

## Building Energy Simulation ♦ User News

### Highlights

- 2 ...Release of **EnergyPlus 2.0**
- 4 ...Updated **EnergyPlus** Example File Generator
- 5 ... Ask an **EnergyPlus** Expert
  - 5 *Modifying Weather Files, Part I*
  - 5 *Modifying Weather Files, Part II*
  - 5 *Window Glass*
  - 6 *Precipitation Data*
  - 6 *Reporting Glare Index*
  - 7 *Complicated Door-in-Wall*
  - 7 *Phase Change material*
  - 7 *Evaluating a Sun Shading Device*
  - 7 *DX Cooling Coil*
  - 8 *Sky Temperature*

### Recent Reports

- 10 ... "On-Site Generation Simulation with EnergyPlus for Commercial Buildings"
- "Window-Related Energy Consumption in the US Residential and Commercial Building Stock" (LBNL-60146)

### Regular Features

- 11 ... Meetings, Conferences, Symposia
- 11 ... May 2007 Educational Classes from Pacific Gas & Electric

**Big List of FREE!** has moved to [section 2 of the User News](#)

### The Buzz

#### *Ask an EnergyPlus Expert*

*All 2006 questions and answers (PDF)*

[http://simulationresearch.lbl.gov/dirpubs/un\\_articles/EP06.pdf](http://simulationresearch.lbl.gov/dirpubs/un_articles/EP06.pdf)

*DOE-2 User Questions*  
*All 2006 questions and answers (PDF)*

[http://simulationresearch.lbl.gov/dirpubs/un\\_articles/O6.pdf](http://simulationresearch.lbl.gov/dirpubs/un_articles/O6.pdf)

#### *2006 Building Energy Data Book (Download)*

<http://buildingsdatabook.eere.energy.gov/>

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## **Release of EnergyPlus 2.0**

### **NEW FEATURES**

#### **DATA SETS**

- New materials data set based on ASHRAE 2005 HOF (replaces legacy DOE-2 and BLAST data).
- Updated solar collector data set from the SRCC adds 55 more collectors for a total of 173.
- Added air change rate to ventilation loads report in StandardReports data set.

#### **INPUT**

- Objects and name lengths can now be 100 characters (previous limit was 60).
- New weather data for 86 locations added: 69 in Australia, 16 in Canada, and 1 in Iran.
- Three new unit ventilator input files created:
  - UnitVent5Zone.idf,
  - UnitVent5ZoneAuto.idf,
  - UnitVent5ZoneFixedOANoCoilOpt.idf.
- Three new thermal storage example input files created:
  - IceStorage-Parallel.idf,
  - IceStorage-Series-ChillerDownstream.idf,
  - IceStorage-Series-ChillerUpstream.idf.
- Example input files created for all new features (More than 225 example files now available)

#### **GEOMETRY • WINDOW • WALLS • SHADING**

- Shadowing Calculations object now allows user to specify maximum figures in shadowing overlaps.
- Phase change materials (PCM) with variable thermal conductivity and a temperature-enthalpy function incorporated in conduction finite difference solution algorithm.
- Basement program now outputs EnergyPlus IDF for wall and floor surface temperatures.
- Users can now enter interzone surfaces once and EnergyPlus will automatically create the mirror interzone surface.

#### **DAYLIGHTING ZONE MODEL**

- Zone Sizing modified to allow standards-type calculation of design outside air flow rates; allows minimum cooling and maximum heating limits on design supply air flow rates.

#### **ON-SITE ENERGY SUPPLY**

- Fuel cell model updated.
- Combustion micro cogeneration model added.

*Continued on the next page*

## **Release of EnergyPlus 2.0**

### **NATURAL AND MECHANICAL VENTILATION**

- Zone forced air units added to reporting of mechanical ventilation rate and loads.
- Simple Ventilation object now reports air changes per hour.
- New options in UnitVentilator include no coil option and fixed amount for outside air control strategy.
- AirflowNetwork model can now use Zone Exhaust Fan, OnOff supply fan and the DX heating coil objects.

### **HVAC**

- Water-to-air heat pumps now use RegulaFalsi solution technique to improve robustness and to speed up simulation.
- Applicability schedule added to System Availability Manager:Low Temperature Turn Off (to support thermal storage).
- Evaporative condenser option added to existing refrigerated case compressor racks including availability schedule and basin heater with controls.
- Draw-through fan configuration added for furnaces, unitary system and air-to-air heat pumps.
- Different supply air flow rates now allowed for cooling, heating and when no cooling or heating is required in unitary, furnace and air-to-air heat pumps.
- Common Pipe for Primary-Secondary systems provides an alternative to the Connection component object to model Primary-Secondary systems
- Balanced flow desiccant heat exchanger option added for the existing heat exchanger-assisted DX cooling coil object.
- Stratified water heater model added.
- Uniform load distribution option added to plant load range based operation scheme.
- Height-dependent air temperature and wind speed now available for most HVAC systems.

### **OUTPUT**

- Report Variables and Meter Variables (rdd and mdd) separately reported and output as IDF.
- Meters can now report cumulative value in addition to resetting at reporting time interval.

### **UTILITIES**

- New EP-Launch utility tab added where users can launch Basement, CalcSoilSurfTemp, CoeffCheck, CoeffConv, Slab and Weather utilities.
- CSVproc now supported in EP-Launch.
- IDF Editor now preserves the order of user IDFs and includes a large number of other new features.

### **WATER MANAGER**

- Green roof simulation added.

### **DOCUMENTATION AND GUIDES**

- Input/Output Reference and Engineering Reference updated and extended for all new features and updates. Total documentation now exceeds 3300 pages.

## ENERGYPLUS EXAMPLE FILE GENERATOR – **UPDATED!!!**

[http://www.eere.energy.gov/buildings/energyplus/interfaces\\_tools.html](http://www.eere.energy.gov/buildings/energyplus/interfaces_tools.html)

DOE and NREL are pleased to announce the update of the EnergyPlus Example File Generator. The goal of the Example File Generator is to provide input files for building models that serve as a starting point for using and learning EnergyPlus. This service is free and available at the EnergyPlus web site ([www.energyplus.gov](http://www.energyplus.gov)) under Interfaces & Other Tools.

Web-based forms allow you to input some general information about the building you want to model. The service then automatically creates a complete EnergyPlus input file, runs an annual simulation on NREL's computers, and then sends you an email with the EnergyPlus input file along with a summary of the annual energy results (and a dxf image file). The attached DXF of an EnergyPlus example file was generated in just a few minutes.

Assumptions should be carefully reviewed. There is no guarantee that the models are fully compliant with the energy performance Standards used to generate model details.

The new version has many new capabilities:

- Generates input file for EnergyPlus version 2.0.
- The input files are now completely annotated with the descriptions of the fields for each object.
- Added input boxes on the web page for New footprints for geometry including Rectangle, Courtyard, L-Shape, H-Shape, T-Shape, U-Shape
- Gas appliances
- Fins
- Continuous daylighting
- Addition of over 50 HVAC systems
- Ventilation rates by people and/or area
- Service Water Heating inputs



Give the service a try! If you have questions or feedback, email [ewi\\_support@nrel.gov](mailto:ewi_support@nrel.gov).

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



**Ask an EnergyPlus Expert . . .**

**MODIFYING WEATHER FILES – PART I**

I am studying building envelope thermal loads, comparing simulation with on site data. The building in question has a weather station on top and I would like to run a simulation with this weather data for a period of one week only.

**Answer**

Look at the Auxiliary Programs guide. It is the document that discusses the weather converter and explains how to create a custom file in detail.

Here is how to make EnergyPlus run for just one week or one month:  
Enter the appropriate dates in the Run Period object, making sure that your Run Control field says to run the weather simulation. You can run more than one run period (i.e., you could run several-week run periods in a single simulation). The weather file must be for one year. Of course the simulation can be for any period. If you only have 1 week of weather data, fill in the rest of the year with whatever you want -- you could use constant conditions or replicate the week you have 52 times.

**MODIFYING WEATHER FILES – PART II**

How can I modify a weather input file just for a particular period of simulation and for a particular variable? Data from weather files are ALMOST the same as those obtained from direct measurements, more precisely wind speed and direction. I would like to modify these two values in order to get better results. Other variables, such as relative humidity and solar radiation are fine; that's why I need to modify only a couple of the parameters.

**Answer**

I'd suggest running the weather file through the WeatherConverter (Weather Statistics and Conversions under EnergyPlus Programs from the Start button) to change it to a CSV (comma-separated values) file. Then you can open and modify it in Excel. This CSV includes headings for the hourly data. Save it back to CSV, then run it through the WeatherConverter again to get your revised EPW.

**WINDOW GLASS**

I am simulating a series of windows with different U-values (conductance,  $w/m^2-k$ ). However, the input of WindowGlass requires Conductivity ( $w/m-k$ ).

**Answer**

Conductance is Conductivity divided by Thickness, but this will give you the conductance of just the glass (and gas) layers only. I presume that the U-values you are referring to also include the inside and outside film (convection) coefficients as well. If they are from Standard 90.1 (or 90.2) they use the film coefficients for a specified set of temperature and wind-speed conditions. EnergyPlus will report this standard U-value in "Report, Surfaces, Details;" See Output Details and Examples document (p. 23, PDF see p. 29) for more information. You will need to use the film coefficients shown there, remove them from the U-value, then calculate the thermal conductivity that will result in the desired U-value.

**Ask an EnergyPlus Expert . . .**

**PRECIPITATION DATA**

I want to examine precipitation at a number of sites and hope to use the data in some epw files. However, I am puzzled by some of the numbers in the data column that correspond to precipitation. The documentation says the data has units mm over the hour in question. However, when looking at the data series for both Phoenix and Seattle the numbers are in the range 5 to 25 and there are no zeros; this suggests there is continual rain. If this range was in mm of precipitation it would amount to a huge rainfall over the year.

**Answer**

That field is not precipitation. Note from our description of the EPW fields:

*Field: Precipitable Water*

*This is the value for Precipitable Water in mm. (This is not "rain" – rain is incorporated in the preceding two fields). It is not currently used in EnergyPlus calculations (primarily due to the unreliability of the reporting of this value). Missing value is 999.*

We use precipitation data sets as long schedules. Examples of these are included with the DataSets\PrecipitationSchedulesUSA.idf. These were modeled from NOAA monthly average rainfall totals with rates and timing adjusted to match the integer codes you are seeing. See the TMY2 weather documentation. Here's the link for the TMY2 manual: <http://rredc.nrel.gov/solar/pubs/tmy2/PDFs/tmy2man.pdf>

**REPORTING GLARE INDEX**

I have been simulating the influence of dynamic shading devices on overall electrical consumption, using monthly data reporting. As might have been expected, when using the control "shading device on if high glare," the electrical consumption for lighting rose. But the reported DGI's are averaged, so absolute numbers are well below the index that triggered the control. Therefore, as a suggestion, would it be possible to include a reporting variable that indicates when daylight glare index was not met, as well as the maximum glare index?

**Answer**

You can report maximum glare index using REPORT:TABLE:MONTHLY. You can also use REPORT:TABLE:TIMEBINS to determine the number of hours the glare index was not met. Set the upper limit of the bin range to equal the glare index setpoint, and then the last column will report the number of hours greater than that value.

Assuming your shading devices can completely cover the window, there should not be any hours where the glare index was not met. If I understand the control algorithm correctly, it first checks for glare levels, then deploys shades as needed, then simulates for that timestep. So, the only times the glare index limit would not be met would be if the shades cannot fully close (in the case of blinds) or the shades are not dark enough or do not cover all windows.

**Ask an EnergyPlus Expert . . .**

**COMPLICATED DOOR-IN-WALL**

There is a door across the top and bottom of a wall. However, both top and bottom have different constructions and have been specified with four vertices each. I'm getting an error file.

**Answer**

If you have split your surface into two different constructions (and surfaces), then you will have to also split your door into two surfaces (with the same construction). Each surface of the split door should lie within the vertices of the corresponding surface to which it is attached.

**PHASE CHANGE MATERIAL**

Is there an example file for phase change materials?

**Answer**

In Version 2.0, refer to this: CondFD1ZonePurchAirAutoSizeWithPCM.idf.

**EVALUATING A SUN SHADING DEVICE**

I am doing research on sun shading devices and I am facing some problems. I have developed a preprocessor that builds a solar shading device with slats using the Surface:Shading:Attached model to define the slats as individual surfaces. I would like to compare the results of my sunshading with the results I get from the Material:Window:Blind object to simulate Venetian blinds. All the dimensions in both objects are similar, yet the inside temperatures resulting from the two models differ from 1C to 2C. I looked through the Engineering Reference but couldn't find out what causes this difference:

**Answer**

The modeling of surface:shading:attached is very simple compared to the model for Material:WindowBlind. Shading surfaces can both shade and reflect. There is no heat balance on shading surfaces. Shading surfaces are generally only useful on the exterior; I assume that is where you are modeling this. External shading surfaces do not block the wind imposed on the exterior surface of the window, but exterior blinds do alter the exterior window convection coefficient. The only result I would expect to be comparable between these two approaches would be the transmitted solar through the window.

**DX COOLING COIL**

I am trying to simulate a rooftop VAV system with DX cooling. What is the best way to simulate a rooftop with four DX compressors, each one representing 25% of the total capacity?

**Answer**

It depends on how the stages are arranged and controlled. If the four stages are all in parallel (four sections of face-split coils), then the best you can do is to model this with two stages using the multimode DX coil. If the staging is through cylinder unloading, then it's more of a PLR curve issue than face-split stages.

**Ask an EnergyPlus Expert . . .**

**SKY TEMPERATURE**

How does Energy Plus compute sky temperature for long-wave radiation heat transfer with exterior surfaces?

**Answer**

It uses the Horizontal IR from sky as a basis (we calculate this on the weather files and design days)

```
! Calculate sky temperature, use IRHoriz if not missing
IF (IRHoriz == "missing") THEN
! Missing, use sky cover
OSky=OpaqueSkyCover
TDewK=MIN(DryBulb,DewPoint)+TKelvin
ESky= (.787 +.764*LOG((TDewK)/TKelvin))*(1. + .0224*OSky -
0.0035*(OSky**2) + .00028*(OSky**3))
SkyTemp=(DryBulb+TKelvin)*(ESky**.25)-TKelvin
ELSE ! Valid IR from Sky
SkyTemp=(IRHoriz/Sigma)**.25 -TKelvin
ENDIF
```

Sky IR is calculated as:

```
! Determine Sky Temp ==>
! Function of DryBulb, DewPoint, OpaqueSkyCover
! Calculate Sky IR
!HIR = ESKY * SIGMA * (TOUT**4)
!
!where
!
!HIR = horizontal IR intensity (W/m2)
!ESKY = sky emissivity
!SIGMA = Stefan-Boltzmann constant = 5.6697e-8 W/m2-K4
!TOUT = drybulb temperature (K)
!
!The sky emissivity is given by
!ESKY = [0.787 + 0.764*ln(TDEW/273)]*[1 + 0.0224*N -
0.0035*(N**2) + 0.00028*(N**3)]
!
!where
!TDEW = dewpoint temperature (K)
!N = opaque sky cover (tenths)
!
!Example: Clear sky (N=0), TOUT = 273+20=293K, TDEW = 273+10=283K:
!
!ESKY = 0.787 + 0.764*0.036 = 0.815
!HIR = 0.815*5.6697e-8*(293**4) = 340.6 W/m2
```

**References:**

George N. Walton, "Thermal Analysis Research Program Reference Manual," NBSIR 83-2655, March 1983, p. 21.  
G. Clark and C. Allen, "The Estimation of Atmospheric Radiation for Clear and Cloudy Skies," Proc. 2nd National Passive Solar Conference (AS/ISES), 1978, pp. 675-678.



## EnergyPlus Version 2.0

### Support Tools

Support software is listed on the main EnergyPlus website.

### Weather Data

Main weather data site is at  
[http://www.eere.energy.gov/buildings/energyplus/cfm/weather\\_data.cfm](http://www.eere.energy.gov/buildings/energyplus/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 program users are answered promptly via the EnergyPlus User Group at Yahoo. To join, go to [http://groups.yahoo.com/group/EnergyPlus\\_Support/](http://groups.yahoo.com/group/EnergyPlus_Support/)  
Selected questions and answers have been compiled into PDF documents:  
for [2002](#), 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](mailto:klellington@lbl.gov)

### Testing and Validation

Go to <http://www.eere.energy.gov/buildings/energyplus/testing.html> for info.

*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, Version 124

### Are you a DOE-2 Consultant?

If you would like to be listed as a DOE-2 consultant on our website and in the monthly *User News* Newsletter, please contact [klellington@lbl.gov](mailto:klellington@lbl.gov)

### Get Free DOE-2 Documentation. Download from <http://SimulationResearch.lbl.gov/>

[DOE-2 Basics Manual \(2.1E\) http://gundog.lbl.gov/dirpubs/BASIC/basiclist.html](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 \(txt file\)](#)

<http://simulationresearch.lbl.gov/dirpubs/VERSIONS.txt>

All changes and bug fixes in a text document.

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

**On-Site Generation Simulation with EnergyPlus  
for Commercial Buildings**

Michael Stadler, Ryan Firestone, Dimitri Curtil, and Chris Marnay,  
Lawrence Berkeley National Laboratory

**Abstract**

Building energy simulation software (e.g. EnergyPlus) is a powerful tool used widely by designers and researchers. However, current software is limited in modeling distributed generation (DG), including DG with heat recovery applied to building end-use, i.e. combined heat and power (CHP). Concurrently, DG investment and dispatch optimization software has been developed, yet has not been linked to a building energy simulation program for accurate assessment of DG designs, particularly under uncertainty in future end-use loads and equipment availability. CHP is a proven approach to cost effective reductions in primary fuel consumption and CO<sub>2</sub> emissions. Integrating DG system design and controls into building energy simulation is an important step towards popular DG acceptance. We propose to extend the existing building energy simulation program, EnergyPlus (E+), to enable the simulation of various DG modules and associated control strategies in order to achieve more accurate and holistic analysis of DG technologies. Extension of EnergyPlus is conveniently facilitated by SPARK, a program capable of modeling building equipment and controls as individual modules. These modules can be automatically integrated with EnergyPlus building models. Candidate DG systems can be selected from the DG investment optimization program, Distributed Energy Resources Customer Adoption Model (DER-CAM). The dispatch of the modeled DG system can be determined by a novel dispatch optimization algorithm, the Energy Manager, that accounts for uncertainty in future load and DG availability, as well as curtailment options. DG equipment and controls can modeled in SPARK and integrated into EnergyPlus building models. The way to this holistic approach will be described in this paper.

LBNL-60146

**Window-Related Energy Consumption in the  
US Residential and Commercial Building Stock**

J. Apte, D. Arasteh  
Lawrence Berkeley National Laboratory

**Abstract**

We present a simple spreadsheet-based tool for estimating window-related energy consumption in the United States. Using available data on the properties of the installed US window stock, we estimate that windows are responsible for 2.15 quadrillion Btu (Quads) of heating energy consumption and 1.48 Quads of cooling energy consumption annually. We develop estimates of average U-factor and SHGC for current window sales. We estimate that a complete replacement of the installed window stock with these products would result in energy savings of approximately 1.2 quads. We demonstrate that future window technologies offer energy savings potentials of up to 3.9 Quads.

**May 2007 Educational Programs Offered by  
Pacific Gas & Electric Company, San Francisco, California**

*For a complete listing of classes or to register go to [www.pge.com/pec](http://www.pge.com/pec)*

**EVENING LECTURE**

May 24 [A Light Affair V](#)

**HVAC**

May 10 [Cool Ducts Workshop](#)  
 May 15 [Using DDC Control Systems to Commission VAV Boxes](#)  
 May 17 [Retrocommissioning Workshop Series III Class 1](#)  
 May 17 [Energy Efficient Data Centers](#)

**BUILDING PERFORMANCE**

May 22 [Beyond Green: Drawing on Nature](#)  
 May 31 [Designing a Successful Zero Energy Home in California](#)

**MARKETING and FINANCE**

May 30 [Understanding Financial Analysis Methods for Photovoltaic \(PV\) Systems](#)

**LIGHTING**

May 03 [Using Non-dimming Strategies to Save Energy and Money](#)  
 May 22 [Lighting Fundamentals](#)  
 May 24 [A Light Affair V](#)

**COMMISSIONING**

May 15 [Using DDC Control Systems to Commission VAV Boxes](#)  
 May 17 [Retrocommissioning Workshop Series III Class 1](#)

**RENEWABLES**

May 09 [Basics of Photovoltaic \(PV\) Systems for Grid-Tied Applications](#)  
 May 30 [Understanding Financial Analysis Methods for Photovoltaic \(PV\) Systems](#)  
 May 31 [Designing a Successful Zero Energy Home in California](#)

**Meetings - Conferences - Symposia**

**2007**

May 21-25	CIB World Building Congress 2007	<a href="mailto:cdejager@saice.org.za">cdejager@saice.org.za</a>
June 10-14	CLIMA 2007	<a href="http://www.clima2007.org/portal/">http://www.clima2007.org/portal/</a>
June 13-15	Roomvent 2007	<a href="http://www.roomvent2007.org">http://www.roomvent2007.org</a>
June 23-27	ASHRAE Annual Meeting	<a href="http://www.ashrae.org">http://www.ashrae.org</a>
July 7-12	Solar 2007	<a href="http://www.ases.org/solar2007/participate.htm">http://www.ases.org/solar2007/participate.htm</a>
Sept 03-06	Building Simulation 2007 Beijing, China	<a href="http://www.bs2007.org.cn">http://www.bs2007.org.cn</a>
Oct 28-31	Int'l Conference on IAQ, Ventilation and Energy Conservation in Buildings	<a href="mailto:yoshino@sabine.pln.archi.tohoku.ac.jp">yoshino@sabine.pln.archi.tohoku.ac.jp</a>
Nov 16	IBPSA-England Symposium	<a href="http://www.ibpsa-england.org/">http://www.ibpsa-england.org/</a>

**2008**

Aug 17-22	Indoor Air 2008	<a href="http://www.indoorair2008.org">http://www.indoorair2008.org</a>
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