Digital Alchemy
THE BUILDING MODELING EXPERTS

Simergy basic training course

	Lesson 1a: Mixed use model with load calculations – Design Alternative	
1	Click on the **File** Menu	
2	Click on the New Menu-Button to create a new project.	
3	In the **Project** workspace	
4	In the Project Information palette	
5	For **Design Alternative 1**, set the **Region** dropdown to	"CA"
6	Set the **Location** dropdown to (or type in "San F" to filter the list) This loads the weather data for the project.	"San Francisco Intl Ap"
7	Rename the **Design Alternative 1** to	"Load calculation"

Create/Edit Design Alternatives   [New] [Copy] [Validate Model] [Delete]

Name	Description	Weather Source	Region	Location
Load calculation	Automatically generated Baseli...	Standard	CA	San Francisco Intl Ap

8	Go to the **Buildings** Workspace	
9	In the **Create/Edit Buildings** ribbon menu	
10	In the **Create/Edit Building** palette	
11	Click on the **Building Sections** tab	
12	Select **Section Type** dropdown as	"Retail Building Section Type"
13	Click on **Save Section**	
14	Click on the **Building Stories** tab	
15	Click the **New Stories** button	
16	Change **Num of Stories** to	2
17	Select the **Shape** dropdown as	"U-shape"
18	Select the **Occupied Configuration** dropdown as	"One Zone Per Floor"
19	Set **Shape Parameter X1** to	120 ft	36 m
20	Check the **Flip X** checkbox	
21	Set **Floor to Floor** to	16 ft	4.8 m
22	Set **Ceiling Elevation** to	13 ft	4 m

Buildings | Building Sections | Building Stories | Glazing | Roof

Building Section: Building Section (A.A)

Building Story Type: Retail Building Story Type [v]   [Edit]

Base Story: 1   Num of Stories: 2

Shape Parameters   **Origin**

Shape: U Shape   X1: 120.00 ft   Y1: 100.00 ft   X: 50.00 ft
Plenum Configuration: No Plenum   X2: 40.00 ft   Y2: 60.00 ft   Y: 50.00 ft
Occupied Configuration: One Zone per Story   X3: 40.00 ft   Y3: ____ ft   Z: ____ ft
Ceiling Configuration: Same As Occupied   ☑ Flip X   ☐ Flip Y   Rot: 0.0 °
Floor Configuration: Same As Occupied

Floor to Floor: 16.00 ft
Above Ceiling Height: 2.60 ft
Ceiling Elevation: 13.00 ft
Top of Floor Elevation: 0.00 ft
Below Floor Height: 0.00 ft
Perimeter Zone Depth: 15.00 ft
Floor Area: 9600.00 ft2
Floor Perimeter: 560.00 ft
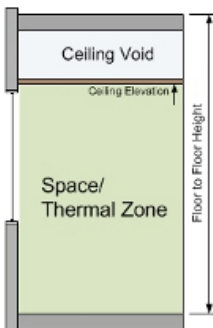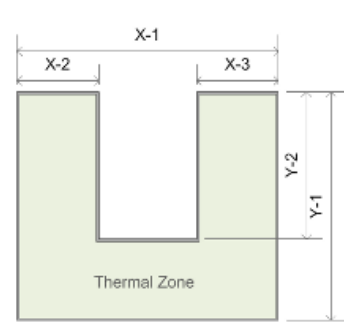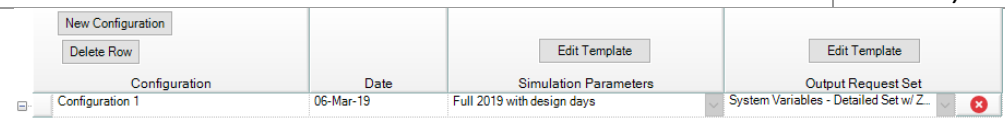
23	Click on the **Glazing** tab		
24	Change the **Calculation Method** to	*Percentage*	
25	Set **Target Win/Wall Ratio** (for all orientations) to	*"50%"*	
26	Set **Win Top Elevation** (for all orientations) to	*12 ft*	*3.6 m*
27	Click on **Save Stories**		

Lesson 1b: Mixed use model with load calculations – 2ⁿᵈ building section

28	In the **Buildings** Workspace	
29	In the **Create/Edit Buildings** ribbon menu	
30	In the **Create/Edit Building** palette	
31	Click on the **Building Sections** tab	
32	Click on **New Section**	
33	Select the **Section Type** dropdown as	*"Office Building Section Type"*
34	Click on **Save Section**	
35	Click on the **Building Stories** tab	
36	Click the **New Stories** button	
37	Change **Num of Stories** to	*4*
38	Select the **Shape** dropdown as	*"Rectangle shape"*
39	Select the **Occupied Configuration** dropdown as	*"One Zone Per Floor"*
40	Set **Shape Parameter X1** to	*120 ft* / *36 m*
41	Set **Shape Parameter Y1** to	*40 ft* / *12 m*
42	Set **Origin X** to	*40 ft* / *12 m*
43	Set **Origin Y** to	*110 ft* / *33 m*
44	Click on **Save Stories**	

45	Go to the **Systems** Workspace		
46		In the **Systems Creator** ribbon menu	
47			Select the **Template Name** dropdown as	*"Default Loads calculation"*
48			Set the radio button for Zone HVAC Groups to	*"One per building"*
49			Click on **Generate Systems**	

50	Go to the **Simulate** Workspace		
51		In the **EnergyPlus** ribbon menu	
52			In the lower left palette	
53			Click on **New Configuration**	
54			Select the **Simulation Parameter** template dropdown as *For the load calculations (sizing) we do not necessarily need the annual run, but since we want to compare results of annual runs later, we are selecting a full annual run here.*	*"Full 2019 with design days"*
55			Select the **Request Set Parameter** template dropdown as	*"System Variables – Detailed Set w/Zones + Meters"*

56	Click on the **File** Menu		
57			Click on the **Save** Button to save the current model.	
58			Set **File name** to	*"BasicTraining1"*
59	In the **Simulate** Workspace		
60		In the **EnergyPlus** ribbon menu	
61			In the lower right palette	
62			Click on **Run Simulation** – watch the progress bar and progress messages thereafter (Step 1: Simulation preparation, Step 2: Simulation) *The Simergy UI is disabled for a short period of time. After that the simulation and its preparation runs in the background and Simergy is enabled again.*	
63			Wait for simulation to finish and click on the **Results** button in the SimRun1 row	

64	In the **Reports** Workspace		
65			Select the **Zone Summary** Report (the default report Project Summary is loaded first)	
66			In the **Zone Summary** report, the first section Zone Summary gives an overview of basic parameters per zone (such as area and volume) but also feedback on the internal loads defined. The second section contains the design day sizing results and we can look at the calculated loads on a per zone basis. Zone loads for the retail spaces are higher the loads for the office spaces.	

Design Day: Zone Cooling (1%) and Heating (99%)

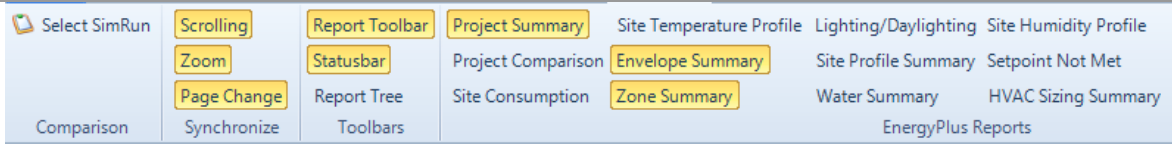|		Calculated Design Load (Btu/h)	User Design Load (Btu/h)	Calculated Design Air Flow (cfm)	User Design Air Flow (cfm)	Date of Peak	External Temperature at Peak (°F)	Humidity Ratio at Peak (lb-H2O/lb-air)	Calculated Cooling Load (Btu/h) ▐	Calculated Heating Load (Btu/h) ▐
									Min	Max
THERMAL ZONE A-1-1	Cooling	239,330.5	275,230.1	9,594.3	11,033	8/21 09	69.84	0.00819	0	251247.5
	Heating	140,112.1	175,140.1	3,701.7	4,625.5	1/21 09	40.82	0.00537	0	167846.1
THERMAL ZONE A-2-1	Cooling	251,247.5	288,934.6	11,348.7	13,050.2	8/21 16	76.93	0.00819	0	251247.5
	Heating	167,846.1	209,807.7	4,403	5,504.9	1/21 09	40.82	0.00537	0	167846.1
THERMAL ZONE B-1-1	Cooling	88,642.3	101,938.6	4,028	4,631.9	8/21 14	78.26	0.00819	0	251247.5
	Heating	36,419	45,523.8	1,063.7	1,330.7	1/21 08	40.82	0.00537	0	167846.1
THERMAL ZONE B-2-1	Cooling	95,276.4	109,567.9	4,331	4,979.4	8/21 15	78.1	0.00819	0	251247.5
	Heating	45,057.5	56,321.8	1,324.3	1,654.8	1/21 08	40.82	0.00537	0	167846.1
THERMAL ZONE B-3-1	Cooling	95,031.7	109,286.4	4,318.3	4,966.7	8/21 15	78.1	0.00819	0	251247.5
	Heating	46,380.7	57,975.9	1,364.6	1,705.7	1/21 08	40.82	0.00537	0	167846.1
THERMAL ZONE B-4-1	Cooling	92,928.7	106,867.9	4,222.9	4,856.5	8/21 15	78.1	0.00819	0	251247.5
	Heating	50,866.4	63,583	1,500.2	1,875.2	1/21 08	40.82	0.00537	0	167846.1

Lesson 2: DESIGN ALTERNATE 1 – Triple glazing with low-e with Building Model Creator

67	In the **Project** workspace	
68	In the Project Information palette	
69	Select the "*Load calculation*" design alternative and click on the **Copy** button	
70	Rename the **Design Alternative 1** to	*"Triple Glazing 1"*
71	Go to the **Buildings** Workspace	
72	In the Create/Edit Buildings ribbon menu	
73	In the Create/Edit Building palette	
74	In the **Buildings** tab	
75	Click the **Edit** button next to **Building Constructions**	

Templates

Building Constructions: | DefaultBuildingConstructions ▾ | Edit |

76	Change the four window constructions dropdowns from "GLAZ_DoublePane" to	*"GLAZ_TriplePane-LowE"*
77	Click on **Save Changes**, then	
78	Click on **Save** on the **Create/Edit Building** palette	
79	Click on the **File** Menu	
80	Click on the **SaveAs** Button to save the current model.	
81	Set **File name** to	*"BasicTraining2"*
82	Go to the **Simulate** Workspace	
83	In the **EnergyPlus** ribbon menu	
84	In the lower right palette	
85	Click on **Run Simulation**	
86	Wait for simulation to finish	
87	Click on the **Reports** Workspace	
88	Click on Select SimRun in the ribbon and select the first two annual SimRuns	
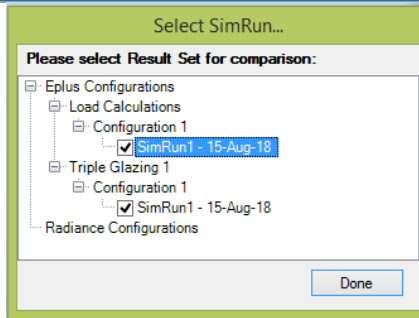
| 89 | Select the **Envelope Summary Report** | |
| 90 | Turn on **Scrolling/Zoom/Page Change** in the **Synchronize** section in the ribbon | |

| 91 | Investigate the **Envelope Summary** report and scroll down to the **Fenestration** section to verify that the window types are correct. | |

Fenestration

	Construction	Area of One Opening (ft2)	Area of Openings (ft2)	U-Factor (BTU/h-ft²-°F)
SPACE A-1-1:WINDOW A.1.1.1	GLAZ_DOUBLEPANE	88	88	0.525
SPACE A-1-1:WINDOW A.1.1.2	GLAZ_DOUBLEPANE	88	88	0.525
SPACE A-1-1:WINDOW A.1.1.3	GLAZ_DOUBLEPANE	88	88	0.525
SPACE A-1-1:WINDOW A.1.1.4	GLAZ_DOUBLEPANE	88	88	0.525
SPACE A-1-1:WINDOW A.1.1.5	GLAZ_DOUBLEPANE	88	88	0.525

Fenestration

	Construction	Area of One Opening (ft2)	Area of Openings (ft2)	U-Factor (BTU/h-ft²-°F)
SPACE A-1-1:WINDOW A.1.1.1	GLAZ_TRIPLEPANE WITH LOWE	89	89	0.289
SPACE A-1-1:WINDOW A.1.1.2	GLAZ_TRIPLEPANE WITH LOWE	89	89	0.289
SPACE A-1-1:WINDOW A.1.1.3	GLAZ_TRIPLEPANE WITH LOWE	89	89	0.289
SPACE A-1-1:WINDOW A.1.1.4	GLAZ_TRIPLEPANE WITH LOWE	89	89	0.289
SPACE A-1-1:WINDOW A.1.1.5	GLAZ_TRIPLEPANE WITH LOWE	89	89	0.289

| 92 | Select the **Project Summary** report | |
| 93 | Compare the **Net Site Energy Intensity** between the two runs to access the energy savings for the triple glazing. | |
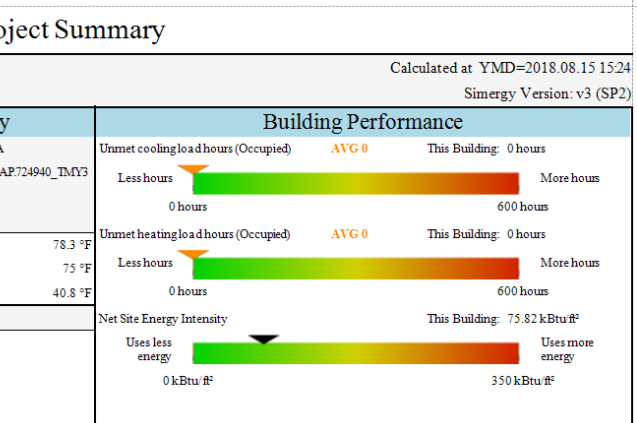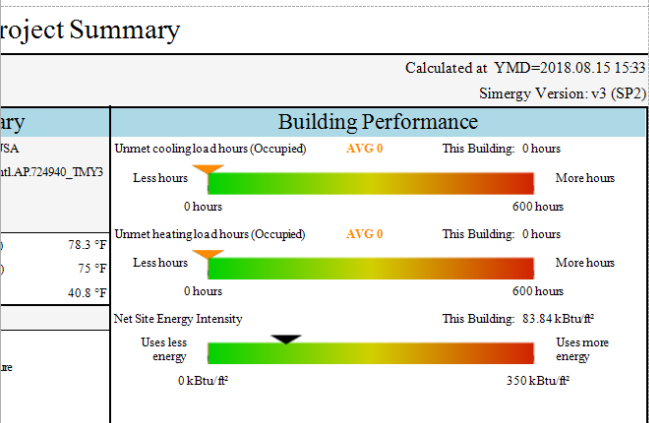
Lesson 3: DESIGN ALTERNATE 2 – Triple glazing with low-e with Measure

94	In the **Project** workspace	
95	In the Project Information palette	
96	Select the "**Load calculation**" design alternative and click on the **Copy** button	
97	Rename the **Design Alternative 1** to	*"Triple Glazing 2"*
98	Go to the **Simulate** Workspace	

99	In the **EnergyPlus** ribbon menu	
100	In the right palette	
101	Click on the plus in front of **Envelope**. Click on the plus left of **Fenestration** Locate the "Add low-e triple glazing to all windows" Measure	
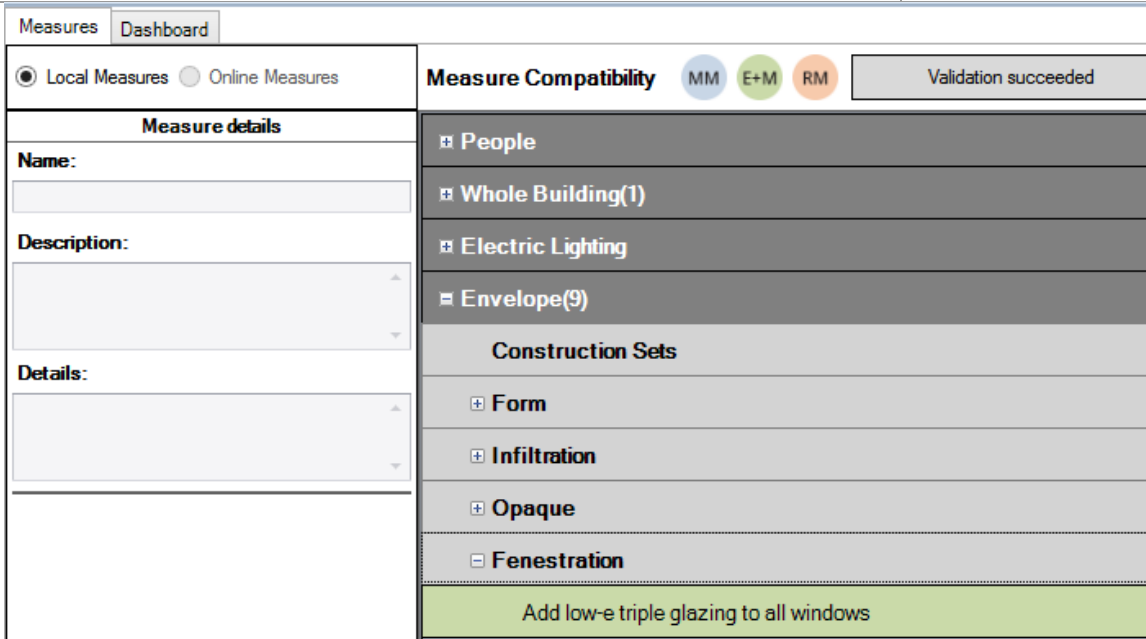
102	Either select the measure and drag and drop it unto the configuration or select the measure and press the **Add selected measures** button	
103	Click on the **File** Menu	
104	Click on the **SaveAs** Button to save the current model.	
105	Set **File name** to	*"BasicTraining3"*
106	Go to the **Simulate** Workspace	
107	In the **EnergyPlus** ribbon menu	
108	In the lower right palette	
109	Click on **Run Simulation**	
110	Wait for the simulation to finish	
111	Click on the **Reports** Workspace	
112	Click on **Select SimRun** and select the both triple glazing alternative SimRuns	
113	Select the **Envelope Summary Report**	
114	Turn on Synchronization of Scrolling/Zoom/Page Change in the ribbon.	
115	Investigate the Envelope Summary report and scroll down to the Fenestration section to verify that the window types are correct. The screenshot below compares identical windows.	

	Lesson 4: DESIGN ALTERNATE 3 – Air to air heat pump	
116	In the **Project** workspace	
117	In the Project Information palette	
118	Select the **"Triple Glazing 2"** design alternative and click on copy	
119	Rename the **Design Alternative 1** to	*"Air to Air Heat Pump"*
120	Go to the **Systems** Workspace	
121	In the **Systems Creator** ribbon menu	
122	Select the **Template Name** dropdown as	*"HeatPump AirToAir COP3.8"*
123	Set the dropdown for Zone HVAC Groups and Air loops to	*"One per zone"*
124	Click on **Generate Systems**	

125	Click on the **File** Menu	
126	Click on the **SaveAs** Button to save the current model.	
127	Set **File name** to	*"BasicTraining4"*
128	Go to the **Simulate** Workspace	
129	In the **EnergyPlus** ribbon menu	
130	In the lower right palette	
131	Click on **Run Simulation**	
132	Wait for simulation to finish	
133	Click on the **Reports** Workspace	
134	Select the **Project Summary** Report.	
135	In the **Project Summary** report verify that unmet load hours are under control and that the Net Site Energy Intensity is about 52 kBtu/ft2.	

Project Summary

| Air to Air HeatPump | Configuration 1 | SimRun1 | Calculated at YMD=2018.08.15 16:07 |
| Project Name: BasicTraining3.simp | Simergy Version: v3 (SP2) |

Building Summary

Building Type	
Conditioned Floor Area	36,122 ft2
Total Building Area	36,122 ft2
Gross Wall Area	32,779 ft2
Window-Wall Ratio	43.31 %
Average Plug Load Density	0.83 W/ft²
Average Lighting Density	1.25 W/ft²
Peak Occupancy	301
Total Outdoor Air Flow	5,216.00 cfm
Cooling Specific Air Flow	33,542.00 cfm
Heating Specific Air Flow	13,349.00 cfm
Site Peak Cooling Load	802,135.4 Btu/h
Site Peak Heating Load	482,214.36 Btu/h

Weather Summary

Location	San Francisco Intl Ap CA USA
Weather File	USA_CA_San.Francisco.IntLAP.724940_TMY3
Latitude	N 37° 37
Time Zone	GMT -8.0 Hours
Summer Design Dry Bulb Temperature (1%)	78.3 °F
Summer Design Wet Bulb Temperature (1%)	75 °F
Winter Design Dry Bulb Temperature (99%)	40.8 °F

User Defined

Summer Design Day Dry Bulb Temperature	
Coincident Design Day Wet Bulb Temperature	
Winter Design Day Dry Bulb Temperature	

Building Performance

Unmet cooling load hours (Occupied)   AVG 0   This Building 1 hours
Less hours — More hours
0 hours — 600 hours

Unmet heating load hours (Occupied)   AVG 0   This Building 0 hours
Less hours — More hours
0 hours — 600 hours

Net Site Energy Intensity   This Building 52.22 kBtu/ft²
Uses less energy — Uses more energy
0 kBtu/ft² — 350 kBtu/ft²

Site Performance

Net Source EUI	165.4 kBtu/ft2
Annual Electrical Consumption	552,814 kWh
Annual Peak Electrical Demand	150.6 KW
Annual Gas Consumption	0 kBtu
Annual Water Consumption	0 ft3
Operating Cooling Load	109,938 kBtu
Operating Heating Load	1,799 kBtu

Site Power Generation

Fuel-Fired Power Generation	0 kWh
High Temperature Geothermal	0 kWh
Photovoltaic Power	0 kWh
Wind Power	0 kWh
Net Decrease in On-Site Storage	0 kWh
Sub-Total On Site Electirc	0 kWh
Electricity Coming From Utility	552,813 kWh
Surplus Electricity To Utility	0 kWh
Net Electricity From Utility	552,813 kWh
Total Electric Sources	552,813 kWh

Site Thermal Energy Recovery

Water-Side Heat Recovery	0 kWh
Air to Air Heat Recovery Cooling	0 kWh
Air to Air Heat Recover Heating	0 kWh
High-Temperature Geothermal	0 kWh
Solar Water Thermal	0 kWh
Solar Air Thermal	0 kWh
Total On-Site Thermal Sources	0 kWh

Lesson 5: DESIGN ALTERNATE 4 – ASHRAE-7

136	In the **Project** workspace	
137	In the Project Information palette	
138	Select the **"Triple Glazing 2"** design alternative and click on copy	
139	Rename the Design Alternative 4 to	*"ASHRAE-7"*
140	Go to the **Systems** Workspace	
141	In the **Systems Creator** ribbon menu	
142	Select the **Template Name** dropdown as	*"ASHRAE-7"*
143	Set the dropdown for Zone HVAC Groups and Air loops to	"One per zone"
144	Click on **Generate Systems**	

All existing systems will be replaced

Template Name: ASHRAE7-VAVwReheat   [Generate Systems] [Save as Template] [Delete Systems]

	Grouping	**Primary Templates**
Zone HVAC Group:	One Per Zone	ASHRAE-AT_VAV_ReH-Wtr_TC
SHW Group:	One Per Building	None Selected
Air loop:	One Per Zone	ASHRAE-VAV_wtrC_wtrH_DT
VRF loop:	One Per Project	None Selected
Hot water loop:	One Per Project	ASHRAE-Boil(2)_HW_VSD
Chilled water loop:	One Per Project	ASHRAE-Chlr(2)_VC_Elec_EIR_VS
Mixed water loop:	One Per Project	None Selected
SHW Loop:	One Per Project	None Selected
Condenser loop:	One Per Project	ASHRAE-CoolTwr(2)_2SP_CSD
Steam loop:	One Per Project	None Selected
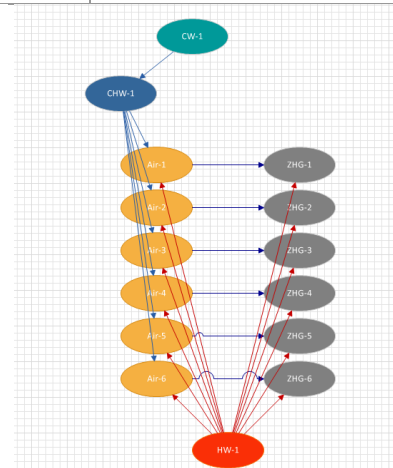
145	Click on the **File** Menu	
146	Click on the **SaveAs** Button to save the current model.	
147	Set **File name** to	*"BasicTraining5"*
148	Go to the **Simulate** Workspace	
149	In the **EnergyPlus** ribbon menu	
150	In the lower right palette	
151	Click on **Run Simulation**	
152	Wait for simulation to finish	
153	Click on the **Reports** Workspace	
154	Select the **Project Summary** Report.	
155	In the **Project Summary** report verify that unmet load hours are under control and compare the Net Site Energy Intensity value to that of the heat pump alternative.	

Project Summary

ASHRAE-7 | Configuration 1 | SimRun1   Calculated at YMD=2018.08.15 16:24
Project Name: BasicTraining3.simp   Simergy Version: v3 (SP2)

Building Summary

Building Type	
Conditioned Floor Area	36,122 ft2
Total Building Area	36,122 ft2
Gross Wall Area	32,779 ft2
Window-Wall Ratio	43.31 %
Average Plug Load Density	0.83 W/ff
Average Lighting Density	1.25 W/ff
Peak Occupancy	301
Total Outdoor Air Flow	5,216.00 cfm
Cooling Specific Air Flow	33,542.00 cfm
Heating Specific Air Flow	13,349.00 cfm
Site Peak Cooling Load	802,135.4 Btu/h
Site Peak Heating Load	482,214.36 Btu/h

Weather Summary

Location	San Francisco Intl Ap CA USA
Weather File	USA_CA_San.Francisco.IntlAP.724940_TMY3
Latitude	N 37° 37
Time Zone	GMT -8.0 Hours
Summer Design Dry Bulb Temperature (1%)	78.3 °F
Summer Design Wet Bulb Temperature (1%)	75 °F
Winter Design Dry Bulb Temperature (99%)	40.8 °F
User Defined	
Summer Design Day Dry Bulb Temperature	
Coincident Design Day Wet Bulb Temperature	
Winter Design Day Dry Bulb Temperature	

Building Performance

Unmet cooling load hours (Occupied)   AVG 6   This Building 128 hours
Less hours / More hours
0 hours / 600 hours

Unmet heating load hours (Occupied)   AVG 1   This Building 9 hours
Less hours / More hours
0 hours / 600 hours

Net Site Energy Intensity   This Building 42.48 kBtu/ff²
Uses less energy / Uses more energy
0 kBtu/ff² / 350 kBtu/ff²

Site Performance

Net Source EUI	125.9 kBtu/ft2
Annual Electrical Consumption	405,622 kWh
Annual Peak Electrical Demand	134.5 KW
Annual Gas Consumption	150,492 kBtu
Annual Water Consumption	10,587.3 ft3
Operating Cooling Load	56,276 kBtu
Operating Heating Load	150,492 kBtu

Site Power Generation

Fuel-Fired Power Generation	0 kWh
High Temperature Geothermal	0 kWh
Photovoltaic Power	0 kWh
Wind Power	0 kWh
Net Decrease in On-Site Storage	0 kWh
Sub-Total On Site Electirc	0 kWh
Electricity Coming From Utility	405,623 kWh
Surplus Electricity To Utility	0 kWh
Net Electricity From Utility	405,623 kWh
Total Electric Sources	405,623 kWh

Site Thermal Energy Recovery

Water-Side Heat Recovery	0 kWh
Air to Air Heat Recovery Cooling	0 kWh
Air to Air Heat Recover Heating	0 kWh
High-Temperature Geothermal	0 kWh
Solar Water Thermal	0 kWh
Solar Air Thermal	0 kWh
Total On-Site Thermal Sources	0 kWh

156	Select the **Project Comparison** Report.	
157	Click on **Select SimRun** and select the ASHREA-7 and the Air to Air HeatPump alternative SimRuns. Between the two alternatives and see that the internal loads are identical (as expected) and that overall the water based systems is using less energy.	

Project Comparison

Alternative Energy End Use and Demand Comparison

Energy Usage	Air to Air HeatPump | Configuration 1 | SimRun1		ASHRAE-7 | Configuration 1 | SimRun1	
	Total Energy End Use (kWh)	Electric Demand (KW)	Total Energy End Use (kWh)	Electric Demand (KW)
Space Cooling	32,244	56.8	16,506	32.23
Space Heating	528	0	44,139	0
Heat Rejection	0	0	983	3.18
Fans	229,386	26.19	86,122	25.33
Pumps	0	0	11,353	6.09
Humidification	0	0	0	0
Heat Recovery	0	0	0	0
Interior Receptacles	99,694	26.99	99,694	26.99
Exterior Receptacles	0	0	0	0
Interior Lighting	190,961	40.67	190,961	40.67
Exterior Lighting	0	0	0	0
Service Water Heating	0	0	0	0
Refrigeration	0	0	0	0
Site Power Generation	0	0	0	0
Grand Total	552,814	150.65	449,761	134.49