Energy Code Ace™
HELPING YOU PLAY YOUR CARDS RIGHT

Decoding CBECC-Com

Let's Talk IESVE and Nonresidential 3D Modeling

Host:
Gina Rodda
Gabel Associates, LLC

Guest Speaker:
Liam Buckley
IES

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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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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

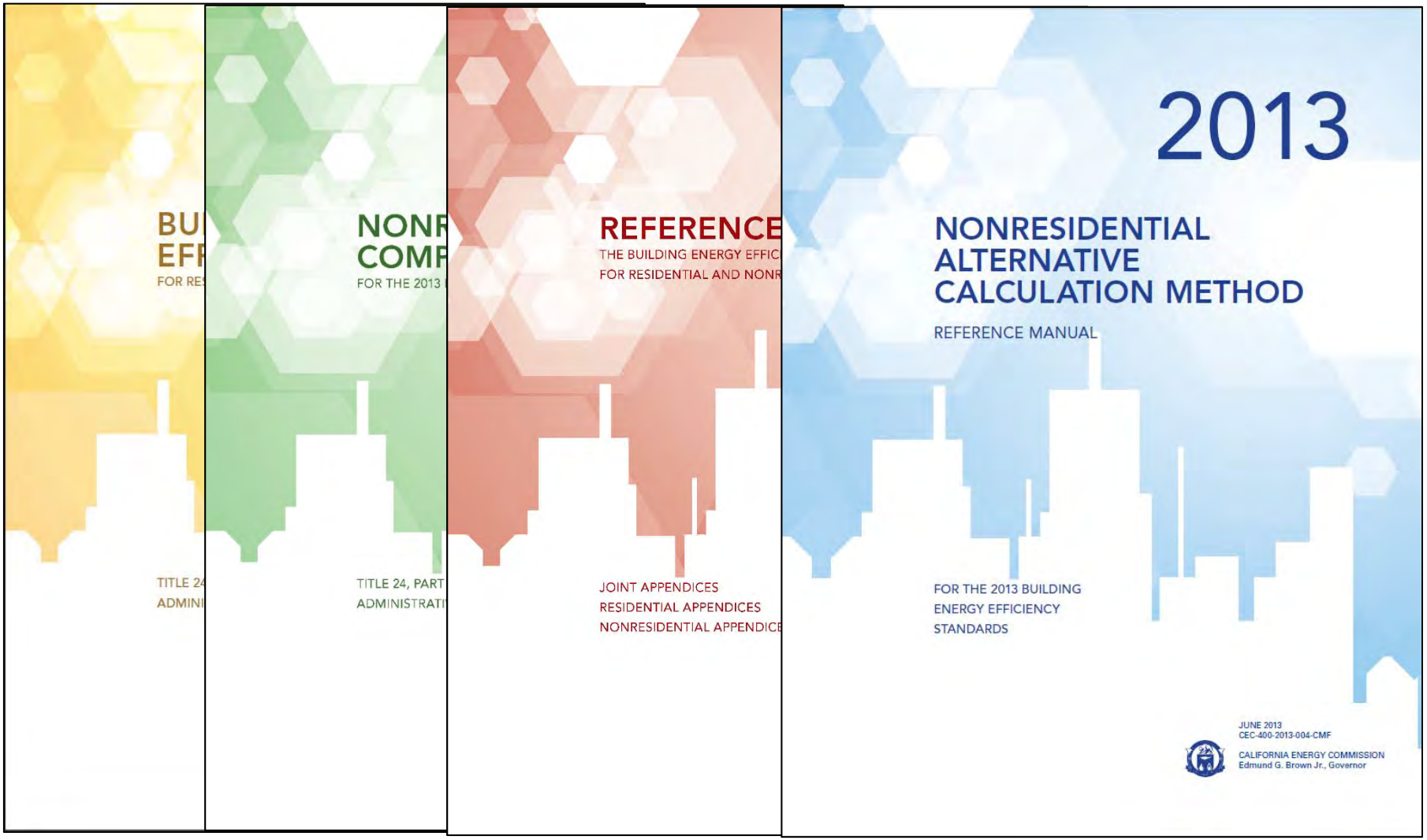
How to efficiently use the program.

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

How to look for buried problems within a given model?

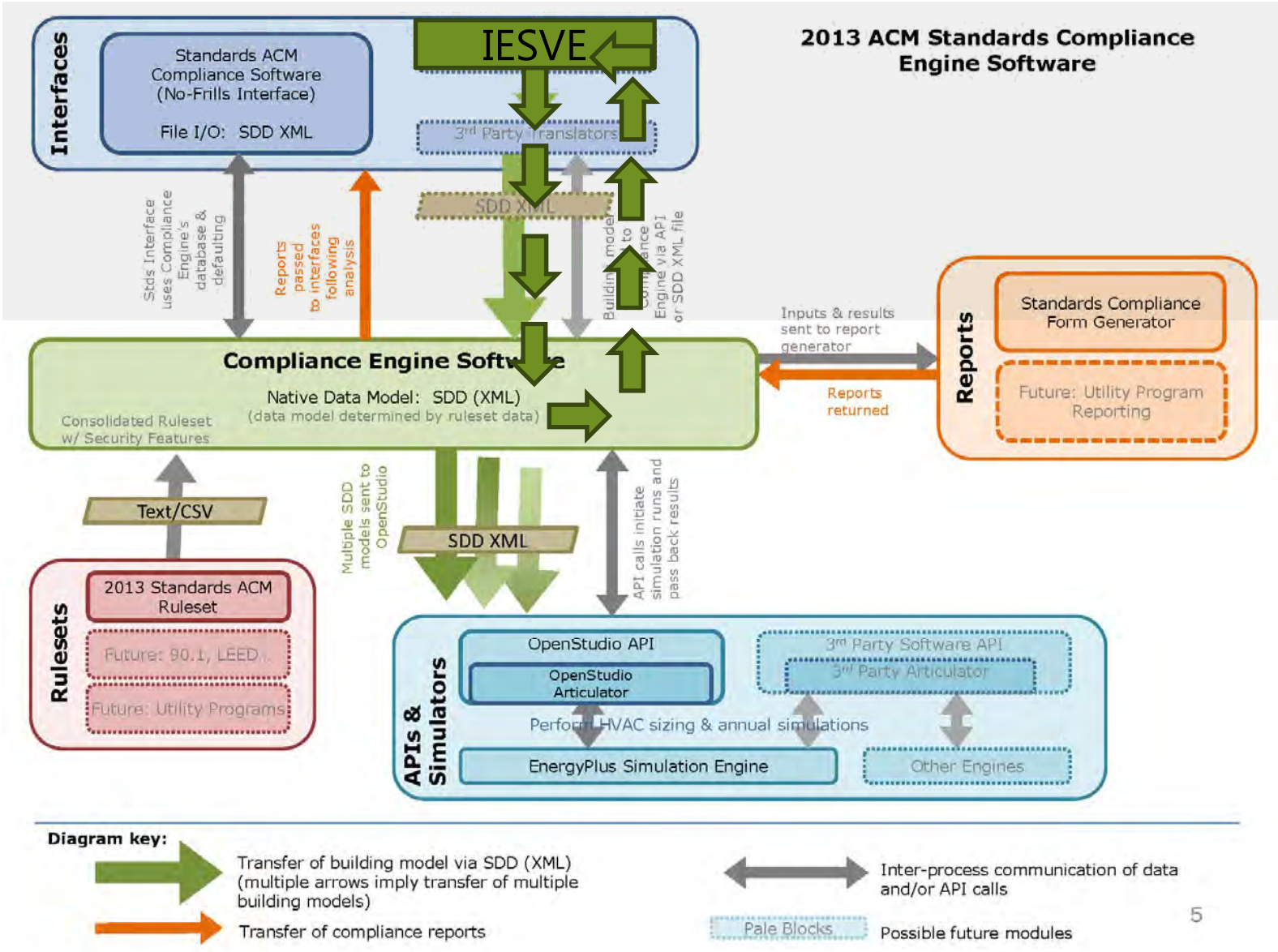
Will the time invested be worth the effort.

Code: CEC Documents



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

What's Under The Hood?



Let's Talk

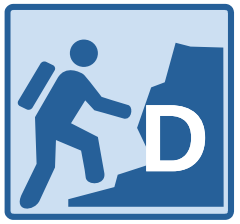
- Welcome
- What We Heard from You
- **Let's Talk**
  - Here, Now and Next
- Next Steps
- Wrap Up

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

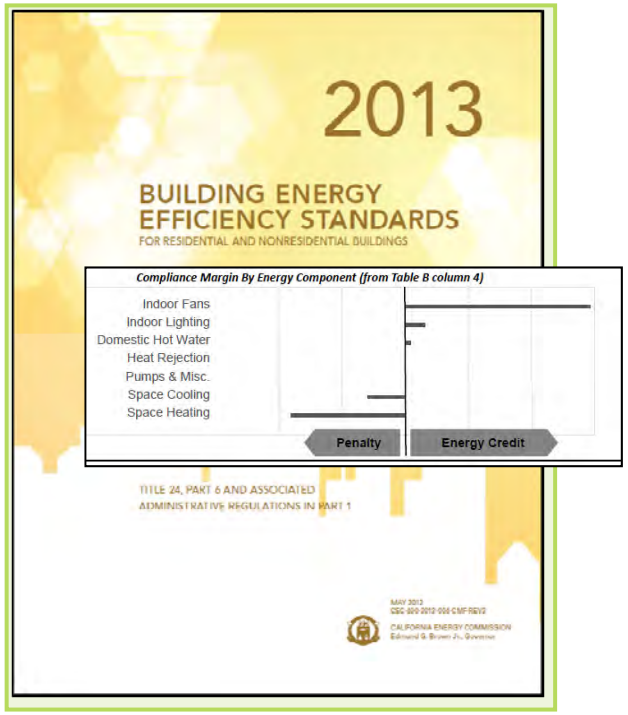
What are the goals?

- Modeling objectives
  - How does that effect your modeling?

How does it work?

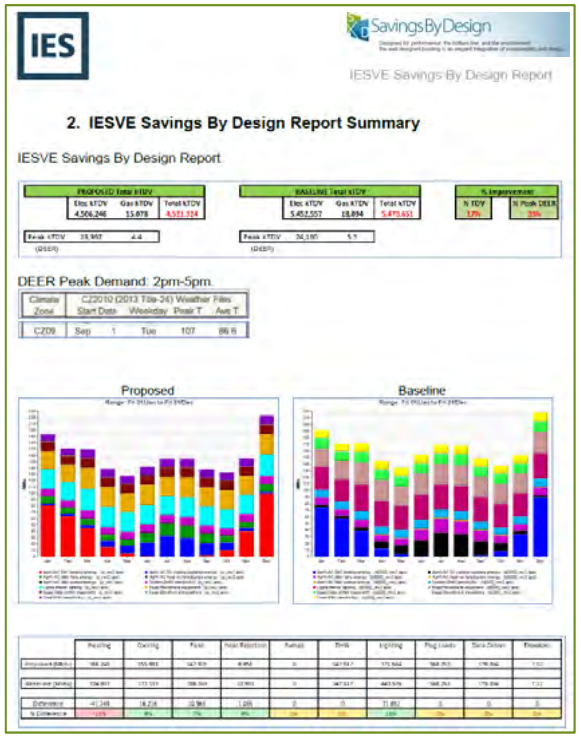
- 3D Model Interoperability
  - Where is it coming from?
- Why use a 3D (detailed) model?
  - Daylighting and how it affects the compliance numbers.
- How can I do this?

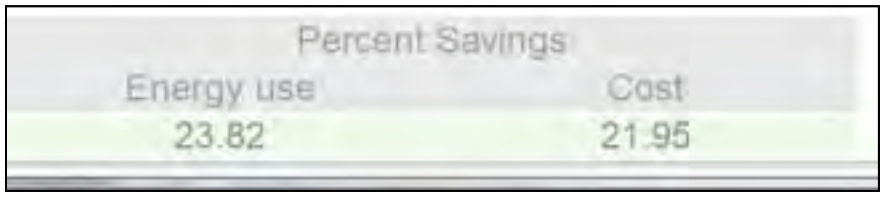
What Are The Goals?



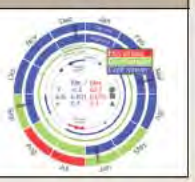
Modeling Objectives

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

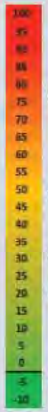




ASHRAE Zero-Net Energy Winners

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

EUI



- ASHRAE 90.1 Baseline
- ECMs Envelope, Shading, Internal Gains
- ECMs: Natural Ventilation
- ECMs: HVAC, Energy Recovery
- ECMs: Renewables -2.6kBtu/ft²/yr

1. 16,500 ft² of PV-T Panels
2. Passive Evaporative Down-Draft Cool Towers
3. Draft Lobby to reduce infiltration

Zero Net Energy Project Description

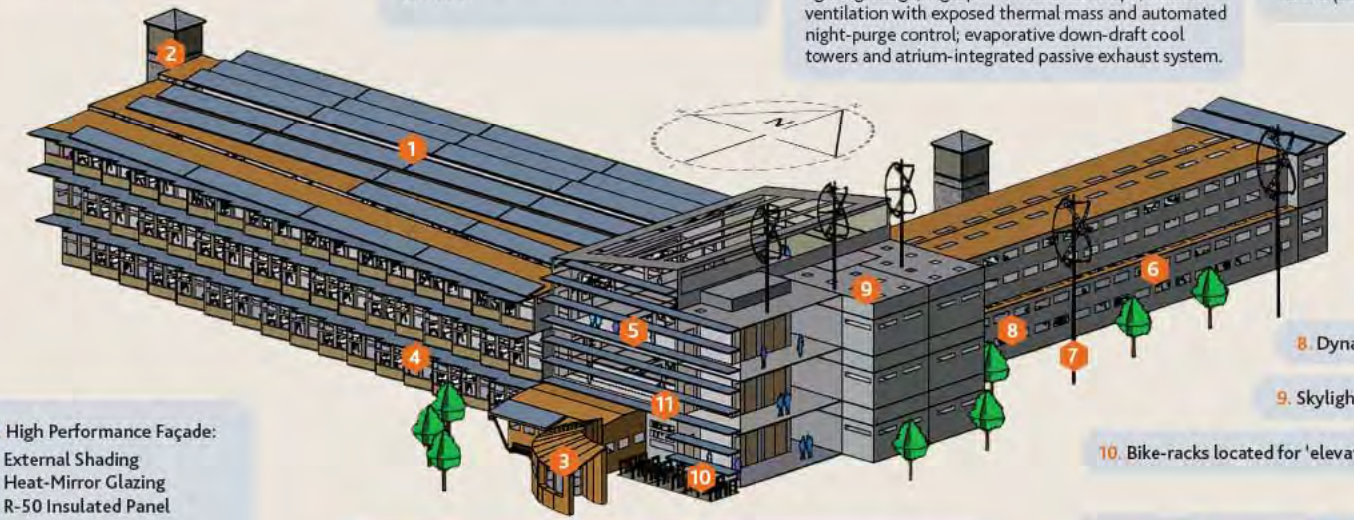
This three-story, 53,600 ft² office building is located in downtown Boulder. The climate experiences vast variations including annual external temperatures (-4° F to 93°F); (6% -100% Relative Humidity) and commonly occurring night-to-day temperature swings of +35°F.

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.

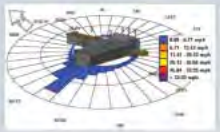
Future-proofing ZNE Status

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).

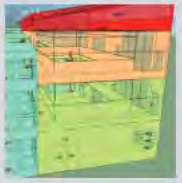


6. Natural Cross-Ventilation
7. Vertical-Axis Wind Turbines
8. Dynamic Blinds on East/West façades
9. Skylights assist with daylight harvesting
10. Bike-racks located for 'elevator-shaming' (ECM not modeled)

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



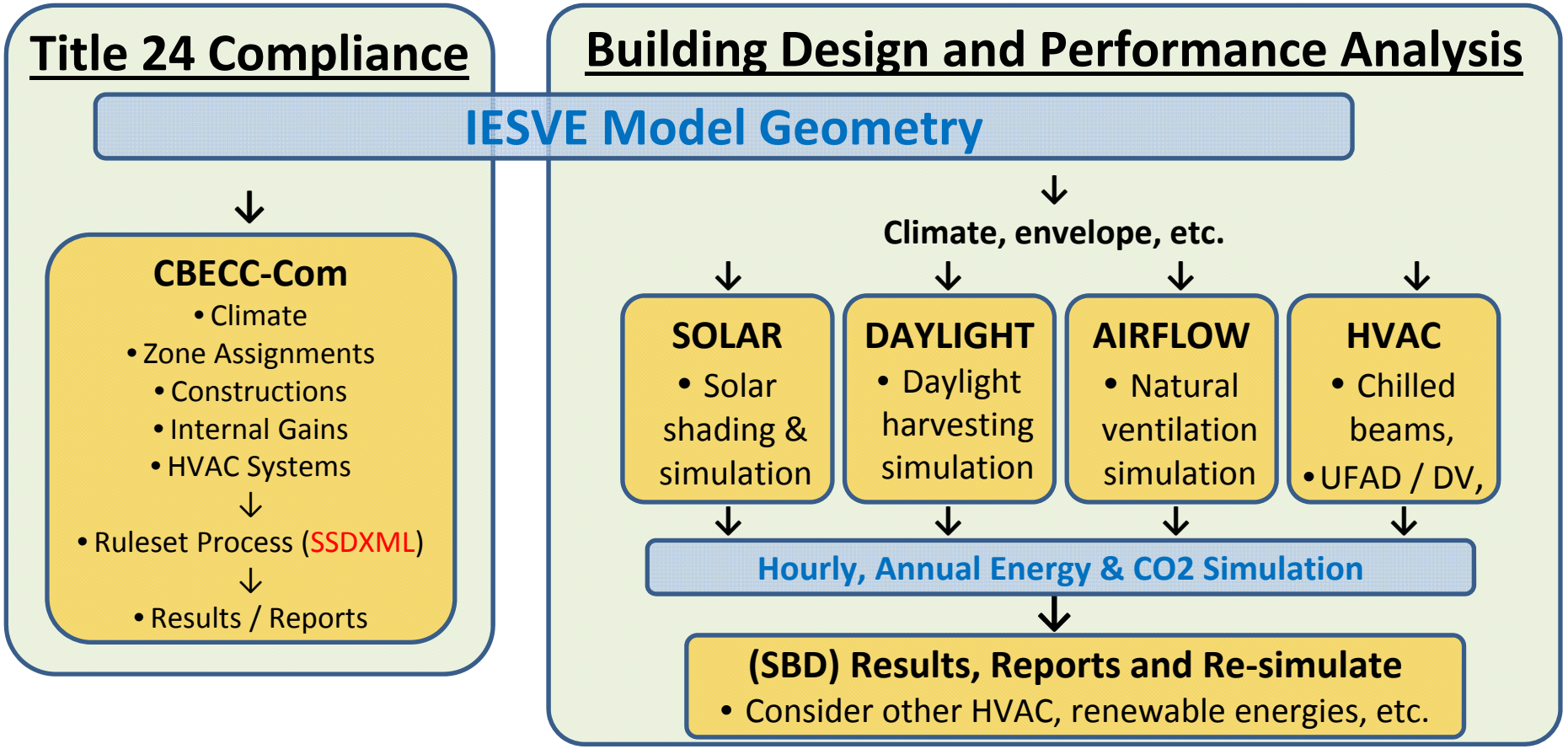
5. Airflow-Integrated Atrium
   - External: Funnels air towards wind-turbines
   - Internal: Passively induces air from office spaces

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 ≠ Energy Modeling

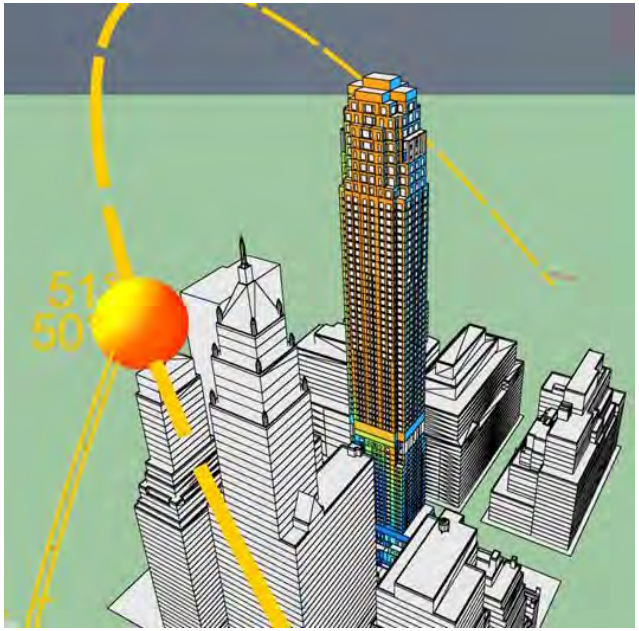
Proposed Rulesets for Compliance

- 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?

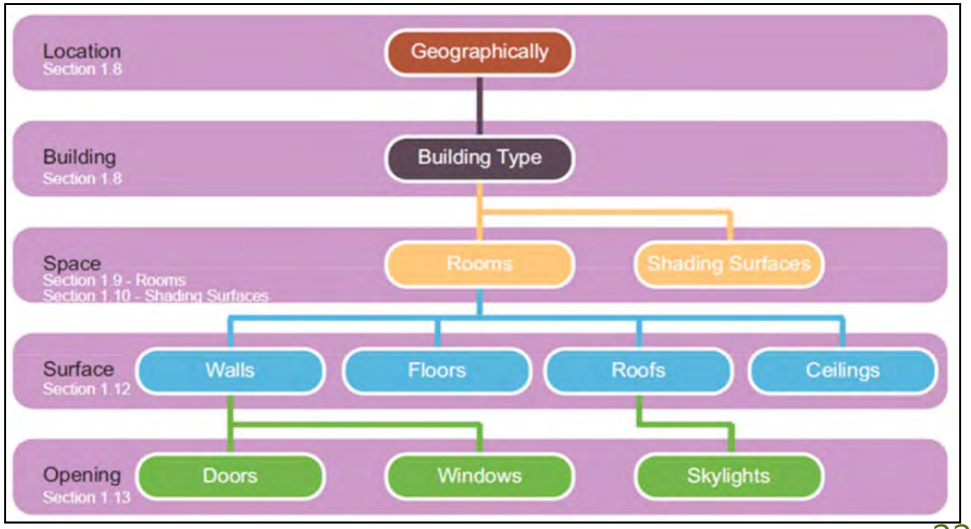
- The drawing needs to come from somewhere.
  - What will you be provided?
- Some drawings may need to be altered to be applicable to the run of choice (see "What are the goals")
  - Zoning
  - Fenestration shading
  - Lighting
  - Etc.

How Does It Work?

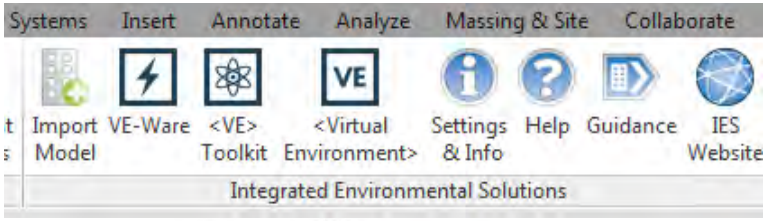
3D Model Interoperability

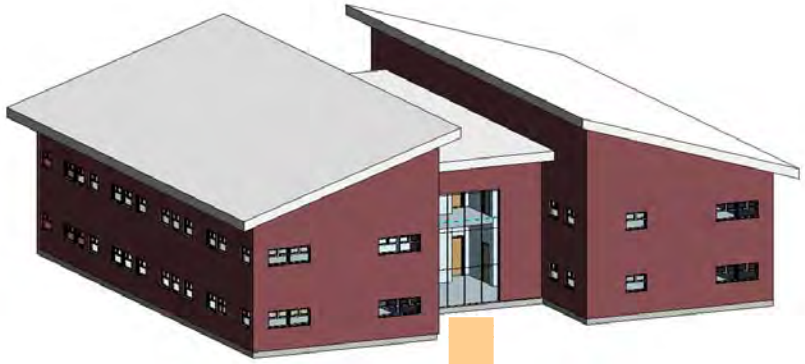
Modeling Software	File Types
AutoCAD, DraftSight	.dwg .dxf
ArchiCAD	.pln .pla
REVIT	.rvt
SketchUp	.skp
Rhino	.3dm
Vectorworks	.ifc
Green Building XML	.xml
IESVE ModelIT	.mit, .gem, osm, .cab

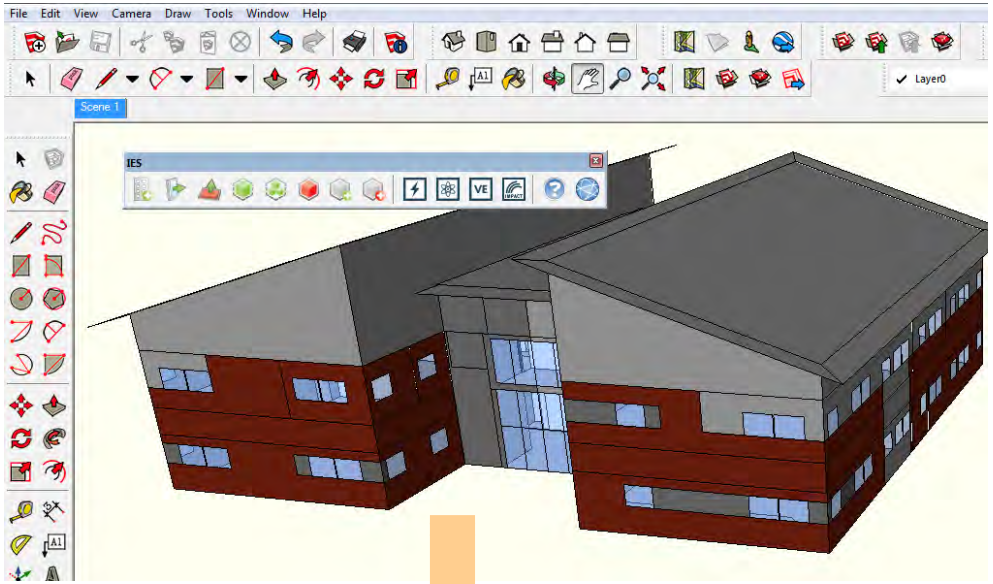
- gbXML file structure:



How Does It Work? (3D Plugins)







Revit To IESVE

www.youtube.com/IESVE

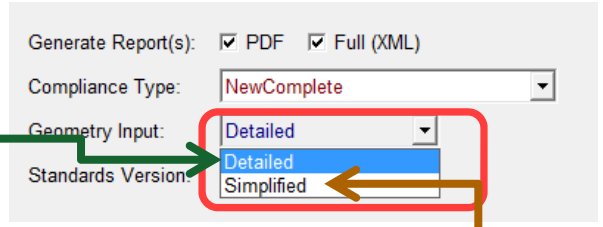
SketchUp Pro To IESVE

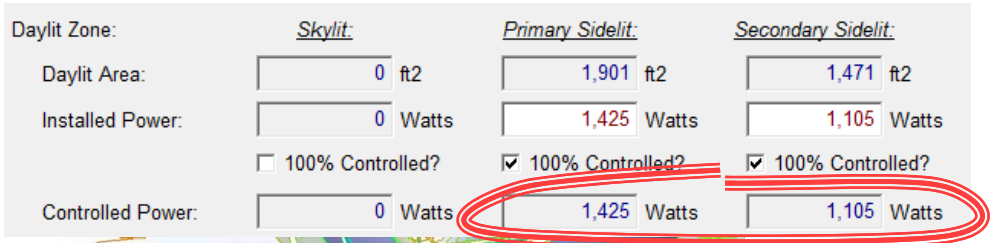
Why Use a 3D Detailed Model?

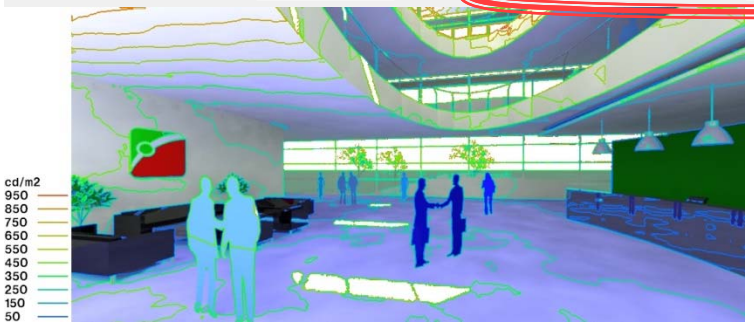
- Achieve a **Better** Title 24 Compliance score (% better than baseline).
- Other Codes & Standards are migrating this into the mandatory language (LEED v4, ASHRAE 90.1-2010) for daylight dimming controls.
- Aligns with alternative 3D design services (BIM, LEED, etc.).

Understanding how CBECC-Com treats the geometry:

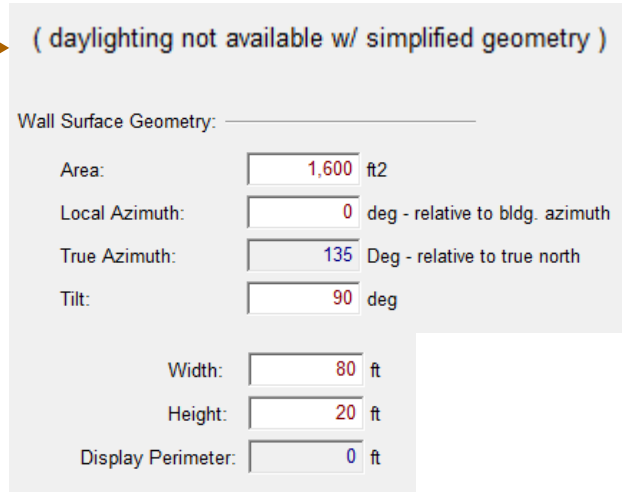
Detailed geometry:







Simple geometry:

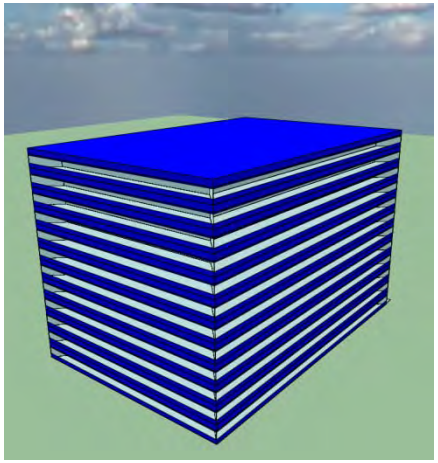


Why Use a 3D Detailed Model?

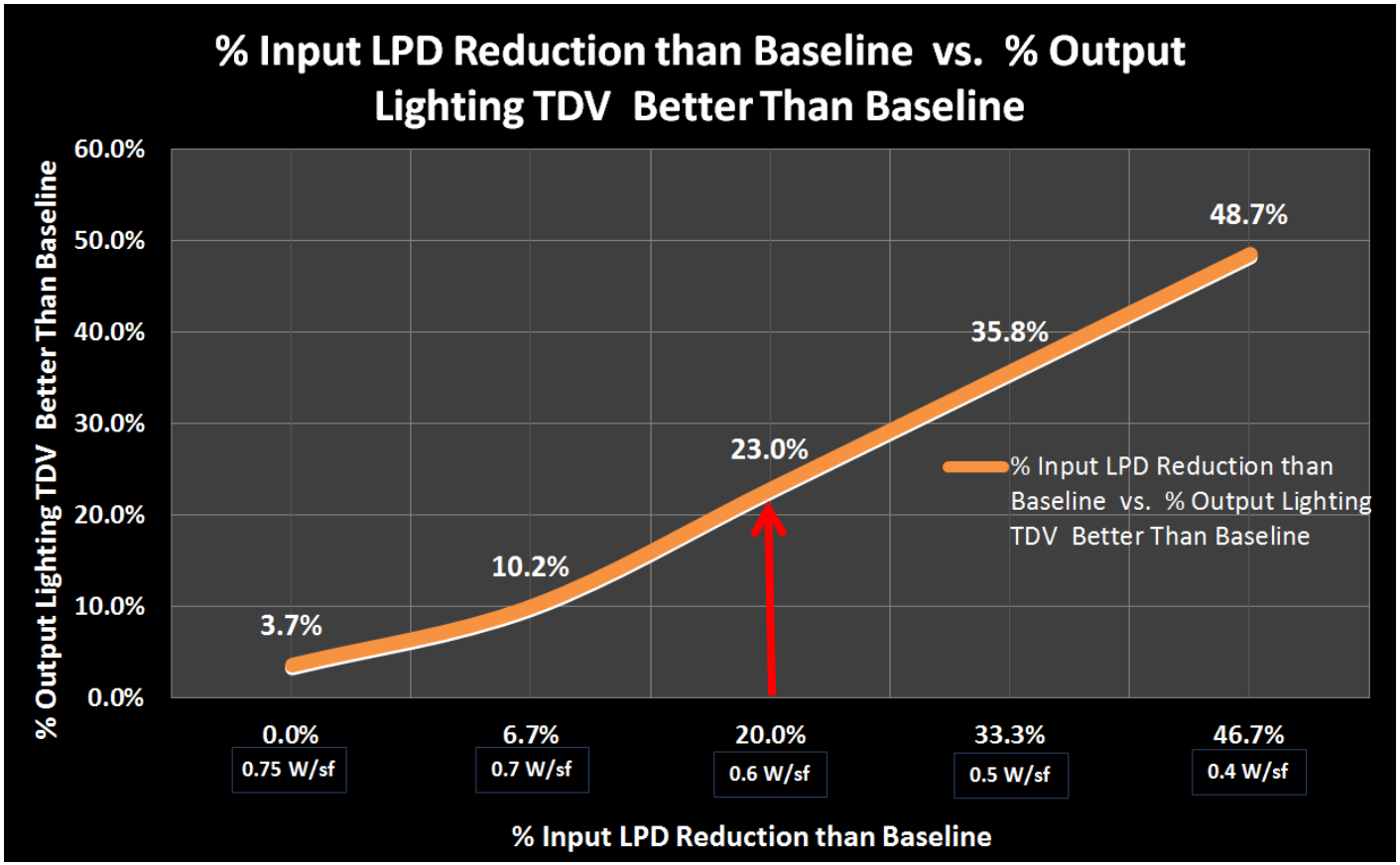
3D Model Advantages with Daylighting

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

Large Office Title 24 Standard Building:



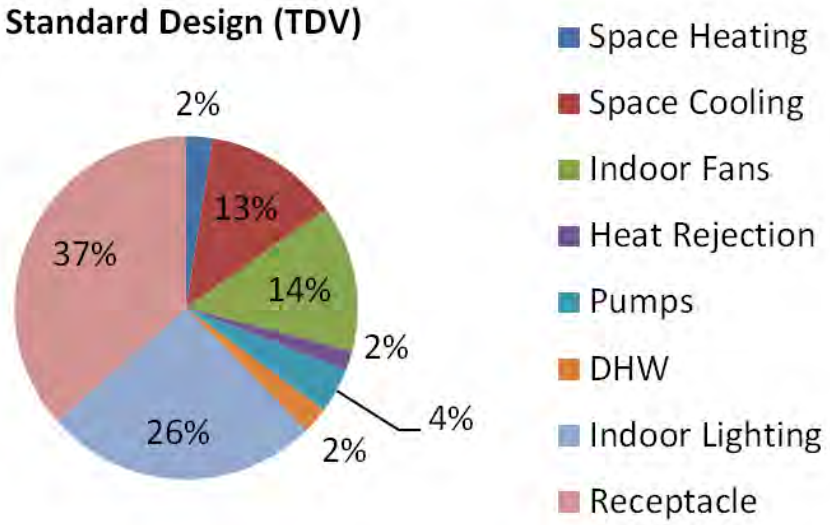
Using continuous daylighting dimming (plus off) controls

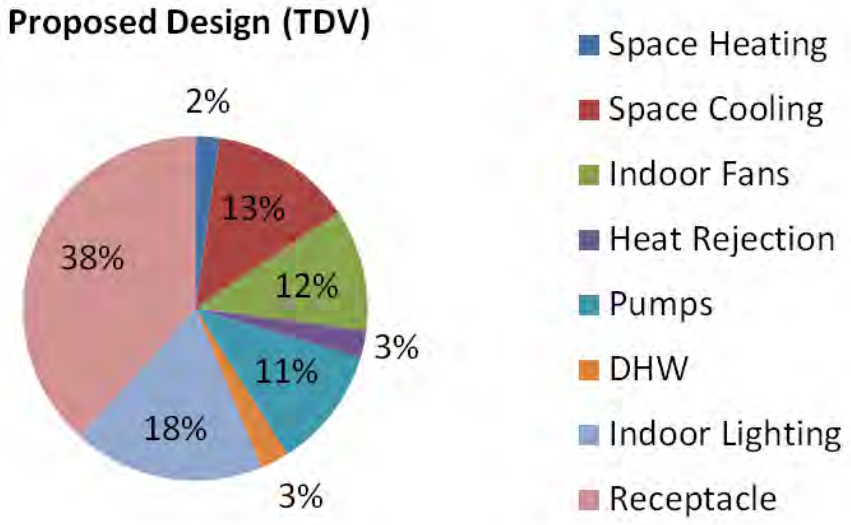


Why Use a 3D Detailed Model?

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.



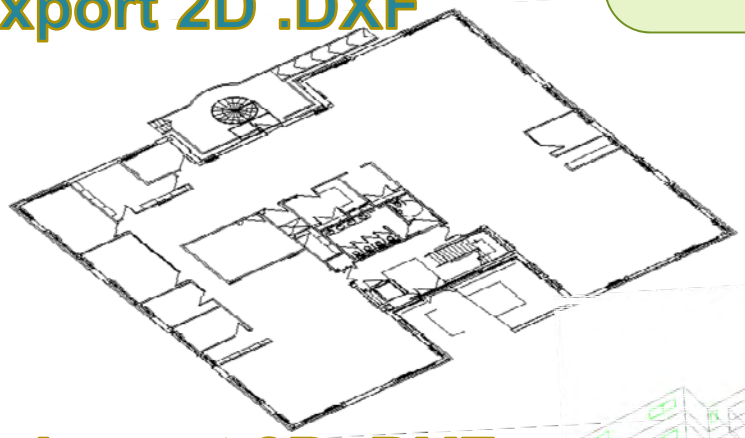


Where is it coming from? 2D

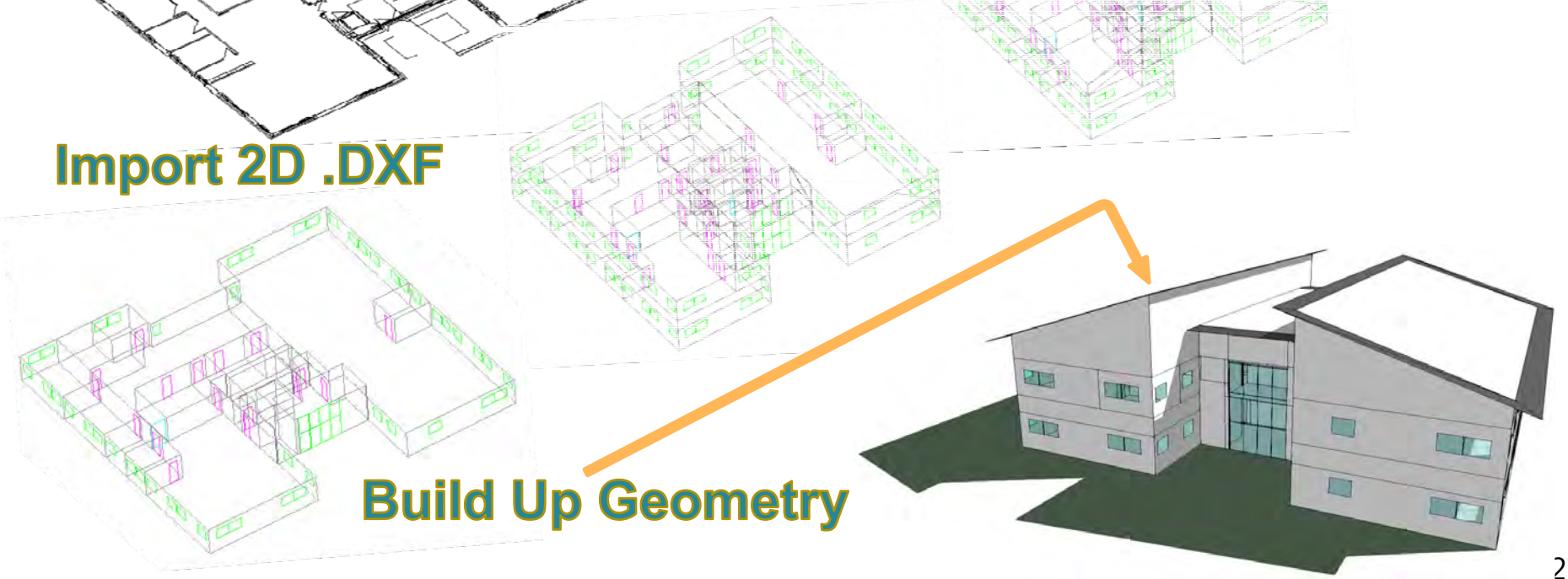
The 3D Model from 2D Drawings

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

Export 2D .DXF



Import 2D .DXF

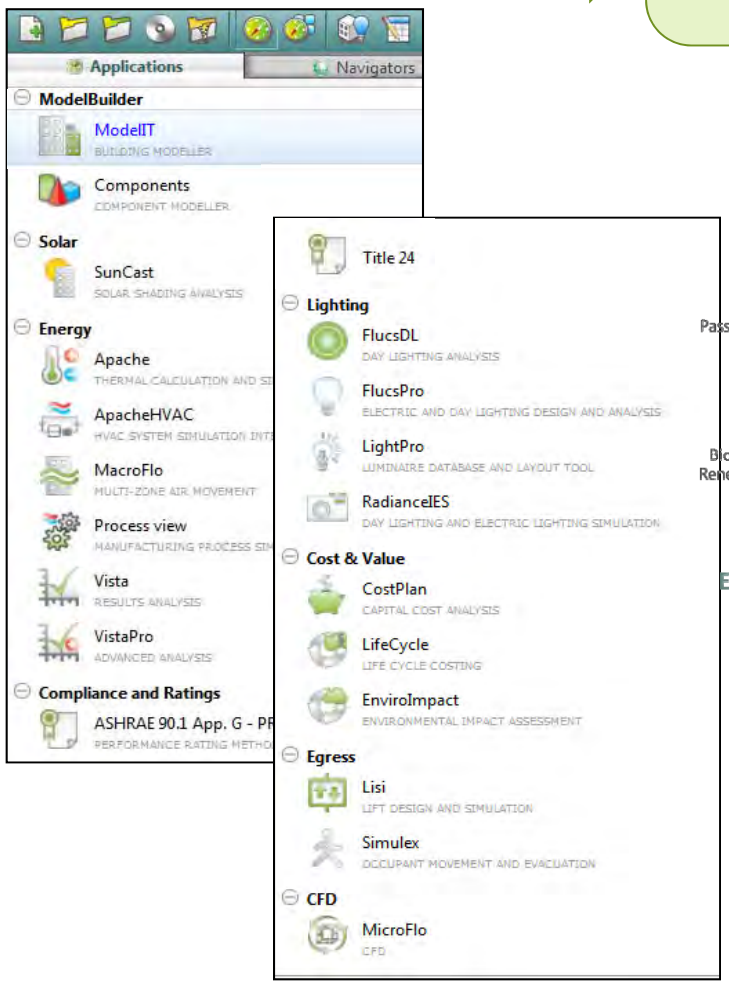


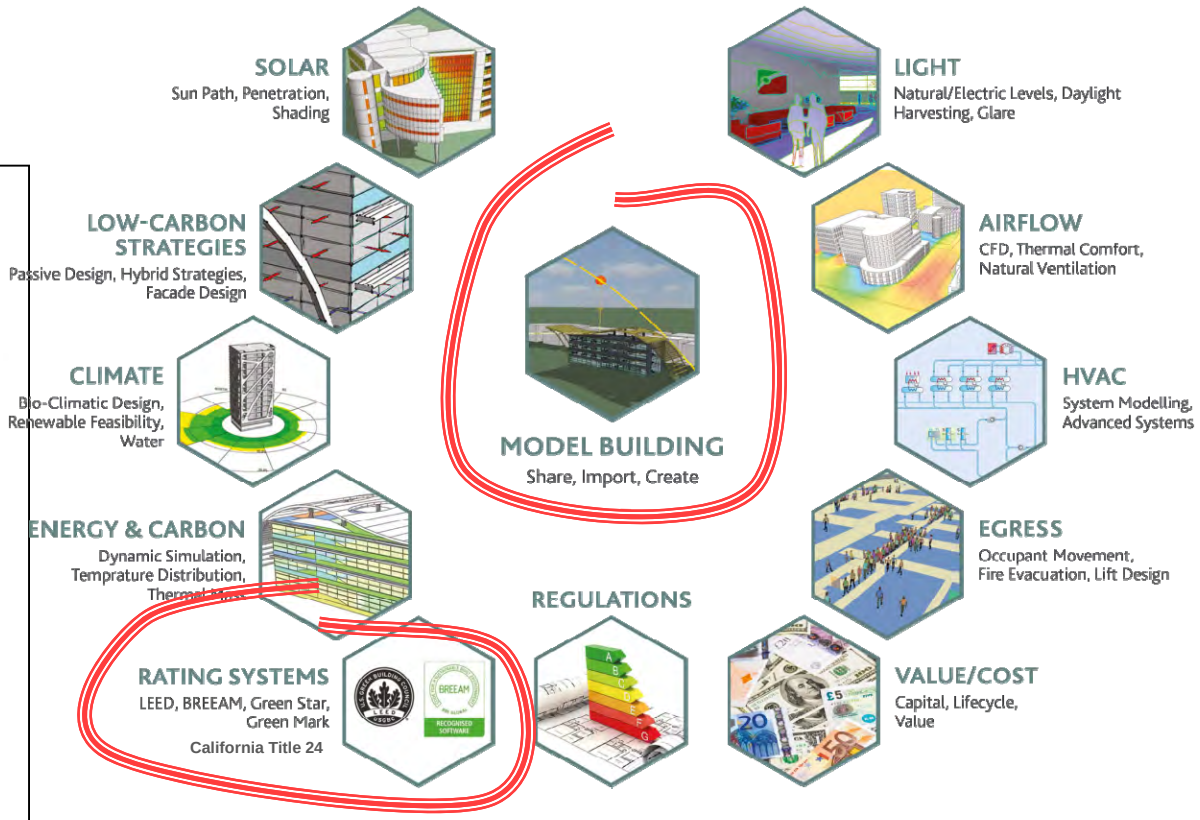
Build Up Geometry

Where is it coming from?

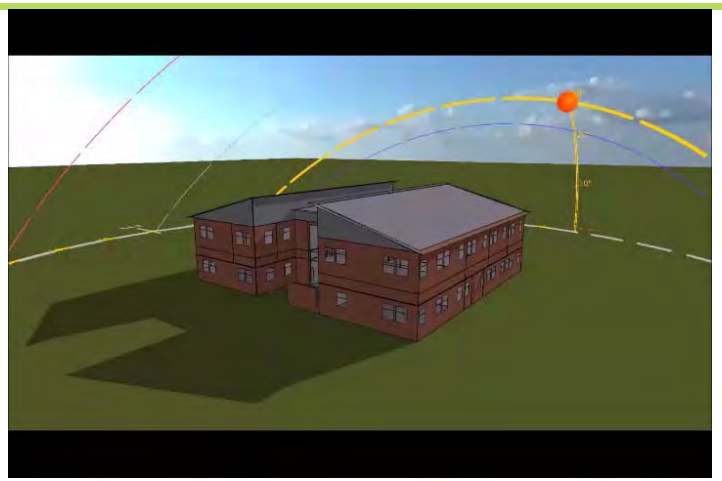
The 3D Model from 2D Drawings

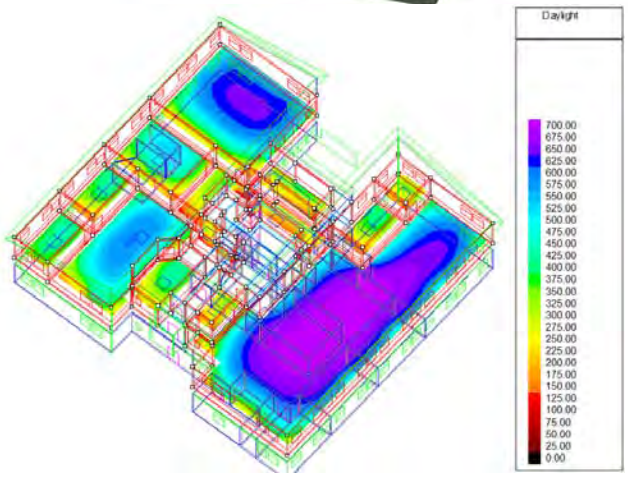
- Once 3D Model is built (ModelIT)
- Perform Various Analysis (Eg. Title 24)

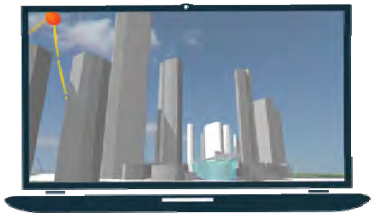




Where is it coming from?







DESIGN

COMMISSIONING

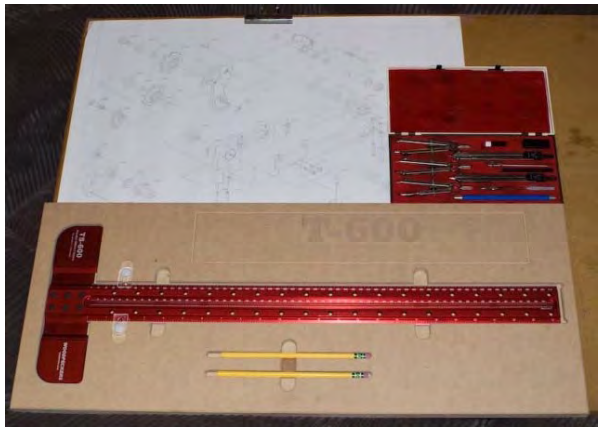
OPERATION

IESVE SOFTWARE

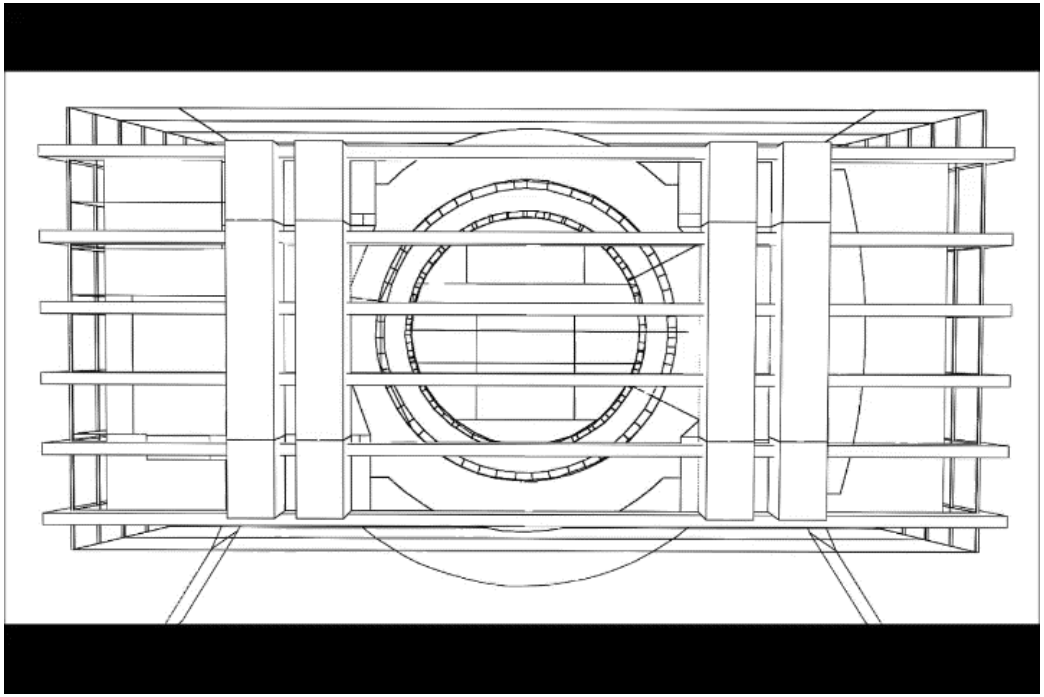
Integrated solutions at all stages of design and beyond

How Can I Do This?

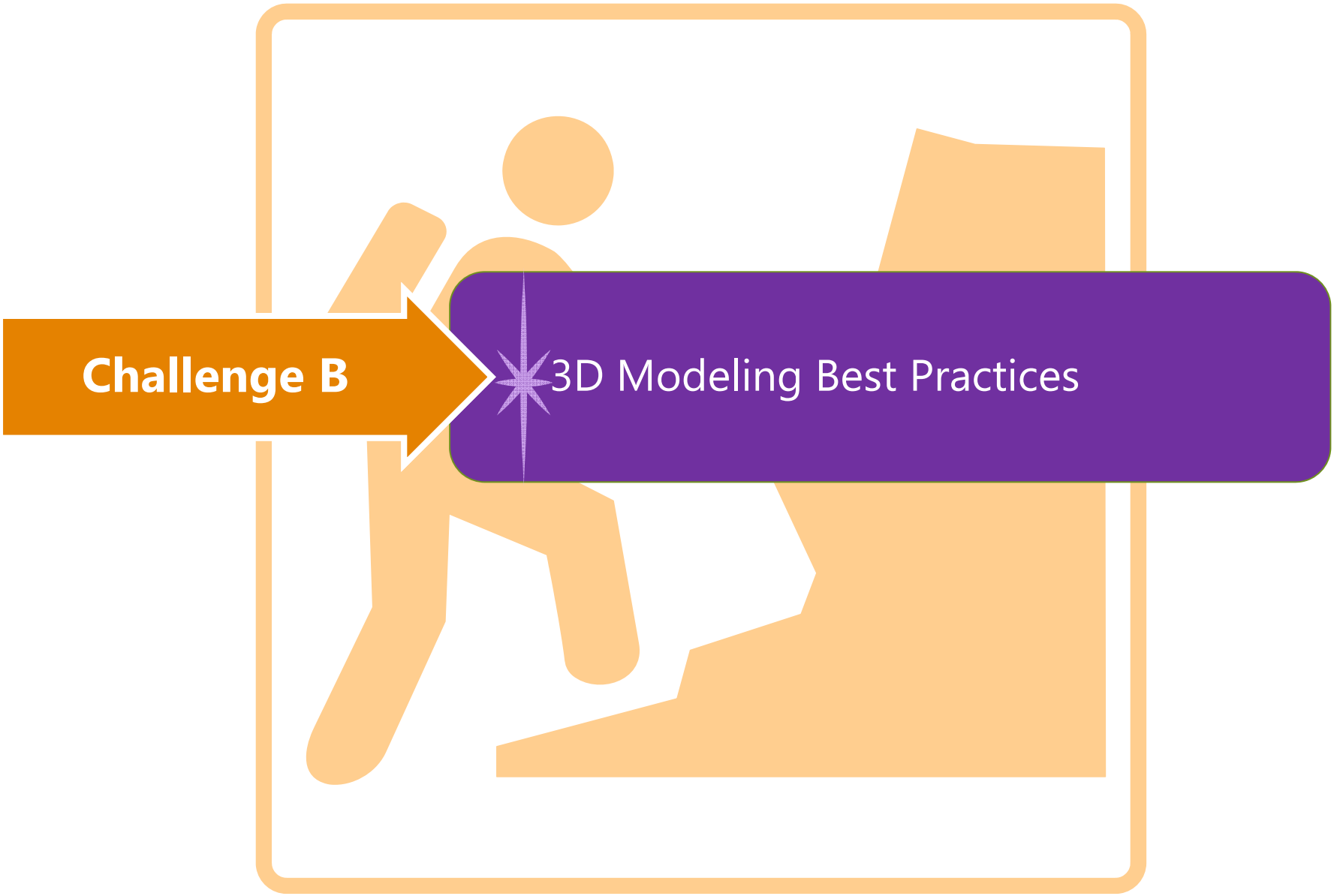
Making the transition from 2D to 3D



- 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: Best Practices for 3D

Liam's Guide to Success

Setting It Up Right

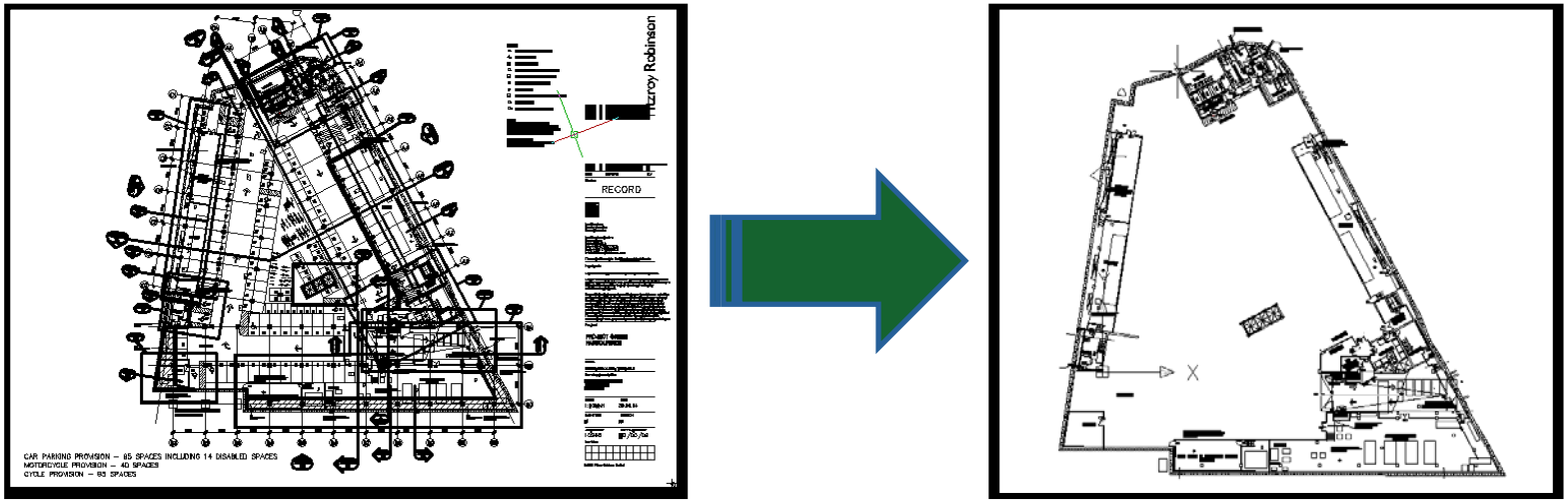
- Importing
- Defining the model settings
- Editing
  - Copy/ Paste / Replace
- Check your work!
  - Use the 3D visual tools
  - HVAC Loads
- HVAC parent/child relationships

What Is Applicable?

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

Best Practices – Setting up the model

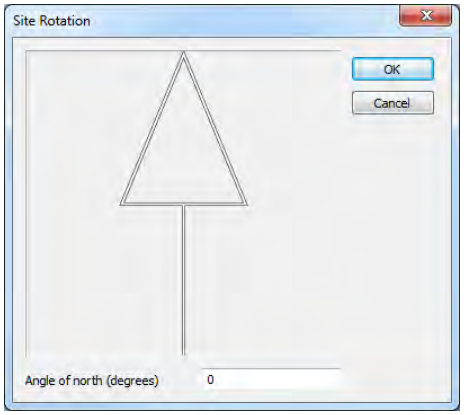
- Importing the model from elsewhere
  - gbXML – know it's limitations (YouTube, DL Training)
- Revit Imports:
  - Turn inner volumes off; note the origin coordinates
- When building the model from scratch & using drawings:

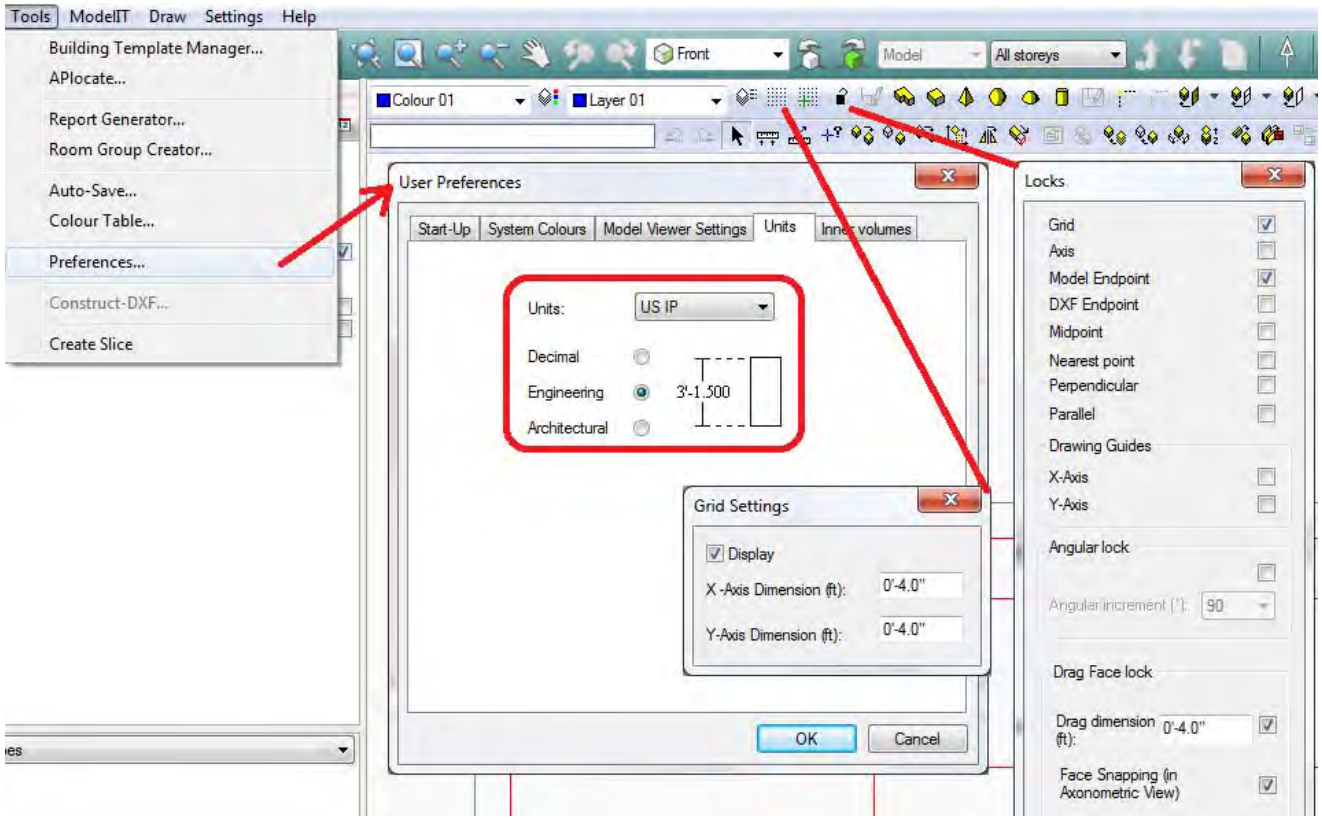


- Copy floor plan .dwg onto a new drawing & save-as a .dxf format

Best Practices – Setting up the model

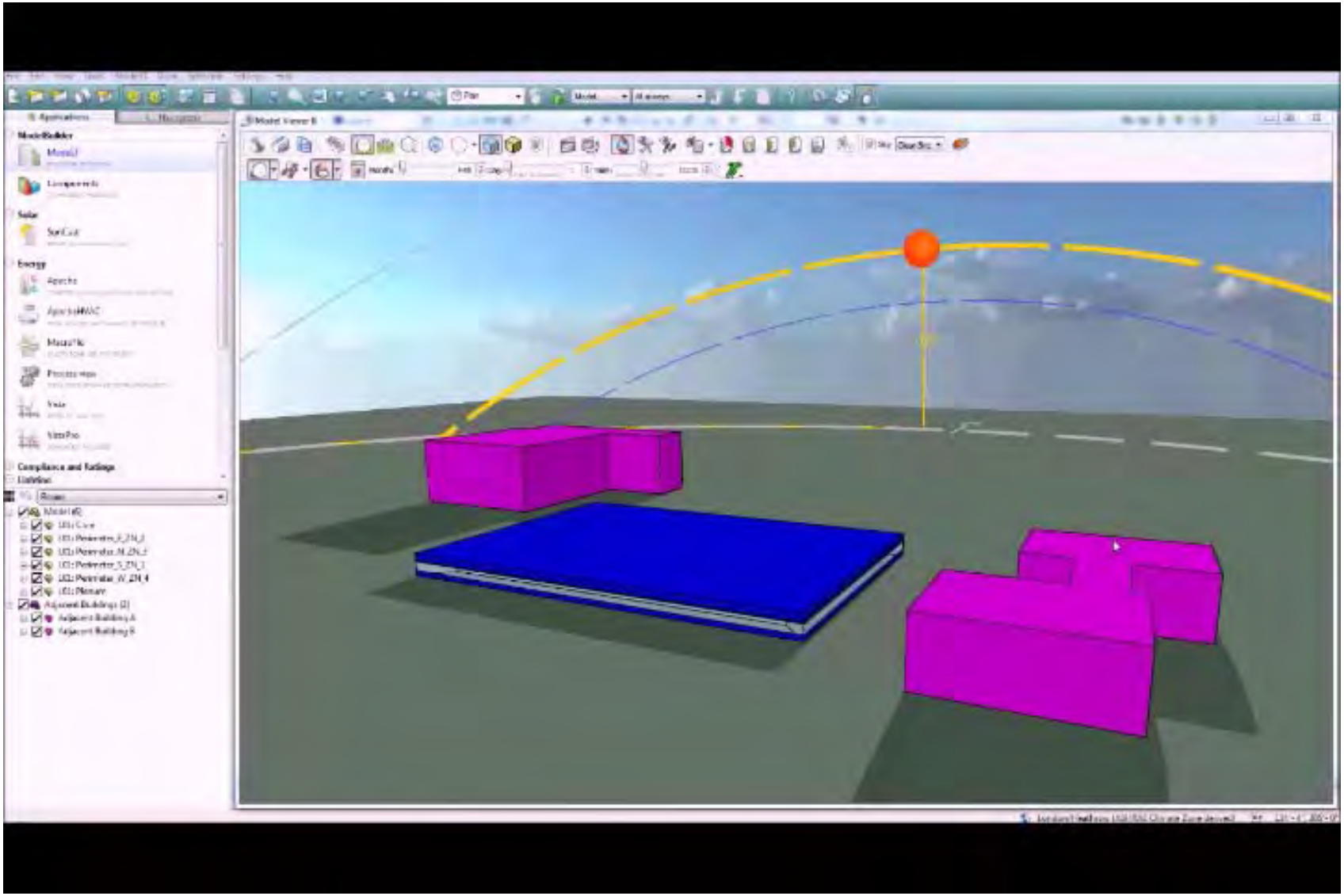
- Measure Distance across the door
- Building Orientation vs Model Rotation:
- Model Building Settings:





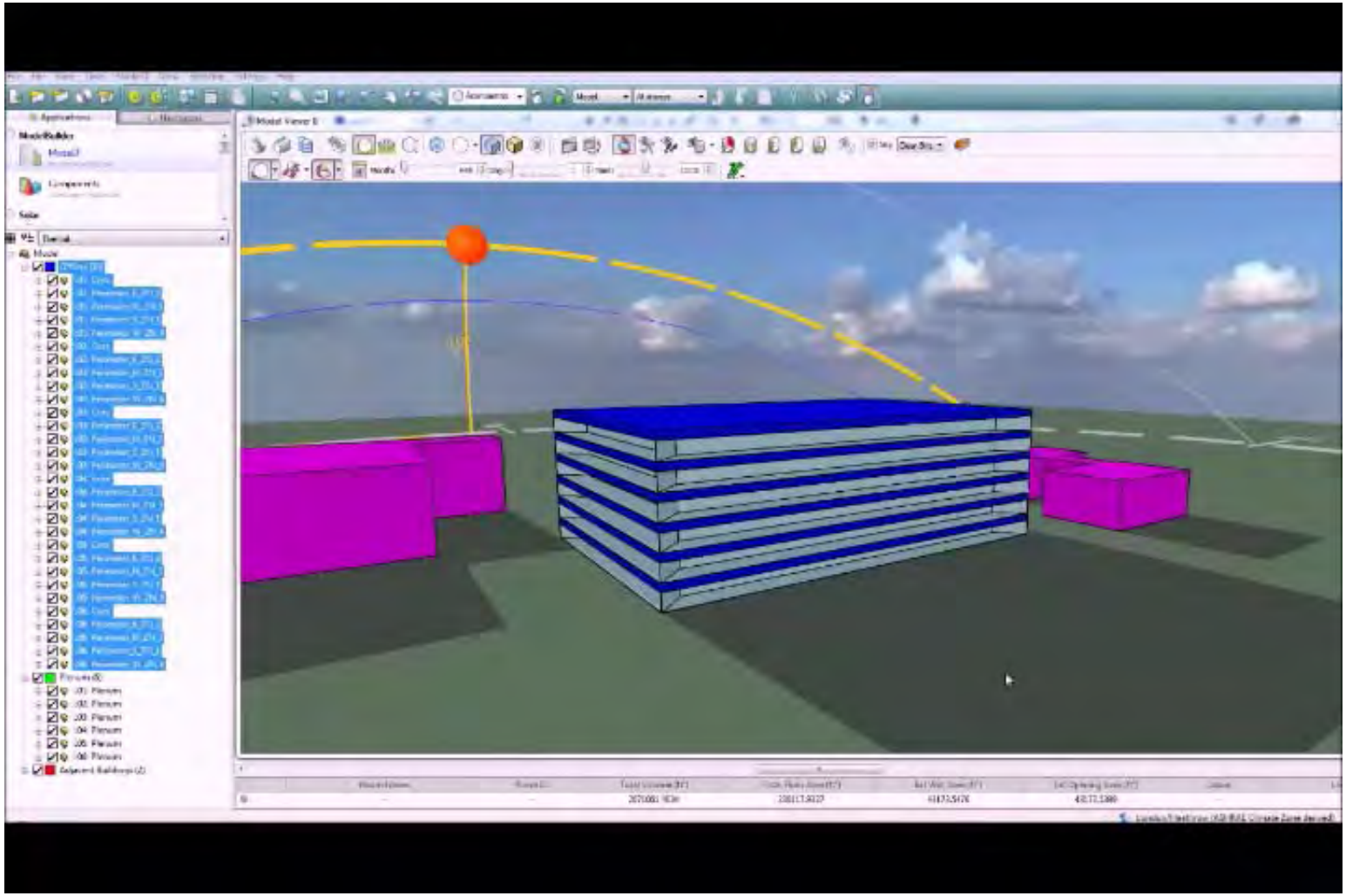
Best Practices – Setting up the model

- Copying Floors – video demo



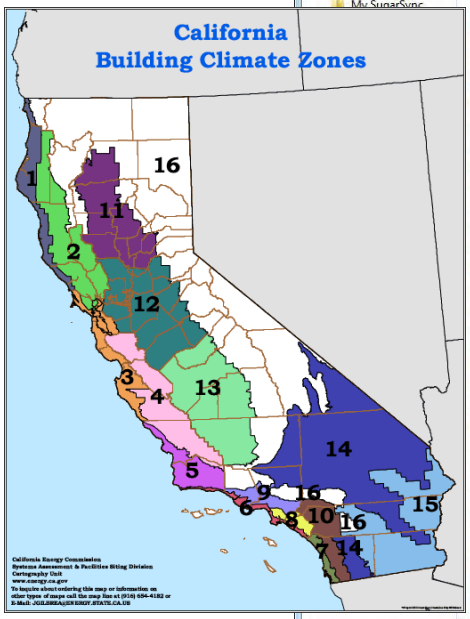
Best Practices – Setting up the model

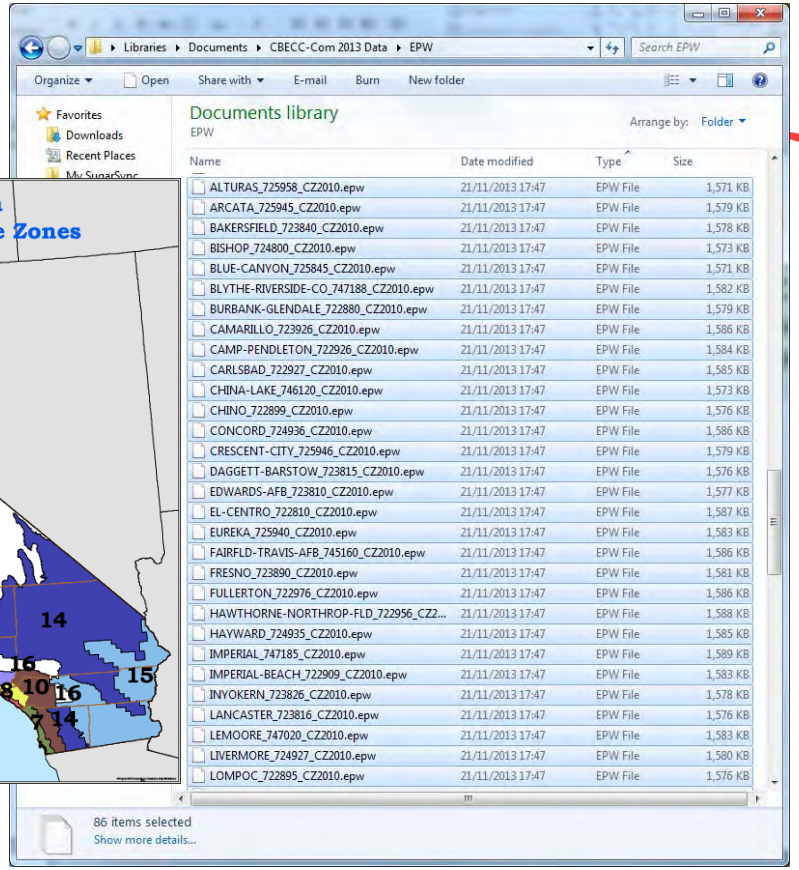
- Quick Glazing Area Study – video demo
  - Assign %WWR x (Area Total Ext. Wall / Area Selected Ext. Wall).

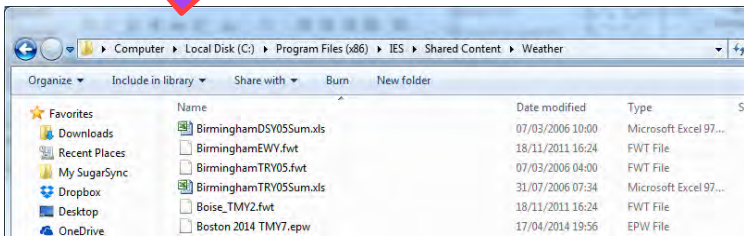


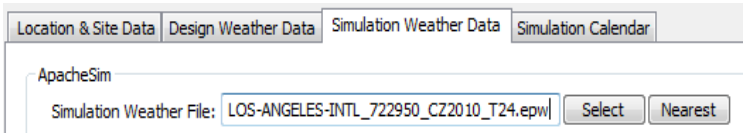
Best Practices – Climate Files

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









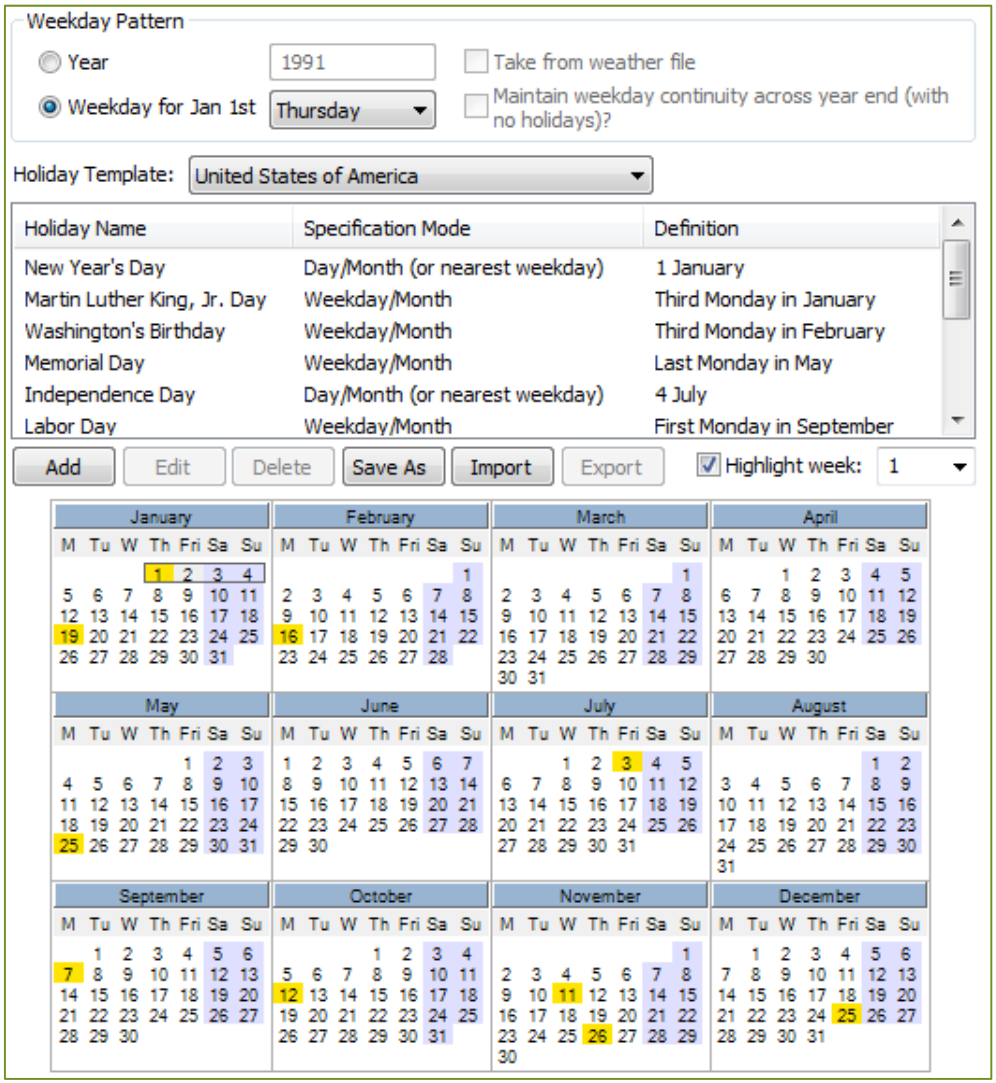
Best Practices – Climate Files

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



Best Practices – Envelope Modeling

Opaque Constructions:

- Must use Title 24 materials

Surfaces | Functional Settings | Regulations

Air - Metal Frame Status: New (New / Existing / Altered)

Construction Layers (Outside To Inside) Project Materials...

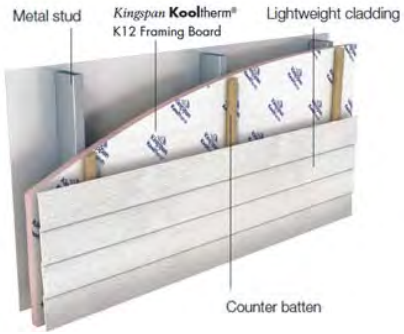
Material	Thickness in	Conductivity Btu·in/h·ft²·°F	Density lb/ft³	Specific Heat Capacity Btu/lb·°F	Resistance ft²·h·°F/Btu	Vapour Resistivity (perm·in)^-1	Category
[T24_0060] Concrete - 140 lb/ft3 - 8 in.	8.00"	13.559	139.780	0.2200	0.590	-	Concrete
[T24_0143] Compliance Insulation R2.19	0.35"	0.160	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

For Title 24

For HVAC Load Calculations, energy modeling, SBD, etc

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

Composite Constructions:



Title24 Composite

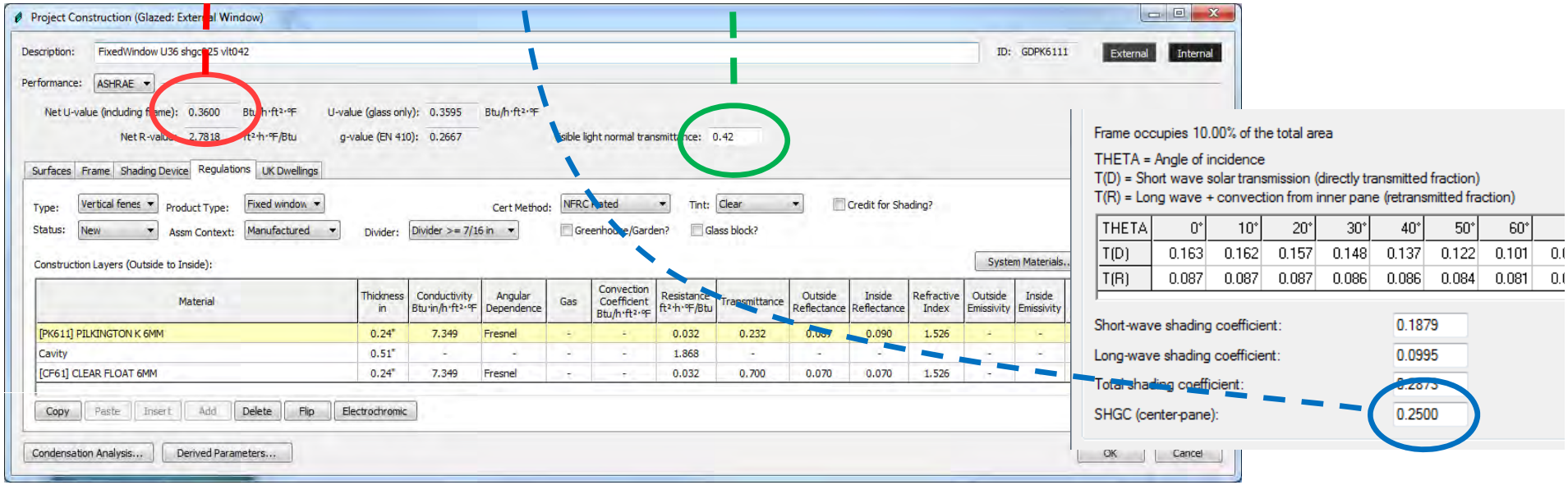
Frame material	Wood	R-value	8.76 degF-ft2-h/Btu
Frame configuration	Wall 16in OC		
Frame depth	3In	Framing factors: Cavity	0.75
Cavity insulation R-value	25.00 degF-ft2-h/Btu	Frame	0.25

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

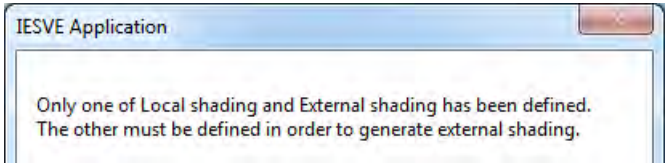
- RSHGC: Relative Solar Heat Gain Coefficient, which takes into account overhang benefits.
- All values shown for (glass + frame)



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

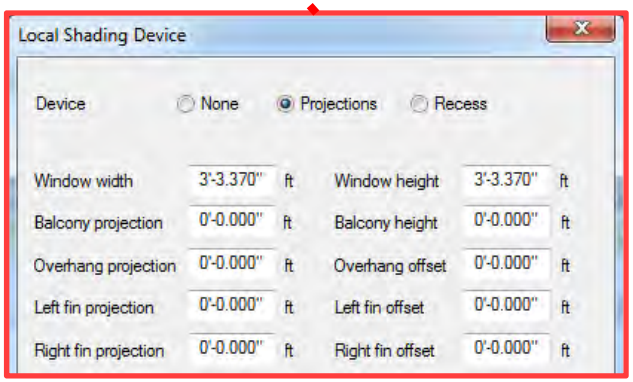
Net R-value: 3.4486 ft²·h·°F/Btu g-value (EN 410): 0.3864 Visible light normal transmittance: 0.7

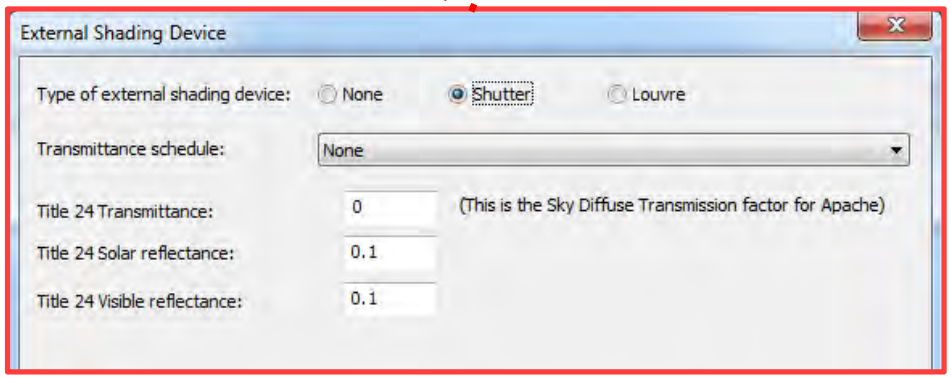
Surfaces | Frame | Shading Device | Regulations | UK Dwellings

Local Shade: ? None External Shade: ? None Internal Shade: ? None

Construction Layers (Outside to Inside): System Materials...

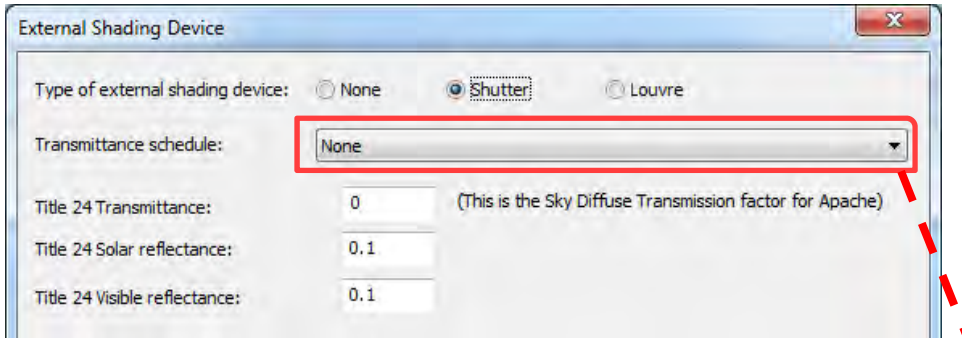
Material	Thickness in	Conductivity Btu·in/h·ft²·°F	Angular Dependence	Gas	Convection Coefficient Btu/h·ft²·°F	Resistance ft²·h·°F/Btu	Transmittance	Outside Reflectance	Inside Reflectance	Refractive Index	Outside Emissivity	Inside Emissivity	Visible Light Specified
[STD_EXW2] Outer Pane	0.25"	7.349	Fresnel	-	-	0.034	0.391	0.287	0.414	1.526	0.837	0.042	Yes
Cavity	0.51"	-	-	-	-	2.380	-	-	-	-	-	-	-
[STD_INW2] Inner Pane	0.25"	7.349	Fresnel	-	-	0.034	0.783	0.072	0.072	1.526	0.837	0.837	Yes



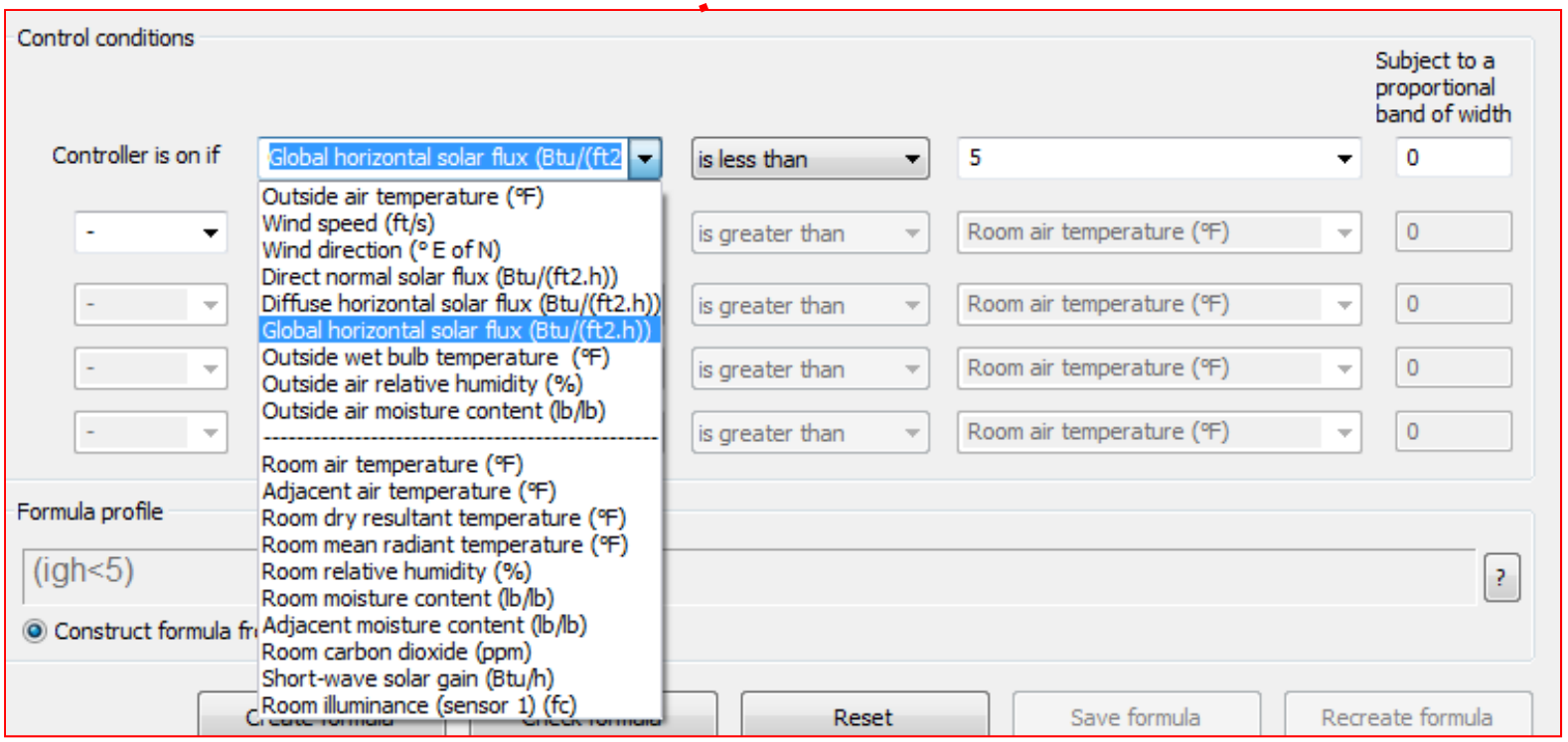


Best Practices – Shading Controls

Window Shading Controls:

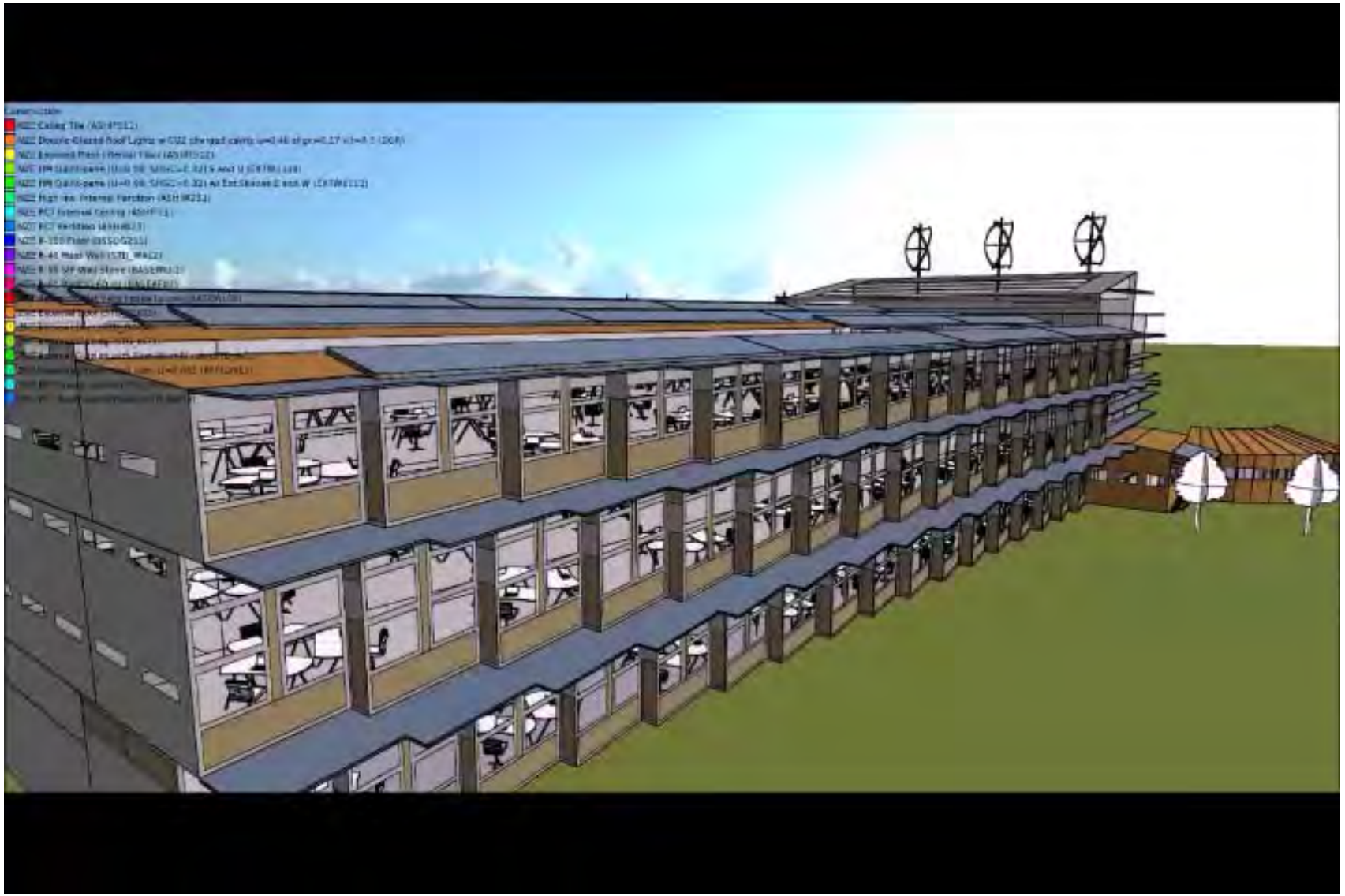


Window Shading Controls (e.g. operable blinds) for *both* Title 24 & SBD:



Best Practices – Envelope Modeling

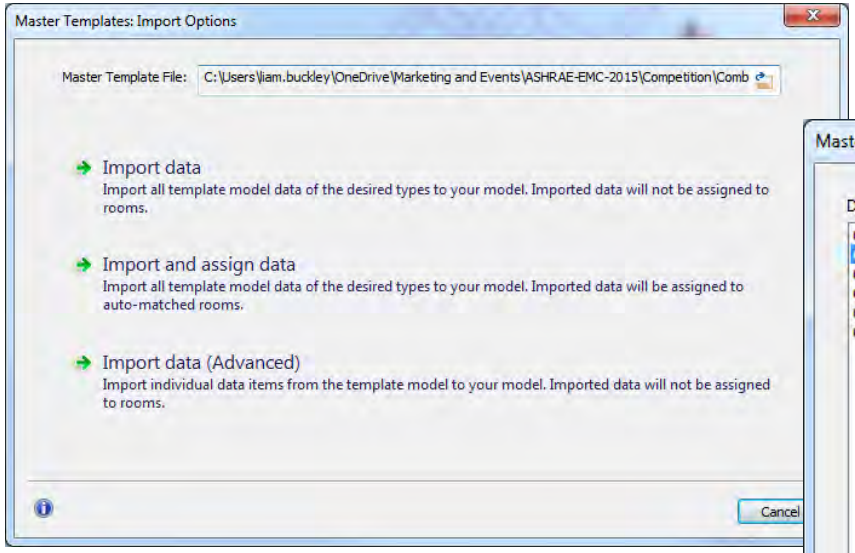
Review Envelope/Constructions Assignment:

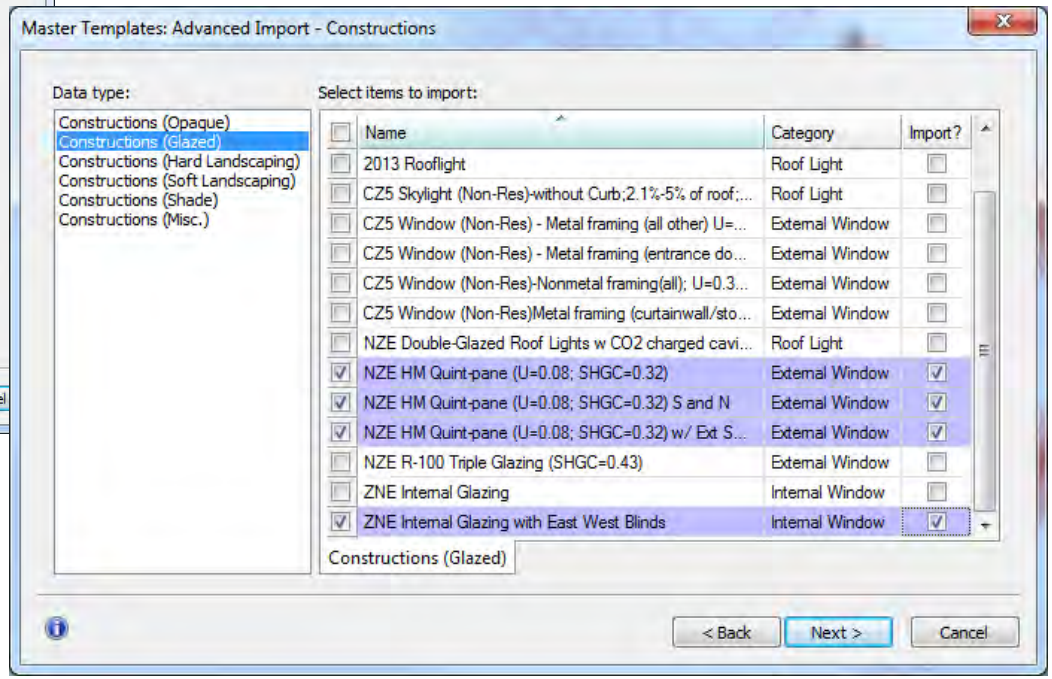


Best Practices – Envelope Modeling

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

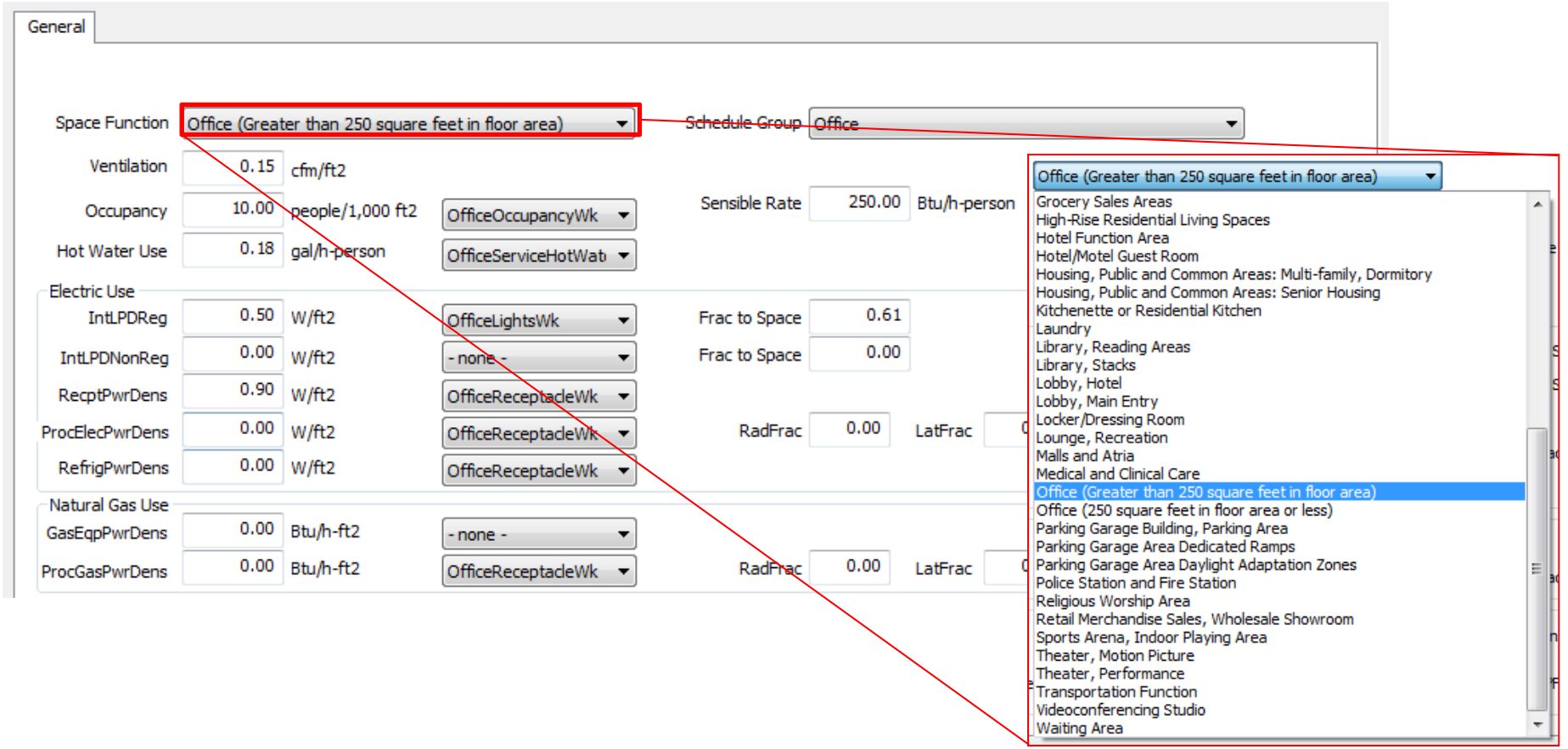




Best Practices – Thermal Templates

Thermal Templates for Better Model Management

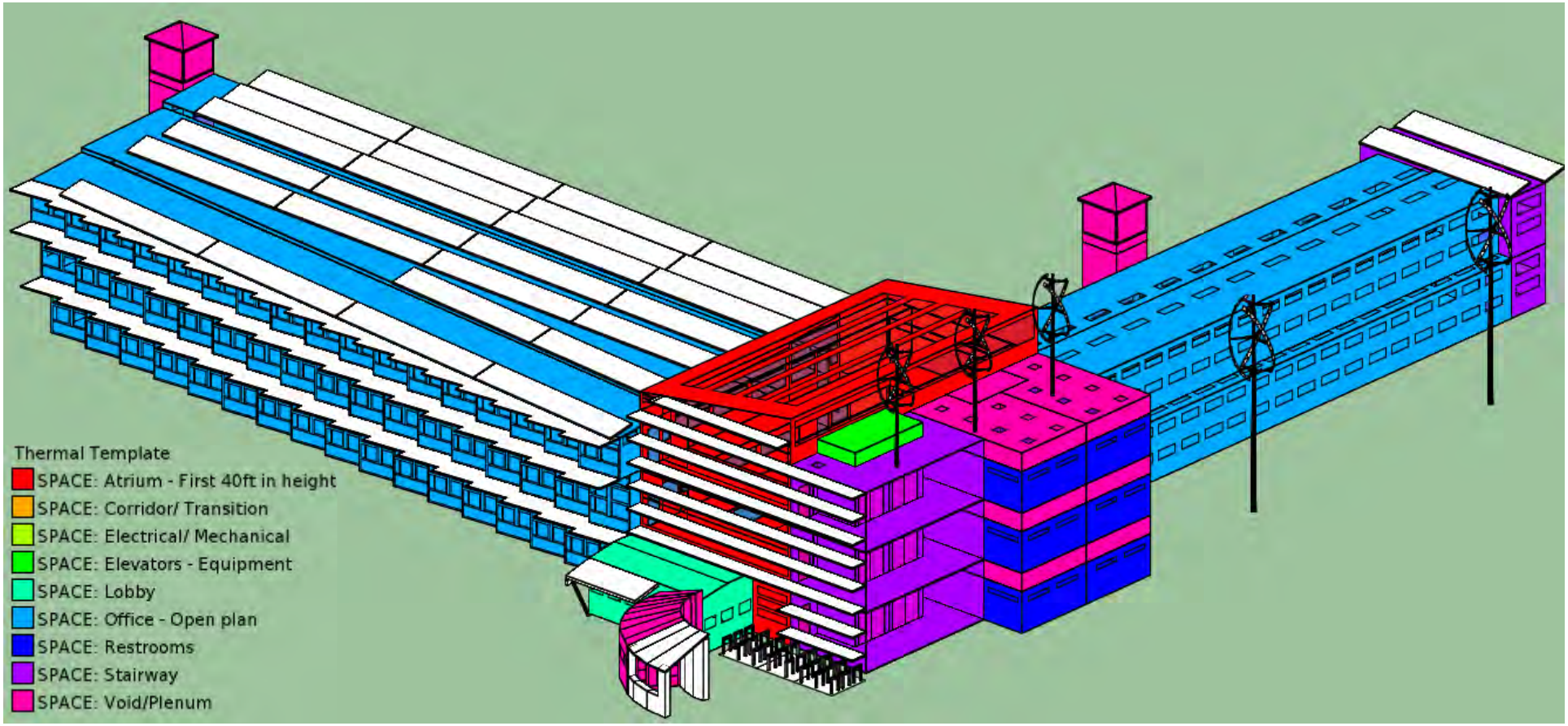
- Thermal Templates should be coupled with Room Group Scheme



Best Practices – Thermal Templates

Thermal Templates Assignment

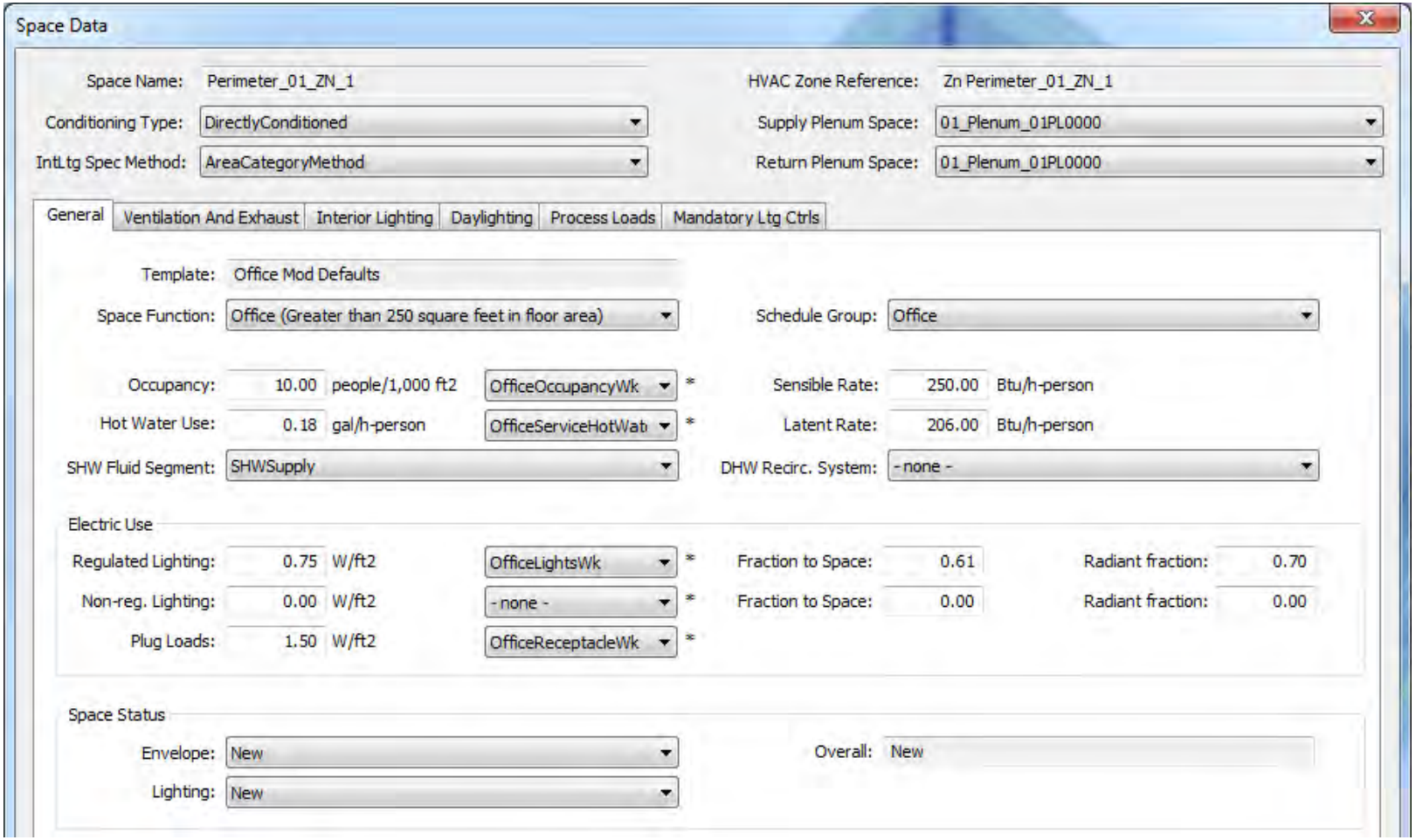
- Easy to determine is everything is assigned correctly.



Best Practices – Thermal Templates

Editing Rooms Data Inputs (Two Methods)

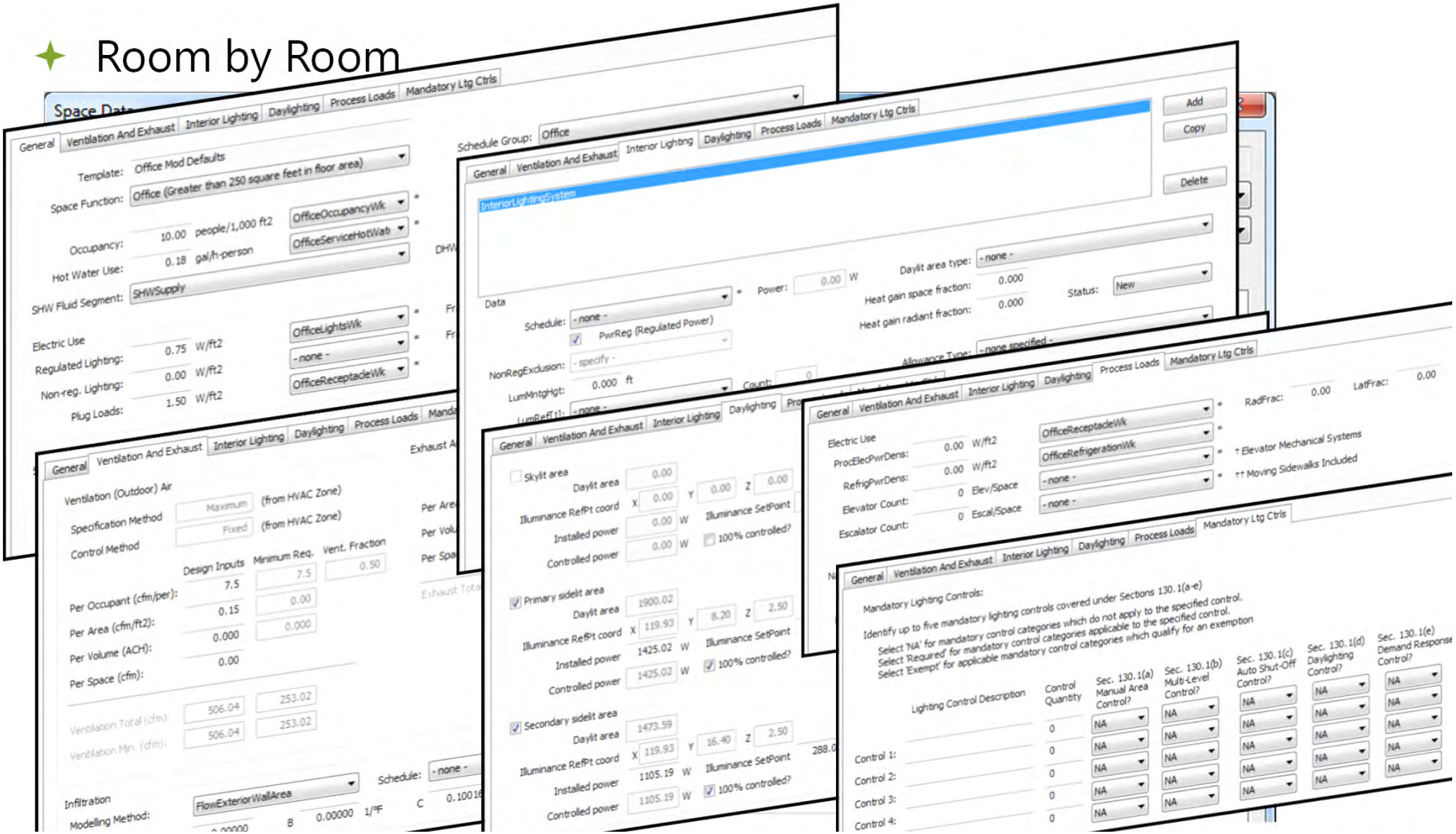
- Room by Room



Best Practices – Thermal Templates

Editing Rooms Data Inputs (Two Methods)

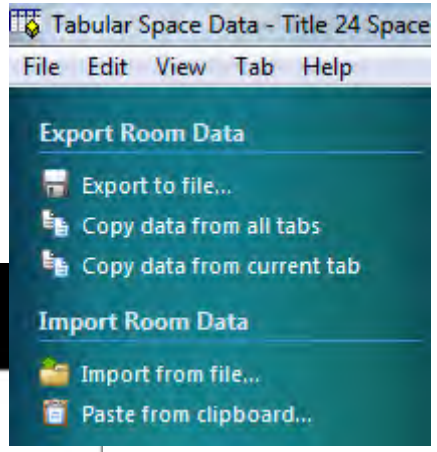
- Room by Room

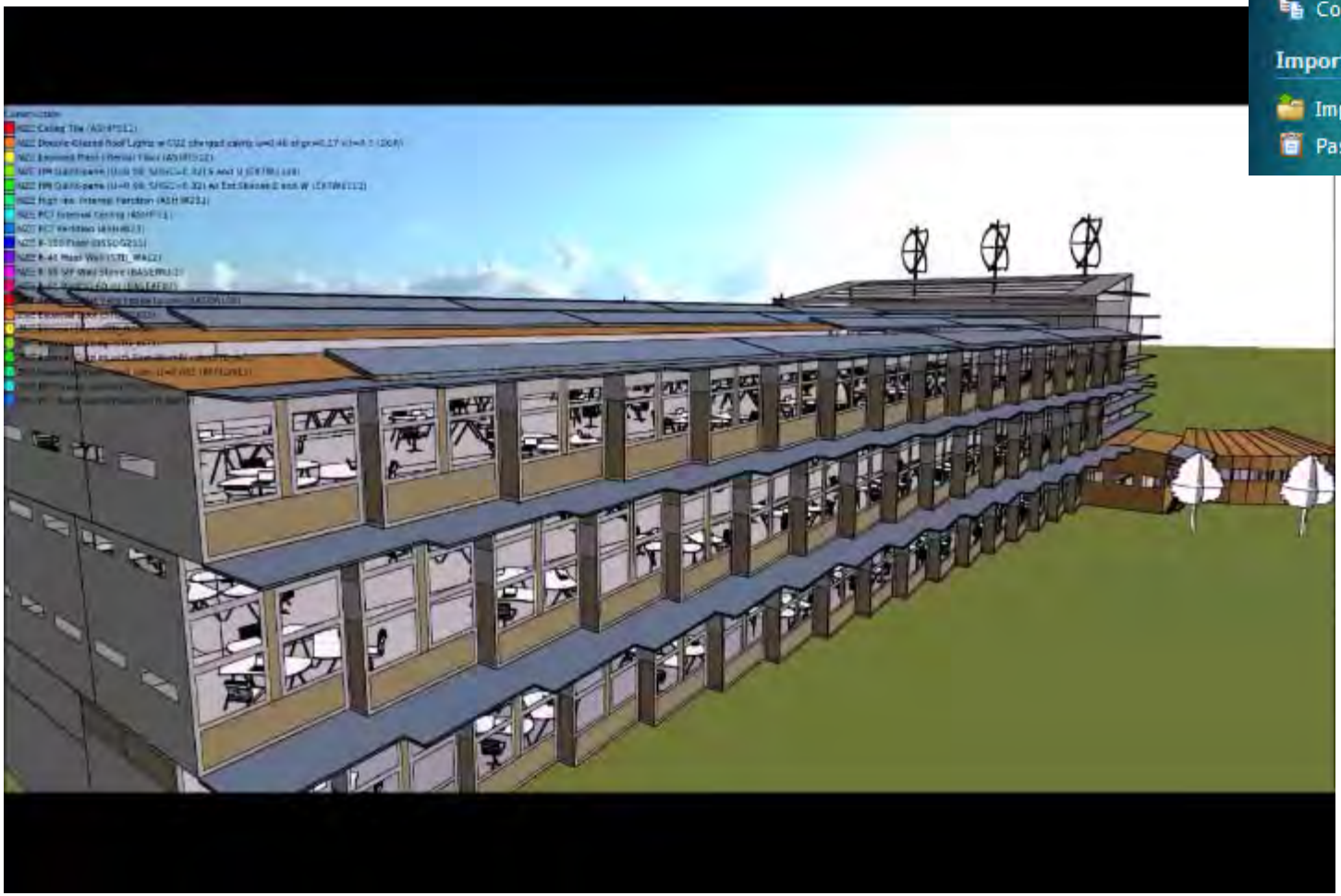


Best Practices – Thermal Templates

Editing Rooms Data Inputs (Two Methods)

- Or with Tabular Editing (Spreadsheet functionality)

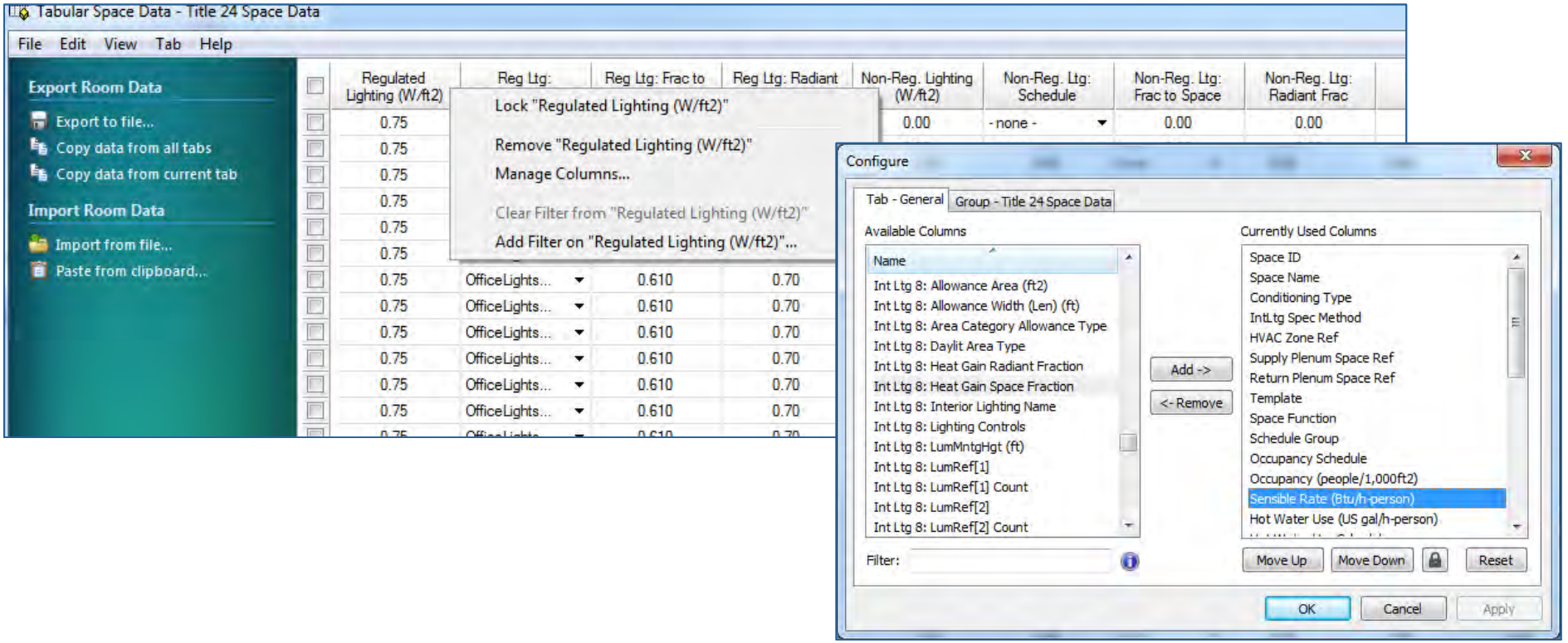




Best Practices – Thermal Templates

Editing Rooms Data Inputs (Two Methods)

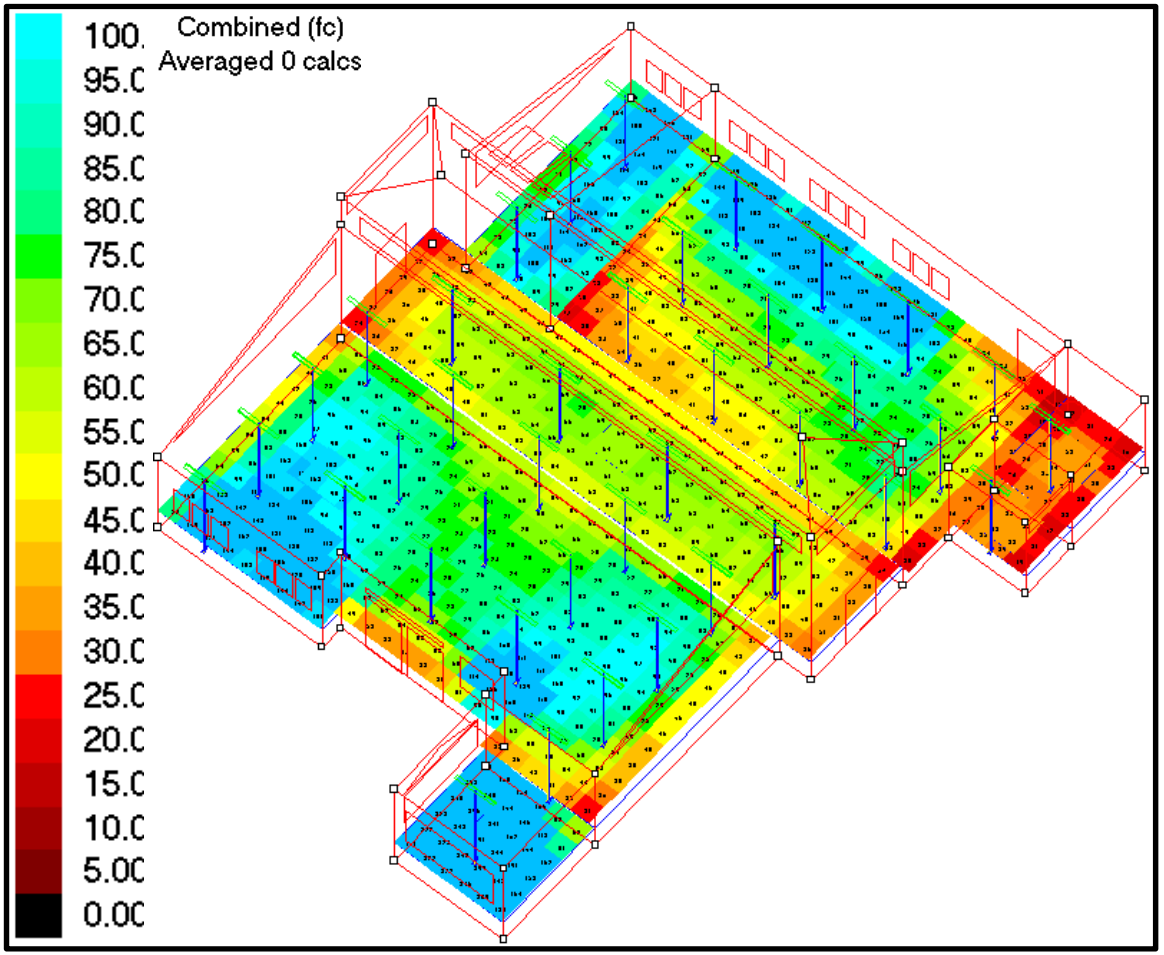
- Or with Tabular Editing (Spreadsheet functionality)

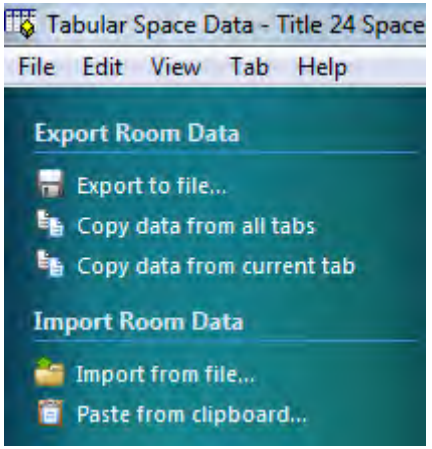


Best Practices – Lighting and Daylighting

Area Category Method: Lighting Design

- Requires Room by Room W/ft^2

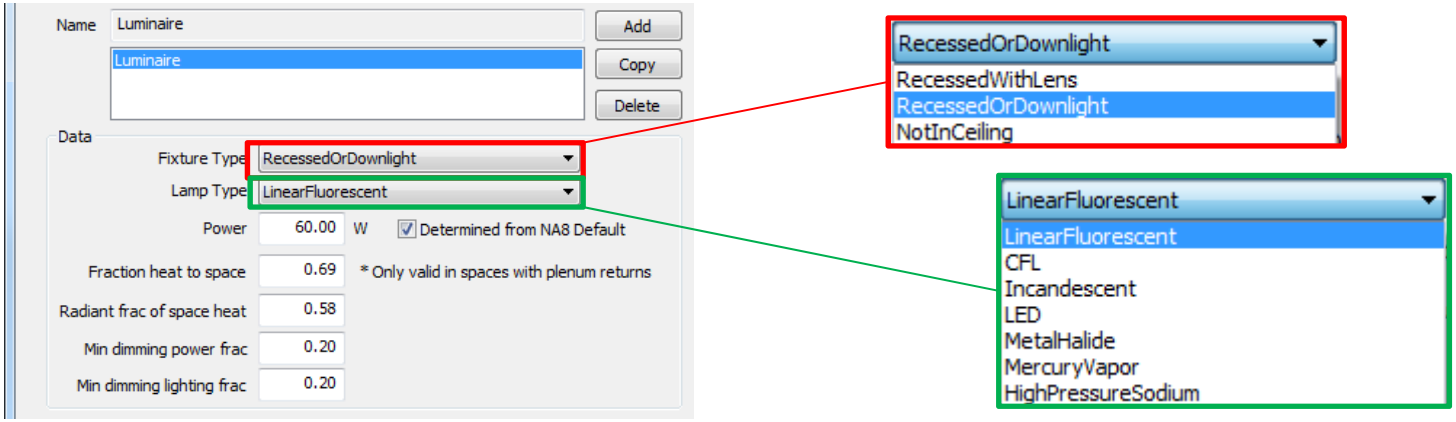


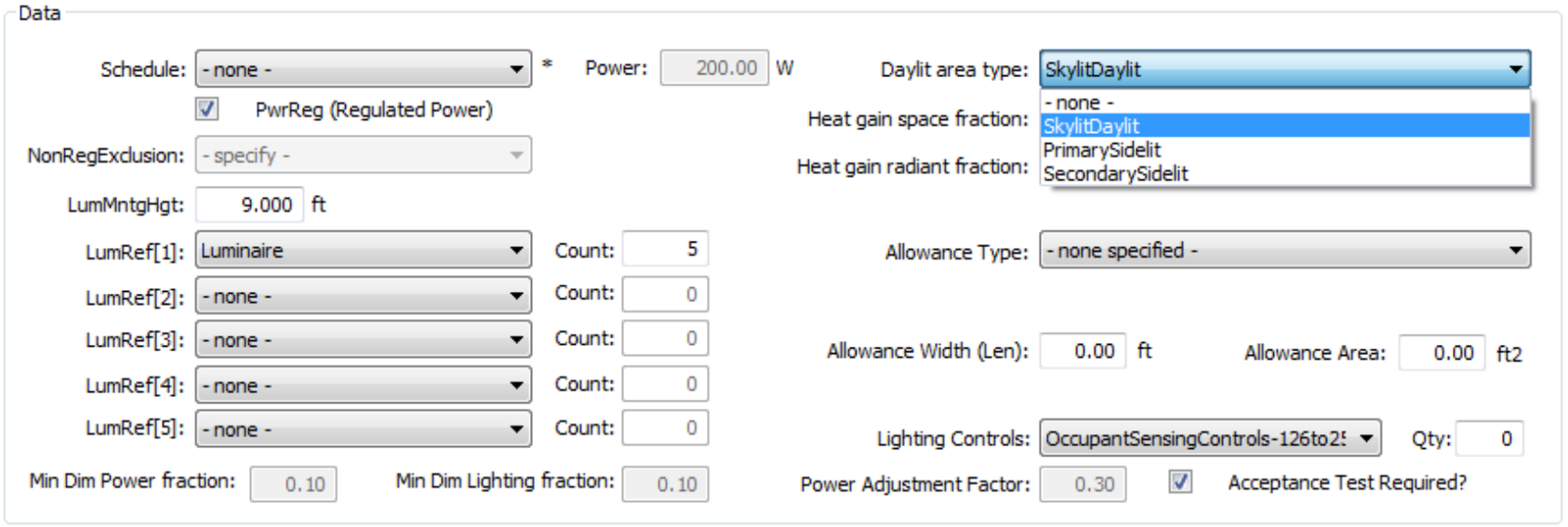


Room SH000000 (Shopping Checkout)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft²)	Power density (W/ft²/(100 fc))	Luminous efficacy (lm/W)
Working plane 1	5900	56	0.56	5.39	105.36
Room DS000000 (Display Gallery)					
Name	Total bare flux (lm)	Total luminaire power (W)	Power density (W/ft²)	Power density (W/ft²/(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/ft²)	Power density (W/ft²/(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/ft²)	Power density (W/ft²/(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/ft²)	Power density (W/ft²/(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/ft²)	Power density (W/ft²/(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/ft²)	Power density (W/ft²/(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

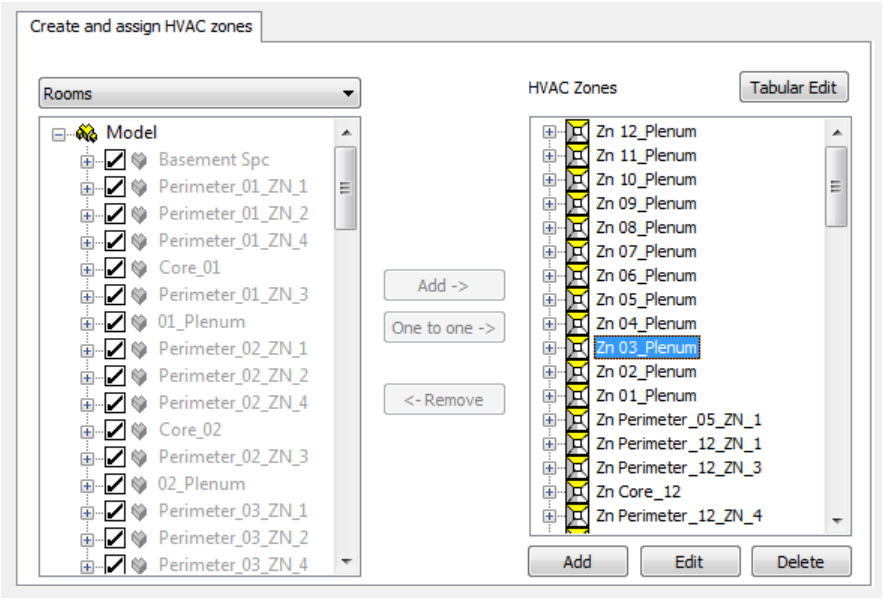


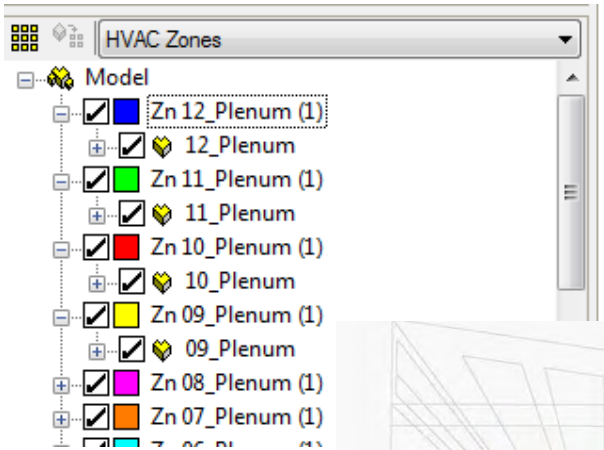


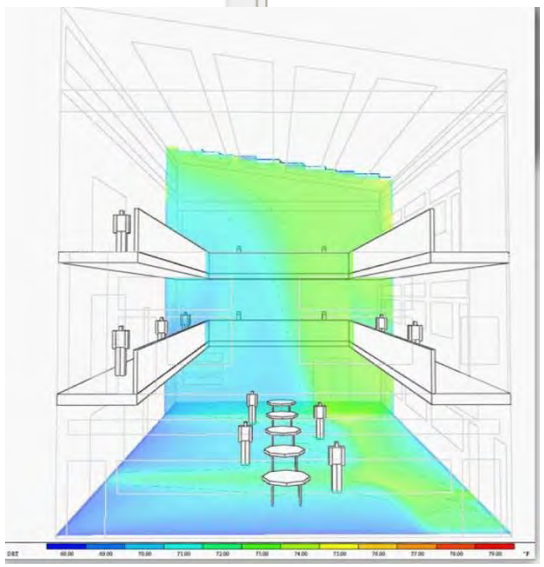
Best Practices – Zoning

HVAC Zoning

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





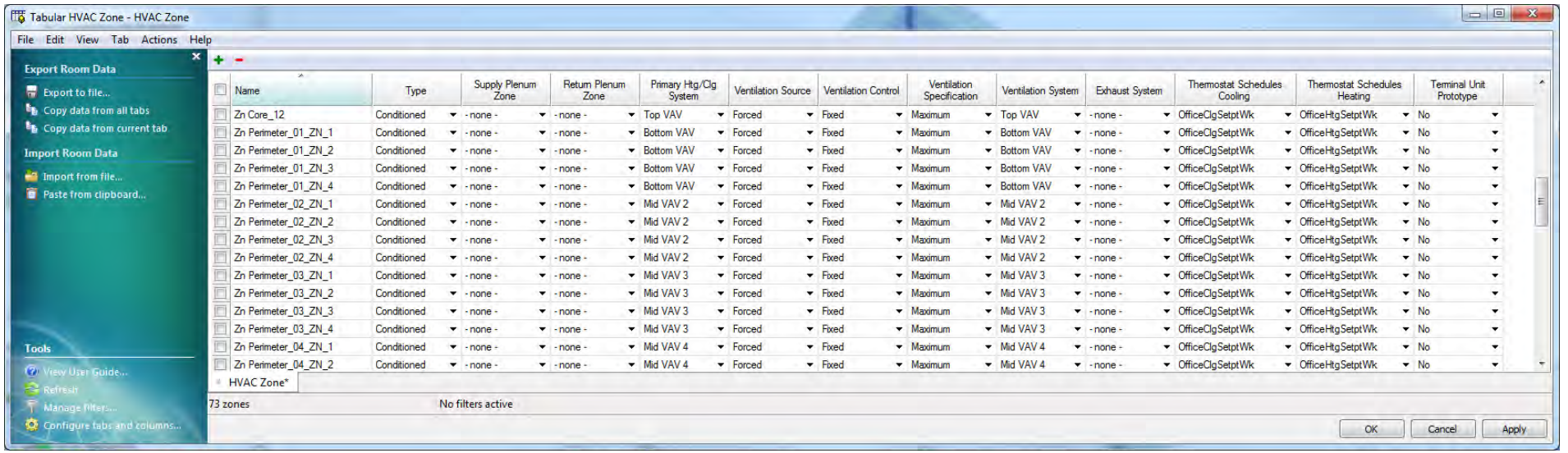


- Take care with vertical zoning-E.g. atrium

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)



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 ft2 – 150,000 ft2	Any	PVAV	Packaged VAV Unit
>150,000 ft2	1 floor	SZVAV	Single-zone VAV Unit
	>1 floor	VAVS	Built-up VAV Unit

- ASHRAE 90.1-2010

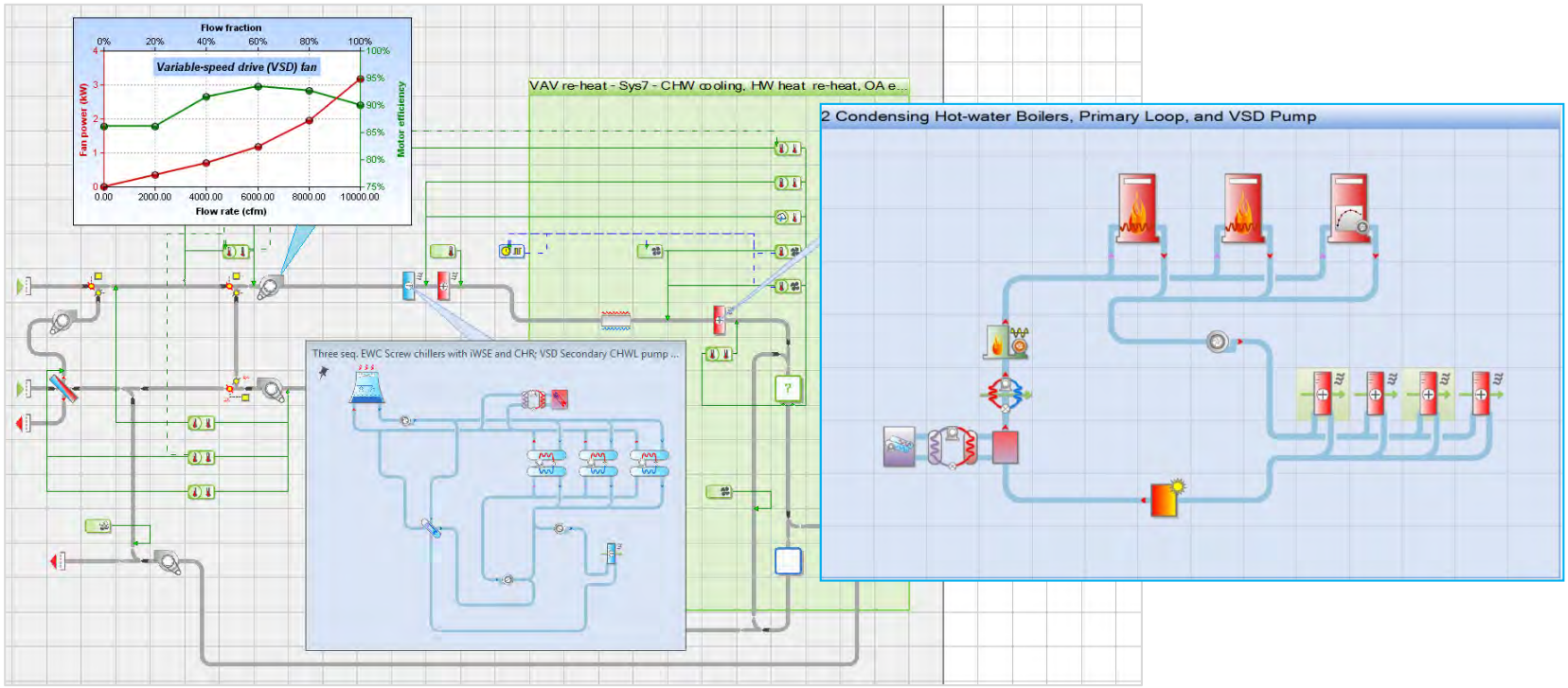
TABLE G3.1.1A Baseline HVAC System Types

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.

Heating Plant

Equipment Name	Equipment Type	Area served (ft²)	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

Cooling Plant

Equipment Name	Equipment Type	Area served (ft²)	Peak Load (kBtu/h)	Time of Peak
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 Loads

System ID	System Name	Area Served (ft²)
PR034_07	a VAV - Reheat [EWC chiller - HW boiler]	4536.9

Coil Sizes	AHU Cooling Coil Sensible Load (kBtu/h)	AHU Cooling Coil Latent Load (kBtu/h)	AHU Cooling Coil Total Load (kBtu/h)	AHU Heating Coil Total Load (kBtu/h)
Peak value	93.9	69.4	163.2	19.4
Time of Peak	7/158:30	7/158:30	7/158:30	8/158:30

Fan Sizes	AHU Supply Fan Flow (cfm)	AHU Return Fan Flow (cfm)	Optional Exhaust Fan Flow (cfm)	Min Vent Airflow (cfm)
Peak Value	3954.5	3954.5	0.0	2566.0
Time of Peak	9/1515:30	9/1515:30		

Engineering Checks	Cooling Checks cfm/ft²	Cooling Checks Btu/h-ft²	Cooling Checks % OA	Heating Checks cfm/ft²	Heating Checks Btu/h-ft²	Heating Checks % OA
Peak Value	0.8	36.0	72.4	0.8	19.00	72.3
Time of Peak	7/158:30	Calculated at time of Peak Cooling Coil Load		8/158:30	Calculated at time of Peak Heating Coil Load	

Rooms Served by System	Components: Cooling Coil Sensible Load (kBtu/h)	Components: Cooling Coil Latent Load (kBtu/h)	Components: Cooling Coil Total Load (kBtu/h)	Components: Heating Coil Total Load (kBtu/h)	Components: Zone recirc Fan Flow (cfm)	Airflows: Maximum Flow (cfm)	Airflows: Minimum Flow (cfm)	Airflows: Exhaust Flow (cfm)	Airflows: OA Flow (cfm)
Classroom 4	-	-	-	12.00	-	681.5	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	-	681.5	545.2	0.0	374.8
Circulation	-	-	-	9.60	-	466.1	200.7	0.0	138.0
Lobby	-	-	-	7.30	-	593.5	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

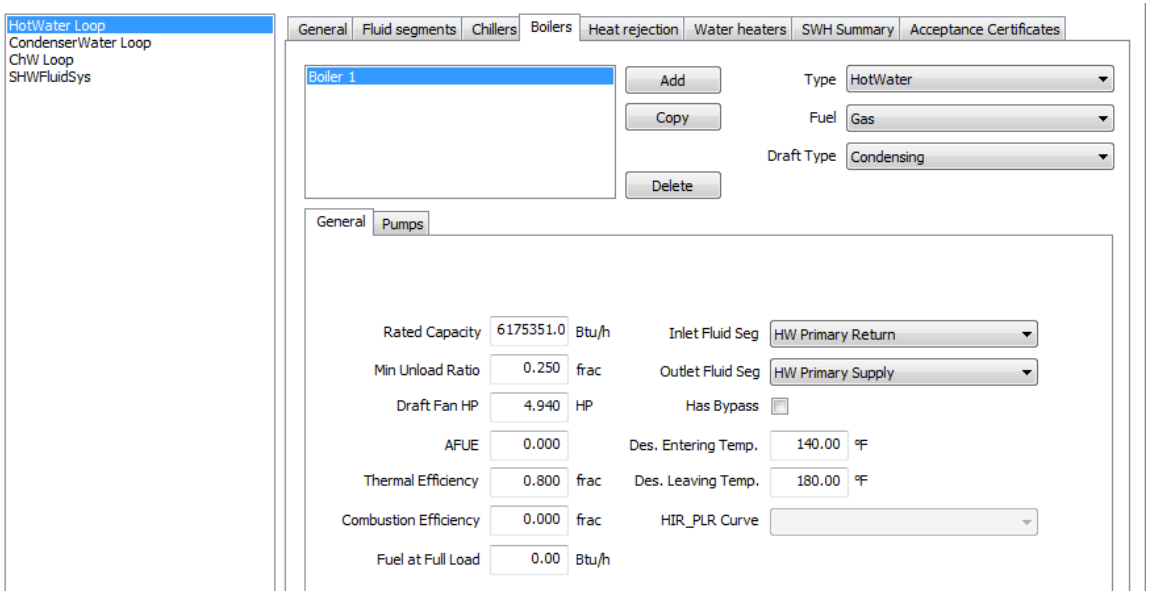
Room input data		Peak room cooling loads (Btu/h)			Peak room heating loads (Btu/h)	
Geometry		Exterior Conduction Gains	Sensible	Latent	Exterior Conduction Gains	Sensible
Floor area (ft²)	547.6	Ext. Walls	59.0	0	Ext. Walls	-411.7
Volume (ft³)	6023.1	Ext. Glazing	379.5	0	Ext. Glazing	-906.8
Ext. wall area (ft²)	403.0	Skylights Conduction	0.0	0	Skylights Conduction	0.0
Int. wall area (ft²)	504.7	Roof	1559.5	0	Roof	-1012.9
Ext. window area (ft²)	123.8	Ground/Exposed Floor	-984.7	0	Ground/Exposed Floor	-640.2
Int. window area (ft²)	0.0	Door	0.0	0	Door	0.0
Skylight area (ft²)	0.0	Internal Conduction Gains	Sensible	Latent	Internal Conduction Gains	Sensible
Room Data		Int. Walls	-2.6	0	Int. Walls	-118.3
Lighting load (W/ft²)	1.0	Int. Glazing	0.0	0	Int. Glazing	0.0
Power load (W/ft²)	0.8	Ceiling	0.0	0	Ceiling	0.0
Number of people	32.0	Floor	0.0	0	Floor	0.0
Area / person (ft²)	17.1	Door	-2.3	0	Door	-7.3
Sens gain / pers	225.30					
Latent gain / person	93.46	Solar Gains	2472.8	0	Solar Gains	0.0
Heating set point (°F)	70.0					
Cooling set point (°F)	75.0	Infiltration Gains	99.1	228.1	Infiltration Gains	-291.3
Max rel. humidity %	60.0					
Min rel. humidity %	0.0	Other air exchange gains	0	0	Other air exchange gains	0
62.1 Occupancy Category	Educational Facilities - Lecture Classroom	Internal Gains	Sensible	Latent	Internal Gains	Sensible
		Lighting	1644.1	0	Lighting Gains	0.0
		Equipment	1196.6	0.0	Equipment	0.0
		People	6408.5	2990.7	People	0.0
		Totals	**12,829**	**3,219**	**Totals**	**-3,388**

Design Air Flows		Environmental Conditions: Peak Rm Cooling		Environmental Conditions: Rm Heating	
Cooling Air Flow(cfm)	600.9	Date	Jul		
Min Air Flow(cfm)	545.2	Time	14:30		
Heating Air Flow(cfm)	681.5	Ext. Drybulb Temp	81.56	Ext. Drybulb Temp	44.60
Return Air Flow(cfm)	600.9	Ext. Wetbulb Temp	70.43	Ext. Wetbulb Temp	37.58
Exhaust Air Flow(cfm)	0.0	Ext. RH	56	Ext. RH	60
Ventilation Air Flow (62.1 Voz) (cfm)	374.8	Room Drybulb Temp	72.13	Room Drybulb Temp	71.13
		Room RH	52	Room RH	19
		Engineering Checks (Cooling)		Engineering Checks (Heating)	
		Air changes per hour	5.0	Air changes per hour	1.8
		cfm/ft²	1.1	cfm/ft²	0.5
		Btu/h-ft²	24.0	Btu/h-ft²	5.4
		% OA	62.4	% OA	100.0
				Environmental Conditions: Peak Heating Coil	
Heating Coil ID: HC002823				Heating Coil ID: HC002823	
Sensible(kBtu/h)	12.0			Date	Sized during heating
Air Flow at Peak(cfm)	681.5			Time	
				Ext. Drybulb Temp(°F)	44.6
				Ext. Wetbulb Temp(°F)	37.6
				Ext. RH	60.2
				Entering (db) Temp(°F)	66.0
				Leaving (db) Temp(°F)	76.1

Best Practices – HVAC Fluid Systems

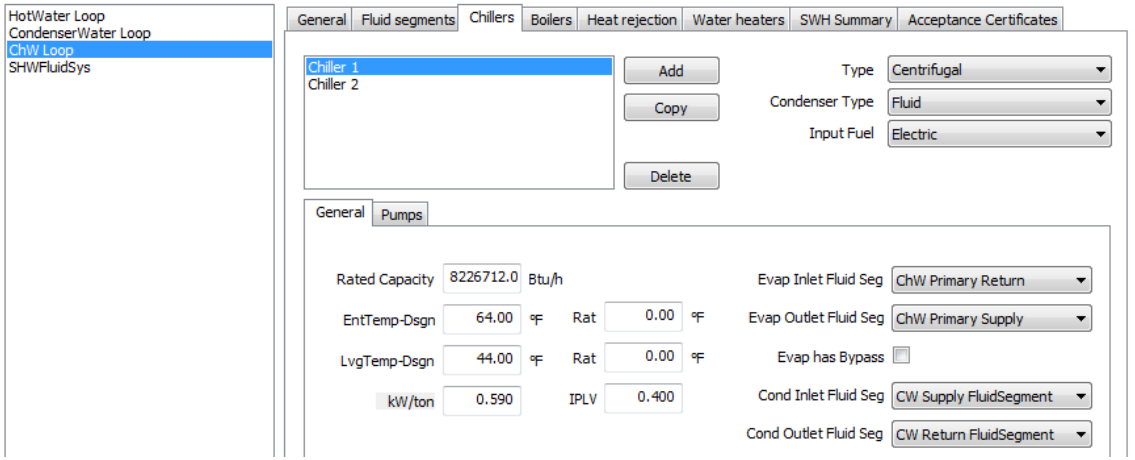
Hot-Water Loops

- Boilers
- Pumps
- Segments



Chilled-Water Loops

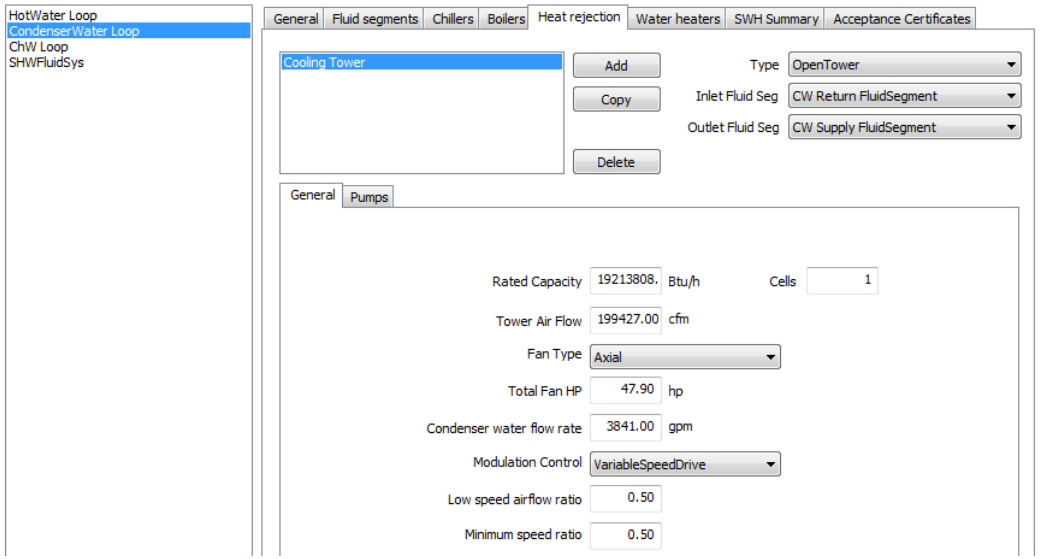
- Chillers
- Pumps
- Segments



Best Practices – HVAC Fluid Systems

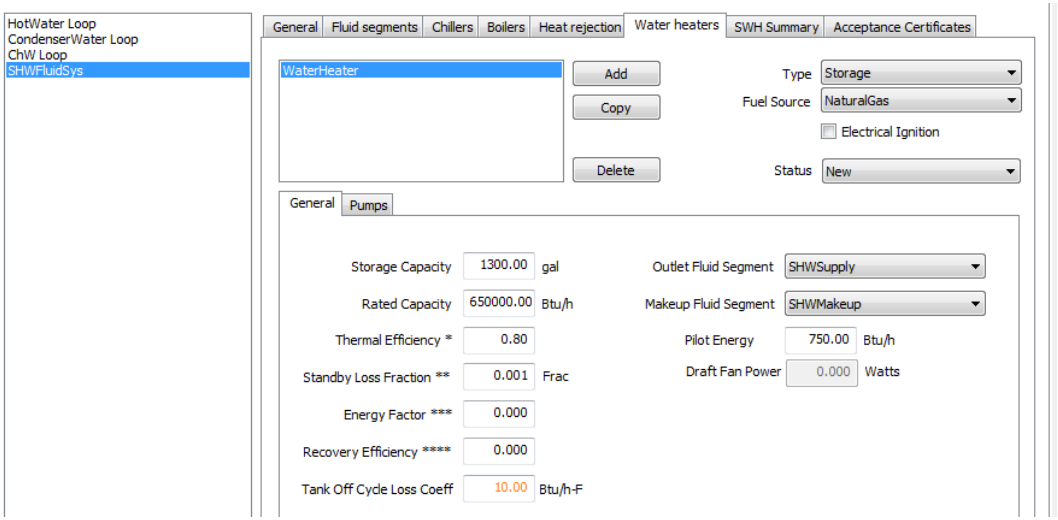
Condenser-Water Loops

- Heat Rejection
- Pumps & CT Fan
- Segments



Domestic-HW Loops

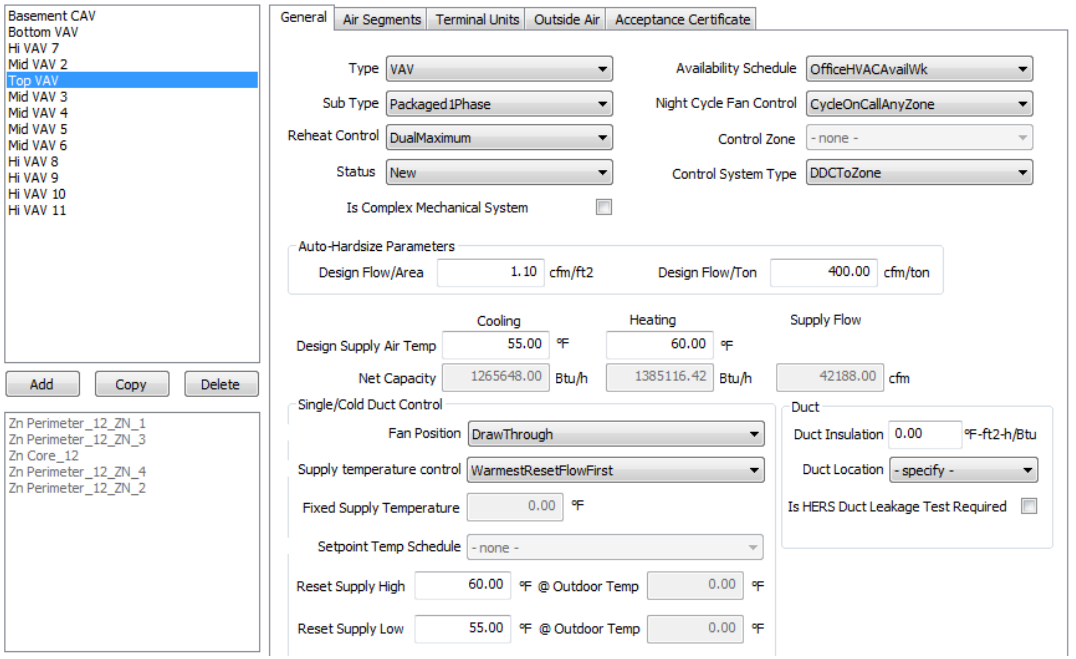
- Storage Water Heater
- Pumps
- Segments
- Recirc. & Solar HW



Best Practices – HVAC Air Systems

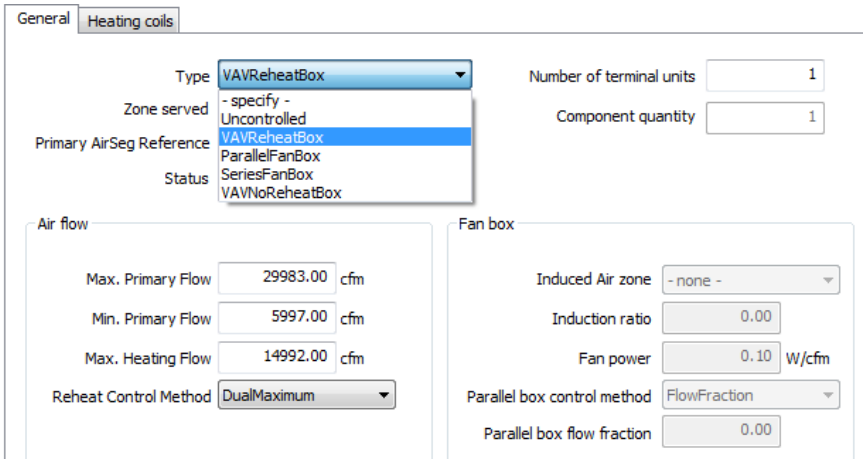
Air Systems

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



Terminal Units

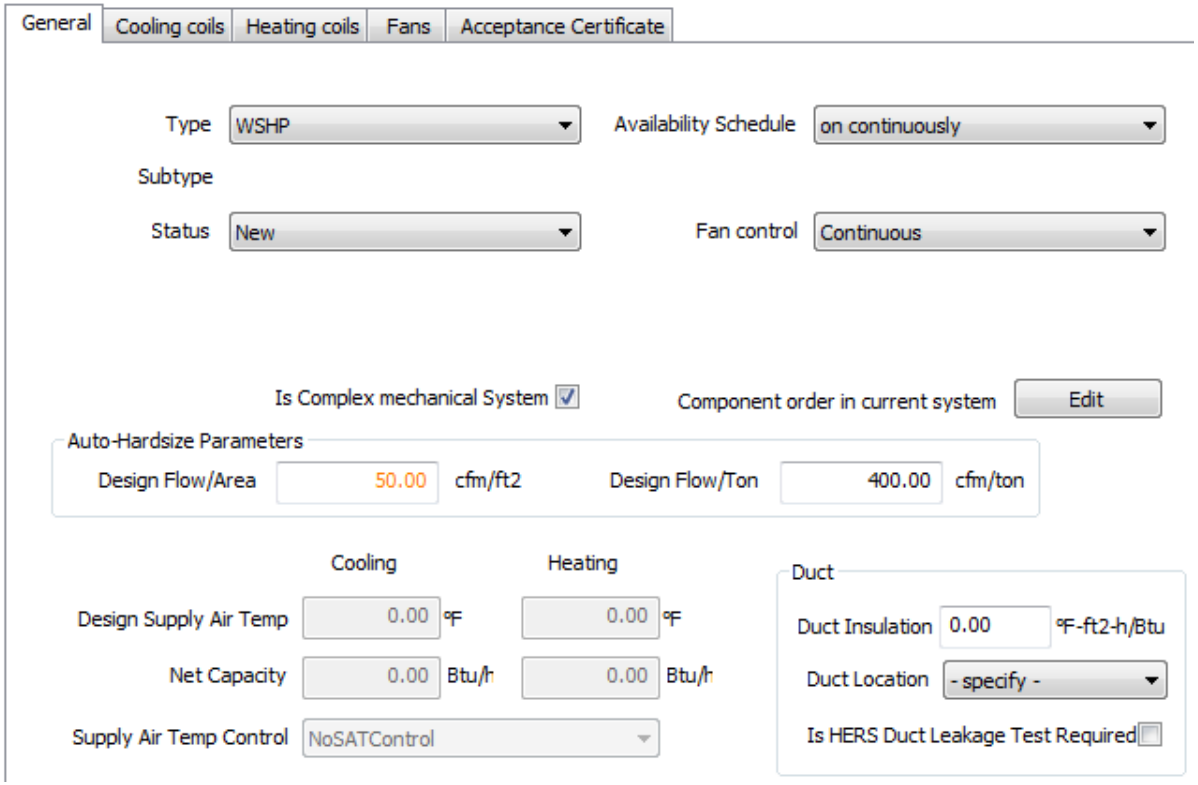
- Type
- Coils, Fans, Controls
- Segment *Mapping*



Best Practices – HVAC Zone Systems

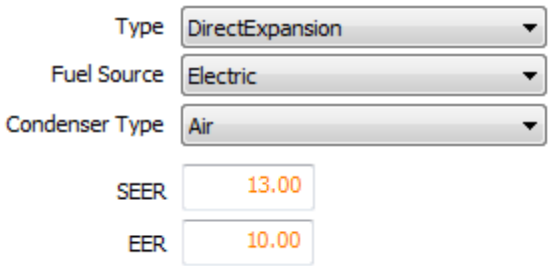
Zone Systems

- System Types
- Coils, Fan, Controls
- Segments



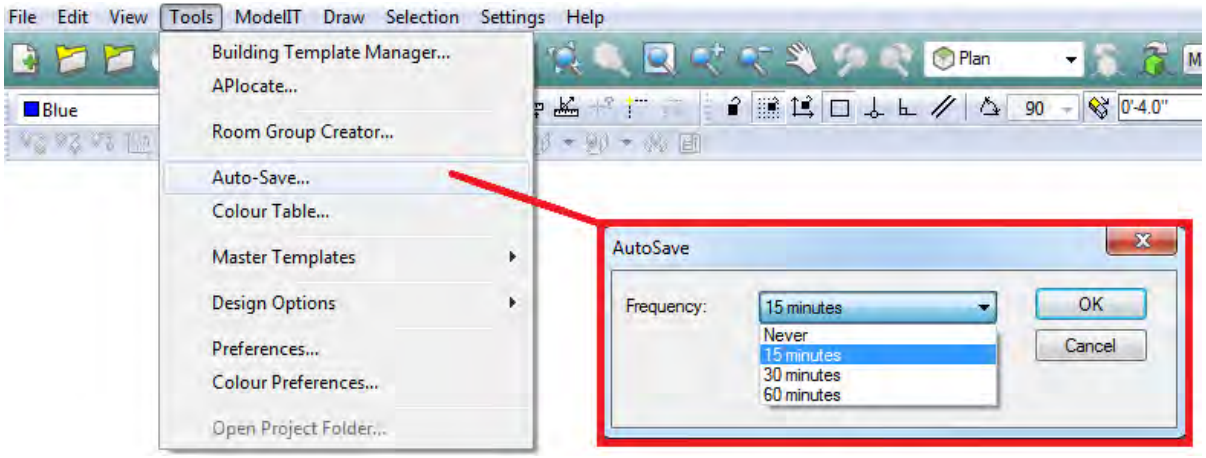
Zone Types

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

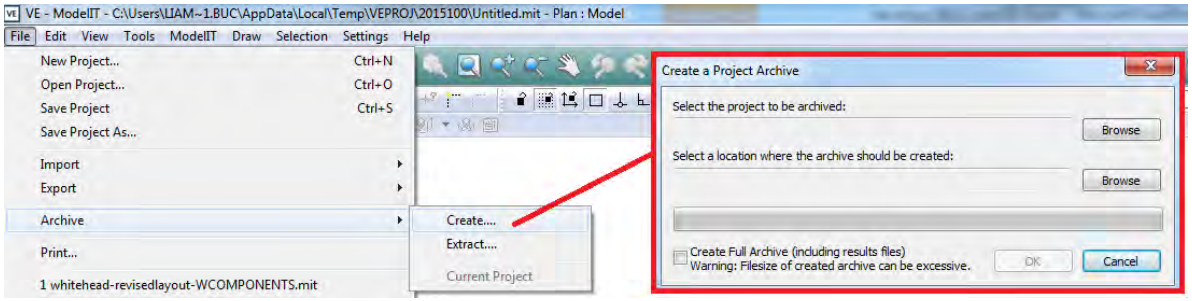


Best Practices – General

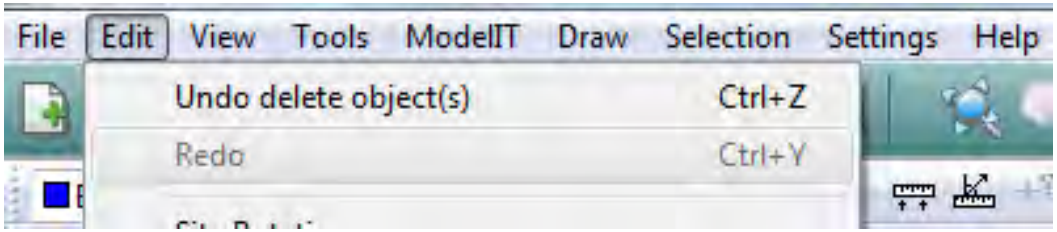
Auto-Save:



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.

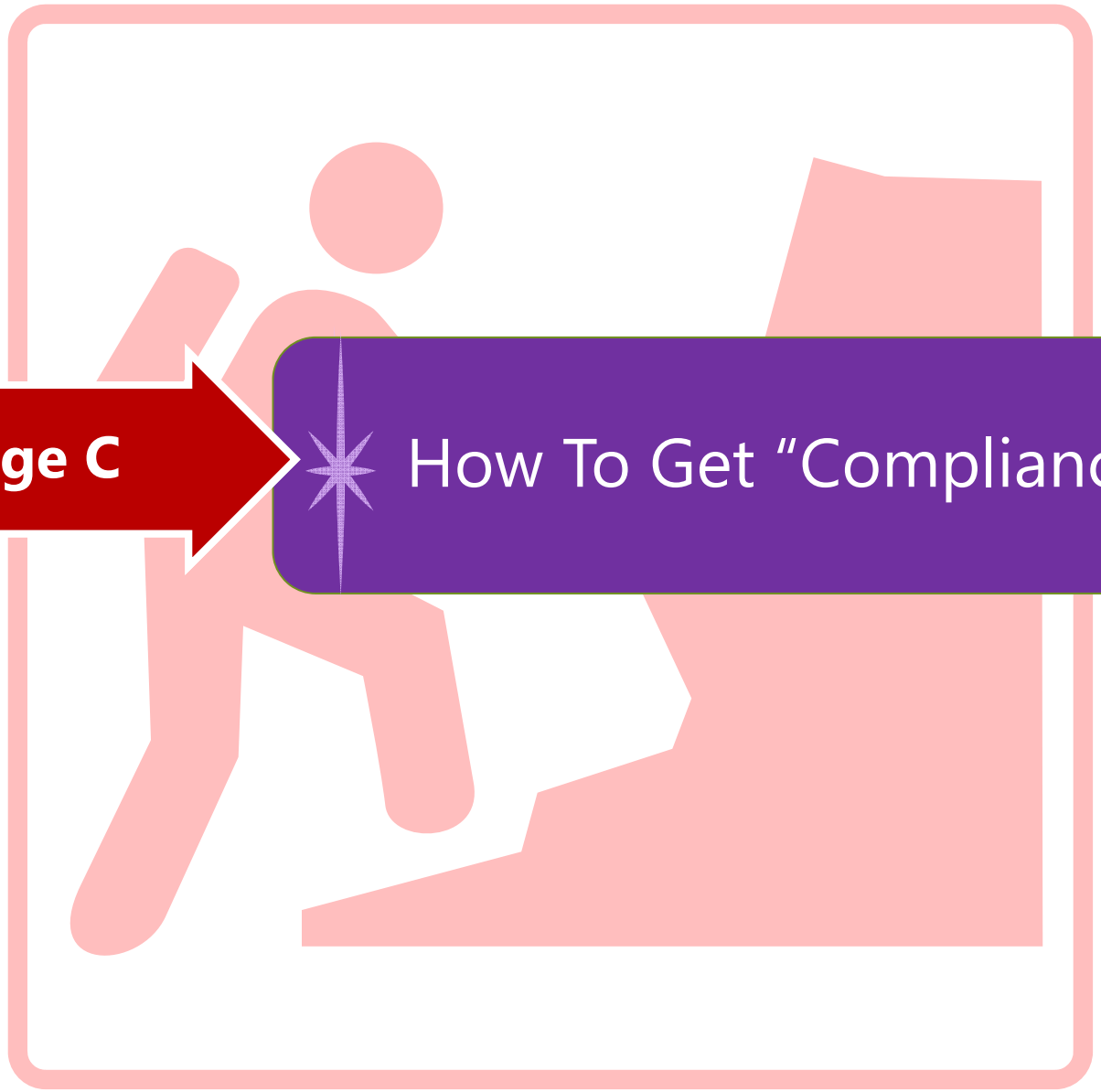
All model design characteristics which could potentially cause an error which would prevent a simulation run should be alerted as the model is being built.

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



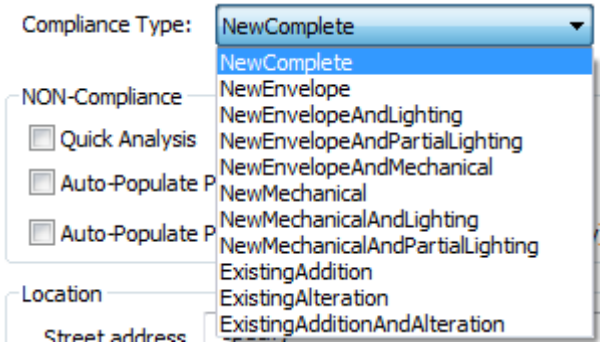
Challenge C

How To Get “Compliance”

How to…. – Avoid CBECC-Com Errors

Errors Protocol:

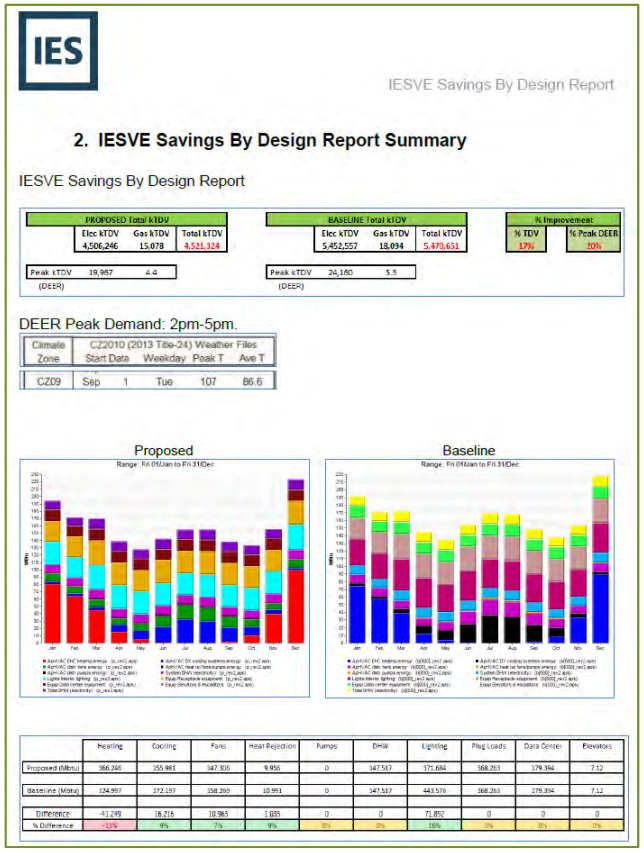
- Keep it simple
  - www.iesve.com/software/title24/title-24-faqs
- If doing a new construction project, start with 'NewEnvelopeAndLighting' to remove:
  - Geometry Errors
  - Envelope Errors
  - Daylighting Omissions
  - Then revert back to 'NewComplete' to finish the HVAC portion



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

How to…. – Savings By Design

Savings By Design (TDV) Reports:



IESVE Savings By Design Report

2. IESVE Savings By Design Report Summary

IESVE Savings By Design Report

PROPOSED Total kTDV		
Elec kTDV	Gas kTDV	Total kTDV
4,506,246	15,078	4,521,324

BASELINE Total kTDV		
Elec kTDV	Gas kTDV	Total kTDV
5,452,557	18,094	5,470,651

% Improvement	
% TDV	% Peak DEER
17%	20%

Peak kTDV	19,967	4.4
(DEER)		

Peak kTDV	24,160	5.5
(DEER)		

DEER Peak Demand: 2pm-5pm.

Climate Zone	CZ2010 (2013 Title-24) Weather Files Start Date	Weekday	Peak T	Ave T
CZ09	Sep 1	Tue	107	86.6

Proposed

Baseline

	Heating	Cooling	Fans	Heat Rejection	Pumps	DHW	Lighting	Plug Loads	Data Center	Elevators
Proposed (Mbtu)	366,246	155,981	147,306	9,956	0	147,517	371,684	368,263	179,394	7.12
Baseline (Mbtu)	324,997	272,197	158,269	10,991	0	147,517	443,576	368,263	179,394	7.12
Difference	-41,249	16,216	10,983	1,035	0	0	71,892	0	0	0
% Difference	-11%	9%	7%	9%	0%	0%	16%	0%	0%	0%

- TDVs Multipliers are located in your My Documents:

Libraries ▸ Documents ▸ CBECC-Com 2013 Data ▸ Documents ▸ RulesetSource ▸ CEC 2013 Nonres ▸ Rules ▸ Tables

TDV (Time Differential Valuation) Multipliers

	25	26	27
	CZ:	9	
	Elec	NatGas	Propane
; MoDaHr	kTDV/kWh	kTDV/thrm	kTDV/thrm
MoDaHr	TDV	TDV	TDV
CZ=	9	9	9
Fuel=	Elec	NatGas	Propane
10101	15.67	194.2	438.49
10102	15.15	194.2	438.49
10103	14.92	194.2	438.49
10104	14.82	194.2	438.49
10105	15.28	194.2	438.49
10106	17.18	194.2	438.49
10107	19.3	194.2	438.49
10108	19.69	194.2	438.49
10109	19.91	194.2	438.49
10110	19.82	194.2	438.49
10111	19.6	194.2	438.49
10112	18.67	194.2	438.49
10113	18.39	194.2	438.49
10114	18.18	194.2	438.49
10115	17.44	194.2	438.49
10116	18.17	194.2	438.49
10117	19.45	194.2	438.49
10118	19.86	194.2	438.49
10119	19.81	194.2	438.49
10120	19.85	194.2	438.49
10121	20.05	194.2	438.49
10122	19.86	194.2	438.49
10123	19.29	194.2	438.49
10124	17.5	194.2	438.49
10201	15.72	194.2	438.49
10202	15.17	194.2	438.49
10203	14.96	194.2	438.49
10204	14.94	194.2	438.49
10205	16.07	194.2	438.49
10206	16.69	194.2	438.49

X

Electricity and Natural Gas Energy Variables from IESVE

Peak kW	64	Peak Therm	2.26

Date	Time	Total electricity (misc.) (kW)	Total nat. gas (kBtu/h)
Fri, 01/Jan	00:30	9.48	2.26
	01:30	6.85	2.16
	02:30	6.12	2.26
	03:30	5.87	2.26
	04:30	5.68	2.26
	05:30	5.74	2.26
	06:30	5.78	2.26
	07:30	5.80	2.26
	08:30	5.99	2.26
	09:30	6.90	2.26
	10:30	8.28	1.10
	11:30	8.04	0.04
	12:30	5.37	0.00
	13:30	2.09	0.00
	14:30	2.07	0.00
	15:30	1.94	0.00
	16:30	2.03	0.00
	17:30	2.06	0.00
	18:30	2.04	0.00
	19:30	2.75	0.15
	20:30	4.02	0.46
	21:30	4.83	0.59
	22:30	4.64	1.00
	23:30	4.58	1.55
Sat, 02/Jan	00:30	6.00	1.92
	01:30	6.77	2.26
	02:30	6.50	2.26
	03:30	6.39	2.26
	04:30	6.17	2.26
	05:30	6.18	2.26

=

Σ=

Total kTDV		
Elec kTDV	Gas kTDV	Total kTDV
4,506,246	15,078	4,521,324

Peak kTDV	19,967	4.4

148.52	4.39	
103.82	4.19	
91.35	4.39	
86.93	4.39	
86.86	4.39	
98.69	4.39	
111.55	4.39	
114.20	4.39	
119.25	4.39	
136.74	4.39	
162.32	2.13	
150.06	0.07	
98.83	0.00	
38.09	0.00	
36.10	0.00	
35.28	0.00	
39.54	0.00	
40.97	0.00	
40.44	0.00	
54.56	0.29	
80.52	0.89	
95.93	1.14	
89.50	1.94	
80.14	3.02	
94.38	3.74	
102.67	4.39	
97.27	4.39	
95.39	4.39	
99.12	4.39	
103.13	4.39	

Challenge D

Challenge D

Where To Get Help

Challenge D: Help!

Where to get help

Know your software

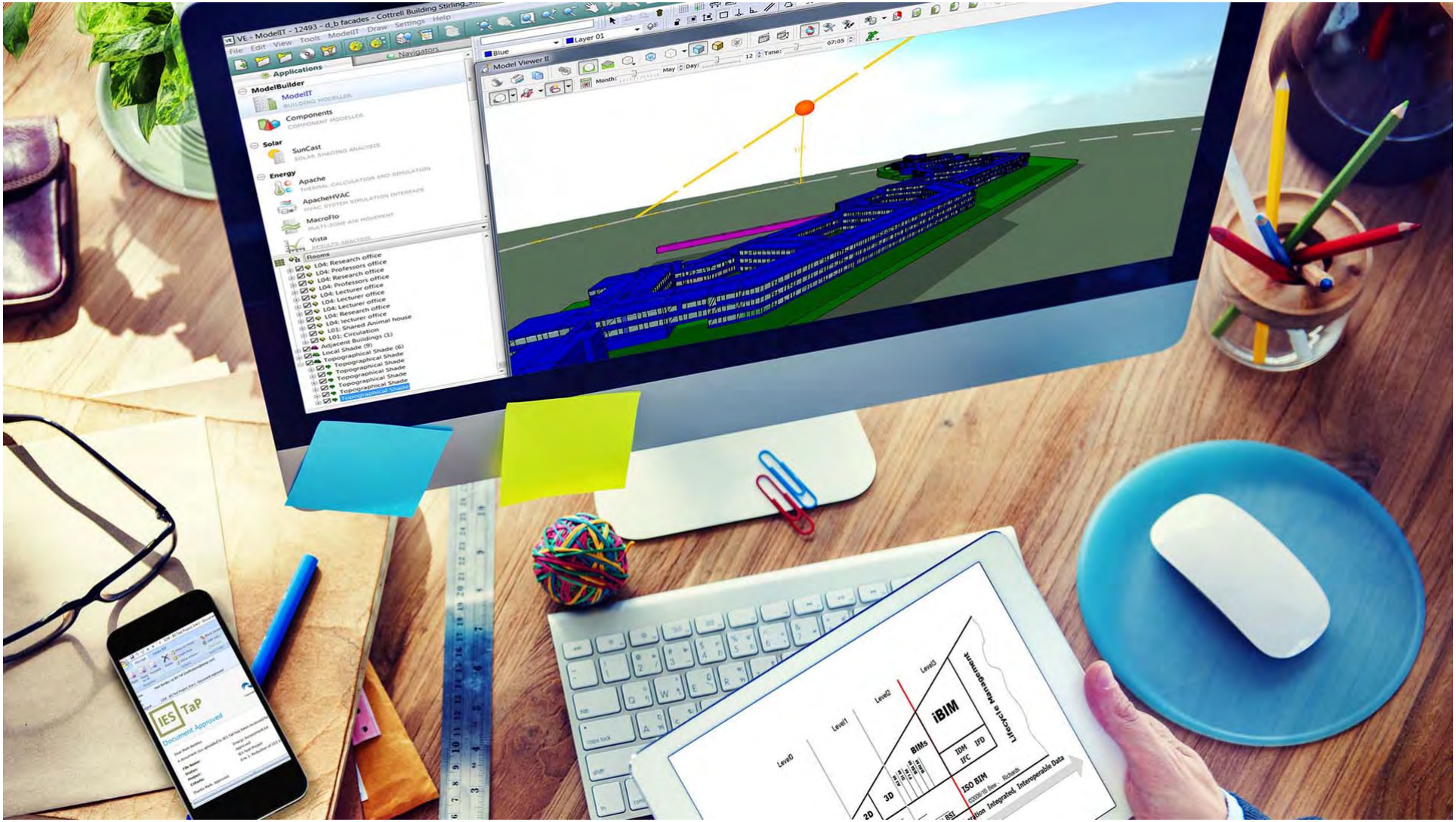
- IESVE:
  - 3D modeling 3rd party software
- CBECC-Com
  - State provided software the defines compliance ruleset
- Open Studio
  - 3D modeling interface to Energy Plus
- Energy Plus
  - Energy modeling engine

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

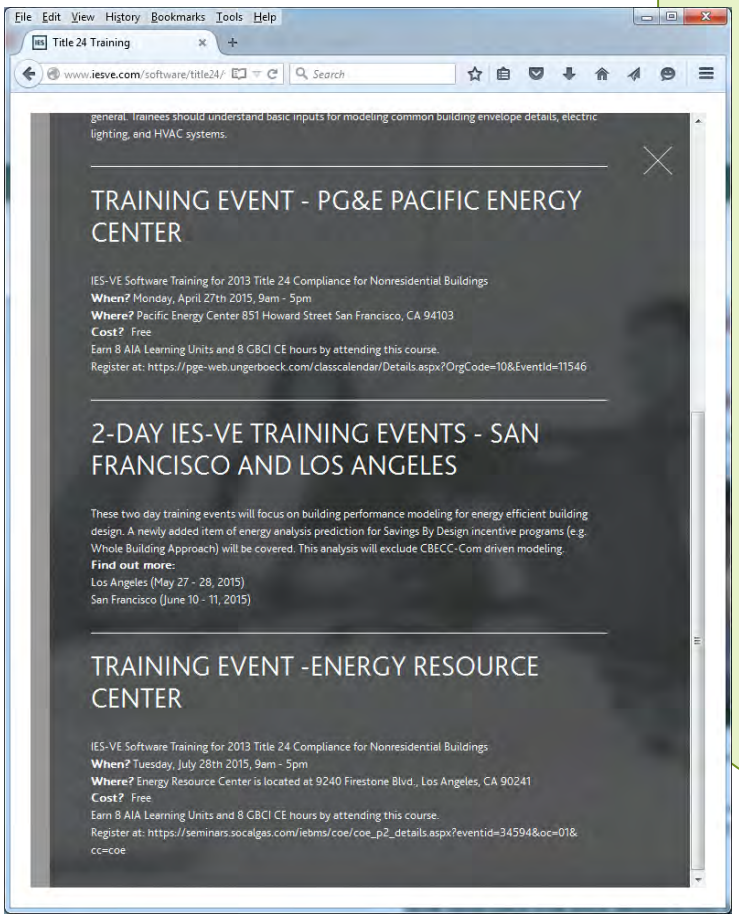
- **www.iesve.com**



Where To Get Help

IESVE

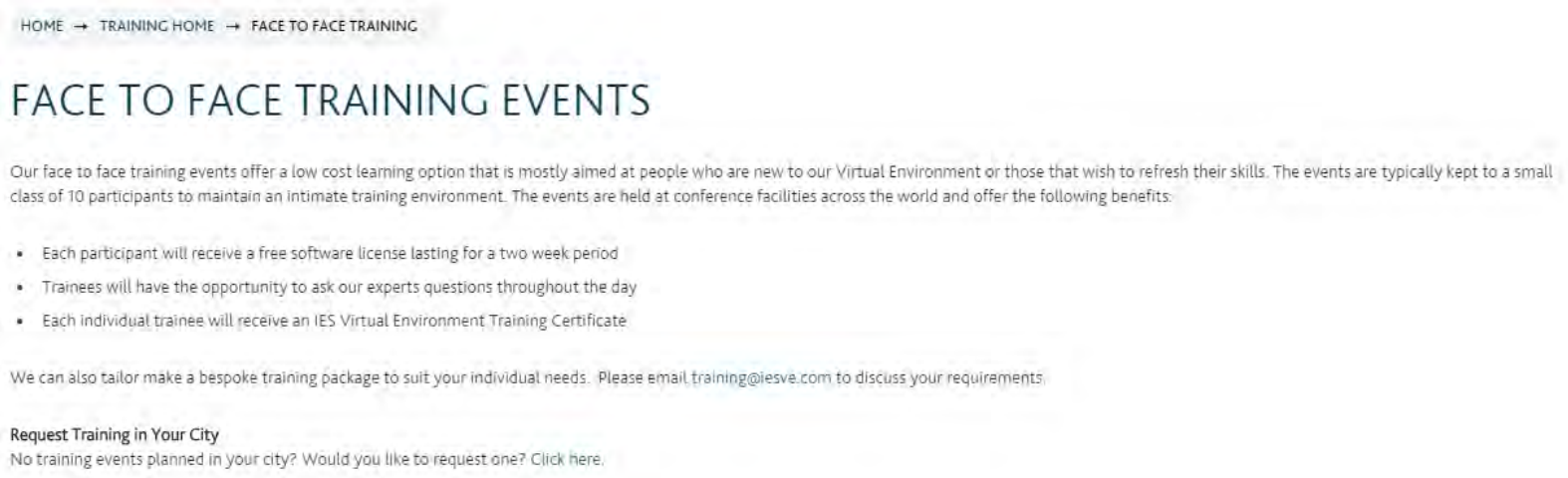
- In Person Classes - FREE!
  - www.iesve.com/software/title24/title-24-training
- A full day hands-on training course, focused on Title 24 Compliance Modeling for non-residential buildings.
  - Model geometry interoperability and 'build from scratch' model geometry.
  - Building data, climate and building 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:

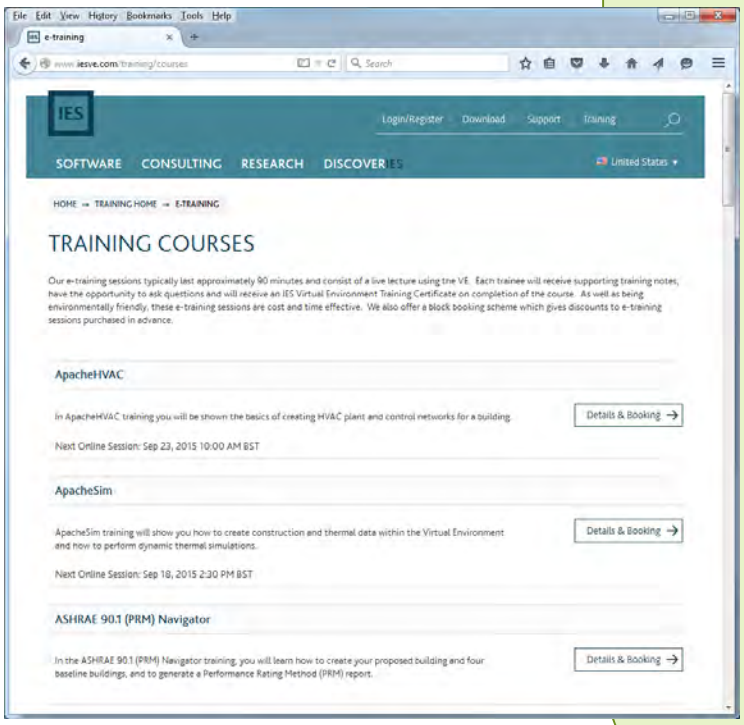
- Each participant will receive a free software license lasting for a two week period
- Trainees will have the opportunity to ask our experts questions throughout the day
- Each individual trainee will receive an IES Virtual Environment Training Certificate

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

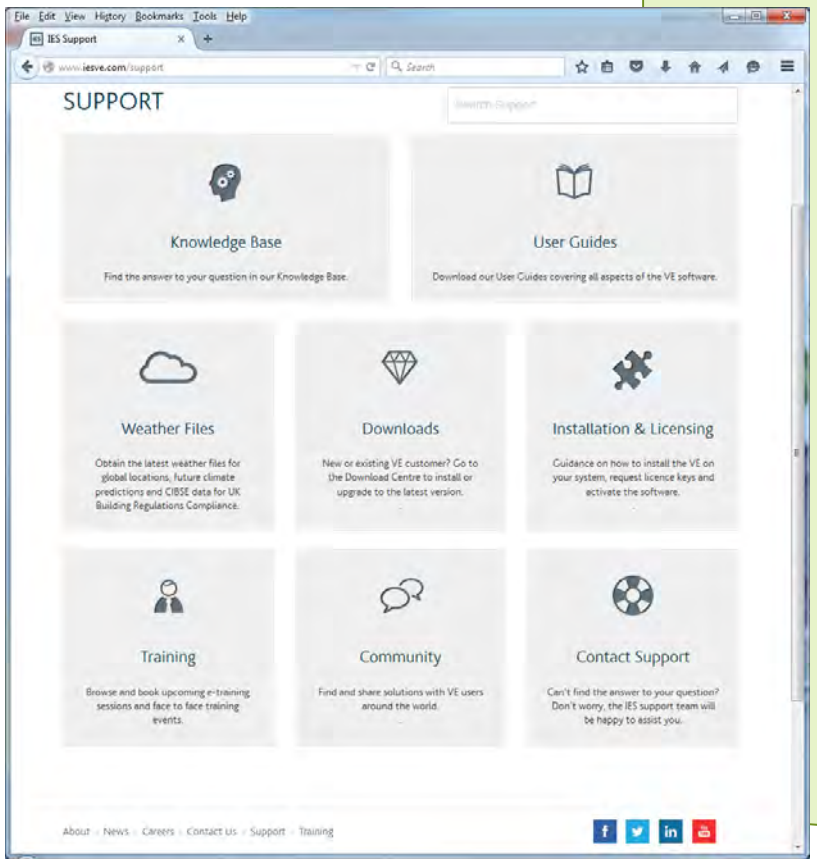


- E-training
  - Online-training
    - Modular based e-training
    - Short 90 minute courses
    - www.iesve.com/training/courses
  - Distance learning
    - Anytime online access to a range of self-paced IESVE training videos
    - Supporting training notes to assist learning
    - Access to test models 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

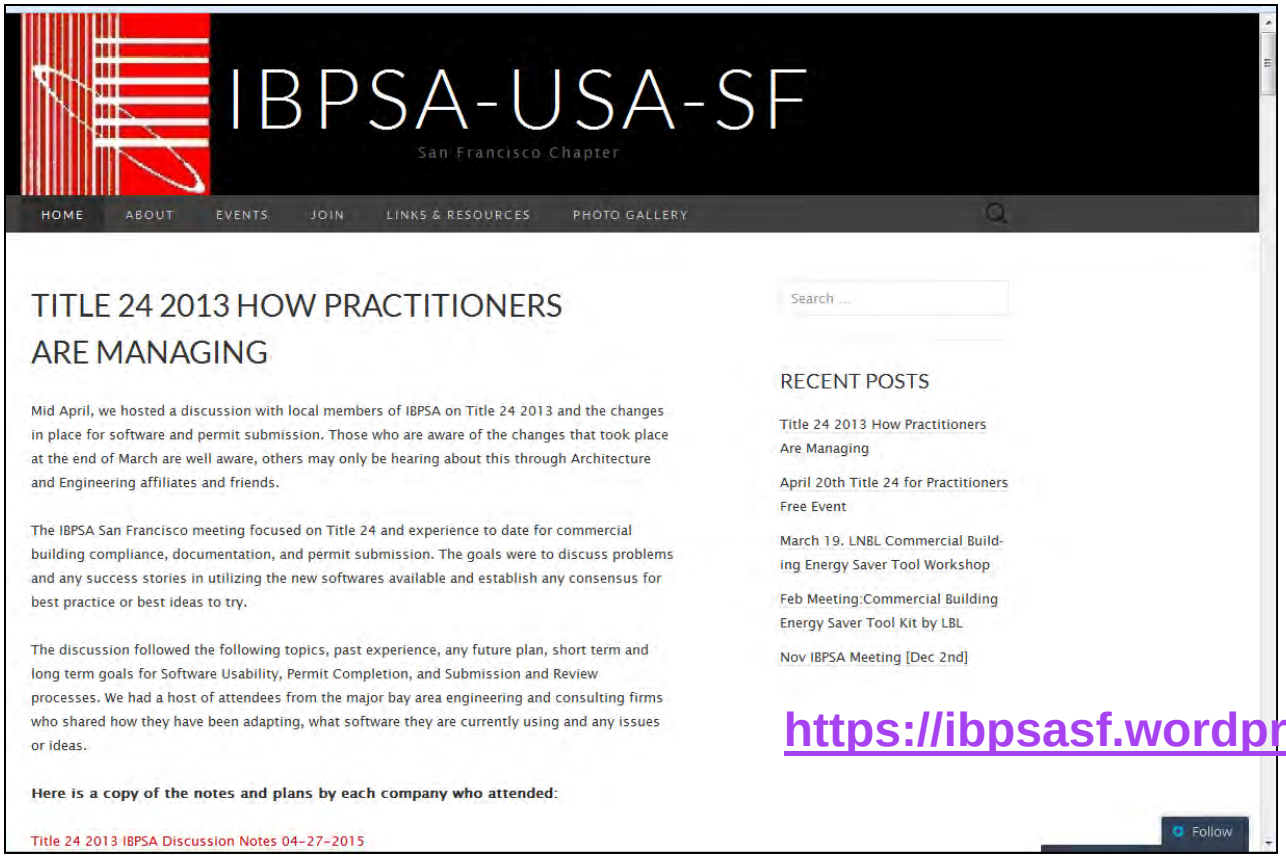


- 24/7 IES support
- Telephone access to IESVE problem solvers
- Community Support: Forum, LinkedIn, YouTube, etc.
- Online bank of Tutorials and User Guides

Where To Get Help

International Building Performance Simulation Association (IPBSA)

- Your local community of IESVE Users:
  - IBPSA-San Francisco Chapter
  - IBPSA-Los Angeles Chapter

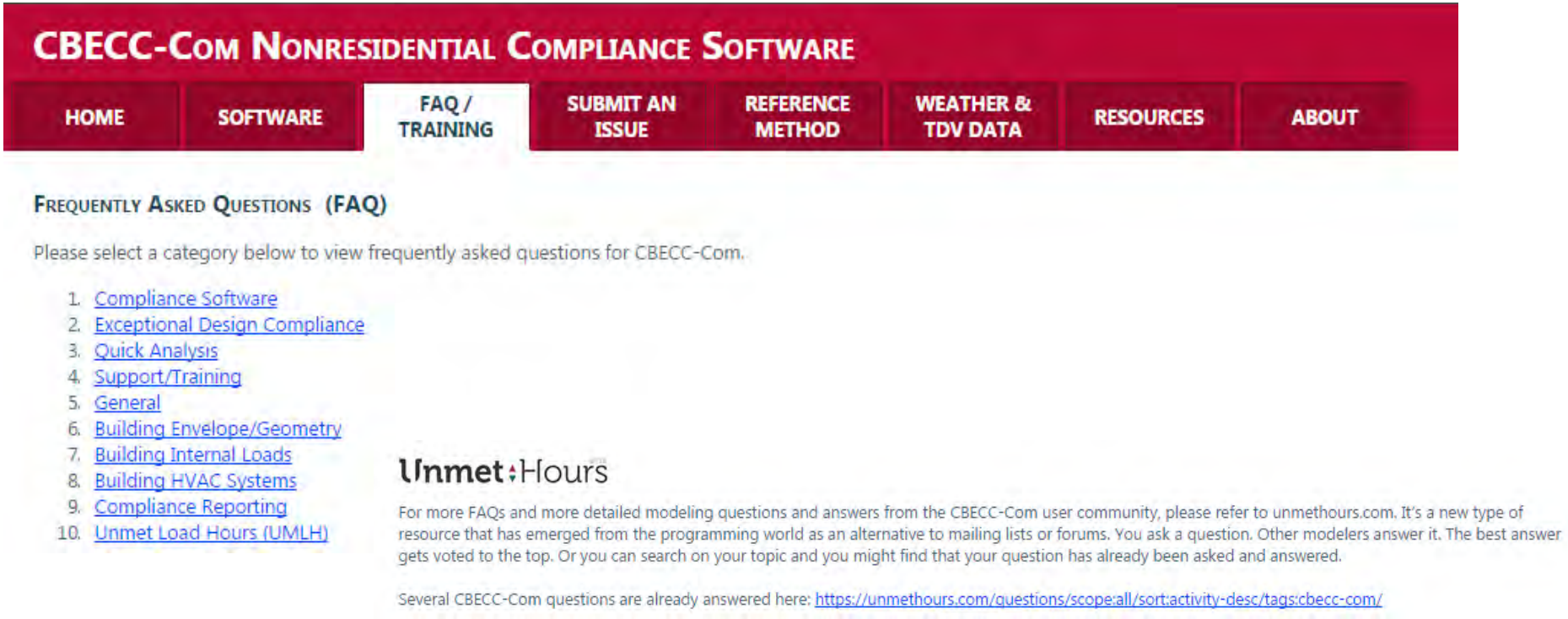


https://ibpsasf.wordpress.com

Where To Get Help

CBECC-Com

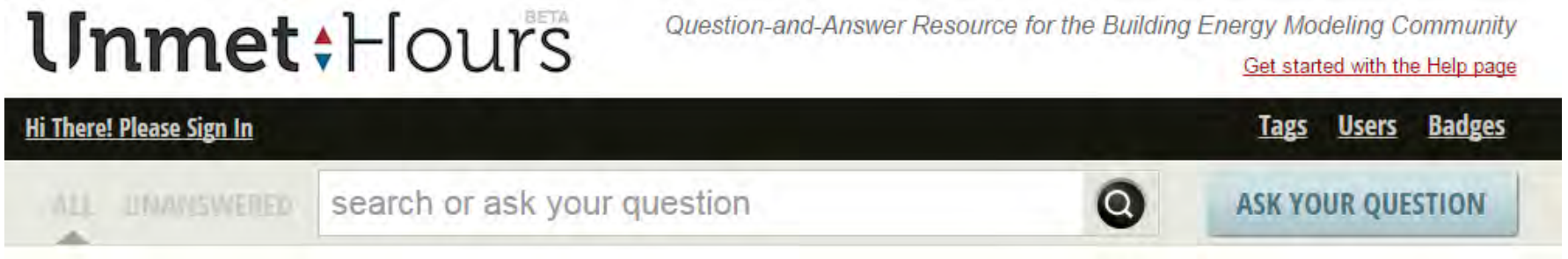
- Take a class!
  - CBECC-Com 2013 Title 24 Nonresidential Compliance Software Training - Introduction and Simplified (2D) Geometry
  - CBECC-Com 2013 Title 24 Nonresidential Compliance Software Training - Detailed (3D) Geometry and Advanced Topics



Where To Get Help

OpenStudio

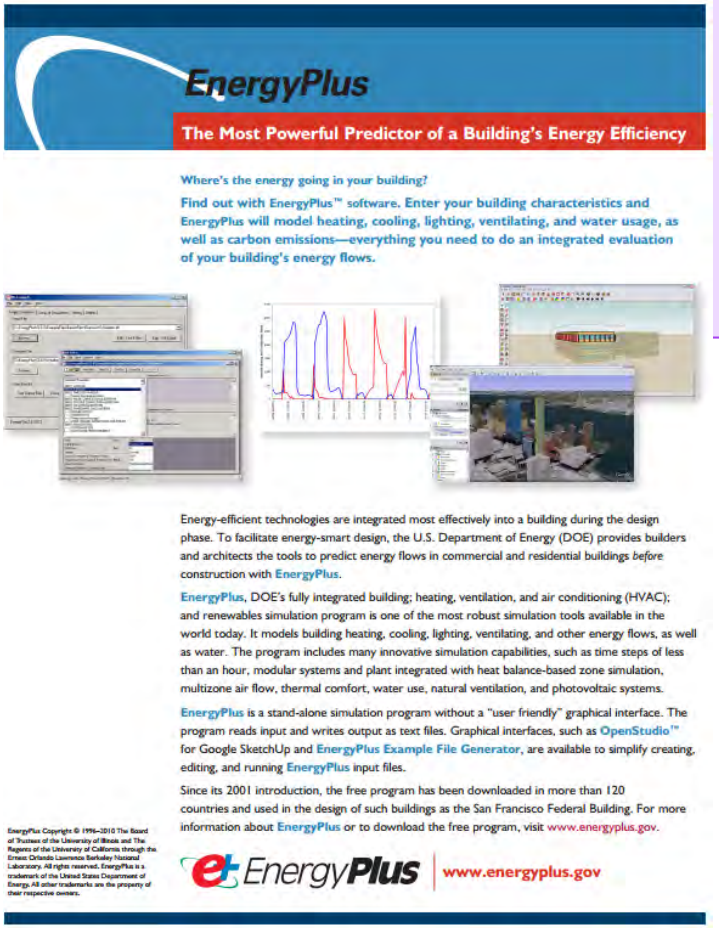
- Interface for EnergyPlus
  - www.openstudio.net/
  - https://unmethours.com
  - www.youtube.com/user/NRELOpenStudio
  - Uses SketchUp
  - http://nrel.github.io/OpenStudio-user-documentation/tutorials/tutorial_cbecc_materials/



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



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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