



Estimating Energy Use Early and Often

The Problem

Building designers can use computer software, such as DOE-2 and EnergyPlus, to evaluate potential energy-saving measures. However, preparing the input in a way that accurately represents the proposed building and its energy-efficient features is a costly, labor-intensive process. As a result, energy analysis is often postponed to a later point in the design process, resulting in a greatly reduced number of cost-effective options for boosting efficiency than if it had been considered from the start.

The Solution

The Green Building Studio (GBS) is a free web-based service that enables building design teams to integrate whole building energy analysis into the early stages of the design process. Architects and engineers use their existing computer-aided design (CAD) systems to communicate the project's building geometry to the GBS web site, which conducts an energy analysis of the building design.

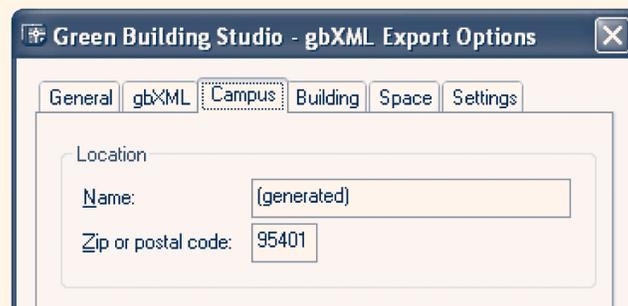
Features and Benefits

GBS enables the design team to look at the energy impact of early decisions, compare alternatives, and share information more broadly than in conventional design practices.

Building energy model. The heart of the system is an open data format called Green Building XML (gbXML), a simple means of sharing data between 3D CAD and energy simulation software. Designers construct their early building design model from their own 3D-CAD system, and then they use gbXML and some simple user inputs to export a building energy model (**Figure 1**). Most commonly used CAD systems are now compatible with gbXML, which is based on Extensible Markup Language (XML). Compatible systems include Autodesk Revit 6, 7, and 8; Autodesk Architectural Desktop 3.3, 2004, and 2005; Autodesk Building Systems 2004 and 2005; Graphisoft ArchiCAD 8.0, 8.2, and 9.0; and Bentley Architecture & HVAC. In addition, major HVAC manufacturers accept gbXML input directly into their energy analysis packages.

Energy analysis. The gbXML export from CAD feeds an energy model that is automatically developed through the use of regional building standards and codes, which enable the GBS system to make intelligent assumptions about items such as insulation and lighting levels. The resulting building description then goes through a DOE-2.2 hourly simulation using typical-year weather

Figure 1: Exporting the building energy model
Specifying the building's ZIP code informs Green Building Studio about its location and allows the system to select appropriate weather, solar, and building equipment parameters.



data for the building's location. The simulation generates estimates for annual energy consumption, costs, and a wide range of data on heating and cooling loads (**Figure 2**, page 2).

Comparing alternatives. Designers can revise the CAD model and rerun a simulation to compare the energy impact of design options such as window types, wall insulation levels, building orientation, multilevel versus single-level designs, and other building geometry considerations that come up early in the design process.

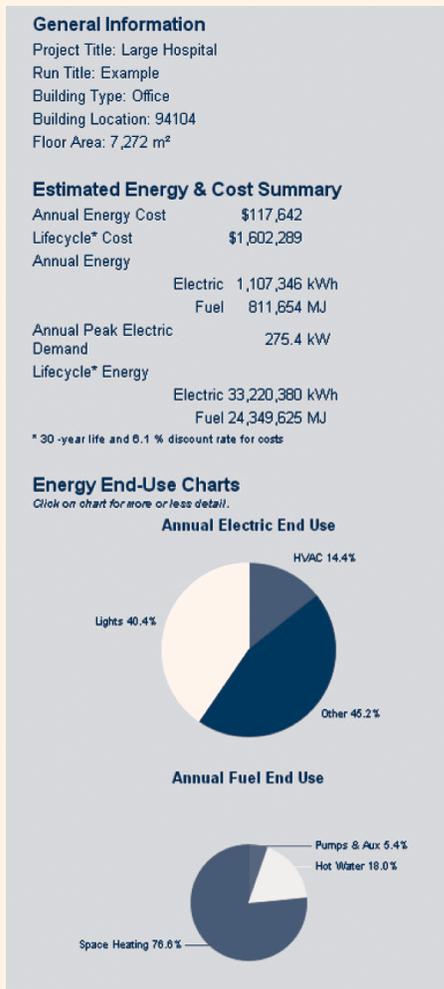
Information sharing. The GBS also facilitates direct sharing of detailed project and building data with engineering firms, which can then run the information through detailed design software, use it to specify equipment, and share it with other parties such as bid preparers and manufacturers of building products.

Saving time on plan takeoff. GBS also makes it easy to go to the next step by creating detailed input files for more-comprehensive energy analysis by DOE-2 and EnergyPlus. The files are created in minutes—a process that could take one to two weeks using plan takeoff or engineering services. Using this capability can reduce the cost of preliminary and downstream building design by \$5,000 to \$10,000 or more.

Product Advisor. The GBS also features a Product Advisor that enables the service to continue to be offered free of charge. Each building project that goes through the GBS provides the design team with relevant product information as early in the process as the planning and schematic design stages. Using a web-style bidding and paid placement approach as well as a building

Figure 2: Energy analysis results

The Green Building Studio energy analysis presents building energy performance in a form that can be viewed online or printed to share with a client.



relevance filter, the system sends highly targeted building component advertisements to the building designer's desktop in the GBS Product Advisor screen. These advertisements are linked to building product libraries online, providing targeted advertising placement for product manufacturers and project-appropriate information for the design team.

Applications

GBS is best suited for use in new construction and major renovation of commercial or residential buildings of any size. It is currently enabled only for facilities located in the United States.

About PIER

This project was conducted by the California Energy Commission's Public Interest Energy Research (PIER) program. PIER supports public-interest energy research and development that helps improve the quality of life in California by bringing environmentally safe, affordable, and reliable energy services and products to the marketplace.

Arnold Schwarzenegger, Governor

California Energy Commission

Chair Joe Desmond, Vice Chair Jackalyne Pfannenstiel

Commissioners: Arthur H. Rosenfeld, James D. Boyd, John L. Geesman

For more information see www.energy.ca.gov/pier

California Codes and Standards

The GBS analysis helps ensure that the basic building design meets local codes. For facilities in California, the system also performs an analysis using building equipment assumptions based on the Savings By Design program—a utility-run effort to improve building efficiency. This option can be used to compare a Title 24-compliant building and a high-efficiency alternative.

What's Next

The PIER program is currently funding the development of a Design Alternatives feature for GBS that will allow users to run parametric studies without entering a new CAD model for each variation. Other plans include adapting the system for use with existing buildings and adding the capability to analyze buildings internationally.

Collaborators

GBS was developed by Green Building Studio Inc. with funding from the PIER program and from the California utilities (Pacific Gas and Electric, Southern California Edison, San Diego Gas & Electric, and The Gas Company) that support the nonresidential new construction program Savings By Design.

For More Information

Reports documenting this project and providing more details may be downloaded from the web at www.energy.ca.gov/pier/final_project_report/500-02-038f.html.

To access the Green Building Studio, go to www.greenbuildingstudio.com.

To view Technical Briefs on other topics, visit www.esource.com/public/products/cec_form.asp.

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