

Decoding CBECC-Com

Let's Talk IESVE and Nonresidential 3D Modeling

Host:

Gina Rodda
Gabel Associates, LLC

Guest Speaker:

Liam Buckley
IES



This program is funded by California utility customers under the auspices of the California Public Utilities Commission and in support of the California Energy Commission.



Welcome

► Welcome

- Who are we?
- Our goal today
- More about you

- What We Heard From you
- Let's Talk
- Next Steps
- Wrap Up





Recording For Future Use

This session is being recorded.





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California Statewide Codes & Standards



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Who Are We?



Host

Gina Rodda, Gabel Associates, LLC

gina@gabelenergy.com

Gina Rodda, our host for the Decoding Talk series, is a Certified Energy Analyst (CEA), Certified Energy Plans Examiner (CEPE) and LEED Accredited Professional (AP).

She is involved in providing residential and non-residential energy calculations for a variety of building types throughout California; an instructor of full day trainings; and host of various webinars specific to Title 24 (Part 6) Building Energy Efficiency Standards.

Gina has been in the energy modeling field since 1991, through the course of seven California building energy code cycles.



GABEL ASSOCIATES, LLC

BUILDING ENERGY ANALYSIS & ENERGY CODE COMPLIANCE



Who Are We?



Guest Speaker:

Liam Buckley, IES

Liam Buckley, C.Eng., MIEI, Member ASHRAE, BEMP, is a Business Development Manager with IES and a Project Manager with IES-Consulting. Liam's consulting work includes lighting design, daylighting, natural ventilation, CFD airflow, HVAC, renewable energy and whole-building energy simulation and optimization. Liam has 10 years' experience with MEP/HVAC Engineering design and building performance modeling, certification and code compliance. Examples include design charrettes for LEED and California's Title 24 Code Compliance.



Liam's business development work with IES' technology has included implementation of simulation-based building energy prediction processes with the top architectural and engineering firms in the world, as well as some governmental and utility agencies.

Liam is a Chartered Engineer in Ireland and the UK, an ASHRAE Member, and is an ASHRAE-certified Building Energy Modeling Professional.



Our Goal Today



Establish some of the basic rules to modeling to be successful using CBECC-Com with 3D modeling for nonresidential buildings:

- ✦ How to get your self organized to be successful
- ✦ Some tips and tricks for IESVE
- ✦ Where to get HELP



We Want To Hear From You

- Welcome

- ▶ **We Want To Hear from You**

- Most common challenges

- Let's Talk

- Next Steps

- Wrap Up





Our Question To You

What are your top 3 concerns regarding IESVE Software and 3D performance modeling for Title 24 part 6 performance calculations?

- Haven't been able to successfully complete a T24 calc in IES (have ended up exporting to xml to CBECC) because of challenges in error-checking

How to efficiently use the program.

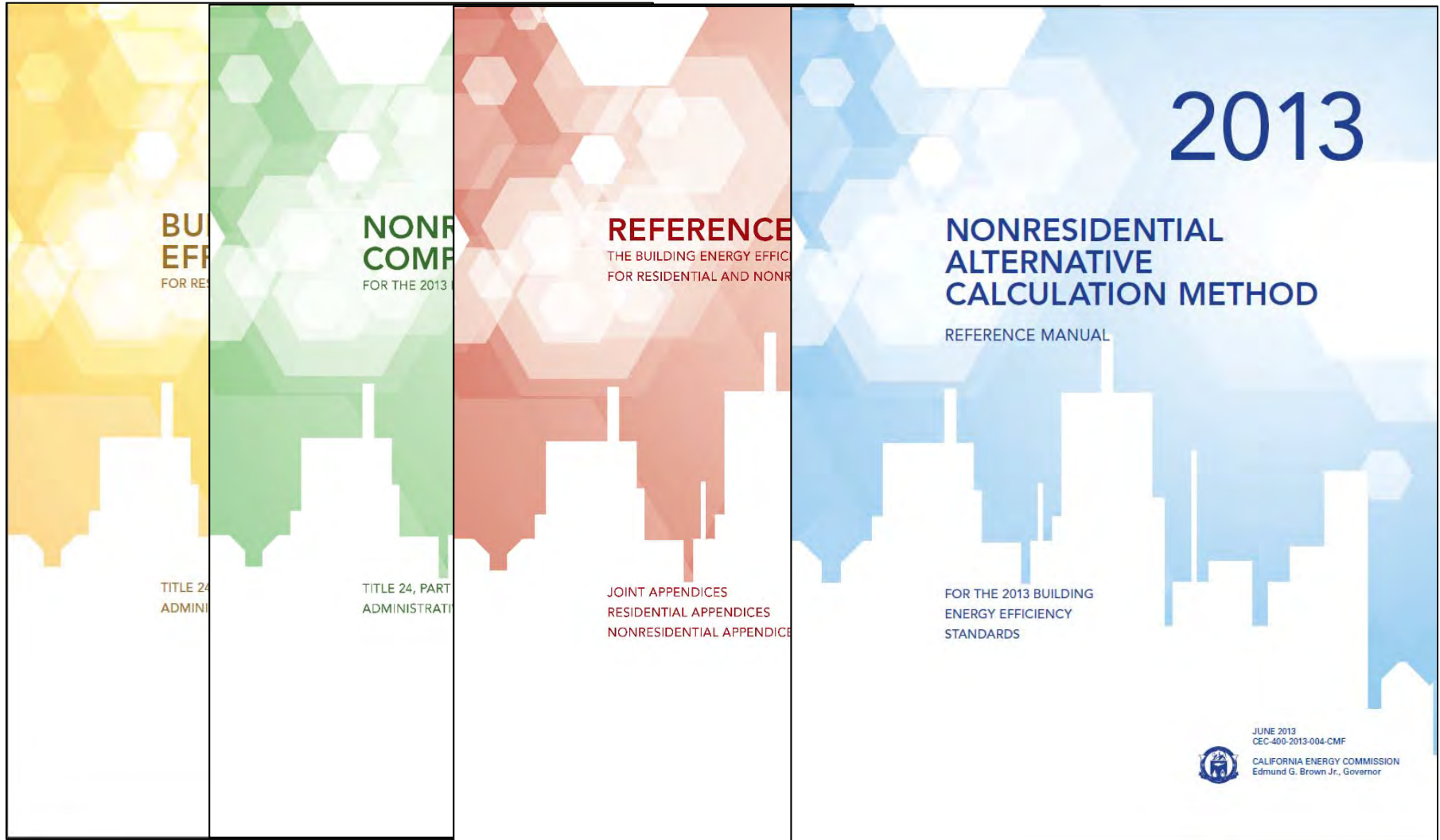
Time for modeling and resolving errors prior to running a simulation.

How to look for buried problems within a given model?

Will the time invested be worth the effort.



Code: CEC Documents



<http://www.energy.ca.gov/title24/2013standards/index.html>



What's Under The Hood?

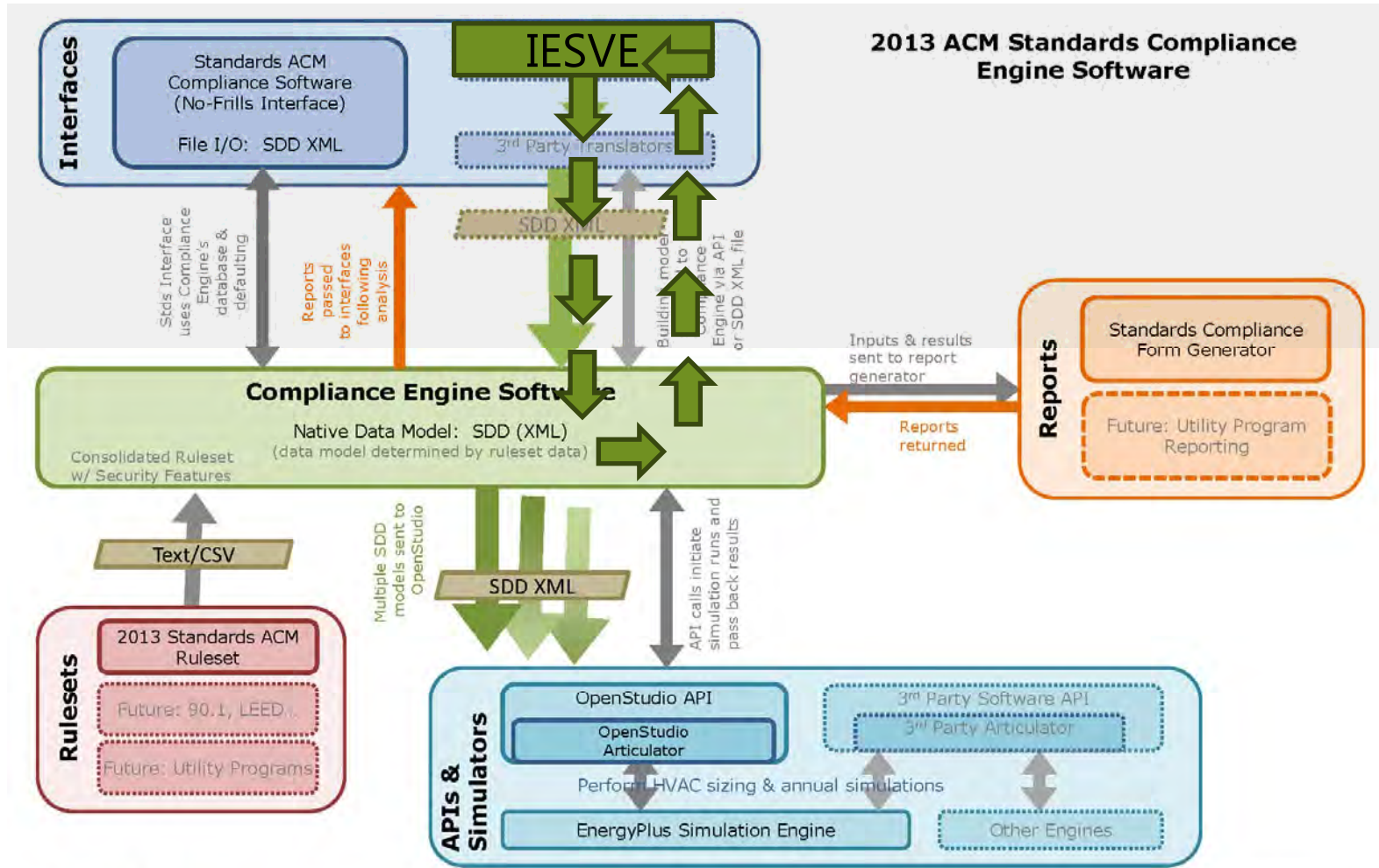


Diagram key:

- Transfer of building model via SDD (XML) (multiple arrows imply transfer of multiple building models)
- Transfer of compliance reports

- Inter-process communication of data and/or API calls
- Possible future modules



Let's Talk

- Welcome
- What We Heard from You

▶ Let's Talk

- Here, Now and Next

- Next Steps
- Wrap Up





Challenges (Phase of Project)



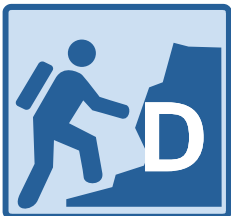
- ✦ **Challenge A**
 - ✦ Organize Yourself



- ✦ **Challenge B**
 - ✦ Best Practices



- ✦ **Challenge C**
 - ✦ How To Get "Compliance"



- ✦ **Challenge D**
 - ✦ Where To Get Help



Our Question To You

How do you prepare for modeling a project, thinking about the new modeling criteria established with CBECC-Com in regards to 3D modeling?

Looking at the overall project and making sure that we are only modeling things that are relevant towards getting building permits, all of the extra stuff is for "fun" when the main work is completed.

2. Review HVAC design/objectives with mechanical engineers with drawings as part of the review. This discussion would involve reviewing tentative design and minimum T24 standards. HVAC systems that can not be modeled as designed due to CBECC-Com limitations deciding on the best approach for a 'work-around' for compliance.

1. Start planning early as the SD phase

Collect documentations, write down assumptions, review these with the client.

3. Start building the model as early as possible to account for design changes prior to deadlines as necessary.



Challenge A





Challenge A: Organize Yourself

Questions to Ask Yourself

What are the goals?

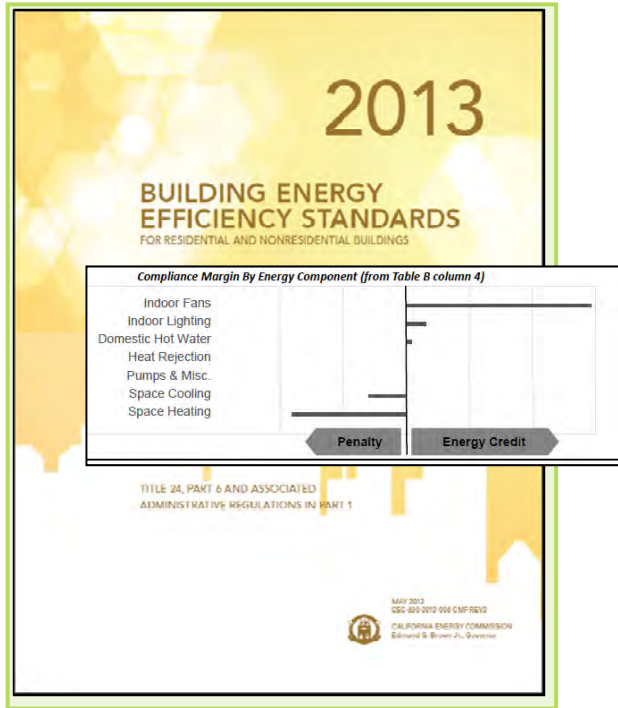
- ✦ Modeling objectives
 - ✧ How does that effect your modeling?

How does it work?

- ✦ 3D Model Interoperability
 - ✧ Where is it coming from?
- ✦ Why use a 3D (detailed) model?
 - ✧ Daylighting and how it affects the compliance numbers.
- ✦ How can I do this?



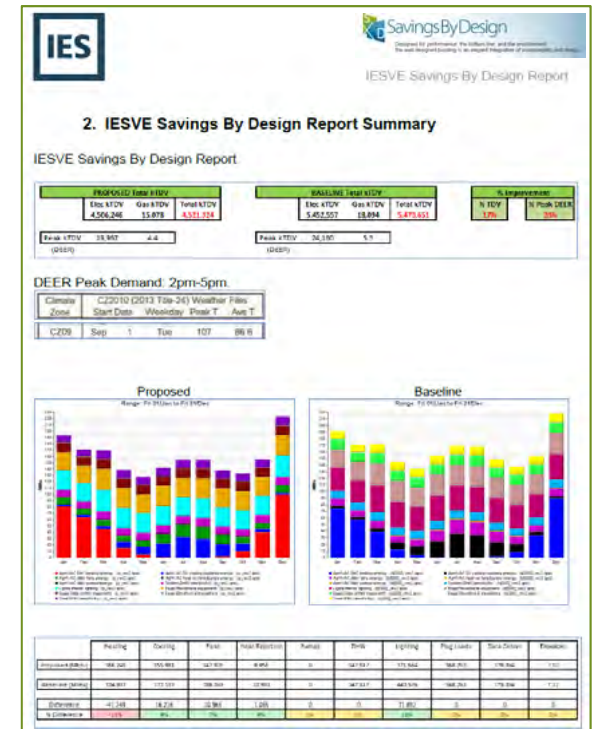
What Are The Goals?



Modeling Objectives

- ✦ Title 24 Part 6 Minimum compliance
- ✦ LEED (ASHRAE 90.1 or Title 24)
- ✦ Savings By Design
- ✦ CMFNH
- ✦ ZNE (CA by 2030)

Percent Savings	
Energy use	Cost
23.82	21.95

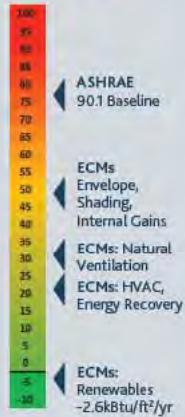




ASHRAE Zero-Net Energy Winners

THE IES TEAM	ASHRAE LOWDOWN SHOWDOWN AND THE ZERO-NET ENERGY PROJECT TEAM MEMBERS					LOCATION	CLIMATE		
 Software Used: IESVE 2015	TEAM COACH	ARCHITECTS		DESIGNERS		ENGINEERS	FANS	CITY OF BOULDER, CO, USA	5A-TMY15
	 Liam Buckley IES Ltd., Oakland, CA	 Ben Brannon AECOM, San Francisco, CA	 Anna Osbourne Integral Group, Oakland, CA	 Shona O'Dea DLR Group, Chicago, IL	 Megan Gunther AEI, San Francisco, CA	 Greg Romanczyk n.d., Midland, FL	 Cory Duggin TLC, Brentwood, TN	 Scott West HKS, Dallas, TX	

EUI



- 16,500 ft² of PV-T Panels
- Passive Evaporative Down-Draft Cool Towers
- Draft Lobby to reduce infiltration

Zero Net Energy Project Description

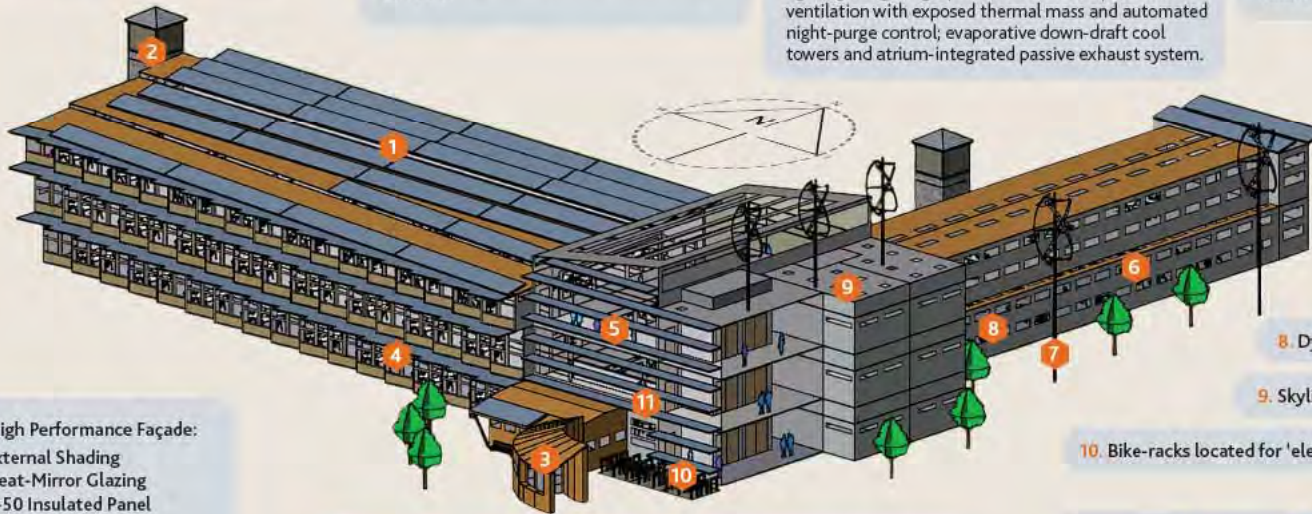
This three-story, 53,600 ft² office building is located in downtown Boulder. The climate experiences vast variations including annual external temperatures (-4° F to 93°F); (6% -100% Relative Humidity) and commonly occurring night-to-day temperature swings of +35°F.

Energy Conservation Measures (ECMs)

Include solar hot-water pre-heating; air-to-water heat pump; energy-star equipment; daylight harvesting controls; plug load schedules from metered end-uses targeting ZNE; fixed and dynamic solar shading; airside heat-recovery wheel; IT server virtualization; radiant floors for improved thermal comfort; optimized electric lighting design; high-performance envelope; natural ventilation with exposed thermal mass and automated night-purge control; evaporative down-draft cool towers and atrium-integrated passive exhaust system.

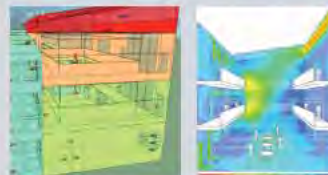
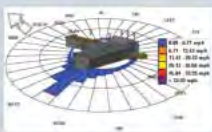
Future-proofing ZNE Status

Energy Usage Intensity (EUI) of -2.6 kBtu/ft²/year is predicted for 2016. However, future ZNE status of the building has been incorporated into the design, by additional simulation of weather data morphed to represent 50 years into the future (2064).



4. High Performance Façade:

- External Shading
- Heat-Mirror Glazing
- R-50 Insulated Panel
- Passive louvres in saw-tooth façade to capture predominant westerly wind for natural cross-ventilation



- ### 5. Airflow-Integrated Atrium
- External: Funnels air towards wind-turbines
 - Internal: Passively induces air from office spaces

6. Natural Cross-Ventilation

7. Vertical-Axis Wind Turbines

8. Dynamic Blinds on East/West façades

9. Skylights assist with daylight harvesting

10. Bike-racks located for 'elevator-shaming' (ECM not modeled)



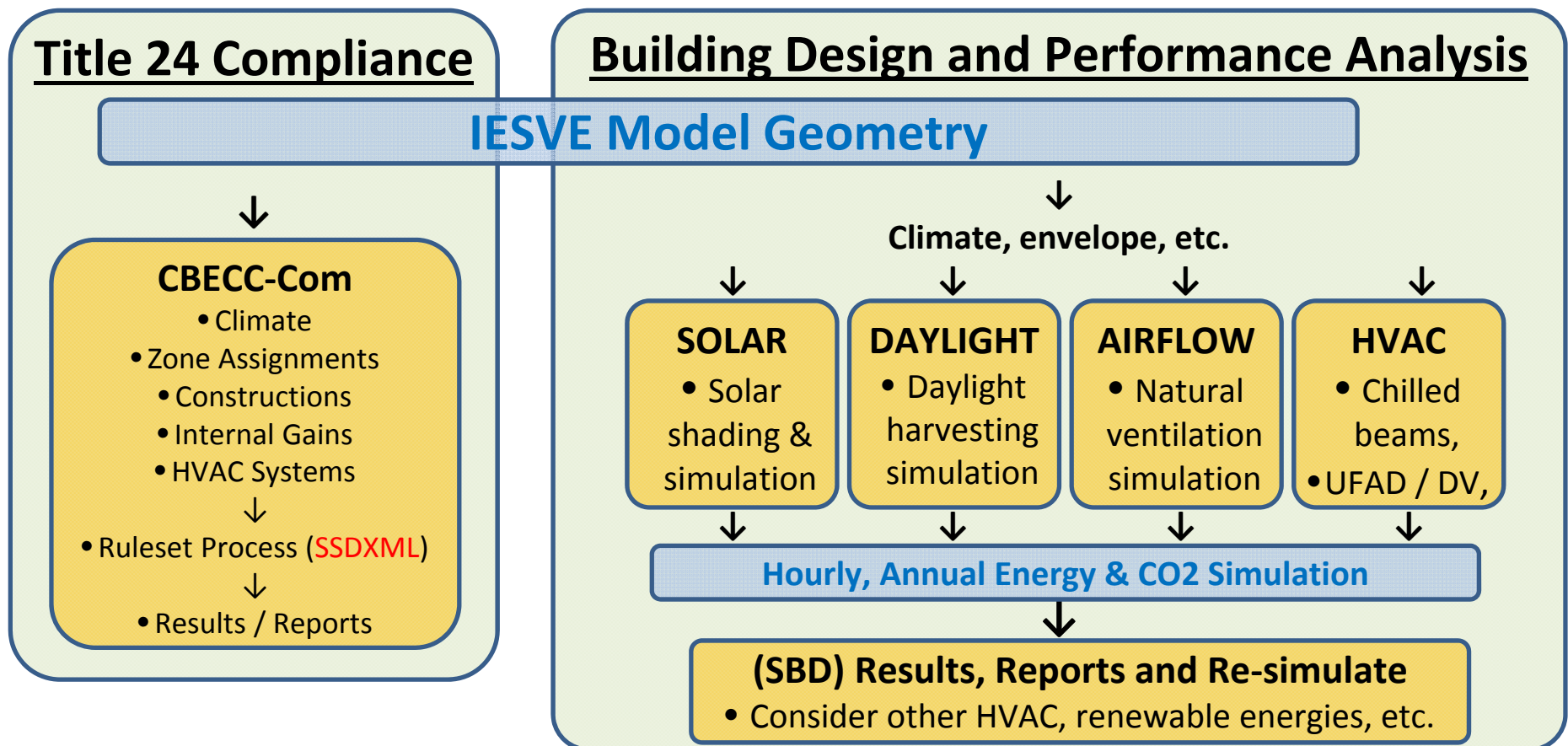
- ### 11. External Shading (PV-T Integrated)
- Summertime solar gains avoided (high-sun)
 - Wintertime passive solar heating (low-sun)



What Are The Goals?

Understanding of the software landscape

✦ Compliance Modeling and Energy Modeling





What Are The Goals?

Understanding of the software landscape

✦ Compliance Modeling \neq Energy Modeling

Proposed Rulesets for Compliance

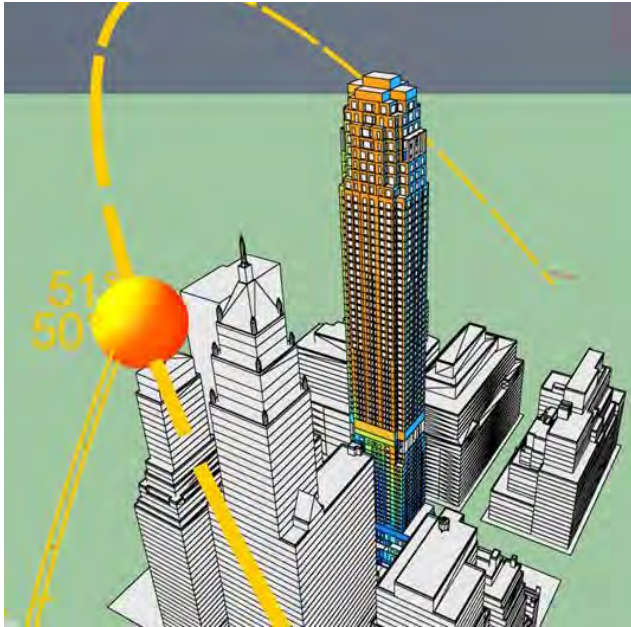
- ✦ Model Geometry (zoning)
- ✦ Weather Data
- ✦ Envelope
- ✦ Internal Gains and Controls
- ✦ Schedules
- ✦ HVAC Sizing

Proposed Limitations for Compliance

- ✦ Model Geometry (Facades, etc)
- ✦ Weather Data (range of dates)
- ✦ Envelope (Electrochromic)
- ✦ Explicit Lighting Controls
- ✦ Schedules (custom operation)
- ✦ HVAC Sizing (ASHRAE Design)



How Does It Work?



What are you building the model from?

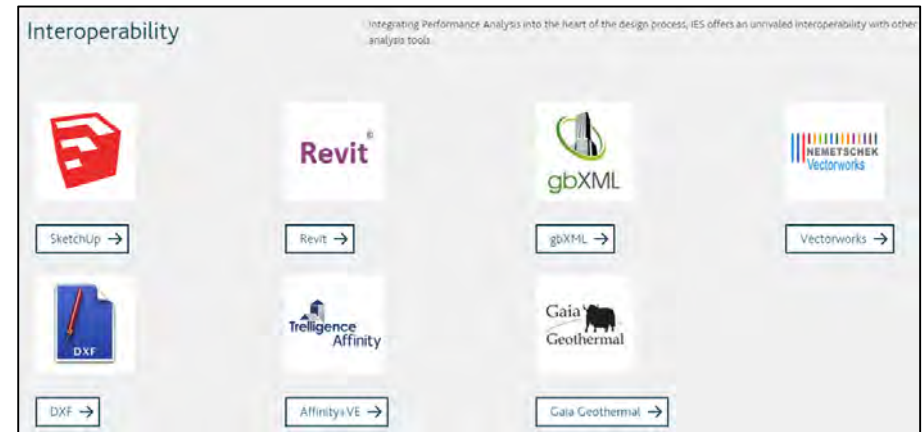
- ✦ The drawing needs to come from somewhere.
 - ✦ What will you be provided?
- ✦ Some drawings may need to be altered to be applicable to the run of choice (see “What are the goals”)
 - ✦ Zoning
 - ✦ Fenestration shading
 - ✦ Lighting
 - ✦ Etc.



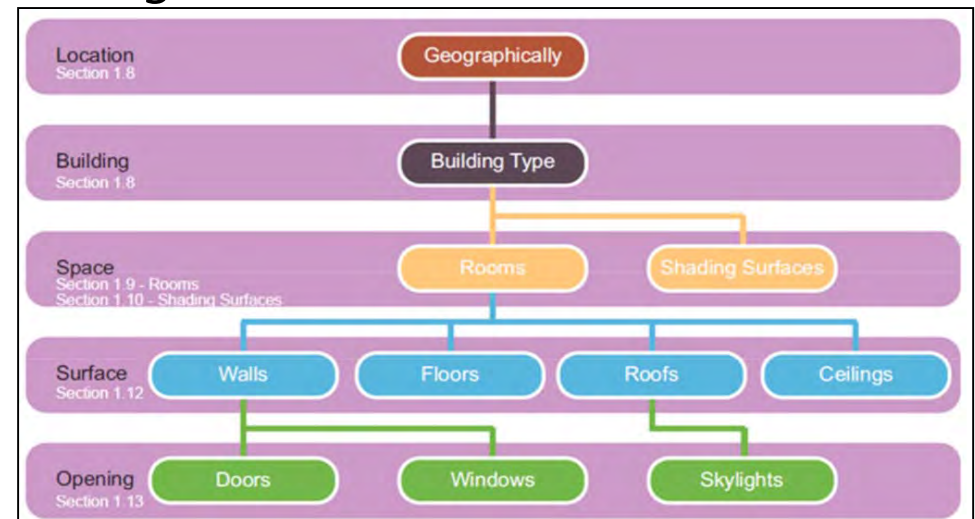
How Does It Work?

3D Model Interoperability

Modeling Software	File Types
★ AutoCAD, DraftSight	★ .dwg .dxf
★ ArchiCAD	★ .pln .pla
★ REVIT	★ .rvt
★ SketchUp	★ .skp
★ Rhino	★ .3dm
★ Vectorworks	★ .ifc
★ Green Building XML	★ .xml
★ IESVE ModelIT	★ .mit, .gem, .osm, .cab

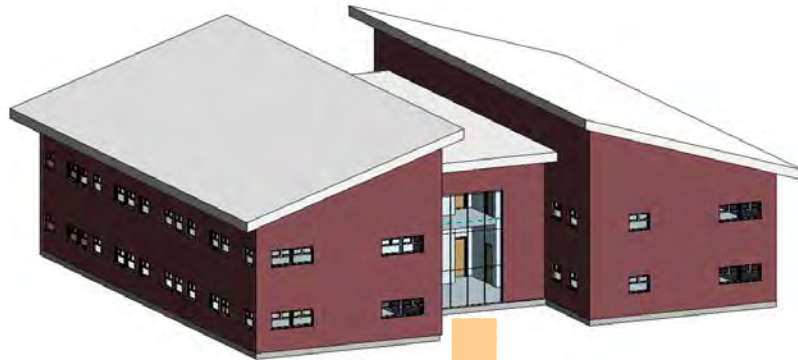
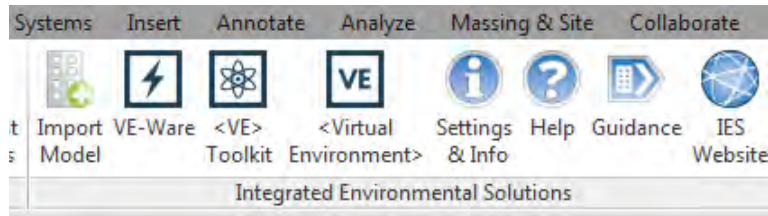


★ gbXML file structure:

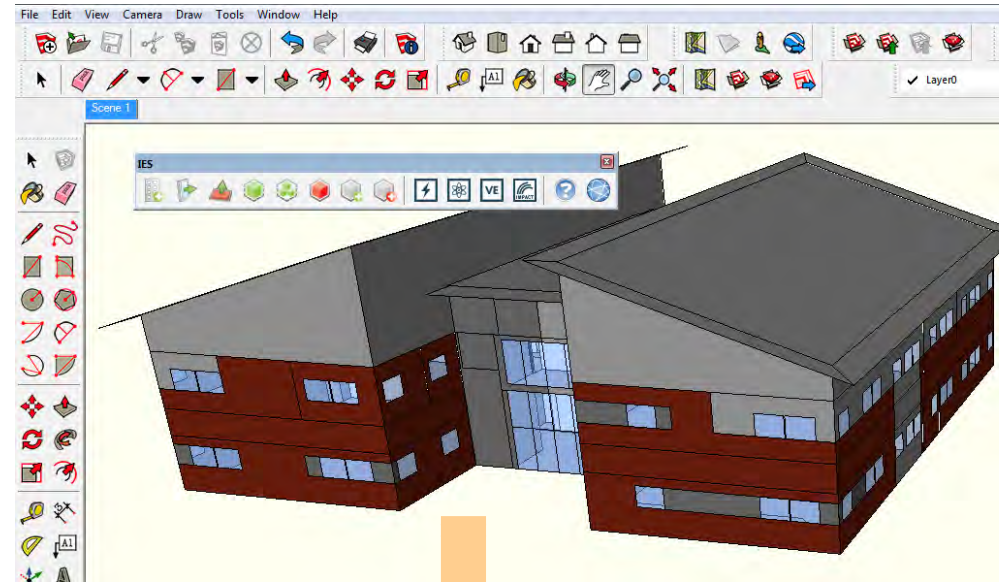




How Does It Work? (3D Plugins)



**Revit To
IESVE**



**SketchUp
Pro To IESVE**



www.youtube.com/IESVE



Why Use a 3D Detailed Model?

- ✦ Achieve a **Better** Title 24 Compliance score (% better than baseline).
- ✦ Other Codes & Standards are migrating this into the mandatory language (LEED v4, ASHRAE 90.1-2010) for daylight dimming controls.
- ✦ Aligns with alternative 3D design services (BIM, LEED, etc.).

Understanding how CBECC-Com treats the geometry:

Detailed geometry:

Generate Report(s): PDF Full (XML)

Compliance Type:

Geometry Input:

Standards Version:

Simple geometry:

Daylit Zone:	Skylit:	Primary Sidelit:	Secondary Sidelit:
Daylit Area:	<input type="text" value="0"/> ft2	<input type="text" value="1,901"/> ft2	<input type="text" value="1,471"/> ft2
Installed Power:	<input type="text" value="0"/> Watts	<input type="text" value="1,425"/> Watts	<input type="text" value="1,105"/> Watts
	<input type="checkbox"/> 100% Controlled?	<input checked="" type="checkbox"/> 100% Controlled?	<input checked="" type="checkbox"/> 100% Controlled?
Controlled Power:	<input type="text" value="0"/> Watts	<input type="text" value="1,425"/> Watts	<input type="text" value="1,105"/> Watts

(daylighting not available w/ simplified geometry)

Wall Surface Geometry:

Area: ft2

Local Azimuth: deg - relative to bldg. azimuth

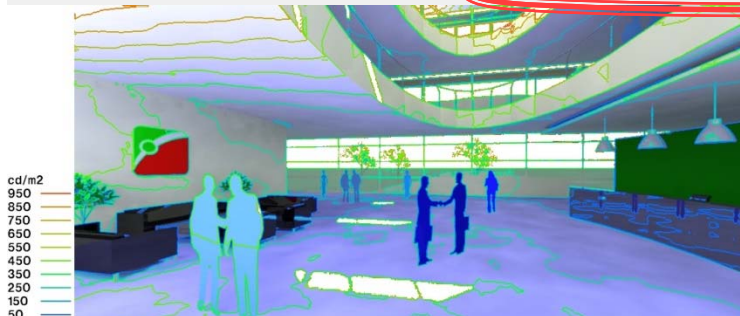
True Azimuth: Deg - relative to true north

Tilt: deg

Width: ft

Height: ft

Display Perimeter: ft



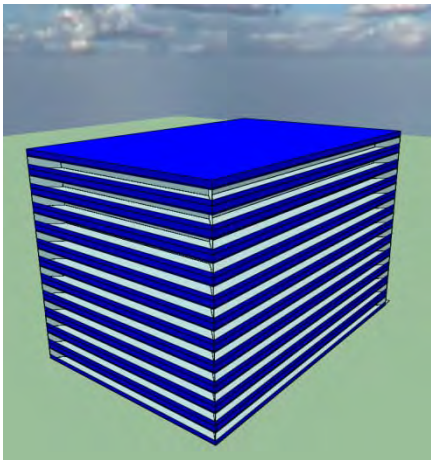


Why Use a 3D Detailed Model?

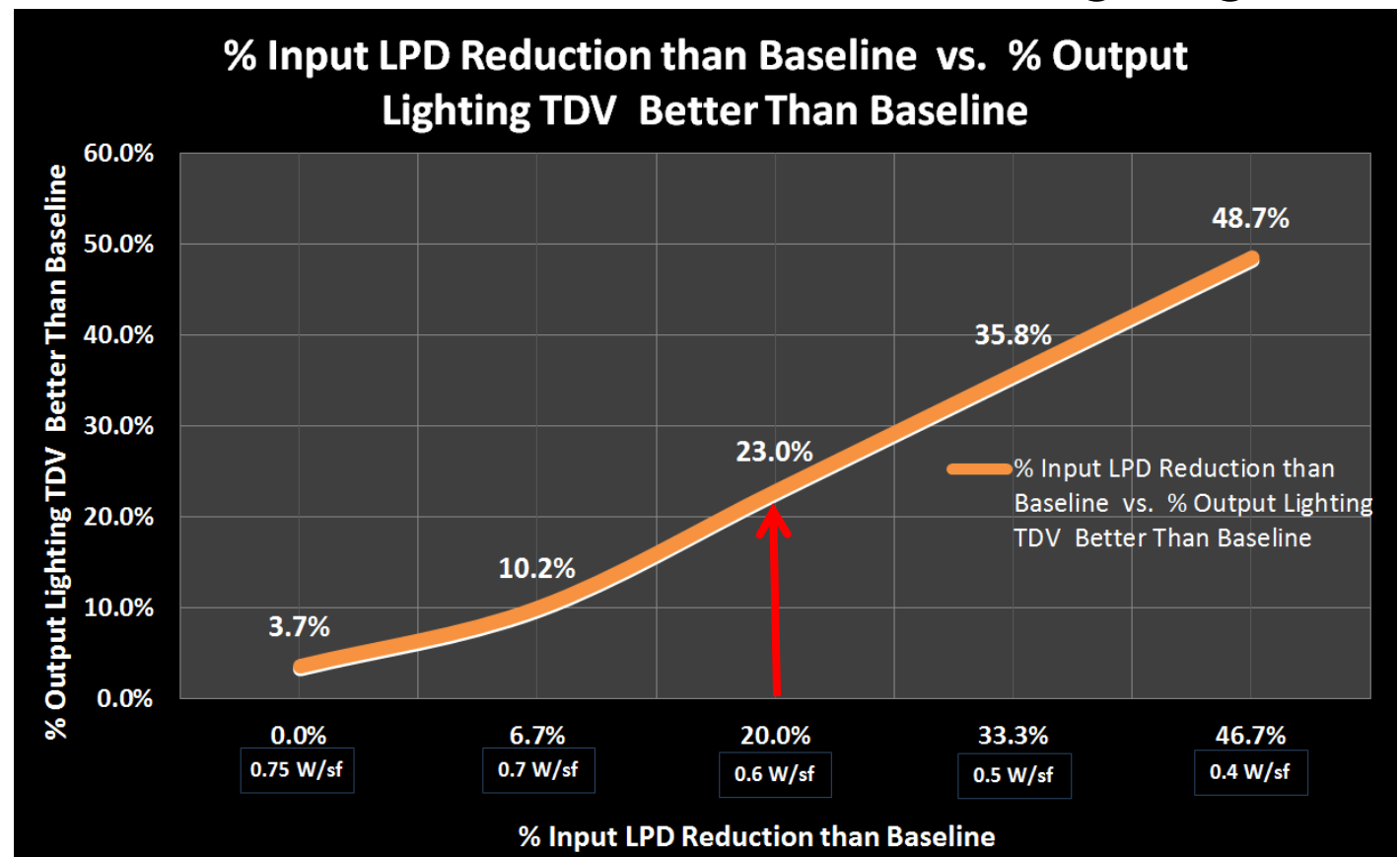
3D Model Advantages with Daylighting

- ★ Eg: 20% Reduction in LPD results in 23% Reduction in Lighting TDV

Large Office Title 24
Standard Building:



Using continuous daylighting
dimming (plus off) controls



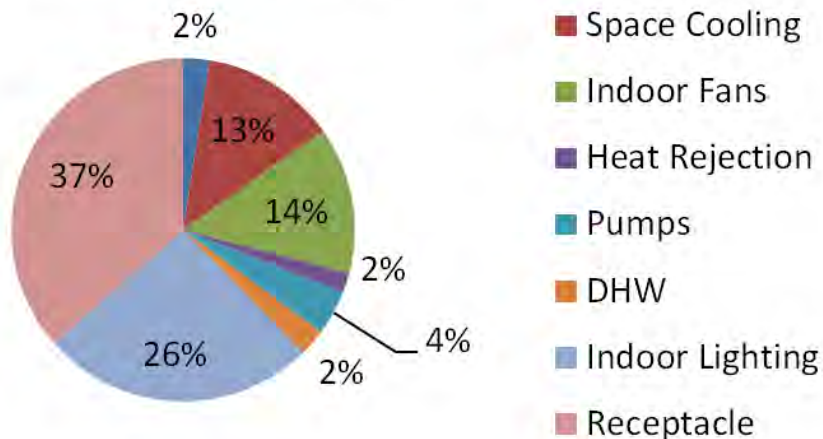


Why Use a 3D Detailed Model?

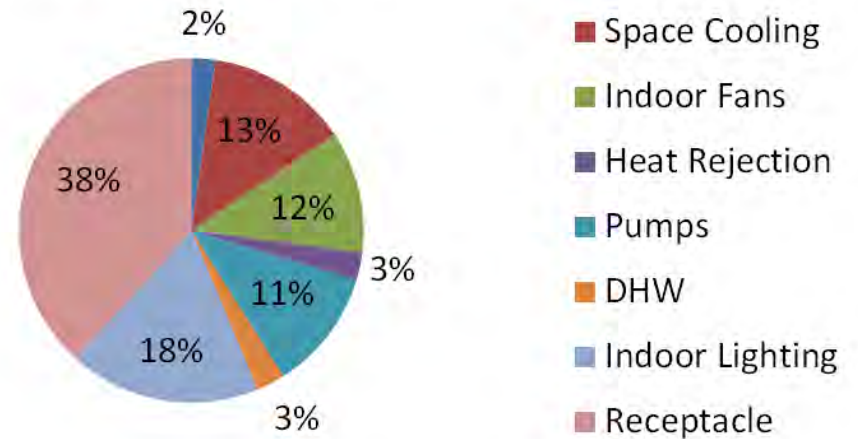
Reduced lighting Energy *Enhances* Other Savings

- ★ Both Proposed & Standard Building are daylit (Affects both TDVs)
 - ✧ Both buildings have a smaller lighting TDV in the pie charts.
- ★ The Lighting TDV changes at a different rates between buildings.
- ★ That means that HVAC, DHW, Envelope savings against the Standard (baseline) building are further enhanced, than without daylighting.

Standard Design (TDV)



Proposed Design (TDV)



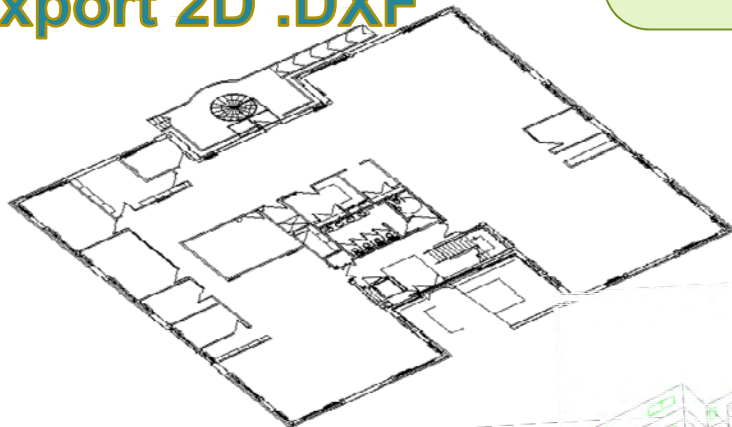


Where is it coming from? 2D

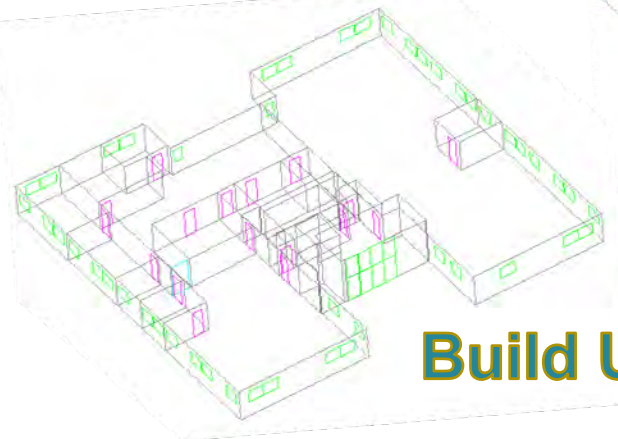
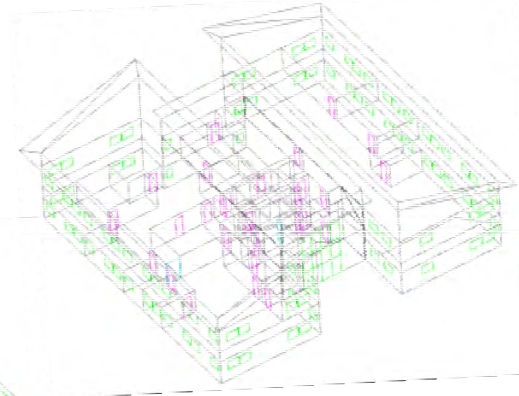
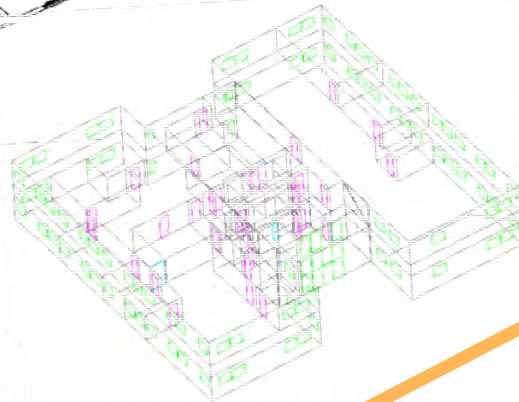
**The 3D Model from
2D Drawings**

Export 2D .DXF

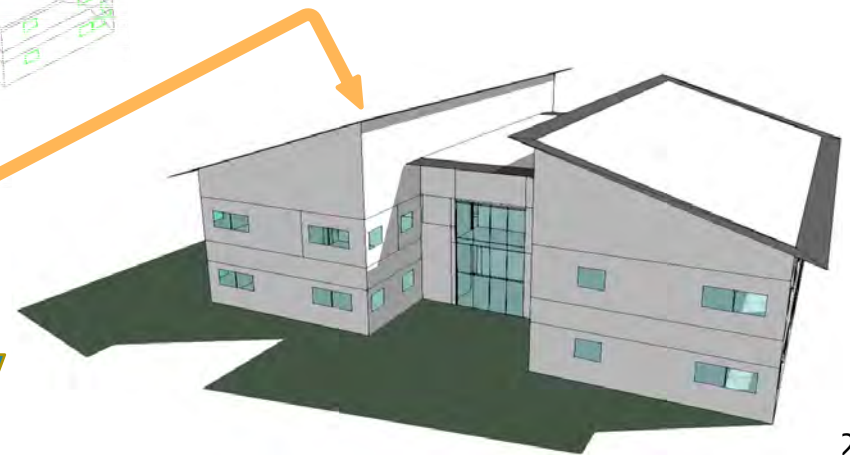
- ✦ Import a 2D drawings (.dxf) to IESVE
- ✦ Trace over the .dxf to create a 3D Model
- ✦ Import a new drawing/floor, and repeat



Import 2D .DXF



Build Up Geometry

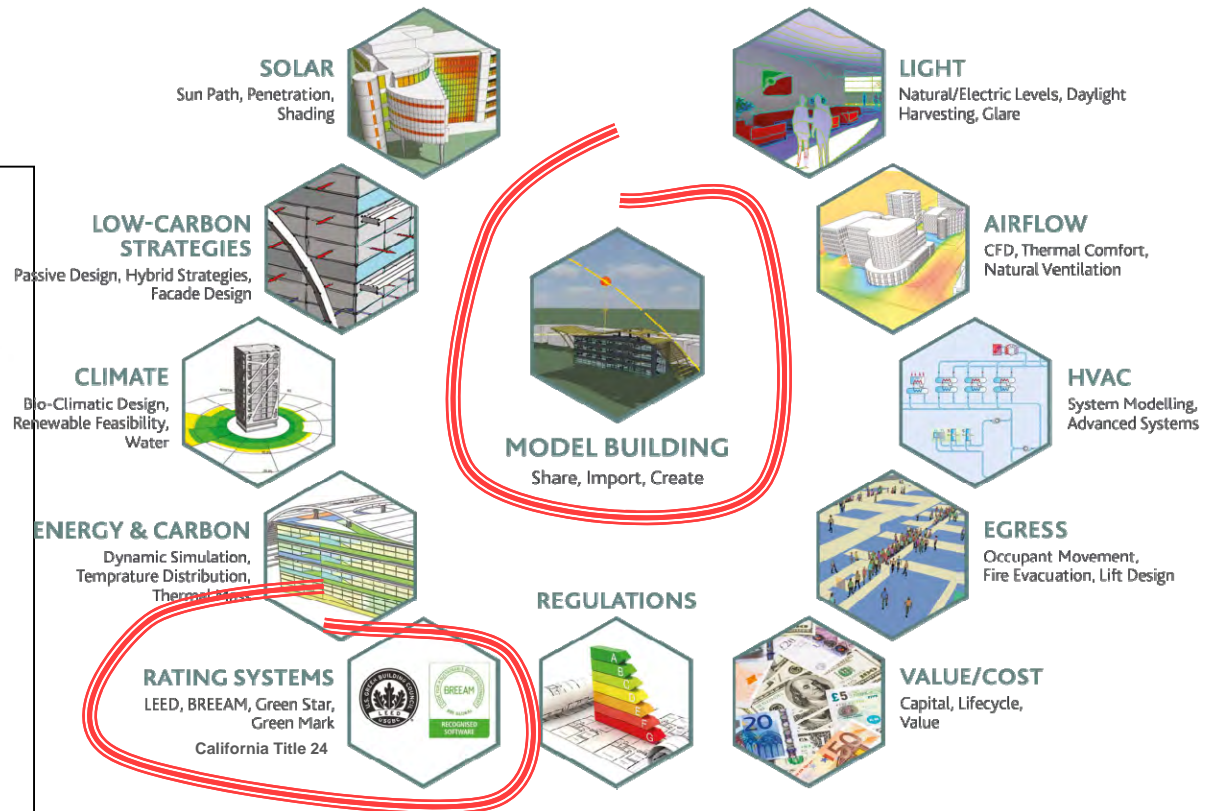
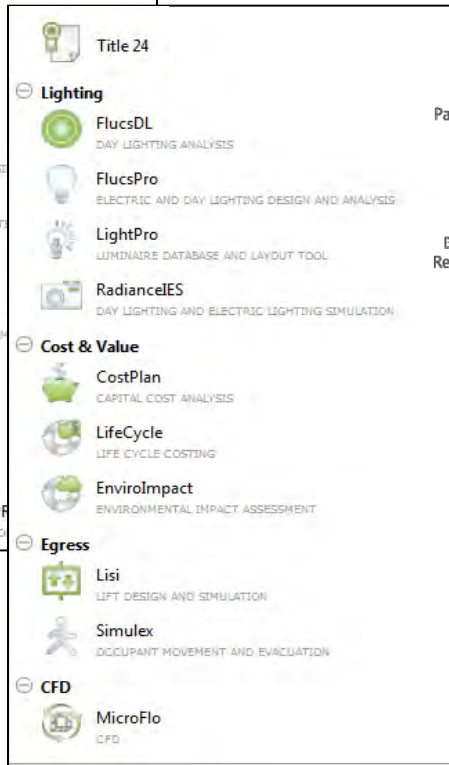
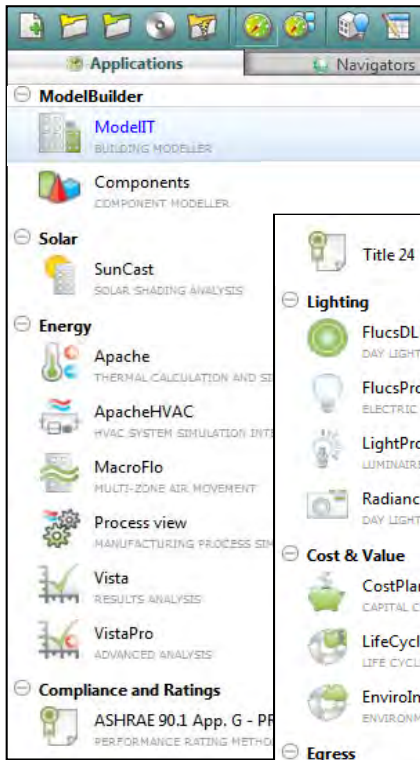




Where is it coming from?

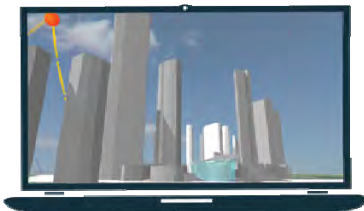
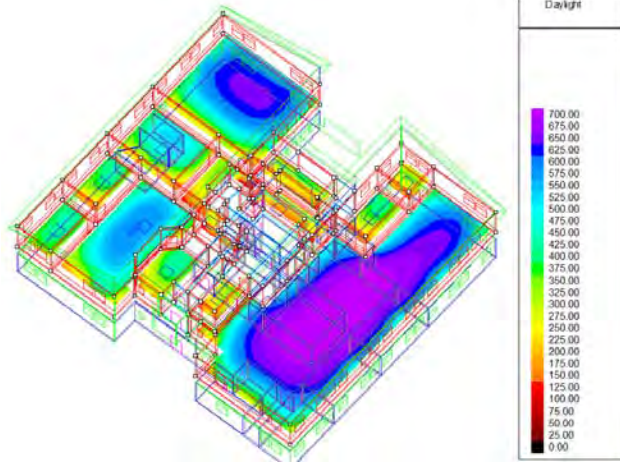
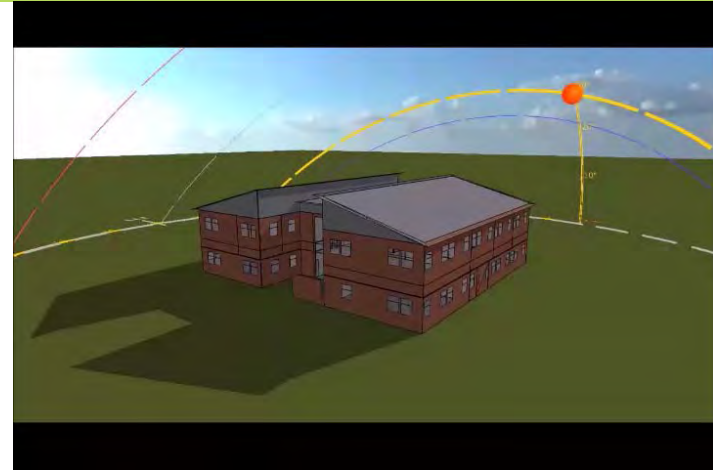
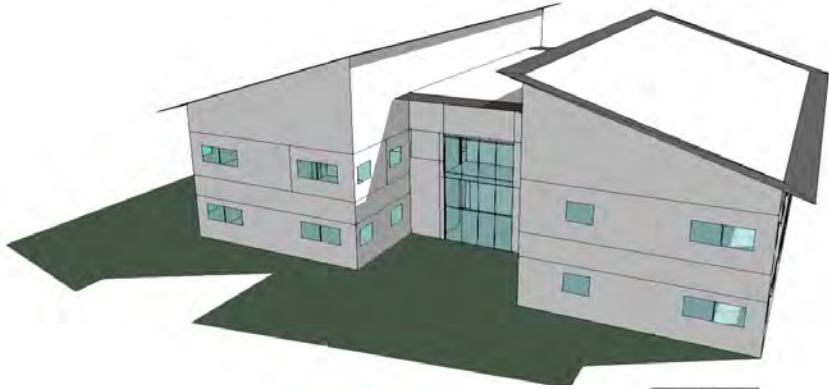
The 3D Model from 2D Drawings

- ◆ Once 3D Model is built (ModelIT)
- ◆ Perform Various Analysis (Eg. Title 24)

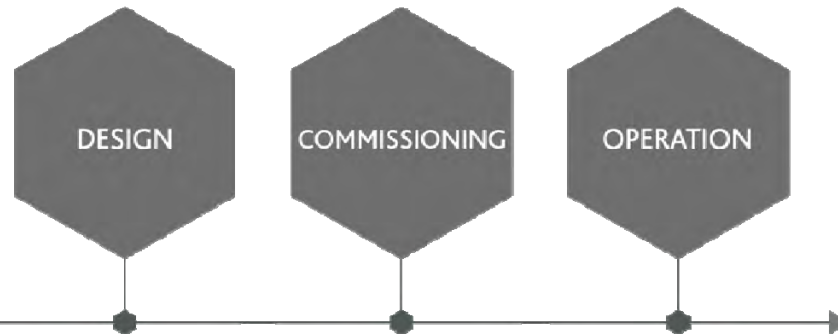




Where is it coming from?



IESVE SOFTWARE
Integrated solutions at all stages
of design and beyond



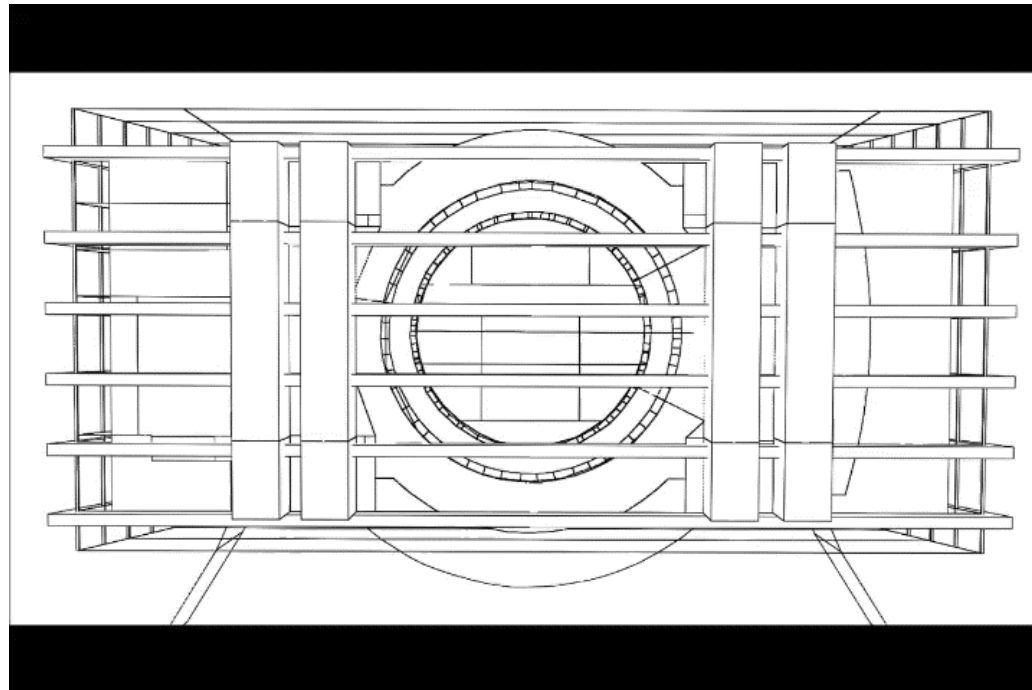


How Can I Do This?



Making the transition from 2D to 3D

- ✦ 3D Modeling is easier than you think!
- ✦ Request a Tutorial
- ✦ IESVE hands-on Training or attend free IES online Masterclasses.
- ✦ Video Demo:





Challenge B

Challenge B

3D Modeling Best Practices



Challenge B: Best Practices for 3D

Liam's Guide to Success

Setting It Up Right

- ✦ Importing
- ✦ Defining the model settings
- ✦ Editing
 - ✧ Copy/ Paste / Replace
- ✦ Check your work!
 - ✧ Use the 3D visual tools
 - ✧ HVAC Loads
- ✦ HVAC parent/child relationships

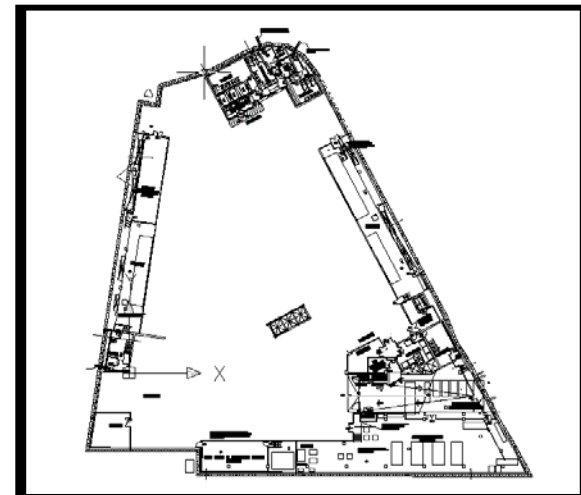
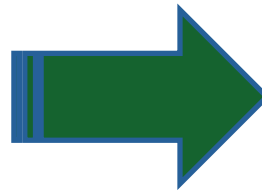
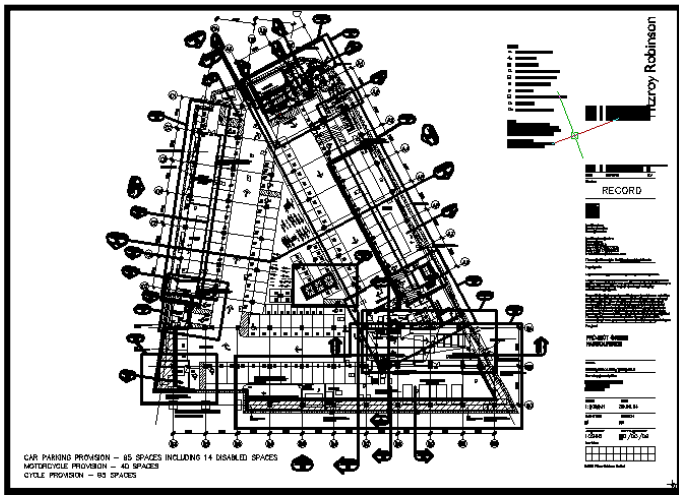
What Is Applicable?

- ✦ Weather files
- ✦ Opaque assemblies
- ✦ Fenestration
 - ✧ Shading
- ✦ Lighting
 - ✧ Area category
 - ✧ Daylighting
- ✦ HVAC baseline



Best Practices – Setting up the model

- ✦ Importing the model from elsewhere
 - ✦ gbXML – know it's limitations (YouTube, DL Training)
- ✦ Revit Imports:
 - ✦ Turn inner volumes off; note the origin coordinates
- ✦ When building the model from scratch & using drawings:

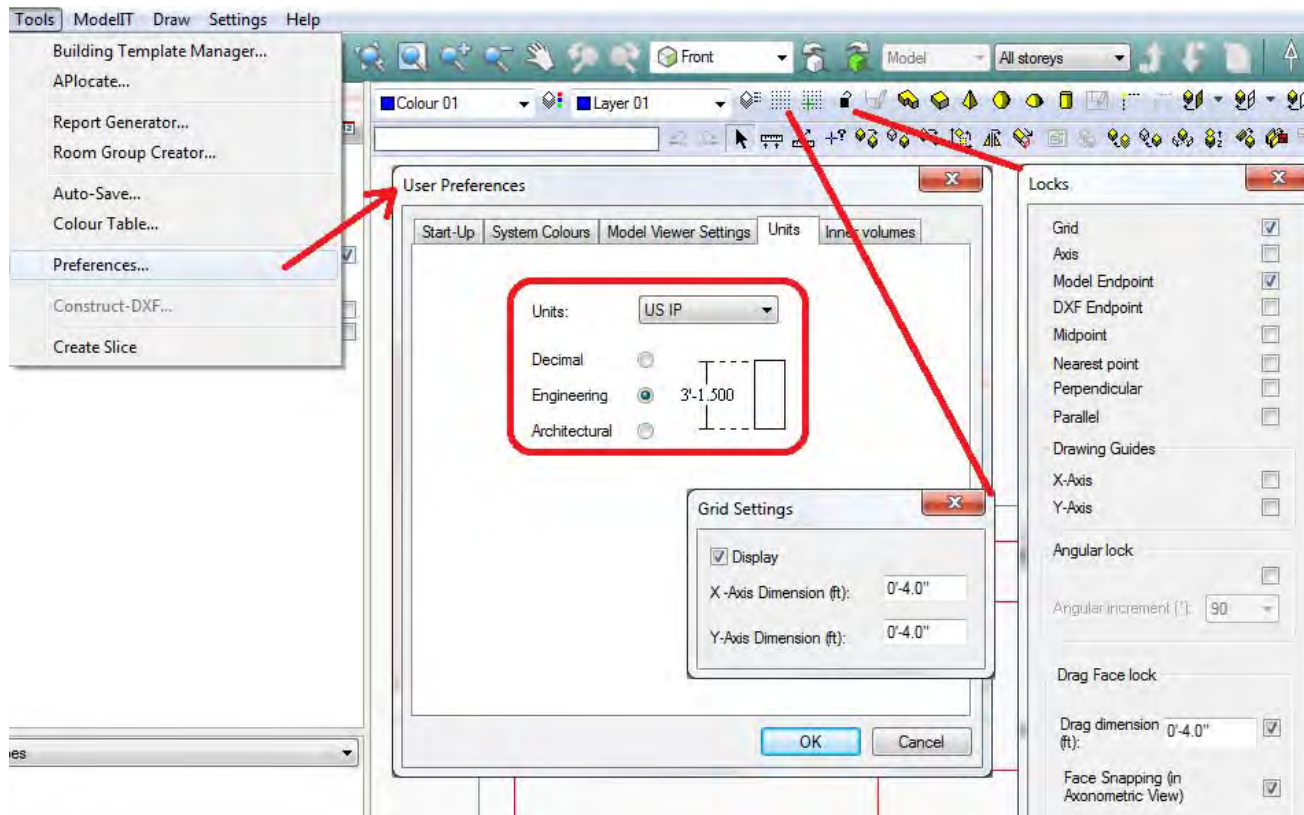
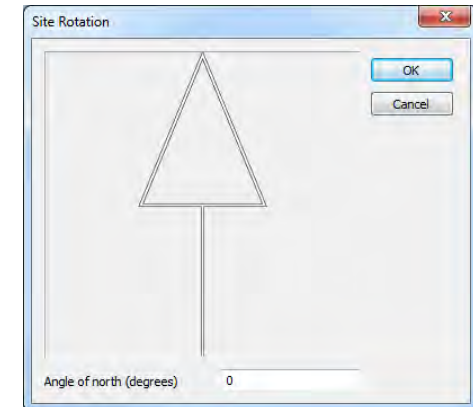


- ✦ Copy floor plan .dwg onto a new drawing & save-as a .dxf format



Best Practices – Setting up the model

- ✦ Measure Distance across the door
- ✦ Building Orientation vs Model Rotation:
- ✦ Model Building Settings:



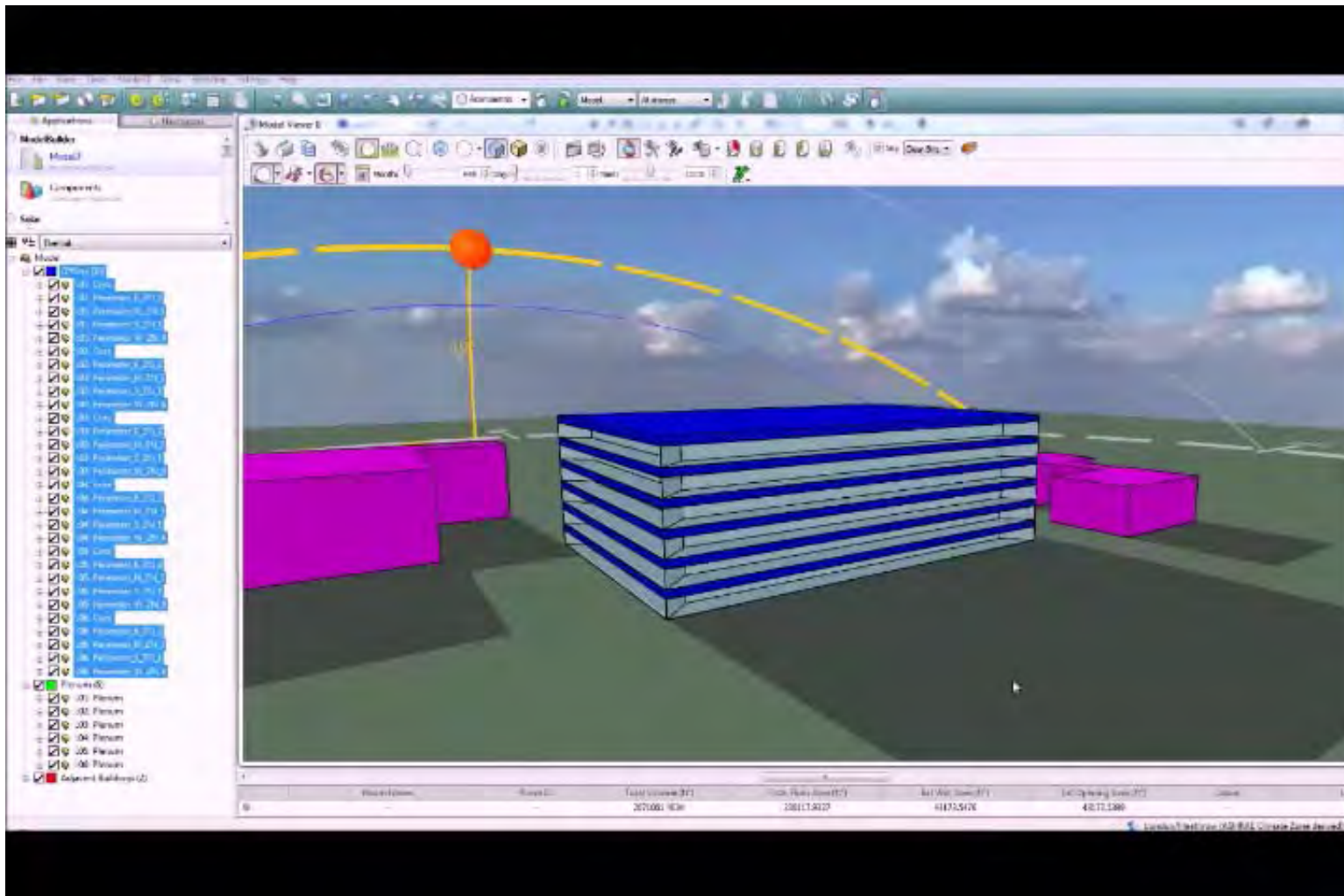


Best Practices – Setting up the model



✦ Quick Glazing Area Study – video demo

✦ Assign %WWR x (Area Total Ext. Wall / Area Selected Ext. Wall).





Best Practices – Climate Files

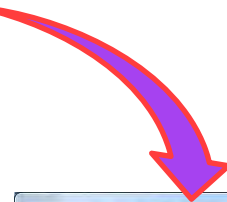
- ✦ Cannot use the Design Weather Files and must use the prescribed weather files
- ✦ Where to locate them if doing Compliance *and* Savings By Design



Documents library
EPW

Name	Date modified	Type	Size
ALTURAS_725958_CZ2010.epw	21/11/2013 17:47	EPW File	1,571 KB
ARCATA_725945_CZ2010.epw	21/11/2013 17:47	EPW File	1,579 KB
BAKERSFIELD_723840_CZ2010.epw	21/11/2013 17:47	EPW File	1,578 KB
BISHOP_724800_CZ2010.epw	21/11/2013 17:47	EPW File	1,573 KB
BLUE-CANYON_725845_CZ2010.epw	21/11/2013 17:47	EPW File	1,571 KB
BLYTHE-RIVERSIDE-CO_747188_CZ2010.epw	21/11/2013 17:47	EPW File	1,582 KB
BURBANK-GLENDALE_722880_CZ2010.epw	21/11/2013 17:47	EPW File	1,579 KB
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CRESCENT-CITY_725946_CZ2010.epw	21/11/2013 17:47	EPW File	1,579 KB
DAGGETT-BARSTOW_723815_CZ2010.epw	21/11/2013 17:47	EPW File	1,576 KB
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EL-CENTRO_722810_CZ2010.epw	21/11/2013 17:47	EPW File	1,587 KB
EUREKA_725940_CZ2010.epw	21/11/2013 17:47	EPW File	1,583 KB
FAIRFIELD-TRAVIS-AFB_745160_CZ2010.epw	21/11/2013 17:47	EPW File	1,586 KB
FRESNO_723890_CZ2010.epw	21/11/2013 17:47	EPW File	1,581 KB
FULLERTON_722976_CZ2010.epw	21/11/2013 17:47	EPW File	1,586 KB
HAWTHORNE-NORTHROP-FLD_722956_CZ2010.epw	21/11/2013 17:47	EPW File	1,588 KB
HAYWARD_724935_CZ2010.epw	21/11/2013 17:47	EPW File	1,585 KB
IMPERIAL_747185_CZ2010.epw	21/11/2013 17:47	EPW File	1,589 KB
IMPERIAL-BEACH_722909_CZ2010.epw	21/11/2013 17:47	EPW File	1,583 KB
INYOKERN_723826_CZ2010.epw	21/11/2013 17:47	EPW File	1,578 KB
LANCASTER_723816_CZ2010.epw	21/11/2013 17:47	EPW File	1,576 KB
LEMOORE_747020_CZ2010.epw	21/11/2013 17:47	EPW File	1,583 KB
LIVERMORE_724927_CZ2010.epw	21/11/2013 17:47	EPW File	1,580 KB
LOMPOC_722895_CZ2010.epw	21/11/2013 17:47	EPW File	1,576 KB

86 items selected
Show more details...



Computer > Local Disk (C:) > Program Files (x86) > IES > Shared Content > Weather

Name	Date modified	Type	Size
BirminghamDSV05Sum.xls	07/03/2006 10:00	Microsoft Excel 97...	
BirminghamEWV.fwt	18/11/2013 16:24	FWT File	
BirminghamTRY05.fwt	07/03/2006 04:00	FWT File	
BirminghamTRY05Sum.xls	31/07/2006 07:34	Microsoft Excel 97...	
Boise_TMY2.fwt	18/11/2011 16:24	FWT File	
Boston 2014 TMY7.epw	17/04/2014 19:56	EPW File	

Location & Site Data | Design Weather Data | Simulation Weather Data | Simulation Calendar

ApacheSim

Simulation Weather File:



Best Practices – Climate Files

Aligning Title 24 Compliance with Savings By Design

- ★ 1991 Weather File
- ★ Select weekday for DEER Peak Demands

Climate Zone	CZ2010 (2013 Title-24) Weather Files				
	Start Date	Weekday	Peak T	Ave T	
CZ01	Sep 16	Wed	81	59.8	
CZ02	Jul 8	Wed	103	75.9	
CZ03	Jul 8	Wed	91	69.2	
CZ04	Sep 1	Tue	99	77.5	
CZ05	Sep 8	Tue	87	64.8	
CZ06	Sep 1	Tue	102	77.1	
CZ07	Sep 1	Tue	90	73.9	
CZ08	Sep 1	Tue	105	79.8	
CZ09	Sep 1	Tue	107	86.6	
CZ10	Sep 1	Tue	109	86.3	
CZ11	Jul 8	Wed	113	88.3	
CZ12	Jul 8	Wed	109	82.4	
CZ13	Jul 8	Wed	108	86.7	
CZ14	Aug 26	Wed	105	86.8	
CZ15	Aug 25	Tue	112	97.5	
CZ16	Jul 8	Wed	90	78.8	

www.energy.ca.gov/deer

Weekday Pattern

Year 1991 Take from weather file
 Weekday for Jan 1st Thursday Maintain weekday continuity across year end (with no holidays)?

Holiday Template: United States of America

Holiday Name	Specification Mode	Definition
New Year's Day	Day/Month (or nearest weekday)	1 January
Martin Luther King, Jr. Day	Weekday/Month	Third Monday in January
Washington's Birthday	Weekday/Month	Third Monday in February
Memorial Day	Weekday/Month	Last Monday in May
Independence Day	Day/Month (or nearest weekday)	4 July
Labor Day	Weekday/Month	First Monday in September

Highlight week: 1



Best Practices – Envelope Modeling

Opaque Constructions:

- Must use Title 24 materials

Surfaces Functional Settings Regulations

Air - Metal Frame Status: **New**

Construction Layers (Outside To Inside) **New**
Existing
Altered

Project Materials...

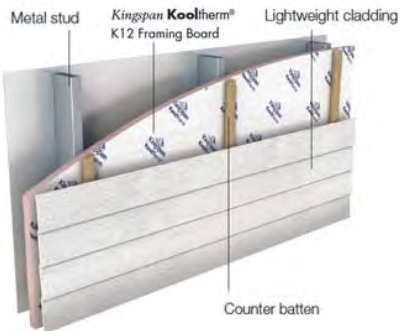
Material	Thickness in	Conductivity Btu·in/h·ft ² ·°F	Density lb/ft ³	Specific Heat Capacity Btu/lb·°F	Resistance ft ² ·h·°F/Btu	Vapour Resistivity (perm·in) ⁻¹	Category
[T24_0060] Concrete - 140 lb/ft ³ - 8 in.	8.00"	13.559	139.780	0.2200	0.590	-	Concrete
[T24_0143] Compliance Insulation R2.19	0.35"	0.160	1.000	0.2700	2.190	-	Insulation Board
Cavity	5.50"	-	-	-	0.650	-	-
[T24_0023] Gypsum Board - 1/2 in.	0.50"	1.111	40.000	0.2700	0.450	-	Bldg Board and Siding

- Bldg Board and Siding
- Bldg Board and Siding
- Building Membrane
- Composite
- Concrete
- Concrete Sandwich Panel
- Finish Materials
- ICF Wall
- Insulation Batt
- Insulation Board
- Insulation Loose Fill
- Insulation Other
- Insulation Spray Applied
- Masonry Materials
- Masonry Units Hollow
- Masonry Units Solid
- Masonry Units with Fill
- Metal Insulated Panel Wall
- Plastering Materials
- Roofing
- SIPS Floor
- SIPS Roof
- SIPS Wall
- Spandrel Panels Curtain Walls
- Straw Bale Wall
- Woods

For Title 24

For HVAC Load Calculations, energy modeling, SBD, etc

Composite Constructions:



Title24 Composite

Frame material: Wood R-value: 8.76 degF-ft²-h/Btu

Frame configuration: Wall 16in OC

Frame depth: 3In Framing factors: Cavity: 0.75

Cavity insulation R-value: 25.00 degF-ft²-h/Btu Frame: 0.25



Best Practices – Glazing Modeling

Window Prescriptive Requirements:

Windows (40% Max Area)			
Type	Max U-Factor	Max RSHGC	Min VT
Fixed	0.36	0.25	0.42
Operable	0.46	0.22	0.32
Curtainwall	0.41	0.26	0.46
Doors	0.45	0.23	0.17

- RSHGC: Relative Solar Heat Gain Coefficient, which takes into account overhang benefits.
- All values shown for (glass + frame)

The screenshot shows a software interface for glazing modeling. The main window displays a construction layer table with the following data:

Material	Thickness in	Conductivity Btu/in/h·ft²·°F	Angular Dependence	Gas	Convection Coefficient Btu/h·ft²·°F	Resistance ft²·h·°F/Btu	Transmittance	Outside Reflectance	Inside Reflectance	Refractive Index	Outside Emissivity	Inside Emissivity
[PK611] PILKINGTON K 6MM	0.24"	7.349	Fresnel	-	-	0.032	0.232	0.067	0.090	1.526	-	-
Cavity	0.51"	-	-	-	-	1.868	-	-	-	-	-	-
[CF61] CLEAR FLOAT 6MM	0.24"	7.349	Fresnel	-	-	0.032	0.700	0.070	0.070	1.526	-	-

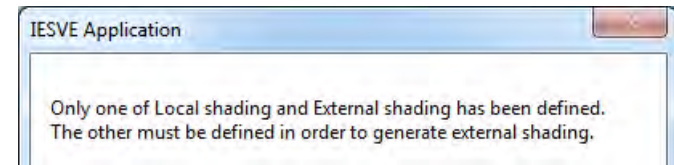
A dialog box titled "Project Construction (Glazed: External Window)" is open, showing performance metrics and shading coefficients. The "Visible light normal transmittance" is set to 0.42. The "Short-wave shading coefficient" is 0.1879, the "Long-wave shading coefficient" is 0.0995, and the "Total shading coefficient" is 0.2673. The "SHGC (center-pane)" is 0.2500.



Best Practices – Shading

Window Shading:

- Two inputs required (local AND External)



Description: Solarban 60 PPG U=0.29 SHGC=0.38 VLT=0.70 ID: SLRB0000

Performance: ASHRAE

Net U-value (including frame): 0.2900 Btu/h·ft²·°F U-value (glass only): 0.2900 Btu/h·ft²·°F
Net R-value: 3.4486 ft²·h·°F/Btu g-value (EN 410): 0.3864 Visible light normal transmittance: 0.7

Surfaces | Frame | Shading Device | Regulations | UK Dwellings

Local Shade: [?] None External Shade: [?] None Internal Shade: [?] None

Construction Layers (Outside to Inside):

Material	Thickness in	Conductivity Btu·in/h·ft²·°F	Angular Dependence	Gas	Convection Coefficient Btu/h·ft²·°F	Resistance ft²·h·°F/Btu	Transmittance	Outside Reflectance	Inside Reflectance	Refractive Index	Outside Emissivity	Inside Emissivity	Visible Light Specified
[STD_EXW2] Outer Pane	0.25"	7.349	Fresnel	-	-	0.034	0.391	0.287	0.414	1.526	0.837	0.042	Yes
Cavity	0.51"	-	-	-	-	2.500	-	-	-	-	-	-	-
[STD_INW2] Inner Pane	0.25"	7.349	Fresnel	-	-	0.034	0.783	0.072	0.072	1.526	0.837	0.837	Yes

Local Shading Device

Device: None Projections Recess

Window width: 3'-3.370" ft Window height: 3'-3.370" ft
Balcony projection: 0'-0.000" ft Balcony height: 0'-0.000" ft
Overhang projection: 0'-0.000" ft Overhang offset: 0'-0.000" ft
Left fin projection: 0'-0.000" ft Left fin offset: 0'-0.000" ft
Right fin projection: 0'-0.000" ft Right fin offset: 0'-0.000" ft

External Shading Device

Type of external shading device: None Shutter Louvre

Transmittance schedule: None

Title 24 Transmittance: 0 (This is the Sky Diffuse Transmission factor for Apache)

Title 24 Solar reflectance: 0.1

Title 24 Visible reflectance: 0.1



Best Practices – Shading Controls

Window Shading Controls:

External Shading Device

Type of external shading device: None Shutter Louvre

Transmittance schedule: None

Title 24 Transmittance: 0 (This is the Sky Diffuse Transmission factor for Apache)

Title 24 Solar reflectance: 0.1

Title 24 Visible reflectance: 0.1

Window Shading Controls
(e.g. operable blinds) for both
Title 24 & SBD:

Control conditions

Controller is on if: Global horizontal solar flux (Btu/(ft2))

is less than 5

is greater than Room air temperature (°F) 0

is greater than Room air temperature (°F) 0

is greater than Room air temperature (°F) 0

is greater than Room air temperature (°F) 0

Formula profile: (igh<5)

Construct formula from

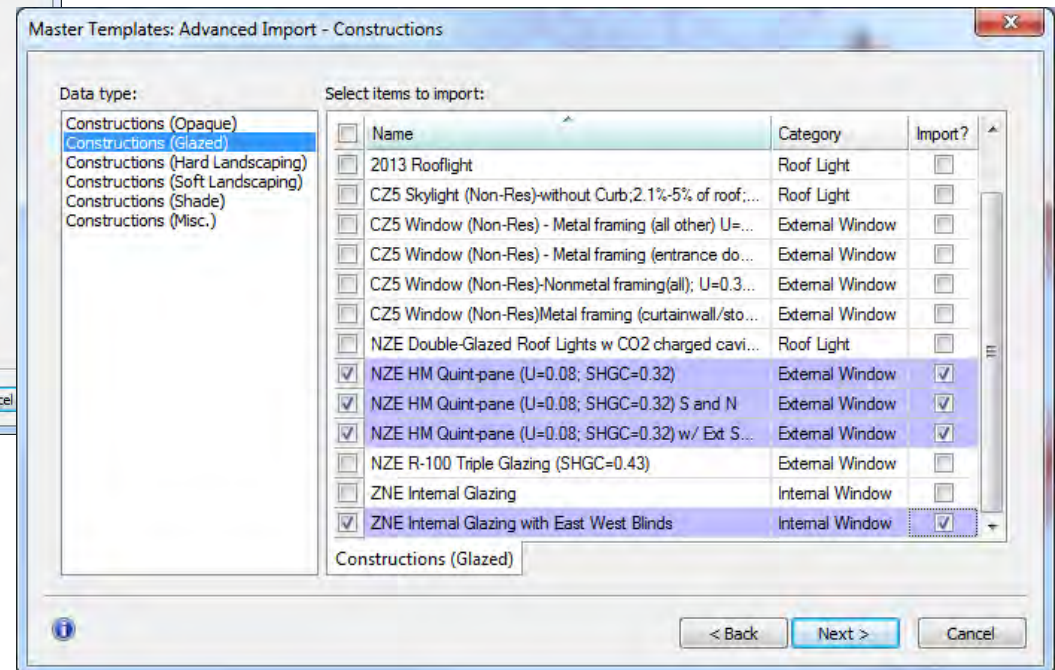
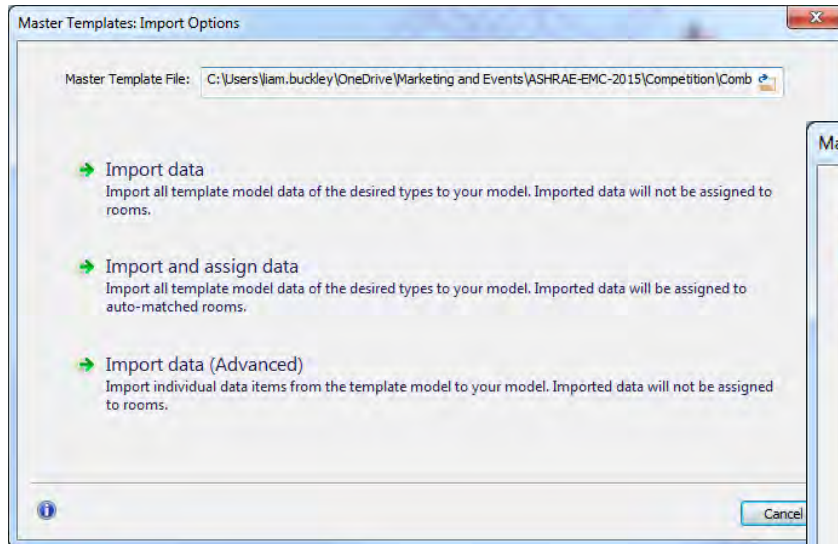
Reset Save formula Recreate formula



Best Practices – Envelope Modeling

Reusing constructions again from past projects, for future projects:

- IESVE Tools Menu > **Master Templates**
- Export the template file on an older project
- Import the construction on the new project





Best Practices – Thermal Templates

Thermal Templates for Better Model Management

- ✦ Thermal Templates should be coupled with Room Group Scheme

The screenshot displays the 'General' tab of a software interface for configuring thermal templates. The 'Space Function' dropdown is highlighted with a red box and labeled 'Office (Greater than 250 square feet in floor area)'. A red line connects this label to a dropdown menu on the right that lists various room types, with the same office template selected. The 'Schedule Group' is set to 'Office'. The interface includes various input fields for ventilation, occupancy, hot water use, electric use, and natural gas use, along with dropdown menus for weekly schedules.

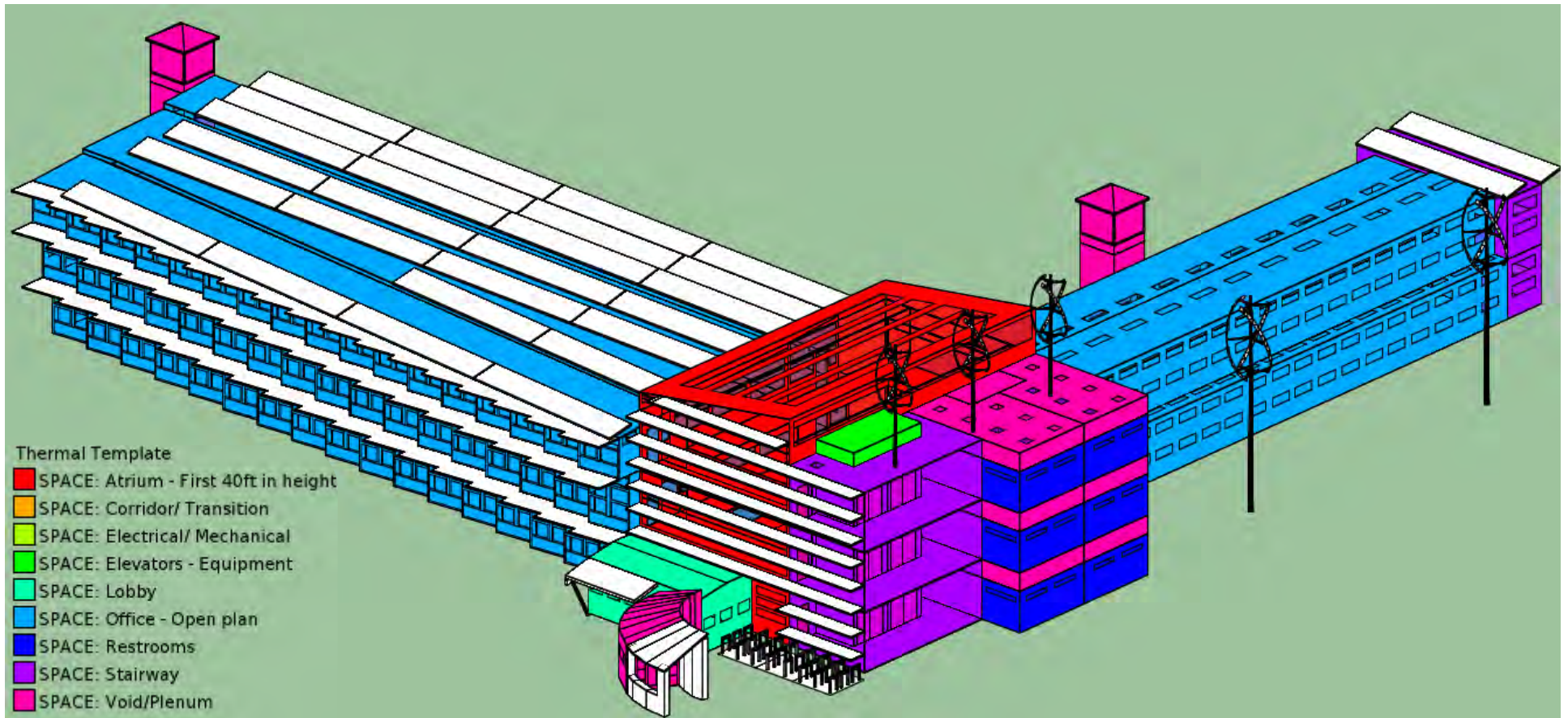
Parameter	Value	Unit	Dropdown
Space Function	Office (Greater than 250 square feet in floor area)		Office
Schedule Group	Office		Office
Ventilation	0.15	cfm/ft2	
Occupancy	10.00	people/1,000 ft2	OfficeOccupancyWk
Hot Water Use	0.18	gal/h-person	OfficeServiceHotWat
Electric Use			
IntLPDReg	0.50	W/ft2	OfficeLightsWk
IntLPDNonReg	0.00	W/ft2	- none -
RecptPwrDens	0.90	W/ft2	OfficeReceptadeWk
ProcElecPwrDens	0.00	W/ft2	OfficeReceptadeWk
RefrigPwrDens	0.00	W/ft2	OfficeReceptadeWk
Natural Gas Use			
GasEqpPwrDens	0.00	Btu/h-ft2	- none -
ProcGasPwrDens	0.00	Btu/h-ft2	OfficeReceptadeWk
Sensible Rate	250.00	Btu/h-person	
Frac to Space	0.61		
Frac to Space	0.00		
RadFrac	0.00		
LatFrac			
RadFrac	0.00		
LatFrac			



Best Practices – Thermal Templates

Thermal Templates Assignment

- ✦ Easy to determine if everything is assigned correctly.





Best Practices – Thermal Templates

Editing Rooms Data Inputs (Two Methods)

✦ Room by Room

Space Data

Space Name: Perimeter_01_ZN_1 HVAC Zone Reference: Zn Perimeter_01_ZN_1

Conditioning Type: DirectlyConditioned Supply Plenum Space: 01_Plenum_01PL0000

IntLtg Spec Method: AreaCategoryMethod Return Plenum Space: 01_Plenum_01PL0000

General | Ventilation And Exhaust | Interior Lighting | Daylighting | Process Loads | Mandatory Ltg Ctrl

Template: Office Mod Defaults

Space Function: Office (Greater than 250 square feet in floor area) Schedule Group: Office

Occupancy: 10.00 people/1,000 ft2 OfficeOccupancyWk * Sensible Rate: 250.00 Btu/h-person

Hot Water Use: 0.18 gal/h-person OfficeServiceHotWat * Latent Rate: 206.00 Btu/h-person

SHW Fluid Segment: SHWSupply DHW Recirc. System: - none -

Electric Use

Regulated Lighting:	0.75 W/ft2	OfficeLightsWk *	Fraction to Space:	0.61	Radiant fraction:	0.70
Non-reg. Lighting:	0.00 W/ft2	- none - *	Fraction to Space:	0.00	Radiant fraction:	0.00
Plug Loads:	1.50 W/ft2	OfficeReceptadeWk *				

Space Status

Envelope: New Overall: New

Lighting: New



Best Practices – Thermal Templates

Editing Rooms Data Inputs (Two Methods)

✦ Room by Room

The image displays several overlapping software windows for editing room data inputs. The windows are organized into tabs: General, Ventilation And Exhaust, Interior Lighting, Daylighting, Process Loads, and Mandatory Ltg Ctrls.

Space Data Window:

- Template: Office Mod Defaults
- Space Function: Office (Greater than 250 square feet in floor area)
- Occupancy: 10.00 people/1,000 ft²
- Hot Water Use: 0.18 gal/h-person
- SHW Fluid Segment: SHWSupply
- Electric Use: 0.75 W/ft²
- Regulated Lighting: 0.00 W/ft²
- Non-reg. Lighting: 0.00 W/ft²
- Plug Loads: 1.50 W/ft²

InteriorLightingSystem Window:

- Schedule: -none-
- Power: 0.00 W
- Daylit area type: -none-
- Heat gain space fraction: 0.000
- Heat gain radiant fraction: 0.000
- Status: New
- NonRegExclusion: -specify-
- LumMntgHgt: 0.000 ft
- LumRef1: -none-

Ventilation (Outdoor Air) Window:

- Specification Method: Maximum (from HVAC Zone)
- Control Method: Fixed (from HVAC Zone)
- Design Inputs: Minimum Req. 7.5, Vent. Fraction 0.50
- Per Occupant (cfm/per): 7.5
- Per Area (cfm/ft²): 0.15
- Per Volume (ACH): 0.000
- Per Space (cfm): 0.00
- Ventilation Total (cfm): 506.04
- Ventilation Min. (cfm): 506.04

Mandatory Lighting Controls Window:

Identify up to five mandatory lighting controls covered under Sections 130.1(a-e). Select 'NA' for mandatory control categories which do not apply to the specified control. Select 'Required' for mandatory control categories applicable to the specified control. Select 'Exempt' for applicable mandatory control categories which qualify for an exemption.

Lighting Control Description	Control Quantity	Sec. 130.1(a) Manual Area Control?	Sec. 130.1(b) Multi-Level Control?	Sec. 130.1(c) Auto Shut-Off Control?	Sec. 130.1(d) Daylighting Control?	Sec. 130.1(e) Demand Response Control?
Control 1:	0	NA	NA	NA	NA	NA
Control 2:	0	NA	NA	NA	NA	NA
Control 3:	0	NA	NA	NA	NA	NA
Control 4:	0	NA	NA	NA	NA	NA



Best Practices – Thermal Templates

Editing Rooms Data Inputs (Two Methods)

✦ Or with Tabular Editing (Spreadsheet functionality)

The screenshot displays the 'Tabular Space Data - Title 24 Space Data' window. The main table has columns: Regulated Lighting (W/ft2), Reg Ltg., Reg Ltg: Frac to, Reg Ltg: Radiant, Non-Reg. Lighting (W/ft2), Non-Reg. Ltg: Schedule, Non-Reg. Ltg: Frac to Space, and Non-Reg. Ltg: Radiant Frac. A context menu is open over the 'Regulated Lighting (W/ft2)' column, showing options like 'Lock "Regulated Lighting (W/ft2)"', 'Remove "Regulated Lighting (W/ft2)"', and 'Add Filter on "Regulated Lighting (W/ft2)"...'. The 'Configure' dialog box is also open, showing 'Available Columns' and 'Currently Used Columns'. The 'Sensible Rate (Btu/h-person)' column is highlighted in the 'Currently Used Columns' list.

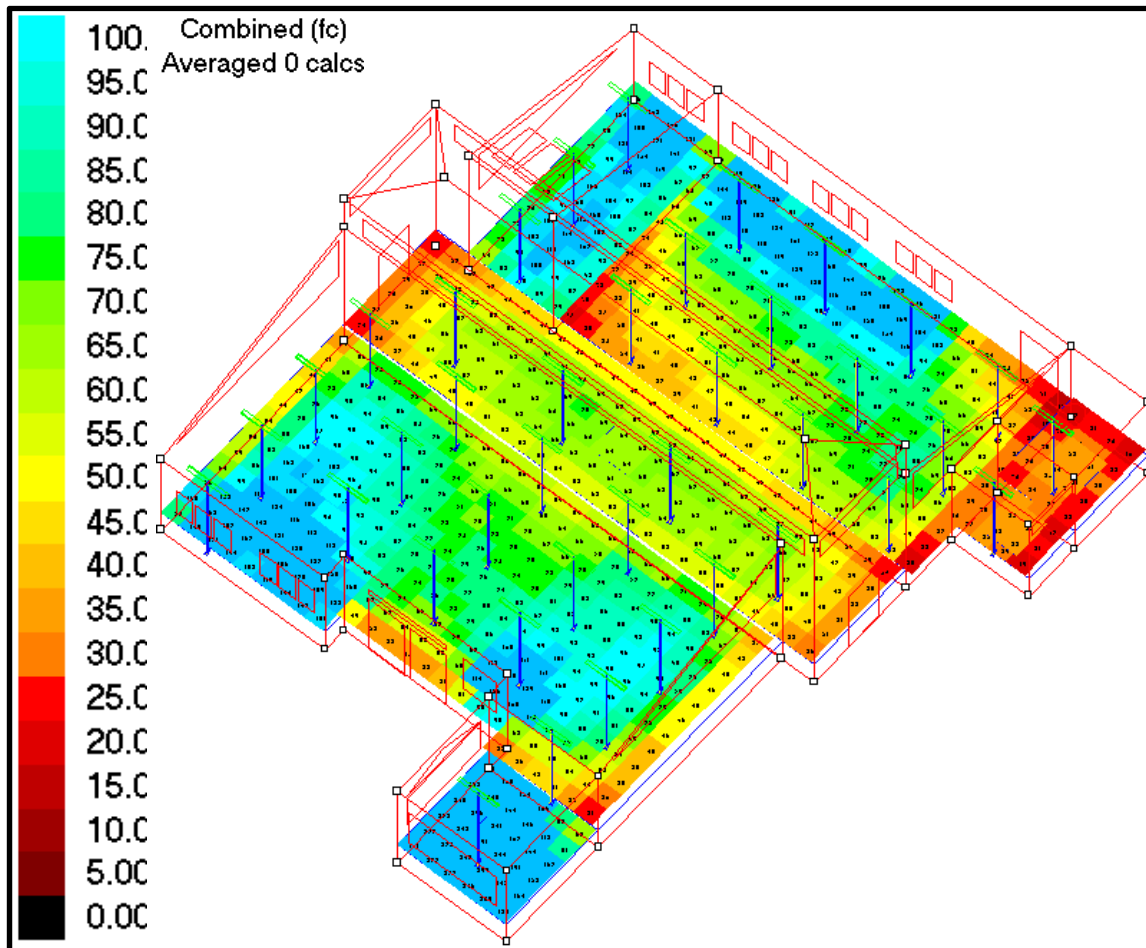
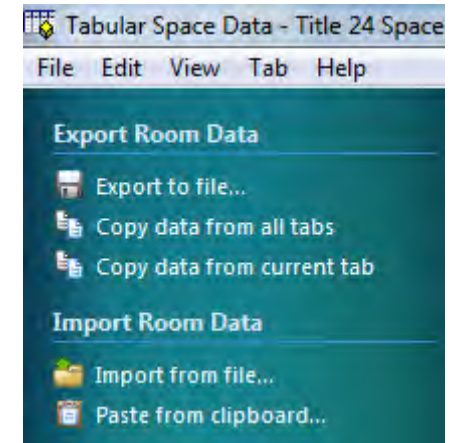
Regulated Lighting (W/ft2)	Reg Ltg.	Reg Ltg: Frac to	Reg Ltg: Radiant	Non-Reg. Lighting (W/ft2)	Non-Reg. Ltg: Schedule	Non-Reg. Ltg: Frac to Space	Non-Reg. Ltg: Radiant Frac
0.75				0.00	- none -	0.00	0.00
0.75	OfficeLights...	0.610	0.70				
0.75	OfficeLights...	0.610	0.70				
0.75	OfficeLights...	0.610	0.70				
0.75	OfficeLights...	0.610	0.70				
0.75	OfficeLights...	0.610	0.70				
0.75	OfficeLights...	0.610	0.70				
0.75	OfficeLights...	0.610	0.70				
0.75	OfficeLights...	0.610	0.70				
0.75	OfficeLights...	0.610	0.70				



Best Practices – Lighting and Daylighting

Area Category Method: Lighting Design

★ Requires Room by Room W/ft²



Room SH000000 (Shopping Checkout)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft ²)	Power density (W/ft ² /(100 fc))	Luminous efficacy (lm/W)
Working plane 1	5900	56	0.56	5.39	105.36
Room DS000000 (Display Gallery)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft ²)	Power density (W/ft ² /(100 fc))	Luminous efficacy (lm/W)
Working plane 1	100300	952	1.24	4.29	105.36
Room ST000000 (Storage)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft ²)	Power density (W/ft ² /(100 fc))	Luminous efficacy (lm/W)
Working plane 1	5900	56	1.6	11.39	105.36
Room CR000000 (Circulation Lobby)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft ²)	Power density (W/ft ² /(100 fc))	Luminous efficacy (lm/W)
Working plane 1	23600	224	0.52	4.42	105.36
Room VD000000 (Video Room)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft ²)	Power density (W/ft ² /(100 fc))	Luminous efficacy (lm/W)
Working plane 1	70800	672	1.15	4.23	105.36
Room FF000000 (Office)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft ²)	Power density (W/ft ² /(100 fc))	Luminous efficacy (lm/W)
Working plane 1	17700	168	1.22	6.05	105.36
Room RS000000 (Restroom)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft ²)	Power density (W/ft ² /(100 fc))	Luminous efficacy (lm/W)
Working plane 1	5900	56	1	7.84	105.36



Best Practices – Lighting

Tailored Lighting Method: Also unlocks Daylighting

Name: Luminaire

Buttons: Add, Copy, Delete

Data:

Fixture Type: RecessedOrDownlight

Lamp Type: LinearFluorescent

Power: 60.00 W Determined from NA8 Default

Fraction heat to space: 0.69 * Only valid in spaces with plenum returns

Radiant frac of space heat: 0.58

Min dimming power frac: 0.20

Min dimming lighting frac: 0.20

RecessedOrDownlight

RecessedWithLens

RecessedOrDownlight

NotInCeiling

LinearFluorescent

LinearFluorescent

CFL

Incandescent

LED

MetalHalide

MercuryVapor

HighPressureSodium

Data:

Schedule: - none - * Power: 200.00 W

PwrReg (Regulated Power)

NonRegExclusion: - specify -

LumMntgHgt: 9.000 ft

LumRef[1]: Luminaire Count: 5

LumRef[2]: - none - Count: 0

LumRef[3]: - none - Count: 0

LumRef[4]: - none - Count: 0

LumRef[5]: - none - Count: 0

Min Dim Power fraction: 0.10 Min Dim Lighting fraction: 0.10

Daylit area type: SkylitDaylit

Heat gain space fraction: SkylitDaylit

Heat gain radiant fraction: PrimarySidelit, SecondarySidelit

Allowance Type: - none specified -

Allowance Width (Len): 0.00 ft Allowance Area: 0.00 ft²

Lighting Controls: OccupantSensingControls-126to2! Qty: 0

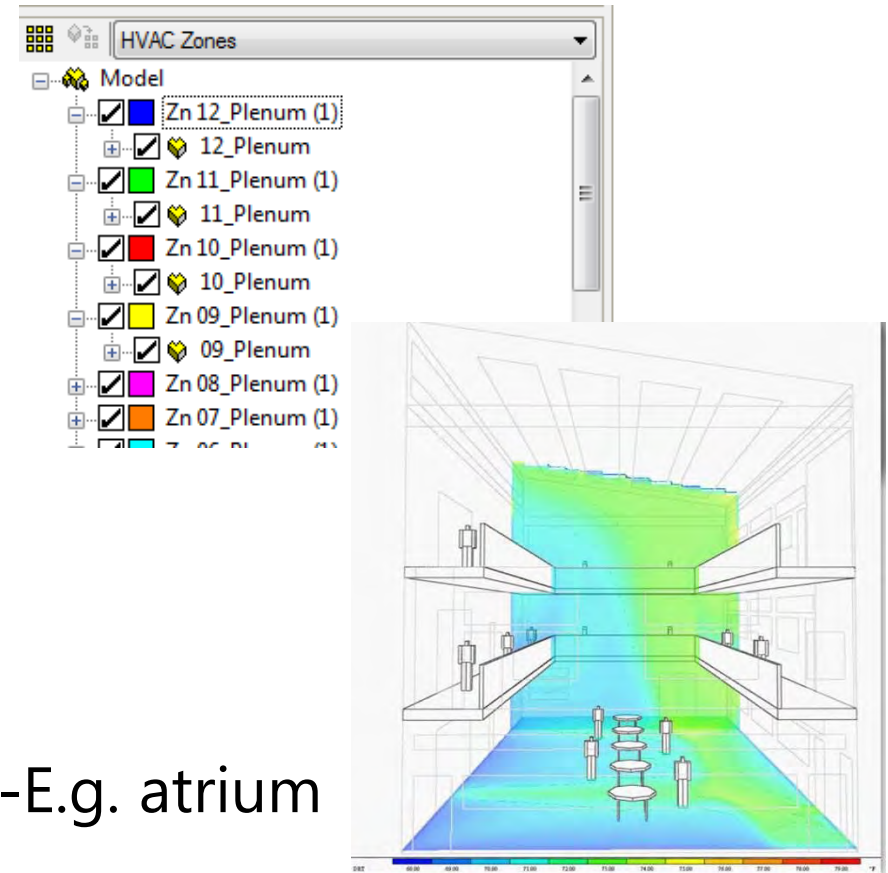
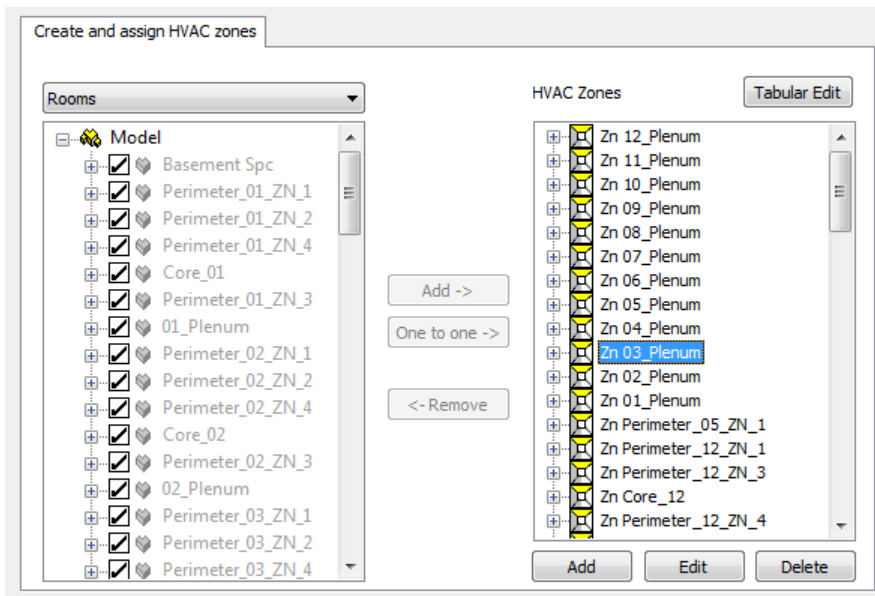
Power Adjustment Factor: 0.30 Acceptance Test Required?



Best Practices – Zoning

HVAC Zoning

- ✦ One-to-one is the easiest option, even to start with.
- ✦ Manage with room groups



- ✦ Take care with vertical zoning-E.g. atrium



Best Practices – Zoning

HVAC Zoning & Tabular Editing

- ★ Useful for Ventilation
 - ✧ Specification (Max., cfm/person, ACPH, sum, cfm/sf, etc.)
 - ✧ Sources (Forced or CO2)
- ★ Terminal Unit Prototype (similar to a multiplex/multiplier)

The screenshot shows a software window titled "Tabular HVAC Zone - HVAC Zone" with a menu bar (File, Edit, View, Tab, Actions, Help) and a toolbar. The main area contains a table with 15 columns and 18 rows of data. The columns are: Name, Type, Supply Plenum Zone, Return Plenum Zone, Primary Htg/Clg System, Ventilation Source, Ventilation Control, Ventilation Specification, Ventilation System, Exhaust System, Thermostat Schedules Cooling, Thermostat Schedules Heating, and Terminal Unit Prototype. The rows list various zones like "Zn Core_12", "Zn Perimeter_01_ZN_1", etc., with their respective configurations. A left sidebar contains "Export Room Data", "Import Room Data", and "Tools" sections. The status bar at the bottom indicates "73 zones" and "No filters active".

Name	Type	Supply Plenum Zone	Return Plenum Zone	Primary Htg/Clg System	Ventilation Source	Ventilation Control	Ventilation Specification	Ventilation System	Exhaust System	Thermostat Schedules Cooling	Thermostat Schedules Heating	Terminal Unit Prototype
Zn Core_12	Conditioned	-none -	-none -	Top VAV	Forced	Fixed	Maximum	Top VAV	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_01_ZN_1	Conditioned	-none -	-none -	Bottom VAV	Forced	Fixed	Maximum	Bottom VAV	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_01_ZN_2	Conditioned	-none -	-none -	Bottom VAV	Forced	Fixed	Maximum	Bottom VAV	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_01_ZN_3	Conditioned	-none -	-none -	Bottom VAV	Forced	Fixed	Maximum	Bottom VAV	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_01_ZN_4	Conditioned	-none -	-none -	Bottom VAV	Forced	Fixed	Maximum	Bottom VAV	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_02_ZN_1	Conditioned	-none -	-none -	Mid VAV 2	Forced	Fixed	Maximum	Mid VAV 2	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_02_ZN_2	Conditioned	-none -	-none -	Mid VAV 2	Forced	Fixed	Maximum	Mid VAV 2	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_02_ZN_3	Conditioned	-none -	-none -	Mid VAV 2	Forced	Fixed	Maximum	Mid VAV 2	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_02_ZN_4	Conditioned	-none -	-none -	Mid VAV 2	Forced	Fixed	Maximum	Mid VAV 2	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_03_ZN_1	Conditioned	-none -	-none -	Mid VAV 3	Forced	Fixed	Maximum	Mid VAV 3	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_03_ZN_2	Conditioned	-none -	-none -	Mid VAV 3	Forced	Fixed	Maximum	Mid VAV 3	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_03_ZN_3	Conditioned	-none -	-none -	Mid VAV 3	Forced	Fixed	Maximum	Mid VAV 3	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_03_ZN_4	Conditioned	-none -	-none -	Mid VAV 3	Forced	Fixed	Maximum	Mid VAV 3	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_04_ZN_1	Conditioned	-none -	-none -	Mid VAV 4	Forced	Fixed	Maximum	Mid VAV 4	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No
Zn Perimeter_04_ZN_2	Conditioned	-none -	-none -	Mid VAV 4	Forced	Fixed	Maximum	Mid VAV 4	-none -	OfficeClgSetptWk	OfficeHtgSetptWk	No



Best Practices – HVAC Systems

Know the Benchmark HVAC System (Baseline/Standard)

★ Title 24 2013 Part 6:

Table 5 – Non-Residential Spaces (not including covered processes)

Building Area	Floors	Standard Design	Description
≤ 10,000 ft ²	1 floor	PSZ	Packaged Single Zone
	>1 floor	PVAV	Packaged VAV Unit
10,000 ft ² – 150,000 ft ²	Any	PVAV	Packaged VAV Unit
>150,000 ft ²	1 floor	SZVAV	Single-zone VAV Unit
	>1 floor	VAVS	Built-up VAV Unit

★ ASHRAE 90.1-2010

TABLE G3.1.1A Baseline HVAC System Types

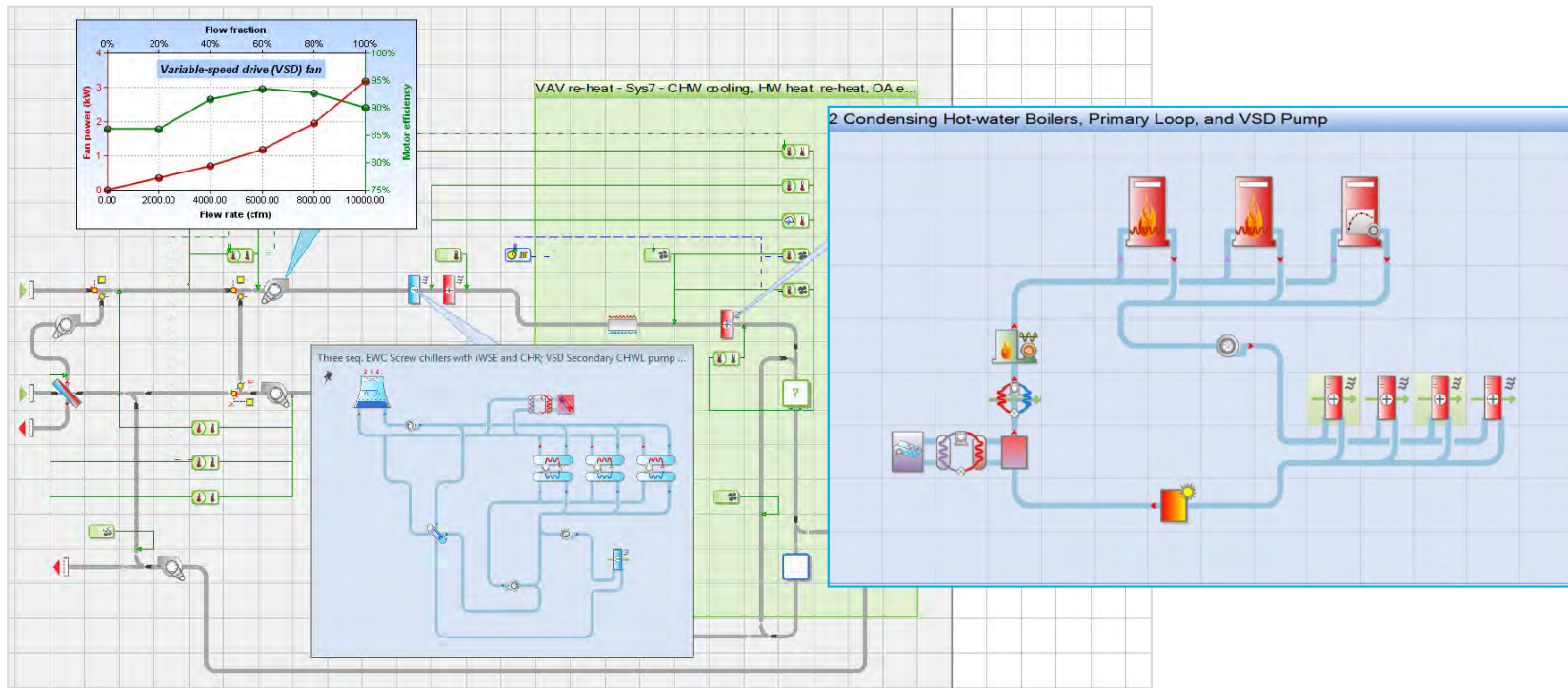
Building Type	Fossil Fuel, Fossil/Electric Hybrid, and Purchased Heat	Electric and Other
Residential	System 1—PTAC	System 2—PTHP
Nonresidential and 3 Floors or Less and <25,000 ft ²	System 3—PSZ-AC	System 4—PSZ-HP
Nonresidential and 4 or 5 Floors and <25,000 ft ² or 5 Floors or Less and 25,000 ft ² to 150,000 ft ²	System 5—Packaged VAV with Reheat	System 6—Packaged VAV with PFP Boxes
Nonresidential and More than 5 Floors or >150,000 ft ²	System 7—VAV with Reheat	System 8—VAV with PFP Boxes
Heated Only Storage	System 9—Heating and Ventilation	System 10—Heating and Ventilation



Best Practices – HVAC System Sizing

Know how the HVAC System was sized

- ★ ASHRAE Heat Balance Method, RTS Method, CLTD.
- ★ 8,760 Simulation-based HVAC sizing?
- ★ Spreadsheets?!, Rules of Thumb, Auto-populating, Oversizing?





Best Practices – HVAC System Sizing

Review the HVAC Load Calculation Reports

SYSTEM SIZING plant loads

NOTE: Oversizing factors used in sizing HVAC system equipment are not applied to peak loads in this report.

Equipment Name	Equipment Type	Area served (ft ²)	Peak Load (kBtu/h)	Time of Peak
HS000000	2 Nat-Draft Boilers, Primary-only HW Loop, Outdoor reset, Const-speed pump	4536.9	66.8	Sized during heating
WL000000	One Electric Water-Cooled Chiller with VSD pump on Secondary CHW Loop	4536.9	163.2	7/158:30

SYSTEM SIZING system loads

NOTE: Oversizing factors used in sizing HVAC system equipment are not applied to peak loads in this report.

System ID	System Name	Area Served (ft ²)							
PR034_07	a VAV - Reheat [EWC chiller - HW boiler]	4536.9							
Coil Sizes									
AHU Cooling Coil	AHU Cooling Coil	AHU Cooling Coil	AHU Heating Coil						
Sensible Load (kBtu/h)	Latent Load (kBtu/h)	Total Load (kBtu/h)	Total Load (kBtu/h)						
Peak value	93.5	89.4	183.2						
Time of Peak	7/158:30	7/158:30	7/158:30						
Fan Sizes									
AHU Supply Fan	AHU Return Fan	Optional Exhaust Fan	Min Vent Airflow						
Flow (cfm)	Flow (cfm)	Flow (cfm)	(cfm)						
Peak Value	3954.5	3954.5	0.0						
Time of Peak	9/1515:30	9/1515:30	2566.0						
Engineering Checks									
Checks	cfm/ft ²	Btu/ft ²	% OA						
Peak Value	0.8	36.0	72.4						
Time of Peak	7/158:30	Calculated at time of Peak Cooling Coil Load	8/158:30						
Components									
Room: Served by System	Cooling Coil Sensible Load (kBtu/h)	Cooling Coil Latent Load (kBtu/h)	Cooling Coil Total Load (kBtu/h)	Heating Coil Total Load (kBtu/h)	Zone recirc. Fan Flow (cfm)	Maximum Flow (cfm)	Minimum Flow (cfm)	Exhaust Flow (cfm)	OA Flow (cfm)
Classroom 4	-	-	-	12.00	-	651.5	545.2	0.0	374.8
Classroom 1	-	-	-	12.10	-	701.1	545.2	0.0	374.8
Classroom 3	-	-	-	12.10	-	754.3	545.2	0.0	374.8
Classroom 2	-	-	-	11.50	-	651.5	545.2	0.0	374.8
Circulation	-	-	-	9.60	-	466.1	200.7	0.0	138.0
Lobby	-	-	-	7.30	-	693.5	379.1	0.0	260.7
Office	-	-	-	2.20	-	255.6	76.7	0.0	26.5

SYSTEM SIZING loads - room data summaries

Classroom 4

Room input data		Peak room cooling loads (Btu/h)		Peak room heating loads (Btu/h)	
Quantity	Value	Sensible	Latent	Sensible	Latent
Floor area (ft ²)	547.6	Ext. Walls	59.0	Ext. Walls	-411.7
Volume (ft ³)	6023.1	Ext. Glazing	379.5	Ext. Glazing	-906.8
Ext. wall area (ft ²)	403.0	Skylights/Conduction	0.0	Skylights/Conduction	0.0
Int. wall area (ft ²)	504.7	Roof	1559.5	Roof	-1012.9
Ext. window area (ft ²)	123.9	Ground/Exposed Floor	994.7	Ground/Exposed Floor	-640.2
Int. window area (ft ²)	0.0	Door	0.0	Door	0.0
Skylight area (ft ²)	0.0	Internal Conduction Gains	Sensible	Latent	Internal Conduction Gains
Room Data		Int. Walls	-2.6	Int. Walls	-119.3
Lighting load (W/ft ²)	1.0	Int. Glazing	0.0	Int. Glazing	0.0
Power load (W/ft ²)	8.8	Ceiling	0.0	Ceiling	0.0
Number of people	32.0	Floor	0.0	Floor	0.0
Area / person (ft ²)	17.1	Door	-2.3	Door	-7.3
Sens gain / pers	225.30	Solar Gains	2472.8	Solar Gains	0.0
Latent gain / person	93.46	Infiltration Gains	99.1	Infiltration Gains	-291.3
Heating set point (°F)	70.0	Other air exchange gains	0	Other air exchange gains	0
Cooling set point (°F)	75.0	Internal Gains	Sensible	Latent	Internal Gains
Max rel. humidity %	60.0	Lighting	1644.1	Lighting Gains	0.0
Min rel. humidity %	0.0	Equipment	1196.6	Equipment	0.0
62.1 Occupancy Category	Educational Facilities - Lecture Classroom	People	6409.5	People	0.0
		Totals	12,029	3,219	-3,388
Design Air Flow		Environmental conditions (Peak HW Cooling)		Environmental conditions (Peak Heating Coil)	
Cooling Air Flow (cfm)	600.9	Date	Jul	Air changes per hour	6.0
Min Air Flow (cfm)	545.2	Time	14:30	cfm/ft ²	1.1
Heating Air Flow (cfm)	661.5	Ext. Drybulb Temp	81.56	Btu/ft ²	24.0
Return Air Flow (cfm)	600.9	Ext. Wetbulb Temp	70.43	% OA	62.4
Exhaust Air Flow (cfm)	0.0	Ext. RH	56	Room RH	52
Ventilation Air Flow (62.1 Voz) (cfm)	374.8	Room Drybulb Temp	72.13	Room RH	19
		Engineering Checks (Cooling)		Engineering Checks (Heating)	
		Air changes per hour		Air changes per hour	
		cfm/ft ²		cfm/ft ²	
		Btu/ft ²		Btu/ft ²	
		% OA		% OA	
		Environmental conditions (Peak Heating Coil)		Environmental conditions (Peak Heating Coil)	
		Date		Date	
		Sized during heating		Sized during heating	
		Temp		Temp	
		Ext. Drybulb Temp (°F)		Ext. Drybulb Temp (°F)	
		37.6		37.6	
		Ext. Wetbulb Temp (°F)		Ext. Wetbulb Temp (°F)	
		50.2		50.2	
		Entering (db) Temp (°F)		Entering (db) Temp (°F)	
		65.0		65.0	
		Leaving (db) Temp (°F)		Leaving (db) Temp (°F)	
		76.1		76.1	



Best Practices – HVAC Fluid Systems

Hot-Water Loops

- ✦ Boilers
- ✦ Pumps
- ✦ Segments

The screenshot shows the 'Boilers' configuration window. On the left, a tree view lists 'HotWater Loop', 'CondenserWater Loop', 'ChW Loop', and 'SHWFluidSys'. The main panel has tabs for 'General', 'Fluid segments', 'Chillers', 'Boilers', 'Heat rejection', 'Water heaters', 'SWH Summary', and 'Acceptance Certificates'. The 'Boilers' tab is active, showing 'Boiler 1' selected. To the right are 'Add', 'Copy', and 'Delete' buttons. Below these are dropdown menus for 'Type' (HotWater), 'Fuel' (Gas), and 'Draft Type' (Condensing). The 'General' sub-tab is active, displaying various parameters: Rated Capacity (6175351.0 Btu/h), Min Unload Ratio (0.250 frac), Draft Fan HP (4.940 HP), AFUE (0.000), Thermal Efficiency (0.800 frac), Combustion Efficiency (0.000 frac), Fuel at Full Load (0.00 Btu/h), Inlet Fluid Seg (HW Primary Return), Outlet Fluid Seg (HW Primary Supply), Has Bypass (checkbox), Des. Entering Temp. (140.00 °F), Des. Leaving Temp. (180.00 °F), and HIR_PLR Curve (dropdown).

Chilled-Water Loops

- ✦ Chillers
- ✦ Pumps
- ✦ Segments

The screenshot shows the 'Chillers' configuration window. On the left, a tree view lists 'HotWater Loop', 'CondenserWater Loop', 'ChW Loop', and 'SHWFluidSys'. The main panel has tabs for 'General', 'Fluid segments', 'Chillers', 'Boilers', 'Heat rejection', 'Water heaters', 'SWH Summary', and 'Acceptance Certificates'. The 'Chillers' tab is active, showing 'Chiller 1' and 'Chiller 2' selected. To the right are 'Add', 'Copy', and 'Delete' buttons. Below these are dropdown menus for 'Type' (Centrifugal), 'Condenser Type' (Fluid), and 'Input Fuel' (Electric). The 'General' sub-tab is active, displaying various parameters: Rated Capacity (8226712.0 Btu/h), EntTemp-Dsgn (64.00 °F), LvgTemp-Dsgn (44.00 °F), kW/ton (0.590), Rat (0.00 °F), IPLV (0.400), Evap Inlet Fluid Seg (ChW Primary Return), Evap Outlet Fluid Seg (ChW Primary Supply), Evap has Bypass (checkbox), Cond Inlet Fluid Seg (CW Supply FluidSegment), and Cond Outlet Fluid Seg (CW Return FluidSegment).



Best Practices – HVAC Fluid Systems

Condenser-Water Loops

- ✦ Heat Rejection
- ✦ Pumps & CT Fan
- ✦ Segments

HotWater Loop
CondenserWater Loop
ChW Loop
SHWFluidSys

General | Fluid segments | Chillers | Boilers | Heat rejection | Water heaters | SWH Summary | Acceptance Certificates

Cooling Tower

Add Copy Delete

Type: OpenTower
Inlet Fluid Seg: CW Return FluidSegment
Outlet Fluid Seg: CW Supply FluidSegment

General | Pumps

Rated Capacity: 19213808 Btu/h Cells: 1
Tower Air Flow: 199427.00 cfm
Fan Type: Axial
Total Fan HP: 47.90 hp
Condenser water flow rate: 3841.00 gpm
Modulation Control: VariableSpeedDrive
Low speed airflow ratio: 0.50
Minimum speed ratio: 0.50

Domestic-HW Loops

- ✦ Storage Water Heater
- ✦ Pumps
- ✦ Segments
- ✦ Recirc. & Solar HW

HotWater Loop
CondenserWater Loop
ChW Loop
SHWFluidSys

General | Fluid segments | Chillers | Boilers | Heat rejection | Water heaters | SWH Summary | Acceptance Certificates

WaterHeater

Add Copy Delete

Type: Storage
Fuel Source: NaturalGas
 Electrical Ignition
Status: New

General | Pumps

Storage Capacity: 1300.00 gal
Rated Capacity: 650000.00 Btu/h
Thermal Efficiency *: 0.80
Standby Loss Fraction **: 0.001 Frac
Energy Factor ***: 0.000
Recovery Efficiency ****: 0.000
Tank Off Cycle Loss Coeff: 10.00 Btu/h-F

Outlet Fluid Segment: SHWSupply
Makeup Fluid Segment: SHWMakeup
Pilot Energy: 750.00 Btu/h
Draft Fan Power: 0.000 Watts



Best Practices – HVAC Air Systems

Air Systems

- ✦ System Types
- ✦ AHU Coils, Fan, Controls
- ✦ Segments, DOAS

Basement CAV
Bottom VAV
Hi VAV 7
Mid VAV 2
Top VAV
Mid VAV 3
Mid VAV 4
Mid VAV 5
Mid VAV 6
Hi VAV 8
Hi VAV 9
Hi VAV 10
Hi VAV 11

Add Copy Delete

Zn Perimeter_12_ZN_1
Zn Perimeter_12_ZN_3
Zn Core_12
Zn Perimeter_12_ZN_4
Zn Perimeter_12_ZN_2

General | Air Segments | Terminal Units | Outside Air | Acceptance Certificate

Type: VAV Availability Schedule: OfficeHVACAvailWk
Sub Type: Packaged1Phase Night Cycle Fan Control: CycleOnCallAnyZone
Reheat Control: DualMaximum Control Zone: - none -
Status: New Control System Type: DDCToZone
Is Complex Mechanical System:

Auto-Size Parameters
Design Flow/Area: 1.10 cfm/ft2 Design Flow/Ton: 400.00 cfm/ton

Design Supply Air Temp: Cooling 55.00 °F Heating 60.00 °F
Net Capacity: Cooling 1265648.00 Btu/h Heating 1385116.42 Btu/h Supply Flow 42188.00 cfm

Single/Cold Duct Control
Fan Position: DrawThrough
Supply temperature control: WarmestResetFlowFirst
Fixed Supply Temperature: 0.00 °F
Setpoint Temp Schedule: - none -
Reset Supply High: 60.00 °F @ Outdoor Temp 0.00 °F
Reset Supply Low: 55.00 °F @ Outdoor Temp 0.00 °F

Duct
Duct Insulation: 0.00 °F-ft2-h/Btu
Duct Location: - specify -
Is HERS Duct Leakage Test Required:

Terminal Units

- ✦ Type
- ✦ Coils, Fans, Controls
- ✦ Segment *Mapping*

General | Heating coils

Type: VAVReheatBox
Zone served: - specify - Uncontrolled
Primary AirSeg Reference: VAVReheatBox
Status: ParallelFanBox
SeriesFanBox
VAVNoReheatBox

Number of terminal units: 1
Component quantity: 1

Air flow
Max. Primary Flow: 29983.00 cfm
Min. Primary Flow: 5997.00 cfm
Max. Heating Flow: 14992.00 cfm
Reheat Control Method: DualMaximum

Fan box
Induced Air zone: - none -
Induction ratio: 0.00
Fan power: 0.10 W/cfm
Parallel box control method: FlowFraction
Parallel box flow fraction: 0.00



Best Practices – HVAC Zone Systems

Zone Systems

- ✦ System Types
- ✦ Coils, Fan, Controls
- ✦ Segments

Zone Types

- ✦ SZAC, SZHP, PTAC, PTHP, FPFC, Baseboard, WSHP, Exhaust
- ✦ VRF unavailable until CBECC-Com v_
 - ✦ SZHP
 - ✦ Or VAV

General | Cooling coils | Heating coils | Fans | Acceptance Certificate

Type: WSHP | Availability Schedule: on continuously

Subtype: | Status: New | Fan control: Continuous

Is Complex mechanical System | Component order in current system: [Edit](#)

Auto-Resize Parameters

Design Flow/Area: 50.00 cfm/ft2 | Design Flow/Ton: 400.00 cfm/ton

	Cooling	Heating
Design Supply Air Temp	0.00 °F	0.00 °F
Net Capacity	0.00 Btu/h	0.00 Btu/h
Supply Air Temp Control	NoSATControl	

Duct

Duct Insulation: 0.00 °F-ft²-h/Btu

Duct Location: - specify -

Is HERS Duct Leakage Test Required

Type: DirectExpansion

Fuel Source: Electric

Condenser Type: Air

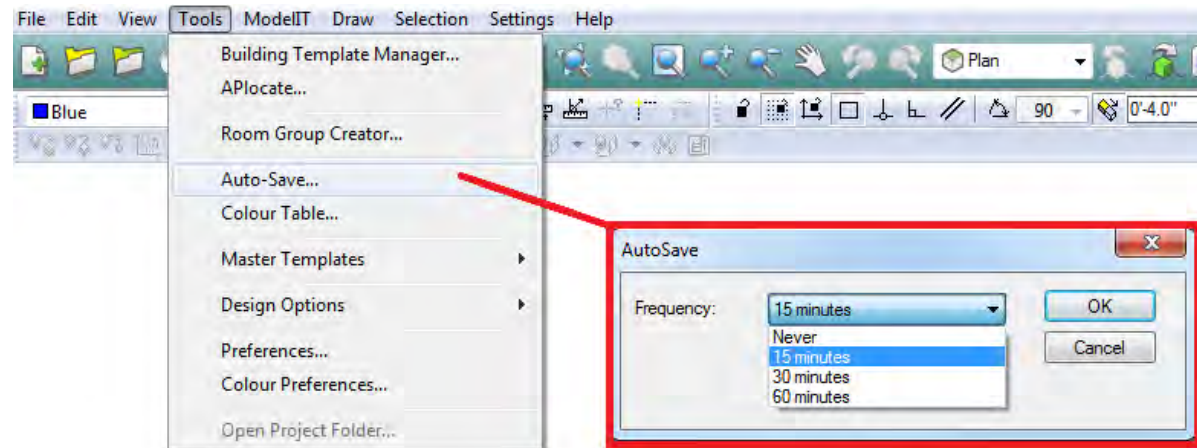
SEER: 13.00

EER: 10.00

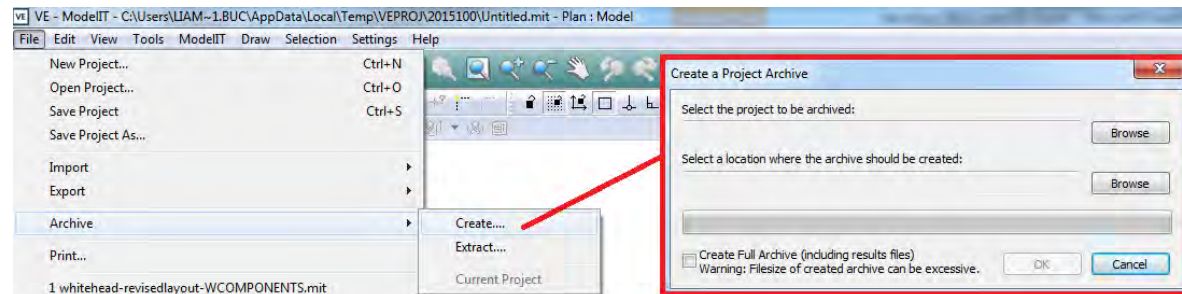


Best Practices – General

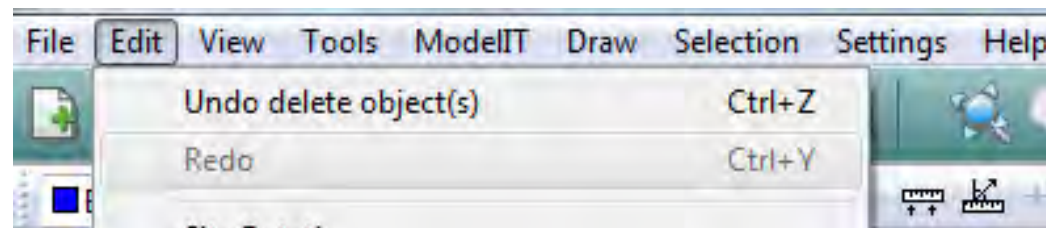
Auto-Save:



Backups:



Undo:





Our Question To You



If you could wave your magic wand, 3D software would include which features to make your job easier?

auto-populate CBECC/T24 assemblies and hvac based on your Apache/ ApacheHVAC system. This would including adding and sizing a "standard" cooling system if your design doesn't have cooling.

All model design characteristics which could potentially cause an error which would prevent a simulation run should be alerted as the model is being built.

Automatically handle all the interior walls and surfaces, generate load calculations and easily establish zoning for daylighting and HVAC.

Full proof conversion of dwg file to a cibd file

Auto Save!! And Undo on a step by step basis. I have lost a few projects due to program crashing and I have simply given up on commercial energy calculations.



Challenge C

Challenge C

✦ How To Get "Compliance"



How to.... – Avoid CBECC-Com Errors

Errors Protocol:

★ Keep it simple

✧ www.iesve.com/software/title24/title-24-faqs

★ If doing a new construction project, start with 'NewEnvelopeAndLighting' to remove:

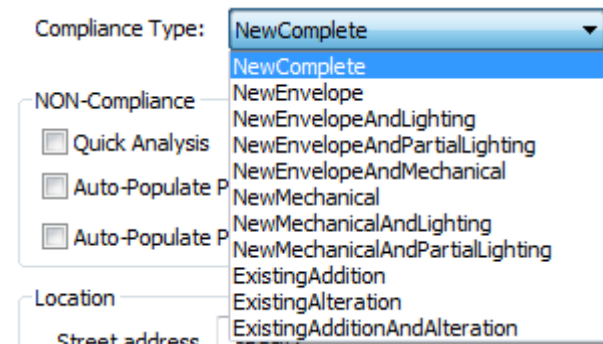
✧ Geometry Errors

✧ Envelope Errors

✧ Daylighting Omissions

✧ Then revert back to 'NewComplete' to finish the HVAC portion

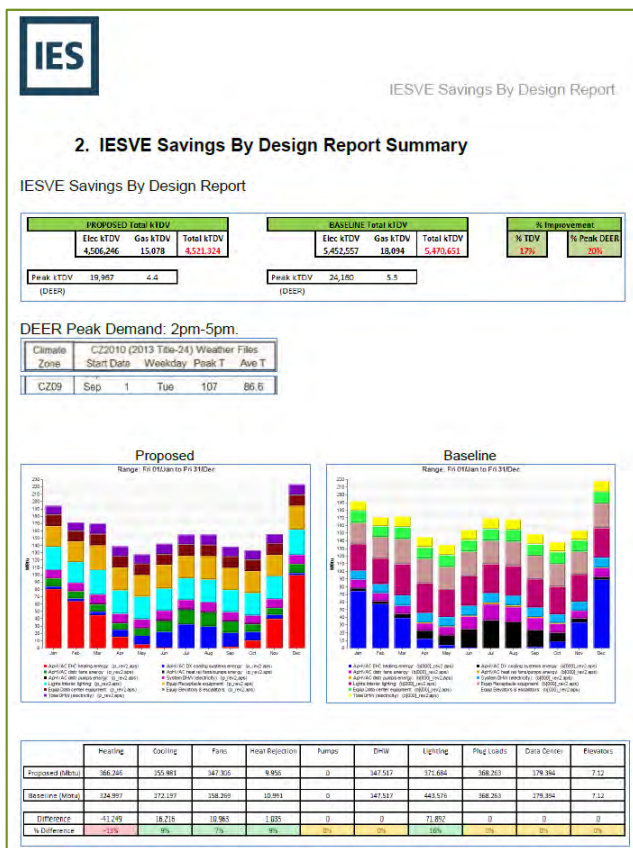
★ Use the 'quick analysis' (only) to solve errors.



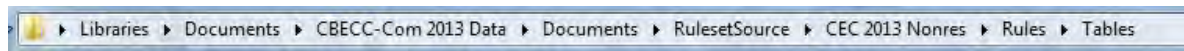


How to.... – Savings By Design

Savings By Design (TDV) Reports:



★ TDVs Multipliers are located in your My Documents:



TDV (Time Differential Valuation) Multipliers				Electricity and Natural Gas Energy Variables from IESVE		Total kTDV			
	25	26	27			Elec kTDV	Gas kTDV	Total kTDV	
	CZ:	9				4,506,246	15,078	4,521,324	
	Elec	NatGas	Propane						
	kTDV/kWh	kTDV/thrm	kTDV/thrm						
MoDaHr	TDV	TDV	TDV			Peak kW	Peak Therm	Peak kTDV	
CZ=	9	9	9			64	2.26	19,967	
Fuel=	Elec	NatGas	Propane					4.4	
10101	15.67	194.2	438.49	<div style="display: flex; align-items: center;"> <div style="font-size: 2em; margin-right: 10px;">X</div> <div> <p>Date: Fri, 01/Jan</p> <p>Time: 00:30</p> <p>01:30</p> <p>02:30</p> <p>03:30</p> <p>04:30</p> <p>05:30</p> <p>06:30</p> <p>07:30</p> <p>08:30</p> <p>09:30</p> <p>10:30</p> <p>11:30</p> <p>12:30</p> <p>13:30</p> <p>14:30</p> <p>15:30</p> <p>16:30</p> <p>17:30</p> <p>18:30</p> <p>19:30</p> <p>20:30</p> <p>21:30</p> <p>22:30</p> <p>23:30</p> </div> <div style="margin-left: 10px;">=</div> </div>					
10102	15.15	194.2	438.49		Total electricity (misc.) (kW)	Total nat. gas (kBtu/h)			
10103	14.92	194.2	438.49		9.48	2.26	148.52	4.39	
10104	14.82	194.2	438.49		6.85	2.16	103.82	4.19	
10105	15.28	194.2	438.49		6.12	2.26	91.35	4.39	
10106	17.18	194.2	438.49		5.87	2.26	86.93	4.39	
10107	19.3	194.2	438.49		5.68	2.26	86.86	4.39	
10108	19.69	194.2	438.49		5.74	2.26	98.69	4.39	
10109	19.91	194.2	438.49		5.78	2.26	111.55	4.39	
10110	19.82	194.2	438.49		5.80	2.26	114.20	4.39	
10111	19.6	194.2	438.49		5.99	2.26	119.25	4.39	
10112	18.67	194.2	438.49		6.90	2.26	136.74	4.39	
10113	18.39	194.2	438.49		8.28	1.10	162.32	2.13	
10114	18.18	194.2	438.49		8.04	0.04	150.06	0.07	
10115	17.44	194.2	438.49		5.37	0.00	98.83	0.00	
10116	18.17	194.2	438.49		2.09	0.00	38.09	0.00	
10117	19.45	194.2	438.49	2.07	0.00	36.10	0.00		
10118	19.86	194.2	438.49	1.94	0.00	35.28	0.00		
10119	19.81	194.2	438.49	2.03	0.00	39.54	0.00		
10120	19.85	194.2	438.49	2.06	0.00	40.97	0.00		
10121	20.05	194.2	438.49	2.04	0.00	40.44	0.00		
10122	19.86	194.2	438.49	2.75	0.15	54.56	0.29		
10123	19.29	194.2	438.49	4.02	0.46	80.52	0.89		
10124	17.5	194.2	438.49	4.83	0.59	95.93	1.14		
10201	15.72	194.2	438.49	4.64	1.00	89.50	1.94		
10202	15.17	194.2	438.49	4.58	1.55	80.14	3.02		
10203	14.96	194.2	438.49	6.00	1.92	94.38	3.74		
10204	14.94	194.2	438.49	6.77	2.26	102.67	4.39		
10205	16.07	194.2	438.49	6.50	2.26	97.27	4.39		
10206	16.69	194.2	438.49	6.39	2.26	95.39	4.39		
				6.17	2.26	99.12	4.39		
				6.18	2.26	103.13	4.39		



Challenge D

Challenge D

Where To Get Help



Challenge D: Help!

Where to get help

Know your software

- ✦ IESVE:
 - ✧ 3D modeling 3rd party software
- ✦ CBECC-Com
 - ✧ State provided software the defines compliance ruleset
- ✦ Open Studio
 - ✧ 3D modeling interface to Energy Plus
- ✦ Energy Plus
 - ✧ Energy modeling engine

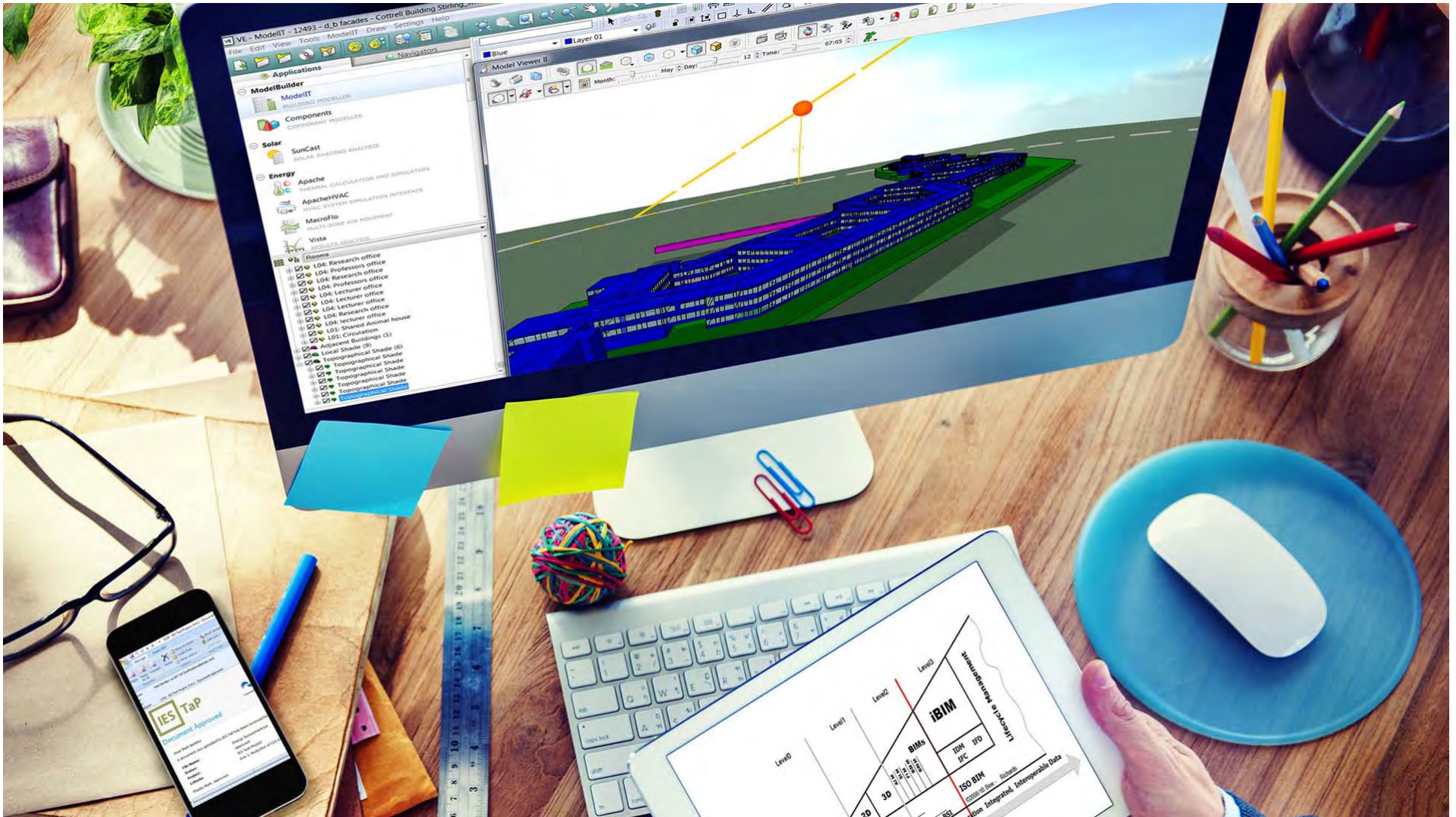
Learn About It

- ✦ IESVE
 - ✧ Hands on training
 - ✧ E-Learning
 - ✧ Support
- ✦ Energy Code Ace
 - ✧ Private Utility Training
- ✦ FAQ's to specific software



Where To Get Help

✦ www.iesve.com

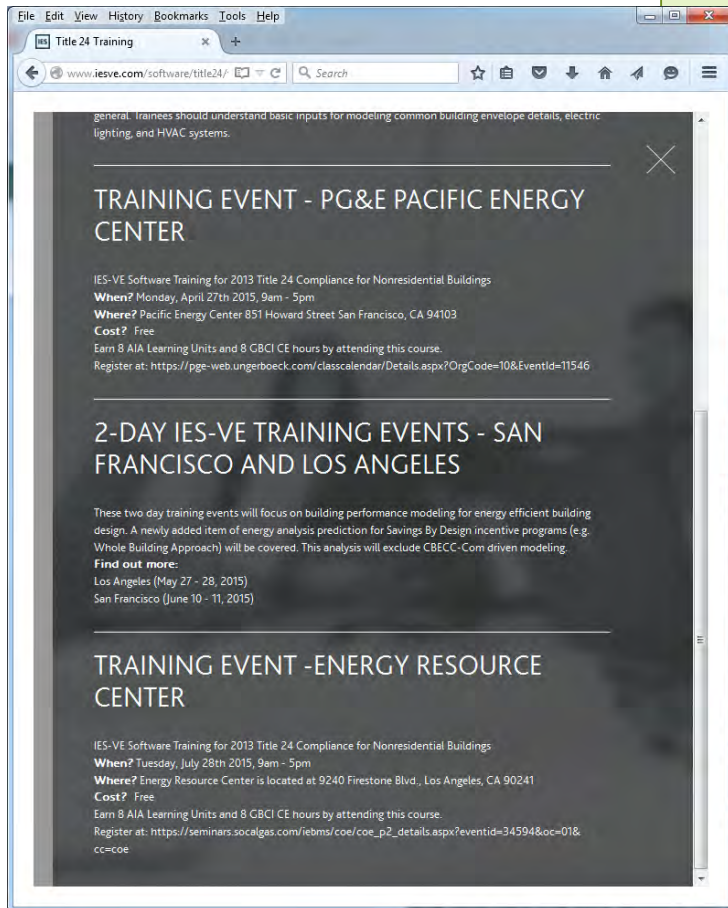




Where To Get Help

IESVE

- ✦ In Person Classes - FREE!
 - ✦ www.iesve.com/software/title24/title-24-training
- ✦ A full day hands-on training course, focused on Title 24 Compliance Modeling for non-residential buildings.
 - ✦ Model geometry interoperability and 'build from scratch' model geometry.
 - ✦ Building data, climate and building constructions modeling.
 - ✦ Organization of building templates, room/zone thermal data, internal gains and profiles/schedules.
 - ✦ HVAC zoning, air/fluids systems.
 - ✦ Generation of summary output reports and required compliance documentation.





Where To Get Help

IESVE

- ✦ Face to Face learning
 - ✦ Take a regular 2-day course through IES.
 - Building Performance Analysis
 - IES classroom based training events
 - Bespoke / Project based training
 - www.iesve.com/training/events

HOME → TRAINING HOME → FACE TO FACE TRAINING

FACE TO FACE TRAINING EVENTS

Our face to face training events offer a low cost learning option that is mostly aimed at people who are new to our Virtual Environment or those that wish to refresh their skills. The events are typically kept to a small class of 10 participants to maintain an intimate training environment. The events are held at conference facilities across the world and offer the following benefits:

- Each participant will receive a free software license lasting for a two week period
- Trainees will have the opportunity to ask our experts questions throughout the day
- Each individual trainee will receive an IES Virtual Environment Training Certificate

We can also tailor make a bespoke training package to suit your individual needs. Please email training@iesve.com to discuss your requirements.

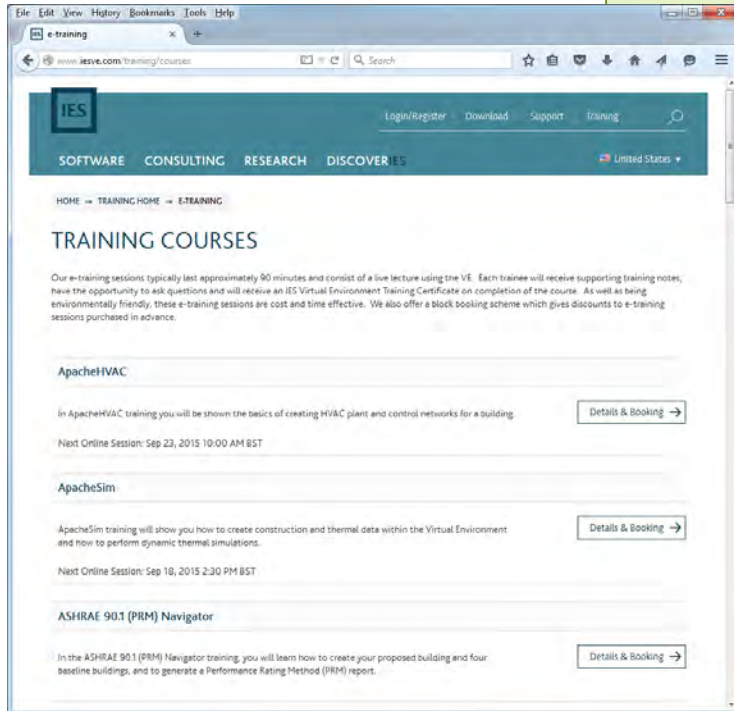
Request Training in Your City

No training events planned in your city? Would you like to request one? [Click here.](#)



Where To Get Help

IESVE



✦ E-training

✦ Online-training

- Modular based e-training
- Short 90 minute courses
- www.iesve.com/training/courses

✦ Distance learning

- Anytime online access to a range of self-paced IESVE training videos
- Supporting training notes to assist learning
- Access to test models to practice on

✦ Master classes – coming soon

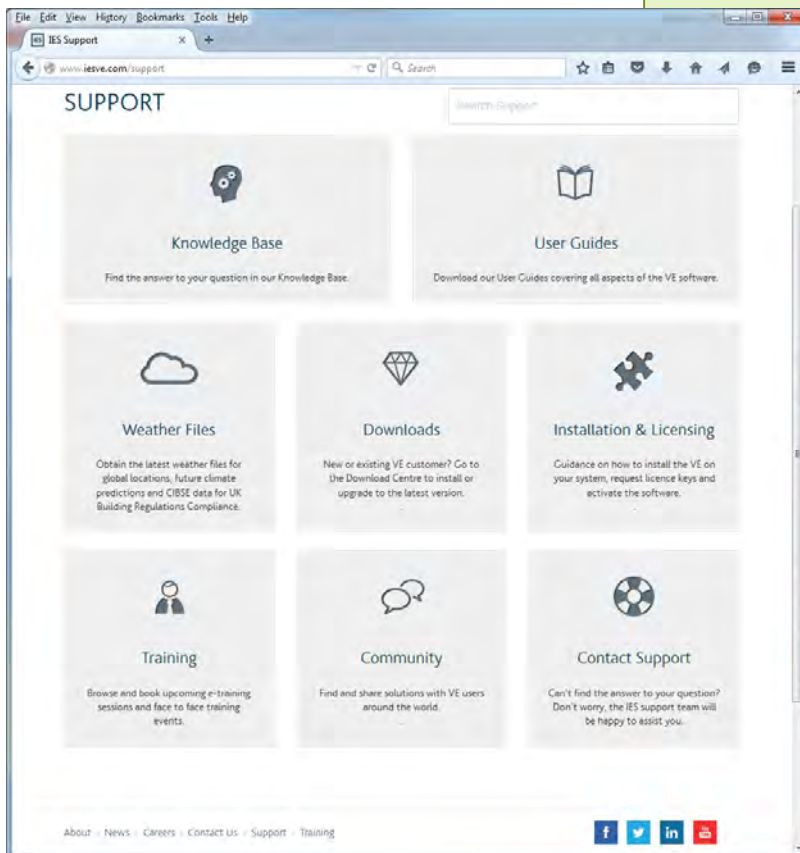


Where To Get Help

IESVE

✦ IES Technical Support

- ✦ www.iesve.com/support
- ✦ Email: support@iesve.com
- ✦ Phone: +1 (404) 806 2018



- 24/7 IES support
- Telephone access to IESVE problem solvers
- Community Support: Forum, LinkedIn, YouTube, etc.
- Online bank of Tutorials and User Guides



Where To Get Help

**International Building Performance
Simulation Association (IPBSA)**

◆ Your local community of IESVE Users:

- ◆ IBPSA-San Francisco Chapter
- ◆ IBPSA-Los Angeles Chapter

IBPSA-USA-SF
San Francisco Chapter

HOME ABOUT EVENTS JOIN LINKS & RESOURCES PHOTO GALLERY

TITLE 24 2013 HOW PRACTITIONERS ARE MANAGING

Mid April, we hosted a discussion with local members of IBPSA on Title 24 2013 and the changes in place for software and permit submission. Those who are aware of the changes that took place at the end of March are well aware, others may only be hearing about this through Architecture and Engineering affiliates and friends.

The IBPSA San Francisco meeting focused on Title 24 and experience to date for commercial building compliance, documentation, and permit submission. The goals were to discuss problems and any success stories in utilizing the new softwares available and establish any consensus for best practice or best ideas to try.

The discussion followed the following topics, past experience, any future plan, short term and long term goals for Software Usability, Permit Completion, and Submission and Review processes. We had a host of attendees from the major bay area engineering and consulting firms who shared how they have been adapting, what software they are currently using and any issues or ideas.

Here is a copy of the notes and plans by each company who attended:

[Title 24 2013 IBPSA Discussion Notes 04-27-2015](#)

Search ...

RECENT POSTS

- [Title 24 2013 How Practitioners Are Managing](#)
- [April 20th Title 24 for Practitioners Free Event](#)
- [March 19. LNBL Commercial Building Energy Saver Tool Workshop](#)
- [Feb Meeting: Commercial Building Energy Saver Tool Kit by LBL](#)
- [Nov IBPSA Meeting \[Dec 2nd\]](#)

<https://ibpsasf.wordpress.com>

Follow



Where To Get Help

CBECC-Com

✦ Take a class!

- ✦ CBECC-Com 2013 Title 24 Nonresidential Compliance Software Training - Introduction and Simplified (2D) Geometry
- ✦ CBECC-Com 2013 Title 24 Nonresidential Compliance Software Training - Detailed (3D) Geometry and Advanced Topics

CBECC-COM NONRESIDENTIAL COMPLIANCE SOFTWARE

HOME

SOFTWARE

FAQ/
TRAINING

SUBMIT AN
ISSUE

REFERENCE
METHOD

WEATHER &
TDV DATA

RESOURCES

ABOUT

FREQUENTLY ASKED QUESTIONS (FAQ)

Please select a category below to view frequently asked questions for CBECC-Com.

1. [Compliance Software](#)
2. [Exceptional Design Compliance](#)
3. [Quick Analysis](#)
4. [Support/Training](#)
5. [General](#)
6. [Building Envelope/Geometry](#)
7. [Building Internal Loads](#)
8. [Building HVAC Systems](#)
9. [Compliance Reporting](#)
10. [Unmet Load Hours \(UMLH\)](#)

Unmet:Hours

For more FAQs and more detailed modeling questions and answers from the CBECC-Com user community, please refer to unmethours.com. It's a new type of resource that has emerged from the programming world as an alternative to mailing lists or forums. You ask a question. Other modelers answer it. The best answer gets voted to the top. Or you can search on your topic and you might find that your question has already been asked and answered.

Several CBECC-Com questions are already answered here: <https://unmethours.com/questions/scope:all/sort:activity-desc/tags:cbecc-com/>



Where To Get Help

OpenStudio

◆ Interface for EnergyPlus

- ◆ www.openstudio.net/
- ◆ <https://unmethours.com>
- ◆ www.youtube.com/user/NRELOpenStudio
- ◆ Uses SketchUp
- ◆ http://nrel.github.io/OpenStudio-user-documentation/tutorials/tutorial_cbecc_materials/

Unmet Hours BETA

Question-and-Answer Resource for the Building Energy Modeling Community

[Get started with the Help page](#)

Hi There! Please Sign In

[Tags](#) [Users](#) [Badges](#)

ALL

UNANSWERED

search or ask your question



ASK YOUR QUESTION



Where To Get Help

Energy Plus

◆ Why?

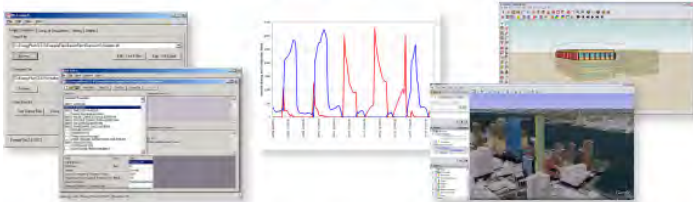
◆ It is the engine behind it all, and some knowledge of this software will enable more stable models and results. In addition, may allow you to use the “exceptional calculation method”.

- <https://github.com/NREL/EnergyPlus/releases/tag/v8.3.0>



Where's the energy going in your building?

Find out with EnergyPlus™ software. Enter your building characteristics and EnergyPlus will model heating, cooling, lighting, ventilating, and water usage, as well as carbon emissions—everything you need to do an integrated evaluation of your building's energy flows.



Energy-efficient technologies are integrated most effectively into a building during the design phase. To facilitate energy-smart design, the U.S. Department of Energy (DOE) provides builders and architects the tools to predict energy flows in commercial and residential buildings before construction with EnergyPlus.

EnergyPlus, DOE's fully integrated building heating, ventilation, and air conditioning (HVAC) and renewables simulation program is one of the most robust simulation tools available in the world today. It models building heating, cooling, lighting, ventilating, and other energy flows, as well as water. The program includes many innovative simulation capabilities, such as time steps of less than an hour, modular systems and plant integrated with heat balance-based zone simulation, multizone air flow, thermal comfort, water use, natural ventilation, and photovoltaic systems.

EnergyPlus is a stand-alone simulation program without a “user friendly” graphical interface. The program reads input and writes output as text files. Graphical interfaces, such as OpenStudio™ for Google SketchUp and EnergyPlus Example File Generator, are available to simplify creating, editing, and running EnergyPlus input files.

Since its 2001 introduction, the free program has been downloaded in more than 120 countries and used in the design of such buildings as the San Francisco Federal Building. For more information about EnergyPlus or to download the free program, visit www.energyplus.gov.

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 www.energyplus.gov



EnergyPlus™ Documentation

Tips & Tricks for Using EnergyPlus

Insider secrets to Using EnergyPlus

(just don't tell anyone...)



Where To Get Help



- Title 24 Part 6 Essentials – Residential Standards for Plans Examiners and Building Inspectors
- Title 24 Part 6 Essentials – Residential Standards for Energy Consultants
- Title 24 Part 6 Essentials – Residential Standards for AC Quality Installation Contractors
- Title 24 Part 6 Essentials – Nonresidential Standards for Plans Examiners and Building Inspectors
- Title 24 Part 6 Essentials – Nonresidential Standards for Energy Consultants
- Title 24 Part 6 Essentials – Nonresidential Standards for Small Commercial AC Quality Installation Contractors
- Title 24 Part 6 Essentials – Standards & Technology for Retail Lighting
- Title 24 Part 6 Essentials – Standards & Technology for Residential Lighting
- Title 24 Part 6 Essentials – Standards & Technology for Office Lighting
- Title 24 Part 6 Essentials – Residential Modeling – Coming Soon
- Title 24 Part 6 Essentials – Nonresidential Modeling – Coming Soon
- Title 24 Part 6 Essentials – Standards for Refrigeration in Retail Food Storage
- CBECC-Com 2013 Title 24 Nonresidential Compliance Software Training - Introduction and Simplified (2D) Geometry
- CBECC-Com 2013 Title 24 Nonresidential Compliance Software Training - Detailed (3D) Geometry and Advanced Topic
- IES-VE Software Training for Title 24 Compliance for Nonresidential Buildings



Wrap Up

- Welcome
- What We Heard from You
- Let's Talk
- Next Steps

► Wrap Up

- Thank you!
- Questions?
- CEUs





Thank you!

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Energy Code Ace	Webinar Registration	decoding.request@energycodeace.com	
CEC Hotline	Energy Standards Hotline	title24@energy.ca.gov	(800) 772-3300
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HELPING YOU PLAY YOUR CARDS RIGHT