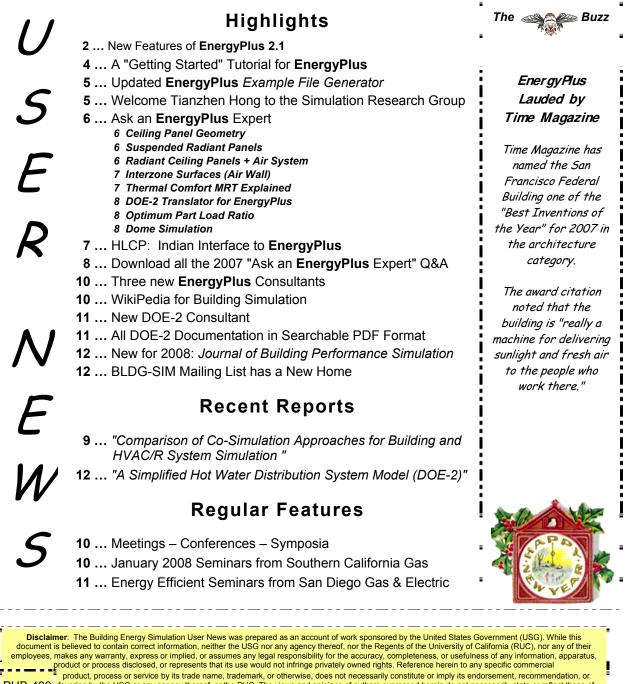
VOLUME 29, No. 01 -- JANUARY 2008

# Building Energy Simulation



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## **New Features of EnergyPlus 2.1**

## NATURAL AND MECHANICAL VENTILATION

• A new system availability manager was added to allow system-level control of hybrid ventilation systems.

## HVAC

- Added water-cooled condenser capability to refrigeration compressor racks for useful heat recovery.
- Chilled and hot-water coils can now be used in the outside air system to preheat or precool outside air.
- New desiccant dehumidifier with additional capabilities and flexibility compared to the existing solid desiccant dehumidifier model.
- Water side economizer (including simulation of integrated and non-integrated water side economizers).
- Packaged terminal air conditioner (PTAC) added to model a fan, DX cooling coil, and a gas, electric, hydronic or steam heating coil serving a single zone.
- Multispeed heat pump with up to four discrete speeds for both cooling and heating.
- Heat losses (and gains) from plant piping.
- New and updated Compact HVAC objects:
  - Compact HVAC chilled water coils now use the COIL:WATER:COOLING model by default, COIL:Water:DetailedFlatCooling can be selected as an option.
  - Compact HVAC unitary system now supports the draw-thru fan placement option, and allows a schedule for the supply fan operating mode (continuous or cycling).
  - New Compact HVAC options for dehumidification and humidification controls for unitary and VAV system types.
  - New primary-secondary loop options for Compact HVAC chilled water loops.
  - Compact HVAC expanded to support specification of outside air as a combination of flow/person, flow/area and flow/zone.
  - Compact HVAC baseboard heat option added for unitary and VAV zones.
  - New Compact HVAC objects for unitary heat pump, unitary VAV, packaged terminal air conditioner, and packaged terminal heat pump.

## INPUT

• Example input files created for all new features (More than 225 example input files now available).

## Continued on the next page

# **Release of EnergyPlus 2.1**

## OUTPUT

- New tabular reports for surface shadowing, shading, lighting, HVAC sizing, system and component sizing, and outside air.
- New Report:SurfaceColorScheme allow users to select their own colors for building elements in the DXF output.

## DATASETS

• Color schemes for DXF. (original and default)

## DESIGN DAY

• User now can choose between ASHRAE Clear Sky and Zhang-Huang solar radiation models for use in design day calculations.

## Geometry/Windows/Walls/Shading

- Surface Surround Subsurface error detection more robust (less false errors)
- Autocalculate now allowed for shading surfaces (number of vertices)

## **ZONE MODEL**

• Zone sizing calculations now include heat gains from domestic/service hot water uses and water heaters.

## UTILITIES

- WeatherConverter now produces KML output (for Google Earth) of latitude, longitude, elevation, and a few climate statistics for locations in a list processing run.
- Add comma delimited form of CLM (ESP-r Ascii files) conversion to WeatherConverter.
- WinEPDraw produces in new default colors.

## DOCUMENTATION AND GUIDES

- The Getting Started Manual has been completely rewritten to provide more hands-on example exercises and other information for getting up to speed on EnergyPlus.
- The Input/Output Reference and Engineering Reference Manuals have been updated and extended for all new features and updates. Total documentation now exceeds 3500 pages.

#### EnergyPlus Available for Apple's Intel-based Macintosh Platform



The newest version of EnergyPlus (2.1), released 10/31/07, is available for Apple's Intelbased Macintosh platform (in addition to Windows and Linux versions). Download at no cost from the EnergyPlus web site: <u>http://www.energyplus.gov</u>.

Our thanks to Greg Stark of Building Synergies, LLC for his help in porting EnergyPlus to the Apple Macintosh platform.

## Status of EnergyPlus Plug-In for SketchUp

DOE plans to release an EnergyPlus plug-in for Google's SketchUp at the end of 2007. This free EnergyPlus plug-in will integrate building simulation functionality into the SketchUp drawing environment. The plug-in stores EnergyPlus input data on SketchUp surfaces as they are drawn by the user. An EnergyPlus toolbar provides a way to create zones and surfaces with only a few mouse clicks. Construction assignments are 'painted' onto surfaces using a palette of EnergyPlus wall, roof, and window constructions. Users will be able to execute an annual simulation from within SketchUp. Watch the EnergyPlus web site <a href="http://www.energyplus.gov">http://www.energyplus.gov</a> and email for more information.

#### EnergyPlus\_Support Group at YahooGroups



Google

Are you a commercial or academic user of EnergyPlus? Join over 1200 EnergyPlus users in an email group on YahooGroups. It's a place to ask your questions and share information with other users. The YahooGroup provides a searchable archive of all 7 years of discussion. You can also upload files to share with other users. This group supplements but does not replace the primary program support. <u>EnergyPlus-Support@gard.com</u>.

The main web page for the group is: <u>http://groups.yahoo.com/group/EnergyPlus\_Support</u>

To subscribe, send an email message to: EnergyPlus Support-subscribe@yahoogroups.com

## A Getting Started Tutorial for EnergyPlus

by Vishal Garg <u>Center for IT in Building Science</u> <u>IIIT Hyderabad</u> India

Dr. Vishal Garg of the International Institute of Information Technology in Hyderbad, India, has created an EnergyPlus tutorial aimed at architects and engineers who are familiar with the basic concepts of energy simulation and HVAC systems. The tutorial out-lines the procedures for modeling a small room using EnergyPlus, including instruction on how to run the simulation, and how to interpret the output files. The output presents both heating and cooling energy consumption, so the user may experiment with size, orientation, material properties, location, etc., and compare heating/cooling energy usage.

http://energyplustutorial.googlepages.com/

## ENERGYPLUS EXAMPLE FILE GENERATOR – UPDATED!!!

#### 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) 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 2.1.
- The input files are now completely annotated with the descriptions of the fields for each object.
- Added input boxes 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

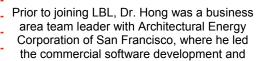


Give the service a try! If you have questions or feedback, email ewi support@nrel.gov.

## Welcome the newest member of the Simulation Research Group!!

Tianzhen Hong has joined the Simulation

- Research Group at Lawrence Berkeley
- National Laboratory as a Research Scientist.
- As a member of the EnergyPlus National
- Team, his current projects include
- EnergyPlus, California Building Energy
- Efficiency Standards, and RESFEN.



- management of the VisualDOE project.
- He was the lead software developer of
   VisualDOE.



Dr. Hong may be reached via email at thong@lbl.gov

EnvStd, CodeComp, and BTP (formerly DeST). He also worked in Supersymmetry Singapore, National University of Singapore, and Tsinghua University of China.

Dr. Hong has a wide interest in building science and technology. He participated in California's PIER, IEA ECBCS, and various research projects. He was the trainer for a dozen building energy simulation workshops in the United States and China, and has played an active role in energy analysis to support sustainable building designs and develop and update the California Building Energy Efficiency Standards. Ask an EnergyPlus Expert . . .

## **CEILING PANEL GEOMETRY**

I have a basic question about the geometry of radiant ceiling panels. In "surfaceHeatTransfer" I added the coordinates of a square ceiling; for example, the coordinates are (0,10) (0,0) (10,0) (10,10). Then I added the surface with a "construction with internal source"; this construction has both the layers of the ceiling and the layers that refer to the structure of the panels. The coordinates of the radiant-ceiling panels are: (2.5,7.5) (2.5,2.5) (7.5,2.5) (7.5,7.5). Is it correct to insert these coordinates, or is it a mistake to consider the surface "twice" where the panels are located?

#### Answer

For this case, where part of the ceiling is heated, and part is not, the more accurate approach would be two surfaces. One surface with the internal source that is the area of the radiant panels, and another surface that is the area of the unheated portion of the ceiling. If the radiant heat source is spread out over a larger area, the average temperature of the surface will be cooler in order to provide the same amount of heat to the space. This could cause a significant difference in total heat load, especially if there are many windows in the zone. The placement of the surface is less critical since EnergyPlus uses approximate view factors. So it is adequate to divide the ceiling into two rectangles to simplify the coordinates.

## SUSPENDED RADIANT PANELS

I'm simulating an office with radiant panels on the ceiling; can I use EnergyPlus? The panels aren't as wide as the ceiling. How do I show this in the surfaceHeatTransfer? Do I show one surface with a normal construction for the ceiling and a smaller one with internal source for the panel?

#### Answer

You could describe a surface that is positioned as though it is suspended. This would have to be a pair of surfaces (one facing up and one facing down) that are connected as "interzone" surfaces even though both are in the same zone. But understand that the radiant view factor calculations are not full 3-D. View factors are affected by azimuths and tilts, but position in the zone does not matter. If the radiant panels are electric, you could use the high temperature radiant model (HIGH TEMP RADIANT SYSTEM) and specify the view factors directly. Low temperature radiant systems are only valid on base surfaces (not subsurfaces, no internal mass). You would need to describe the ceiling as two or more SURFACE:HEATRANSFER objects, one with the area of the radiant panel, and one with the remaining ceiling area.

## **RADIANT CEILING PANELS + AIR SYSTEM**

Can I use EnergyPlus to model an office where I'm using radiant ceiling panels for zone temperature control and an air system for zone humidity control?

#### Answer

You can add an air-loop system to serve the same zones that are being served by the radiant panels. By adding dehumidification controls, the air system can control for humidity (cooling priority 1 in the zone equipment list) and the radiant panels can pick up the remaining sensible load (priority 2).

If you already have an air system described and want to add humidity controls, take a look at example file 5ZoneWaterCooled\_HighRHControl.idf (chilled water system) or FurnaceWithDXSystemRHcontrol.idf (DX system).

If you have not already set up the air system description, the quickest way to would be to use COMPACT HVAC unitary or VAV objects. Get the updated COMPACT HVAC interim release from the yahoo group files are (CompactHVACInterimUpdateV2-0-0.zip in the Updates folder). This update includes humidity control options on the VAV and unitary system types.

<u>WARNING:</u> If you add this to your idf that already contains the radiant system, the run will fail, because COMPACT HVAC will create duplicate instances of CONTROLLED ZONE EQUIPMENT and ZONE EQUIPMENT LIST. Take the expidf output file and edit it to merge these objects for the two systems.

#### Ask an EnergyPlus Expert . . .

## **INTERZONE SURFACES (AIR WALL)**

I need help to create multiple zones within one space. In order to define two zones as being in thermal contact with one another, you need to specify a surface in each respective zone, and enter the name of one zone's surface in the other's OutsideFaceEnvironment Object field (and vice versa). But when you specify a surface, you are also obliged to specify a construction for that surface -- despite the fact that there is no such construction exosts! Is it as simple as creating a void construction of some kind and using this for the zone-separating surface?

#### Answer

This type of connection between two zones, sometimes referred to as an "air wall," is not simple. There is no good answer to fully model this connection. The best you can do is to put a lightweight, high conductivity interzone surface between the two zones. If you want to model solar gains penetrating into the interior zone, then this surface must be a window. If you expect the two zones to be at significantly different temperatures and/or humidities, then you may also want to add a CROSS MIXING object to exchange air between the two zones.

#### Question

When two surfaces are specified as thermally communicating using the OutsideFaceEnvironment and OutsideFaceEnvironment Object fields, what construction is used to calculate thermal transfer between the zones? Are the constructions of the thermally communicating surfaces "stuck together, are they averaged, or is one or the other chosen based on some criteria?

#### Answer

When describing interzone surfaces, there is one construction that applies to both instances of the surface. They are not stuck together, they are not averages, they are one.

For example, WALLAtoB is assigned a construction consisting of CementBlock+Gypsum Board, and its OutsideFaceEnvironmentObject is WALLBtoA. WALLBtoA must have a construction that uses exactly the same material layers but in reverse order, Gypsum board+CementBlock. The total mass of this interzone wall is one layer of cement block and one layer of gypsum board.

## THERMAL COMFORT MRT EXPLAINED

I was confused recently after reviewing the output for an HVAC system simulation; specifically, the term "Thermal Comfort MRT." In general, I know Zone MRT, but I think this is something different and I don't know the meaning.

#### Answer

To clarify the documentation, the following report variable definition has been added to the Input/Output Reference in the "People Outputs" section:

#### ThermalComfortMRT [C]

This report variable is the mean radiant temperature (MRT) used in the thermal comfort calculations. This value is computed according to the "MRT Calculation Type" specified in the PEOPLE object. If a high temperature radiant system is present in the zone, this value will be adjusted according to the current heater operation and the "Fraction of radiant energy incident on people" specified in the HIGH TEMP RADIANT SYSTEM object.

## Indian Interface to EnergyPlus: HLCP Hourly Load Calculation Program

HLCP (Hourly Load Calculation Programme) is a graphical user interface for design-day and hourly load calculations for Indian cities, meant to be used with the EnergyPlus simulation engine.

Note that HLCP is a for-purchase program. For details, please go to http://www.hvacindia.com/hlcp/

Ask an EnergyPlus Expert . . .

## **DOE-2 TRANSLATOR FOR ENERGYPLUS**

I want to translate my DOE-2 models to EnergyPlus. Where is the translator?

#### Answer

It is available to download from the yahoo group files area. Go the the main EnergyPlus Support site (<u>http://tech.groups.yahoo.com/group/EnergyPlus\_Support/</u>), log in, then go to the "files" area and find /Release\_Pieces/DOE2Translator.zip.

<u>Caveat</u> -- this translator only works for DOE-2.1E input files and is limited to building envelope, internal gains, schedules, etc. It does not translate HVAC systems.

## **OPTIMUM PART LOAD RATIO**

For the Chiller:Electric:EIR, what is the point of the "Optimum Part Load Ratio" input since the three performance curves specified the maximum efficiency point?

#### Answer

See the Input/Output Reference document for a description of the Plant Loop Load Distribution Scheme.

#### Plant Loop Object:

Field: Load Distribution Scheme

This alpha field contains the Load Distribution Scheme Keyword. The Load Distribution Scheme selects the algorithm used to sequence equipment operation in order to meet the plant loop demand. Currently, two schemes are functional. SEQUENTIAL\* \*uses each piece of equipment to its maximum part load ratio and will operate the last required piece of equipment between its minimum and maximum part load ratio in order to meet the loop demand. OPTIMAL\* \*operates each piece of equipment at its optimal part load ratio and will operate the last component between its minimum and maximum part load ratio in order to meet the loop demand. UNIFORM evenly distributes the loop demand amongst all available components on the equipment list for a given load range.

## DOME SIMULATION

I need to simulate a dome. Can I use EnergyPlus?

#### Answer

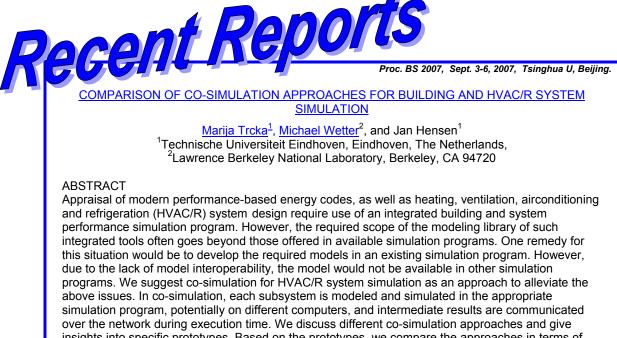
<u>Structural Dome</u>: If you mean a structural dome, it must be described as a collection of flat surfaces. EnergyPlus is not yet able to model curved surfaces. However, some of the user interfaces may allow you to draw a dome shape and triangulate it automatically.

Light Tube Dome: If you mean a small dome serving a light tube, then yes. See TDD:DOME, TDD:DIFFUSER, and Daylighting Device:Tubular. One thing to clarify: the TDD:DOME object is used to model the plastic dome of a tubular daylighting device, but it does not make any special optical calculations because it is a dome...it actually just models it the same as a flat window. We hope to add special optical dome calculations in the future.

#### Ask an EnergyPlus Expert -- 2007 Questions and Answers

All the "Ask an EnergyPlus Expert" questions and answers from 2007 that appeared in the *Building Energy Simulation User News* have been combined into one .pdf file. Download from http://SimulationResearch.lbl.gov/dirpubs/un\_articleEP07.pdf

If you'd like to review past years' "Expert" files, they are all on our <u>Technical Reports page</u> at <u>http://SimulationResearch.lbl.gov/report.html</u>.



insights into specific prototypes. Based on the prototypes, we compare the approaches in terms of accuracy, stability and execution time, using a simple case study. We finish with results discussions and recommendations on how to perform co-simulation to maintain the required accuracy of simulation results. http://gundog.lbl.gov/dirpubs2/BS07/eplus 503.pdf

Support Tools
Support software is listed on the main EnergyPlus website.
Weather Data
Main weather data site is at <u>http://www.eere.energy.gov/buildings/energyplus/cfm/weather_data.cfm</u> Weather data for more than 800 locations are now available in EnergyPlus weather format. See the write-up on how to create <u>Meteonorm Files</u>
Ask an EnergyPlus Expert
Questions from program users are answered promptly via the EnergyPlus User Group at Yahoo. To join, go to <u>http://groups.yahoo.com/group/EnergyPlus_Support/</u> Selected questions and answers have been compiled into PDF documents: for <u>2002</u> , for <u>2003</u> , for <u>2004</u> , for <u>2005</u> , for <u>2006</u> , for <u>2007</u> .
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 <u>klellington@lbl.gov</u>
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).

## Man Can Cure Disease But He Cannot Cure Fate

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## Meetings - Conferences - Symposia

	2008	
January 19-23	ASHRAE Winter Meeting in New York City	http://www.ashrae.org
May 03-08	Solar 2008	http://www.ases.org/solar2008/
June 16-18	8th Nordic Symposium on Building Physics	http://www.nsb2008.org/
June 21-25	ASHRAE Annual Meeting in Salt Lake City, UT	http://www.ashrae.org
July 30 -Aug 01	SimBuild 2008 (Univ.Calif at Berkeley)	http://gaia.lbl.gov/ocs.index.php/simbuild/2008
August 17-22	Indoor Air 2008	http://www.indoorair2008.org

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#### WikiPedia for Building Simulation

What do you get when you combine *Building Simulation* with a *WikiPedia*?? You get *Simupedia* -- a user-driven encyclopedia aimed at building simulation practitioners!!
The idea originated with IBPSA-Germany and it is hoped that Simupedia will become a world-wide effort. Add to it at <u>http://129.187.44.165/index.php/Simupedia/en</u>.
IBPSA-Germany website: <u>http://www.ibpsa-germany.org/</u>



	January 2008 Technical Seminars           Presented by Southern California Gas Company           Located at the Energy Resource Center in Downey, California           http://www.socalgas.com/business/resource_center/erc_home.shtml	
January 15	EnergyPro Training: Indoor & Outdoor Lighting	
January 15	EnergyPro Training: Envelope and Windows	
January 16	EnergyPro Training: Advanced	
January 16	EnergyPro Training: Mechanical	
January 17	2008 Non-Res Title 24 Standards: Compliance, TDV & Beyond	

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 <i>User News</i> please contact <u>klellington@lbl.gov</u>
DOE-2 Documentation OCR'd by the Energy Systems Lab, TAMU
PDF files at this link: http://esl.tamu.edu/pub/DOE%2D2%5FOCR%5FManuals/
More Free DOE-2 Documentation. Download from http://SimulationResearch.lbl.gov/
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.
<u>Changes and Bug Fixes to DOE-2.1E (txt file)</u> <u>http://simulationresearch.Ibl.gov/dirpubs/VERSIONS.txt</u> All changes and bug fixes in a plain-text document.

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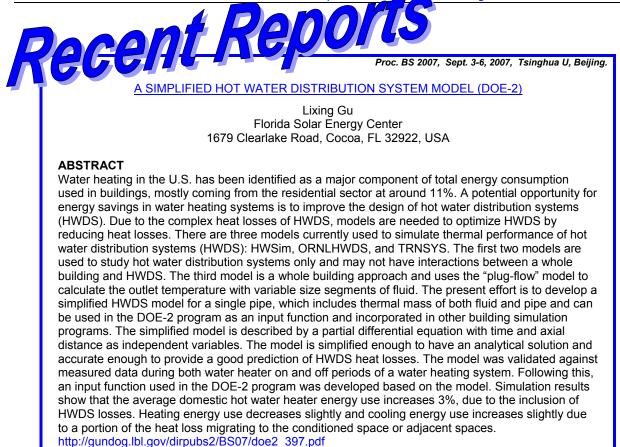
#### NEW DOE-2 CONSULTANT IN CALIFORNIA (USA)

Kajal Chatterjee, LEED® AP	kchatterjee@rumseyengineers.com
Rumsey Engineers	http://www.rumseyengineers.com
99 Linden Street	Phone: (510) 663-2070 x206
Oakland, CA 94607	Fax: (510) 663-2080
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Those energetic folks at the Building Simulation Laboratory at Texas A&M University have scanned all the DOE-2 manuals into pdf files. Jeff Haberl and Company have generously made the files available to DOE-2 users. Follow the link to the searchable pdf files [including the rare "Engineers Manual"].

#### http://esl.tamu.edu/pub/DOE%2D2%5FOCR%5FManuals/

S			fficient Business Seminars Company <u>http://www.sdge.com/training/</u>
Jan 30	2008 Nonresidential Title 24 Standards	Mar 18	Demand Response - A Practical Approach
Feb 07	Advanced Lighting Technologies	Mar 18	System Duct Design (Part 1 & 2 of a 4-night class)
Feb 19	Heat Pump Part 1	Mar 20	System Duct Design (Part 2 of a 4-night class)
Feb 21	Heat Pump Part 2	Apr 15	System Design (Part 3 of a 4-night class)
Mar 06	Adjustable Speed Drives	Apr 17	System Design (Part 4 of a 4-night class)



#### New for 2008: the Journal of Building Performance Simulation

A message from Ian Beausoleil-Morrison and Jan Hensen, Co-editors of the new Journal of Building Performance Simulation:

The International Building Performance Simulation Association (IBPSA) has reached an agreement with a publisher to launch a new academic journal for 2008: the Journal of Building Performance Simulation. This exciting new publication is aimed at advancing and promoting the science of building performance simulation as a vibrant and important academic area. An official announcement of the journal and a call for papers will be made in the near future. Please note that this initiative has no association with IBPSA. For more information, contact Ian Beausoleil-Morrison at ibeausol@mae.carleton.ca

#### **BLDG-SIM Mailing List has a New Home**

The popular BLDG-SIM mailing list has moved from Gard Analytics to OneBuilding.org. If you subscribe to BLDG-SIM (or any of the other lists formerly maintained by GARD) you will be automatically switched over to OneBuilding.org. An archive of all BLDG-SIM posts is located at the following URLs.

Archived by thread:	http://www.gard.com/ml/bldg-sim-archive/threads.html
Archived by date	http://www.gard.com/ml/bldg-sim-archive/maillist.html
Conoral information about	t the meiling list is at http://liste.enchuilding.org/listinfe.egi/hldg.eim.enchuilding.e

General information about the mailing list is at: <u>http://lists.onebuilding.org/listinfo.cgi/bldg-sim-onebuilding.org</u>. See also <u>http://lists.onebuilding.org/pipermail/bldg-sim-onebuilding.org/</u>