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BUILDING ENERGY SIMULATION USERS NEWS

For Users of EnergyPlus, VisualSPARK, DOE-2, BLAST, Genopt, BDA, ENERGY-10 and their Derivatives

EnergyPlus Wins R&D 100 Award

R&D Magazine recently announced that EnergyPlus is one of the winners of the 41st annual R&D 100 Awards, which honor the 100 most technologically significant new products of the year.

Features

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Ask An EnergyPlus Expert

LOADS BREAKDOWN

I ran a simulation and wanted the heating and cooling loads for two design days; however, I need to break down those loads into conduction through walls, through roof, and windows (conduction and radiation). For the zones with roof I asked for Zone Opaque Surface Inside Face Conduction Gain/Loss(W) and, since I thought that it would include loads due to walls and roof, I also asked for Opaque Surface Inside Face Conduction Gain/Loss(W) for the roof surface. But I found that there was a gain through the opaque surfaces of a zone of 670 W and the gain due to the roof in that particular zone was 870 W. Do the opaques surfaces in a zone include the roof when there is one? Since it happens during the first hour of the summer design day, could it be that there is a gain through the roof and some walls that is causing loss so that the total amount due to opaque surfaces is lower than the roof gain? I am sure I am missing something or maybe not asking for the right output variables.

Answer
Opaque Surface Inside Face Conduction is intended for detailed examination of the heat balance on a particular inside surface, primarily to support comparisons with measured data. It is not meaningful as a component of the current heating or cooling load. Surfaces interact with the zone air heat balance by convection. So, the value of most interest is

(SurfaceInsideTemperature - ZoneAir Temperature) * SurfaceArea * SurfaceInsideConvectionCoefficient

The best way to calculate the contribution from the envelope is to take the total load and subtract off the gains from windows, internal loads, infiltration, and ventilation. The remainder will be the impact of the envelope. An explanation of this output variable may be found in the Input Output Reference. Search the document for the variable name of interest.

SCHEDULES AND TEMPERATURE SETTINGS

I want to calculate cooling and heating loads in a commercial building that needs control temperatures on during the day but not at night. In the example files, the temperature is set for 24 hours; does this mean that cooling loads or heating loads will be consumed all the time? How do I set the schedules differently?

Answer
Many of the examples use the DUAL SETPOINT WITH DEADBAND control type with setback/setup during unoccupied hours. With this type of control, the space temperature is allowed to float until conditions reach the setback/setup temperature, then there will be loads to maintain that temperature. If you want to completely shut off the HVAC system during unoccupied hours, then use the system availability manager to do so. If you want to run the fans, but not actively control the space temperature, then you can schedule off individual components (such as the cooling or heating coils) or you can set the thermostat control type to zero during those hours.

The *Building Energy Simulation User News* (Vol. 25, No. 1, January/February 2004) had an article about using compact schedules on p. 11. See also the Input Output Reference for a complete explanation of Schedules.

Ask An EnergyPlus Expert

GROUND CALCULATION

I am using the Auxiliary Ground Temperature program to calculate the outside face temperatures of my walls and floor of the basement for my house. I understand that this program was meant for slab-on-grade but saw that I could use the core temperatures for my basement floor and perimeter temperatures for my basement walls. I know that this will be a lot better than using the ground temperatures in the weather file but I am curious about the applicability of this program to modeling basement heat transfer.

Answer
Just for your information, a basement ground heat transfer program is being readied for inclusion with EnergyPlus. This will use the same "dividing plane" concept, but will enable the users to have temperatures that apply to basement walls and floors. This will be in the September 2004 release.

Question
Okay, so what is the correct way to specify an unconditioned basement? Here is what I've been doing so far: instead of entering my setpoints for the conditioned zones as the monthly averages, I use the monthly averaged temperatures of the unconditioned basement from a previous EnergyPlus run. As a result, this significantly decreased the calculated monthly ground temperatures.

Answer
The first question has to be: How did you model the unconditioned basements? The results you get would be heavily influenced by the assumptions made. For example, you should probably use an interzone partition for the ceiling/floor above the basement to include the gains from above. Include other incidental gains as well. In addition, I would suggest using the core slab ground temperature for the floor, and making a run with insulated walls. From those results, see what monthly average unconditioned basement temperatures are. Then, with those results, try using the perimeter slab temperatures on the basement walls and see what the effect is.

Question
What about using the daily sine wave variation amplitude, since my basement zone experiences larger daily fluctuations then my conditioned zones.

Answer
The daily variations get damped out so they have little effect on the results.

Question
Should I specify my slab and soil material properties differently than those recommended for the slab on grade?

Answer
If you can come up with some information that is more local, definitely use it. One problem always is that basement excavations are filled with material, like sand, that is nothing like the earth in the vicinity.

Question
Should I specify my insulation configuration vertical or under the slab? And how thick should I specify my slab?

Anwer
We suggest under the slab. It probably won't have a huge effect in this case, but 4 inches or 100mm is common.

Ask An EnergyPlus Expert

MANIPULATING WEATHER FILES

I need to modify weather files (change solar radiation and dry bulb temperature) in order to test some glazing options for a commercial building. How do I change the files?

Answer
The simplest way to modify a weather file (epw) is to use the WeatherConverter program (optionally installed by default when you install EnergyPlus) and save the incoming epw file as a "csv" file. You can then import this file into Excel or other spreadsheet software. Once successfully imported, the weather data will be in columns with the "header columns" near the top of the file. Change the data and resave as a "csv" format file. Then, run the weather converter program again to input the csv file and save as an epw file. Documentation on the EnergyPlus weather format and the csv is in AuxiliaryPrograms.pdf beginning on p. 2 (or 11 of 139 in the pdf).

Question
I can get the following six parameters' data by measurement: outside dry bulb temperature (C), outside relative humidity (%), wind direction (deg), wind speed (m/s), solar beam intensity (W/m^2), solar normal flux (W/m^2). However, other than dew point temperature, what other parameters in the weather file can be calculated based on the six parameters mentioned above? And for the parameters that cannot be calculated, how should I treat them? Can I just keep their original value in the weather file?

Answer
From your measurements, it is possible to calculate/model all the needed radiation data. But it can be quite involved and more suited to research rather than practice. Since we don't know exactly what solar data you have, the Perez All Weather Sky model is useful for getting to Direct Normal Radiation and Diffuse Horizontal Radiation. (There exists Fortran code from an ASHRAE research project that implements this model.) Methods for getting to Horizontal IR Intensity (or Sky Cover if you prefer) are more obscure; one simple method is by Auer and implemented in TRNSYS Type69. If you did manage the above, then Atmospheric Station Pressure is likely the only data you would have to leave as-is; as long as the elevations are similar there wouldn't be much error.

DISCREPANCY OF WEATHER DATA IN EPW FILE AND CSV REPORT FILE

I notice that the same weather data (such as the Outdoor Dry Bulb and Outdoor Relative Humidity) are slightly different in the epw weather file and csv report file. Does it matter ?

Answer
No, it does not matter. To explain in more detail. The standard EnergyPlus weather files (epw) contain hourly data. For state variables such as temperature and humidity, the values in the epw file are the instantaneous measurements at 1:00 am, 2:00 am, and so on. Because EnergyPlus uses zone timesteps of less than one hour, these values are linearly interpolated for each time step. Weather data values reported from EnergyPlus at the Timestep frequency will match the weather file one timestep per hour on the hour. Values reported at the hourly frequency represent the average value over the hour, so they will not match the instantaneous value in the weather file. The solar radiation values in the weather file are integrated total values for the hour, so the interpolation must be done differently. The total radiation in [Wh/m^2] is used as an average rate for the hour in [W/m^2], and this average rate is assumed to be the value at the midpoint of the hour. Again, linear interpolation is used to determine the value for each timestep. The reported solar values in the output will match the value in the weather file on the half hour.

Ask An EnergyPlus Expert

WINDOW GEOMETRY

I am simulating a two story office building with 40 windows of the same size and material. Is it possible to combine windows in the same zone and surface/wall?

Answer
Yes - there are two easy methods to model groups of windows:

1. You may combine all the windows of the same type on the same wall to one of equivalent area. Studies have shown the results to be very similar and fewer surfaces take less computation time.
2. There is a Window Multiplier in the Surface:HeatTransfer:Sub object.

```
N2 , \field Multiplier
     \note Used only for Surface Type = WINDOW or GLASSDOOR
     \note Non-integer values will be truncated to integer
     \default 1.0
     \minimum 1.0
```

You can use this field to easily "multiply" the number of windows on a wall. However, do not use multiplier on windows in zones with daylighting or if SolarDistribution=FullInteriorAndExterior in the Building object.

MOISTURE TRANSFER FUNCTION (MTF)

MTF requires four material properties; however, I have only limited information on specific building materials. Are there datasets of material properties for MTF that can be used in EnergyPlus? I also need possible ranges of each property value.

Answer
The DataSets Folder includes the file, MoistureMaterials.idf, which contains the MTF moisture properties as well as EMPD moisture properties for several materials.

In the Engineering Reference (numbered page 24 -- actual page 51) the section entitled "Moisture Transfer Material Properties" gives background and references for information on these for other materials.

Also see the caution about the MTF model on p. 16 (pdf p. 44) in the Input Output Reference.

THE "PEOPLE" OBJECT

I want to calculate "predicted mean vote" (PMV) using the Fanger thermal comfort model. I expect that the thermal sensation scale is between -4 and 4. However, after simulation, I found that the scale can be very large, i.e., between -9 to 4. Is this abnormal?

Answer
EnergyPlus does not limit thermal comfort results to the standard reporting ranges. If -4 indicates that people are cold, then -9 indicates that they are *very very* cold. Report the values for Mean Air Temperature and Mean Radiant Temperature in the zone. If these values are reasonable, then check the inputs in the People object.

Ask An EnergyPlus Expert

RESIDENTIAL FAN PERFORMANCE

I want to model a blow-through on/off fan for a furnace/AC system and a draw-through on/off fan for a heat pump system.

1. Should I specify the blow-through and draw-through differently?

2. What should I put for efficiency? I have 65% for the total efficiency and 90% for the motor efficiency. I have all the motor inefficiency lost as heat to the air stream but want to know what happens to the energy lost due to the fan efficiency.

3. How should I specify the pressure difference across the fan? Building America specifies that the air handler should consume 0.00055 kW/CFM. Therefore, should I change my pressure difference to meet this figure based upon whatever my CFM is sized to be?

Answer
1. For furnace/AC systems, EnergyPlus currently only allows for the "blow-through" configuration; you should use FURNACE:BLOWTHRU:HEATCOOL. For air-to-air heat pumps, one of the input fields sets the fan location, so you would use UNITARYSYSTEM:HEATPUMP:AIRTOAIR, and then set field Fan placement to "draw-through."

2) The fan and motor efficiencies that you propose are too high for residential equipment. Total efficiencies are more like 35% to 45%. Motor efficiencies depend on type (permanent split capacitor or ECM). Motor efficiencies tend to be higher for larger commercial size motors.

3) Fan pressure difference will be site-specific. Total pressure difference would probably be somewhere between 150 and 225 Pascals for residential systems.

CTFs in EnergyPlus

In DOE-2, users have access to the Response Factors (transfer functions) calculated for delayed walls (in the Building Description Language). Is it possible to have access to the Conduction Transfer Functions calculated in EnergyPlus?

Answer
Yes, they are available. All you have to do is put this in your *.idf file:

```
       report,
     construction;            !- Type_of_Report
```

This will report the CTF calculations, or coefficients, in the *.eio file. Remember that the *.eio file is a comma-separated file and it is best viewed in Excel or some type of a spreadsheet program to have the headers and data line up.

Ask An EnergyPlus Expert

HVAC LOOPS

I'm confused about the HVAC loops in EnergyPlus. There are six loop section types and I don't understand them clearly. Would you explain them distinctly? And is there a diagram?

Answer
Each plant loop has two sides, a supply side and a demand side. This is true for hot water, chilled water, and condenser loops.

Supply side

The supply side may consist of a single branch containing a pump and a single piece of supply equipment such as a boiler or chiller. Or it may consist of an inlet branch containing a pump, then a splitter, then one or more equipment and bypass branches in parallel, then a mixer, then an outlet pipe.

Demand side

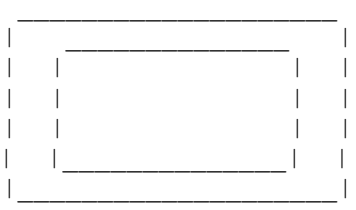
The demand side must always begin with an inlet pipe, then a splitter, then one or more demand components (coils, chiller condenser side, etc.) and bypass branches in parallel, then a mixer, then an outlet pipe.

The example files and the HVAC diagram outputs will help you. Run the 5ZoneWaterCooled.idf example with Chicago weather, then view the HVAC diagram in the svg file. In EP-Launch, select View → Single File → HVAC Diagram-SVG. This will display a schematic block diagram of the air and plant loops in your browser. Viewing the svg file requires a special browser plugin. (If the file will not open, you can download a free svg viewer from www.adobe.com/svg. When the drawing is open in the viewer, right-click in the drawing for help and other options.)

You may also find it helpful to use the HVAC Templates to generate the initial input for your system. See the Auxiliary Programs document for instructions and schematic diagram in the Engineering Reference Manual.

SURFACE DESCRIPTION

I have a question about transfer surfaces. I want to model a building as follows: I have assigned the central area as a zone, and the perimeter as a zone. My question is, how do I set the roof and ground of the perimeter zone? Only three or four sides are allowed, but I need eight vertices to describe the ground and the roof of the perimeter zone.



Answer
To describe a non-rectangular surface, divide it into multiple rectangles and/or triangles. There is no requirement that the floor (or roof or whatever) of a zone be described as a single surface. If the perimeter zone has windows, then divide it into multiple perimeter zones in order to see the cooling peaks as the sun moves around the building.

Ask An EnergyPlus Expert

CHANGE THE UNITS?

Can I change the units in the report meter file from [J] and [W] to [kW]?

Answer
No, you cannot change units of the output variables from EnergyPlus. However, what you can do very easily is when you open the *.csv file in a spreadsheet program you can convert the answers to units that are appropriate for your use.

EnergyPlus Introductory Workshop for Experienced Modelers

The objective of this workshop is to introduce EnergyPlus to experienced modelers who are familiar with the basic concepts of energy simulation. The course will cover the mechanics of using EnergyPlus with an emphasis on aspects of EnergyPlus that differ substantially from other common modeling tools (DOE-2, BLAST, etc.), such as the use of sub-hour time-steps, the integrated simulation of loads/systems/plant, and defining fluid and air loops. Time will be set aside to allow students to model basic building envelopes and systems using the latest version of EnergyPlus on their own laptop computers. Time for questions and answers will be provided for each topic. Class size will be limited to no more than 40.

Location and Date

- Boulder, CO, August 2 – 3, 2004

Course Fees and Deadlines

- $250. Registration will be closed after July 16, 2004

Instructors
Richard L. Liesen, Ph.D., University of Illinois at Urbana-Champaign (EnergyPlus Development)
Michael J. Witte, Ph.D., GARD Analytics, Inc. (EnergyPlus Support and Testing)

The Forecast Looks Favorable for …

(Free!) Weather Data on Demand

You can access archived weather data from around the world through this U.S. DOE web interface:

www.eere.energy.gov/buildings/energyplus/cfm/weatherdata/weather_request.cfm

Hourly weather data is continuously collected and stored into a local database, available through this web interface. Most stations have information for dry bulb temperature, wet bulb temperature, wind speed/direction, atmospheric pressure, visibility, cloud conditions, and precipitation type.

EnergyPlus Version 1.2

To download a free copy of the program go to www.energyplus.gov

EnergyPlus Support Tools

Support software is listed on our website (http://SimulationResearch.lbl.gov/EP/ep_tools.html) and in Section 2 of this newsletter.

EnergyPlus Weather Data from www.energyplus.gov/

There are 275 locations in the United States, 16 California thermal zones, 55 Canadian locations, and 233 international locations in more than 80 countries.

Ask an EnergyPlus Expert

Questions from EnergyPlus users are answered promptly via email by program developers. To submit questions, join the EnergyPlus User Group at http://groups.yahoo.com/group/EnergyPlus_Support/.
A selection of questions/answers is compiled (yearly) into a downloadable PDF document:
Q and A for 2002, Q and A for 2003.

EnergyPlus Validation

For reports about testing and validation, go to http://www.eere.energy.gov/buildings/energyplus/testing.html.

Are you an EnergyPlus Consultant ?

If you are engaged in EnergyPlus consulting, and would like to be listed in the *Building Energy Simulation User News* and on our website (http://SimulationResearch.lbl.gov), 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. We invite questions about program usage and suggestions for improvement to the code. Go to http://groups.yahoo.com/group/EnergyPlus_Support/

Translate EnergyPlus Web Pages

A new link on the main EnergyPlus web page (www.energyplus.gov/) allows you to view the pages in any of eight languages. Unfortunately, the translator doesn't work with PDF files. Look for the fish at the bottom of the web page. Pages may be translated into Chinese, French, German, Italian, Japanese, Korean, Portuguese and Spanish.

EnergyPlus is being developed by University of Illinois and Lawrence Berkeley National Laboratory, with the assistance of DHL Consulting, C. O. Pedersen Associates, Florida Solar Energy Center, GARD Analytics, the National Renewable Energy Laboratory, Oklahoma State Universit, 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).

SPARK is an equation-based simulation environment that allows you to build customized models of complex physical processes by connecting calculation objects that represent system components like walls, fans, heat exchangers, chillers, ducts, mixing boxes, controls, etc. It is aimed at the simulation of innovative and/or complex building systems that are beyond the scope of whole-building programs like DOE-2 and EnergyPlus. VisualSPARK adds a graphical user interface to SPARK to simplify its use.

Download VisualSPARK free of charge from

http://SimulationResearch.lbl.gov/

Please go to our website to download this new VisualSPARK documentation:

- **New Features, Bug Fixes, and Changes**
- **Frequently Asked Questions**
- **How To Port Atomic Classes To SPARK 2.*x***
- **Theoretical Speed-Up Using SPARK**

SPARK was developed by the Simulation Research Group at Lawrence Berkeley National Laboratory and by Ayres Sowell Associates, with Support from the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technologies Program of the U.S. Department of Energy, Program Manager Dru Crawley.

From WinterGreen, the Steven Winter Associates newsletter ...

GREEN SCHOOLS ONLINE

Interested in designing and building better-performing school facilities? Well, now there's an information and training resource just a few mouse-clicks away. *Online Training for High Performance School Design* is offered as a series of internet-based courses for anyone interested in sustainable design as it pertains to K-12 school buildings. Sponsored by the U.S. Department of Energy (DOE) and the National Association of State Energy Officials, these courses are based on the *National Best Practices Manual for Building High Performance Schools*. Curriculum topics include: site design; daylighting; energy efficient building shell; resource-efficient building products; commissioning; and a comparison of the CHPS and LEED™ rating systems.

This program was developed by the New York State Energy Research and Development Authority and five organizations at the forefront of high performance school design and internet training: the Sustainable Buildings Industry Council; the Collaborative for High Performance Schools; Building Media, Inc.; the New Jersey Institute of Technology; and Architectural Energy Corporation (formerly Eley Associates).

Take the program and you'll receive continuing education credit for the completion of each course. Complete all 25 courses and you're eligible to attend a NYSERDA workshop for A/Es and be listed on various referral lists for school districts. For more information or to sign up, visit http://www.hpschooldesigntraining.com/

Job Opening for an Energy Engineer

Provide technical energy audits and analysis of commercial and industrial facilities. Engineering degree required. Experience with design and/or analysis of energy systems required. Computer simulation, field monitoring, technical reporting a plus; 1-5 years experience.

Mark E. Case, President, etc Group, Inc., 3481 South 2300 East, Salt Lake City, UT 84109, **www.etcgrp.com**

GenOpt 2.0
Generic Optimization Program

GenOpt *is an optimization program for the minimization of a cost function, such as annual energy use, that is evaluated by an external simulation program.*

GenOpt *can be used with any simulation program -- such as EnergyPlus, SPARK or DOE-2 -- that has text-based input and output. It also offers an interface for adding custom optimization algorithms to its library.*

GenOpt Technical Reports

- *Generalized Pattern Search Algorithms with Adaptive Precision Function Evaluations* by Elijah Polak and Michael Wetter (click on the title to download the document)
- *Comparison of a Generalized Pattern Search and a Genetic Algorithm Optimization Method*, by Michael Wetter and Jonathan Wright (click on the title to download the document)
- *A Convergent Optimization Method Using Pattern Search Algorithms with Adaptive Precision Simulation*, by Michael Wetter and Elijah Polak (click on the title to download the document)

All reports and GenOpt documentation are available free of charge from http://SimulationResearch.lbl.gov/

Features of Version 2.0

Capability to Process Discrete Independent Variables

GenOpt can now process discrete independent variables, such as different window constructions, either for optimization problems with mixed discrete and continuous independent variables or for doing parametric studies.

New Optimization Algorithms

The following optimization algorithms are new in *GenOpt 2.0*:

- `GPSCoordinateSearch` and `GPSHookeJeeves`: These algorithms are members of the family of Generalized Pattern Search (GPS) algorithms. They can be used to solve optimization problems with continuous independent variables. Both algorithms can be run using multiple starting points to increase the chance of finding the global minimum if the cost function has several local minima.
- `DiscreteArmijoGradient`: An algorithm that approximates gradients by finite differences and uses the Armijo line search algorithm.
- `PSOCC`, `PSOCCMesh`, and `PSOIW`: These algorithms are members of the family of Particle Swarm Optimization algorithms (which are global heuristic optimization algorithms). They can be used to solve optimization problems with continuous and/or discrete independent variables.
- `GPSPSOCCHJ`: This is a hybrid global optimization algorithm that starts by performing a Particle Swarm Optimization for continuous and discrete independent variables and then switches to the Hooke-Jeeves Generalized Pattern Search algorithm to refine the continuous independent variables.

Pre- and Post-Processing

Some simulation programs, such as EnergyPlus, cannot pre-process the independent variables or post-process values that are computed during the simulation. For such situations, *input function objects* and *output function objects* can now be used without having to modify *GenOpt's* source code.

GenOpt 2.0 **(with documentation) may be downloaded free of charge from**

http://SimulationResearch.lbl.gov > GenOpt

Recent Reports

This report is available from the Simulation Research Group at Lawrencet Berkeley National Laboratory.

LBNL-51434 (download document here)

China's Energy Efficiency Design Standard For Residential Buildings In The "Hot-Summer/Cold-Winter" Zone

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ABSTRACT
To respond to increasing energy use in the building sector, China has a national effort to develop Energy Codes for building construction. Several years ago, an Energy Code was promulgated for the northern portion of the country, where energy consumption for heating is the primary concern. In 2000-2001, an Energy Code was developed for residential buildings in the "Hot-Summer/Cold-Winter" Zone along the Yangtze River. The Compiling Team consisted of representatives from key cities within the region (Chongqing, Shanghai, Wuhan, Nanjing and Chengdu). International support was provided by the Energy Foundation, the Natural Resources Defense Council, and Lawrence Berkeley National Laboratory. This work was complicated by the fact that the "Hot-Summer/Cold-Winter" Zone area has both significant heating and cooling loads. Consequently, the "Hot-Summer/Cold-Winter" Zone Energy Code needed to be more sophisticated than the previous Energy Code adopted in China. In addition to balancing the relative importance of heating and cooling loads, the project also involved a judgment of how comfort conditions in residential buildings might be expected to improve over time. The range of energy efficiency measures that were evaluated is presented (including multiple glazing, frame and shading options for windows, and insulation options for the walls and roof).

LBNL-51435 (download document here)

Development Of Chinese Weather Data For Building Energy Calculations

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ABSTRACT
To support the development of building energy standards in China, the authors have recently developed a set of Typical Meteorological Year (TMY) weather data for 26 locations. These TMY weather data have been produced from 16 years of historical weather (1982-1997) reported by Chinese airports and recorded by the U.S. Climatic Data Service. Since the weather data records only cloud conditions at various heights, a substantial effort was made towards estimating the total and direct solar radiation from the cloud information, combined with information on temperature, humidity, and wind speed. Comparisons of the estimated solar to actual measured hourly solar for three locations and daily totals for all 26 locations showed good agreement to with 20% for hourly and 10% for daily values. The 26 weather files are available as either ASCII files in SI units, or as packed DOE-2.1E weather files.

Recent Reports

This report is available from the Simulation Research Group at Lawrence Berkeley National Laboratory. Send email to Kathy Ellington.

LBNL-51436 (download document here)

Development Of Typical Year Weather Data For Chinese Locations

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Berkeley, CA USA

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ABSTRACT
Since their development starting in the late 1970's, computer simulations have become accepted as the most detailed way to calculate the dynamic behavior and energy use of a building over an entire year. Their use in China, however, has been hampered by the absence of detailed weather data. For computer simulations, the weather data must have hourly records of at least temperature, humidity, wind speed, and both direct and total solar radiation. Furthermore, to avoid the random variations in weather from year to year, the weather data should be for a hypothetical typical year, rather than an actual year of record. In support of the development of residential building energy standards for the "Hot-Summer/Cold-Winter" region in central China, the authors developed Typical Meteorological Year (TMY) weather data for 28 Chinese locations that will eventually be expanded to 69. These TMY weather data have been produced from historical weather (1982-1997) reported by Chinese airports and obtained from the U.S. Climatic Data Center. Since the weather data records only cloud conditions at various heights, a substantial effort was made towards estimating the total and direct solar radiation from the cloud information, combined with information on temperature, humidity, and wind speed. Comparisons of the estimated solar to measured hourly solar radiation for two locations resulted in an R2 of 0.87, while comparisons of annual global and diffuse solar radiation for 9 locations showed standard deviations of 5% and 12%, respectively. The creation of the artificial TMY uses a similar methodology to that used for the United States TMY data, with a four-step process to select the most representative month from the 16 available historical months. The 12 representative months were then combined to form the Typical Meteorological Year for each city.

(download document here)

Framework for Coupling Room Air Models to Heat Balance Model Load and Energy Calculations

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ABSTRACT
Most energy and load calculation procedures have assumed that room air is well mixed; this may lead to significant errors in sizing HVAC systems, estimating building energy use, and predicting thermal comfort for buildings with buoyancy-driven room airflow. This investigation has developed a framework and computer code for coupling detailed air models with building energy and load calculations as an extension to the ASHRAE Toolkit for Building Load Calculations. Two nodal models and a momentum-zonal model were selected for testing the coupling framework in a program for hourly load calculations of a single thermal zone. The heat balance model for load and energy calculations is reformulated to use zone air temperature as a variable defined separately for each surface. Air system flow rates are determined using air model predictions for temperature at the air system returns and a room air control location. The effect of air models on sensible load was found to be minor except when aggressive diurnal thermal mass strategies were involved. Nodal models appear practical to implement in load and energy programs and should improve results for air system flow rate and return air temperatures. Results show increases of about a factor of four in computing time for nodal models compared to the well-mixed model. Computing time is increased by two orders with the three-dimensional momentum-zonal model.

ENERGY-10, VERSION 1.6

ENERGY-10 is a design tool for smaller residential or commercial buildings that are less than 10,000 ft^2 or buildings that can be treated as 1- or 2-zone increments. It performs whole-building energy analysis for 8760 hours/year, including dynamic thermal and daylighting calculations. ENERGY-10 was specifically designed to facilitate the evaluation of energy-efficient building features in the very early stages of the design process.

Version 1.6 Upgrades

Synchronize Libraries
Libraries may now be associated with more than one building.

Free Run Mode
Automated process of monitoring how a building operates without any HVAC system.

Clear All Internal Gains
The name is self-explanatory.

New Buttons on Provisional Data Dialog Box
Users may specify whether they want autobuild HVAC sizing to be computed with or without daylighting.

Performance Summary Reports
Three performance summary reports have been added. One is a simple performance summary, which breaks down the standard summary into more readable chunks and adds a column that reflects the percentage change of going from Building 1 to Building 2. The other two are daylighting reports that show the standard daylighting factor calculated for each lighting zone.

NewDefaults Library
A new set of libraries contains all the standard libraries such as floorlib, rooflib, etc. with updated values.

Registry Path for ENERGY-10 Data
New registry path allows users to maintain separate copies of the three most recent versions of *ENERGY-10*. In addition, the installation script allows installation for either "all users" or the "current user only."

Additional Tutorials on Installation CD
Three new tutorials are included in the slide show section of the installation CD, including Economics, Daylighting, and Using *ENERGY-10* in the Design Process.

Douglas K. Schroeder
1331 H Street N.W., #1000
Washington, DC 20004

Tel: 202.628.7400 ext 210
Fax: 202.383.5043
www.sbicouncil.org

Sustainable Buildings Industry Council (SBIC)

ENERGY-10 User Group www.sbicouncil.org/forum

SBIC Bookstore www.sbicouncil.org/store/resources.php - pubs

BLAST*news*

www.bso.uiuc.edu

Building Systems Laboratory
University of Illinois, 30 Mechanical Engineering Building,
1206 West Green Street, Urbana, IL 61801
Tel: (217) 333-3977 - Fax: (217) 244-6534
support@blast.bso.uiuc.edu

The **Building Loads Analysis and System Thermodynamics (BLAST** program predicts energy consumption, energy system performance and cost for new or existing (pre-retrofit) buildings.

BLAST contains three major sub-programs:

- **Space Load Prediction** computes hourly space loads in a building based on weather data and user inputs detailing the building construction and operation.
- **Air Distribution System Simulation** uses the computed space loads, weather data, and user inputs.
- **Central Plant Simulation** computes monthly and annual fuel and electrical power consumption.

Heat Balance Loads Calculator (HBLC)
The BLAST graphical interface (HBLC) is a Windows-based interactive program for producing BLAST input files. You can download a demo version of HBLC (for MS Windows) from the BLAST web site (User manual included).

HBLC/BLAST Training Courses
Experience with the HBLC and the BLAST family of programs has shown that new users can benefit from a session of structured training with the software. The Building Systems Laboratory offers such training courses on an as needed basis typically at our offices in Urbana, Illinois.

WINLCCID 98
LCCID (Life Cycle Cost in Design) was developed to perform Life Cycle Cost Analyses (LCCA) for the Department of Defense and their contractors.

To order BLAST-related products, contact the Building Systems Laboratory at the address above.

Program Name	Order Number	Price
PC BLAST Includes: BLAST, HBLC, BTEXT, WIFE, CHILLER, Report Writer, Report Writer File Generator, Comfort Report program, Weather File Reporting Program, Control Profile Macros for Lotus or Symphony, and the Design Week Program. The single CD-ROM includes soft copies of the BLAST Manual, technical articles and theses related to BLAST, nearly 400 processed weather files with a browsing engine, and complete source code for BLAST, HBLC, etc.	3B486E3-0898	$1500
PC BLAST Package Upgrade from level 295+	4B486E3-0898	$450
WINLCCID 98: executable version for 386/486/Pentium	3LCC3-0898	$295
WINLCCID 98: update from WINLCCID 97	4LCC3-0898	$195

The last four digits of the catalog number indicate the month and year the item was released or published. This will enable you to see if you have the most recent version. All software will be shipped on 3.5" high density floppy disks unless noted otherwise.

HOMER !!

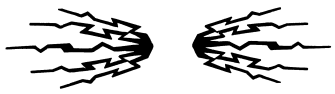
HOMER is a computer model that simplifies the task of evaluating design options for both off-grid and grid-connected power systems for remote, stand-alone, and distributed generation applications. HOMER's optimization and sensitivity analysis algorithms allow you to evaluate the economic and technical feasibility of a large number of technology options and to account for variation in technology costs and energy resource availability. HOMER models both conventional and renewable energy technologies such as wind turbines, solar photovoltaic, hydrogen, fuel cells, battery banks, etc. HOMER is free.

http://www.nrel.gov/homer/

Building Energy Software

from the Environmental Energy Technologies Division of Lawrence Berkeley Laboratory

Free Downloads	
BDA 3.0 (Building Design Advisor) (building decision-making from design through completion)	**gaia.lbl.gov/BDA**
COMIS (multi-zone air flow and contaminant transport model)	**www-epb.lbl.gov/comis**
EnergyPlus 1.2 (new-generation whole-building energy analysis program, based on BLAST and DOE-2)	**www.energyplus.gov/**
GenOpt® 2.0 (generic optimization program)	**SimulationResearch.lbl.gov**
Optics 5.1.02 (for analyzing optical properties of glazing systems)	**windows.lbl.gov/materials/optics5/**
RADIANCE 3.5 (analysis and visualization of lighting in design)	**radsite.lbl.gov/radiance/**
Desktop Radiance 2.0β (integrates the Radiance Synthetic Imaging System with AutoCAD Release 14)	**radsite.lbl.gov/deskrad/**
Radiance Control Panel (automates some Radiance tasks once the model has been created)	**www.squ1.com/site.html**
THERM 5.2 (models two-dimensional heat-transfer effects in building components where thermal bridges are of concern)	**windows.lbl.gov/software/therm/therm.html**
VisualSPARK 2.01 (Simulation Problem Analysis and Research Kernel) (connect component models to simulate innovative building envelope and HVAC systems)	**SimulationResearch.lbl.gov**
WINDOW 5.2 (thermal analysis of window products)	**windows.lbl.gov/software/window/window.html**
Free Software / Request by Fax from 510.486.4089	
RESFEN 3.1 (choose energy-efficient, cost-effective windows for a given residential application)	**windows.lbl.gov/software/resfen/resfen.html**
Web Based (free)	
Home Energy Saver (quickly computes home energy use) and ***Home Improvement Tool*** (simplified Home Energy Saver)	**hes.lbl.gov** and **hit.lbl.gov**



Daylight in Buildings

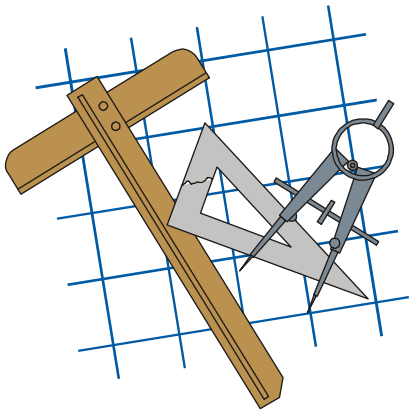
A Source Book on Daylighting Systems and Components

Free!!

This source book gives a comprehensive overview of innovative daylighting systems, the performance parameters by which they are judged, and an evaluation of their energy savings potential and user acceptance. The book has been written to overcome a lack of evidence of the advantages of daylighting in buildings and a lack of knowledge regarding the performance of innovative daylighting systems in buildings. The information presented here is intended to be used in the earliest stages of the building design process.

Innovative daylighting systems are designed to redirect sunlight or skylight to areas where it is required, without glare. These systems use optical devices that initiate reflection, refraction, and/or use the total internal reflection of sunlight and skylight. Advanced daylighting systems can be designed to actively track the sun or passively control the direction of sunlight and skylight. The systems included in this book have been generally limited to passive devices.

*Daylight in Buildings is available **FREE OF CHARGE** from the Building Technologies Department at Lawrence Berkeley National Laboratory. Send your request to Kathy Ellington (klellington@lbl.gov).*



Building Energy Tools Directory

The web-based Building Energy Tools Directory contains information on more than 270 building-related software tools from around the world.

For each tool in the directory, a short description is provided, along with information about technical expertise required, users, audience, input, output, validation, computer platforms, programming language, strengths, weaknesses, technical contact, availability and cost. A link is also provided for directly translating the web pages into more than eight languages.

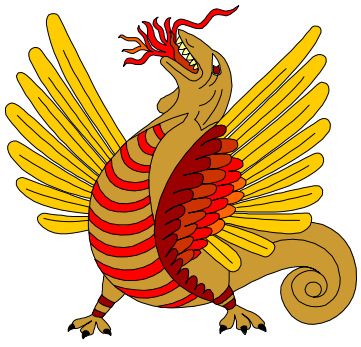
Know of a tool (yours?) that isn't in the directory? Visit http://www.eere.energy.gov/buildings/tools_directory/your_software_here.html or contact Dru Crawley at Drury.Crawley@ee.doe.gov.

Join the BLDG-SIM Mailing List

BLDG-SIM is a mailing list for users of building energy simulation programs like EnergyPlus, DOE-2, Trace-600, HAP, BLAST, ESP, SERIRES, TRNSYS, TASE, ENERGY-10 and others. Because building simulation professionals are located worldwide, the BLDG-SIM list is an attempt to foster the development of a community of those users. Users of all levels of expertise are welcome and are encouraged to share their questions and insights about these programs. To subscribe, send a blank email message to BLDG-SIM-SUBSCRIBE@GARD.COM

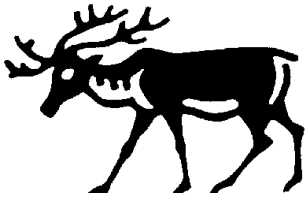
The web page for BLDG-SIM is www.gard.com/bldg-sim.htm

Jason Glazer, P.E., of GARD Analytics, Inc., Is the list administrator (jglazer@gard.com).



Run for safety, foolish pedestrians!

DOE-2



DOE-2.1E (v. 121) 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)
- DOE-2 Reference Manual (Part 2)
- DOE-2 Supplement to the Reference Manual (2.1E)
- DOE-2 BDL Summary (2.1E)
- DOE-2 Engineers Manual (2.1A)

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 remaining 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://simulationresearch.lbl.gov/> DOE-2 > Documentation)

DOE-2 Basics Manual (2.1E)

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 2003 for 2002
A compilation of all the "how to" and "DOE-2 Puzzler" articles from the *Building Energy Simulation User News.*

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

DOE-2 listings are continued on the next page

DOE-2 (continued)

DOE-2 Training

Private or group DOE-2 courses for beginning and advanced users.
Contact Marlin Addison at (602) 968-2040, marlin.addison@doe2.com

DOE-2 Help Desk

Email (klellington@lbl.gov) or fax the Simulation Research Group with your questions. Fax: (510) 486-4089

I am having a difficult time trying to model two independent boiler plants in a multi-building campus. Each boiler plant has a different fuel source.

Can DOE-2.1E model this?

Answer

If you are modeling the campus in one run, you can assign different sets of systems to two different plant-assignments. Then two plant inputs with the different plant-assignments will model the two different plants. The limitation is that each plant must simulate independent sets of systems. You can't have one plant serving a system's zone coils and another serving the same systems central heating coil. In one plant, in order to model two different boilers they would have to be different types: for instance, HW-BOILER and STM-BOILER. This doesn't make much difference to DOE-2. However, they would both have to be on the same loop and see the same heating load. You would have to decide how to run them.

E-nnouncements is a free, monthly electronic news service for the energy and environmental community; it covers CADDET Annexes (energy efficiency and renewable energy) and GREENTIE (greenhouse gas mitigation technologies).

GREENTIE IEA OECD

Visit www.greentie.org to sign up for the newsletter

Southern California Gas Company

Educational Programs ➤◄ July and August, 2004

http://www.socalgas.com/business/resource_center/erc_seminar_info.shtml

July 6 & 8	System Design (two-night program) (Seminar 11417)
July 13 & 15	System Design (two-night program) (Seminar 11419)
July 22	Design Strategies for High Performance Glass (Seminar 11418)
August 03	HVAC Maintenance for Efficiency (Seminar 11421)
August 10	HVAC Maintenance for Efficiency (Seminar 11422)

The Gas Company's Energy Resource Center, 9240 Firestone Boulevard, Downey, CA