Energy modeling and building simulation has become an important tool for the design, construction and operation of buildings today. Designers are incorporating building simulation models into every stage of design to help make performance-based decisions. Projects seeking certification for the USGBC’s LEED rating system are documenting performance through energy models. Everyone from architects, engineers, consultants, educators to researchers is working with simulation modeling tools.

What is the best building simulation software? That depends on what you want to study. There are a lot of software tools available, which range from application specific to whole-building analysis. The DOE has a simulation tool directory where you can get a comprehensive list of simulation tools with a general description, recommended application and pros and cons. It’s at http://apps1.eere.energy.gov/buildings/tools_directory/. There are hundreds of software platforms listed, and it’s difficult to know where to get started.

**Comparison of Simulation Software Packages**

*eQuest®, EnergyPlus, Ecotect®, Trane Trace™ 700, and IES<VE> are a few of the most widely used building simulation programs. The following software reviews are based on our testing, and recommendations are based on our experience.*

**eQuest®** is one of the most popular modeling platforms available today. The free program is based on the DOE 2.2 simulation engine and features wizards that allow almost anyone to create an energy model. The program is simple to operate and easy to learn, and executes simulations quickly. Parametric reports are easily generated as well as a 3D graphic representation of the model. eQuest was created for California Title 24 compliance and is not formatted for the ASHRAE Performance Rating Method (PRM) used for LEED compliance.

Among the program’s deficiencies, it lacks ability to study detailed infiltration or natural ventilation and has limited daylight analysis. It is a great tool for simple buildings, massing models and parametric analysis. It is recommended for the beginner modeler or users who don’t use simulation software frequently. The program is not ideal for detailed simulations of complex buildings where whole-building analysis is necessary.

**EnergyPlus** has an online modeling tool that can be used for a simple parametric study or massing analysis in minutes. It’s at http://apps1.eere.energy.gov/buildings/energyplus/cfm/inputs/index.cfm. EnergyPlus weather data can be used by almost any simulation program. The Department of Energy frequently updates this data, and real-time weather data is also available. It’s at http://apps1.eere.energy.gov/buildings/energyplus/weatherdata_about.cfm.

**Ecotect®** is an Autodesk® product that provides a 3D graphical interface that allows for analysis of solar, thermal, lighting and acoustics. The tool is very good for developing and analyzing conceptual massing models and performing parametric analysis. As with most 3D represented modeling software tools, graphical representations tend to lead to unnecessary detail that can often make simulation and analysis slow and difficult. Ecotect relies on other software for energy analysis such as Green Building Studio and EnergyPlus.

This program is best applied by the designer working through qualitative conceptual decisions. The interface to third-party simulation tools for energy analysis does provide the ability to do high-performance simulation in concept, but often fails in reality, as the model made for qualities analysis is not the same model needed for energy analysis.

**Trane Trace™ 700** is an HVAC-based simulation tool that can be used to design building systems and analyze energy performance. The program is most commonly applied by MEP designers and requires knowledge of system design and controls to use effectively. The program is an excellent >
tool for ASHRAE ECB/PRM compliance as baseline templates, and pre-formatted reporting features are included in the package. Trace lacks the graphical representation necessary to analyze daylighting, solar shading and other qualitative aspects.

The program allows for Revit models to be imported through the gbXML schema. However, this method rarely works well, as Revit models are too detailed.

Trace is not a good conceptual design tool and requires training and experience to use effectively. Trace is best applied by engineers designing HVAC systems and for creating ASHRAE ECB/PRM simulations.

**IES<VE>** is a full-building simulation tool that features 3D model building, solar shading, thermal simulation, daylight simulation (radiance integrated into the program), bulk airflow simulation (infiltration and natural ventilation), and computational fluid dynamics modules.

The program is an advanced suite that allows designers the ability to holistically review building designs. The program is integrated with Revit and Google SketchUp, which is convenient for conceptual analysis. The program is expensive compared to other packages we’ve reviewed, but it is modular so you can purchase only what you need. IES<VE> requires training and full-time use to master. It is recommended for power users who are performing advanced building simulations.

There are many other software packages that have outstanding capabilities, but no software I’ve tested or reviewed is a complete package. All of these programs are built around the most common scenario, and it’s important to understand how to manipulate the software and analyze results. If you are looking to purchase a modeling software package, consider the depth of analysis you need, the capability of your analyst and the frequency you’ll be using the software. It’s not uncommon to use multiple software platforms at different phases of design.

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