

Energy Performance Simulation: Measuring and Verifying Your Expectations

By Matthew Higgins

For the last 40 years, Energy modeling has been used to various extents, with early versions of software having no more capability than a very basic spreadsheet. Today energy modeling programs are used for many purposes and range from simple spreadsheets to interactive three-dimensional Building Information Models (BIM). While energy modeling was intended to be used to evaluate design alternatives, recently, much of the energy modeling that is performed is done in order to prove energy efficiency. This trend is likely due to recent requirements enacted for green building certifications, federal tax credits, and application for Recovery Act funds. Nevertheless, whether models are to be used as design tools or compliance mechanisms, energy modeling is playing a larger role across all sectors of new and existing building industries.

Many modern modeling tools are shedding previous limitations and bringing capabilities far beyond what many of today's projects actually require. Whether evaluating the effectiveness of natural ventilation, thermal comfort or acoustics are pertinent to your building, models are making it possible to evaluate likely outcomes of capital investments before they are made. And as industry tools improve, the findings from them are becoming increasingly reliable, allowing for more confident energy efficiency capital investments. While this confidence is growing in new construction projects, modeling is equally valuable and applicable to existing buildings in equipment replacement and retrofit scenarios. With this added confidence, owners can begin to evaluate different design alternatives, and with measurement and verification, see the effectiveness of chosen Energy Conservation Measures (ECM).

Measurement and Verification (M&V), as its name suggests, is the process of measuring building energy usage and verifying it against design phase or energy audit ECM predictions. This process allows owners and design professionals to not only understand the accuracy of predictions, but more importantly, once they are in place the process verifies the return on investment of capital investments in energy efficiency. And while M&V is important to the individual buildings in which it was implemented, the lessons learned from the process can be applied elsewhere to determine whether chosen ECM's are worth investing in, in other buildings of the same type. For more about M&V, the *Efficiency Valuation Organization* has provided guidelines for energy professionals, as a framework to execute concise M&V protocols involving energy modeling and the use of data loggers.

However, the most valuable protocol is a hybrid approach, using both energy models and data loggers to verify where energy is being used. This combination highlights energy usage patterns beyond what utility providers are reporting in monthly bills. This hybrid approach also determines a building's energy profile, separating how much energy is being consumed by an individual end-use, such as lighting or HVAC (see Image 1). In an existing building, this combination can be utilized to inform equipment upgrade and replacement decisions based on where the most energy is being consumed. While this



approach may sound expensive, and can be, manufacturers are beginning to meet the need for affordable and easy-to-use loggers, making the process easier to initiate.

To become more familiar with these concepts, national benchmarking tools such as Energy Star's Target Finder let building owners compare how efficient new and existing buildings are, or are likely to be. Using Energy Star's Portfolio Manager, buildings can be tracked in Energy Star's online database as a simplified method of M&V, allowing owners to catalog building performance against Energy Star metrics for efficiency. If buildings receive an Energy Star score of 75 or higher, using these tools, they are eligible to receive an Energy Star label and plaque signifying energy efficiency in the 75th percentile for buildings of that type. If a building does not receive an Energy Star Rating, detailed energy modeling and M&V can be used to investigate why, highlighting what can be done to bridge the gap between current and targeted energy performance.

With increased global attention paid to energy and energy accountability, the current concern for these high-dollar components of owning and operating a building needs to be strengthened. Because while many jurisdictions are not yet experiencing mandatory building labeling programs, such as ASHRAE's proposed Building Quotient, energy-stingy buildings are already coming forward as models for their counterparts. For the few programs that are already in place, less performing buildings are also in view, making clear who needs to focus more on eliminating energy waste.

For building owners and operators, cataloging the performance of their buildings, energy modeling and M&V are the best tools. Together, this combination will help eliminate energy waste while preparing for the accountability associated with building labeling and usage-based energy rates. Owners that see the benefit of these measures now may also reap the benefits of significant energy cost savings and the prestige of an Energy Star Label, as well as benefits from energy-saving tax credits and rebates.

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IMAGE 1
(From: eQuest - Energy Simulation Program)

