply roofing application density of 34 kg/m^2 or 695 lbs/square (100 sq.ft.).

Exterior Wall Assumptions

- Concrete masonry exterior walls were assumed to be standard weight, 8"x8"x16" hollow concrete blocks; every third vertical core was assumed to be grouted and reinforced with one steel bar.
- ICF exterior walls were assumed to be 8" in total thickness with a finished R-value of 20. 4000psi concrete with average (9%) flyash content was assumed; steel reinforcement included; wood sill plates and rough opening framing included.
- Cast-in-place concrete walls were assumed to be 8" thick, with 4000 psi (30 MPa) concrete for commercial buildings and 3000 psi (20 MPa) for residential buildings. Both have 25% flyash content; #5 rebar reinforcement included; allowance for form-ties, wire, etc.
- Concrete tilt-up walls were assumed to be 8" thick, with 4000psi concrete with average (25%) flyash content; #5 rebar reinforcement included; allowance made for CIP steel angle, lifting inserts/accessories, etc.
- Curtainwall assemblies assumed self-supporting grid comprising most of the exterior wall envelope area. Grid system was assumed to be aluminum (100 mm deep mullions) on 2 m centers vertically and 1.5 m horizontally. Provided take-off assumed every vertical mullion in the curtainwall is structurally connected via structural steel at every floor.
- Wood studs were assumed to be kiln dried, 2x6 (nom.). Double top plates and a single bottom plate included. Fasteners included. For residential buildings, there is also one extra corner or nailing stud included every 30 ft.
- Steel studs were assumed to be 1 5/8" x 3 5/8" or 1 5/8" x 6" 20 ga. Studs, top and bottom tracks included; fasteners included.

- Brick cladding was assumed to be standard 7.6"x 3.5"x 2.3" cored clay brick; includes flashing and mortar.
- Steel cladding assumed 26 ga. galvanized steel siding for commercial buildings, and 30 ga. For residential buildings, both with one coat of latex paint.
- Precast cladding was assumed to be 4” thick, with 5,000 psi concrete.
- Stucco was assumed to be Portland cement based traditional stucco with steel mesh reinforcement. Galvanized flashing and 15# felt moisture barrier included.
- Vinyl cladding was assumed to include aluminum flashing and 15# felt moisture barrier.
- Wood siding used data from beveled pine lap siding. One coat of latex paint included.
- All exterior wall rigid insulation was assumed to be extruded polystyrene at R-5 per inch, with thickness dependent on required R-value per ASHRAE 90.1 for commercial buildings and 2009 IECC for residential buildings.
- All batt insulation in exterior walls was assumed to be fiberglass at R-3.13 per inch, with thickness dependent on required R-value per ASHRAE 90.1 for commercial buildings and 2009 IECC for residential buildings.

Interior Wall Assumptions

- Interior concrete masonry walls were assumed to be 8” thick.
- Wood studs were assumed to be 2”x4”, kiln dried. Single top and bottom plates included; fasteners included.
- Steel studs were assumed to be 25 ga, 1 5/8” x 3 5/8”. Top and bottom tracks included; fasteners included.