

EnergyPlus Articles from the *Building Energy Simulation User News*

01/01/2004 through 12/31/2004

**Simulation Research Group
MS: 90-3147
Lawrence Berkeley National Laboratory
University of California at Berkeley
Berkeley, CA 94720-0001**

January 2005

Copyright © 2004/5 The Regents of the University of California; pending approval by the U. S. Department of Energy. All rights reserved.

This work was supported by the Assistant Secretary for Energy Efficiency and Renewable Energy, Office of Building Technologies, Building Systems and Materials Division of the U.S. Department of Energy, under Contract No. DE-AC03-76SF00098. Disclaimer: This document was prepared as an account of work sponsored by the United States Government. While this document is believed to contain correct information, neither the United States Government nor any agency thereof, nor the Regents of the University of California, nor any of their employees, makes any warranty, express or implied, or assumes any legal responsibility for the accuracy, completeness, or usefulness of any information, apparatus, product or process disclosed, or represents that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process or service by its trade name, trademark, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by the United States Government or any agency thereof, or the Regents of the University of California. The views and opinions of authors expressed herein do not necessarily state or reflect those of the United States Government or any agency thereof or of the Regents of the University of California

Table of Contents

AIR CROSS-MIXING	4
CHILLER STATUS	4
PEOPLE SENSIBLE VS. LATENT LOAD	4
TIME STEP REDUCTION	5
ZONE GEOMETRY.....	5
SHADING CONTROL.....	6
BLINDS' EFFECT ON TEMPERATURE	6
ZONES WARNINGS.....	7
ZONE TEMPERATURES	7
INLET VENTS (COMIS).....	7
PUMP FATAL ERROR.....	8
COMPACT SCHEDULES.....	9
ROOFTOP UNIT	10
EPMACRO – DOE-2 TO ENERGYPLUS.....	10
EPMACRO -- PARAMETRIC RUNS	10
IFCTOIFD ERRORS	11
FLOOR TILT	11
WALL TILT	11
WATER TANK AS AN ENERGY STORAGE DEVICE	12
COMIS QUESTIONS AND ANSWERS.....	12
RADIATION DATA IN THE EPW WEATHER FORMAT	13
LOADS BREAKDOWN	14
SCHEDULES AND TEMPERATURE SETTINGS.....	14
GROUND CALCULATION	15
MANIPULATING WEATHER FILES	16
DISCREPANCY OF WEATHER DATA.....	16
WINDOW GEOMETRY	17
MOISTURE TRANSFER FUNCTION (MTF).....	17
THE “PEOPLE” OBJECT	17
RESIDENTIAL FAN PERFORMANCE	18
CTFS IN ENERGYPLUS	18
HVAC LOOPS	19
SURFACE DESCRIPTION	19
CHANGE THE UNITS?	20
GLARE INDEX.....	21
NON-CLOSED SPACES	21
SINGLE ZONE SYSTEM.....	21
PURCHASED AIR	22
DAYLIGHTING, INTERREFLECTION	22
INFILTRATION	23
FALSE CEILING	24
ENERGY CONSUMPTION COMPARISONS.....	24
AIRFLOW, UNITARY SYSTEM.....	25
THERMAL MASS	25
SWITCHABLE GLAZING EXAMPLES	26
PSZDRAWTHROUGH.IDF	26
DAYLIGHTING, COORDINATE SYSTEM	26
RADIATION TERMS.....	26
WATER HEATER TEMPERATURE NODE	27
HVAC-DIAGRAM.....	27
WATER BYPASS LOOP	27
HEAT RECOVERY	28
WATER HEATERS.....	28
OUTSIDE BUILDING TEMPERATURE	29
SYSTEM SIZING	29

SUB-HOURLY SCHEDULES	30
CEILING DIFFUSER.....	30
SKY MODEL.....	30
RADIANT PANELS	31
OUTDOOR DRY BULB TEMPERATURE.....	31
TDD: DIFFUSER VS DOME	32
TEMPERATURE CURVE	33
DESIGN DAYS	33
COMIS -- AIRFLOW:OPENING	34
COMIS -- SUBSURFACE ON INTERZONE SURFACE	35
PURCHASED AIR, OUTLET NODES.....	35
COOLING COIL CONTROL.....	35
MODELING GLASS DOORS	36
COOLING AND HEATING RATES	36
AIRFLOW, UNITARY SYSTEM.....	36
SIMPLE COOLING COIL WARNING.....	37
AUTOSIZING	37
INDEX	38

AIR CROSS-MIXING

I am trying to add cross-mixing of air between zones into a building. The limitations of cross-mixing (not being able to link multiple zones) prevent me from using it where I have a hallway with two bedrooms along with an adjacent living space. Because of this, I have to use the standard mixing function, which does not affect energy balances of the source zones. Doesn't this generate "false energy" within a simulation? If another mixing function is added in reverse, in order to link the two zones, would the flow rates then have to be identical to keep the energy balances accurate?

Answer

You are correct in that improper use of MIXING objects can violate conservation of energy. The original intent of the MIXING objects was to model flow from one space to another to another, with the assumption that infiltration, or an HVAC system imbalance, was driving the flow to go through the zones and out the final zone as exfiltration. You should be able to use opposing MIXING objects to accomplish what you want.

CHILLER STATUS

Is it possible to turn a chiller off for less than an hour in EnergyPlus simulations? I ran into problems after defining the relevant schedules on a 24-hour basis.

Answer

You can create sub-hourly schedules using DAYSCHEDULE:INTERVAL and DAYSCHEDULE:LIST. Then use these schedules in your PLANT OPERATION SCHEMES object. Note that all schedules are resolved to the zone time step. For example, if you set TIMESTEP IN HOUR = 4, the zone time step will be 15 minutes. If you describe a sub-hourly schedule with 10-minute intervals, the schedule values will be interpolated to determine the value every 15 minutes to match the zone time step.

PEOPLE SENSIBLE VS. LATENT LOAD

I have two conditioned zones that are maintained at roughly the same comfort conditions. The latent percentage of the human-emitted heat in one of the zones seems fine, roughly varying between 20 to 30 percent. Yet my other zone reports the latent percentage at zero most of the time and at the maximum 1 percent. I looked at the engineering document to verify this but the equation does not show how such low latent percentages could appear. The heat given off in the first zone is 96W while the second zone is 64W. If someone could clear this up I would appreciate it.

Answer

The equation on p. 169 of the [Engineering Reference](#) (v1.1.1.012) determines the sensible heat gain from people as a function of metabolic rate and air temperature (dry bulb). The latent gain is the difference of total gain less the sensible gain.

Figure 72 on p.169 (pdf-p.189) shows plots of sensible gain vs. metabolic rate (total gain) at various air temperatures. Whenever the curves show a value of sensible gain \geq the total gain, there will be no latent gain from the people. This occurs at low metabolic rates and low air temperatures. For example, at 21.1C (70F, the magenta line) shows sensible \geq total at metabolic rates below approximately 80W. Those sensible gains

that are greater than the total are artifacts of the curve-fitting process and are set in the algorithm to equal the total; this results in 100 percent sensible gains from people at those conditions.

TIME STEP REDUCTION

I am interested in the comparison and relative assessment of heating concepts. One special focus is the "stochastic use" of individual rooms and the possibility of energy savings if very fast ("almost massless") heating devices are used. I can, of course, limit the periods of occupation to single hours that are distributed adequately over the various days of some example year, but I did not want to:

1. either define a starting time of the heating equipment relative to the onset of the room use with very short precursing time (like some minutes), or
2. tell EnergyPlus to report comfort and temperature readings in minute ranges after the heating sets in, which might be an alternative approach in assessing those interesting values.

In my understanding the smallest time step is 1/6th of an hour, which would not be adequate for this kind of investigation.

Answer:

If all you need to do is change the number of time steps in an hour, you can do this (advanced feature) by changing the line in the EnergyPlus.idd:

```
TIMESTEP IN HOUR,  
    \unique-object  
    N1 ; \field Time Step in Hour  
    \required-field  
    \note Number in hour: validity 1 to 6: 4 suggested  
    \note Should be evenly divisible into 60  
    \note Specifying 6 as maximum as higher values may cause  
instability.  
    \default 4  
    \type integer  
    \minimum 1  
--->    \maximum 6  
  
to      \maximum 60
```

This would allow you to specify a time step in an hour of 60 (1 minute time steps). The value still needs to be evenly divisible into 60, so 30 (2 minute time steps) will also work.

ZONE GEOMETRY

I have a 5-story building with an exterior wall that is adjacent to 11 zones (two on each floor plus the atrium). I am modeling this wall as adiabatic since I am only modeling a certain section of the building. My question is: can I enter it as one wall or must it be broken up into 11 smaller walls (one with each zone)? if it can be entered as one wall, then what should my input for "InsideFaceEnvironment" be (since EnergyPlus allows only one option)? OutsideFaceEnvironment is ExteriorEnvironment, which shouldn't matter as it is adiabatic.

Answer

You should break up that wall into separate surfaces that each conform to the different zones. If you set the outside face to ExteriorEnvironment, then your wall is not going to be "adiabatic." The closest you can come to adiabatic (with boundary conditions) is to set the outside face to "otherzonesurface" and then use the name of the surface itself as the "Outside Face Environment Object." Note that this surface is still modeled with thermal mass and is not really "adiabatic" since it will store and release heat if the interior temperature changes as with setup/setback. You could also set an interior layer of the wall to an unrealistic, extremely low conductance if you really want to emulate "adiabatic."

SHADING CONTROL

I would like the shading control "AlwaysOn" at night instead of during the day, and I need to have a control on the angle of the blind slat. It's an exterior blind and the angle I want is 105° relative to the horizontal. I need this control to maximize the solar gain in winter. Can you help me?

Answer:

Here's how to set the angle you require: Note that "AlwaysOn" means that the blind will be in place day and night.

1. In MATERIAL:WINDOWBLIND set
Slat angle = 105
2. In WINDOWSHADINGCONTROL set
Shading Control Type = AlwaysOn
Type of Slat Angle Control for Blinds = FixedSlatAngle

BLINDS' EFFECT ON TEMPERATURE

I simulated interior window blinds in a naturally-ventilated space. The blinds were modeled following the EnergyPlus package example "PurchAirWindowBlind.idf": blinds controlled by incident solar on blinds. If the windows of the space face south, then indoor temperature (Tin) with blinds is noticeably higher than without blinds in the morning until 2:00 pm. Then in the afternoon, the space without interior blinds is warmer. Similarly, if the window faces west, with blinds is warmer 1-3F than without between 12:00 pm to 16:00 pm. I'm just wondering whether such result is valid and how to check?

Answer

Look at Report Variables "Window Blind Slat Angle" and "Fraction of Time Shading Device Is On" to determine whether the blinds are deployed during the morning hours. Depending on the control setpoint there may be enough incident diffuse solar to deploy the blinds in the morning. Blinds will affect both the solar and thermal performance of the window. Blinds reflect solar back outside, but they also convert transmitted solar into a rapid convective gain instead of allowing solar to be absorbed by building surfaces. With all of these interactions to consider, it is certainly possible that blinds might cause the space to be warmer in the morning.

ZONES WARNINGS

I am simulating a radiant slab cooling system (hydraulic low temperature radiant slab system) in a 40m*40m plan building. If I use DOE-2 to simulate a conventional HVAC system, this building could be considered as five different zones (one central zone and four perimeter zones) with no internal wall between zones. Now, if I use EnergyPlus to simulate the radiant slab system, do I need to zone the building to five zones? And if the building is taken as five zones, with no internal walls between zones, will the simulation result issue a warning for zones that do not have six surfaces. Could I omit this warning or should I add a internal wall between zones?

Answer

The presence of interior walls will affect both the radiant exchange and the thermal mass of the zones. If these walls do not exist in the building, then it is appropriate to model your zones without them. You might consider adding internal mass objects to each zone to account for the mass of furniture and cubicle partitions, if present. Warnings from EnergyPlus are intended to point out something unusual so the user does not omit something by mistake. Severe errors indicate that there may be a problem with the results. In this case, if you get warnings you can simply ignore them.

ZONE TEMPERATURES

How does EnergyPlus determine the initial temperatures of zones ?

Answer

EnergyPlus starts off initial conditions with a fairly high temperature and then iterates until convergence is reached using the actual weather conditions. You will see "# warmup days" in the .eio file as an indicator or, if things did not converge, you will see "Loads initialization did not converge" in the .err file. You can affect the convergence tolerances by setting values in the "Building" object; this is also discussed a bit in [FAQ Reference](#) and should be in the Building Object itself.

INLET VENTS (COMIS)

I am attempting to model "self regulating inlet vents" as part of the natural ventilation strategy in a five story office building. Even though these inlet vents will be on different floors, they are designed to provide a relatively constant flow rate over a range of air pressure differences due to stack effect and external wind conditions. How can I model this using EnergyPlus? Also, is there a specific air-flow component that I could use or will I have to trick an opening/crack to achieve this?

Answer

If these inlet vents are expected to provide a constant flow rate, the simple Ventilation command may be appropriate. Using the polynomial coefficients you can define the flow relationship versus wind speed and temperature difference, or you can set the coefficients to provide a constant flow with no dependence on outdoor conditions.

or

If the self-regulation of the inlet vents is due totally to natural forces then you could model them as COMIS Openings. However, all COMIS Surfaces must be associated with a Heat Transfer Surface or Subsurface, so you would have to define a fictitious window of the appropriate dimensions and set its heat transfer and solar properties to zero. Also, make sure its location, especially its height (Z) relative to the zone that it serves, are input correctly.

NIGHT PURGE

I am modeling a naturally ventilated building using the COMIS link. I want to investigate the effect a night purge has on daytime temperatures. The night purge would involve some sort of mechanical ventilation system that would run throughout the night or when the temperature inside reaches a certain point and the exterior temperature drops to a certain point. Does anyone know the best way to model this using Energy Plus.

Answer

We worked out some techniques for night purge that involve using schedules and multiple runs of EnergyPlus. We used results from an initial run to compute a schedule for when it makes sense to do night purge. Then we assigned the schedule to the minimum outdoor air in an outdoor air mixer (note this was broken in version 1.0.3). We then created a full, 8760-value schedule using external code and a decision making algorithm (e.g., cool OA, no warm-up heating, etc.). This isn't easy, but it is something useful, made possible by the versatile scheduling capabilities of EnergyPlus.

Alternatively, you could use a simplistic approach and use the VENTILATION object in each zone.

PUMP FATAL ERROR

I'm simulating a building with three thermal zones and a central "simple boiler"; I received this message:

```
" Fatal ** The following pump is not the first component on its loop: HW CIRC PUMP"
```

I have controlled the branch list and the inlet and outlet node and the pump is the first component of the supply side. Why the fatal error.

Answer

The first branch must be the supply side inlet branch and the first component on this branch must be the pump.

COMPACT SCHEDULES

The staff at the EnergyPlus Users Office often receives questions about schedules. Here's a tip about the new (and much easier) schedule:compact feature. Usually you would start a schedule by creating one or more dayschedules, then a weekschedule, then a schedule. With compact schedules, you can do it all in one command. Here is a relatively simple schedule:

<pre>DAYSCHEDULE, OC-1, !- Name Fraction, !- ScheduleType 0.0, !- Hour 1 0.0, !- Hour 2 0.0, !- Hour 3 0.0, !- Hour 4 0.0, !- Hour 5 0.0, !- Hour 6 0.0, !- Hour 7 0.0, !- Hour 8 1.0, !- Hour 9 1.0, !- Hour 10 1.0, !- Hour 11 0.8, !- Hour 12 0.4, !- Hour 13 0.8, !- Hour 14 1.0, !- Hour 15 1.0, !- Hour 16 1.0, !- Hour 17 1.0, !- Hour 18 0.5, !- Hour 19 0.1, !- Hour 20 0.1, !- Hour 21 0.0, !- Hour 22 0.0, !- Hour 23 0.0; !- Hour 24</pre>	<pre>DAYSCHEDULE, OC-2, !- Name Fraction, !- ScheduleType 0.0, !- Hour 1 0.0, !- Hour 2 0.0, !- Hour 3 0.0, !- Hour 4 0.0, !- Hour 5 0.0, !- Hour 6 0.0, !- Hour 7 0.0, !- Hour 8 0.0, !- Hour 9 0.0, !- Hour 10 0.0, !- Hour 11 0.0, !- Hour 12 0.0, !- Hour 13 0.0, !- Hour 14 0.0, !- Hour 15 0.0, !- Hour 16 0.0, !- Hour 17 0.0, !- Hour 18 0.0, !- Hour 19 0.0, !- Hour 20 0.0, !- Hour 21 0.0, !- Hour 22 0.0, !- Hour 23 0.0; !- Hour 24</pre>	<pre>WEEKSCHEDULE, OC-WEEK, !- Name OC-2, !- Sunday DAYSCHEDULE Name OC-1, !- Monday DAYSCHEDULE Name OC-1, !- Tuesday DAYSCHEDULE Name OC-1, !- Wednesday DAYSCHEDULE Name OC-1, !- Thursday DAYSCHEDULE Name OC-1, !- Friday DAYSCHEDULE Name OC-2, !- Saturday DAYSCHEDULE Name OC-2, !- Holiday DAYSCHEDULE Name OC-1, !- SummerDesignDay DAYSCHEDULE Name OC-2, !- WinterDesignDay DAYSCHEDULE Name OC-1, !- CustomDay1 DAYSCHEDULE Name OC-1; !- CustomDay2 DAYSCHEDULE Name SCHEDULE, OCCUPY-1, !- Name Fraction, !- ScheduleType OC-WEEK, !- Name of WEEKSCHEDULE 1 1, !- Start Month 1 1, !- Start Day 1 12, !- End Month 1 31; !- End Day 1</pre>
--	--	--

This whole process can be simplified by using a compact schedule (example below):

A set of schedules in the new compact format for commercial and residential building types is included with EnergyPlus v1.1.1. Look for schedules.idf under datasets. Compact schedules are described in the [Input/Output Reference](#) beginning on page 49.

```
! Schedule Occupancy
SCHEDULE:COMPACT,
OCCUPY-1,
Fraction,
For: Weekdays SummerDesignDay,
Through: 12/31,
Until: 08:00, 0.0,
Until: 11:00, 1.0,
Until: 12:00, 0.8,
Until: 13:00, 0.4,
Until: 14:00, 0.8,
Until: 18:00, 1.0,
Until: 19:00, 0.5,
Until: 21:00, 0.1,
Until: 24:00, 0.0,
For: Sunday Saturday Holiday WinterDesignDay,
Through: 12/31,
Until: 24:00, 0.0;
```

ROOFTOP UNIT

I need to model a rooftop unit. The air of the system passes through an evaporator. However, I also need to model the compressor and the two condenser fans in order to know the real consumption of the system. I reviewed the IndEvapCoolerRTUOffice.idf, but don't understand why COIL:DX:CoolingBypassFactorEmpirical is used? Any suggestions? Is there an IDF example?

Answer

The Coil:DX:CoolingBypassFactorEmpirical is used to cool system air; it represents the evaporator, condenser and condenser fan. DX stands for direct expansion, meaning the coil is directly served by refrigerant rather than chilled water. If you know the performance of the unit then you'll have to convert this knowledge into five performance curves -- see the [Input/Output Reference](#) entry for Coil:DX:CoolingBypassFactorEmpirical (look in the Coils group). Also, look at FurnaceWithDXSystem.idf for another example of using a unitary system (e.g., rooftop package) to meet the cooling and heating loads for several zones. In IndEvapCoolerRTUOffice.idf, the HVAC system uses indirect evaporative coolers in combination with rooftop packaged units. This example file uses the object DXSystem:AirLoop to model the rooftop packaged units. The packaged units are comprised of DX cooling coils and gas heaters (see the top of the idf file for a description of the system).

As described in the documentation, COIL:DX:CoolingBypassFactorEmpirical models the direct expansion cooling coil (sensible and latent capacity delivered to the supply air stream) and the compressor plus condenser fan energy use (DX Cooling Coil Electric Consumption). The energy use of COIL:DX:CoolingBypassFactorEmpirical plus the energy use for the supply air fan describe the total electrical energy use for the rooftop packaged units.

EPMACRO – DOE-2 TO ENERGYPLUS

I am trying to convert my DOE-2 file to an EnergyPlus file. I used the DOE2Translator and got an .imf file. As I read from the readme file of DOE2Translator, EPMacro is needed for an .imf file. But I can't find EPMacro. Can anyone help me?

Answer

EPMacro is automatically installed when you install EnergyPlus. The program is located in the "root" directory (C:\energyplus) by default but you don't need to run it separately. Use the EP-Launch program or the RunEnergyPlus batch file -- they both already call EPMacro when an .imf file is used.

EPMACRO -- PARAMETRIC RUNS

Is there a fast and efficient way of doing parametric runs in EnergyPlus?

Answer

Please refer to the list of EnergyPlus Support Tools at http://simulationresearch.lbl.gov/ep_tools.html. The Deringer Group offers EzPlus-Parm, a stand-alone Windows tool intended primarily for EnergyPlus parametric analysis. It was designed to simplify the running of multiple parametric EnergyPlus simulations and helps a user organize and edit files.

Another option is to use EpMacro. EpMacro is distributed with EnergyPlus to generate the input files. This is the same macro processing "language" contained in DOE-2 and it works by substituting variables or blocks of code. You can use a single *.imf file to produce a number of variations in the *.idf.

IFCTOIFD ERRORS

When I use IFCToIDF software, I get an error message of "Type Doesn't Match" from the EnergyPlus BSClient. I cannot convert any IFC file to an IDF file within WIN98 or XP for use in EnergyPlus. I have installed the BSpro server correctly.

Answer

You may have a mismatched IFCToIDF client and BSPro COM Server. If you have previous versions of EnergyPlus installed on your computer, you should uninstall BSPro (using Windows Add/Remove Programs) and then install the version of BSPro that came with the version of EnergyPlus that you are currently running. The installation program for BSPro for EnergyPlus is named BSPro_e+.EXE and is located in the PreProcess/IFCToIDF subdirectory where you installed EnergyPlus.

FLOOR TILT

I got this message even though the view factor to the ground is 1:

```
Program Version,EnergyPlus 1.1.1.012, 26.02.2004 10:51
** Warning **
Floor Tilt=0.0, much less than expected tilt of 180,
for Surface=ZN001:FLOOR001, in Zone=ZONE ONE
```

Answer

This means that your floor is upside down, because your coordinates have been entered in reverse order. To fix this, reverse the order of your four sets of vertices. To check surface tilt, azimuth, area and other specifications for all of your surfaces, add "Report, Surfaces, Details;" to your idf file. The report appears in the eio output file, and is comma-separated for easy viewing in a spreadsheet program.

WALL TILT

I want to consider different wall tilt angles. Is it enough to modify the ViewFactorToGround or do I have to alter the Surfaces and SubSurfaces of the relevant walls?

Answer

Surface tilt and azimuth are controlled by the surface coordinates. ViewFactorToGround is only used to specify the amount of diffuse solar reflected from the ground that is incident on the surface.


```
COMIS Air-Flow Link, SURFACE_2, WALL, CR_0000001, -EX4, WEST_ZONE
COMIS Air-Flow Link, SURFACE_3, WALL, CR_0000002, NORTH_ZONE, WEST_ZONE
COMIS Air-Flow Link, DOORINSURFACE_3, DOOR, WI_0004_1, NORTH_ZONE, WEST_ZONE
COMIS Air-Flow Link, SURFACE_4, WALL, CR_0000002, EAST_ZONE, WEST_ZONE
COMIS Air-Flow Link, SURFACE_8, WALL, CR_0000001, -EX3, EAST_ZONE
COMIS Air-Flow Link, SURFACE_9, WALL, CR_0000001, -EX2, EAST_ZONE
COMIS Air-Flow Link, SURFACE_11, WALL, CR_0000002, NORTH_ZONE, EAST_ZONE
COMIS Air-Flow Link, SURFACE_14, WALL, CR_0000001, -EX4, NORTH_ZONE
COMIS Air-Flow Link, SURFACE_15, WALL, CR_0000001, -EX1, NORTH_ZONE
COMIS Air-Flow Link, WINDOW2, WINDOW, WI_0003_2, -EX1, NORTH_ZONE
COMIS Air-Flow Link, SURFACE_16, WALL, CR_0000001, -EX2, NORTH_ZONE
```

The sum of the "FromZone to ToZone" and "To Zone to FromZone" flows should be zero if you are careful to take into account the flow direction; this means you have to know what the FromZone and ToZone is for each crack or opening, as explained above.

Note that, depending on wind conditions, stack effect, etc., an opening can simultaneously have a non-zero value for both the "FromZone to ToZone" and "ToZone to FromZone" flow. This is because openings (like open windows) can have bi-directional flows.

Question

How does EnergyPlus calculate and display the neutral pressure level for a tall stack?

Answer

The neutral pressure level is not displayed. The calculation is described on pp. 12-13 of H.E. Feustel, "COMIS -- An International Multizone Air-Flow and Contaminant Transport Model," [LBNL-42182](#) (pdf file). COMIS download, user manual and more reports are at <http://epb1.lbl.gov/comis/users.html> .

Question

EnergyPlus does an "automatic calculation of COMIS wind pressure coefficients for rectangular buildings" but the user is asked to input COMIS CP ARRAY and CP VALUES by wind direction. Is this redundant or does the program use the user-defined values over calculated ones? Is it better if I enter zero for all CP values?

Answer

If you specify automatic calculation of wind pressure coefficients, then COMIS CP ARRAY, COMIS CP VALUES and COMIS EXTERNAL NODE are not used and do not have to be entered. See description of "Wind Pressure Coefficients" in the COMIS Simulation object.

RADIATION DATA IN THE EPW WEATHER FORMAT

I need to know how the radiation data is handled on an hourly basis for the EPW format weather file; i.e., does the data for hour 11:00 am to 12:00 noon get integrated from 11:00 am to noon; or from 11:30 am to 12:00 pm and then get assigned to 12:00 noon.

Answer

In an EPW file, hour 12 represents 11:00 am to 12:00 noon. The solar radiation values for a given hour are the integrated total radiation over the hour in Wh/m². For hour 12, the value in the EPW file should be the total from 11:00 am to 12:00 noon. For hourly weather files, EnergyPlus uses this value as the average radiation rate for the hour in W/m². The average rate is assumed to occur on the half-hour, at 11:30 am in this example. Rates for the other time steps in the hour are determined by interpolation between the half-hour values of the previous and next time step.

LOADS BREAKDOWN

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

Answer

Opaque Surface Inside Face Conduction is intended for detailed examination of the heat balance on a particular inside surface, primarily to support comparisons with measured data. It is not meaningful as a component of the current heating or cooling load. Surfaces interact with the zone air heat balance by convection. So, the value of most interest is $(\text{SurfaceInsideTemperature} - \text{ZoneAir Temperature}) * \text{SurfaceArea} * \text{SurfaceInsideConvectionCoefficient}$. The best way to calculate the contribution from the envelope is to take the total load and subtract off the gains from windows, internal loads, infiltration, and ventilation. The remainder will be the impact of the envelope. An explanation of this output variable may be found in the [Input Output Reference](#). Search the document for the variable name of interest.

SCHEDULES AND TEMPERATURE SETTINGS

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

Answer

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

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

GROUND CALCULATION

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

Answer

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

Question

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

Answer

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

Question

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

Answer

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

Question

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

Answer

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

Question

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

Answer

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

MANIPULATING WEATHER FILES

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

Answer

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

Question

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

Answer

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

DISCREPANCY OF WEATHER DATA

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

Answer

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

WINDOW GEOMETRY

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

Answer

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

You may combine all the windows of the same type on the same wall to one of equivalent area.

Studies have shown the results to be very similar and fewer surfaces take less computation time.

There is a Window Multiplier in the Surface:HeatTransfer:Sub object.

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

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

MOISTURE TRANSFER FUNCTION (MTF)

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

Answer

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

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

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

THE "PEOPLE" OBJECT

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

Answer

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

RESIDENTIAL FAN PERFORMANCE

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

1. Should I specify the blow-through and draw-through differently?
2. What should I put for efficiency? I have 65% for the total efficiency and 90% for the motor efficiency. I have all the motor inefficiency lost as heat to the air stream but want to know what happens to the energy lost due to the fan efficiency.
3. How should I specify the pressure difference across the fan? Building America specifies that the air handler should consume 0.00055 kW/CFM. Therefore, should I change my pressure difference to meet this figure based upon whatever my CFM is sized to be?

Answer

1. For furnace/AC systems, EnergyPlus currently only allows for the "blow-through" configuration; you should use FURNACE:BLOWTHRU:HEATCOOL. For air-to-air heat pumps, one of the input fields sets the fan location, so you would use UNITARYSYSTEM:HEATPUMP:AIRTOAIR, and then set field Fan placement to "draw-through."
- 2) The fan and motor efficiencies that you propose are too high for residential equipment. Total efficiencies are more like 35% to 45%. Motor efficiencies depend on type (permanent split capacitor or ECM). Motor efficiencies tend to be higher for larger commercial size motors.
- 3) Fan pressure difference will be site-specific. Total pressure difference would probably be somewhere between 150 and 225 Pascals for residential systems.

CTFs in EnergyPlus

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

Answer

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

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

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

HVAC LOOPS

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

Answer

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

Supply side

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

Demand side

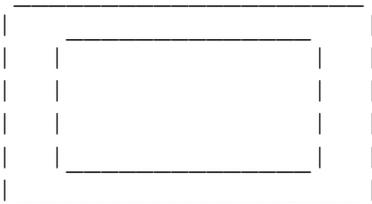
The demand side must always begin with an inlet pipe, then a splitter, then one or more demand components (coils, chiller condenser side, etc.) and bypass branches in parallel, then a mixer, then an outlet pipe.

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

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

SURFACE DESCRIPTION

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



Answer

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

CHANGE THE UNITS?

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

Answer

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

GLARE INDEX

I've simulated the daylight performance of a residential block which includes a kitchen, a living room, two bedrooms and a master bedroom. I called out the annual glare index with hourly basis of each room. The results show that there is no glare (means 0) in the kitchen, one bedroom and the living room; however, there are glare indexes in other two rooms. The five rooms each has a window facing with the same direction (east). Since I know glare index never reaches 0, what's happening and how can I solve the problem?

Answer

The coordinates or facing angle of the daylighting reference point in these zones might be incorrect. Remember that daylighting reference points are always relative to the zone origin, even when World Coordinates have been specified. In the dxf drawing file, the daylighting reference points are drawn as small red circles to help you verify the location. You may need to comment out all of the daylighting objects and then add them back one by one to make sure each reference point is within the appropriate zone.

NON-CLOSED SPACES

I understand that EnergyPlus does not need a closed space in order to do an energy calculation. If I have a space for which I have not specified a roof or floor, what assumption will EnergyPlus make about these surfaces?

Answer

You are correct that EnergyPlus does not need a completely enclosed space to perform a load or an energy calculation. In addition, EnergyPlus will not assume any "default" values for things that do not exist because it does not check for the presence of, say, a roof or floor in every zone. The lack of any particular surface is basically ignored from the perspective of heat transfer through it and interaction with other defined surfaces within a zone. Note, however, that the lack of a surface does not leave a big hole through which you would receive more ventilation, infiltration, etc. The basic philosophy inside EnergyPlus is this: what the user does not define is not simulated and something will affect the simulation only if the user defines it. Lack of a particular surface could be seen as one way of specifying an adiabatic surface without any thermal mass.

SINGLE ZONE SYSTEM

I would like to simulate a Single Zone system with an economizer, i.e., a constant volume system that heats or cools the air as required to meet the zone setpoint, and has an outdoor air mixer. The system should not use both heating and cooling coils at the same time (as in a constant volume reheat system). What is the easiest way to set up this system in EnergyPlus?

Answer

The SmOffPSZ.idf example file illustrates the type of system you want to model. You can substitute a chilled water coil for the dx coil in the example, if desired.

PURCHASED AIR

When using purchased air, the report "Purchased Air Cooling Sensible Cooling Energy" is higher than "Purchased Air Total Cooling Energy." Shouldn't the latter be higher since it consists of both sensible and latent loads?

Answer

The purchased air model is very simple but it can produce confusing results when the outside air option is used. The purchased air model takes return air from the zone and mixes it with the specified outside air volume. If the purchased air flow rate is less than the outside air flow rate, then the purchased air flow rate is used and is 100% outside air. It then takes this mixed air condition (dry bulb temperature and humidity ratio) and calculates the enthalpy change required to condition this air to the specified supply air temperature and humidity ratio. This is the total cooling reported. It also determines the sensible change required, and this is the sensible cooling reported. If the mixed air is drier than the specified supply air humidity ratio, then the total cooling will be less than the sensible cooling.

Purchased air with the outside air option is useful for determining peak loads. If you are using purchased air for an annual load, it is better to introduce the outside air directly to the space using ventilation or infiltration.

Question

How do I use the night temperature setback feature when doing energy efficiency analysis performance improvements with the purchased air? I am varying the level of insulation, window size and types

Answer

Night temperature setback is controlled via the thermostat setpoint schedules. Use the DUAL SETPOINT WITH DEADBAND thermostat type (control type = 4). Setback is accomplished by varying the heating and cooling setpoint schedules. The PSZDrawThru.idf example file has details.

DAYLIGHTING, INTERREFLECTION

I noticed that after changing the wall color, I got different lighting illuminance results. Am I correct to assume that EnergyPlus takes "light bouncing" into consideration?

Answer

Yes, when you are performing daylighting analysis as part of your EnergyPlus simulation, interreflection of visible light between interior surfaces is taken into consideration. The appropriate visible reflectance of each interior surface must be input to account for different surface "colors."

When using the Daylighting:Detailed method in EnergyPlus, the effects of interreflection are calculated using a "split-flux" method. This is described in the Daylighting and Window Calculations section of the EnergyPlus [Engineering Document](#) that is part of the included documentation.

When using the Daylighting:DElight method in EnergyPlus, the effects of interreflection are calculated using a "radiosity" method.

INFILTRATION

I am simulating a two story office building with a corridor in both stories. In the simulation, the corridor is unconditioned because the doors are assumed to be open all day. Therefore, it is difficult to control the temperature of the corridors. However, the temperature of the corridors may be less than the outside environment due to the infiltration from the conditioned rooms. How can I consider the outside environment of the walls that are exposed to the corridors?

Answer

You should model the corridor as a separate thermal zone, and the walls between the conditioned rooms and the corridor should be interzone heat transfer surfaces with `OutsideFaceEnvironment=OtherZoneSurface`, and `OutsideFaceEnvironmentObject=`corresponding wall in the corridor zone.

Question

I don't understand how to estimate the constants A, B, C, and D in the infiltration equation. In the [Input Output Reference](#) it says only that these values are user-specified constants and they are dependent on the external environment. How do I estimate these constants for a given climate?

Answer

The question of typical values for these coefficients is subject to debate. Ideally, one should do a detailed analysis of the infiltration situation and then determine a custom set of coefficients using methods such as those laid out in Chapter 26 of the [ASHRAE Handbook of Fundamentals](#). The EnergyPlus defaults are 1,0,0,0; this gives a constant volume flow of infiltration under all conditions. The coefficients are not climate-dependent, rather they are dependent on the types of openings and cracks present in the building.

BLAST (one of the EnergyPlus predecessors) used the following values as defaults: 0.606, 0.03636, 0.1177, 0. These coefficients produce a value of 1.0 at 0C ΔT and 3.35 m/s (7.5 mph) windspeed, which corresponds to a typical summer condition. At a winter condition of 40C ΔT and 6 m/s (13.4 mph) windspeed, these coefficients would increase the infiltration rate by a factor of 2.75.

In DOE-2 (the other EnergyPlus predecessor), the air change method defaults are (adjusted to SI units) 0, 0, 0.224 (windspeed), 0. With these coefficients, the summer conditions above would give a factor of 0.75, and the winter conditions would give 1.34. A windspeed of 4.47 m/s (10 mph) gives a factor of 1.0.

The source of the BLAST defaults is noted in the BLAST documentation as:

"Empirical equation and the coefficient default were determined from ASHRAE journal articles and other data on the effects of outdoor weather conditions."

The source of the DOE-2 defaults is based on examining the infiltration relationships described in the ASHRAE Handbook of Fundamentals.

The EnergyPlus example files use all of the above: the BLAST defaults in some (GeometryTest), the DOE-2 defaults in some (5ZoneAirCooled), and the EnergyPlus defaults in some (LgOffVAVDetCoil).

FALSE CEILING

I'm simulating a building with a false ceiling in some zones. I defined the false ceiling as an OtherZoneSurface and the roof as an ExteriorEnvironment. Now I need to erase the warnings caused by this situation.

Answer

Try using a separate Zone for the ceiling's plenum space. The "floor" of this interstitial space is an interior partition -- actually the suspended ceiling. The ceiling surfaces are described in conforming pairs (one for the room and one for the ceiling space) and use each other for OtherZoneSurface names. The Roof is then part of the ceiling plenum's Zone.

ENERGY CONSUMPTION COMPARISONS

I have two VAV systems, one is with a reheat coil and the other is with a baseboard heater. So, assuming that they are in the same location and of the same construction, if the heating loads are the same no matter what system is chosen, and if I use purchased hot water only for heating, the "purchased hot water energy" outputs for the two systems should be same, right?

However, since the heat transfer algorithms for the two systems are different, then the total HVAC energy consumption spent by the two systems is going to be different. The question then is which output shows the total HVAC energy spent for a specific system?

Answer

If the heating and cooling setpoints are different, then there will be a difference in heating energy consumption when the zone requires cooling. The consumption should be the same when the zone requires heating. To compare heating output, see the reports "Baseboard Heating Energy (or Rate)" and "Total Water Heating Coil Energy (or Rate)." To compare heating supply input, see the report "Purchased Hot Water Energy (or Rate)." If the water flow rates for the two systems are different, then the "Pump Heat To Fluid (or Energy)" will also be a small factor.

AIR FLOW, UNITARY SYSTEM

I am using the FURNACE:BLOWTHRU:HEATCOOL unitary system. Can I specify one flow rate for the cooling operation and a different flow rate for the heating operation? Or can this type of system only be specified at one flow rate?

Answer

FURNACE:BLOWTHRU:HEATCOOL operates with a single flow rate for both heating and cooling. You must model two systems, one for heating and one for cooling, to have different flow rates. Because a given zone may be served by only one AIR PRIMARY LOOP, the second system must be a piece of zone equipment, such as AIR CONDITIONER:WINDOW:CYCLING or UNIT HEATER.

Question

So, if I can't specify two flow rates for this system, is there another unitary system that I can use or do I have to create two separate systems, one for heating and one for cooling?

Answer

It depends on what you are trying to learn with your model. If you have unlimited purchased air capacity and set it to be the first priority, then the entire load will be met by purchased air and the other system will never operate. If you specify the baseboard system as first priority, the purchased air will pick up the remaining load.

THERMAL MASS

What is the difference between non-thermal mass walls and thermal mass walls in EnergyPlus? Are thermal mass walls supposed to simulate only furniture? Also, I can't find an example idf file for the problem I need to solve: namely, I want the external walls to have thermal mass.

Answer

Non-thermal mass walls

are those described with all layers (or only one layer) using "Material:R" materials -- i.e., described only by resistance. All other walls will have inherent "thermal mass" (i.e., described with L,Cp,K,D characteristics).

Internal Mass

walls should be described with the normal characteristics (i.e., L,Cp,K,D) so that the mass of the item(s) do interact with the heat balance solution. Internal mass could be used for internal partitions, furniture, or other items that may affect the thermal balance.

Virtually all of the sample files have exterior surfaces described with thermal mass.

SWITCHABLE GLAZING EXAMPLES

Are there examples of how to model switchable glazing?

Answer

Switchable Glazing is used in:

- DXSys.idf
- DXSysWithHR.idf
- PurchAirWithDaylighting.idf
- PSZ.idf
- PSZDRAWTHROUGH.IDF

DAYLIGHTING, COORDINATE SYSTEM

I get this warning message a lot:

"Warning World coordinate system selected. Some building zone..."

Because I use switchable glazing, I have to do the daylighting calculations and need to get rid of this warning.

Answer

You can ignore the warning, which is telling you that you selected "world coordinates" in your SurfaceGeometry object but have non-zero origins in the Building and Zone statements. The Detailed Daylighting model uses these non-zero coordinates as you enter the reference points for the daylighting in "relative (to building/zone origins) coordinates." The World Coordinate system does not use the building/zone origins at all.

RADIATION TERMS

I am trying to calculate the total radiation incident that is absorbed on a surface. The outputs for radiation incident on a surface are sky diffuse, ground diffuse, and solar beam. However, the absorptance constants for the building material are thermal, solar, and visible. How do I calculate the fraction of each radiation that is absorbed?

Answer

The reported sky diffuse, ground diffuse and beam radiation incident on a surface are all solar quantities. They should be multiplied by the solar absorptance of the surface to get the amount of each that is absorbed.

Question

What about the IR heat exchange? The IR heat exchange with the sky can be estimated from the known sky and surface temperature. In the case of the IR heat exchange with the ground, do the ground temperatures from the weather file have to be accounted for? What is the IR emittance coefficient for the ground like in EnergyPlus?

Answer

For calculating IR from the ground, the ground is assumed to have an IR emissivity of 0.9 and a surface temperature equal to the outside air temperature. The ground temperatures from the weather file are not used.

The IR from the sky depends on the sky temperature, which is calculated from outside air temperature, atmospheric moisture and cloud cover.

WATER HEATER TEMPERATURE NODE

I would like to have the "use loop" of a solar heating system plant available whenever the water heater temperature is above the temperature of a node in another circuit. I am using a "system availability manager:differential thermostat" object but I can't get the value of the water heater temperature node.

Answer

Use the "Use Side Outlet Node" of the water heater to get the water heater temperature.

HVAC-DIAGRAM

How do I access the HVAC diagram? I tried looking at it from the EP-Launch window but got the warning "No SVG Browser Selected." What does this mean and how can I look at the HVAC diagram? My output said that it was created successfully so I am assuming it is there somewhere.

Answer

After you have installed an SVG viewer, then in EP-Launch you must also choose "Autoselect Programs" from the File menu to set the viewer application in EP-Launch. You only need to do this once and it will remember the setting. The HVAC-Diagram tool is discussed in the AuxiliaryPrograms document (you have to go through the "enhancing EnergyPlus submenu"). There is a free SVG reading tool from Adobe (<http://www.adobe.com/>) that you can then tell EP-Launch about and bring it up in the browser. There are probably other SVG readers available.

WATER BYPASS LOOP

I tried to connect Purchased:Chilled Water to my cooling coil but got an error message that said a PLANT LOOP was needed. I put the Purchased Chilled Water branch onto a PLANT LOOP, then got an error message that said a PUMP was needed! Then I wondered whether CONNECTOR LIST, SPLITTER, MIXER, PIPE, would also be needed? So, for my Purchased:Chilled Water, I would like to know what is needed and what is not. And do I need to construct a bypass loop ?

Answer

For Purchased:Chilled Water and Purchased:Hot water simply replace a chiller or boiler. You still need a complete plant loop with pump and controls. See the 5ZoneAuto.idf example file. You can also use the HVAC template commands "ChillerSupply1WithBypass-Autosize" and "BoilerSupply1WithBypass-Autosize" to set up your plant loop description.

If you use a variable speed pump, then you do not need a bypass. If you use a constant speed pump, then you need a bypass. It never hurts to include a supply bypass branch even if it is never used.

HEAT RECOVERY

Why is it necessary to have an outside air mixer in order to use the Air-to-Air Heat Exchanger:Generic? In the system I want to simulate, there is a fan together with a heating coil and a cooling coil in each zone to heat or cool the circulation air. The ventilation air is provided by a separate outdoor air system, in which I would like to have total heat recovery between outside air and relief air. There should not be air mixture between supply air and return air. I am not sure how I can implement this system in EnergyPlus.

Answer

The mixing box and its controller are needed to set the flow rate for the outside air stream. If you set the minimum outside air flow to equal the supply air flow then you will get 100% outside and therefore no mixing as desired.

WATER HEATERS

If I use WaterHeater:Simple only for domestic hot water, how do I connect the nodes in the water loop? Since I don't connect the WaterHeater to any coil or equipment, do I make up a dummy hot water loop for my WaterHeater ?

Answer

The WaterHeater:Simple object is a multipurpose object that can serve both domestic hot water demands and also serve as a source of heat to a hot water coil loop. The example file is called EnergyPlus\ExampleFiles\Misc\HRGenChill.idf. Currently, WaterHeater:Simple will not be executed unless it sits on a branch, and the branch will not get executed unless it sits on a loop. So, yes, you must make up a dummy hot water loop.

Question

If I put the WaterHeater in a zone, say, HouseBasement, EnergyPlus doesn't do heat balance between the tank and the zone air.

Answer

No it does not automatically interact with the heat balance.

Question

Are there other WaterHeater objects in EnergyPlus that can interact with zone air?

Answer

The hot water heater needs to have the standby losses specified by the user for the hot water tank. This loss affects the amount of time the burner has to run to maintain the tank temperature. And the same loss can be input in the building as an additional internal load.

OUTSIDE BUILDING TEMPERATURE

Can EnergyPlus simulate a building that has a different outside temperature for each floor? The heat rejection from the air conditioners will increase the temperature around building, and I want to factor the increased temperature into the building energy simulation. How sensitively can EnergyPlus simulate for the different outside temperature? And is there an example?

Answer

EnergyPlus is very sensitive to different outside temperatures, although there is no way to specify a different outside temperature for different parts of the building. However, you might try editing the weather file and then run the entire building at the warmer temperature. To edit the weather data, use the weather converter to convert your base weather file to csv format, then use a spreadsheet program to alter the outdoor dry bulb temperature, then convert it back to epw format.

For more details on how to manipulate weather files, see page 4 of the [Building Energy Simulation User News Vol. 25, No. 3 \(May/June 2004\)](#).

SYSTEM SIZING

I am sizing my air loop system which consists of the air to air heat pump (UNITARYSYSTEM: HEATPUMP: AIRTOAIR). I want to size the entire system based upon the cooling coil requirements. Therefore, I want the maximum air flow rate based upon that needed by the cooling system and the cooling coil capacity to be sized strictly on what is necessary for the design cooling load. The current system I have now sizes to meet the heating loads, since the necessary heating maximum design air flow rate is roughly 0.2 m³/s greater than the cooling maximum design air flow rate. Also, the design heat load is roughly 3 kW greater than the design cool load. The remaining heating load that the heat coil cannot satisfy I want to be met with the supplemental heating. What I want to know is how can I manipulate the idf file to size the system based on the cooling requirements? I have already tried to set the cooling capacities and all the air flow rates to that specified to meet just the design cooling load and left the heat capacity and supplemental heating to autosize. When I try to run this, EnergyPlus shuts down without giving me an error message. Can I specify sizes on certain inputs such as the cooling capacity and flow rates but just autosize the heating coil and supplemental heating?

Answer

In general, you cannot mix and match autosizing with specified sizes. In the zone sizing object, you can specify design air flow rates for both heating and cooling and let everything else autosize accordingly. See the [Input Output Reference](#) explanation for the Zone Sizing object.

SUB-HOURLY SCHEDULES

Does EnergyPlus have the capability of looking at sub-hourly schedules to investigate the dynamic response of systems to short-duration, high-intensity loads? I would like to investigate the response of different system options and capacities in a waiting area that will see occasional 15-minute periods with very high occupancy (3-5 SF/person) every couple of hours with very low loads in between.

Answer

EnergyPlus can do this. The zone/heat balance time-steps go down to 10 minutes. If your sub-hourly schedules don't line up with the time-steps, you can control if the program should interpolate schedule values to them (or not). HVAC system "detailed" time-steps are finer and should show how systems might respond to the impulse. You can also see how zone air temperatures and comfort models are affected.

CEILING DIFFUSER

Can I specify the location of the ceiling diffuser in a zone? For example, in the center of the zone, near the perimeter area. I want to measure the difference in energy consumption if the diffuser is placed in different locations around the room.

Answer

No. The correlations are based on an "office sized room" (9ft W x 9ft H x 15ft L) with a centrally located radial ceiling diffuser and a corner, floor return.

SKY MODEL

I took the sky temperatures from the results in EnergyPlus and compared them to the predictions of some models from the literature (Cole's, Clarke's, Czeplak, etc., for the same weather file). However, none of them matched the results in EnergyPlus. How does EnergyPlus calculate the sky temperatures; are they taken from the weather files? If yes, how are these temperatures calculated?

Answer (From the code)

```
! 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/m^2

!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.

Also, don't forget that EnergyPlus uses horizontal infrared in units of watts per square meter rather than a sky temperature in Kelvin.\

RADIANT PANELS

I am modeling a radiant cooling slab system with a perimeter radiant panel heating system. I can't find the "hydraulic radiant panel system" in EnergyPlus. Should I set the "Radiant Panel" as "Baseboard Heater: Water:Convective"? And what about other directions?

Answer:

You have two options: Either use Baseboard Heater:Water:Convective which is thermostatically controlled and adds heat to the space by convection -- or -- use LOW TEMP RADIANT SYSTEM:HYDRONIC with the source near the inside face of the surface and a very thin layer of material on top of it.

OUTDOOR DRY BULB TEMPERATURE

I just compared my outdoor dry bulb temperature from the EnergyPlus output to the outdoor dry bulb temperature listed in the weather file and they are not the same. Is there any reason for this?

Answer

This is expected. The difference comes from interpolating hourly weather data for subhourly time-steps in EnergyPlus. In an hourly weather file, the temperatures and other state-point readings are the value at the time the reading was taken. For example, in the USA_IL_Chicago-OHare_TMY2.epw file, the outdoor dry bulb value for July 2, hour 1, is 19.4C. This is the temperature at 1:00 am.

If you set TIMESTEP IN HOUR = 1, then EnergyPlus will report 19.4C for 07/02 01:00 and will use that value for the entire one hour time-step.

If TIMESTEP IN HOUR = 4, then 19.4C is used only for the time-step that ends at 01:00. The other time-steps use linearly interpolated values between the hourly weather file values. When you report at the "hourly" frequency in EnergyPlus, you see the average temperature over the hour. If you report at the "time-step" frequency, you will see the values from the weather data file appear at the last time-step of each hour.

TDD: DIFFUSER VS DOME

There are two choices (out of five in the IDF editor) for surface type called TDD:DIFFUSER and TDD:DOME. Are these choices selectable or can we choose only window, door, or glassdoor?

Also, can the DIFFUSER be used for an inlet vent that would have pre-assigned zero heat transfer and solar properties so the user could assign some airflow properties to it?

Answer

The TDD:DIFFUSER and TDD:DOME sub-surfaces are used for constructing Tubular Daylighting Devices (TDD), i.e., tubular skylights. The TDD:DIFFUSER is a diffuser for light, not air flow.

I believe the documentation for this object didn't quite make it into the PDFs in the first few weeks of the release (but it's since been fixed). The updated Input Output Reference and Engineering Reference with a complete description of TDDs can be found at:

<http://www.eere.energy.gov/buildings/EnergyPlus/documentation.html>

For more information, check out the recent publication [*Simulation Of Tubular Daylighting Devices And Daylighting Shelves In Energyplus*](#) by Peter G. Ellis (National Renewable Energy Laboratory, Golden, CO), Richard K. Strand and Kurt T. Baumgartner (School of Architecture, University of Illinois at Urbana-Champaign, Champaign, IL) Proc. SimBuild 2004, Building Sustainability and Performance Through Simulation, August 4-6, 2004, Boulder, CO, USA.

TEMPERATURE CURVE

I'm simulating a building with no HVAC system. As there is no facility to input detailed ground temperatures, I've used monthly average temperatures. I observed a 5F Δ in the floor temperatures from the actual recorded data. Because of this, I think that the entire zone surface temperatures are slightly higher than expected. So I'm curious how much difference it would really make if I assigned a temperature curve (from actual data collected in the building) to the floor for a span of four days. Could somebody elaborate on how this could be done?

Answer

OtherSideCoefficients allows you to assign a schedule as the outside surface temperature for any surface.

1. In Surface:HeatTransfer, OutsideFaceEnvironment=OtherSideCoeff and OutsideFaceEnvironment Object="Scheduled Ground Temp" (or whatever name you choose).

2. Then add this object:

```
OtherSideCoefficients,  
  Scheduled Ground Temp,    !- OtherSideCoeff Name  
  -1, !- Combined convective/radiative film coefficient  
  0, !- User selected Constant Temperature {C}  
  1, !- Coefficient modifying the user selected constant temperature  
  0, !- Coefficient modifying the external dry bulb temperature  
  0, !- Coefficient modifying the ground temperature  
  0, !- Coefficient modifying the wind speed term (s/m)  
  0, !- Coefficient modifying the zone air temperature part of the equation  
  Ground Temp Schedule;    !- ScheduleName for constant temperature
```

3. Create the appropriate "Ground Temp Schedule" objects.

4. Be sure to report the outside surface temperature to confirm the values are what you expect.

DESIGN DAYS

I simulated a building using design days. The air temperature (15C) in the zones on the north side of the building is much lower than the setpoint in winter (21.1C). However, the other three side zones meet the setpoint. Only when I increase the sizing factor from 1.3 to 1.8 do the temperatures of north side zones reach the setpoint.

Answer

This is a VAV system and all zones are meeting setpoint on the cooling design day. The north zones are not meeting setpoint on the heating design day because the VAV damper heating action is defaulting to NORMAL.

In these zones, the heating design airflow rate is greater than the minimum supply fraction (0.3) times the cooling design airflow; therefore, in these zones, it is necessary to use REVERSE ACTION or supplement the heat with baseboard. We tested this case with all the zones set to REVERSE ACTION and the zone met setpoint on the winter design day.

COMIS -- AIRFLOW:OPENING

My windows are either fully opened or fully closed. So in COMIS AIRFLOW:Opening I set the numbers as follows:

Number of opening factors: 2

Opening factor #1:	0	Opening factor #2:	1
Discharge. coeff. for opening factor #1:	0	Discharge. coeff. for opening factor #2:	1
Width factor for opening factor #1:	0	Width factor for opening factor #2:	1
Height factor for opening factor #1:	0	Height factor for opening factor #2:	1
Start height factor for opening factor #1:	0	Start height factor for opening factor #2:	0

But with this setup I always get a severe error:

```
** Severe ** &-WI: *WI_0001_1: Cd is zero just in some lines!  
***** It has to be zero in every line (Cd will be calculated)  
***** or in no line.  
** Severe ** &-NET-LINKs: LinkNr: Srf_000039  
***** Room depth has to be input with H/D/W option !  
***** Otherwise Cd cannot be calculated!
```

When I change Discharge Coefficient for opening factor #1 to, let's say, 0.1 the error goes away. I don't think I understand the real meaning for these inputs from [Input Output Reference](#).

Answer

This might clarify how the various inputs interact with each other.

1. The current implementation of COMIS in EnergyPlus requires that all COMIS AIR FLOW:OPENING Discharge Coefficients be >0. The Input Output Reference and the IDD incorrectly state that zero is a valid value.
2. When the window is closed, the "Air Mass Flow Coefficient When Window or Door Is Closed" and "Air Mass Flow Exponent When Window or Door Is Closed" are the primary factors specifying the flow rate at 1Pa along with crack length modifiers.
3. When venting is active, the "Window Open Factor for Ventilation" specified in COMIS SURFACE DATA specifies the opening factor to be used when the venting controls fully open this window. So, if this value is 0.5, then the window can never have an opening factor greater than 0.5.
4. If the venting controls modulate, the modulation is for opening factors from 0 to the value specified in 3 above.
5. If venting is active and modulating, as the modulation approaches zero, the values associated with Opening Factor #1 in the COMIS AIR FLOW:OPENING object (Discharge Coefficient, Width Factor, Height Factor, and Start Height) control the flow. When the venting controls completely close the window, it reverts to using the factors in 2.

COMIS -- SUBSURFACE ON INTERZONE SURFACE

Do I need to define one interzone surface between two zones twice, as different surface names for each zone? Also, for heat transfer purposes, if I have a door on that interzone surface, does the door also need to be defined twice with different names for each of the two zones?

Answer

Yes -- interzone subsurfaces must be described twice, once in each zone. Then for COMIS, you attach a COMIS opening to one of these two instances of the subsurface. The subsurface that is attached to the COMIS opening then governs which zone is the controlling zone for the opening (if it has any operable vent controls).

PURCHASED AIR, OUTLET NODES

I am simulating a building with no HVAC system; however, I do need the values for the purchased cooling and heating rates. But when I try to simulate this condition, EnergyPlus aborts with a fatal error and reports that there are no outlet nodes.

Answer

In PURCHASED AIR, "Zone Supply Air Node Name"=NODE_1, the node names should match. In CONTROLLED ZONE EQUIP CONFIGURATION, "Zone Air Inlet Node(s)"=Zone1Inlets. There is a NODE LIST, named "Zona1Inlets", that maps to NODE_1. The problem can be fixed by changing "Zone1Inlets" to "Zona1Inlets" and the same for the other zones.

COOLING COIL CONTROL

I am doing a sensitivity analysis with humidity control and have to set an appropriate range of the parameters related to the control of heating/cooling coils. Three parameters are in question:

1. Leaving relative humidity from cooling coil
2. Heating coil: Controller convergence tolerance
3. Cooling coil: Controller convergence tolerance

Are there references that give typical ranges of these parameters?

Answer

The controller convergence tolerance values are specific to EnergyPlus; you will not find any technical literature discussing them. The value here depends on the type of equipment you are using. Some tolerances are ΔC , some are fraction of load. The default values are reasonable, or you may choose to use smaller numbers. We would not use anything larger than the defaults.

Item 1 implies that you are using COIL:Water:SimpleCooling. Due to limitations in this model, it is being phased out. For a study focusing on humidity control, we would strongly recommend upgrading to EnergyPlus 1.2.1 and using the new COIL:Water:Cooling or using COIL:Water:DetailedFlatCooling.

MODELING GLASS DOORS

I have roll-up bay doors with glass panes in its construction and wanted to model it as just a glass door. I was trying to enter data for the windows and glass doors into the field Surface:HeatTransfer:Sub and noticed it only gave me the options entered in the CONSTRUCTION field. Then I noticed that in the construction field I can only choose items entered in Materials:Regular; it won't let me choose from the glass materials I entered into Material:WindowGlass. Why can't I do this as in the 3zvent example?

Answer

All the types of materials that are present in your idf file should appear in the pull-down list for CONSTRUCTION layers. Predefined materials are available in various files in the DataSets folders. In EnergyPlus 1.2.0, you must use a text file editor to open the dataset file and your idf file and then copy/paste from one to the other. In EnergyPlus 1.2.1 you can open both files in IDF editor and copy/paste between them.

COOLING AND HEATING RATES

I am simulating a building with walls, lights and some electrical material. There are no HVAC systems, chiller, etc.

But I need to have as output the Purchased Cooling Rate and the Purchased Heating Rate. It is possible?

Answer

Yes, you can get just the cooling and heating rates without any HVAC systems. To do that, you use 'purchased air', 'purchased chilled water' and 'purchased hot water'. See several of the example files such as any of the ones beginning 'PurchasedAir...' in the \EnergyPlus\ExampleFiles directory. Purchased Air is discussed beginning on page 520 (page 548 of the PDF) of the Input Output Reference under Group - Zone Forced Air Units. Purchased:ChilledWater is on page 424 (page 452 of the PDF) and Purchased:HotWater is on page 425 (page 453 of the PDF). Purchased Heating/Cooling, etc. are often an option on many of the systems--search for 'purchased' in the [Input Output Reference](#) manual.

AIR FLOW, UNITARY SYSTEM

I am using the FURNACE:BLOWTHRU:HEATCOOL unitary system. Can I specify one flow rate for the cooling operation and a different flow rate for the heating operation? Or can this type of system only be specified at one flow rate?

Answer

FURNACE:BLOWTHRU:HEATCOOL operates with a single flow rate for both heating and cooling. You must model two systems, one for heating and one for cooling, to have different flow rates. Because a given zone may be served by only one AIR PRIMARY LOOP, the second system must be a piece of zone equipment, such as AIR CONDITIONER:WINDOW:CYCLING or UNIT HEATER.

Question

So, if I can't specify two flow rates for this system, is there another unitary system that I can use or do I have to create two separate systems, one for heating and one for cooling?

Answer

It depends on what you are trying to learn with your model. If you have unlimited purchased air capacity and set it to be the first priority, then the entire load will be met by purchased air and the other system will never operate.

If you specify the baseboard system as first priority, the purchased air will pick up the remaining load.

SIMPLE COOLING COIL WARNING

My model with simple cooling coil always returns the following warning message:

```
Convergence failure Simple cooling coil, iteration limit exceeded
```

I tried the autosize and used the recommended UA value, but it didn't help much.

Answer

This may be the result of a mismatch in the coil sizing inputs. Make sure that the coil UA and water flow rate are consistent with the air loop flow rate and load.

Note that COIL:Water:SimpleCooling will be eliminated in the next release of EnergyPlus, because there are some deficiencies in the model. We recommend that you use one of the other chilled water coil models, COIL:Water:DetailedFlatCooling or the new COIL:Water:Cooling.

AUTOSIZING

I have a question about the autosizing of the DX cooling coil. I have a one-zone building conditioned by a unitary system with DX cooling coil COIL:COOLING:BYPASSFACTOREMPIRICAL. I input the SHR of the cooling coil as 0.75. I asked EnergyPlus to do the autosizing of the component wherever possible and I got a severe error message:

```
** Severe **
For object = COIL:DX:COOLINGBYPASSFACTOREMPIRICAL, name =
"ROOFTOPUNIT_Z_SINGLE COOLING COIL", the combination of rated air
volume flow rate, total cooling capacity and sensible heat ratio
yields coil exiting air conditions above the saturation curve.
Possible fixes are to reduce the rated total cooling capacity,
increase the rated air volume flow rate, or reduce the rated
sensible heat ratio for this coil.
```

Then I reduced the coil SHR to 0.74 and it worked.

Also, I have a thermostat object for this zone but I do not have a humidistat object. My understanding is that EnergyPlus will autosize the cooling coil in order to meet the thermostat setpoint and leave the indoor humidity as whatever it is. But is this really the case? I am wondering if anyone can give me some explanation of this.

Answer

The error message occurred because the specified SHR could not possibly be achieved for air at the autosized flow rate entering at ARI rated conditions and being cooled at the autosized capacity, which was determined by the specified supply air temperature in the sizing objects.

The easiest approach in this case is to autosize all three values (capacity, air flow rate, and rated SHR). The last line of the error states this:

```
"If autosizing, it is recommended that all three of these values
be autosized."
```

You are correct that the DX coil is sized to meet the sensible load without providing any active humidity control. However, the coil will do latent cooling, and it cannot do less latent cooling than psychrometrics would allow.

INDEX

- air cross mixing, 4
- air flow, unitary system, 25
- airflow
 - COMIS, 34
 - rates, 36
 - unitary system, 36
- autosizing, 37
- basement, 15
- blinds, temperature, 6
- ceiling diffuser, zone, 30
- chiller, 4
- COMIS
 - airflow, 34
 - inlet vents, 7
 - interzone, 35
 - neutral pressure, 13
 - night purge, 8
 - reports, 12
 - wind pressure, 13
- conduction, 14
- conduction transfer functions, 18
- cooling coil, 35
- cooling coil, warning, 37
- cooling/heating rates, 36
- corridor, infiltration, 23
- daylighting
 - coordinate system, 26
 - glare index, 21
 - interreflection, 22
 - switchable glazing, 26
 - tdd, 32
- design days, 33
- DOE-2, EPMacro, 10
- door, glass, 36
- energy consumption, 24
- energy storage, water tank, 12
- EPMacro, DOE-2 to EnergyPlus, 10
- EPMacro, parametric, 10
- error, fatal, 8
- errors, IFCToIDF, 11
- false ceiling, 24
- fan, residential, 18
- floor tilt, 11
- function
 - moisture transfer, 17
- functions
 - conduction transfer, 18
- geometry
 - transfer surfaces, 19
 - window, 17
 - zone, 5
- glare index, 21
- glass door, 36
- glazing
 - switchable, 26
- heat exchange, radiation, 26
- heat recovery, 28
- heating/cooling rates, 36
- HVAC loops, 19
- HVAC-Diagram, 27
- IFCToIDF, errors, 11
- infiltration, typical values, 23
- internal mass, 25
- interzone surface, 35
- load
 - conduction, 14
 - latent, 4
 - radiation, 14
- loop
 - HVAC, 19
 - water bypass, 27
 - water heater temperature, 27
- mass, internal, non-thermal, 25
- moisture transfer function, 17
- neutral pressure, COMIS, 13
- night purge, 8
- OtherSideCoefficient, 33
- outlet nodes, 35
- parametric, EPMacro, 10
- People object, 17
- people sensible vs latent load, 4
- pump fatal error, 8
- purchased air, 22, 35
- radiant panel, 31
- radiation, 14, 26
- reports, COMIS, 12
- rooftop unit, 10
- schedule
 - compact, 9
 - sub-hourly, 30
- shading control, 6
- sizing, system, 29
- sky model, 30
- slab, soil, 15
- space, non-closed, 21
- surface, interzone, 35
- switchable glazing, 26
- system

- single zone, 21
- sizing, 29
- tdd, 32
- temperature
 - ground calculation, 15
 - outdoor dry bulb, 31
 - outside building, 29
 - settings, 14
 - sky, 30
 - zone, 7
- temperature curve, 33
- tilt, floor and wall, 11
- time step, 5
- unitary system, 36
- unitary system, air flow, 25
- units, how to modify, 20
- wall tilt, 11

- warnings, zone, 7
- water heater, 28
- water heater temperature, 27
- water tank, energy storage, 12
- weather
 - EPW vs CSV, 16
 - modify files, 16
 - radiation data, 13
 - timestep in hour, 31
- wind pressure, COMIS, 13
- window geometry, 17
- zone
 - ceiling diffuser, 30
 - false ceiling, 24
 - geometry, 5
 - temperature, 7
 - warning, 7