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Exploring Building Energy Use Modeling

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EXPLORING BUILDING ENERGY USE MODELING

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INTRODUCTION: THE WHY

OBJECTIVE: The project objective was to analyze and test building energy use modeling software programs to find a quick and easy to use tool that can be implemented in the early stages of design. A list of programs was developed and narrowed down based on criteria important to architects in early design stages. Programs were tested and rated using a weighted crite–ria formula. Recommendations for capabilities and user interface of future energy modeling programs were made. This research is aimed at creating a methodology that makes it easier to analyze new energy modeling tools as they are developed in the coming years.

POTENTIAL PROGRAM SELECTION CRITERIA

WHOLE BUILDING ENERGY SIMULATION

LOAD CALCULATIONS

HVAC SYSTEMS

PARAMETRICS & OPTIMIZATION

ENERGY CONSERVATION MEASURES

MODEL INPUT CALIBRATION

PLATFORM

CODE COMPLIANCE

RATINGS AND CERTIFICATES

UTILITY BILL AND METER DATA

WEATHER DATA & CLIMATE ANALYSIS

BUILDING ENERGY AUDTING

BUILDING ENERGY BENCHMARK

LIGHTING SIMULATION

INDOOR AIR QUALITY

LIFE CYCLE ANALYSIS

DETAILED ENVELOPE SIMULATION

SOLAR AND PHOTOVOLTAIC

ELECTRICAL SIMULATION

WATER USE ANALYSIS

PRICING/FREE

PROGRAMS

During any phase of the design process, energy modeling can provide valu–able information. Narrowing down which program is best suited for your particular needs can be a difficult process. It is important to decide what criteria are most important.

What are the most important criteria for you?

Programs should....

1) Give output categorization by usage category and by building assembly, which allows the designers to compare systems and assemblies.

2) Contain reasonable default values and assumptions for basic energy–modeling parameters, which removes the burden of determining details unknown in the current design stage.

3) Allow the designer to change parameters quickly in order to run comparative models showing the relative effects of change.

4) Give month–by–month or annual outputs.

5) Allow the designer to see the parameters used in any given model, so they may check for typos or incorrect assumptions.

THE DESIGN PROCESS

Conceptual Design

Skilled modelers might quickly assemble a simplified model of the building, per–haps with a single zone per major occupancy type, which can be used to test the effects of site location, building massing and orientation.

Schematic Design

Energy modeling allows those involved in the design process to optimize their focus on the most promising energy saving strategies. Seeing how the energy consumption of a building breaks down by fuel type, task and building component allows the design team to focus on the major drives of energy use.

Design Development

Energy modeling permits parametric studies to be done. Eliminations of para–metrics is a diagnostic technique that allows a better understanding of the ener–gy use impact of each building component. A series of simulations are done that sets one component of energy use to zero at a time. When the results are viewed, a clearer picture of of building energy use emerges.

Construction & Document

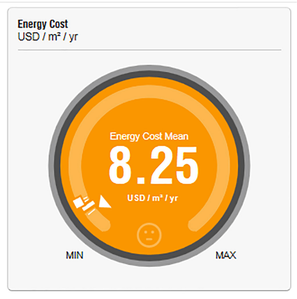
During the construction phase, energy modeling allows comparison of the pro–posed design with the code minimum base case. This happens to some extent when we do the modeling for LEED compliance.

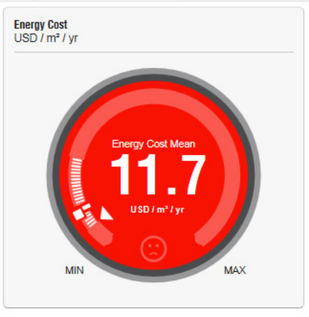
Post Occupancy Evaluations

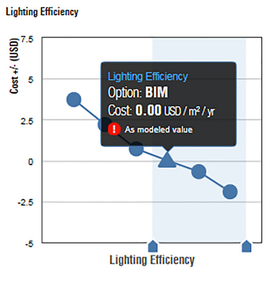
POE surveys give the designer an opportunity to compare the digital modeling data done throughout the design process to observable results once the project is completed. Recalibration of an energy model using actual usage data can be used to increase accuracy for future models.

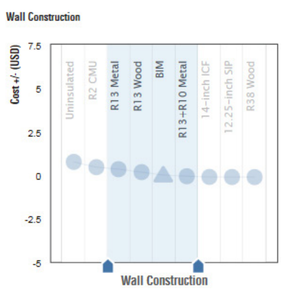
ANALYZING OUTPUTS

The Relative Effects of Design Changes

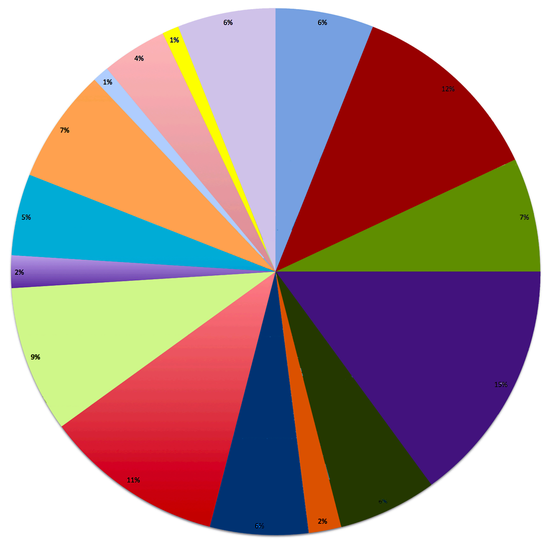








WEIGHTED CRITERIA



- Geometry & Output Comparisons
- Thermal Comfort Analysis
- Daylighting Analysis
- Full–year Hourly Analysis
- Accurate
- Quick Changes
- Quick Availability of Results
- Imports Model Geometry
- Contains Default Values for Building Assembly Details
- Precise
- Units Can Be Changed
- Training Resource & Help File Quality
- Natural Ventilation Analysis
- User Interface
- Cost

COMPARING THE RESULTS