BIM and the Autodesk Green Building Studio

The whitepaper explores how the Autodesk® Green Building Studio® service allows architects to more easily evaluate the carbon "footprint" of a Revit-based building design using the new Green Building Studio plug-in for Revit.

Since buildings account for 70% of electricity consumption[1] and 39%[2] of greenhouse-gas emissions, it's clear that reducing the carbon footprint of the built environment is critical to improving our environment. The 2030 challenge (*www.2030.org*) and the rise of LEED® (*www.usgbc.org/leed*) and other green building certification systems are visible examples of the building industry's commitment to sustainable design.

The ability to perform whole building energy, water, and carbon emission analyses early in the design process is essential for sustainable building design. The Autodesk Green Building Studio service allows architects—the majority of whom are not specially trained in these analyses—to more easily evaluate the carbon "footprint" of a building design using the Green Building Studio plug-in for Revit as part of the BIM workflow.

Analyzing a Building Design

A computable Revit design model is a great fit for the analyses needed for sustainable design—even during schematic design. As soon as the layout of a building's walls, windows, roofs, floors and interior partitions (elements that define a building's thermal zones) are established, the information used to create a Revit model can be used to perform whole building analyses.

Performing these analyses in a CAD workflow is a fairly difficult undertaking as the CAD model has to be exported and carefully massaged to work with analysis programs. In addition, most analysis software is complex and requires special training—making it unsuitable for occasional users like architects or designers. And the output of most analysis programs is complicated, making it hard for architects or designers to understand what to do to improve upon their designs.

Using the Autodesk Green Building Studio web-based service to analyze building designs within the BIM workflow greatly simplifies this process.

[1] Source: U.S. Department of Energy

[2] Source: U.S. Energy Information Administration

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Autodesk Green Building Studio

The original Green Building Studio web-based service was first introduced in 2004 and by 2007 its analysis results had met ASHRAE Standard 140 and were certified by the U.S. Department of Energy. The service was even awarded the *Microsoft Ingenuity Point Award* in 2008.

Built specifically for architects and using gbXML for easy data exchange across the Internet, the web-based service was one of the first engineering analysis tools to deliver easy-to-use interoperability between building designs and sophisticated energy analysis software programs such as DOE-2.

The link between the Revit platform and the Green Building Studio web service, now an Autodesk product, has been streamlined through a plug-in that enables registered users to access the service directly from their Revit design environment.

Inline Energy Analysis

The Autodesk Green Building Studio web-based service allows users to perform fast, whole building energy, water, and carbon emission analyses of a Revit-based building design. These analyses can be performed by architects directly over the Internet from within their own design environment. This streamlines the entire analysis process and allows architects to get immediate feedback on their design alternatives—making green design more efficient and cost effective.

Based on the building's size, type, and location (which drives electricity and water usage costs), the web-based service determines the appropriate material, construction, system and equipment defaults by using regional building standards and codes to make intelligent assumptions. Using simple drop-down menus, architects can quickly change any of these settings to define specific aspects of their design; a different building orientation, a lower U-value window glazing, or a 4-pipe fan coil HVAC system for example.

The service uses precise hourly weather data, as well as historical rain data, that are accurate to within 9 miles of a given building site. It also uses emission data for electric power plants across the United States and includes the broad range of variables needed to assess carbon neutrality.

Usually within minutes, the service calculates a building's carbon emissions and the user is able to view the output in a web browser, including the estimated energy and cost summaries as well as the building's carbon neutral potential. Users can then explore design alternatives by updating the settings used by the service and rerunning the analysis, and/or by revising the building model itself in the Revit-based application and then rerunning the analysis.

The output also summarizes the water usage and costs and electricity and fuel costs, calculates an ENERGY STAR score, estimates photovoltaic and wind energy potential, calculates points towards LEED daylighting credit, and estimates natural ventilation potential. Unlike most analysis output, the Autodesk Green Building Studio report is very easy to understand—giving architects and other users the actionable information they need to make greener design decisions.

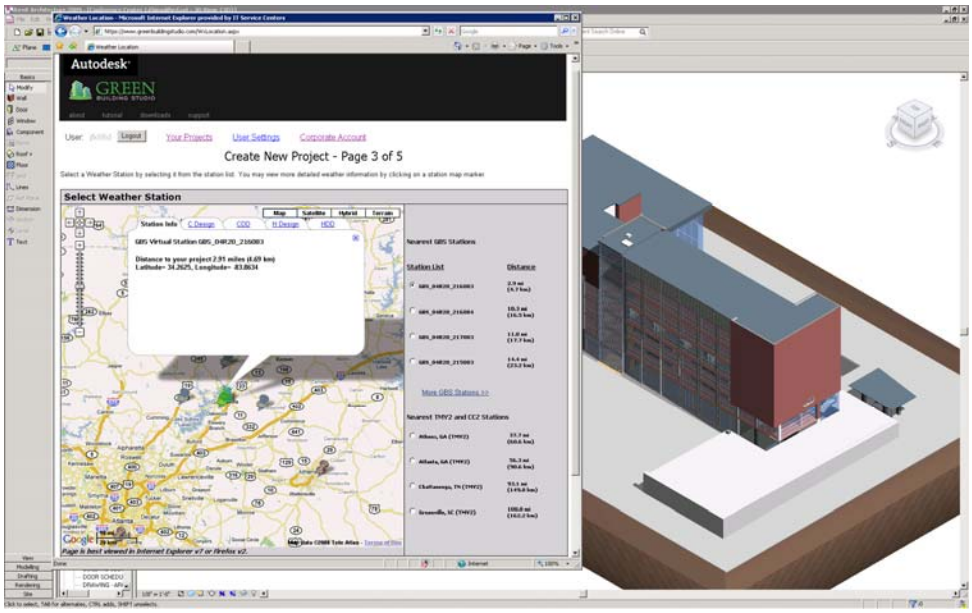

Figure 1:

The Autodesk Green Building Studio web-based service enables fast, whole building energy, water, and carbon emission analyses of a Revit –based building design. The building location (being defined here) drives the resulting electricity and water usage costs.

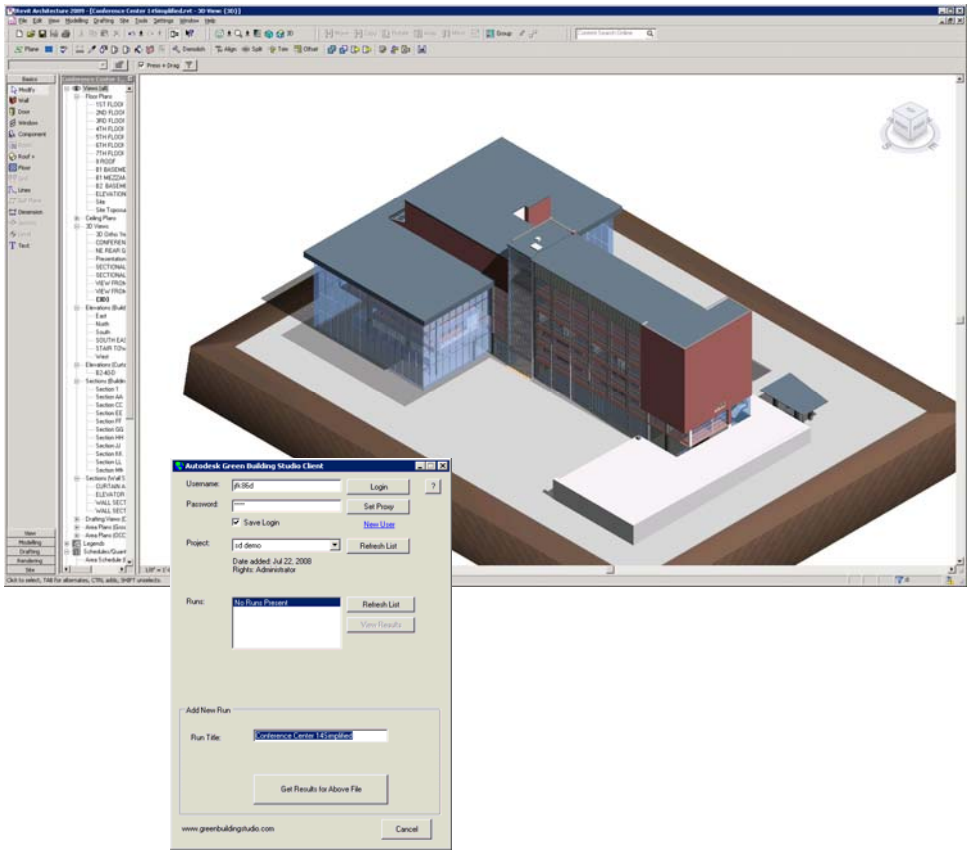

Figure 2:

The link between the Revit platform and the Autodesk Green Building Studio web-based service has been streamlined through a plug-in that enables registered users to access the service directly from their Revit design environment.

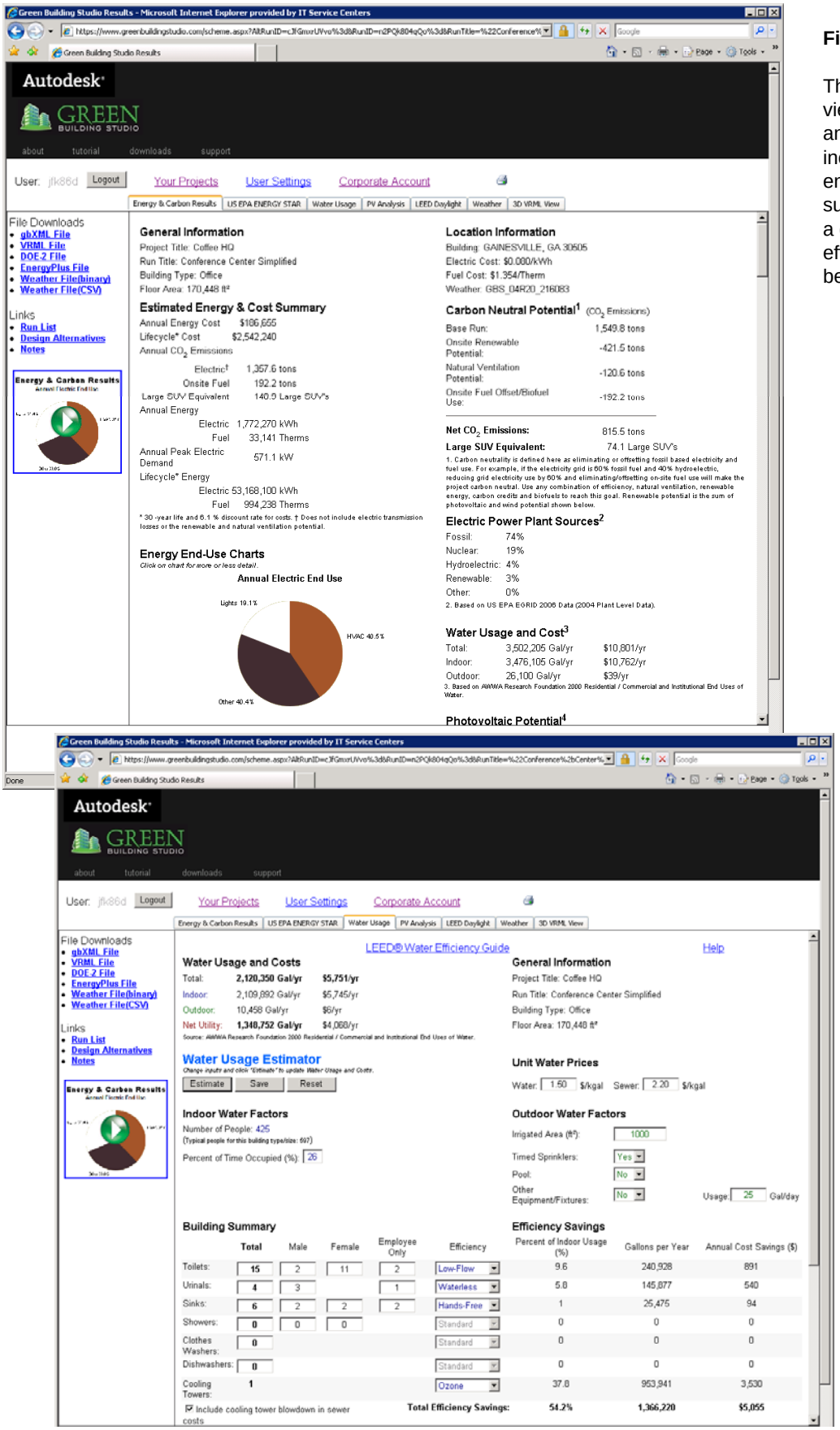

Figure 3:

The Revit application user views the output of the analyses in a web browser, including the estimated energy and carbon emission summaries (shown left) and a detailed LEED water efficiency guide (shown below).

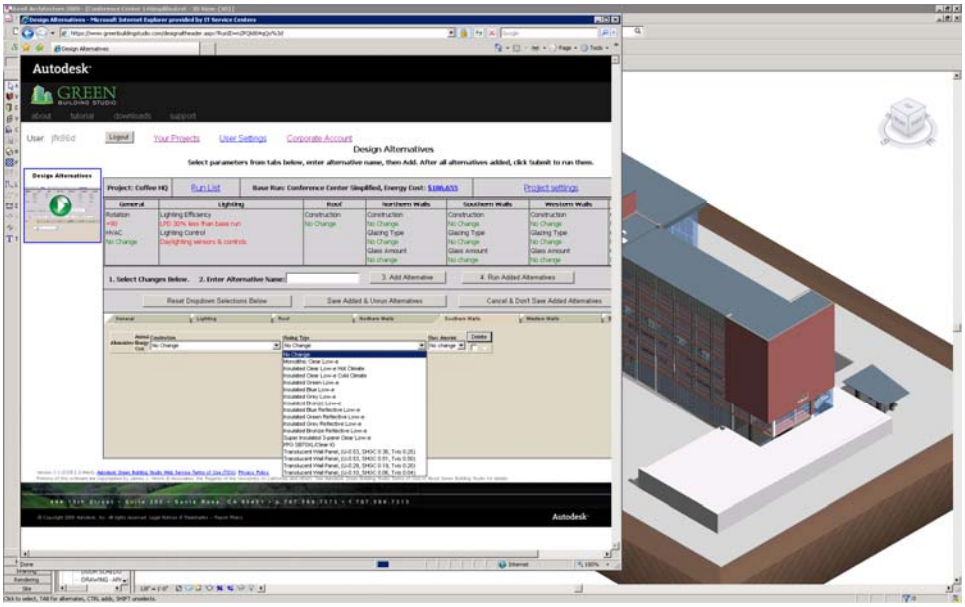

Figure 4:

Architects and other users can then explore design alternatives by updating the settings used by the web-based service and rerunning the analysis, and/or revising the building model itself in the Revit-based application and then rerunning the analysis.

Autodesk Green Building Studio in Action

Van H. Gilbert Architect PC (*www.vhgarchitect.com*) is a full service architectural firm providing planning, architecture and interior design services. This 28-person firm, headquartered in Albuquerque, New Mexico, has been using Revit Architecture since 2006. Good design practices—including cost-effective sustainably measures—are the foundation of the client-centric firm. The firm wanted to analyze their Revit designs but had no energy analysis expertise and only a few LEED-accredited architects, so in 2007 they turned to the Autodesk Green Building Studio web service and the firm now uses it on every conceptual design.

“We like the simple user interface and web-based analysis software of the Autodesk Green Building Studio web service,” remarks Stephen Smith, IT Director. “It allows even our less technically-inclined members of the firm to analyze their designs and make decisions regarding energy usage early in the design process—when it can have the greatest impact—and it prompts early collaboration with our MEP partners as well.”

For example, one of the firm’s current projects is a new elementary school, being designed as a High Performance (HiP) School in the harsh climate of southern New Mexico. One of the architects on the project began using the service for the first time and, in less than a day, reduced the design’s energy use and carbon emissions by nearly 50%. All the architect had to do was submit the Revit design model for analysis, run a baseline analysis and then try out a few slight design adjustments—selecting the highest possible window glazing rating or increasing the insulation in the south-facing wall for example. “The results were impressive,” exclaims Smith. “It’s like taking nearly 30 Hummers off the roads.”

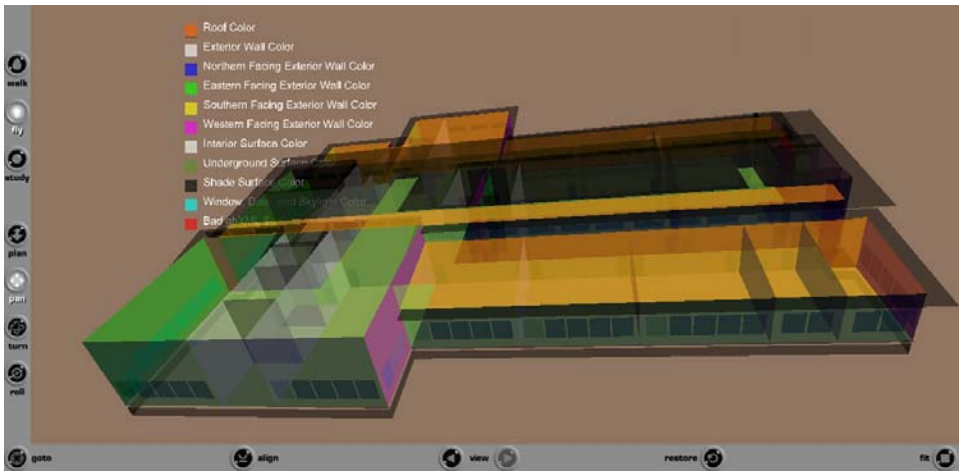

Figure 5:

The link between the Revit platform and the Autodesk Green Building Studio web – based service enables designers at Van H. Gilbert Architect PC to analyze their own designs (such as the school building shown here as a thermal model) and make decisions regarding energy usage early in the design process.

Summary

The high-quality, computable design data resulting from a Revit for BIM workflow and the easy-to-use whole building energy analysis provided by the Autodesk Green Building Studio web-based service work in combination to reduce the cost and time to perform energy modeling and analysis.

This integration enables architects and other users to optimize the energy efficiency of their designs and work toward carbon neutrality earlier in the design process—a key ingredient not only for incorporating energy efficiency into standard building design practices but also for mitigating the carbon footprint of our built environment.

About Revit

The Revit platform is Autodesk's purpose-built solution for building information modeling. Applications such as Revit Architecture, Revit® Structure, and Revit® MEP built on the Revit platform are complete, discipline-specific building design and documentation systems supporting all phases of design and construction documentation. From conceptual studies through the most detailed construction drawings and schedules, applications built on Revit help provide immediate competitive advantage, better coordination, and quality, and can contribute to higher profitability for architects and the rest of the building team.

At the heart of the Revit platform is the Revit parametric change engine, which automatically coordinates changes made anywhere — in model views or drawing sheets, schedules, sections, plans… you name it.

For more information about building information modeling please visit us at *http://www.autodesk.com/bim*. For more information about Revit and the discipline-specific applications built on Revit please visit us at *http://www.autodesk.com/revit*.

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