BIM and Energy Software Analysis

NET-ZERO ENERGY BUILDINGS EXPERT ROUNDTABLE II

Sustainable architect Bruce Haxton and *ED+C* senior editor Michelle Hucal, organized a Net-Zero Energy Building (NZEB) Expert Roundtable: BIM and Energy Analysis Software teleconference to investigate some of the issues uncovered in the first NZEB Roundtable conference (see *ED+C*, July 2010).

Twenty industry professionals answer critical software and building information modeling (BIM) questions, including:

- What energy analysis software is used in the design of NZEB?
- When was the software used during the design process and for what purpose?
- To what extent is BIM and energy analysis software interface integrated?
- What are the energy software and BIM companies developing for the future?

Hosted by Russ Drinker, of Perkins+Will, San Francisco, the teleconference focused on software developers and users, but conferees also included owners, users, architects, engineers, contractors and consultants.

The two project teams that supplied recent NZEB built experience include:

- U.S. Department of Energy's National Renewable Energy Laboratory's (NREL) Research Support Facility in Golden, Colo. (proposed LEED Platinum three-story, $64 million facility with 218,000 gross square feet); and
- The Aldo Leopold Legacy Center, Baraboo, Wisc., a LEED Platinum, net-zero energy, carbon neutral facility (the four-building complex totals 12,000 square feet).

Software manufacturers Autodesk, Bentley Systems, IES and NREL share their expertise in the design and analysis of NZEBs, extending from existing buildings to new facilities.

The full transcribed teleconference and additional resources are available at www.EDCmag.com. The following are excerpts that best illustrate important information on NZEB energy analysis.

NREL Energy Analysis

Haxton requests the NREL team discuss energy analysis software and energy modeling for the new NREL Research Support Facility (RSF).

Ron Judkoff: NREL and some of the other National Labs have a whole team of people who currently work together on EnergyPlus development. The National Lab work is foundational in that we create the simulation tools and algorithms many others use.

In the case of the RSF, modeling helped us determine the energy target that we set. We used a combination of modeling and data from projects we had monitored across the country to help us determine that the 25 kBtu/ft^2/yr was challenging but practically achievable.

David Okada: Before we even got together as a design-build team, Stantec took the RFP [request for proposal] and we did some reality checking of our own. It was clear right away that lighting and daylighting were absolutely critical. We used some of the daylighting components in IES Virtual Environment. And we also did some preliminary energy calculations in eQUEST to make sure we were going in the right direction before we even got to that initial charrette.

We continued on through with AEC doing the daylighting in Radiance, Stantec doing the energy modeling in eQuest, natural ventilation simulations in IES, and also some calculations using LBNL's THERM program. We layered that into our eQUEST calculations to modify the construction values of the walls and such so that we were taking into account the potential thermal bridging conditions. And then we started getting into some pretty significant work-around calculations that were essentially done in giant Excel spreadsheets to calculate the performance of our rather intricate heat-recovery strategy for the project.

Craig Wheatley: Picking up on Ron Judkoff's point about performance or energy modeling being part of the design process to help inform good low-energy decisions — let's not beat about the bush. This approach is very much at the crux of achieving net-zero energy facilities, and there is definitely a need within the industry to think about the design process and analysis in an entirely new way, not just modify existing practices.

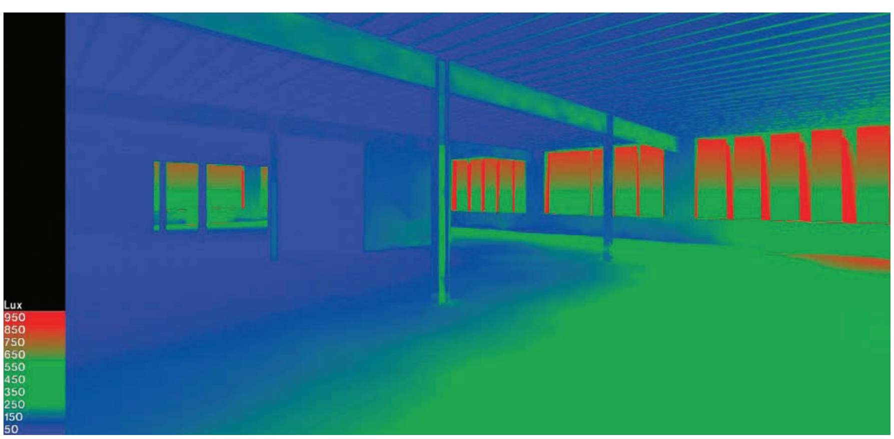
The approach we're talking about is that climate needs to be the starting point. Basic building design must be climate responsive, or the passive systems won't work, and the mechanical systems won't be small enough to be powered by renewable energy. Deriving the building form from an energy performance perspective, as described here, is really the only way to reduce energy demands/building loads enough.

Cost Analysis

Haxton asks conferees to address costing into the future software.

Allan Daly: Having the cost estimator play a role early on is very important. Certainly, improved windows will increase performance, but at what cost? So you certainly need to have that in your equation, and you need to do so early on.

Ron Judkoff: That's why we have an effort here at NREL to create optimization meta-programs that can sit on top of the calculation engine itself. OptEPlus is our optimization program that goes along with EnergyPlus for commercial buildings. BEOpt is our optimization program that goes along with DOE 2 for residential buildings, and it can also talk to TRNSYS when needed. The human engineer is then free to explore other ideas for even more creative and cost-effective energy savings that may not be covered by the optimization software.



ENERGY ANALYSIS, IMAGE COURTESY OF ARBA STUDIOS (VIA AUTODESK).

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Adam Hirsch: We at NREL and other DOE labs are now working on a series of 50 percent energy-savings guides. At NREL, we are using the optimization framework to study trade-offs between energy savings and cost to try to help provide advice for the industry on broad-brush approaches to hit 50 percent energy savings for major commercial building types.

Haxton requested that Russ Drinker and his Perkins+Will team describe how their team used some of this software on their projects.

Russ Drinker: As architects, we are primarily using Autodesk Ecotect software in our projects to understand how to optimize building performance. We model the building concepts in Ecotect early on and have found the program to be very useful to inform strategies for such concerns as massing, orientation and daylighting. Of course, we are also working closely with our engineers from the beginning of the design effort, and they are using a variety of software programs, as well.

Zaki Mallasi: There are two approaches for energy analysis undertaken, and each is utilizing the appropriate tool.

The first is to understand the energy target tools early in the project. And here the designer can have a 3D prototype model. (I call it a prototype model because we are experimenting with the building mass, the building form, shadow range studies, the size and location of ... climatic conditions.) We are trying to understand and agree on certain targets that we want this building to perform within.

We have been utilizing Green Building Studio from Autodesk, which can incorporate a simple Revit massing model. And therefore, we can study and compare the amount of glazing and window sizes. The tool produces easy-to-use reports regarding the energy and carbon results. It is worth mentioning here that output results from Green Building Studio are approved for documenting data for tax credit (IRS Code 179D).

In this first stage of utilizing the energy analysis tools, our goal is to formalize a measureable understanding of the energy targets. We're not proposing a solution for a building scheme yet. Instead, we are trying to understand and make the designer aware of the situation of the building and the specific size and climate.

The second stage occurs when the project progresses into design development phase (early construction documents), where the design team begins to advocate certain solutions. In this approach, a sustainability analyst works with the design team do test design options utilizing a more-detailed 3D prototype model. (We utilize Ecotect primarily for our analysis at design development.)

One of the important things in the future of BIM technology is that energy analysis tools that look at the project from an analytical point have to communicate with energy-modeling tools. That means a new generation of designers and technologies out there that would allow the architect and designers to formulate the basic energy model to perform basic analysis. And then the same information can be utilized by the mechanical engineer for adding more systems and mechanical devices to fine-tune the performance of the building, perhaps apply some optimization to the model.

Russ Drinker: We are really pushing the limits of the capability of Ecotect to fine-tune the design through all phases. We want to assure that we're optimizing the penetration of daylight into the space and minimizing heat gain and glare. We use the program to help us evaluate alternatives for shaping the ceilings, configuring the shading systems or active façades, and determining the glazing assemblies. … Every project is staffed by a team that is thinking about sustainable design, and LEED accredited and trained, and conversant in Ecotect. We make broad use of Ecotect right from day one. One of the first tasks on any project is to use Ecotect to understand the site climatic conditions for solar orientation, wind, etc.

Perkins+Will created 2030e2 and has made it available for anyone to use through our website (http://2030e2.perkinswill.com). It's really meant to be a simple analytical tool. It's oriented to North America because of the data that's in there; we're continuing to add data and expand its usefulness.

Zaki Mallasi: Basically the user will input the energy of the building square footage — how much they want to reduce the building energy use. The tool will forecast the energy use baseline so that it can be compared with other design options for a similar region. It's a Web-based application that takes you through five or six pages. You input the building information or the project information, the region, the building type, and it guides you through a "'quick and dirty" forecast of how much the energy use baseline can be.

Aldo Leopold Legacy Center Energy Analysis Software

Haxton asks the Aldo Leopold Legacy Center project team to describe energy analysis software as used on the project.

Joel Krueger: We were charged with building a building that represented the Aldo Leopold ethic. It all starts with, How does one live on a piece of land without spoiling it? This thinking as a baseline brought big questions to the table for Buddy Huffaker, the director of the Legacy Center. He didn't come to us saying he wanted a LEED Gold building. He came to us saying he wanted a carbon-neutral building. He wanted a net-zero building. He wanted a LEED rating. But it wasn't important that we pick the rating as a target. He was talking about bigger issues. Understand that this was in early 2004 — we're talking about carbon issues, but there really weren't many tools available for us to begin that whole process.

Without going into great detail on the architecture, our design process begins with understanding the visions and the needs and wishes of the client and how they live and work. So we go through a significant pattern-writing process. Even before there's a program for the building, we find a way to understand how the existing site might impact the project, where are the existing energy sources (such as the sun), how the people that live in the building behave, and on and on. Even before we considered energy issues, we were spending a lot of time on the site understanding what the site brought to us and brought to the project. So again, it starts with, for us, a very big challenge and a well-informed client who didn't understand what carbon neutral meant in detail, but knew that it was important and that it would be something that we needed to consider and measure.

Russ Drinker: One of the things I would like to throw on the table for discussion: When we talk about carbon neutral and zero-net energy, we're not including embedded energy in these discussions, right? I'm just curious to what extent this comes up in discussions with the design teams and with clients.

Mike Utzinger: When we had the first major meeting with the design team, the client and the commissioning agent at the end of the programming phase, the issue of what carbon neutral meant did come up. We decided that, while the carbon emissions due to the actual materials that were going into construction were critical and not necessarily to be avoided, at that particular time (the winter of 2004-2005), we didn't believe that the construction industry had in place tools that would make it very easy to track the carbon footprint of manufactured goods, as well as concrete, which would be easier to track.

I had spent some time prior to that meeting studying building energy performance, going through the six case studies that NREL had published, and I visited the Woods Hole Research Center, which had an energy utilization intensity (EUI) of roughly 17,000 kBtu per square foot per year.

We set the Woods Hole energy utilization intensity as a goal for our building. A solar array that would produce about 50,000 kilowatt-hours would be required to balance the building energy demand. I should also point out here that this building is very small — 13,000 square feet gross total, of which only 10,000 square feet is actually mechanically ventilated and conditioned.

With those decisions, the design team produced a building that would require about 75 percent less energy than a typical code-minimum building. We integrated CAD and energy simulations tools separately. The CAD tool SketchUp was used to model solar access, shading and solar control. We used TRNSYS, which is most similar to EnergyPlus, to model energy use in a rather pragmatic way.

David Bradley: I think one of the important things to point out early is that we didn't have a process when we went into this. Our focus at Thermal Energy System Specialists (TESS) is entirely on energy modeling, but this project was not only the first carbon-neutral building that we had worked on, it was to some extent one of the most complete whole-building analyses that we had ever done.

We had set about trying to integrate energy modeling into the larger design process. We also wanted to integrate all of the pieces of the energy design in one software tool. We chose TRNSYS in part because of our prior level of experience with it but much more because of the near total flexibility it offers in putting systems together and the relative ease with which new models can be added to its libraries.

We needed a tool that offered us as much flexibility as possible. And while we started out doing some models to inform building massing, load minimization, shell tweaks, windows studies, etc., I must say that the architect had done a very, very thorough job of coming up with a building that didn't really require all that much of the early sort of site analysis.

Very early on we started looking at an analysis not only at the building shell but also of subsystems. In some ways, the question that we were trying to answer, even at this stage, was whether these subsystems were going to work at all.

We found ourselves using the energy model to look at these sensitivities and found ourselves developing models of occupant behavior within the space. From that point, we moved from learning about how the building operated into development of sequences of operation.

In many ways, instead of starting simple and getting more and more complex with our energy model, we began with a detailed model of a very small subsystem in the building. Once we proved that would work, we added another detailed model to it and so on until we had the whole building modeled and a deep understanding of its workings. For example, once we proved that radiant floors were going to provide acceptable comfort in heating and cooling, we turned our attention to ventilation. We preconditioned air using earth ducts or using energy-recovery ventilators.

Mike Utzinger: There were two places we were looking at occupants integrated in the building operation: light operation and natural ventilation. Occupants control the lights with manual switches. This approach is used in a couple of other buildings that I worked on with The Kubala Washatko Architects. We measured lighting use in those buildings and used the measured result to come up with a simulation model of occupant control. What we had to do in the simulation model was to somehow figure out how to turn the lights on and off, assuming that that was somehow modeling the occupant. So we actually didn't write a model of an occupant, but we made a decision that, in general, occupants adjust lighting depending upon outside conditions, and we set up a step function based on the ambient solar radiation level. We had basically three steps: one-third, two-third, and all on.

Light use in the building was metered. Our model estimated annual lighting energy use at roughly 12,000 kilowatt-hours. The actual measured energy use from the occupants controlling the lights was around 7,000 kilowatt-hours.

Haxton asks TKWA to describe the future of analysis.

Mike Utzinger: CAD software is better connected to thermal simulation tools now. However, there is still much work to be done. The plug-in software for CAD to Thermal Simulation translation is currently one-way. The CAD tools can provide 3D building geometry to the simulation program, but material properties of walls and occupant schedules added in the simulation model do not translate back to the CAD program. BIM modeling is not yet seamlessly integrated into the thermal analysis programs. So there are some improvements since the Aldo Leopold Foundation Legacy Center was designed five years ago, but we still have a long way to get a building BIM database that can be accessed and modified from CAD, thermal simulation programs and illumination modeling programs.

EHDD Design

Haxton asks the EHDD team describe how it designs its net-zero energy buildings using BIM and energy analysis software.

Scott Shell: We've found that the energy models are definitely not the same as reality, so our design teams have really been focusing on actual real measured energy use rather than just modeled energy. We've completed a handful of zero-energy buildings and the monitoring always turns up something unexpected.

In addition to the unpredictability of user behaviors, the way the building is outfitted and operated has varied a lot more than I would have expected. After the Chartwell School was completed, someone donated an old commercial 48-inch freezer from their restaurant. And then the school's security recommended they keep all of the site lighting on at night because they are on a remote site. And then the irrigation system wasn't getting enough pressure, so they installed the five-horsepower irrigation booster pump. And then a few faculty members felt it was distracting to the students to have the blinds open and kept them closed, short-circuiting the daylighting scheme.

On a number of projects, we've added a new phase to our work after commissioning to focus on the building in use. To measure the energy use — at least at the system level, compare that to our predictions, and see what isn't working as expected.

One way we've tried to address this issue is to use both an energy model and to try and find a strong set of comparable facilities with measured energy use to use as a benchmark. On the other hand, on Chartwell School, it turns out our benchmarks that we selected were not accurate and led us to undersize the photovoltaic system.

Allan Daly: On the Chartwell School, these issues started to come out little by little and gather momentum. At the point when the project started, we'd done quite a bit of standard energy modeling where we compared one simulated case to another to help inform design decisions. We call this relative analysis because the results are always relative to some base-case model. But when we started to talk about absolute energy performance goals in the real world, like getting to zero, it made us think off the bat that we needed to do energy modeling in a different way. In retrospect, we should have done it in a much more substantially different way because we didn't quite get it right the first time.

We recognized that to go beyond relative modeling and start to predict actual absolute performance, we needed to do some kind of benchmarking of our model to figure out if the simulation results were reasonable and believable. We started to realize that getting our models to predict believable absolute results might be difficult because we know that energy models are only as good as the input data we enter. It's the classic garbage-in-garbage-out situation.

We performed benchmarking of the models based on some school data sets that we had available to us at the time. The benchmarks did not represent an appropriate set of buildings for us to compare ourselves to. They were simply too low, and because we scaled our models to these low values, in the end, our models under-predicted the actual energy use of the built campus.

The project and post-occupancy work has been a real learning process for us. The next time that we go back to the start of a zero-energy design process, we'll have much better understanding of value that a properly executed benchmarking exercise can give to the modeling work. In general, we do benchmarking much more carefully now, and in fact, we'd like to see the development of better databases and better tools to allow us to do benchmarking in even more relevant, useful ways for our models.

Scott Shell: The other key point I'd like to make is how our use of BIM is affecting the building design and daylighting. The speed with which we're now able to do early design modeling has allowed us to look at architectural design issues in a much more facile way. It lets us very quickly test numerous options and look at the sun shading and daylighting.

George Loisos: Our work on the Chartwell School project consisted of working with Scott Shell to help understand how daylight could be used to provide task light for the classrooms. While we did not use BIM-based models on this project, some of the work we did prepared us for the work we have been doing for the last couple of years where we use BIM-based projects with good success.

For this work, we created the geometry of the building into input files for native Radiance. We use Radiance in its native form, as opposed to software that has a front end for Radiance like Ecotect because we want to make sure that we have complete control of all the different variables that control the simulation.

George Loisos: Our approach to computational fluid dynamics is a little complex. One of the things that we have learned about it is that there's a significant number of variables that one needs to define to have a robust simulation, and we have not been able to find yet a reliable method for error checking to ensure that our simulations are accurate.

Bruce Haxton: The follow up question to that is, Do you do displacement air conditioning for large places using something other than computational fluid dynamics?

George Loisos: We use EnergyPlus for that, and so far, we've had relatively good success with that. The EnergyPlus algorithms are based on first principles.

David Bradley: EnergyPlus, I believe, builds an airflow model written at LBNL called COMIS into the building's thermal solution engine. TRNSYS has a link to COMIS as well as a link to a bulk airflow modeling tool called CONTAM written by National Institute of Standards and Technology. Both of these are bulk airflow modeling tools, and what they try to do is to perform a pressure balance on the zones of the building.

However, we've had occasion to carry out some experiments on natural ventilation flow within rooms and were able to verify that the modeling assumptions we had made were pretty decent. It sounds as though George Loisos had the same experience — that you can get pretty-reasonable-looking results that match reality pretty nicely, even though these are quite simplified mathematical tools as compared to the actual processes that occur in the building.

George Loisos: That's exactly what I was alluding to — that these tools get us reliably within the ballpark, and the highly complex CFD process may mislead or actually confuse the issue and sometimes can get us in trouble.

LBNL Research and Software

Haxton asks Stephen Selkowitz to describe what his group is doing at Lawrence Berkeley National Laboratory (LBNL) in regard to NZEB research and software.

Stephen Selkowitz: In addition to the critical importance of tracking actual energy consumption, the next important frontier for the use of simulation tools is to use them to operate the building in a manner that is optimized for the current weather, occupancy, utility pricing, etc. The vision here is to repurpose the simulation tools and the associated BIM that have been used previously in design. If the tools and BIM are updated to reflect as-built conditions (perhaps accomplished in the commissioning phase where they could assist that process, as well) then they are ready to be used as an integral part of the building energy management system to inform the operator and to help continuously optimize performance against desired energy targets. This is still a vision for the future, but at LBNL we are partnering with a few building owners to test the concept and better understand how tools (and operators) will need to change in order to accomplish this on a routine basis.

BIM Software

Haxton asked the software companies to describe their view of the future of BIM and energy analysis interface.

Noah Eckhouse: Very complex projects that are tough to take a snapshot of and say, "Here was my data file — my input file, if you will — at the time I did this run." It's hard to recreate what you were doing if you go back historically. It's also very difficult to train and support and, finally, just a bear to modify or to morph into compliance with the rating system when you get to LEED versus just doing pure building energy or other calculations. From a Bentley perspective, we are working very hard on this problem, and we don't have the magic bullet today. But we think we have it in our sights and are working hard on it. This includes the ability to model complex geometry (which is definitely an issue with eQuest and some of the other tools, where you end up being forced to a wedding-cake modeling environment for your building work flow), to be able to model complex things like dual skin, natural ventilation, even mixed-mode ventilation — to able to model all kinds of different, complex HVAC systems. In the future, we expect to provide a slider that allows an energy modeler to do a coarse analysis or a fine analysis and be able to have the same tool with you throughout the process. … Then as you go forward, you add engineering data as the design is turned over design from architect, to engineering team, to specialized energy analysis firm. This same tool can go with you, and everyone's working off the same trusted set of data.

We are also working hard on the capability to take in BIM models from all kinds of products across the industry that architects might use, including Bentley products, but also things like Revit, Graphisoft, SketchUp, ArchiCad, etc. This import capability will allow the key members of the design team to begin developing a mutually beneficial, trusted model as early in the process as possible. We see this as key to "getting it right" with engineering precision.

John Kennedy: The common thread that I'm hearing is doing analysis thoroughly and as often as you can throughout the project. Autodesk is really trying to face how BIM can effectively scale that process to allow many more teams to be able to do this analysis as frequently on a project, as well as applying it to many more projects, with a lot of confidence — and learning this new domain of net-zero energy building design and analysis.

We are focusing on enabling these analyses at the very earliest stage within our BIM tools. Linking to our sustainable design analysis tools, like Green Building Studio or Ecotect Analysis, gives people that opportunity to immediately start asking questions and getting answers or a net-zero energy building.

Not everyone has the time or budget to do all the analyses required that were done on these projects. So we're trying to greatly empower people to do these analyses on many more projects. And not just on new buildings that are being worked on but also the hundreds of millions of existing buildings.

Future of BIM

Tom Kubala: As a studio, we have been quite cautious in the adoption of CAD software, be it BIM or energy analysis. We recognize that design tools selected in the studio's past have had a remarkable impact on our design process, both negative and positive. Since we have taken great pains over the last 25 years to craft a design process based on wholeness (the exquisite interconnectedness of all things), we need to fully understand the ramifications of software choices with regard to the undividedness of our approach. We will be looking for tools that support collaboration amongst diverse team members; allow a straightforward, easy-to-use graphical user interface; provide instant energy/carbon feedback on early study models; offer multiple ways in which information can be displayed; and most importantly, we need tools that do not impose themselves on a design process based on the gradual unfolding of a design solution and the orderly inclusion of feedback from various points of view. The future for us is a smoothly flowing interactivity replete with digestible information.

Russ Drinker and Zaki Mallasi: Perkins+Will recognizes the clear advantage and importance of implementing sustainability solutions for projects and to its clients, specifically to meet The 2030 Challenge and achieve net-zero energy projects. The firm believes that it can accomplish such goals through a successful, multidisciplinary BIM actively transforming concepts that facilitate sustainable design and integrated project delivery. The firm sees this as a natural extension of its BIM strategy and it's quickly becoming the standard. Designers in the near future can perform comprehensive building energy/performance analysis at very early design stages when utilizing BIM and energy analysis tools. A much closer look at the future of design professionals reveals a cultural change toward a "performance-driven" building design. This, in effect, may help interrelate the designer's decisions made in order to achieve the project energy-performance targets.

Noah Eckhouse: At Bentley Systems, we believe that the market is demanding a number of key factors from energy analysis software vendors: improved accuracy; a flexible platform to rapidly incorporate many new building materials and technologies; and robust integration with third-party products.

Craig Wheatley: The issue, as we see it at IES, is that most building-performance simulation tools are deemed not compatible with architects' working methods and needs, but that the most impact is made when their feedback is incorporated right at these earliest stages. From the perspective of many architects, such tools are judged as too complex and cumbersome.

The advent of BIM and recent direct links of performance-analysis tools to BIM and other CAD tools is pushing a more-integrated, information-sharing approach to design team working. Addressing this is exactly what we've been trying to achieve at

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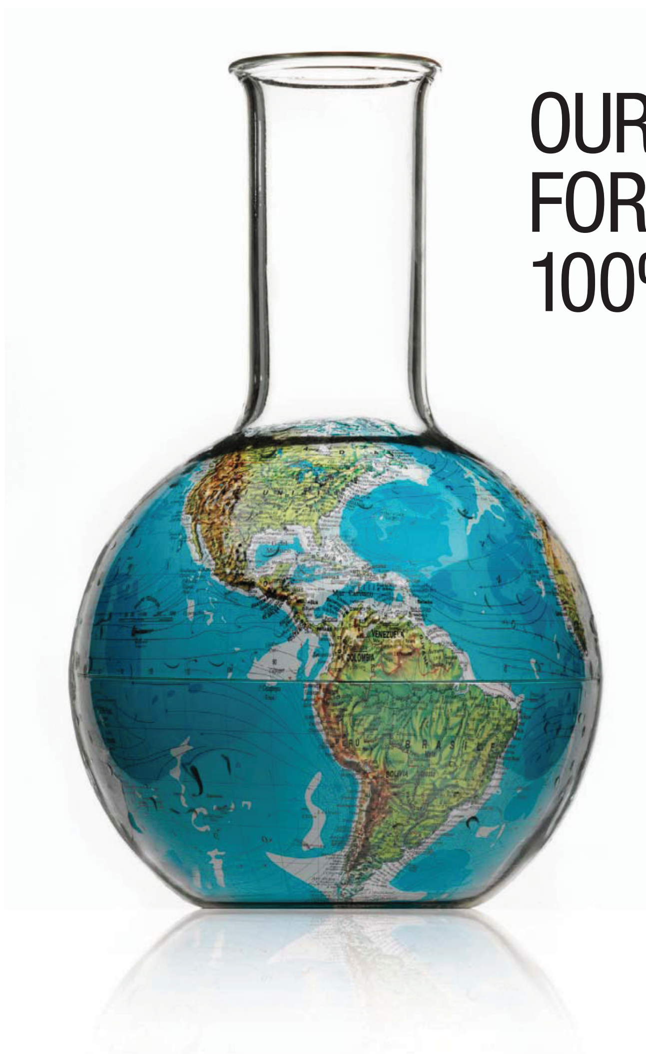

10 LESSONS LEARNED

1. Review performance data from buildings in similar climates, similar size buildings, and similar types of buildings that are very energy efficient. Do this as early as possible; that is, when you start to work on your building modeling.
2. In order to optimize the performance of buildings in a cost and energy way, model early and often.
3. The building design must be climate responsive or the passive systems won't work and the mechanical systems won't be small enough to be powered by renewable energy.
4. Allow different levels of analysis detail to be undertaken at different stages by providing links with BIM platforms and early CAD tools alongside model translation aids and standard data sets — for comparative analysis at early stages through to flexible, guided access to more-detailed tools with advanced analysis capabilities.
5. Specific climate interrogation tools and early abilities to evaluate building form, material use, natural resources and other such metrics address time-consuming tasks that will help define the initial building form, orientation and potential passive strategies.
6. New software can facilitate easy compliance with rating and regulation energy modeling.
7. The energy modeling needs to include a fine level of detail involved with the modeling process, particularly looking at plug loads, process loads, and energy uses like transformer power loss in the electrical distribution system.
8. There might be as many as or more than eight major energy-model iterations with some smaller tweaks developed during a project.
9. Focus on the "building in use." Measure the energy use at least at the system level. Compare that to predictions, and see what isn't working as expected.
10. Develop standard energy modeling where you compared one simulated case to another to help inform design decisions. This is called relative analysis because the results are always relative to some base-case model.

A complete list of 25 "Lessons Learned" is available at www.EDCmag.com.

IES through the development of different levels of interface to the robust technical capabilities of our core suite, the <Virtual Environment>.

The reality is that most designers and engineers still use a mix of analysis tools — like eQuest or EnergyPlus and Radiance — so Autodesk software for BIM and sustainable analysis works with these engines, helping architects and engineers to more easily go from a preliminary analysis to a more detailed simulation without having to recreate the building form and model.

We are continuing to extend the capabilities of BIM to enable more seamless handoff to and from analysis engines as well as looking to cloud-based solutions for more computing power, which will allow you to run multiple design scenarios and compute intensive analysis simultaneously rather than sequentially — all from the cloud versus the local machine. The goal is to support the expanded use of BIM solutions to enable more people to easily conduct traditionally compute-intensive analysis more quickly and more often.

Tom Hootman: Sustainable design and analysis software is making great strides at being valuable and relevant tools throughout the design process. However, we (along with many others in the building industry) are still waiting for the promise of BIM when one integrated model can be used for all of the analysis and design studies we conduct. We currently build numerous independent models in the process of designing and delivering a sustainable project. As architects and designers, we are very interested in software that supports our sustainable design efforts, particularly early in the process when the decisions can have the biggest impact. This means two attributes are key: quick and early. At this stage we are not looking for accuracy as much as understanding the relative merit of various design decisions under study. We are bringing this early design phase analysis in-house with tools such as IES <VE> and Ecotect. We also do an amazing amount of work with good old-fashion Excel spreadsheets.

Advanced Analysis

Haxton asked David Okada to share his personal thoughts regarding energy analysis from an engineering perspective.

David Okada: From the engineering, energy and sustainability consulting perspective, we see that advanced analysis has become a critical part of high-performance buildings. Currently, tools are available to help quantify and answer most of the questions we have about building performance. That said, we continue to wrestle with several challenges: Hitting the decision-making sweet spots with results shortly after the many assumption inputs are available; justifying the cost of our time required to build multiple building models required to address different issues (energy, thermal comfort, etc.); and keep up with the design as it evolves.

My expectation is that, in the next few years, integration of building analysis tools, including BIM platforms, will help us address these challenges while forcing us to address new details in coordination between disciplines. As building analysis software gets more sophisticated, integrated, and easier to use, we are faced with the opportunity and necessity to elevate our understanding of building performance. ed+c

RESOURCES: Visit www.EDCmag.com for related research papers and other resources provided by the conference participants, including Design Process and Software Comparison (architectural design process and software use by architectural project phase on a firm by firm comparison basis).

NOTE: The software identified in the article may or may not be applicable for the analysis you have in mind for your project. Contact the software manufacturer and verify that the software they are producing is intended for your type of project and that it will produce the kind of results you need. It is a good practice to verify that the software performance is within the parameters of your specific project through performance testing.