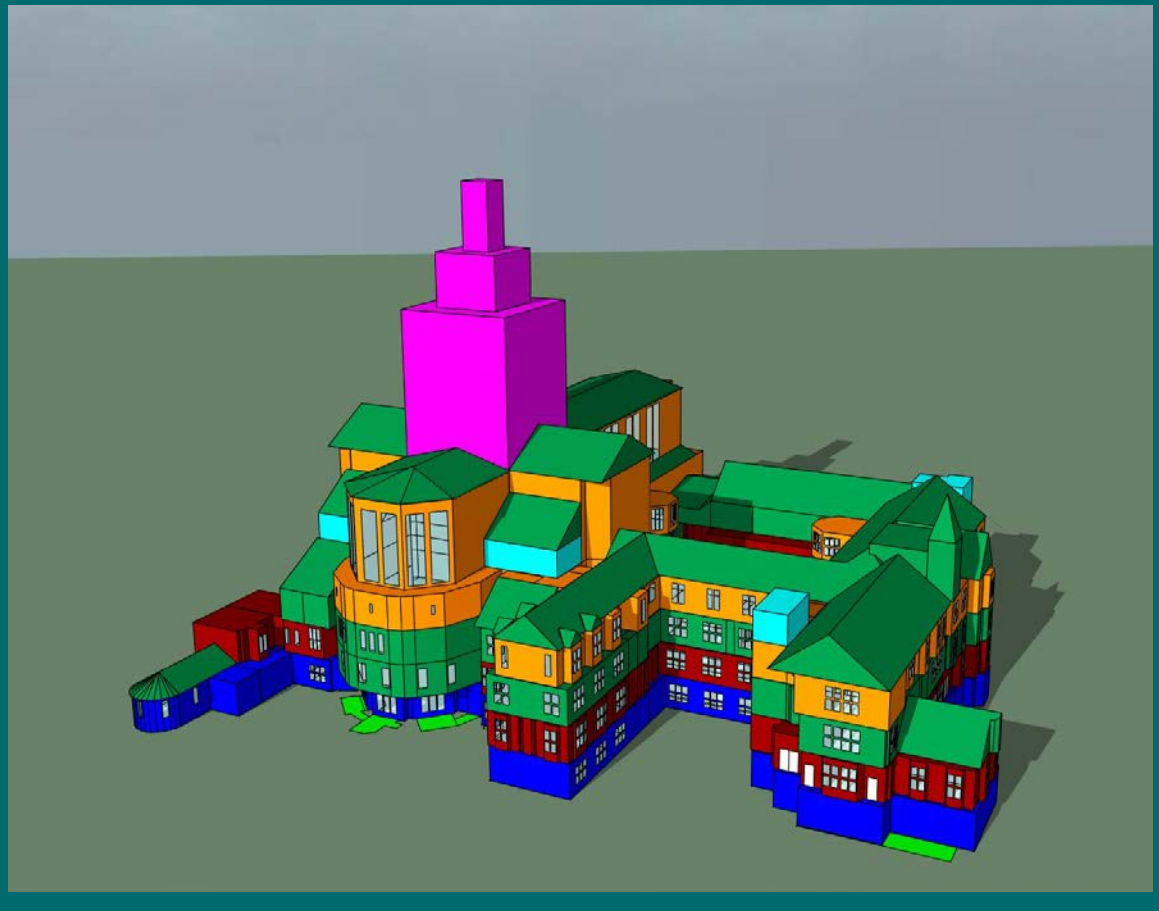


IES Whole-Building Energy Model Energy Model Input/ Output Report – 65 Ton Multi-stack system

East Liberty Presbyterian Church – 14 009



For: East Liberty Presbyterian Church

By: Jeffery Ison, James Construction

Date: April 7, 2015



Table of Contents

1	Location, Site & Climate data	3
2	Building Form, Layout & Zoning	5
3	Materials & Constructions	8
4	Space use classification and schedules	8
5	Lighting	9
6	HVAC Systems	9
7	Results	13

1 Location, Site & Climate data

City	Pittsburgh
Country	United States of America
Latitude	40.46N
Longitude	79.93 W
Altitude	1273 ft
Time Zone (+GMT)	-5.0 hours
Daylight saving time adjustment	1
From:	March
To:	October
Ground Reflectance	0.2
Terrain Type	City
Wind Exposure	Normal
Annual hourly climate data file	USA_PA_Pittsburgh.Intl.AP.725200_TMY3.epw

Table 1: Summary Location and Site Data

1.1 Climate

ASHRAE Climate Zone	5A
Annual percentile for Heating loads design weather	99.60%
Annual percentile for Cooling loads design weather	1.0%
Heating Loads Weather data: Outdoor winter design temperature	4.28°F
Cooling loads weather data: Max. Dry-Bulb	93.20°F
Max. Wet-Bulb	73.58°F

Table 2: Climate Data Summary

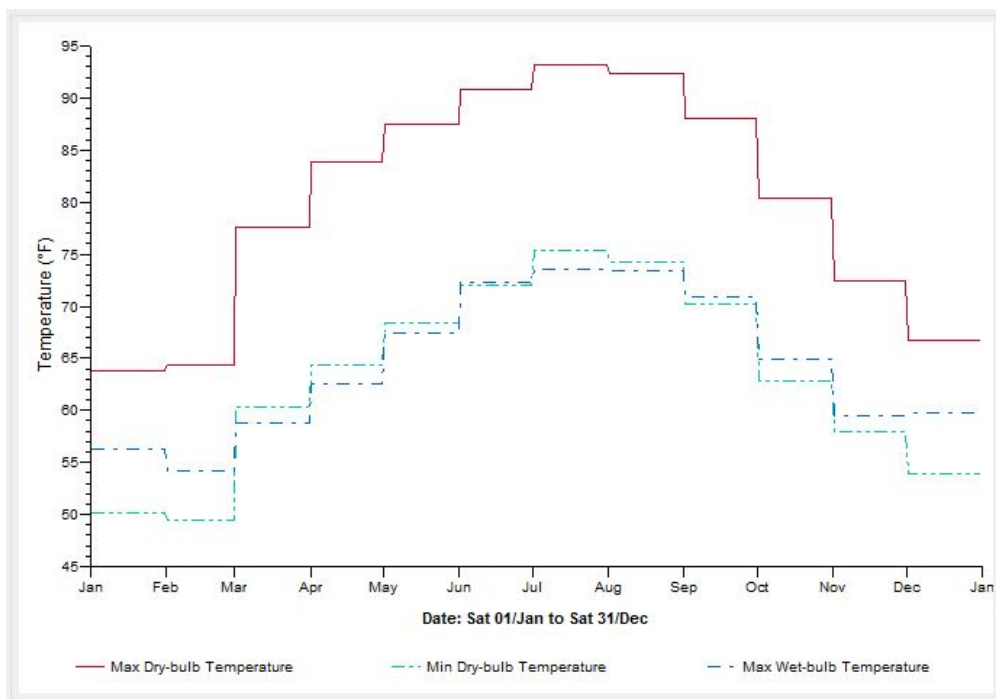


Figure 1: Dry Bulb / Wet Bulb Summary



Figure 2: Climate metrics chart

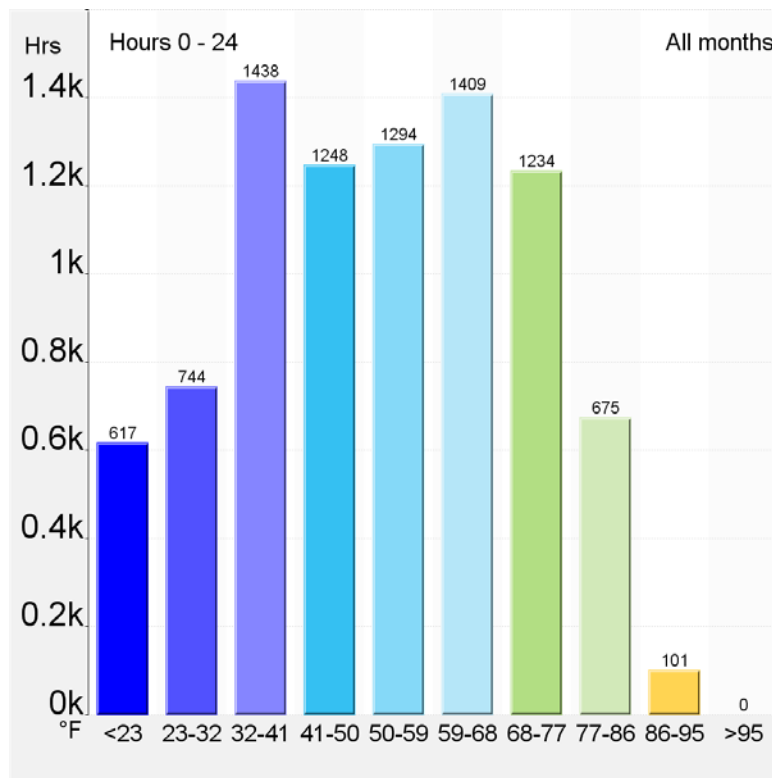


Figure 3: Temperature distribution chart (in Hrs.)

2 Building Form, Layout & Zoning

2.1 Summary

Architectural plans, sections and elevations have been used to develop the 3D Virtual Environment model. Model geometry is represented as internal volumes.

2.2 Model View (no surroundings)



Figure 4: Model view – Perspective (no surroundings)

2.3 North Elevation Model View

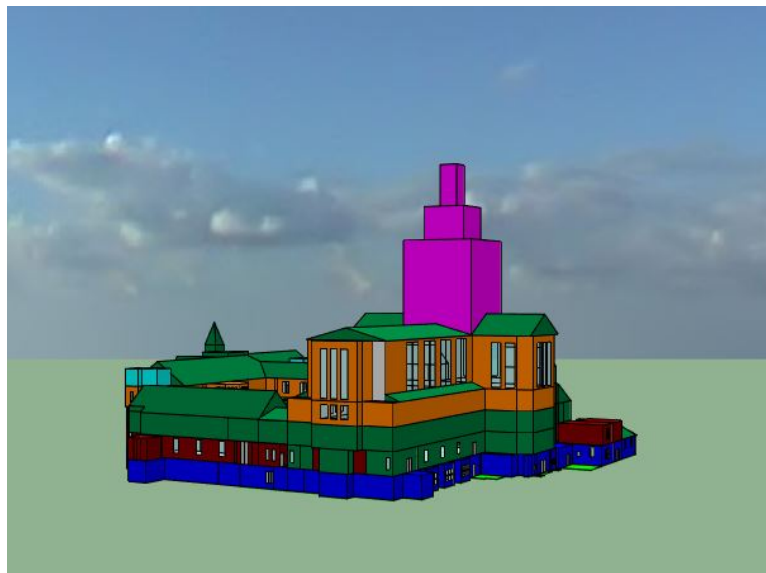


Figure 5: Model view – North elevation

2.4 South Elevation Model View

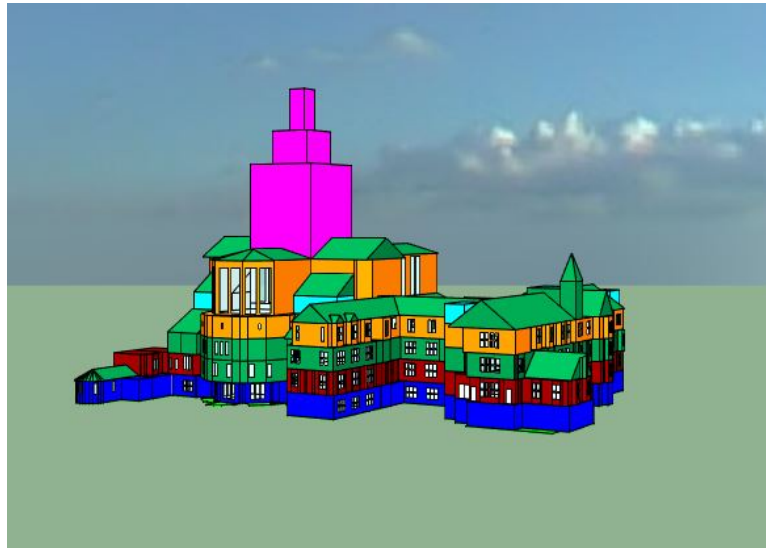


Figure 6: Model view – South elevation

2.5 East Elevation Model view

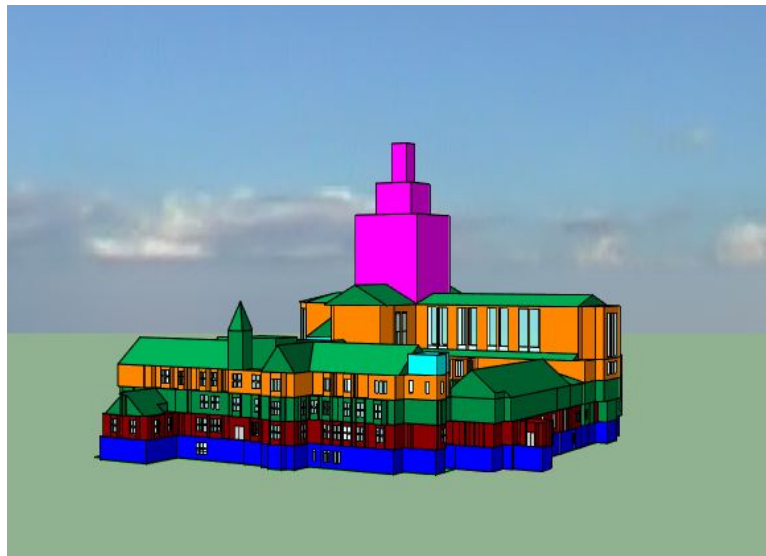


Figure 7: Model View – East elevation

2.6 West Elevation Model View

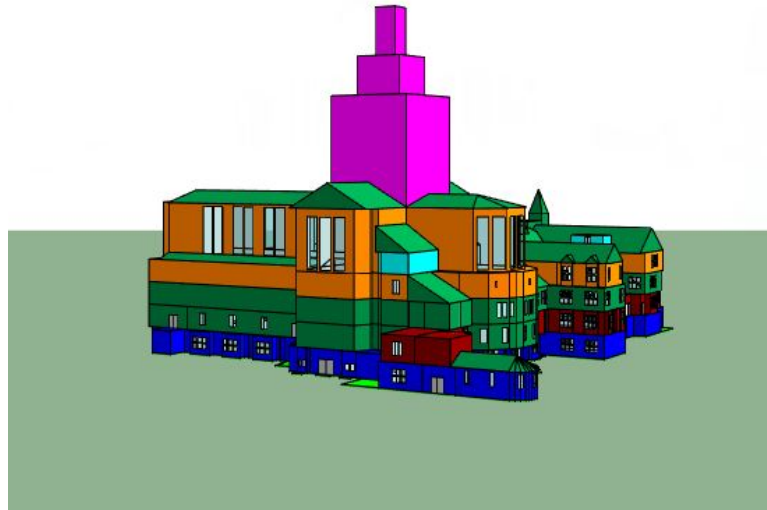


Figure 8: Model view – West elevation

2.7 Floor / Room / Zone Summary

Floor	Floor Area (ft ²)	Deck to Deck (ft)	Exterior Walls (ft ²)	Volume (ft ³)
Sub-Basement	24880.28	10	17388	298563.4
Basement	31467.25	10	23571	369264.3
Ground	29513.9	12	22774	446610.9
First	35057.32	12	29327	420689.3
Second	23201.19	12	21894	408468.9
Third	16511.6	12	18980	328193.7
Fourth	1581.98	12	21626	376010.2
Total:	162213.52	80	155560	2647801

Table 2: Model Area Summary

Functional Area	Floor Area (ft ²)
Worship:	56216 Sf
Administration:	46002 Sf
Social Hall:	12755 Sf
Gym:	3061 Sf
Bowling Alley:	2503 Sf
Core:	43178 Sf
Total	163,715.00 Sf

Table 3A: Energy Star Portfolio Manager, Gross Square Feet

3 Materials & Constructions

3.1 External Constructions

- Construction
- Base Ground Floor Construction 4" (BASEFL00)
 - ELPC 3" WOOD DOOR (DOOR1)
 - ELPC BASE CEILING (BASECL00)
 - ELPC BASE FLOOR/CEILING (STD_CEI1)
 - ELPC EXT WALL 12" ASHLAR/CIP/PLASTER (ASHWL117)
 - ELPC EXT WALL 2' CIP (ASHWL112)
 - ELPC EXT WALL 24" ASHLAR/CIP/PLASTER (ASHWL115)
 - ELPC EXT WINDOW CLEAR (SGL)
 - ELPC FLAT MEMBRAIN ROOF (STD_ROOF)
 - ELPC INT 4" PLASTER/SPEEDTILE/PLASTER (ASHIW11)
 - ELPC PITCHED SLATE ROOF (STD_ROO1)
 - US ASHRAE INTERIOR-WALL-1 (ASHIW1)
 - US ASHRAE WALL-11 (ASHWL11)
 - concrete slab internal ceiling (INCEIL-S)
 - solid hardwood door (normally hung) (DTSH)

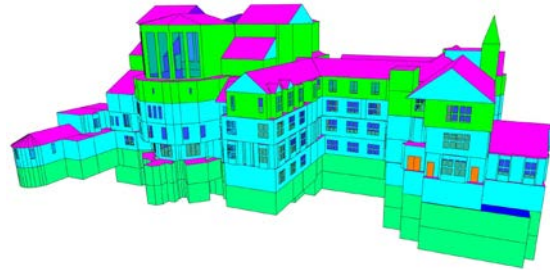


Figure 9: External Constructions Chart

ID	Category	Description	Data source	U value (Btu/h-ft ² ·°F)	Thickness (in)
ASHIW1	Internal Partition	US ASHRAE INTERIOR-WALL-1	ASHRAE	0.2603	5.504
ASHIW11	Internal Partition	ELPC INT 4" PLASTER/SPEEDTILE/PLASTER	Generic	0.2603	5.504
ASHWL11	External Wall	US ASHRAE WALL-11	ASHRAE	0.3517	13.752
ASHWL112	External Wall	ELPC EXT WALL 2' CIP	Generic	0.1225	36
ASHWL115	External Wall	ELPC EXT WALL 24" ASHLAR/CIP/PLASTER	Generic	0.1809	24
ASHWL117	External Wall	ELPC EXT WALL 12" ASHLAR/CIP/PLASTER	Generic	0.3018	12
BASECL00	Internal Ceiling/Floor	ELPC BASE CEILING	SBEM equivalent	0.3178	18
BASEFL00	Ground/Exposed Floor	Base Ground Floor Construction 4"	SBEM equivalent	0.13	46
DOOR1	Door	ELPC 3" WOOD DOOR	Generic	0.2466	3
DTSH	Door	solid hardwood door (normally hung)	Generic	0.4503	1.654
INCEIL-S	Internal Ceiling/Floor	concrete slab internal ceiling	Generic	0.1882	16.535
SGL	External Window	ELPC EXT WINDOW CLEAR	Generic	0.9795	0.236
STD_CEI1	Internal Ceiling/Floor	ELPC BASE FLOOR/CEILING	Generic	0.3109	9.154
STD_ROO1	Roof	ELPC PITCHED SLATE ROOF	Generic	0.8146	6
STD_ROOF	Roof	ELPC FLAT MEMBRAIN ROOF	Generic	0.8654	4.5

Figure 10: Constructions Thermal Values

4 Space use classification and schedules

4.1 Building Schedules

Functional Area	Lighting / Occupancy Daily Profile	Weekly Profile
Worship:	-	-
Sanctuary	Day 10:00-12:00	week 10:00-12:00 SUNDAY WORSHIP
Chapel	Day 15:00-22:00 CHAPEL	week 15:00-22:00 CHAPEL
Administration:	Day 08:00-17:00	week 08:00-17:00
Social Hall:	SOC.HALL LGHTNG 15:00 TO 22:00	week 15:00-22:00 SOCIAL HALL
Gym:	Day 16:00-22:00	week 16:00-22:00 GYM
Bowling Alley:	Day 16:00-22:00	week 16:00-22:00 GYM
Core:	Day 07:30-14:30	week 7:30-14:30

Table 4: Lighting / Occupancy Profiles

5 Lighting

The model is using the “Space by space” lighting power calculation method. Lighting power densities have been calculated with a blended method of actual wattage/ASHRE watts per SQ.FT. values. For detail lighting information see Appendix A.

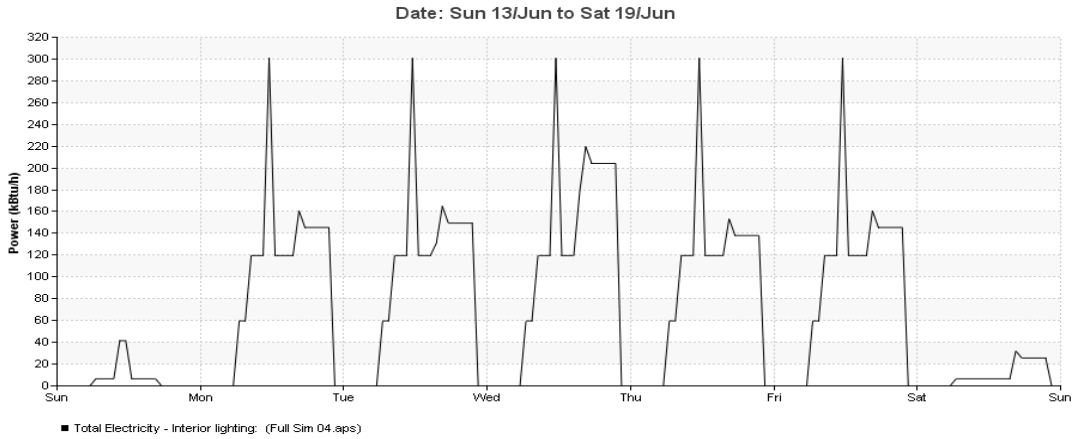


Figure 11: Typ. Weekly Lighting Loads

6 HVAC Systems

6.1 Proposed Systems

6.1.1 Airside

The church is utilizing constant air volume air handling units in select areas of the building. Outside air is provided by some air handling units.

Area Served	Sanctuary	Social Hall	Narthex	Chapel	Organ Blower Rooms	ACCU-1	ACCU-2	ACCU-3
Total Airflow (CFM)	13,700	1,890	390	1,870	1,090	955	1,790	1,150
Outside Air (CFM)	4,764	587	-	610	-	-	-	-
Supply Fan Power (hp)	10	5	-	1.5	2	0.2	0.3	0.2
Return Fan Power (hp)	7.5	2	1	1	-	-	-	-
Cooling Capacity (kBtu/h)	-	-	-	-	19	34	64	48
Heating Capacity (kBtu/h)	904	0	30	148	24	-	-	-

Table 5: Ventilation System Summary Performance

Exhaust System	Total Airflow (CFM)	Fan Power (hp)
Toilets	4,845	2
Kitchen	1,645	2

Table 6: Exhaust and Ventilation Fan System Summary Performance

Heater Type	CFM	Total Capacity (kBtu/h)	Total HP
Room Radiators	-	5116.74	-

Table 7: Heater and Radiator Summary Performance

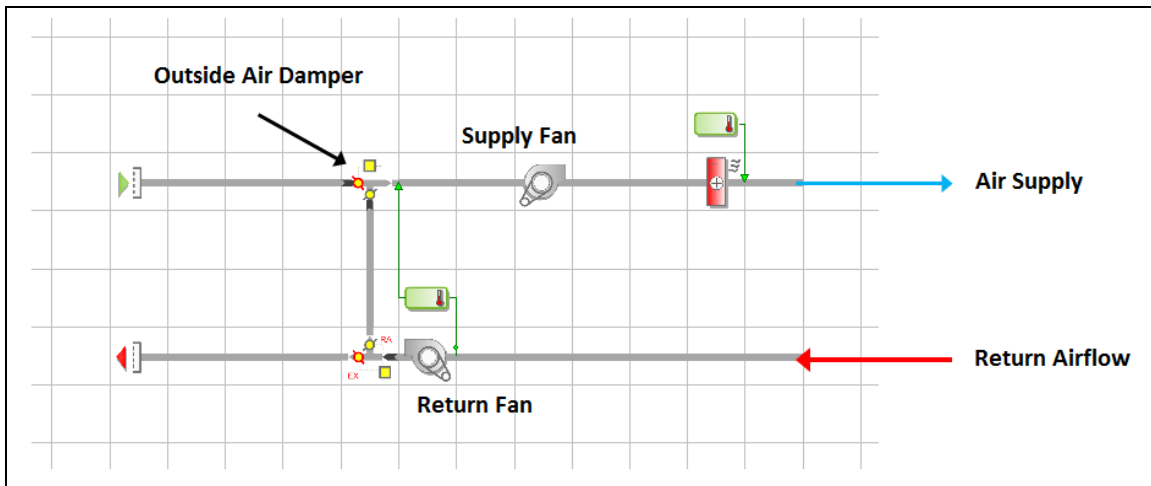


Figure 12: Sanctuary System Air Handling Unit Configuration in IES <VE> Systems Analysis Tool ApHVAC

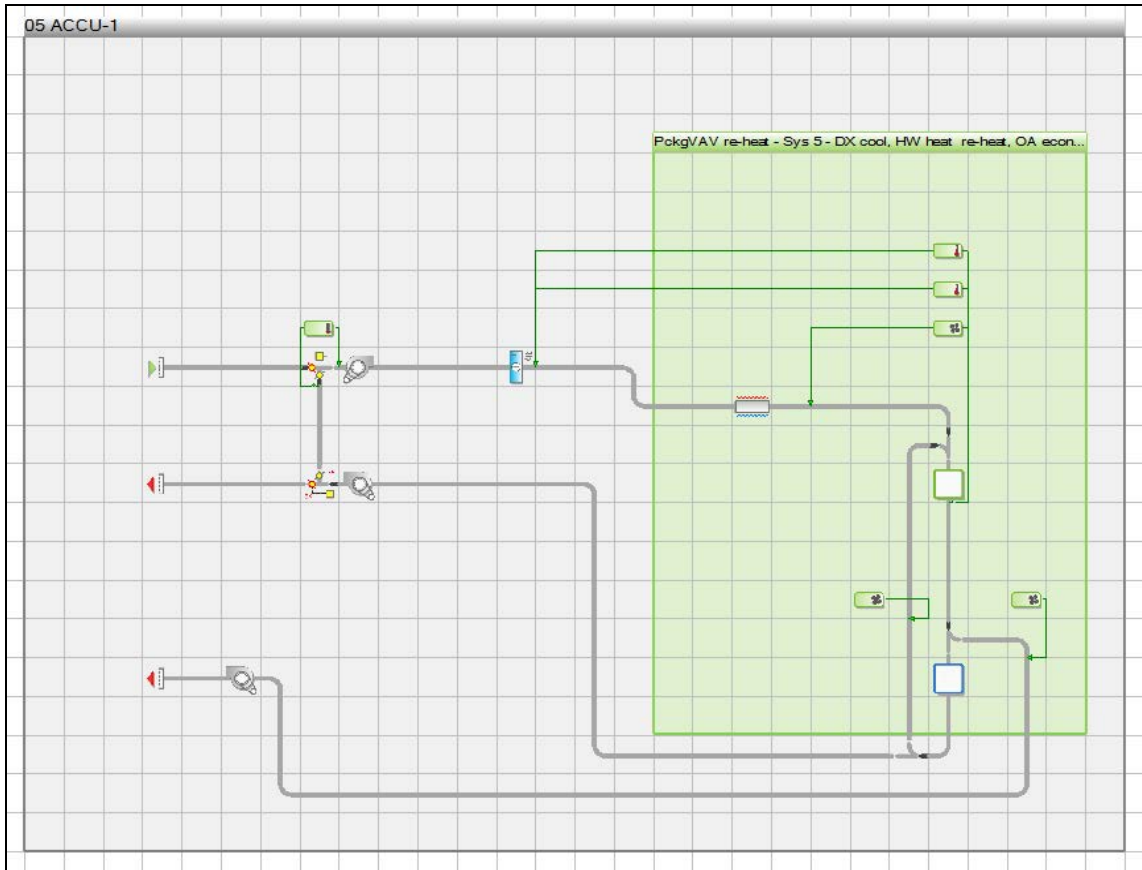


Figure 13: Administration AHU Configuration in IES <VE> Systems Analysis Tool APHVAC

6.1.2 Plant

6.1.2.1 Steam Loop

The heating system consists of two gas fired steam boilers. The loop provides heating for air handler heating coils as well as space radiators.

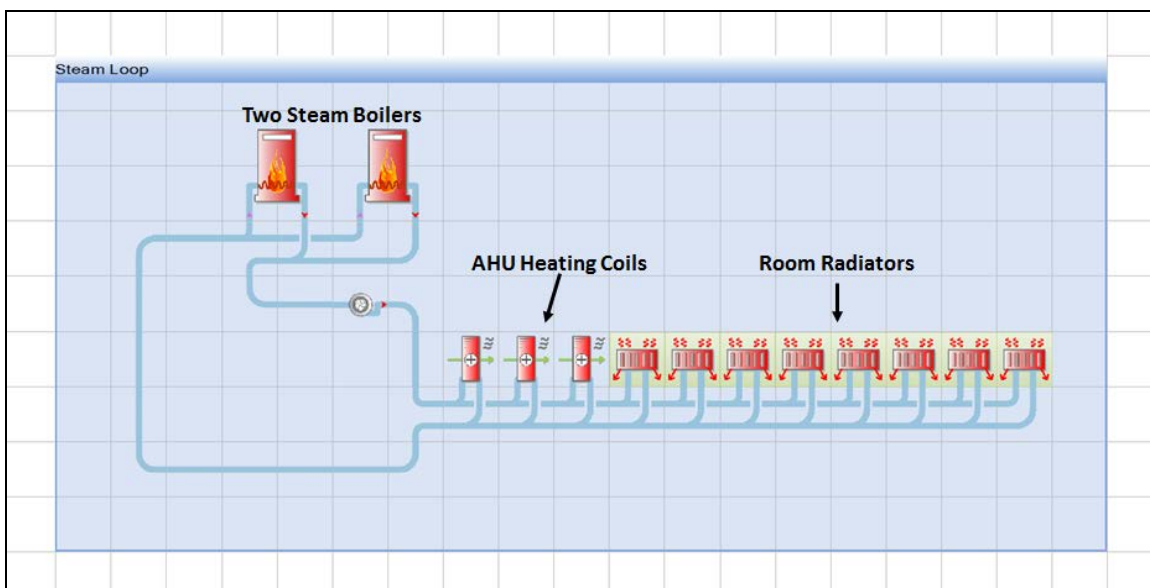


Figure 14: Steam Loop Configuration in IES <VE> systems analysis tool APHVAC

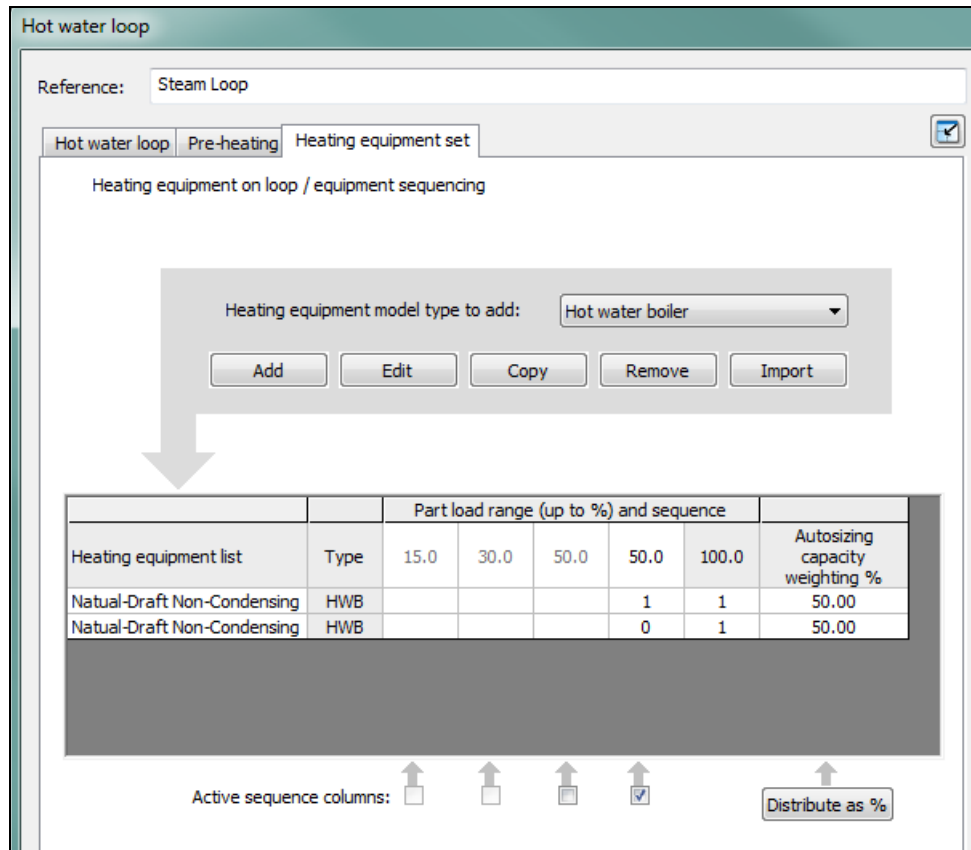


Figure 15: Boiler Sequencing in IES <VE> systems analysis tool ApHVAC

6.2 Service Hot Water

Service water loads and usage have been estimated. Service hot water is provided by a separate gas steam loop.

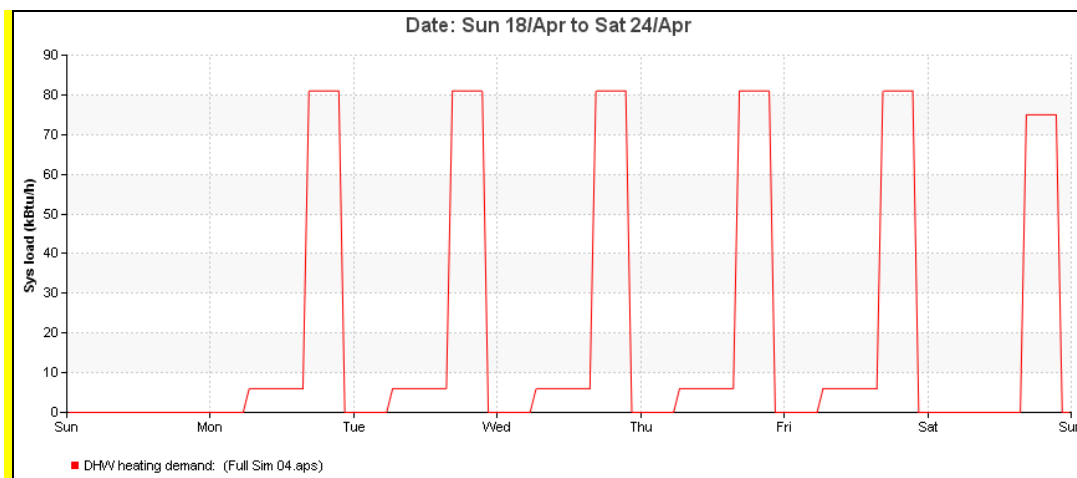


Figure 16: Typical Domestic Hot Water Heating Demand

7 Results

7.1 Total Building Energy Usage Inputs (5 Yr. Avg.)

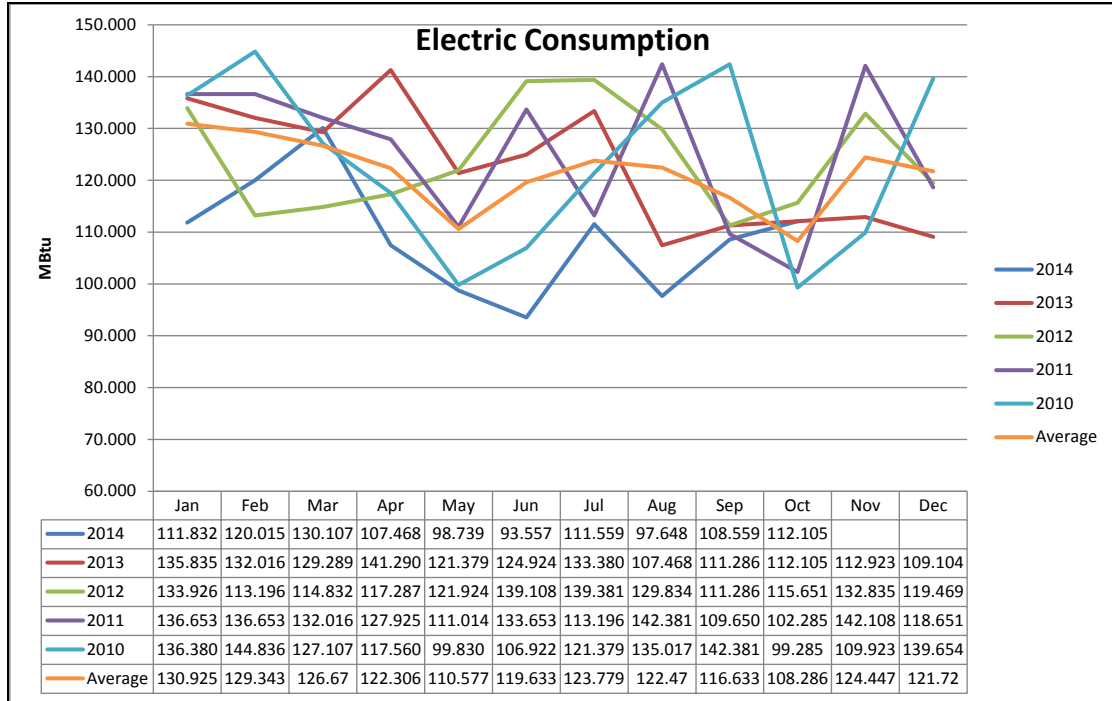


Figure 17: Electric Consumption (5 Yrs.)

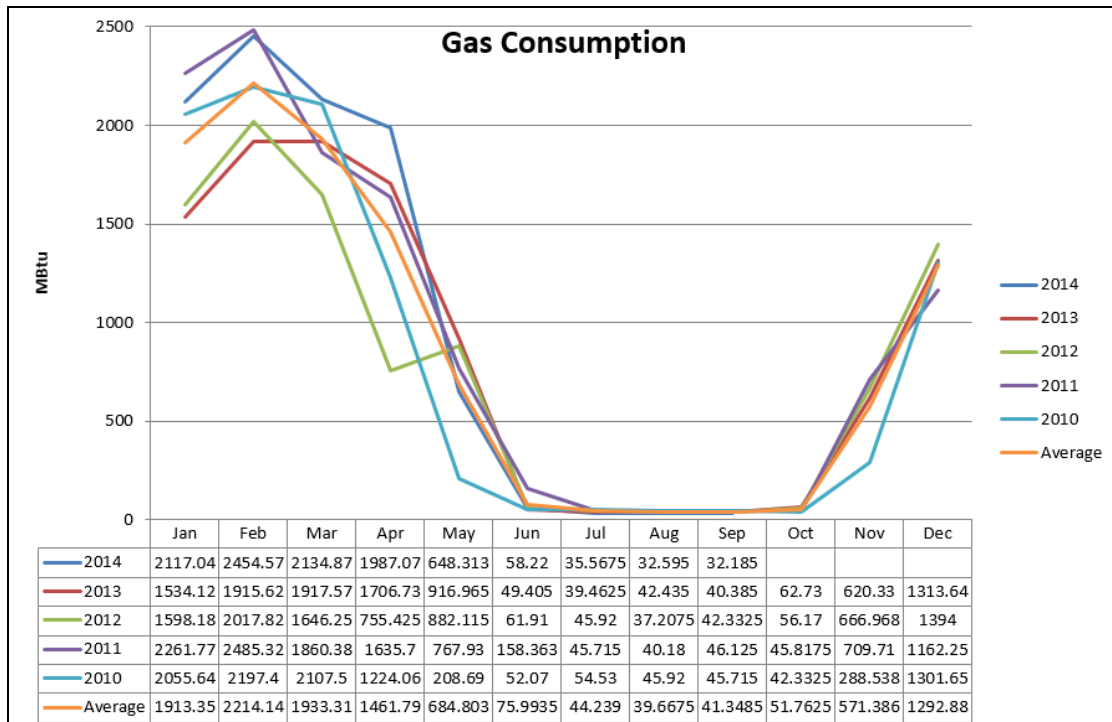
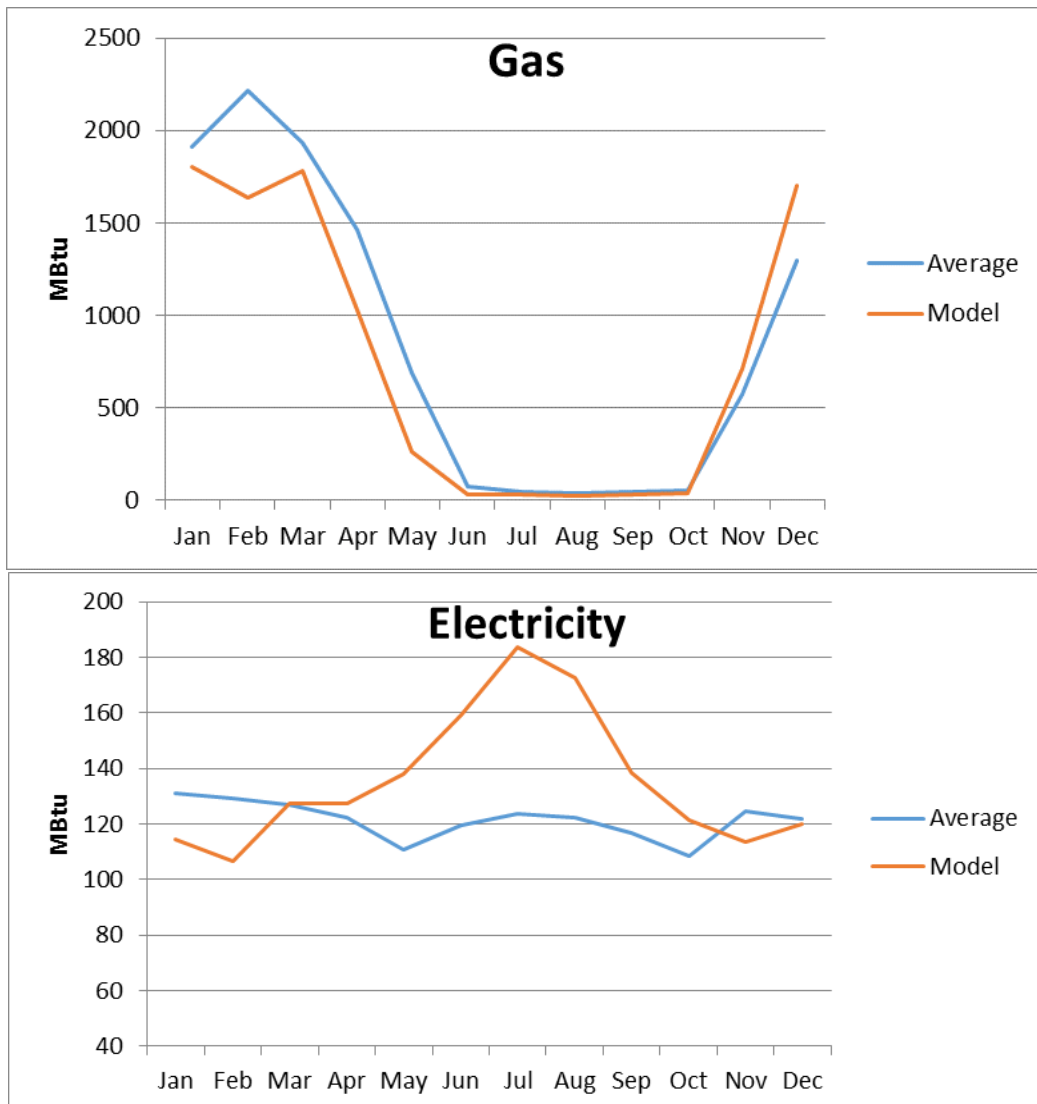
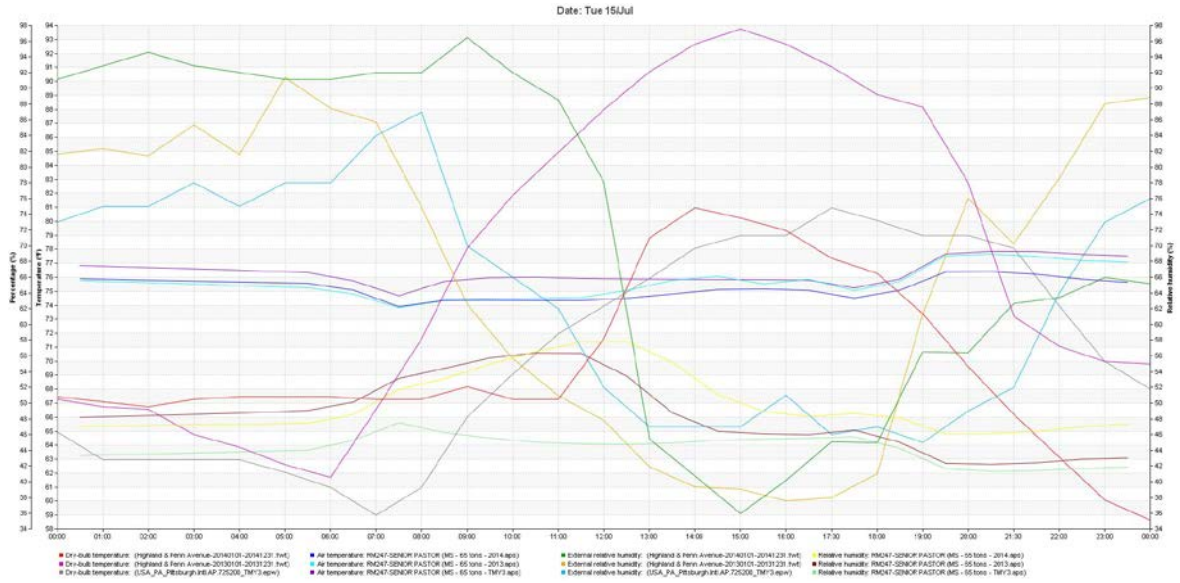


Figure 18: Gas Consumption (5 Yrs.)

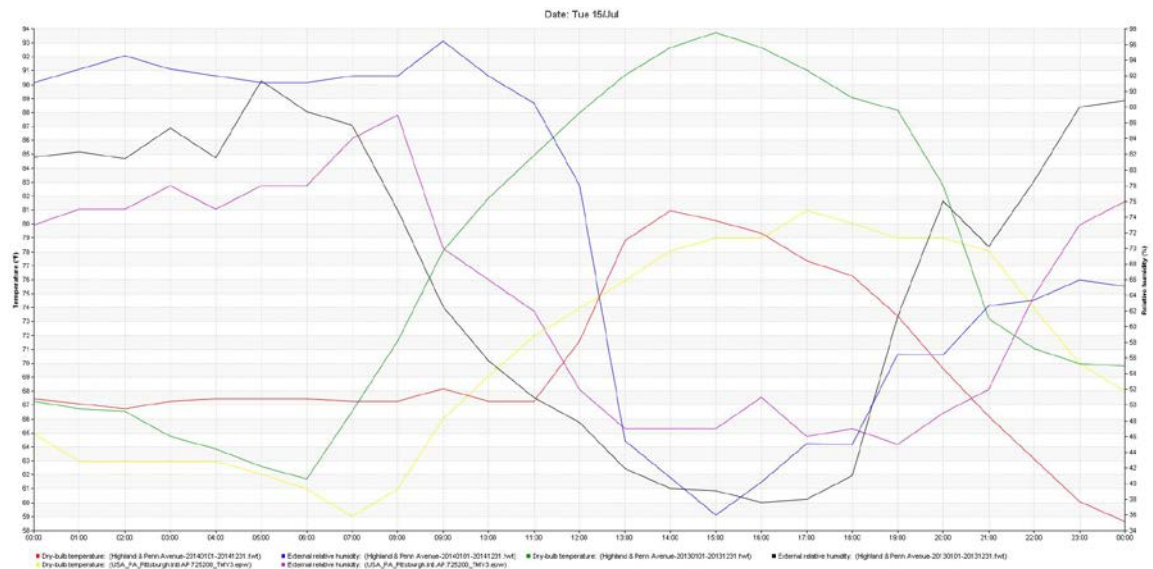
7.2 Total Building Energy Usage- Model Outputs (1 Calendar Yr.)



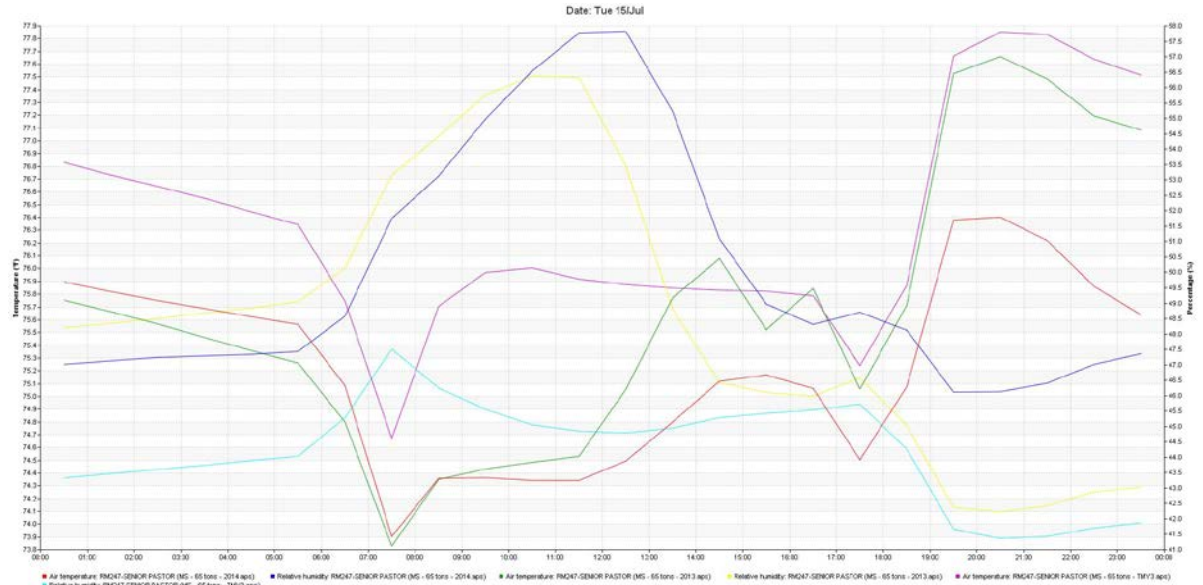
Estimated Building Consumption – Gas | Electric Concept 1a-65 Ton Multi-stack



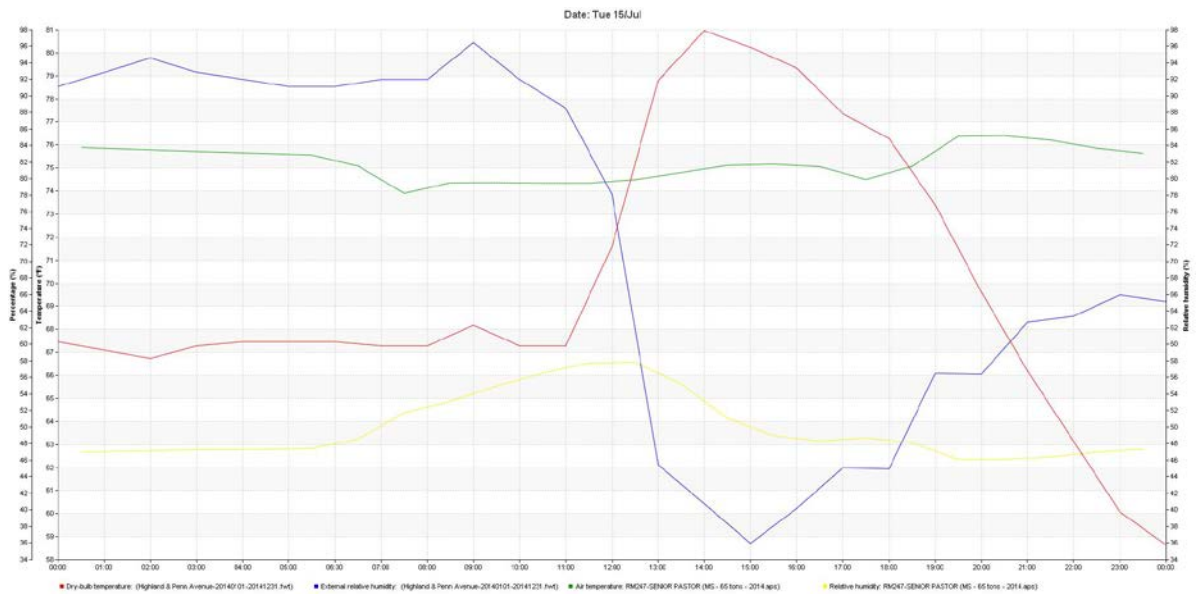
Concept 1a-65 TON Multi-stack | External / Internal Temp. & Humidity | RM247-Senior Pastors Office 15-July
2014, 2013 & TMY Combined



Concept 1a-65 TON Multi-stack | External Temp. & Humidity | 15-July
2014, 2013 & TMY Combined



Concept 1a-65 TON Multi-stack | Internal Temp. & Humidity | RM247-Senior Pastors Office 15-July 2014, 2013 & TMY Combined



Concept 1a-65 TON Multi-stack | External / Internal Temp. & Humidity | RM247-Senior Pastors Office 15-July-2014