Primera

ENERGY MODELING 101:

Save Money on Your Next Buildings Project

BY: KEVIN RIEMER, EIT

As humanity progresses, it's becoming more and more crucial to consider energy efficiency in engineering design, not only to meet energy code, but also to sustain the planet. During my 4+ years with Primera, I have served as the lead energy modeler in the Buildings division. I strive every day to ensure energy efficiency is at the forefront of our design process. Despite its importance, not many people know about energy modeling, and even fewer people know how to incorporate it throughout a project. **The goal of this article is to educate the reader on the basics of energy modeling and to bring awareness to a vital facet of the buildings industry.**

Energy modeling uses software to simulate the performance of an entire building throughout a full year of operation. Primera prefers eQUEST software, but there are other options such as IES and EnergyPlus. For every energy modeling project, there must be two different energy models. The first one is called the baseline model. This energy model is constructed completely under the direction of the energy code (ASHRAE 90.1). The code provides a set of instructions for how to build the model based on the building size and type in the project. The baseline model is eventually compared to the second energy model in the project, called the proposed model.

"For every energy modeling project, there must be two different energy models."

The proposed model is the energy model which is constructed according to the project team's design. It uses the architect's building envelope, the mechanical team's HVAC systems, the lighting designer's lighting loads, the electrical team's plug loads, etc. At the end of the project, the proposed model is compared to the baseline model. Each model is simulated over a full year, assuming the same occupancy and weather conditions, and a total energy cost is calculated based on expected utility rates. If the proposed model's energy cost is lower than the baseline model's energy cost, the team's design out-performs the energy code, and the building can be constructed. If it performs worse than the baseline mode, the design must be re-evaluated.

There are typically four phases of energy modeling during a project:

1. **Early Phase**
2. **Design Development**
3. **Construction Documents**
4. **Construction**

At the end of each phase, sometimes multiple times per phase, the energy modeler creates a report to update the client on the status of the energy analysis. These reports serve as building blocks for the final report issued after the completion of the construction documents phase.

During early phase, an energy modeler usually consults with the architect to assist them in determining the most energy efficient building envelope for the project. This can be done using eQUEST, or other early phase energy modeling tools such as Slipstream or Cove.tool. This high-level energy simulation manipulates the building envelope to reveal the most efficient configuration.

Once the design development phase is underway, the other engineering teams get started on their designs. Because most of the details needed for the proposed model are not yet known, the energy modeler

will focus on building the baseline model according to the energy code throughout this phase.

In the construction documents phase, the engineering teams are well on their way to completing their designs. It is during this stage that the energy modeler begins the proposed energy model. To save time, the best practice is to create a copy of the baseline model so that the building envelope won't need to be reconstructed and only the inside components of the model need to be altered. This phase is the most time-consuming for the energy modeler. The proposed model often has a lot of nuances that require great detail to round-out. The baseline model may require revisions if factors change, or additional information needs to be added. Once the models are complete, the energy modeler writes a full report on the findings of the energy analysis. This report includes a summary of the building parameters, methodology of the analysis, screenshots of important inputs from within the energy modeling software, as well as the results.

The construction phase marks the end of the project for the energy modeler. It usually doesn't require much work, if any, to the models. However, there are times when pieces of equipment might be changed, requiring energy model revisions. In that case, the modeler can revise the proposed model as needed and re-simulate to verify that the proposed design still beats the baseline model.

"The construction phase marks the end of the project for the energy modeler."

As time goes on, energy codes are becoming more and more stringent in an effort to promote energy efficient designs, proving that energy modeling is an integral component of any design project in the buildings industry. It is multi-faceted, involved in every project phase, and will dictate important design decisions for the team. Therefore, it is important that project teams consider energy efficiency a critical part of the design process.

About The Author

KEVIN RIEMER, ENERGY ENGINEER

Kevin Riemer, EIT is one of Primera's leading mechanical engineers and energy efficiency experts. His expertise is the result of nearly five years of experience highlighted by energy efficient and sustainable designs as well as serving as the mechanical engineer on LEED design projects. Kevin specializes in commissioning, energy efficiency, and energy modeling. He has provided commissioning and energy services for a wide range of facilities and clients in various sectors including higher education, K-12, commercial, and residential. His background mostly includes new construction, renovations, and additions throughout Illinois.

Primera