VOLUME 28, NO. 02 -- FEBRUARY 2007

*EnergyPlus*SPARK*DOE-2* EnergyPlus*VisualSPARK*EnergyPlus*DOE-2*GenOpt*EnergyPlus*
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BUILDING ENERGY SIMULATION ★ USER NEWS

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The Buzz

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Ask an EnergyPlus Expert
All 2006 questions and answers in one PDF file.
http://simulationresearch.lbl.gov/dirpubs/un_articleEP06.pdf

New EnergyPlus Consultant
Turn to p. 3 for details.

DOE-2 User Questions
All 2006 questions and answers in one PDF file.
http://simulationresearch.lbl.gov/dirpubs/un_articles06.pdf

New DOE-2 Consultant
See p. 9 for details.

2006 Building Energy Data Book (Download)
http://buildingsdatabook.eere.energy.gov/

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PUB-439

Message from Dru Crawley, USDOE, to the EnergyPlus community,

As of January 9, 2007, the current release (V 1.4) of EnergyPlus topped 3000 downloads in the shortest time ever. More than 46,000 copies of EnergyPlus have been downloaded in the last 5-1/2 years.

The next release of EnergyPlus will be Version 2.0 in April. From that point forward, we will be concentrating our efforts to add new features that support low-energy buildings.
Here are a few of the key things we know V 2.0 will include:

- *finite difference conduction -- allows modeling of phase-change materials*
- *energy management system (more controls to follow in V 2.1, October 2007)*
- *refrigerated cases with evaporative condenser (refrigerant loops on the way)*

We may also see green roof modeling, with research and model development by Portland State University.

Dru and the EnergyPlus Team

PS As we move forward with V 2.0 and future releases, we definitely need your feedback on new modeling capabilities. Please send email directly to Dru Crawley (drury.crawley@ee.doe.gov) with your suggestions.

Introduction to EnergyPlus and DesignBuilder
March 13-15, 2007 in Irvine, California
For details and to register, go to
http://www.gard.com/training.htm

Ask an EnergyPlus Expert

FRESH AIR QUESTION

I have a fan coil system with fresh air; chillers provide chilled water and the outside air flow rate (per person) is set in the zone sizing. Does the cooling capacity and energy consumption of the chiller include the capacity and energy that the fresh air needs?

Answer
The sizing of the fan coil's cooling coil chilled water flow rate takes into account the ventilation air. The chiller size will have built in the capacity necessary to meet the cooling load including fresh air. During the simulation the fan coil will act to meet its total load: zone cooling and outside air. This load will be passed to the chiller through the chilled water loop so the chiller will also meet the total load.

To EnergyPlus Documentation

http://www.eere.energy.gov/buildings/energyplus/documentation.html

Ask an EnergyPlus Expert

DAYLIGHTING OBSTRUCTIONS

Can EnergyPlus be used to model large internal obstructions to solar and daylighting penetration within a zone using surfaces or other objects? Clearly this would require the full exterior and interior solar distribution option, but I just wondered whether the presence of any internal obstruction surfaces would be accounted for in the calculation of daylight factors and solar distribution about the space. Are Daylighting:Detailed and Daylighting:DELight the same in this respect?

Answer

(From Mike Witte) -- I see that the daylighting section of the Input/Output Reference is inconsistent on these subjects. (On the list to fix.) Referring to p. 290 of the Input/Output Reference (pdf p. 327), internal obstructions accounted for in daylighting. This is not mentioned in the list of differences for DElight, so I assume that DElight also accounts for internal obstructions. I cannot say that I have verified this for either of the daylighting models. For solar gains, interior obstructions are not accounted for. The Full Interior solar distribution options require a "convex" zone. From p. 12 (pdf p. 49) "A formal definition of convex is that any straight line passing through the zone intercepts at most two surfaces."

(From Rob Hitchcock DElight expert) -- Regarding daylight (visible light) interreflections within a zone, the Detailed method uses a split-flux method, whereas DElight uses a modified radiosity method. The split-flux method divides transmitted daylight into "downward-going" and "upward-going" fluxes and evenly distributes a portion of these fluxes as reflected light based on an area-weighted average surface reflectance for the zone. See the Engineering Documentation page 116 (pdf page 148) for more detail. This method does not accurately account for interior obstructions in the interreflection calculation. The radiosity method more accurately accounts for interreflection between interior surfaces by discretizing each surface into nodal patch areas and accounting for the reflective exchange of visible light between the patch areas.

Regarding direct daylight distribution (i.e., exterior light directly reaching reference points and interior surfaces through apertures), the Detailed method does account for the obstruction, by the interior face of zone surfaces, of direct daylight on reference points (but not on interior surfaces), while the DElight method currently does not, assuming zones are convex, as Mike describes above for solar gains.

You might want to take a look at this paper
DELIGHT2 DAYLIGHTING ANALYSIS IN ENERGYPLUS: INTEGRATION AND PRELIMINARY USER RESULTS by William L. Carroll and Robert J. Hitchcock, Proc. 9th International IBPSA Conference, Building Simulation 2005, August 15-18, 2005 in Montreal, Canada.

New EnergyPlus Consultant

David S. Eldridge, Jr., Project Engineer
LEED v2.0 Accredited Professional
Tel: (847) 328-3555 ext. 224
dse@grummanbutkus.com

Grumman/Butkus Associates
820 Davis St., Suite 300
Evanston, IL 60201

Ask an EnergyPlus Expert

SCHEDULES

I have a question about Schedules used with annual energy calculations, coupled with Design-Day calculations. For instance, if I have 100 zones and they all have the same annual schedule for heat gain, then I am able to define a single schedule and reference this schedule for all zones. If, however, I want to use different schedule data for the design summer or winter day for room, this design-day data must be defined as a design-day schedule and referenced as the SummerDesignDay or WinterDesignDay in a WEEKSCHEDULE and then in a year SCHEDULE. If I have slightly different design-day schedules for each room, but the same annual schedules, must I then define different annual and weekly schedules for each room, in order to get the different design-day schedules defined? Or is there some other means of tagging rooms with just design-day schedule data and using common annual schedules for the annual calculation.

Answer
Your understanding is correct. You need a different annual/week schedule for each unique combination of design-day and regular-day schedules. You may find it easier to generate this using the SCHEDULE:COMPACT approach rather than DAYSCHEDULE/WEEKSCHEDULE/SCHEDULE. SCHEDULE:COMPACT is described in the EnergyPlus Input/Output Reference. There was also an explanatory article on p. 9 of the 2004 "Ask an EnergyPlus Expert" compilation, which can be found at this link: http://simulationresearch.lbl.gov/dirpubs/un_articleEP04.pdf.

TALL BUILDING SIMULATION -- SHORTCUTS

I need to simulate an 80-floor skyscraper. I tried using a multiplier, but there is a differential load between different high floors. For example, there will be about 0.6C between 20m heights. And for so many floors, the gap cannot be ignored. It's a huge job if I have to simulate each floor, especially with an HVAC system. Also, run time is a problem. Are there any shortcuts I can apply to this problem?

Answer by Peter Ellis, NREL, EnergyPlus Development Team
Not too long ago I had to deal with exactly the same problem in order to model the Freedom Tower at the World Trade Center (the previous twisty design, not the current one). The results of that exercise ended up going into a paper called "Simulating Tall Buildings Using EnergyPlus" that I presented at SimBuild 2005. The paper is available in the Conference Proceedings, or can be directly accessed at this link: http://www.ibpsa.org/proceedings/BS2005/BS05_0279_286.pdf

The surprising conclusion (to me anyway) was that despite height dependent variation of air temperature, wind speed, and shading from surrounding buildings, you get less than 1% error by simulating a single floor with a multiplier, e.g., 80, as long as you choose one near the mid-height of the building, i.e., floor number 40, when comparing whole-building annual energy results to a full simulation of all 80 floors explicitly. In the time since the paper was written, we have changed EnergyPlus so that, by default, the local air temperature and wind speed at a surface or a zone are now calculated based on its height above ground. We have also made it easier for the user to control the height dependent variation of atmospheric properties in EnergyPlus, even allowing height dependent variation to be turned off, if desired. See the WEATHER STATION object and SITE ATMOSPHERIC VARIATION object in the Input/Output Reference and Engineering Reference for more details.

Ask an EnergyPlus Expert

HEAT PUMP

Can you tell me which field controls the heat pump's cooling/heating operation? Or are the modes simply shifted by the difference between the indoor air temperature and the setpoint? In my simulation of one internal zone and four external zones, I have one heat pump per zone. The heat pump in the internal zone will (hopefully) cool the space (which has large heat gains) in the winter while the other heat pumps in the outside zones are delivering heat.

Answer
The zone thermostat is the control. The heat pump will try to provide cooling when the thermostat calls for cooling, likewise for heating. One can schedule individual coils, so it is possible to disable cooling or heating with a schedule if desired.

RESIDENTIAL BOILER

I'm trying to model simple residential house with three zones -- living, attic and garage. It's an older home with a central, coal-fired boiler used for heating. My problem is that I don't know how to "connect" the boiler with convective heat exchangers in the three zones.

Answer
In the ExampleFiles folder, see WindACAuto.idf - Window air conditioners with hot water convectors served by purchased hot water (substitute a boiler for the purchased hot water). Run the example file and view the svg output file to see the types of components used to connect the hot water loop. Review the input file to see the input objects used to describe those components. See also 5ZoneAirCooled.idf - Example with a boiler.

CONVERTING DOE-2 BINARY FILES INTO EPW FORMAT

I have some DOE-2 weather files in binary format (no text original inputs) that I'd like to convert to EPW format. Has anyone discovered a (hopefully) painless way to do this conversion?

Answer
Using the DOE2 WTH tool, convert to text format. The EnergyPlus Weather Converter reads that format and can convert into EPW. You will need to use the DOE2 bin to fmt converter first. All the utilities you need are in our "Yahoo Groups" file area; the folder name is DOE-2_Weather_Converter.

When you have the file in fmt format, the EnergyPlus WeatherConverter can convert to EPW format. You might also download the latest EPLusWth.dll; again, this is in our "Yahoo Groups" area in a folder Updates/Windows/.

Join the EnergyPlus Support group at http://tech.groups.yahoo.com/group/EnergyPlus_Support/

***Caveat*:** Be aware that DOE-2 binary weather files save temperatures in integer F and solar radiation in integer BTU/ft^2, so any such file converted to EPW will lose precision compared to the original source data. In other words, the resulting decimal on these EPW files is good only to 0.3C precision, not 0.1C.

Ask an EnergyPlus Expert

SUPPLY FAN AND RETURN FAN AIR FLOW RATE

I ran into a problem when I modeled a supply constant volume fan and return fan in the same air system. The air system uses 100% outdoor air flow with heat recovery. The supply fan air flow rate is 0.62m^3/s. When I did not add the return fan, the system node check showed the system air flow rate was 0.62m^3/s. To represent the real situation, a return fan was added to the air system with the fan air flow rate of 0.56m^3/s (90% of supply flow rate, so that room has 10% positive pressure). However, I found that the system supply air flow rate was also reduced to 0.56m^3/s. When I changed the return fan airflow rate, the system supply air flow rate stayed the same as the return fan airflow rate.

In my air system, the component configuration sequence is "return fan-cooling coil-heating coil-supply fan." The heat recovery unit is also in the air system but not listed in the air system branch. I have no ideal what is wrong with the configuration. I cannot find an example that includes both return fan and heat recovery unit in the air system.

Answer
EnergyPlus currently requires that all flow rates in an air loop be balanced. To model a system like this, you must specify zone exhaust fans which remove 10% of the flow directly from the zones. Set the ZONE EXHAUST FAN delta pressure to zero so that it does not consume additional electric power.

Question
So, the zone exhaust fan is the constant air flow fan module, right? If both supply and return fans are variable air flow, then the zone exhaust fan cannot be used. Can I use fan:simple:variable volume as the relief fans with delta pressure as zero?

Answer
You are correct, ZONE EXHAUST FAN is a constant volume fan. The flow rate can be scheduled, but it cannot track the system supply volume in a variable volume system.

A relief air fan will not accomplish what you want. For a variable volume system, there is no way to reduce the central exhaust flow by a percentage of total system flow. You will need to let the return fan have the same flow rate at the supply (non-pressurized system). By adjusting the return fan power and the effectiveness of the heat recovery unit, you can make the simulation behave as if there was 10% less return air flow.

COOLING TOWER

I am trying to model a Cooling Tower -- basically a chimney connected to the lobby at ground level with a wind catcher on top. There is also evaporative cooling in the tower with nozzles that spray water in the air. This cooler air is supposed to drive the air flow through the lobby. How do I account for this cooling effect in EnergyPlus?

Answer
An appropriate modeling strategy for the cooling tower would be to use a direct evaporative air system and then decrement out the associated fan energy. If the air flow rates match reasonably well, it should work okay.

Ask an EnergyPlus Expert

GLASS VARIABLES DEFINED

Is there a document that defines each report variable? I can't figure out what is meant by just looking at the name; for example:

"Blind/Glass System Beam-Beam Solar Transmittance"
I don't know exactly what "beam-beam" means. Also, is visible light being transmitted for "transmittance," or is it heat, total energy?

"Blind/Glass System Diffuse-Diffuse Solar Transmittance"
Again, I'm confused by "diffuse-diffuse." And does the window system include the frame, the dividers, the blinds??

Answer
Refer to the Input/Output Reference document for a complete description:

Blind/Glass System Beam-Beam Solar Transmittance [ ]
The fraction of exterior beam solar radiation incident on an exterior window with a blind (excluding window frame, if present) that is transmitted through the blind/glass system as beam solar radiation. Depends on various factors, including type of glass; solar incidence angle; slat angle, width, separation, and thickness; and horizontal solar profile angle (for blinds with horizontal slats) or vertical solar profile angle (for blinds with vertical slats).

Blind/Glass System Diffuse-Diffuse Solar Transmittance [ ]
The fraction of exterior diffuse solar radiation incident on an exterior window with a blind (excluding window frame, if present) that is transmitted through the blind/glass system as diffuse solar radiation. Depends on various factors, including type of glass and slat angle, width, separation, thickness and reflectance. For blinds with a fixed slat angle the transmittance value reported here will be constant.

OTHERSIDE COEFFICIENT

I need to simulate a room that is located among three other classrooms (the other rooms are above, on the left and on the right). In order to establish exterior conditions for the walls connected to the other rooms, I defined air temperatures for the other rooms. I know that I need to define other parameters, such as convective/radiative film coefficient, etc. Do I have to define all of them?

Answer
It all depends on what you are trying to answer in your simulation. If the surrounding spaces are similar to the classroom you want to model, and are conditioned to the same temperatures, then you may want to make the interior surfaces adiabatic. For example Surface:HeatTransfer, Name=Wall1, OutsideFaceEnviornment=OtherZoneSurface, OutsideFace Environment Object=Wall1. Or you can model the surrounding spaces in their entirety as separate thermal zones if the conditions in those zones will be significantly different.

Ask an EnergyPlus Expert

FAÇADES

I need to model two façades for a 10-story building. One façade area is almost 100% glass, while the other is composed of a frame and divider that is part glass and part sheet metal.

Answer
In EnergyPlus, all windows must be modeled as a subsurface (Surface:HeatTransfer:Sub) that is placed on a base surface (Surface:HeatTransfer). If you make the base surface material match the properties of the frame, then you can place windows on the base surface to cover almost all of the surface (however, there must always be a small amount of base surface area remaining). For the façade with dividers, you can either place multiple windows on the base surface, or place one large window and use WindowFrameAndDivider to add the dividers. Note that the frame area of WindowFrameAndDivider is added outside the Surface:HeatTransfer:Sub area.

EnergyPlus Version 1.4.0

Download a free copy of the program

http://www.energyplus.gov/

Support Tools

Support software is listed on the main EnergyPlus website: www.energyplus.gov

Weather Data from http://www.eere.energy.gov/buildings/enegyplus/cfm/weather_data.cfm

Weather data for more than 800 locations are now available in EnergyPlus weather format. See the write-up on how to create Meteonorm Files

Ask an EnergyPlus Expert

Questions from EnergyPlus users are answered promptly via email by program developers. To submit questions, join the EnergyPlus User Group (details below).
A selection of questions/answers are compiled (yearly) into a downloadable PDF document: Q and A for2002, for 2003, for 2004, for 2005, for 2006

Are you an EnergyPlus Consultant ?

If you are an EnergyPlus consultant and would like to be listed in this newsletter and on our website, please send details to klellington@lbl.gov

Join the EnergyPlus User Group

The developers of EnergyPlus have formed a support group to foster discussion and maintain an archive of information for program Users. To join, go to http://groups.yahoo.com/group/EnergyPlus_Support/

Testing and Validation http://www.eere.energy.gov/buildings/energyplus/testing.html

EnergyPlus is being developed by University of Illinois and Lawrence Berkeley National Laboratory, DHL Consulting, C. O. Pedersen Associates, Florida Solar Energy Center, GARD Analytics, the National Renewable Energy Laboratory, Oklahoma State University and others. Development of EnergyPlus is supported by the U. S. Department of Energy, Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technologies Program (Program Manager, Dru Crawley).

DOE-2.1E

DOE-2.1E (version 124) 1,000-Zone version for Windows from ESTSC; other vendors of DOE-2 based programs are listed on our website: http://SimulationResearch.lbl.gov/

Cost is as follows:
- $ 300 U.S. Government/Non-Profits/Education
- $ 575 U.S. Public, Mexico, Canada
- $1129 to $1268 Other Foreign

DOE-2 Documentation on a CD from ESTSC - Cost US$100

What is included on the CD?
- DOE-2 Reference Manual (Part 1) and (Part 2)
- DOE-2 BDL Summary (2.1E)
- DOE-2 Engineers Manual (2.1A)
- DOE-2 Supplement to the Reference Manual (2.1E)

Order Software and ESTSC Documentation

Ed Kidd or Kim Buckner
NCI Information Systems, Inc.
Energy Science and Technology Software Center (ESTSC)
P.O. Box 1020, Oak Ridge, TN 37831

Phone: 865/576-1037
Fax: 865/576-6436
Email: estsc@adonis.osti.gov

Purchase DOE-2 Documentation

DOE-2 Sample Run Book (2.1E) -- The Sample Run book is the only DOE-2 manual not available electronically. It must be purchased separately from NTIS; ordering information may be found at http://SimulationResearch.lbl.gov > DOE-2 > Documentation

Free DOE-2 Documentation http://gundog.lbl.gov/dirsoft/d2getdoc.html

DOE-2 Basics Manual (2.1E) http://gundog.lbl.gov/dirpubs/BASIC/basiclist.html

Update Packages: Update Packages are not cumulative; each one contains different information. Download all four packages then print and insert the pages into your existing DOE-2 manuals.

- Update Package #1: DOE-2.1E Basics, the Supplement and BDL Summary
- Update Package #2: BDL Summary and Supplement.
- Update Package #3: Appendix A of the Supplement.
- Update Package #4: (1000-zone DOE-2.1E) BDL Summary.

DOE-2 Modeling Tips (pdf files) for 2006 2005 2004 2003 2002
A compilation of all the "how to" and "DOE-2 Puzzler" articles from the newsletter.

Changes and Bug Fixes to DOE-2.1E (txt file) -- All changes and bug fixes in a text document.

New DOE-2 Consultant

David S. Eldridge, Jr., Project Engineer
LEED v2.0 Accredited Professional
Tel: (847) 328-3555 ext. 224
dse@grummanbutkus.com

Grumman/Butkus Associates
820 Davis St., Suite 300
Evanston, IL 60201

Recent Reports

Proceedings ACEEE Summer Study on Energy Efficiency in Buildings, August 13-18, 2006 • Pacific Grove, CA

Development of a Model Specification for Performance Monitoring Systems for Commercial Buildings

Philip Haves and Robert J. Hitchcock (Lawrence Berkeley National Laboratory),
Kenneth L. Gillespie, Jr. (Pacific Gas and Electric Company),
Martha Brook (California Energy Commission), Christine Shockman (Shockman Consulting),
Joseph J. Deringer (Deringer Group), Kristopher L. Kinney (QuEST)

ABSTRACT

The paper describes the development of a model specification for performance monitoring systems for commercial buildings. The specification focuses on four key aspects of performance monitoring:

- performance metrics
- measurement system requirements
- data acquisition and archiving
- data visualization and reporting

The aim is to assist building owners in specifying the extensions to their control systems that are required to provide building operators with the information needed to operate their buildings more efficiently and to provide automated diagnostic tools with the information required to detect and diagnose faults and problems that degrade energy performance. The paper reviews the potential benefits of performance monitoring, describes the specification guide and discusses briefly the ways in which it could be implemented. A prototype advanced visualization tool is also described, along with its application to performance monitoring. The paper concludes with a description of the ways in which the specification and the visualization tool are being disseminated and deployed.

Halfway to Zero Energy in a Large Office Building

Mark Hanson (Hoffman LLC/Vertegy), Steven Carlson (CDH Energy),
Dan Sammartano (Alberici Constructors), Thomas Taylor (Vertegy)

ABSTRACT

A 108,000 square foot Class A office building was completed in December 2004 in the Midwest with one goal being an energy cost reduction in excess of 50%. Other project goals were to meet corporate office needs for the owner, provide Class A office space at a conventional cost defined as $150 per gross square foot of office space (excluding land acquisition and parking costs), and achieve a LEED Platinum Rating. The paper describes the design-build approach taken, including the role of a core project team that guided the integrated design and construction approach for the owner. The final energy design with State-of-the-Shelf components is described in terms of central design elements; building systems technical descriptions; construction cost; energy modeling estimates, and energy performance for the first twelve months of operation. The building has been awarded a LEED Platinum rating at 60 points. Project implementation was accomplished with ongoing interaction of the owner, designers, and constructors for the entire design and construction cycle. These participants were guided by a core project team that relied on energy modeling and examples of building elements to guide project decisions. The management structure and processes were highly useful in meeting project goals. The project demonstrates substantial energy cost savings in the first 12 months of operation, but it is too early to definitively conclude that a 50% savings will be achieved with State-of-the-Shelf technologies and within a conventional cost budget.

Please visit our website at http://SimulationResearch.lbl.gov

Recent Reports

Proceedings of SimBuild 2006, held at MIT in Cambridge, Mass., August 2-4, 2006

A MODEL FOR NATURALLY VENTILATED CAVITIES ON THE EXTERIORS OF OPAQUE BUILDING THERMAL ENVELOPES

Brent Griffith (National Renewable Energy Laboratory, Golden, CO)

ABSTRACT
This paper describes a model for naturally ventilated cavities that are formed by lightweight baffles on the exteriors of opaque building thermal envelopes. The model can be used for building components that are slightly detached from the main envelope (but do not connect to the interior), such as photovoltaic panels, double roofs, rain screens, and unglazed transpired collectors. The model provides values for baffle surface temperature as well as exterior boundary conditions for convection and radiation to use in modeling heat transfer in the underlying surface. Two quasi-steady energy balances are used to solve for temperatures: one for the baffle surface and the other for the air in the cavity. The model assumes that the heat capacity in the baffle can be neglected, since it is much lower than the underlying mass surface. Natural ventilation rates are calculated with simplistic correlations that are based on user-provided discharge coefficients. Convection coefficients inside the cavity are based on those used for window gaps as documented in ISO (2003) Standard 15099. Radiation coefficients are linearized. The model has been implemented in **EnergyPlus**.

ANALYSIS PROCESS FOR DESIGNING DOUBLE SKIN FACADES AND ASSOCIATED CASE STUDY

Ian Doebber, Maurya McClintock (Arup, San Francisco, CA)

ABSTRACT
Double Skin Façade systems, adopted prevalently across Europe for a number of years, are becoming increasingly popular in the United States. However, the design community lacks validated modeling programs and the knowledge base (established on real performance data) necessary to understand the complex thermal behavior of Double Skin Façade systems. The following paper summarizes how naturally ventilated Double Skin Façade systems are analyzed and designed despite limitations. Specifically, the paper highlights how currently published information and a suite of modeling programs are used to determine the critical design criteria affecting thermal performance, the optimal solution to those criteria, and the anticipated performance of the final design. The intention is to provide insight for research initiatives to make real performance data publicly available, establish analysis methods, and to develop validated modeling programs.

Blog On, Energy Simulation Enthusiasts, at http://bleer.lbl.gov

2007 Energy Efficient Business Seminars
Presented by San Diego Gas and Electric Company
http://www.sdge.com

February 20	Heat Pumps Part 1 5416	March 27	System Design Part 1 5421
February 21	Heat Pumps Part 2 5417	March 28	System Design Part 2 5422

Please visit our website at http://SimulationResearch.lbl.gov

Recent Reports

Proceedings of SimBuild 2006, held at MIT in Cambridge, Mass., August 2-4, 2006

DEVELOPMENT OF METHODS FOR DETERMINING DEMAND-LIMITING SETPOINT TRAJECTORIES IN COMMERCIAL BUILDINGS USING SHORT-TERM DATA ANALYSIS

Kyoung-ho Lee and James E. Braun
Ray W. Herrick Laboratories, School of Mechanical Engineering
Purdue University, West Lafayette, IN

ABSTRACT
This paper presents simple approaches for estimating building zone temperature set-point variations that minimize peak cooling demand during critical demand periods. Three different methods were developed that are termed the semi-analytical (SA), exponential setpoint equation-based semi-analytical (ESA), and load weighted-averaging (WA) methods. The three methods are different in terms of requirements for input data and ability to reduce peak demand. The SA and ESA methods employ simple inverse building models trained with short-term data and use analytical solutions from the models to determine setpoint trajectories. The WA method is a data-based method in which an optimal weighting factor is found that minimizes a weighted average of two loads. In addition to determining setpoint trajectories, the methods provide estimates of peak load reduction. A companion paper (Lee and Braun 2006b) presents evaluations of the peak load reduction potential associated with implementation of these methods.

A LIBRARY OF HVAC COMPONENT MODELS FOR USE IN AUTOMATED DIAGNOSTICS

Peng Xu, Philip Haves, Dimitri Curtil
Lawrence Berkeley National Laboratory

ABSTRACT
The paper describes and documents a library of equipment reference models developed for automated fault detection and diagnosis of secondary HVAC system (air handling units and air distribution systems). The models are used to predict the performance that would be expected in the absence of faults. The paper includes a description of the use of automatic documentation methods in the library.

From the *Way Cool* Department:

Check Out the New 'Google' Map of the Lawrence Berkeley National Laboratory.
Go to http://isswprod.lbl.gov/labmap/labmap.htm and see it all.

Meetings – Conferences – Symposia

2007		
March 06	IBPSA England Symposium	http://www.ibpsa-england.org
March 22-23	Canadian Conference on Building Science + Technology	http://www.nbec2007conference.com/
May 21-25	CIB World Building Congress 2007	cdejager@saice.org.za
June 10-14	CLIMA 2007	http://www.clima2007.org/portal/
June 13-15	Roomvent 2007	http://www.roomvent2007.org
June 23-27	ASHRAE Annual Meeting (Long Beach, CA)	http://www.ashrae.org
September 03-06	Building Simulation 2007 – IBPSA China	http://www.ibpsa.org

Performance Criteria for Residential Zero Energy Windows

Dariush Arasteh, Howdy Goudey, Joe Huang, Christian Kohler and Robin Mitchell
[1]Lawrence Berkeley National Laboratory

Abstract:
This paper shows that the energy requirements for today's typical efficient window products (i.e. ENERGY STAR products) are significant when compared to the needs of Zero Energy Homes (ZEHs). Through the use of whole house energy modeling, typical efficient products are evaluated in five US climates and compared against the requirements for ZEHs. Products which meet these needs are defined as a function of climate. In heating dominated climates, windows with U-factors of 0.10 Btu/hr-ft2-F (0.57 W/m2-K) will become energy neutral. In mixed heating/cooling climates a low U-factor is not as significant as the ability to modulate from high SHGCs (heating season) to low SHGCs (cooling season).

Download Paper Here
↓
http://btech.lbl.gov/papers/59190.pdf

Be sure to visit page 15 for the list of free e-Newsletters!

February 2007 Educational Programs

Pacific Gas & Electric Company

San Francisco, California

For a complete listing of classes or to register go to www.pge.com/pec

LIGHTING

Feb 21 Lighting Fundamentals
May 22 Lighting Fundamentals

TITLE 24

Feb 27 Multifamily Energy Efficiency Program - Design Basics

SOFTWARE

Feb 27 Multifamily Energy Efficiency Program - Design Basics

RENEWABLES

Feb 14 Basics of Photovoltaic (PV) Systems for Grid-Tied Applications

The Big List of Free

Free!!! Books

2006 Buildings Energy Data Book	http://buildingsdatabook.eere.energy.gov/
Daylight in Buildings (book on CD)	klellington@lbl.gov
Residential Lighting Design Guide (California)	http://www.cltc.ucdavis.edu/

Free!!! Building Energy Software *

BDA 3.1	http://gaia.lbl.gov/BDA
"Best Practices" Software from USDOE	http://www1.eere.energy.gov/industry/bestpractices/software.html/
Climate Consultant	http://www.aud.ucla.edu/energy-design-tools/
COMIS	http://www-epb.lbl.gov/comis/
EnergyPlus 1.4.0	http://www.energyplus.gov
GenOpt 2.0	http://SimulationResearch.lbl.gov
Optics 5.2	http://windows.lbl.gov/software/default.htm/
HEED, SOLAR 5.7, OPAQUE, etc.	http://www.aud.ucla.edu/energy-design-tools
HOMER (off-grid and grid-connected power systems)	http://www.nrel.gov/homer/
RADIANCE 3.5	http://radsite.lbl.gov/radiance/
RESFEN 3.1	http://windows.lbl.gov/software/default.htm/
THERM 5.2	http://windows.lbl.gov/software/default.htm/
VisualSPARK 2.0	http://SimulationResearch.lbl.gov/
WINDOW 5.2 (window thermal analysis)	http://windows.lbl.gov/software/default.htm/

* See also the "big daddy" of building energy software lists, compiled by Dru Crawley of USDOE, at http://www.eere.energy.gov/buildings/tools_directory/ -- some software on the USDOE list is not free ☹

Free!!! Memberships

IBPSA-Australasia	veronica.soebarto@adelaide.edu.au
IBPSA-Switzerland	http://www.ibpsa.ch
IBPSA-USA	peter_ellis@nrel.gov

Free!!! Newsgroups (Mailing Lists)

BLDG-SIM	bldg-sim-subscribe@gard.com
EnergyPlus User/Support Group	http://groups.yahoo.com/group/EnergyPlus_Support/
GARD Analytics (http://www.gard.com/) for:	
ASHRAE 4.7 Energy Simulation	tc47-l-subscribe@gard.com
ASHRAE 2.8 Building Environmental Impacts/Sustainability	tc28-l-subscribe@gard.com
Standards Project - Test for Building Energy Analysis Software	spc140-l-subscribe@gard.com

Free!!! Weather Data

Real Time Weather Data	http://www.eere.energy.gov/buildings/energyplus/cfm/weatherdata/weather_request.cfm
California Climate Zones on GoogleEarth™ **Download, install and launch GoogleEarth then download and open the Climate Zones CA-CZ.kmz 120 kb file.**	http://earth.google.com/

Continued Next Page

The Big List of Free -- Continued

Free!!! e-Newsletters

Architecture Week	http://www.architectureweek.com/
ASHRAE	http://www.ashrae.org/template/enewsletterlanding/
BLUEPRINT (State of California)	http://www.energy.ca.gov/efficiency/blueprint/
Buildings Research Post (FSEC)	http://www.fsec.ucf.edu/en/news/newsletters/brpost/
Conservation Update (by state)	http://www.eere.energy.gov/state_energy_program/update/
EERE Network News (USDOE)	http://www.eere.energy.gov/news/newsletters.cfm
e-FFICIENCY NEWS (Alliance to Save Energy)	http://www.ase.org/section/_audience/e_fficiency
Energy Chronicle (FSEC)	http://www.fsec.ucf.edu/en/news/newsletters/echron/index.htm
eNews (Energy Design Resources)	http://www.energydesignresources.com/publication/en/
Green Energy News	http://www.nrglink.com/index.html
IBPSANews	http://www.ibpsa.org
Lighting Link (Calif Lighting Technology Center)	http://169.237.101.18:8080/cltc/the-lighting-link
Rocky Mountain Institute	http://www.rmi.org
SBSE (Society of Building Science Educators)	http://www.sbse.org
Setting the Standard (standards and guidelines USDOE)	http://www.energycodes.gov/news/
Steven Winter Associates	
Buildings Inside and Out (SBIC)	http://www.swinter.com/Services/06Tech_Trans/co_sbic.html
CARB-News (Consortium for Advanced Residential Bldgs)	http://www.carb-swa.com/carbfax.html
Party Walls (multi-family bldgs)	http://www.swinter.com/Services/06Tech_Trans/co_partywalls.html
RUSH (HUD projects)	http://www.swinter.com/Services/06Tech_Trans/co_rush.html
WinterGreen	http://www.swinter.com/Services/06Tech_Trans/co_wintergreen.html

Free!!! Web Tools

Home Energy Saver (home energy use)	http://hes.lbl.gov/
Mechanical Engineering – world wide virtual library	http://dart.stanford.edu/vlme/
ORNL Building Envelope Calculators	http://www.ornl.gov/sci/roofs+walls/index.html/
eCalc – Energy & Emissions Toolkit (Texas)	http://ecalc.tamu.edu/

Free!!! Stuff

Poster: "Energy and Buildings in the 20th Century"	klellington@lbl.gov

Sacramento Municipal Utility District – Free Energy Education Classes

For details and registration, go to http://www.smud.org/education/index.html/

March 07	Title 24 for Mechanical	March 21	Renewal Energy + Buildings = Efficient Energy
March 08	Title 24 - Update to Lighting	May 02	HVAC Static Pressure and Air Flow
March 14	Designing with Light	May 19	Heating, Cooling, and Fans:
March 14	Owning and Operating an Efficient Cooling Tower	June 19	Advanced Lighting Technology

Practical Information on the Energy Policy Act of 2005

State of California http://www.energy.ca.gov/efficiency/2005_federal_tax_credits.html

ACEEE has compiled the tax incentives in an "at-a-glance" format at this web site (see also the p. 16 of this newsletter) http://www.aceee.org/press/Tax_incentive05.pdf

Florida Solar Energy Center offers extensive information on the EPAct at this site http://www.fsec.ucf.edu/en/news/press/enews/2005/2005-03_EPAct2005.htm

An Important Distinction
There is an important difference between a tax deduction and a tax credit.

- A **tax deduction** is subtracted from income before total tax liability is computed.
- A **tax credit** is subtracted directly from the total tax liability.

This means that a deduction and a credit have very different values, with a credit being 3 or more times more advantageous to the taxpayer than a deduction. For example, a tax credit of $1,000 for someone in the 28% tax bracket is equivalent to a tax deduction of $3,571.

Commercial Buildings
(Link to qualified software -- http://www.eere.energy.gov/buildings/info/qualified_software/)
This provision offers business taxpayers a deduction of $1.80 per square foot for commercial buildings that achieve a 50% reduction in annual energy cost to the user, compared to a base building defined by the industry standard ASHRAE/IESNA 90.1-2001. Energy costs refer only to heating, cooling, lighting and water heating, since only these uses are within the scope of the ASHRAE standard and within the control of the building designer.

Each of the three energy-using systems of the building — the envelope, the heating, cooling and water heating system, and lighting system — is eligible for one third of the incentive if it meets its share of the whole-building savings goal. Explicit interim compliance procedures are provided for lighting.
Eligible buildings include commercial buildings such as: offices, retail buildings, warehouses, etc., rental housing of four stories or more, and publicly-owned buildings. For publicly-owned buildings, there is an interesting provision allowing the credit to pass through to the "person primarily responsible for designing the building."

New construction in an existing building is also eligible for the tax deduction, with one third of the deduction amount for new construction that affects the new energy-using system (such as lighting or heating, cooling and water heating).

Compliance is determined by third party inspectors who review the plans and the actual in-place construction. Energy savings are determined by software that must be certified by the Department of Energy as meeting criteria of consistency and accuracy, following the successful experience of California's performance-based energy code enforcement.

The complete conference bill for the Energy Policy Act may be downloaded here (2.5 MB PDF file). The solar and energy efficiency provisions are found in Title XIII, Subtitle C, beginning on page 1332 through page 1390 of the act.

The ACEEE summary of energy efficiency tax incentives is on the next page.

Summary of Energy Efficiency Tax Incentives in Energy Policy Act of 2005

Product	Eligibility Level	Units	Amount of Incentive	Years Covered	Notes
Existing homes and other non-business applications					$500 per taxpayer cap for existing home credits
Central air conditioners (split systems)	15 12.5	SEER EER	$300 if meets SEER & EER	2006 & 2007	For list of qualified products, go to the Consortium for Energy Efficiency Product Directory-
Central air conditioners (package systems)	14 12	SEER EER	$300 if meets SEER & EER	2006 & 2007	www.ceehvacdirectory.org/continue.html Look for "Residential Tier 2" Air Conditioners
Heat Pumps (air cooled)	15 13 9.0	SEER EER HSPF	$300 if meets SEER, EER & HSPF	2006 & 2007	See CEE list (link above) for products that meet 15 SEER and 9 HSPF. There is no way to identify equipment that meets 13 EER without contacting the manufacturer/distributor (or contractor).
Group-source heat pumps					All Energy Star labeled Geothermal Heat Pumps qualify for credit
Closed loop	14.1/3.3	EER/COP	$300	2006 & 2007	System must also provide water heating.
Open loop	16.2/3.6	EER/COP	$300	2006 & 2007	System must also provide water heating.
Direct expansion (DX)	15/3.5	EER/COP	$300	2006 & 2007	System must also provide water heating.
Water heaters (non-business applications)					See GAMA Web site for list of qualifying products:
Electric	2.0	EF	$300	2006 & 2007	www.gamanet.org/gama/inforesources.nsf/vContentEntries/Product+Directories?OpenDocument
Gas and oil	0.8	EF	$300		
Gas and oil furnaces and boilers					See GAMA Web site (link above) for list of qualifying products.
High combustion efficiency equipment	95%	AFUE	$150	2006 & 2007	Can earn either one or both incentive with the same unit.
High electric efficiency equipment	Meets CEE spec		$50	2006 & 2007	CEE spec requires electricity use to be <=2% of site use.
Envelope improvements to existing homes					
Insulation, exterior doors, duct sealing and infiltration reduction	Meet 2000/2003 IECC + supplements		10% up to $500	2006 & 2007	Includes duct sealing and infiltration reduction. All Energy Star windows and doors qualify for credits.
Windows and skylights	Same as above		10% up to $200	2006 & 2007	Credits cover cost of components only, and do not include
Pigmented metal roofs	Meet Energy Star spec		10% up to $500	2006 & 2007	costs of onsite prep, assembly or installation.
Appliances					All appliance incentives go to manufacturer, not consumer;
Refrigerators					manufacturers are expected to reduce prices accordingly.
Save 15-19.9% relative to federal standard	Look to left		$75	2006	
Save 20-24.9% relative to federal standard	Look to left		$125	2006 & 2007	
Save 25% or more relative to federal standard	Look to left		$175	2006 & 2007	
Clothes washers	1.72 MEF, 8.0 WF		$100	2006 & 2007	This is the 2007 Energy Star specification.
Dishwashers	2007 Energy Star		$32.31	2006 & 2007	Incentive likely to be around $30.
New homes					Incentives go to the builder, not the homebuyer.
Site-built or manufactured homes	50%	savings	$2,000	2006 & 2007	Savings relative to 2004 IECC.
Manufactured homes	30% or meets Energy Star	savings	$1,000	2006 & 2007 2006 & 2007	Savings relative to 2004 IECC.
Commercial buildings					Max. is $0.60/sq.ft. per system or $1.80/sq.ft. for whole bldg.
Whole building	50%	savings	Deduction of $1.80/sq.ft.	2006 & 2007	Savings relative to ASHRAE 90.1-2001.
Lighting, HVAC or envelope	50%	savings	Deduction of $0.60/sq.ft. per system	2006 & 2007	Savings relative to ASHRAE 90.1-2001.
Lighting savings of at least 25%	25-50%	savings	Sliding scale: $.30/sq.ft. for 25% svgs	Unclear	Term of this provision depends on Treasury rulemaking.
Fuel cells and microturbines					
Fuel cells (business or individual credit)	30%	efficiency	30% up to $1000/kW	2006 & 2007	Systems >=0.5 kW for business credit. No size floor or efficiency requirements for individual credit.
Microturbines (only business credit)	26%	efficiency	10% up to $200/kW	2006 & 2007	Systems < 2000 kW.
Passenger vehicles	Complicated formula -- see http://aceee.org/press/0508hybridtaxcr.htm				
Heavy-duty vehicles	Complicated formula -- a description of the credit will be put on www.aceee.org shortly.				

Key: AC= air conditioner; AFUE= annual fuel utilization efficiency; ASHRAE = American Society of Heating, Refrigerating & Air-Conditioning Engineers; CEE = Consortium for Energy Efficiency COP= coefficient of performance; EER= energy efficiency ratio; EF= energy factor; HP= heat pump; HSPF= heating season performance factor; IECC= International Energy Conservation Code kW= kilowatt; MEF= modified energy factor; SEER= seasonal energy efficiency ratio; WF= water factor.

Prepared by the American Council for an Energy-Efficient Economy, February 27, 2006.