

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

\*EnergyPlus\*SPARK\*DOE-2\* EnergyPlus\*VisualSPARK\*EnergyPlus\*DOE-2\*GenOpt\*EnergyPlus\*  
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### The Buzz

*EnergyPlus Training*, p. 9

*All Free All The Time!*  
Starting with this issue,  
we'll run a regular column  
of free books,

downloadable software, e-  
newsletter subscriptions,  
etc. Let us know if you  
have anything to add to  
the list. Thanks!  
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## ***EnergyPlus Certified for U.S. Tax Deduction!!***

As of June 23, 2006, EnergyPlus was certified as being *Qualified Computer Software for Calculating Energy Savings for Purposes of the Energy-Efficient Commercial Building Tax Deduction under Internal Revenue Code §179D.*

### **Background**

On August 8, 2005, President Bush signed into the law the Energy Policy Act of 2005, which provide a variety of tax incentives for homeowners, businesses, and manufacturers for the purchase of energy efficient equipment and buildings.

The Department of the Treasury amended tax form 1040 to include a line for energy tax credits and has issued regulations specifying which energy efficiency equipment and improvements qualify for tax credits. The IRS recently released interim guidelines pertaining to the deduction for energy-efficient commercial buildings under Section 179D of the Tax Code. Specifically, the interim guidelines address the process by which a taxpayer obtains certification that installed energy-efficient property qualifies under Section 179D for the full deduction, and establish the total annual energy savings required for obtaining a partial deduction. The interim guidelines also provide information about the software programs that must be used in calculating power and energy expenditures.

### **Qualifying Energy-Efficient Commercial Building Property -- Potential Deductions**

Section 179D provides commercial building owners and leaseholders with a deduction for implementing energy-efficient commercial building property in their buildings between December 31, 2005, and January 1, 2008. The deduction is available whether the respective space is new construction or previously existed and applies in the year in which the energy-saving property was made ready for its intended use.

As defined in the Tax Code, "energy efficient commercial building property" is property:

- (a) with respect to which depreciation (or amortization) is allowable;
- (b) installed in a building located in the United States and within the scope of Standard 90.1-2001 of American Society of Heating, Refrigerating, and Air Conditioning Engineers and the Illuminating Engineering Society of North America; and
- (c) installed as part of the interior lighting systems, heating, cooling, ventilation and hot water systems, or as part of the building envelope. Further, the installed interior lighting, heating, cooling, ventilation, hot water systems and building envelope must either reduce the total annual energy and power costs by fifty percent (50%) or more, or be part of a taxpayer's overall plan, which includes the subsequent installation of the same, and which will reduce the total annual energy and power costs by fifty percent (50%) or more, as compared with a "Reference Building," which is compliant with the minimum requirements of Standard 90.1-2001. For taxpayers meeting this threshold, the maximum deduction available to them is \$1.80 per square foot, less the aggregate amount of the Section 179D deductions allowed with respect to the building for all prior taxable years.

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## ***EnergyPlus Certified for U.S. Tax Deduction!!***

Section 179D also provides for a partially qualifying commercial property deduction, which applies to property that would otherwise qualify as energy-efficient commercial building property but results in reductions in the total annual energy and power costs of less than fifty percent (50%) but greater than or equal to sixteen and two-thirds percent (16.66%). For taxpayers meeting this threshold, the maximum deduction available to them is \$0.60 per square foot, less the aggregate amount of the Section 179D deductions allowed with respect to the building for all prior taxable years. Section 179D also provides interim guidelines encouraging and providing a deduction for improvements made to lighting systems.

### **Certification of Qualified Property**

Section 179D requires that, before a taxpayer may claim a deduction, the property must be certified as energy-efficient commercial building property by a qualified individual. The requirements of a qualified individual include that the person may not be related to the taxpayer and must be an engineer or contractor that is properly licensed in the jurisdiction where the building is located. The certification does not need to be attached to the taxpayer's tax return, but taxpayers are required to maintain books and records that would satisfy investigation into the applicability of the deduction.

### **Approved Software Programs**

Section 179D requires that certain software programs be used to identify energy expenditures for the purposes of the deduction. The Department of Energy has established a public list of software, which may be viewed at [http://www.eere.energy.gov/buildings/info/tax\\_credit\\_2006.html](http://www.eere.energy.gov/buildings/info/tax_credit_2006.html)

### **Important Links**

[http://www.irs.gov/irb/2006-26\\_IRB/ar11.html](http://www.irs.gov/irb/2006-26_IRB/ar11.html)

Complete text of Internal Revenue Bulletin: 2006-26, dated June 26, 2006, Notice 2006-52, *Deduction for Energy Efficient Commercial Buildings*

<http://www.irs.gov/pub/irs-drop/n-06-52.pdf>

IRS document that spells out details of the deduction (U.S. Internal Revenue Service website)

[http://www.eere.energy.gov/buildings/info/qualified\\_software/energyplus.html](http://www.eere.energy.gov/buildings/info/qualified_software/energyplus.html)

List of EnergyPlus qualifications (U.S. DOE website)

[http://www.eere.energy.gov/buildings/info/qualified\\_software/](http://www.eere.energy.gov/buildings/info/qualified_software/)

List of qualified software (U.S. DOE website) – right now this list only includes EnergyPlus and TRACE 700

[http://www.eere.energy.gov/buildings/info/tax\\_credit\\_2006.html](http://www.eere.energy.gov/buildings/info/tax_credit_2006.html)

List of tax incentives for energy-efficient buildings and products (U.S. DOE website)

## Release of EnergyPlus 1.3.0

The tenth major version of EnergyPlus (1.3.0) was released on April 25, 2006 and is now available in versions for both the Windows and Linux operating systems. Download this newest release at no cost from the EnergyPlus web site: [www.energyplus.gov](http://www.energyplus.gov).

### New Features

- UFAD (Under Floor Air Distribution) room air model for exterior zones is now available.
- Completely reworked airflow modeling -- the new AirflowNetwork model replaces both COMIS and ADS and has the combined capabilities. Calculation of infiltration, ventilation, mixing and cross mixing moved to system time step for future feature development of hybrid (mixed mode) ventilation control. Differences in results are usually minor.
- Outside air temperature is now varied as a function of zone or surface height above ground. Wind profile options can be set separately for the weather station and the building site. Includes new zone and surface report variables for height dependent properties. There will be differences in results, particularly in files with Ventilation or Infiltration.
- Simple earth tube model for preconditioning (heating/cooling) outside air.
- Tempering valve (3-way valve emulation) for effective and safe use of stored thermal energy.
- Variable and constant speed headered pumps.
- Detailed ice storage.
- New Compact HVAC models for fan powered VAV, fan coil, night cycle controls, outside air heat recovery, supply air temperature reset, chilled/hot water temperature reset, VAV supply fan part-load options, VAV fan blow through or draw through option, and zone supply and return plenums.
- Energy end-use subcategories are now user-definable.
- New report variable for Zone Operative Temperature (Operative Temperature Control planned for V 1.4 in October).

**And many other enhancements and significant speed improvements throughout.**

## NEW ENERGYPLUS TESTING AND VALIDATION RESULTS

### HVAC COMPONENT TESTING

A new set of test results for HVAC Components is now available near the bottom of this web page on the EnergyPlus web site:

<http://www.eere.energy.gov/buildings/energyplus/testing.html>

This new EnergyPlus HVAC Components Test checks the accuracy of EnergyPlus component simulation results compared to manufacturer catalog data, when available. The test procedure makes use of ANSI/ASHRAE Standard 140 procedures for generating hourly equipment loads and ASHRAE Standard 140 weather files. The test suites described within this report are for testing of the EnergyPlus electric chiller referred to within EnergyPlus by the object name CHILLER:ELECTRIC:EIR and the EnergyPlus hot water boiler referred to within EnergyPlus by the object name BOILER:SIMPLE.

## Ask an EnergyPlus Expert

### POLYGONS

How do I define the vertices of a rectangle when the EnergyPlus documentation states:

*"define all roofs and floors as rectangles regardless of the shape of the zone."*

#### Answer

With the advent of >4 sided polygons, you no longer have to limit yourself to 4-sided/rectangular floors/roofs though it is perfectly correct (reference example file Flr\_Rf\_8Sides.idf for a floor and roof with 8 sides covering an L-Shaped zone). This is the only example file with >4 sided polygons that comes with EnergyPlus so any of the others will (usually) illustrate making a rectangular floor or roof (ZoneAirCooled.idf, for example).

### MINIMUM HUMIDITY CONTROL

I want to control minimum relative humidity in a zone and have added the following to an air handling system generated using COMPACT HVAC objects THERMOSTAT, ZONE:UNITARY, and SYSTEM:UNITARY. This is what I've done:

- Humidistat controlling RH in Zone 1 according to a specified RH schedule.
- Humidifier located downstream of the AHU "Cooling Coil" and upstream of the "Zone Splitter." The inlet and outlet nodes of the humidifier are "Air Loop Outlet" and "Supply Path Inlet" and both nodes were generated using the COMPACT:HVAC objects.
- A "Setpoint Manager: Single Zone Min Hum" object with "AHU 1 Supply Path Inlet" as the SetPoint Node and "ZONE 1 ZONE AIR NODE" as the name of the Control Zone Node. Note that the latter field is called "Name of a Node list (or Node)" in the IDF, while the Input/Output Reference describes it as the "name of the zone node of the humidity control zone." Input was based on the description provided in the Input/Output Reference.

The above modifications made no difference to the results. The minimum RH specified in the humidistat RH schedule has not been met. Inspection of the "eplusout.bnd" indicates that there is no humidifier in the system.

1. Is it possible to add a component, such as a humidifier, to an air system created using COMPACT:HVAC objects?
2. How is the signal from the Humidistat used by the "Setpoint Manager" or the "Humidifier"? I do not see a call/reference to the humidistat from either of these objects.
3. Do I need to add other objects besides those described above to simulate minimum humidity control?

#### Answer

1. Run the base input file that contains the COMPACT HVAC objects.
2. Copy the resulting .expidf output file to a new *name.idf*. (The expidf file is the resulting input file in which the COMPACT HVAC objects have been replaced with sets of basic EnergyPlus HVAC objects.)
3. Add the humidifier and related objects to this input file. Note that you must add the humidifier to the BRANCH object for the air loop, and you must change the outlet node name of the preceding component, or the inlet node name of the component after the humidifier in order for this to flow properly.

## Ask an EnergyPlus Expert

### COORDINATE SYSTEMS

#### Question

In a relative coordinate system, are the coordinates of surface and sub-surface vertices entered relative to the BUILDING ORIGIN or to the applicable ZONE ORIGIN?

#### Answer

No Building Origin is ever entered; relative coordinates are relative to the Zone Origin, if input. Also, the relative coordinate system does use both Building and North Axes; see the Input/Output Reference Manual, p. 128 /pdf p. 164).

#### Question

Is the North axis shown on the DXF file True North or Building North?

#### Answer

The arrow on the DXF outputs are annotated "True North."

#### Question

By default, the Blast Translator converts models into the absolute coordinate system. Is there a way of retaining the relative coordinate system when converting BLAST models?

#### Answer

No

### MASS FLOW EQUATION ERROR

Usually the unit of Effective Leakage Area (ELA) is  $\text{cm}^2$  in SI. However, in EnergyPlus the AirflowNetwork ELA is listed as  $\text{m}^2/\text{m}^2$ , which is the ratio of the leakage area of the associated surface. And when compared to the equation in the 2005 ASHRAE Handbook of Fundamentals, p. 27.13, there is no figure on the density of air. Is the EnergyPlus equation correct?

#### Answer

There are two mistakes in object AirflowNetwork:Multizone:Surface Effective Leakage Area in the Input/Output Reference on page 601. The first mistake occurs in the equation where the square root of air density is missed. The correction equation should be:

$$m = ELA * Cd * (2 * Air \text{ Density})^{0.5} * (dP_r)^{(0.5-n)} * (dP)^n$$

The second mistake is the unit of effective leakage area (Field:Effective Leakage Area) on the next page. The correct unit should be  $\text{m}^2$ , instead of  $\text{m}^2/\text{m}^2$ . The program uses  $\text{m}^2$ .

There is a detailed description in the NIST publication on page 144 of the *CONTAMW 2.0 User Manual* by W. S. Dols and George Walton, NISTIR-6921, 2002.

<http://fire.nist.gov/bfrlpubs/build02/art178.html>

We will correct the mistakes in both Input/Output Reference and EnergyPlus .idd. And thank you for bringing this error to our attention.

## Ask an EnergyPlus Expert

### MAXIMUM HUMIDITY CONTROL

I get this message when I use the "Max Humidity Control" option with the object "Furnace:BlowThru:HeatCool."

```
** Severe ** Node Connection Error, Node="ZONE 2 ZONE AIR NODE",
Sensor node did not find a matching node of appropriate type.
** ~~~ ** Reference Object=SET POINT MANAGER:SINGLE ZONE MAX HUM,
Name=ZONE2MAXRH
```

The goal of the controller is met (RH in Zone 2 does not exceed 50%) despite the node connection error! I really would like to know the meaning/implications of the error.

#### Answer

There are two node names requested in the Set Point Manager:Single Zone Max Hum object. Both of these nodes must be defined elsewhere in the EnergyPlus input.

The Name of the set point Node or Node list (A4): The node name or each node name in the node list should be a valid node in the air loop (this name is used by other air loop objects; for example, the outlet node name of the cooling coil).

The Control zone air node name (A5): This is the zone name where the humidity is to be controlled. This node name must be listed in a Controlled Zone Equip Configuration object.

Inputs for Control Variable (A2) and Schedule Name (A3) will no longer be needed in future versions of EnergyPlus.

If this does not help, check the spelling of all node names referenced by the Set Point Manager:Single Zone Max Hum object and make sure they show up elsewhere in the input and in the appropriate places.

```
SET POINT MANAGER:SINGLE ZONE MAX HUM,
  \min-fields 5
  A1 , \field Name
      \required-field
      \reference SetPointManagers
  A2 , \field Control variable
      \note Deprecated Field. This field is not used
  A3 , \field Schedule name
      \note Deprecated Field. This field is not used
  A4 , \field Name of the set point Node or Node List
      \required-field
      \note Node at which humidity ratio set point will be set
  A5 ; \field Control zone air node name
      \required-field
      \note Name of the zone air node for the humidity control zone
```

### DesignBuilder Interface for EnergyPlus – New Office in the United States

DesignBuilder Software of the U.K. has opened an office in Amherst, Massachusetts. Contact D. Charlie Curcija ([curcija@designbuildersoftware.com](mailto:curcija@designbuildersoftware.com)) at DesignBuilder Software, 18 Tanglewood Road, Amherst, Mass 01002 – Tel: (413) 256-4647, Fax: (413) 256-4823.

## Ask an EnergyPlus Expert

### AUTOSIZING -- HEAT RECOVERY LOOP

If I want to autosize the heat recovery loop, which type of loop should be input in the plant-sizing field? I used a water heater to recover the exhaust heat from an IC engine and supply hot water to the HVAC terminals. There is no node-branch connection error in my idf file, and I do get the correct svg file. But the pump in the heat recovery loop does not work; there is no flow getting through the pump. Therefore, the water heater uses the electric heater to keep the water temperature in the allowed range. I have compared my file with the example file "HeatRecoveryPlantLoop.idf." The setpoint manager and the schedules are the same. The only difference is that my file autosizes the heat recovery loop, and the example file does not. So I wonder whether it is even possible to autosize the heat recovery loop?

#### Answer

Check the component sizing reports in the eio output file. It's possible that the flow rate in the heat recovery loop is sizing to zero, which explains why there is no flow. There is a known problem related to plant loop autosizing when the component flow rates are not autosize-able. This is part of the problem you are having. You will not be able to autosize the flow rate of the heat recovery loop.

### AUTOSIZING -- COIL VALUE

Whenever I ask EnergyPlus to autosize the SHR for a coil (DX:CoolingByPassFactorEmpirical) it always returns a value of about 0.64. This is the case whether the room has a high or low sensible to latent load (e.g., meeting room vs. computer room for a given size). What factors or inputs determine the SHR? Should it be changing depending on the ratio of latent to sensible for given room size?

#### Answer

The EnergyPlus autosizing calculations are currently driven by sensible load requirements (which establish the air volume flow rates) and the user-specified supply air humidity ratios (in the SYSTEM SIZING object in this case). Note that the DX coil SHR is at ARI rated conditions, so the autosized SHR uses the ARI rated entering conditions and the user-specified leaving conditions. You should see a change if you alter the cooling supply humidity ratio in the SYSTEM SIZING object.

### FAN COIL AND AUXILIARY AIR

Is it possible to configure a primary air loop to supplement a set amount of auxiliary air AND have a Fan Coil unit provide the additional tempering of the zone conditions?

#### Answer

Yes, that will work. However, make sure you set the heating and cooling priority of the fan coil unit to 2 (in the Zone Equipment List for each controlled zone) so that it runs after the air from the air loop has been supplied, in case that air changes the net load.

## Ask an EnergyPlus Expert

### PURCHASED AIR LATENT LOAD

I am using purchased air in a building. In the output, when I looked at the sensible and total loads, I realized that, in some zones, the sensible is higher than the total load. Does this mean that I have a negative latent load?

#### Answer

The purchased air model is very simple. Using the specified supply air temperature, it determines the flow rate required to meet the current zone load. It takes air from the zone, adds outside air if specified (use this with caution), and then provides the calculated flow rate of air at the specified supply temperature and humidity. To determine the total load, the change in enthalpy is used. To determine the sensible load, the change in temperature is used. If the change in humidity is in the opposite direction of the change in temperature, then you will see the condition where sensible is greater than total. Purchased air is an excellent model for calculating sensible loads. The latent loads calculated by purchased air are very approximate and are somewhat arbitrary given that the supply air humidity ratio is specified directly rather than computed as part of a system model.

### ONE ZONE, TWO FLOORS?

Is it possible for one zone to have two floors? I would like to split the floor of a zone into two parts, one exposed to air and the other adjacent to a lower floor.

#### Answer

Yes, you can have as many floors (and roofs and walls) as necessary to define the boundaries of the zone. Even if the outside environment is the same, it is sometimes easier to describe certain shapes by breaking them into two parts.

### GOOGLE'S "SketchUp" -- A NEW WAY TO VIEW DXF\* OUTPUT!

*A Tip From The EnergyPlus Team*

#### Brent Griffith (NREL)

Google SketchUp is a really great tool for viewing the DXF output files from EnergyPlus. The software is free and can be downloaded from <http://www.sketchup.com/>. After using VoloView for so long, I was blown away by how much better the models look in SketchUP. Be sure to check out the X-ray view.

#### Dru Crawley (USDOE)

Not only that, but you can change the windows to transparent and put materials on the rest... make it look like a real building.

*\*DXF = drawing file in Autocad Format*

2006 EnergyPlus Training from <http://www.gard.com/training.htm>

**August 01**

**Cambridge, Massachusetts (at MIT)**

Immediately before the IBPSA-USA SimBuild Conference at MIT

Early registration deadline is June 28, 2006; Registration closes after July 24

## [New EnergyPlus Interface!!](#)

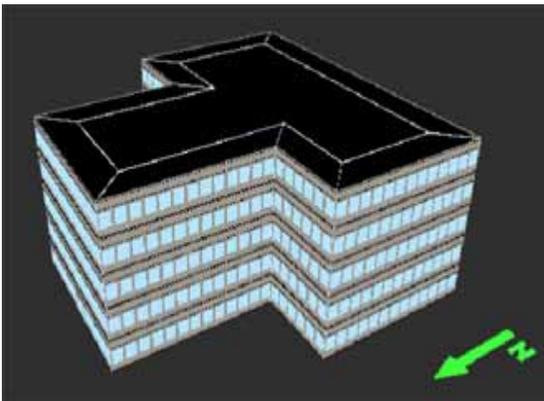
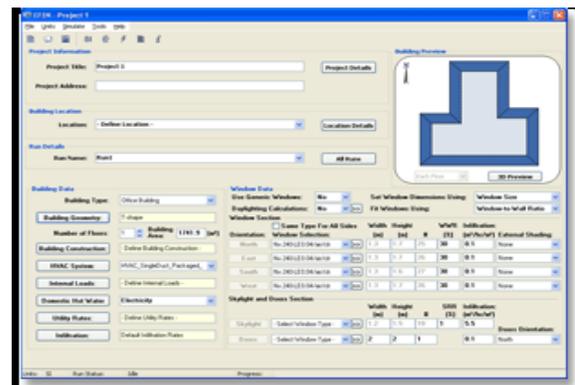
### **EFEN -- Software for Fenestration Systems**

<http://www.designbuildersoftware.com/efen.php>

EFEN is an energy simulation program designed to analyze the energy impacts and cost effectiveness of fenestration systems in various commercial and high-rise residential buildings. EFEN incorporates a user-friendly graphical user interface (GUI) and enables quick and effective parametric analyses of different fenestration systems. EFEN uses the EnergyPlus calculation engine to perform building energy consumption analysis. The main feature of the program is that it incorporates several pre-defined default commercial building types with typical construction, interior loads, operating schedules, and HVAC system configurations, such that users can quickly develop a building energy model.

Annual energy consumption and cost results are produced by the program and organized in intuitive output tables and graphs enabling users to quickly evaluate comparative results (i.e., parametric runs). EFEN also provides options for customizing report generation.

The EFEN program has an interface to the LBNL **WINDOW** program to assist in the accurate specification of fenestration systems. Users can simply select from the library of WINDOW products, specify dimensions, shading devices, location within the building and orientation schedule.



The inner structure of the program is based on number of predefined EnergyPlus files representing various building types and characteristics, which are accessed by EFEN and utilized to simulate the energy consumption of the building.

#### Main characteristics of EFEN

- Simple and intuitive user interface limits the time spent preparing an energy simulation.
  - EnergyPlus simulation engine ensures high-level of accuracy and reliability in comparative energy simulation.
  - Pre-defined default building types and configurations have already been incorporated, using well researched building characteristics.
- Pre-existing database with weather, operating schedules, HVAC system details, and constructions
  - Direct link for fenestration input with industry standard WINDOW program.
  - Intuitive output tables and graphs so that users can effectively evaluate results.
  - Customized versions of program with links to manufacturers' window product database available.

Future versions of EFEN will incorporate modules for code compliance and other voluntary criteria, like Energy Star, ASHRAE 90.1, etc.

EFEN is currently under alpha testing and is scheduled for release by early fall of 2006.

## [New EnergyPlus Interface!!](#)

### **HEVACOMP -- A Design Simulation Package for EnergyPlus**

<http://www.hevacomp.com>

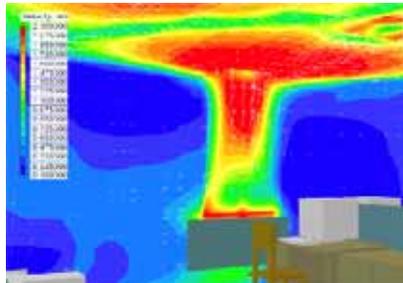
[Hevacomp](#), a leading UK software firm, has developed a Design Simulation package that uses EnergyPlus as the calculation engine. An important feature of the Design Simulation package is that simulation can be carried out using the same project data that engineers have already set up to use with simple load calculations. This enables simulation studies to be carried out without entering any more project data.

#### Building Design

A building is set up by tracing around the internal perimeter of each room. Adjacent surfaces are automatically detected as partitions and data-bases of constructional elements are used. An extensive roof and floor modeling may then be traced from DXF files. Walls and partitions are automatically trimmed vertically to fit the roof, and rooms above and below target rooms are detected. Thus, a full 3D model may be produced for little more effort than a simple 2D tracing.

#### Weather Data

In addition to ASHRAE and CIBSE weather data, an extensive Meteorom weather database of over 7000 locations is included for annual energy simulation.



#### Simulation

Once the building has been set up, the building simulation linked to EnergyPlus can be carried out to examine room heat losses and gains, summer overheating, peak design months, overheating frequency and building energy. The package also produces 3D external shading graphics and internal solar penetration graphics that show moving sunshine patches within rooms.

#### CFD Analysis

Results from Design Simulation can automatically be used for CFD analysis, enabling room air movement and temperature studies to be carried out. Hevacomp provides an extensive object library so that you can place items such as furniture and people in rooms to see the effect on air movement.

#### Plant Simulation Module

A plant simulation module will be released in 2006. This will enable engineers to simply define both HVAC systems (radiators, warm air, constant volume a/c, VAV, fan coils, room a/c units, etc.) and central plant items such as boilers, chillers and cooling towers. Databases of common plant and equipment are provided. From a brief HVAC set of data, the package will automatically set up all the required HVAC components, water and air networks and central plant. Although simple to set up, complex systems can be defined, which are not limited to Compact HVAC components. With plant simulation, plant sizing can be carried out, using summer and winter design-days, plant and equipment sizing schedules are produced. Annual energy consumption can be computed, together with fuel cost and CO<sub>2</sub> consumption.

More information on Hevacomp's Design Simulation is available from [www.hevacomp.com](http://www.hevacomp.com).

***MORE from the Department of Time-Wasting Guilty Pleasures . . .***

*Sadly, only for residents of New York City, Philadelphia and San Francisco,  
check out <http://www.garbagescout.com> -- unreal!*

# Recent Reports

Click on the link to download these (pdf) reports.  
If you run into problems, contact [kl Wellington@ibl.gov](mailto:kl Wellington@ibl.gov).

[Download paper \(PDF\)](#)

The 9<sup>th</sup> International IBPSA Conference, Building Simulation 2005  
Held August 15-18, 2005 in Montreal, Canada

## DESIGN OF THE NATURAL VENTILATION SYSTEM FOR THE NEW SAN DIEGO CHILDREN'S MUSEUM

G. Carrilho da Graça<sup>1</sup>, P.F. Linden<sup>2</sup> and M. Brook<sup>3</sup>

<sup>1</sup>NaturalWorks Inc., <sup>2</sup>University of California, San Diego. Dept. of Mechanical and Aerospace Engineering,  
<sup>3</sup>California Energy Commission

### ABSTRACT

This paper presents an analysis of the thermal behavior of the new San Diego Children's museum and the subsequent development of a low energy climate control system. The museum was designed as a naturally ventilated building with no mechanical heating or cooling. The exhibition space consists of two galleries on the first and second floors and an atrium that extends over the two floors. There are openings on each floor, at the roof level and a solar chimney. The assessment of the ventilation system consisted of an initial analysis of the stack-driven ventilation. It was found that using only stack-driven ventilation led to predictions of significant periods of overheating in the museum. An analysis of the weather data then showed that there is a high correlation between the days of high temperature and a moderate prevailing wind – the sea breeze. Consequently, it was decided to use this wind to supplement the stack-driven flow. As a result additional openings were placed in the façade, and the solar chimney opening was oriented to be in suction during these periods. A BMS system and a control strategy were developed to optimize the performance of the building. Because of these measures the number of predicted hot hours decreased significantly, and the results suggest that the building will operate satisfactorily. The tools used in this analysis were a specifically designed weather analysis spreadsheet, EnergyPlus with COMIS and computational fluid dynamics (CFD).



*Bird's eye view of the San Diego  
Children's Museum*

[www.elsevier.com/locate/enbuild](http://www.elsevier.com/locate/enbuild)

Energy and Buildings 38 (2006) 463–471

## Application Of Switchable Glazing To High-Rise Residential Buildings In Hong Kong

Francis Yik

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### Abstract

For a typical high-rise residential building in Hong Kong, we evaluated the impact of using switchable glazing on energy use for space cooling. By using software EnergyPlus, it was found that application of switchable glazing would lead to a reduction in annual cooling electricity consumption by up to 6.6% where the actual amount depends on existence of overhangs, orientation of building wings, types and locations of rooms. Energy saving by this magnitude, however, cannot justify use of switchable glazing in residential buildings in Hong Kong, mainly because of the high glazing cost.

## EnergyPlus Version 1.3.0

Download a free copy of the program

<http://www.energyplus.gov/>

### Support Tools

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

### Weather Data from [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 Meteorom files for EnergyPlus](#).

### 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/](http://groups.yahoo.com/group/EnergyPlus_Support/).

A selection of questions/answers are compiled (yearly) into a downloadable PDF document: Q and A for [2002](#), Q and A for [2003](#), Q and A for [2004](#), Q and A for [2005](#)

### 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](mailto: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/](http://groups.yahoo.com/group/EnergyPlus_Support/)

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

*EnergyPlus is being developed by University of Illinois and Lawrence Berkeley National Laboratory, with the assistance of 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).*

**ENERGY-10™** Version 1.8 is now available for purchase online through SBIC at:

[www.Energy-10.com](http://www.Energy-10.com).

- ✓ **Photovoltaic module** that provides the ability to model and simulate the performance of a PV system that is either stand-alone or integrated with the building.
- ✓ **Solar Domestic Hot Water module** provides a new solar domestic/service hot water modeling capability.
- ✓ **A new library** ("ASHRAELIB") is included with Version 1.8 defining constructions (wall, roof, window, etc.) as spelled out in ASHRAE 90.1-2004.

## ENERGYPLUS Example File Generator

There is a new (beta version) Web-based interface for EnergyPlus called the EnergyPlus Example File Generator. It quickly creates, runs, and emails user-defined simple models of commercial buildings with only a few inputs. This is an easy way to create and review EnergyPlus input and output results, and should greatly simplify learning how to use EnergyPlus. Using web-based forms, input files use defaults based on ASHRAE Standard 90.1, CBECS and other data sources. To try out the EnergyPlus Example File Generator, go to [http://www.eere.energy.gov/buildings/energyplus/interfaces\\_tools.html](http://www.eere.energy.gov/buildings/energyplus/interfaces_tools.html) (note that pop-ups must be enabled).

### Web-Based Calculators from the Building Envelopes Program at Oak Ridge National Laboratory <http://www.ornl.gov/sci/roofs+walls/index.html>

*These interactive calculators allow you to enter values specific to your construction type and location to determine the energy efficiency of your new or existing building.*

<a href="#">Modified Zone Method</a>	Calculate thermal resistance (R-values) for metal stud walls with insulated cavities.
<a href="#">Moisture Control in Low-Slope Roofing</a>	Determine if a roof design needs a vapor retarder or if the roofing system can be modified to enhance its tolerance for small leaks. <ul style="list-style-type: none"> <li>Also, with the Radiation Control Calculator, you can estimate annual energy cost savings from the use of solar radiation control on <u>low-slope roofs for commercial buildings</u>.</li> <li>Estimate annual energy cost savings from the use of solar radiation control on <u>steep-slope roofs for residential buildings</u>.</li> <li>First-time users are encouraged to visit the <u>Solar Radiation Control Fact Sheet</u> first for essential background on use of the estimating tool.</li> </ul>
<a href="#">Whole Wall R-value Calculator</a>	Determine thermal resistance (R-values) for whole walls by selecting the components that make up the walls in your home.
<a href="#">Thermal Mass Calculator</a>	Determine energy efficiency and energy cost savings benefits based upon your climate.
<a href="#">ZIP-Code R-Value Recommendation</a>	Find the most economic insulation level and cost value for new or existing construction based on your climate.

## Meetings - Conferences - Symposia

### 2006

August 2-4	SimBuild 2006 - IBPSA USA	<a href="http://www.ibpsa.us/">http://www.ibpsa.us/</a>
August 13-18	ACEEE Summer Study on Energy Efficiency in Buildings	<a href="http://www.aceee.org">http://www.aceee.org</a>
August 13-18	International Heat Transfer Conference	<a href="http://www.ihtc-13.com">http://www.ihtc-13.com</a>
August 27-31	International Building Physics/Science Conference (IBPC3)	<a href="http://www.bcee.concordia.ca/ibpc3/">http://www.bcee.concordia.ca/ibpc3/</a>
September 13-14	World Energy Engineering Congress	<a href="http://www.energycongress.com">http://www.energycongress.com</a>
September 13-15	Energie 2006	<a href="mailto:gcelery@etai.fr">gcelery@etai.fr</a>
September 19-22	Rethinking Sustainable Construction 2006	<a href="http://www.treoo.ufl.edu/rsc06/">http://www.treoo.ufl.edu/rsc06/</a>
November 15-17	Greenbuild 2006 (usgbc)	<a href="mailto:greenbuild@conferon.com">greenbuild@conferon.com</a>
December 11-13	System Simulation in Buildings (SSB 2006)	<a href="http://www.ulg.ac.be/labothap/ann-ssb.htm">http://www.ulg.ac.be/labothap/ann-ssb.htm</a>



# DOE-2



DOE-2.1E (version 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) and (Part 2)	DOE-2 BDL Summary (2.1E)
DOE-2 Engineers Manual (2.1A)	DOE-2 Supplement to the Reference Manual (2.1E)

## Order Software and ESTSC Documentation

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

Phone: 865/576-1037  
Fax: 865/576-6436  
Email: [estsc@adonis.osti.gov](mailto:estsc@adonis.osti.gov)

## Purchase DOE-2 Documentation

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

## Free DOE-2 Documentation (<http://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 2005](#) [for 2004](#) [for 2003](#) [for 2002](#)

A compilation of all the "how to" and "DOE-2 Puzzler" articles from the newsletter.

### [Changes and Bug Fixes to DOE-2.1E \(txt file\)](#)

Description of all changes and bug fixes in a text document.

## Seminars from Southern California Gas Co -- <http://seminars.socalgas.com/int/default.asp/>

- |                 |   |
|-----------------|---|
| <b>August 1</b> | <b>EnergyPro Training: Indoor &amp; Outdoor Lighting –and- Envelope and Windows</b> |
| <b>August 2</b> | <b>EnergyPro Training: Advanced and Mechanical</b>                                  |
| <b>August 3</b> | <b>2005 Non-Residential Title 24 Standards: Compliance &amp; Beyond</b>             |

# Recent Reports

Click on the link to download these (pdf) reports.  
If you run into problems, contact [klleington@lbl.gov](mailto:klleington@lbl.gov).

[Download paper \(PDF\)](#)

*The 9<sup>th</sup> International IBPSA Conference, Building Simulation 2005  
Held August 15-18, 2005 in Montreal, Canada*

## TWO DOE-2 FUNCTIONS

Tianzhen Hong, Charles Eley, and Erik Kolderup  
Architectural Energy Corporation, 142 Minna Street, San Francisco, CA 94105, USA

### ABSTRACT

This paper presents two DOE-2 functions to expand the modeling capability of DOE-2.1E, a popular calculation engine for building energy simulations. The first function models sensible and total heat recovery between outside air and exhaust air, with optional evaporative precooling of exhaust air before the heat recovery. The existing heat recovery of DOE-2 only allows preheating outside air when exhaust air is more than 10°F warmer than outside air. The second function models distributed energy storage for direct expansion air conditioners which cannot be modeled by any existing system type of DOE-2.1E.

### Change of Address for DOE-2 Consultants

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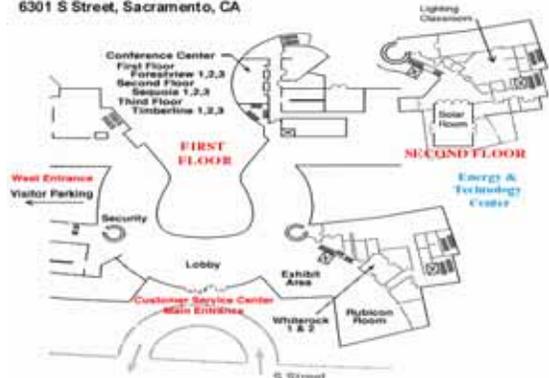
### Sacramento Municipal Utility District (SMUD)

Workshops and Seminars August-November 2006

<https://usage.smud.org/yourAccount/ETCstudent/classlist.asp>

Aug 8	<a href="#">Solar Energy for Homeowners</a>
Aug 9	<a href="#">Lighting Control Solutions for Daylit Spaces</a>
Aug 10	<a href="#">Multifamily Buildings: 2005 Title 24 Energy Code</a>
Sep 16	<a href="#">Hot Attics, Cool Pools for Homeowners</a>
Sep 19	<a href="#">Daylighting Update: Toplighting</a>
Oct 07	<a href="#">Heating, Cooling, and Fans for Homeowners</a>
Oct 12	<a href="#">LEED &amp; Lighting Controls: A 'Green Opportunity'</a>
Oct 19	<a href="#">Nonresidential Fenestration</a>
Oct 28	<a href="#">Windows &amp; Weatherization for Homeowners</a>
Oct 30	<a href="#">Efficient Chilled Water Systems</a>
Nov 02	<a href="#">HVAC Static Pressure and Air Flow</a>
Nov 09	<a href="#">Lighting: Best Practice Report</a>

SMUD Customer Service Center  
6301 S Street, Sacramento, CA



## The Big List of Free

### Free!!! Books

2005 Buildings Energy Data Book	<a href="http://buildingsdatabook.eere.energy.gov/">http://buildingsdatabook.eere.energy.gov/</a>
Daylight in Buildings (book on CD)	<a href="mailto:kl Wellington@lbl.gov">kl Wellington@lbl.gov</a>
Residential Lighting Design Guide (California)	<a href="http://www.cltc.ucdavis.edu/">http://www.cltc.ucdavis.edu/</a>

### Free!!! Building Energy Software \*

BDA 3.1 (Building Design Advisor)	<a href="http://gaia.lbl.gov/BDA">http://gaia.lbl.gov/BDA</a>
COMIS (multi-zone air flow and contaminant transport model)	<a href="http://www.epb.lbl.gov/comis">http://www.epb.lbl.gov/comis</a>
EnergyPlus 1.3.0	<a href="http://www.energyplus.gov/">http://www.energyplus.gov/</a>
GenOpt <sup>®</sup> 2.0 (generic optimization program)	<a href="http://SimulationResearch.lbl.gov">http://SimulationResearch.lbl.gov</a>
Optics 5.2 ( optical properties of glazing systems)	<a href="http://windows.lbl.gov/materials/optics5/">http://windows.lbl.gov/materials/optics5/</a>
HOMER ( off-grid and grid-connected power systems)	<a href="http://www.nrel.gov/homer/">http://www.nrel.gov/homer/</a>
RADIANCE 3.5 (analysis and visualization of lighting in design)	<a href="http://radsite.lbl.gov/radiance/">http://radsite.lbl.gov/radiance/</a>
RESFEN 3.1 (residential windows )	<a href="http://windows.lbl.gov/software/resfen/resfen.html">http://windows.lbl.gov/software/resfen/resfen.html</a>
THERM 5.2 (2-D heat-transfer effects)	<a href="http://windows.lbl.gov/software/therm/therm.html">http://windows.lbl.gov/software/therm/therm.html</a>
VisualSPARK 2.0 (connect component models to simulate innovative building envelope and HVAC systems)	<a href="http://SimulationResearch.lbl.gov">http://SimulationResearch.lbl.gov</a>
WINDOW 5.2 (thermal analysis of windows)	<a href="http://windows.lbl.gov/software/window/window.html">http://windows.lbl.gov/software/window/window.html</a>

\* See also the "big daddy" of building energy software lists, compiled by Dru Crawley of USDOE, at [http://www.eren.doe.gov/buildings/tools\\_directory](http://www.eren.doe.gov/buildings/tools_directory) -- note that some software on the USDOE list is not free ☹

### Free!!! Memberships

IBPSA-Australasia	<a href="mailto:veronica.soebarto@adelaide.edu.au">veronica.soebarto@adelaide.edu.au</a>
IBPSA-USA	<a href="mailto:peter_ellis@nrel.gov">peter_ellis@nrel.gov</a>

### Free!!! Newsgroups (Mailing Lists)

BLDG-SIM	<a href="mailto:BLDG-SIM-SUBSCRIBE@GARD.COM">BLDG-SIM-SUBSCRIBE@GARD.COM</a>
EnergyPlus User/Support Group	<a href="http://groups.yahoo.com/group/EnergyPlus_Support/">http://groups.yahoo.com/group/EnergyPlus_Support/</a>
GARD Analytics ( <a href="http://www.gard.com/">http://www.gard.com/</a> ) for:	
ASHRAE 4.7 Energy Simulation	<a href="mailto:tc47-l-subscribe@gard.com">tc47-l-subscribe@gard.com</a>
ASHRAE 2.8 Building Environmental Impacts/Sustainability	<a href="mailto:tc28-l-subscribe@gard.com">tc28-l-subscribe@gard.com</a>
Standards Project - Test for Building Energy Analysis Software	<a href="mailto:spc140-l-subscribe@gard.com">spc140-l-subscribe@gard.com</a>

### Free!!! Newsletters

ASHRAE	<a href="http://www.ashrae.org/template/enewsletterlanding">http://www.ashrae.org/template/enewsletterlanding</a>
BLUEPRINT (State of California)	<a href="http://www.energy.ca.gov/efficiency/blueprint/">http://www.energy.ca.gov/efficiency/blueprint/</a>
FSEC (Florida Solar Energy Center)	<a href="http://www.fsec.ucf.edu/bldg/resources/newsletter/">http://www.fsec.ucf.edu/bldg/resources/newsletter/</a>
IBPSA	<a href="http://www.ibpsa.org">http://www.ibpsa.org</a>
Society of Building Simulation Educators (SBSE)	<a href="http://www.sbse.org">http://www.sbse.org</a>

**Continued Next Page**

## ***The Big List of Free -- Continued***

### **Free!!! Weather Data**

Real Time Weather Data (on demand) [http://www.eere.energy.gov/buildings/energyplus/cfm/weatherdata/weather\\_request.cfm](http://www.eere.energy.gov/buildings/energyplus/cfm/weatherdata/weather_request.cfm)

California Climate Zones on GoogleEarth™  
Download, install and launch GoogleEarth then download and open the Climate Zones CA-CZ.kmz 120 kb file. <http://earth.google.com/>

### **Free!!! Web Tools**

Home Energy Saver (home energy use) <http://hes.lbl.gov>

ORNL Building Envelope Calculators <http://www.ornl.gov/sci/roofs+walls/index.html>

### **Free!!! Stuff**

Poster: "Energy and Buildings in the 20<sup>th</sup> Century" [klcellington@lbl.gov](mailto:klcellington@lbl.gov)

### **ASHRAE Online Seminar Series – Fall 2006**

<http://www.ashrae.org/>

#### [Introduction to Green Buildings and Sustainable Construction](#)

Wednesday, September 13, 2006  
1:00 p.m. to 4:00 p.m. ET

#### [Introduction to Green Buildings and Sustainable Construction](#)

Wednesday, September 13, 2006  
1:00 p.m. to 4:00 p.m. ET

#### [Complying with ASHRAE Standard 90.1-2004 HVAC/Mechanical](#)

Wednesday, September 20, 2006  
1:00 p.m. to 4:00 p.m. ET

#### [Leadership Skills for Engineering Leaders-Situational Leadership®](#)

Wednesday, September 27, 2006  
1:00 p.m. to 4:00 p.m. ET

#### [Designing Residential Ventilation Systems to Meet ASHRAE Standard 62.2](#)

Wednesday, October 4, 2006  
1:00 p.m. to 4:00 p.m. ET

#### [Complying with Requirements of ASHRAE Standard 62.1-2004](#)

Wednesday, October 11, 2006  
1:00 p.m. to 4:00 p.m. ET

#### [Understanding and Designing Dedicated Outdoor Air Systems \(DOAS\)](#)

Wednesday, October 18, 2006  
1:00 p.m. to 4:00 p.m. ET