Simulation Aided Design for High Performance Buildings

March 8, 2011

Should we create a new standard for the use of building energy simulation software during the design process?

- We have almost reached the limit of prescriptive building energy standards.
- We want higher performance buildings and those often use simulation during design process.
- Owners would be able to hire consultant and know what they are getting.
- Consultants would be able to describe simulation design services to the non-technical.
- Software vendors could help automate required simulations.

Title Purpose and Scope

The ASHRAE process for creating a new standard involves providing the title, purpose and scope of the standard to a committee that is responsible for writing the document. Since the title, purpose and scope are, in effect, the new committee's marching orders they must be crafted carefully. The following draft is a starting point but comments are welcome to make the new standard as useful as possible.

Title: Simulation Aided Design for High Performance Buildings

Purpose: Provide a list of required measures to be simulated during each stage of the building design process.

Scope: The design of all new commercial buildings.

The proposed new standard would describe a methodology to incorporate building energy simulation into the design process. It would contain descriptions of specific measures to be assessed. The standard would describe a way of using simulation during the design process and would allow energy consultants to claim using a specific procedure when making recommendations.

With beyond energy code programs, such as LEED and GreenGlobe, as well as tax incentives, the interest in using energy simulation during the building design process is greater than ever before. Different energy consultants, architects and engineers using building energy simulation have many sources of information about how to use building energy simulation but may have very different approaches on how to apply it to the design process. The standard would provide building owners with the assurance that a minimum set of simulations were performed and considered for the building. This is especially valuable to a building owner due to the technical nature of building energy simulation being outside their field of knowledge.

Currently, the use of simulation only at the end of the design process may be wrongly interpreted as a building that has benefited from the use of simulation to help make design decisions. Instead, those simulations are simply used to quantify the energy savings of a fixed design against a baseline, such as Standard 90.1 Appendix G. The use of building energy simulation throughout the design process offers many advantages by the consideration of options on the overall shape and orientation of the building, choices between different system options and major equipment types, fenestration systems including shading, etc. So many decisions that are made during the traditional design process seldom benefit from the knowledge of predicted energy use of various options and lead to far from optimal choices. The use of energy simulation from the earliest stages of a building concept would help assure full incorporation of energy efficiency in the completed building.

With an increasing emphasis on energy conservation and a limit being nearly reached on prescriptive standards such as Standard 90.1 and 189.1, performance oriented standards such as the one being proposed may have an important role in building design in the future. The proposed standard would not circumvent minimum standards such as 90.1 but would help supplement the design process and could be used alongside Standard 189.1.

The Design for Performance section lists the simulation based comparisons that are performed during the stages of the design process. The list of simulations may vary by building category. This could possibly have several grade levels with "A" being the most comprehensive. A lower grade of "D" would require just a few different options be considered at each point. The section would consist mainly of tables for each building category such as office, retail, school, single family residential, high rise residential, etc. In each table, the measures that need simulation for each grade level and each stage of the design process would be provided. The details on each measure are shown in the Library of Measures section.

The Library of Measures section would describe each of the referenced simulations from the Design for Performance section. The simulations would be described in enough details to create input representations of the measures but not tied to a specific simulation program. If the measures only apply to certain portions of the building model or specific categories of building use, that would be also shown. Program developers could provide additional guidelines specific to their programs that correspond to each library item and provide implementation details. It is possible that a Users Guide could be developed and sold by ASHRAE to provide this for common simulation programs.