Creating an Energy Model of 41 Cooper Square

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Introduction

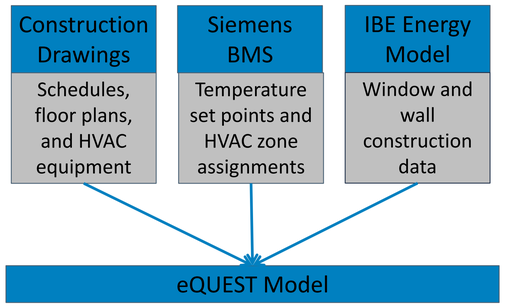
The building simulation tool eQUEST was used to create an energy model of 41 Cooper Square (41 CS). An energy model is a virtual model of a building that simulates energy use for the entire year.

Energy modeling is usually used during the design phase to evaluate design choices like building orientation, window position and glazing, and HVAC equipment efficiency.

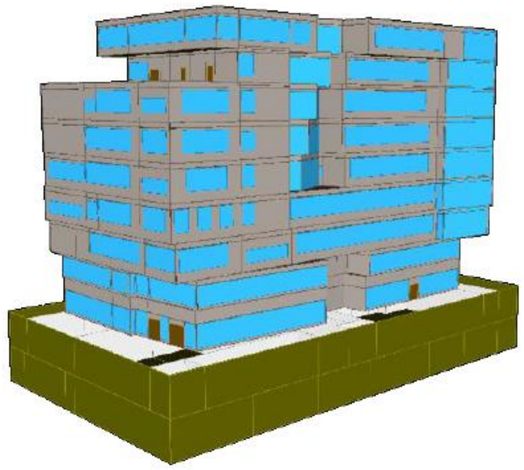
IBE Consulting Engineers created an energy model of 41 CS in 2006 using the software VisualDOE, which uses the same computation engine as eQUEST.

Method

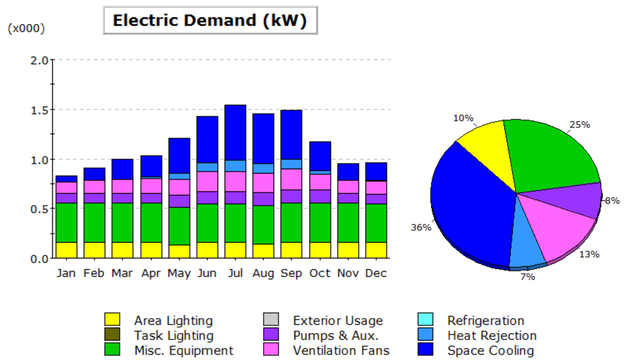
The data entered into eQUEST for 41 CS comes from three main sources:



Data is manually entered into eQUEST. When the model was fully populated, it was simulated and eQUEST generated reports on energy usage.



The graph on the right compares the annual utility (combined gas and electric) costs for the IBE model, eQUEST model, the actual cost for 41 CS in 2011. The IBE model significantly under-predicted the actual energy usage, mostly due to incorrect assumptions about how much the building would be used. The eQUEST prediction is much closer to the actual energy usage; it over-predicts energy consumption by only 9%.

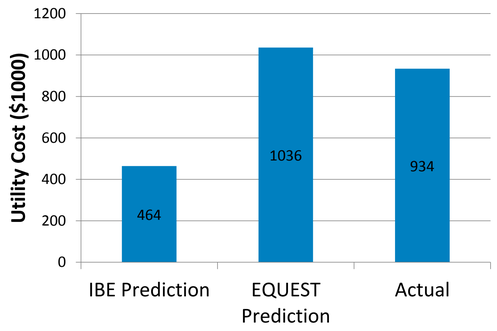


Annual Electric Bill: $904,000

Results

Once the eQUEST model was sufficiently populated with information from the construction drawings, Siemens building management system (BMS), and IBE model, energy usage simulations were performed successfully.

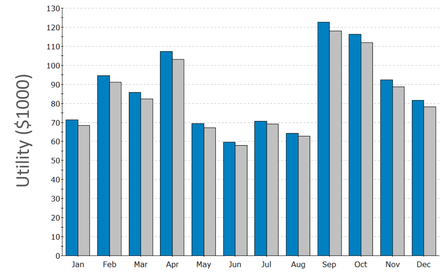
EQUEST generates many different reports on building energy usage, such as monthly and yearly utility bills and energy consumption by end use. The accuracy of the eQUEST energy model was evaluated by comparing the predicted annual utility bill to the actual utility costs for the building.



The graph and chart to the left are part of the simulation output for the eQUEST model. They break down the electricity consumption of the building into specific systems within the building. From these graphs it is apparent that space cooling and miscellaneous equipment (plug loads) are the largest consumers of electricity, so any energy saving measures applied to these systems would have a large impact on the total energy consumption of the building.

Sensitivity Analysis

A sensitivity analysis was performed using the Parametric Run feature in eQUEST. The following graph shows monthly utility costs for 41 CS for two different thermostat set points.



Cool: 72°F and Heat: 72°F (actual building set points)
Cool: 76°F and Heat: 68°F

Changing thermostat saves: **$38,000** annually

Future Work

The eQUEST model can be used to analyze current building operation and to look for potential energy saving opportunities. More sensitivity analyses, like the thermostat set point analysis shown above, can be performed easily with the Parametric Run tool within eQUEST.

Sensitivity analyses could be performed for laboratory ventilation, cogeneration, blinds, lighting power density, or any change in building operation that might affect energy usage.

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