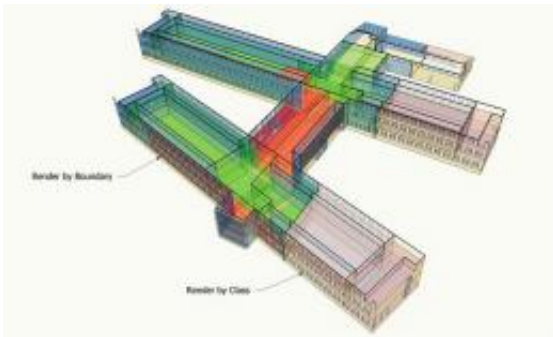


# OpenStudio visualizes energy use in buildings

March 9 2011, By Heather Lammers

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OpenStudio leverages Google Sketch-up to create 3-D building geometry. Designers used the program to create energy models for NREL's Research Support Facility. Credit: Roger Hedrick, Architectural Energy Corporation and David Goldwasser, NREL

Look around you. Odds are, you are indoors reading this story using a computer or mobile device, perhaps sipping on a favorite cup of coffee. If you are indoors at this moment, you're draining energy from one of the largest consumers of energy in the U.S. -- a building.

Together, residential and commercial buildings account for a staggering 40 percent of [energy use](#) in the United States. However, the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) is developing a suite of tools to tame this energy beast — and it is free to anyone who wants to use it.

Whether retrofitting existing buildings or designing new buildings, energy modeling is a core component to changing a building from an energy guzzler to an energy sipper. "It's much cheaper to run an energy model than it is to build the wrong building or do the wrong retrofit," said NREL Senior Engineer Nicholas Long.

DOE's [EnergyPlus](#) is a powerful simulation engine that provides comprehensive building energy modeling. NREL is working to add tools to EnergyPlus, via its OpenStudio Application Suite, to improve overall functionality and make EnergyPlus easier to use.

## **New Tools Help Carve out Energy Savings**

"The easiest way to describe OpenStudio is a wrapper on top of EnergyPlus," Long said. "OpenStudio handles the building geometry, building envelope, plug loads, people and daylighting, along with many other inputs. It adds all of that data into one big massive engine and spits out results. Industry professionals will find that OpenStudio will help them quickly and easily analyze the energy use in their buildings."

The first version of OpenStudio was released in 2008 and is a plug-in that leverages Google SketchUp, a user-friendly 3-D drawing program. "OpenStudio was originally developed so people could view and edit geometry for EnergyPlus models," NREL OpenStudio Developer David Goldwasser said. "We've now expanded it to be able to view and edit a lot of the other attributes of EnergyPlus building models, for example putting in loads like lights, equipment and simple HVAC systems."

"OpenStudio goes a long way towards easing workflows for industry professionals," said Larry Brackney, NREL manager for analysis tools in commercial buildings. "We've enhanced it and there are a slew of new features — some of which NREL has developed and some of which we are just leveraging from Google and their massive investment in

SketchUp."

The new suite of OpenStudio tools includes the SketchUp plug-in plus:

- **ModelEditor** which provides users with a simpler way to edit the building model. It includes a way to access components that don't have a physical representation in a building, like a mechanical system.
- **ResultsViewer**, a way to review EnergyPlus simulation data in a graphical format. It allows users to look at the data, draw conclusions and compare results.
- **RunManager**, an application to run simultaneous simulations. This powerful tool can be used to run simulations on a desktop, computer cluster or even a super computer. Designers can compare results between differing models to see where the best energy savings can be achieved.

The OpenStudio plug-in also heavily leverages a feature in SketchUp called Match Photo which uses photographs of a building to create a 3D model — almost effortlessly. Once the 3D model is finished, users can use the plug-in to trace over windows and doors for EnergyPlus' use in running an energy model. It's a tool that developers believe fills a need, especially for crews planning a building retrofit. "I see Match Photo as a killer app because this is an area that's not been well served in the market," Brackney said.

"We really appreciate Google's integration goals. We think that with a lot of the things they are connecting — like Google Earth and Building Maker and SketchUp — there is collaboration between all of these technologies. It is creating this rich set of building geometry models that we can use for energy modeling. There's a great synergy there between what they are doing and what we are trying to do."

## Open Source Makes User Customization Easy

Although collaboration with Google is important to the NREL development team, more important is collaboration with OpenStudio users.

"OpenStudio uses open source code so if someone wants a feature that we don't have the time or the funds to write, there are two options," Goldwasser said. "First, they can write that code and submit it to us. We look at it and decide if it gets accepted and works with what we want. Another option is for them is to use an API [application programming interface] and 'plug-in' to our software and write applications without changing our code."

OpenStudio is made available to anyone under the GNU Lesser General Public License, which allows third-parties to easily integrate the functionality into their applications without requiring them to contribute their code back. "We're not selling this product, it's free. And, what's nice about it being open source is that someone can integrate it into their workflow," said Brackney.

For users, "our goal at NREL is to help people design buildings that are more efficient so that we use less energy," added Brackney.

To show how easy it is to develop an API to "plug-in" to OpenStudio, NREL developed a simple API for Heating, Ventilation, and Air Conditioning (HVAC) modeling. "SystemOutliner is a graphical user interface for constructing HVAC systems, which has been one of EnergyPlus' Achilles' heels," Brackney said. "It's an awesome example of how quickly users can build a very deep, meaningful user interface to OpenStudio that meets a real need."

"The key is all about accessibility, making the notion of doing energy

modeling more and more accessible and eliminating the excuse for not doing energy modeling."

Another potential barrier to using any new software is training; but NREL has seen to the user's needs here as well. "We have extensive online video tutorials on how to use the new OpenStudio tools to help get users up and running sooner," Long said.

In fact, the OpenStudio Web site and YouTube Channel have nearly two hours of videos that walk users through differing workflow applications for the program. The site also has full documentation for the API and source code to browse, and it is continually being updated by NREL staff.

"What's great is that if I get a lot of questions on a certain subject, I can add in documentation on the fly and I don't have to wait for the next release," Goldwasser said.

There is also a user's forum moderated by NREL for people to post questions and ideas for OpenStudio.

"The user support we provide is incredible," Goldwasser added. "We provide a quick response, and if it's a valid question, it might result in a new training video."

"I'm really pleased with the way NREL is approaching this software development," Brackney said. "We've got a full-blown software development team using rigorous software development process to produce a quality product that people can use to see if there are any other [energy](#) savings they can squeeze out of their buildings."

**More information:** [openstudio.nrel.gov/](http://openstudio.nrel.gov/)

Provided by National Renewable Energy Laboratory

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