



ATHENA® EcoCalculator for Assemblies

The building sector is being called upon to help fight climate change by achieving ambitious reduction targets for greenhouse gas emissions while at the same time incorporating other “green” considerations. Life Cycle Assessment (LCA) - which allows the impartial comparison of building designs based on measures such as global warming potential - is an essential part of this effort and, thanks to a new tool, is now more accessible than ever before to mainstream design professionals.

With the introduction of the ATHENA® *EcoCalculator for Assemblies*, architects, engineers and others now have access to instant LCA results for hundreds of common building assemblies. The results embedded in the *EcoCalculator* are based on detailed assessments completed with the ATHENA® *Impact Estimator for Buildings*, which in turn uses Athena’s own widely-acclaimed datasets and data from the US Life Cycle Inventory Database (www.nrel.gov/lci).

Developed by the Athena Institute in association with the University of Minnesota and Morrison Hershfield Consulting Engineers, the tool was commissioned by the Green Building Initiative™ (GBI) for use with the Green Globes™ environmental assessment and rating system. Because of its value as an indicator of climate change impacts, the GBI supported the team’s creation of a generic version for use by the entire sustainable design community. This version, the ATHENA® *EcoCalculator*, is available, free of charge, from the Athena website, www.athenaSMI.org.

Using the EcoCalculator for Assemblies

The *EcoCalculator* can be used for new construction projects, retrofits and major renovations, and for industrial, institutional, office or residential designs, either to compare specific assemblies or to assess all of the assemblies in a structure.

The first step is to select an assembly sheet from one of the following categories:

- Foundations and footings
- Columns and beams
- Intermediate floors
- Exterior walls
- Windows
- Interior walls
- Roofs

The number of assemblies in each category varies widely depending on the possible combinations of layers and materials. Within the exterior wall category, for example, there are nine basic wall types, seven cladding types, three sheathing types, four insulation types and two interior finish options. The number of assemblies for exterior walls represents all viable combinations of these options.

Assemblies are assessed in terms of a range of performance measures: global warming potential, embodied primary energy (fossil fuel depletion), pollution to air and water using EPA TRACI measures, and weighted resource use.

To develop results, the user indicates the square footage (or metreage for Canadian regions) represented by selected assemblies. Users can evaluate multiple assembly types within a category (e.g., exterior walls), in which case their impact measurements will be combined to arrive at a total environmental impact for that category.

Design results are available in tabular form and show real time changes as the inputs are adjusted by the user. This allows different assembly options to be considered in light of their environmental impacts and provides the information necessary to make informed, scientifically-based choices.





Ensuring Fair Life Cycle Comparisons

The ATHENA® *EcoCalculator for Assemblies* is able to generate instant LCA results because each preset assembly has already undergone a lengthy assessment using the ATHENA® *Impact Estimator for Buildings*.

The results take into account:

- Resource extraction and processing
- Product manufacturing
- On-site construction of assemblies
- All related transportation
- Maintenance and replacement cycles over an assumed building service life
- Structural system demolition and transportation to landfill

Operating energy effects are covered in whole building LCA, but are not included in the *EcoCalculator*. Where the tool is used as part of a green building rating system, these effects are covered elsewhere.

To ensure fair comparisons between assemblies, the following assumptions were made:

- Results are presented on a per unit area basis (e.g., per square foot), but the *Impact Estimator* software actually took into account much larger quantities, such as 1,000 linear feet of wall.

- Installation for all assemblies was assumed to utilize components and loadings typical for central areas of the United States.
- It was assumed that all assemblies would be used in “owner occupied office buildings” with a 60-year lifespan - which affects the maintenance and repair/replacement schedules of relevant building envelope materials (e.g., roofing membranes, claddings and window systems).
- Other specific assumptions covered factors such as:
 - Window-to-wall ratio
 - Concrete strength and flyash content
 - Gypsum board type and thickness with latex paint
 - Live load for all intermediate floors, columns and beams, and roofs
 - Bay sizes
 - Column heights
 - External wall thicknesses depending on construction system
 - Stud size/strength and spacing
 - Sheathing and decking materials

The Athena Institute is a non-profit organization dedicated to the sustainability of the built environment - a goal that can only be achieved by meeting the building community's need for better information and tools. Through offices in Canada and the United States, the Institute furthers the use and science of LCA through groundbreaking software, world class databases and customized consulting services, and by working collaboratively with the international research community.