



Calibrating an Existing Building Energy Model

MP3784-P

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Autodesk University 2012 Power Track

- Energy Optimization for Retrofits
 - MP3397-P - Taking Advantage of BIM for CFD Modeling
 - MP3565-P - Using a Retro-BIM Workflow: Case Studies in Energy-Driven Retrofit Projects
 - MP3765-P - Using BIM to Streamline Your Energy Modeling Workflows
 - *MP3784-P - Calibrating an Existing Building Energy Model*

Class Summary

This session discusses the process of calibrating an energy model for an existing building, based on actual energy consumption. The first part will go over how to build a simplified energy model in Autodesk® Vasari Beta 1.0 software and calibrate the model to monthly utility data in Autodesk® Green Building Studio® web-based software. The second, and more involved, portion will cover how to calibrate the simulated results of a DOE2 energy model to the actual building's energy performance as captured by a properly configured BEMS system. Both of these strategies will be covered in a case study on the Autodesk headquarters building in San Rafael, CA

Learning Objectives

At the end of this class, you will be able to:

- Create a rapid energy model using Autodesk® Vasari Beta 1.0 and calibrate it using utility bills
- Create a baseline energy model using Autodesk® Revit, Green Building Studio® and eQuest
- Convert trended BMS data into useful spreadsheets and graphs using Excel
- Create comparison charts to graphically demonstrate the accuracy of the current model
- Use trended BMS data to calibrate your energy model

“Always make the audience suffer as much as possible” – Alfred Hitchcock

Why calibrate an energy model?

- Develop an accurate representation of the building
- Understand how the existing building is actually performing
- Define potential Energy Conservation Measures (ECMs)
- Compare the effectiveness of various ECMs

111 McInnis Pkwy, San Rafael, CA

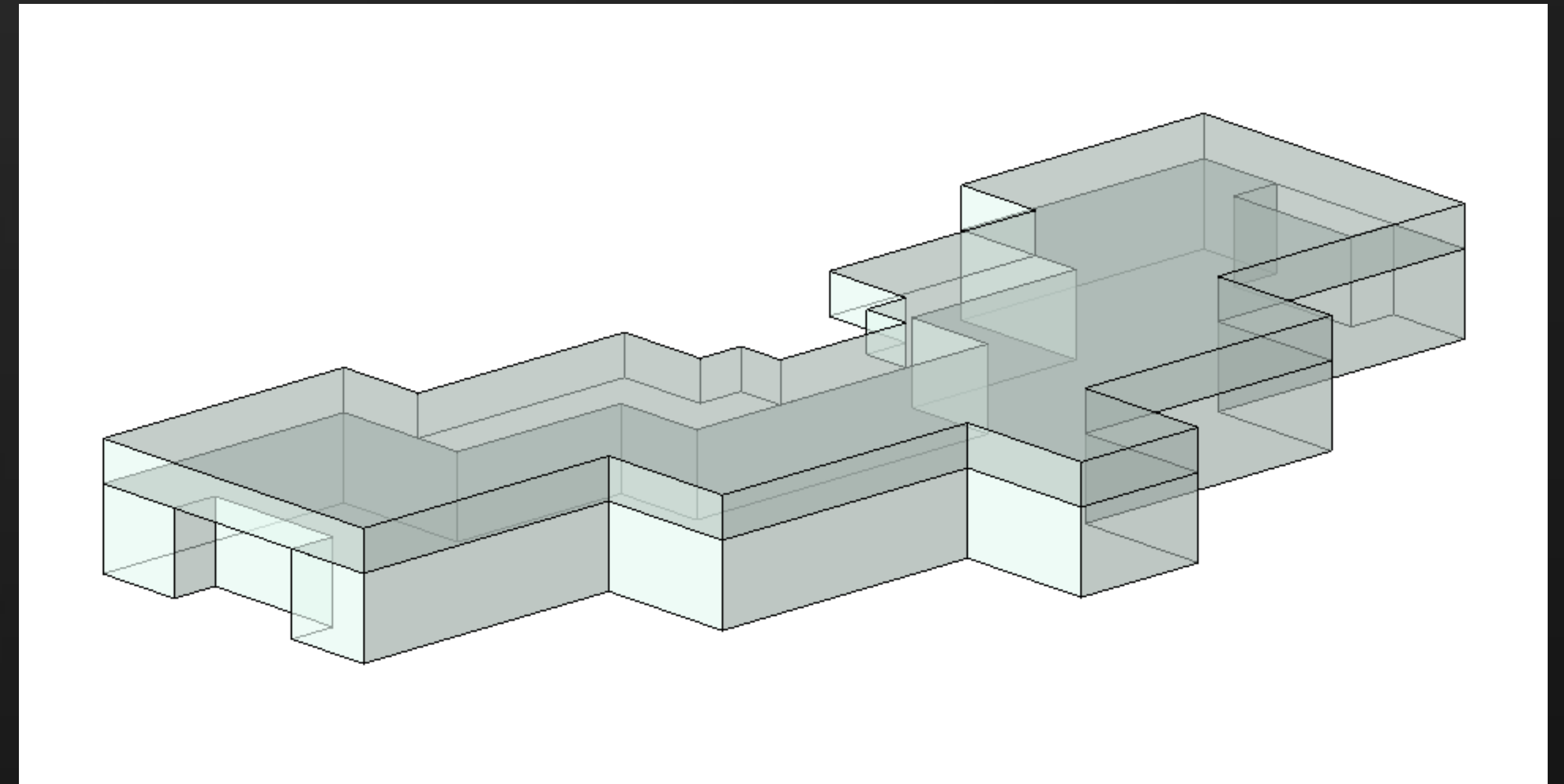
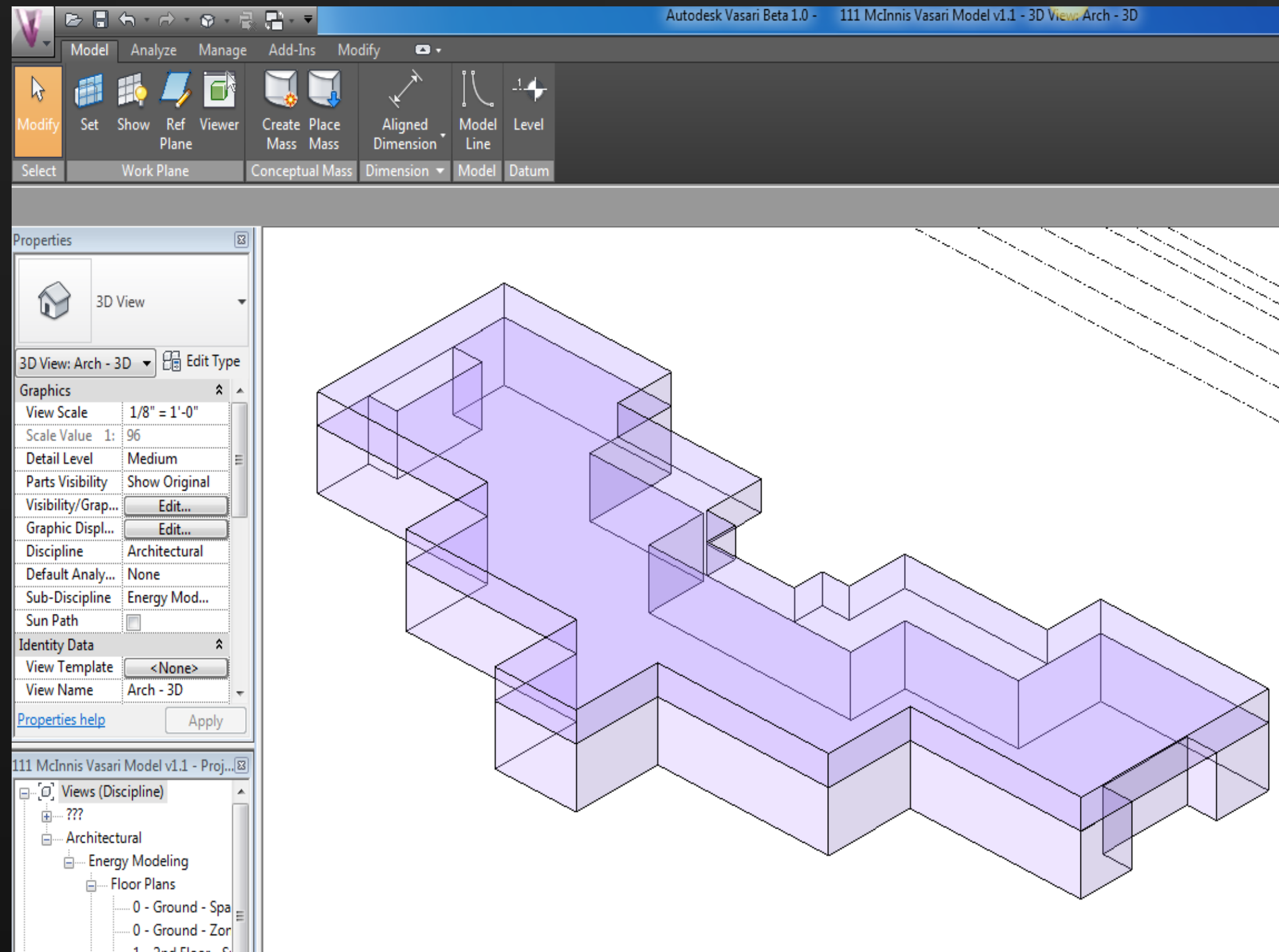


Rapid Energy Modeling

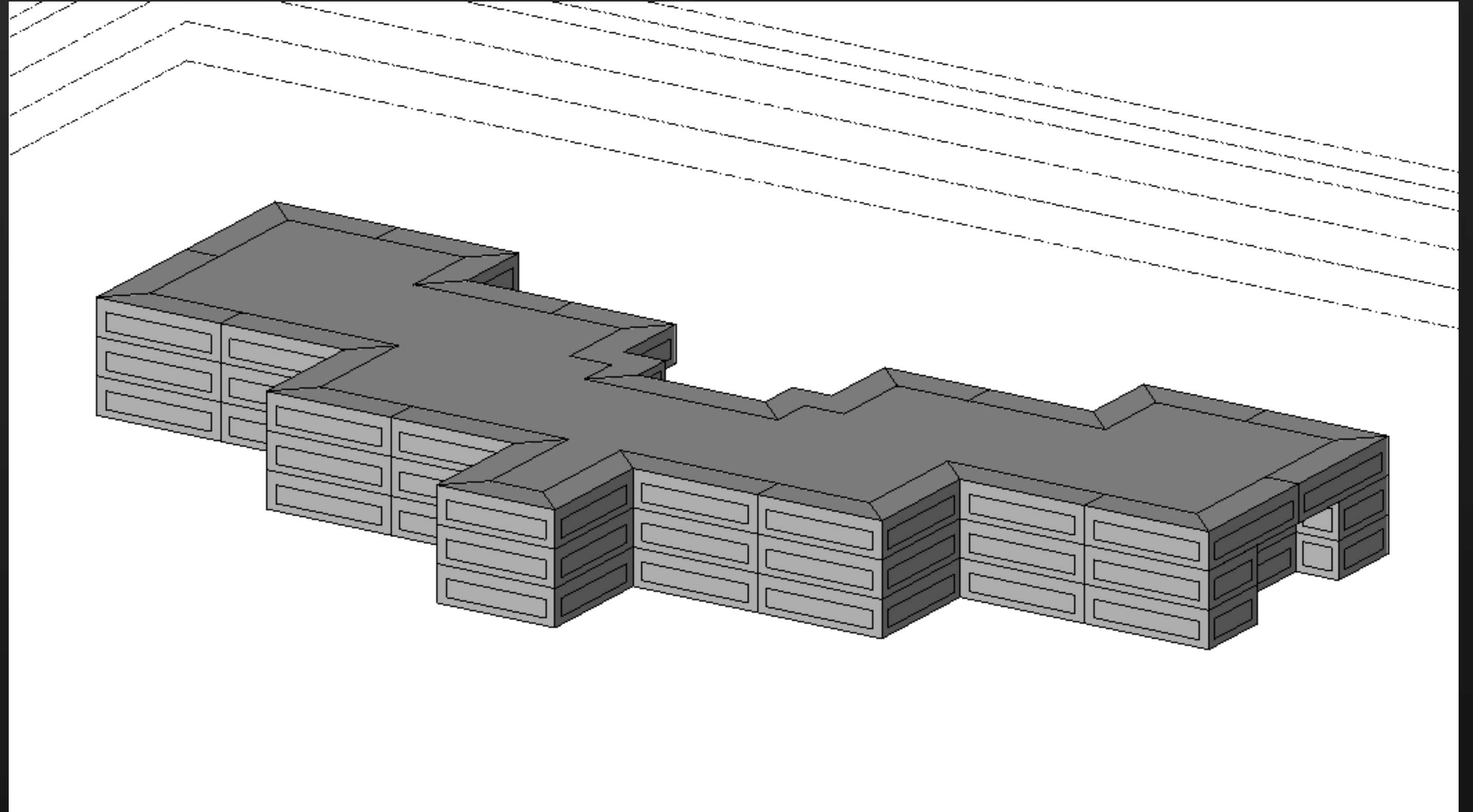
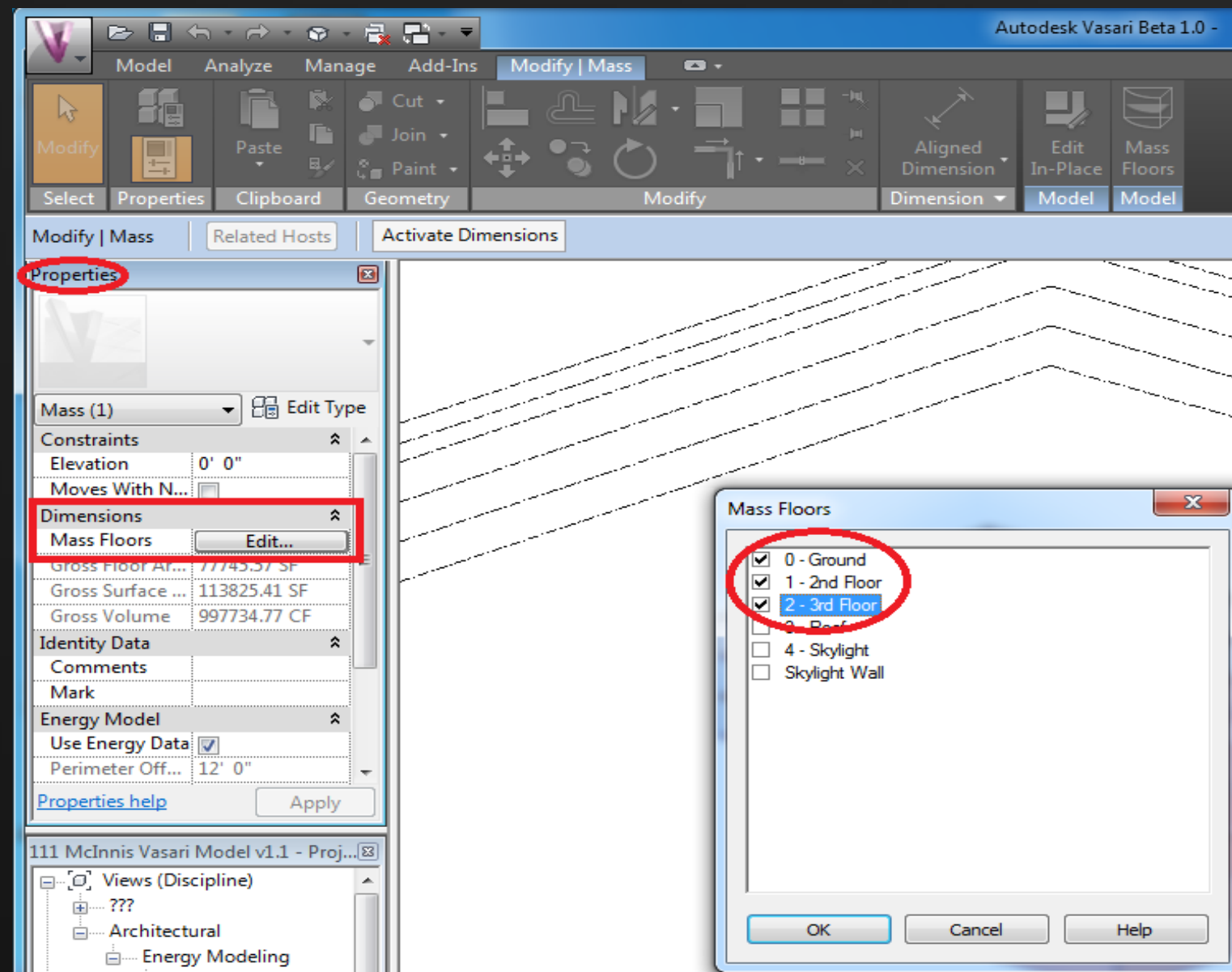
What do we need to create a rapid energy model?

- Autodesk® Vasari Beta 1.0 – Build 3D geometry, generate the rapid energy model, produce quick results, create .gbxml file
- Autodesk® Green Building Studio (GBS) – Upload utility data, modify some standard defaults, produce slightly calibrated results

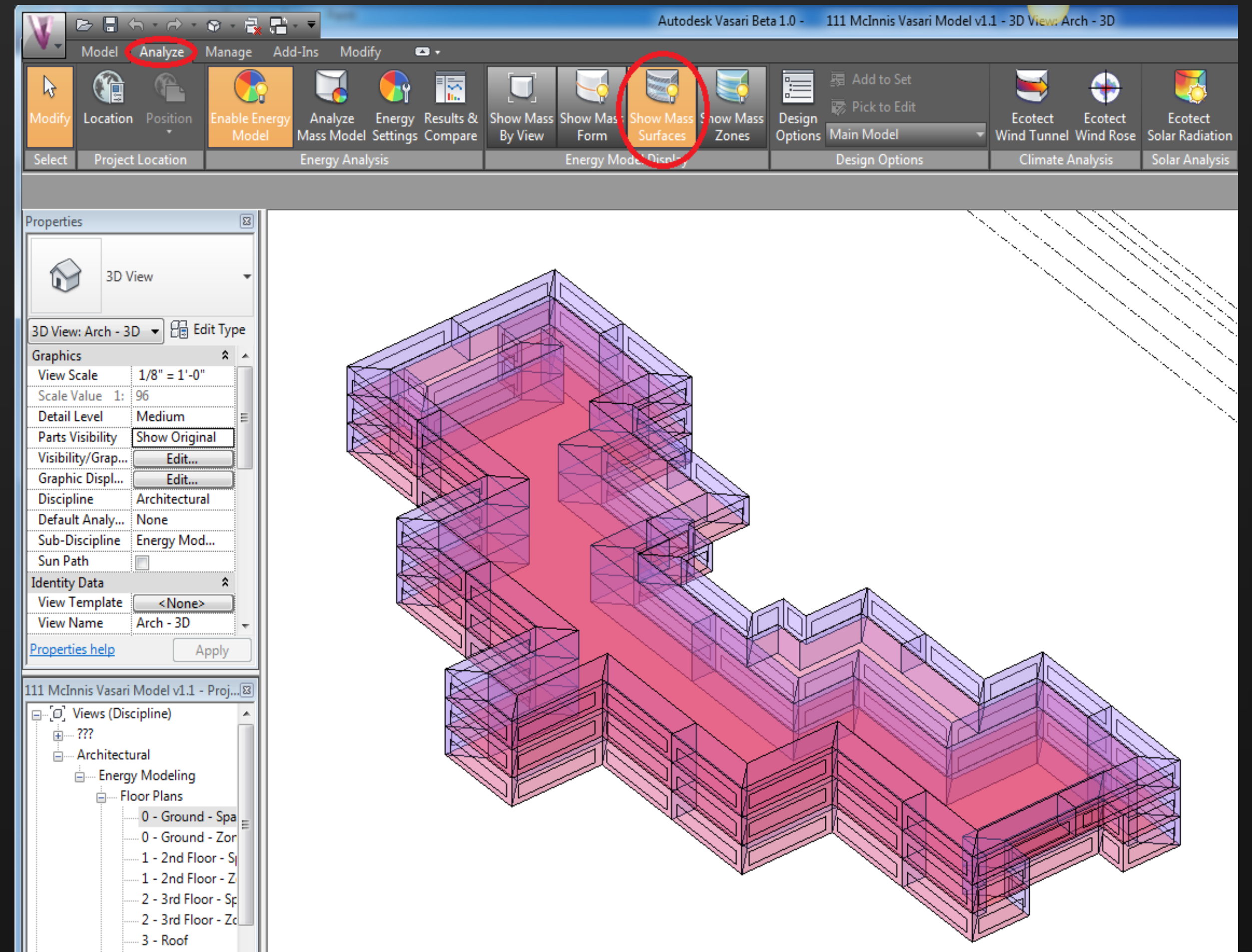
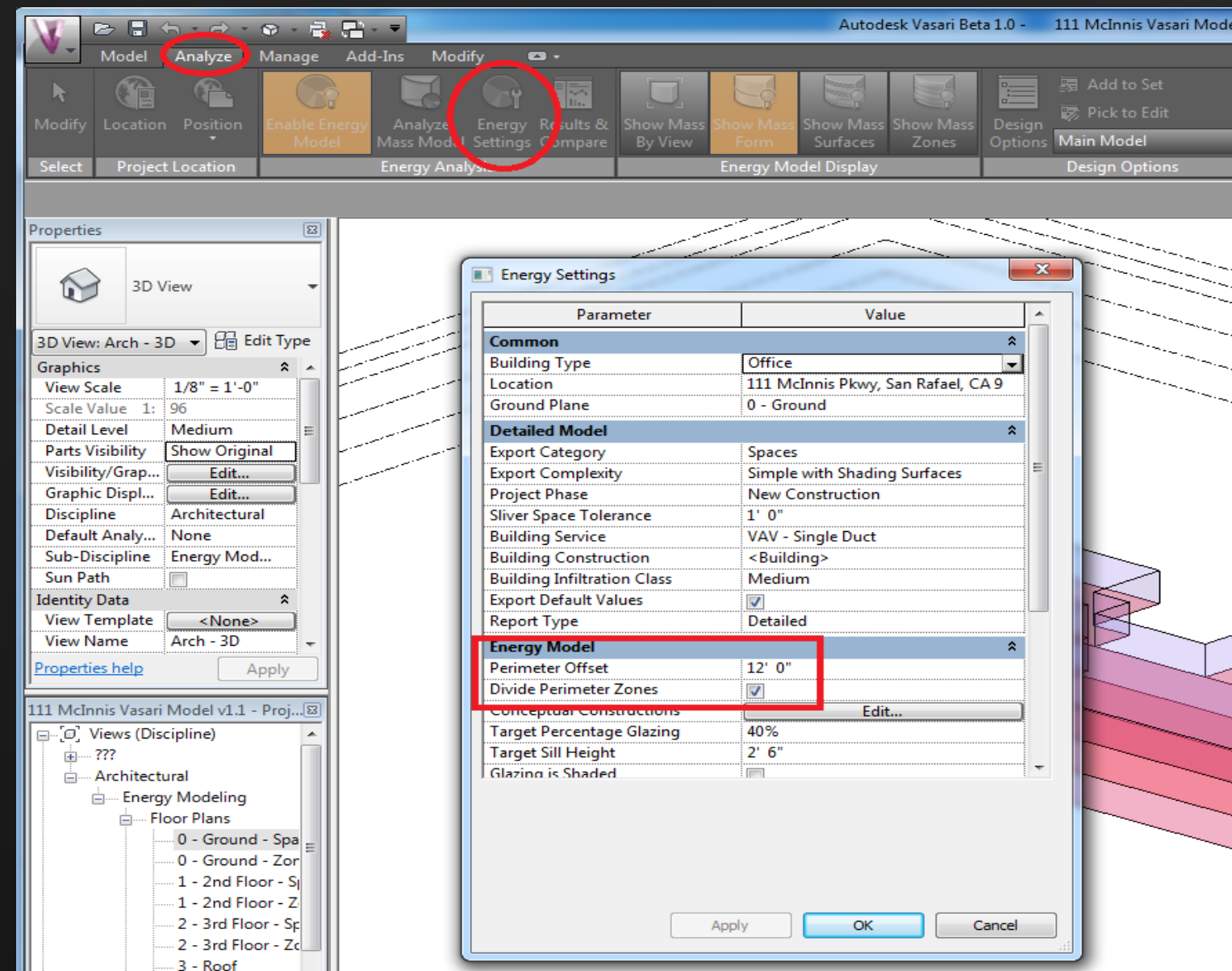
Vasari Beta 1.0



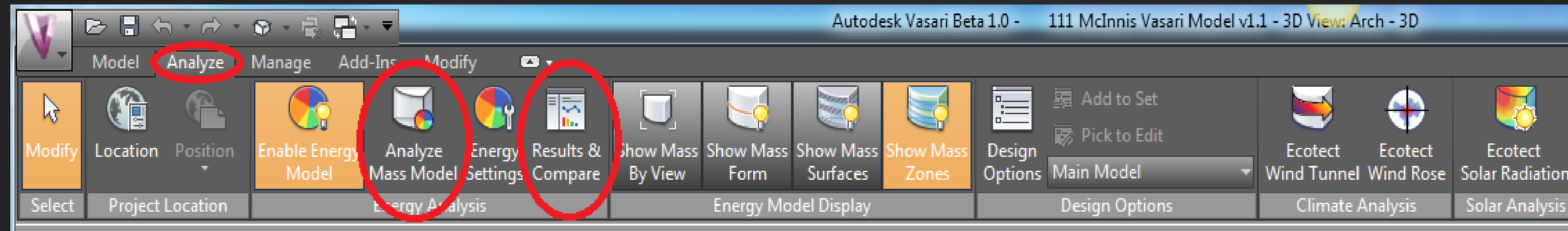
Vasari – Add Floors



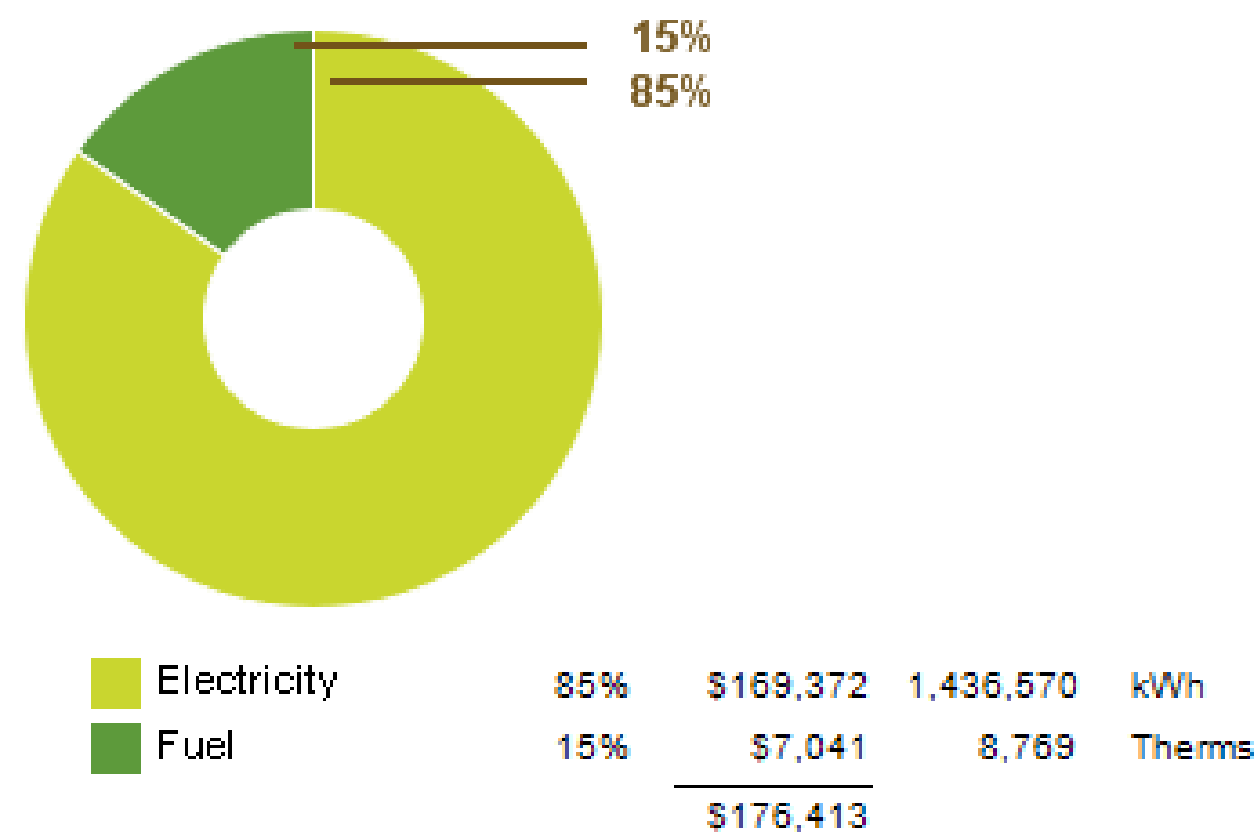
Vasari – Add Zones



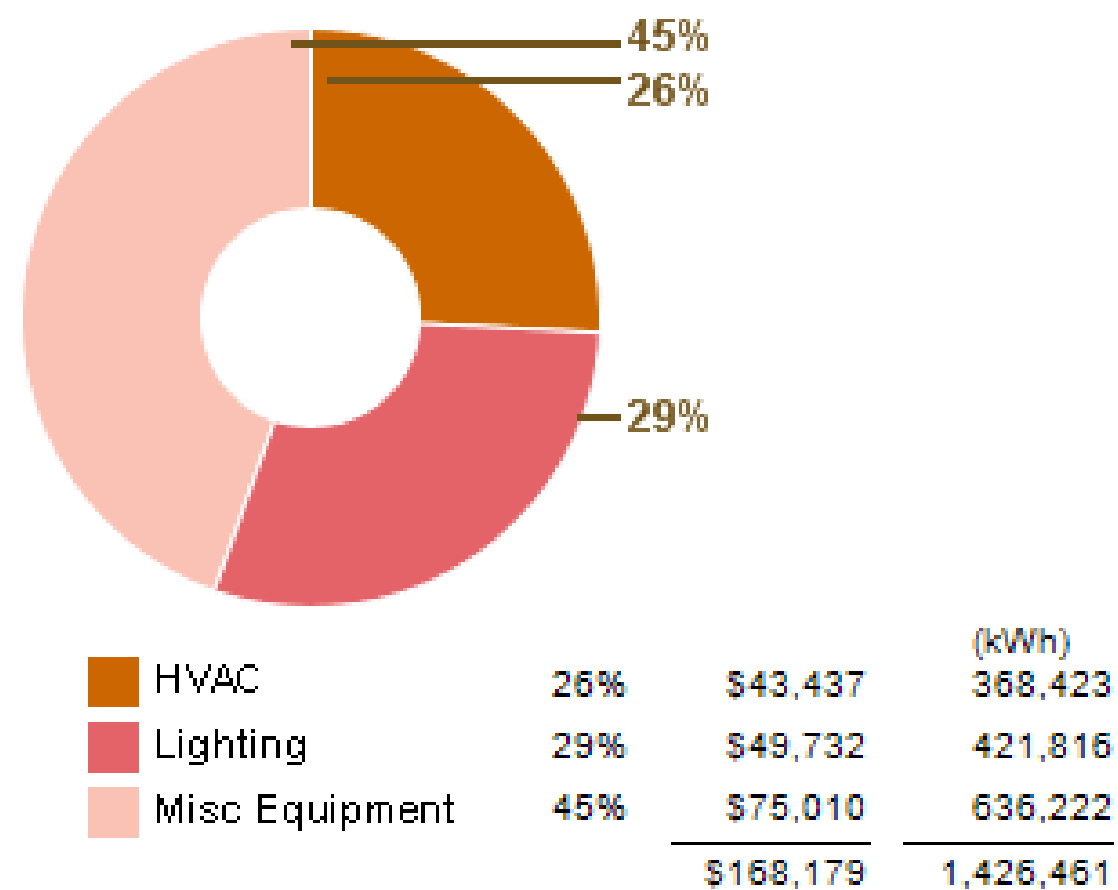
Vasari – Results



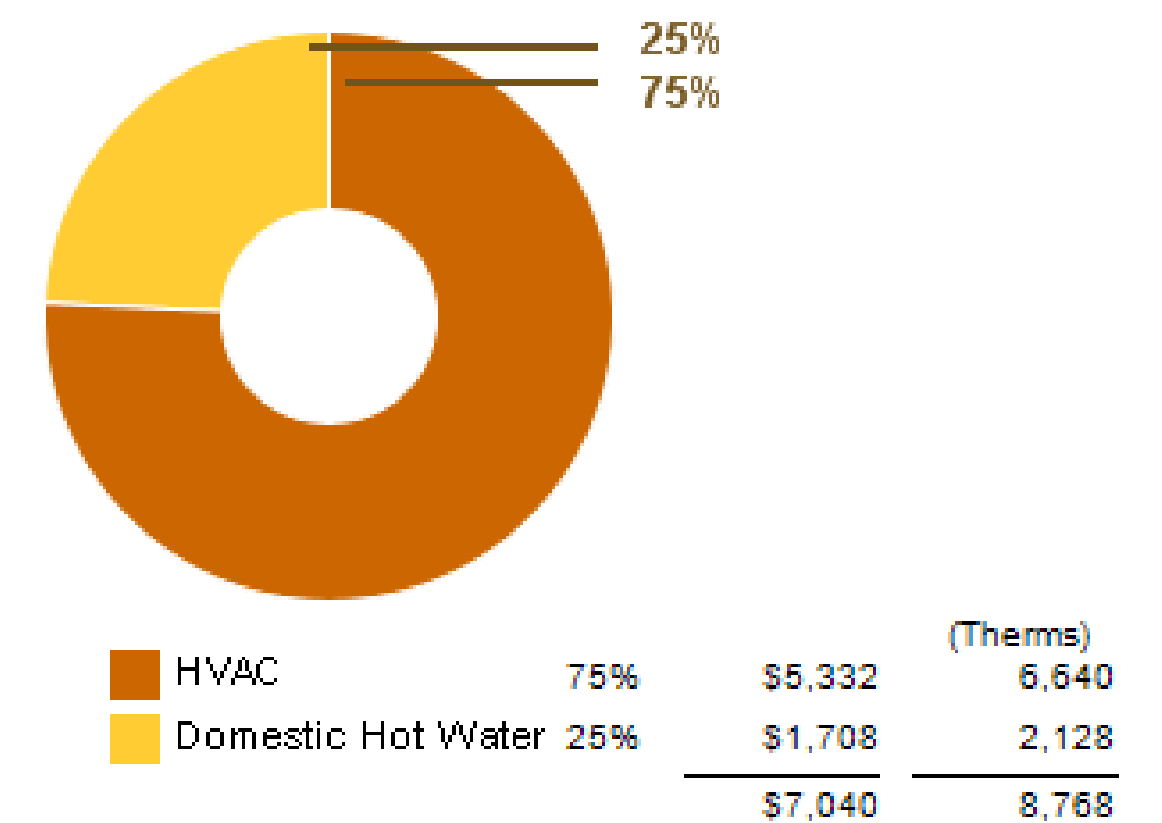
Annual Energy Use/Cost



Energy Use: Electricity



Energy Use: Fuel



Green Building Studio – Utility Bills

Autodesk Green Building Studio

My Projects > 111 McInnis Detailed Energy Model

Run List Run Charts Project Defaults Project Details Project Members **Utility Information** Weather Station

Project Default Utility Rates

Utility Billing Data Sets

Add a New Utility Bill Data Set

Step1: Install required tools

[Download Tools](#)

Step2: Complete the Utility Billing Data Set Template.

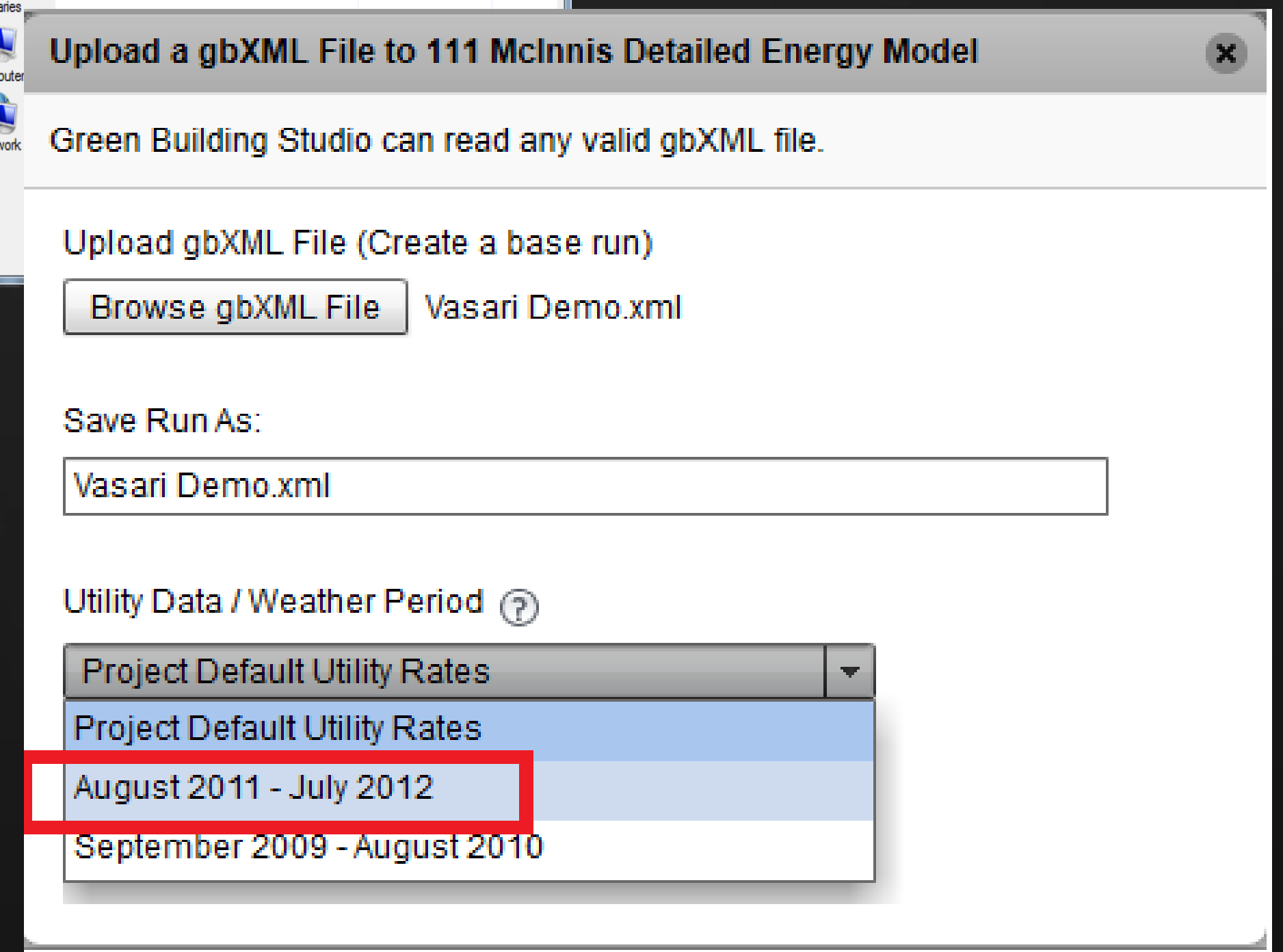
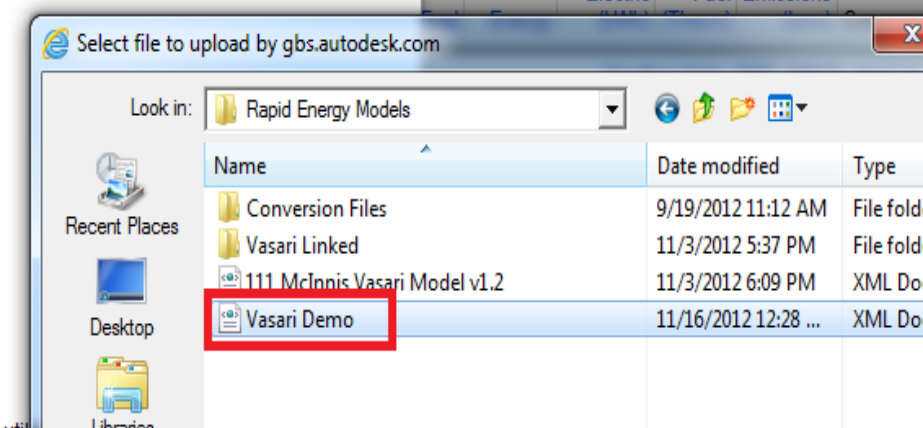
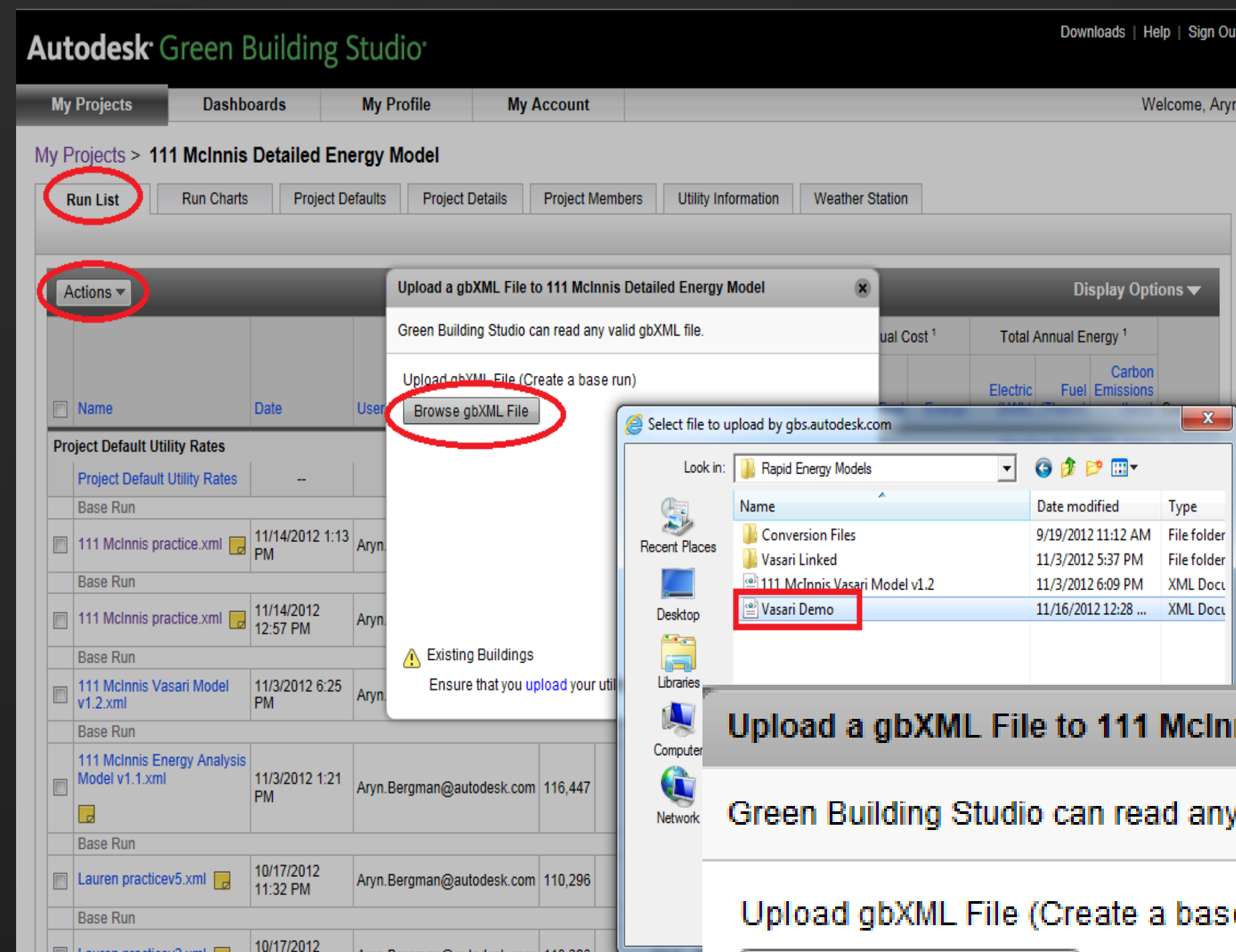
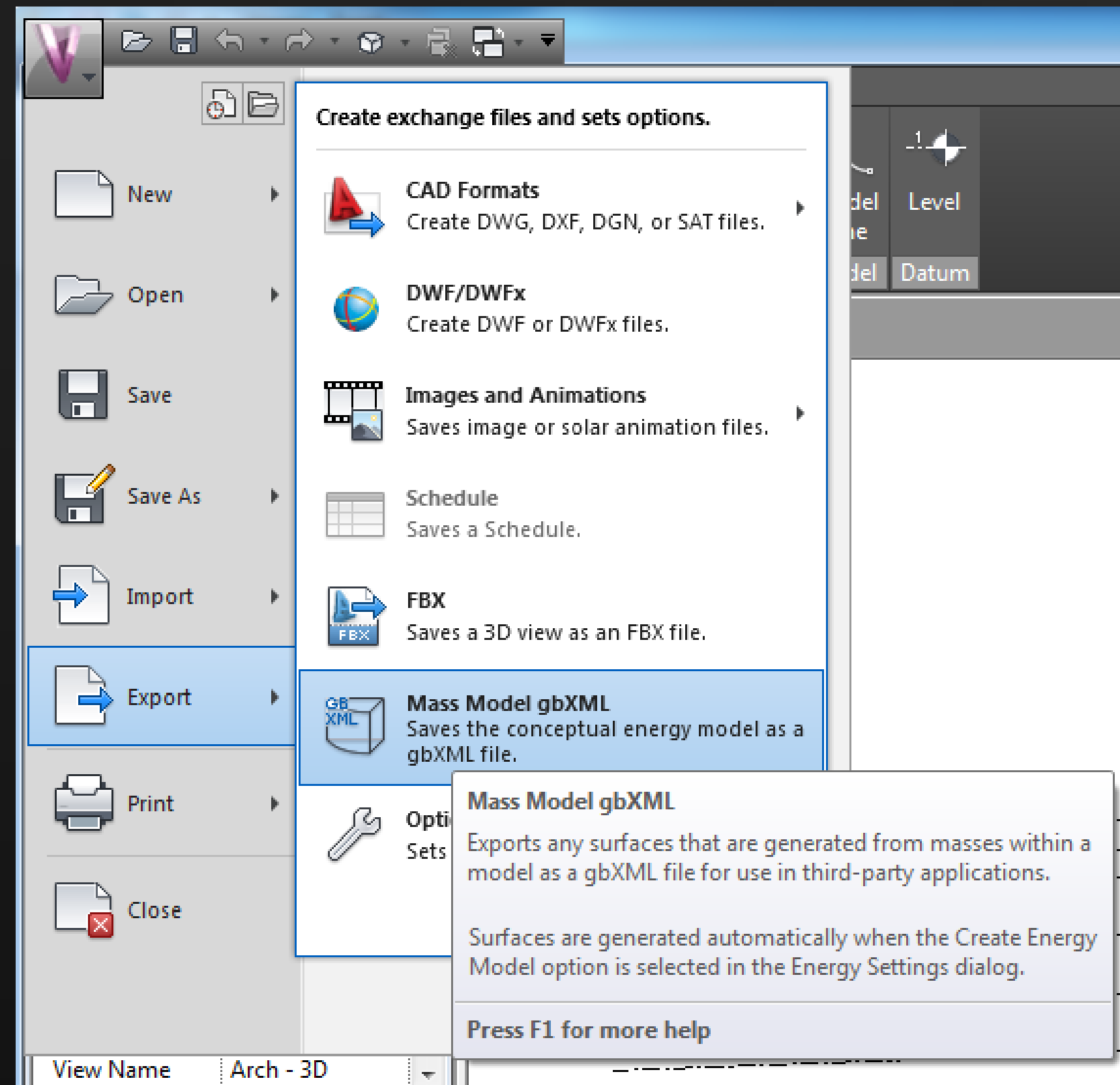
[Download the Utility Data Set Template](#) Excel (.xlsx file format)

Step3: Use the "Upload" button in the spreadsheet to send the new utility billing data set to Green Building Studio.

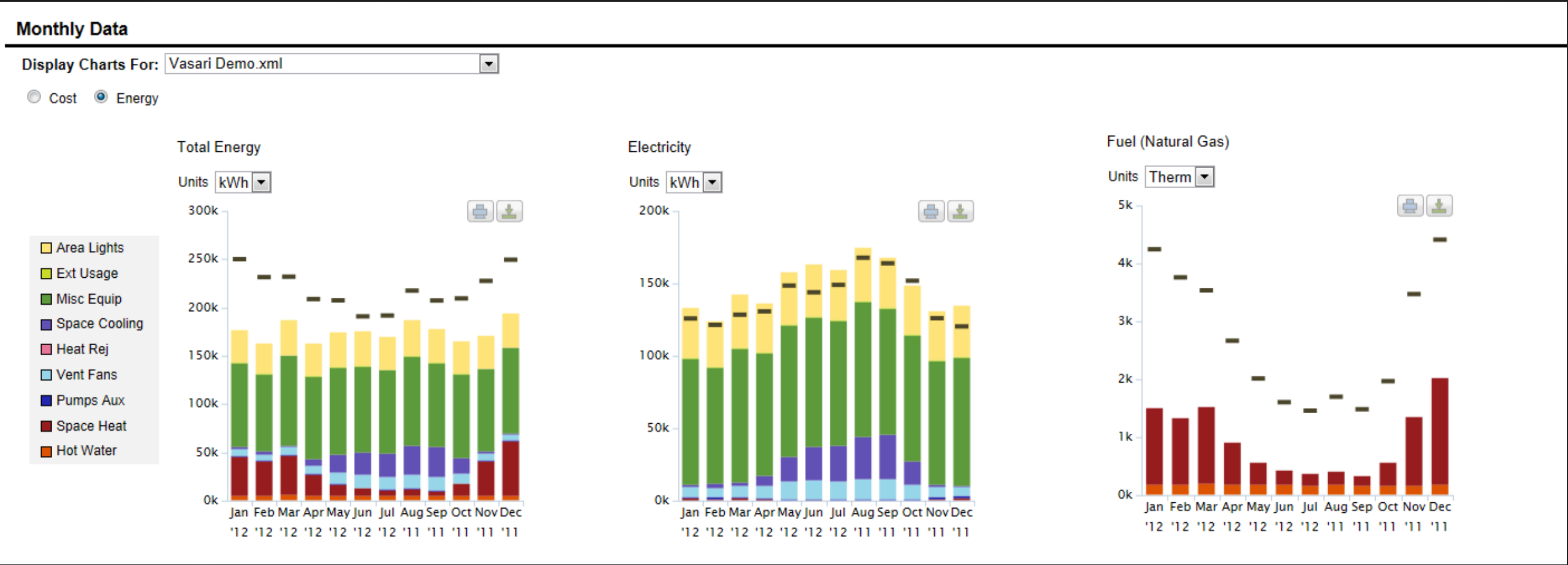
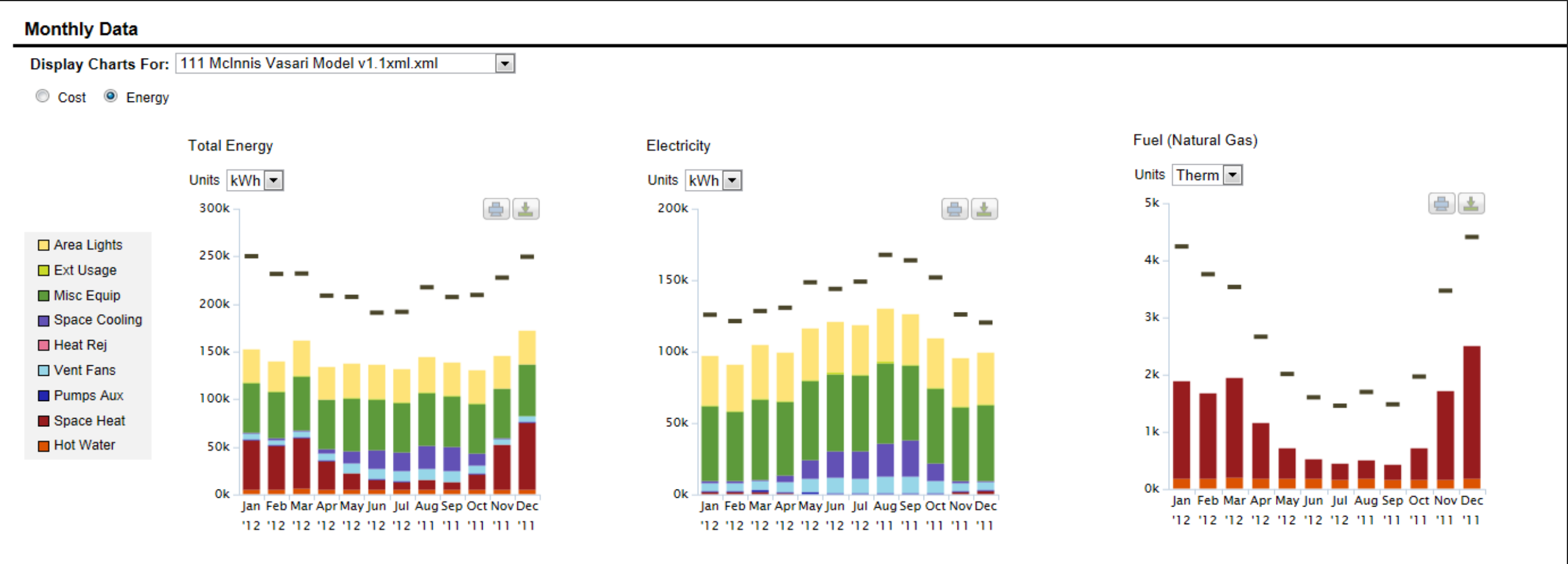
	A	B	C	D	E	F	L
1							
2	1) Sign In to Green Building Studio using your Autodesk ID, and then select a project.						
3							
4							
5							
6							
7	2) All fields in white below can be completed, columns with asterisks (*) are required.						
8							
9							
10	Green Button: import your monthly utility data into this spreadsheet.						
11	a) Check to see if your utility company has adopted the Green Button initiative .						
12	b) Go to your utility company's website to download your Green Button data file.						
13							
14							
15							
16	Note: the Month and Units fields contain drop-down menus.						
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35	Note: currency is set by the selected project.						
36							

			units	kWh	kW	therm
			* Electricity		Electric	* Fuel Usage
	Month	Year	Usage		Demand	(natural gas)
	August	2011	167745.5089		498	1697
	September	2011	163839.2104		521	1480
	October	2011	151816.5736		472	1967
	November	2011	125934.3847		432	3468
	December	2011	120291.3204		410	4408
	January	2012	125748.1001		389	4244
	February	2012	121329.2535		417	3758
	March	2012	128351.3189		406	3533
	April	2012	130680.6354		452	2663
	May	2012	148498.2613		460	2013
	June	2012	143817.136		484	1603
	July	2012	148962.6317		510	1458
	Annual Use or Peak		1,677,014		521	32,292
	Annual Cost		287201.61			28640
	Unit Cost		0.1713			0.8869
	Currency		US Dollar (USD)			

Vasari to GBS



GBS Results



Autodesk Green Building Studio

My Projects Dashboards My Profile My Account

My Projects > 111 McInnis Detailed Energy Model

Run List Run Charts **Project Defaults** Project Details Project Members Utility Information Weather Station

Project Default: 111 McInnis Detailed Energy Model_de Load Selected Template

Save Changes Save as New Template Assign Template to Project

Info	Building	Spaces	Zones	Surfaces	Openings	HVAC & DHW	Units	Criteria	Notes
<input type="checkbox"/>	Use	Parameter	Value						
<input type="checkbox"/>		Condition Type	Select one:				N/A	Always	
<input type="checkbox"/>		Space Type*	Select one:				N/A	Always	
<input type="checkbox"/>		Lighting Power Density*					W / ft²		
<input checked="" type="checkbox"/>		Equipment Power Density*	2.5				W / ft²	Always	
<input type="checkbox"/>		Area per Person*					ft² / person	Always	
<input type="checkbox"/>		Sensible Heat Gain*					BTU / person	Always	
<input type="checkbox"/>		Latent Heat Gain*					BTU / person	Always	
<input type="checkbox"/>		Design Temperature*					°F	Always	

Lessons Learned

Vasari Beta 1.0

- Quick way to generate a very basic energy model
- Can't modify default settings
- Poorly suited for existing buildings
- Good for comparing new design options

Vasari + GBS

- Can incorporate actual utility rates
- Can modify some basic default settings
- Slightly better suited for existing buildings

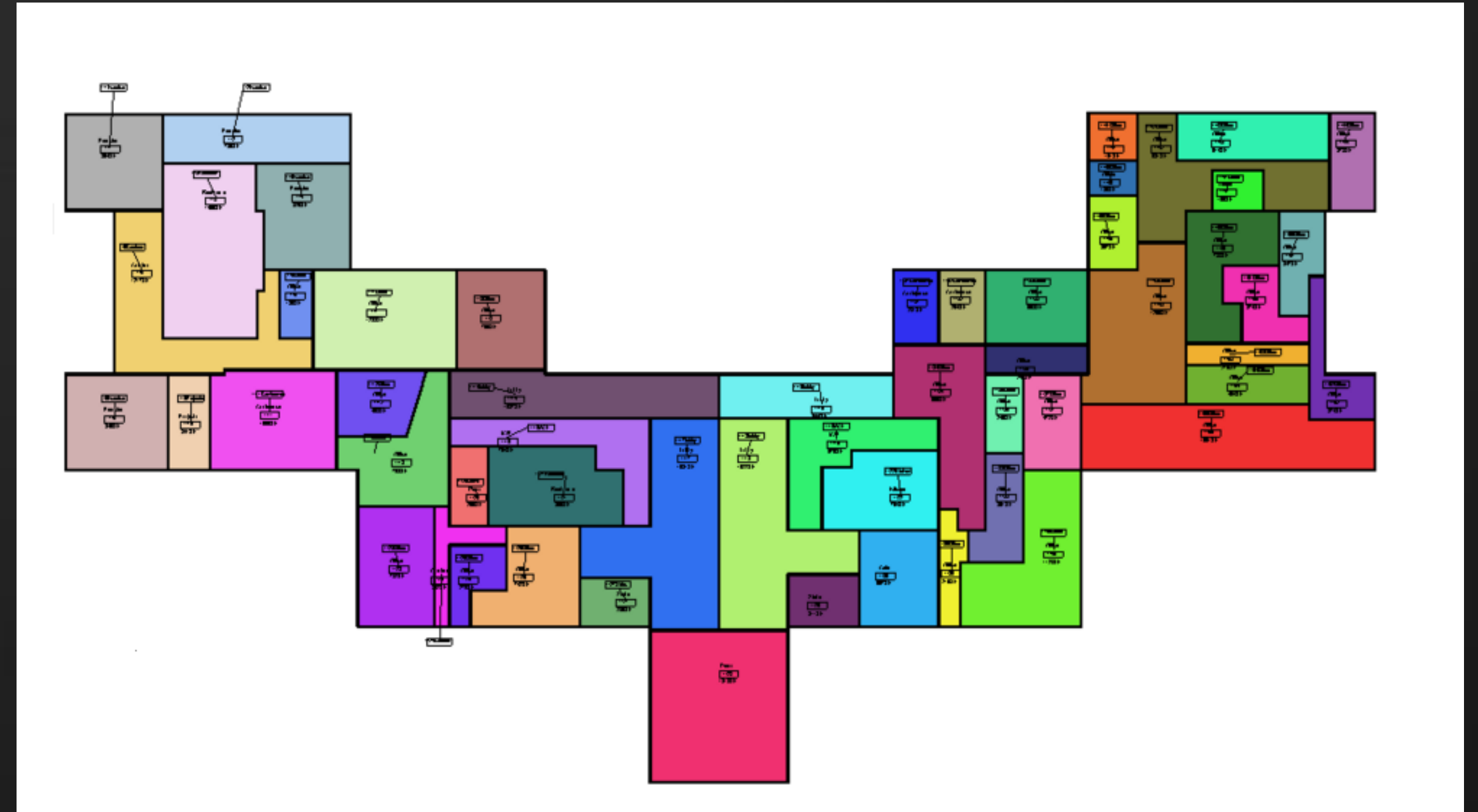
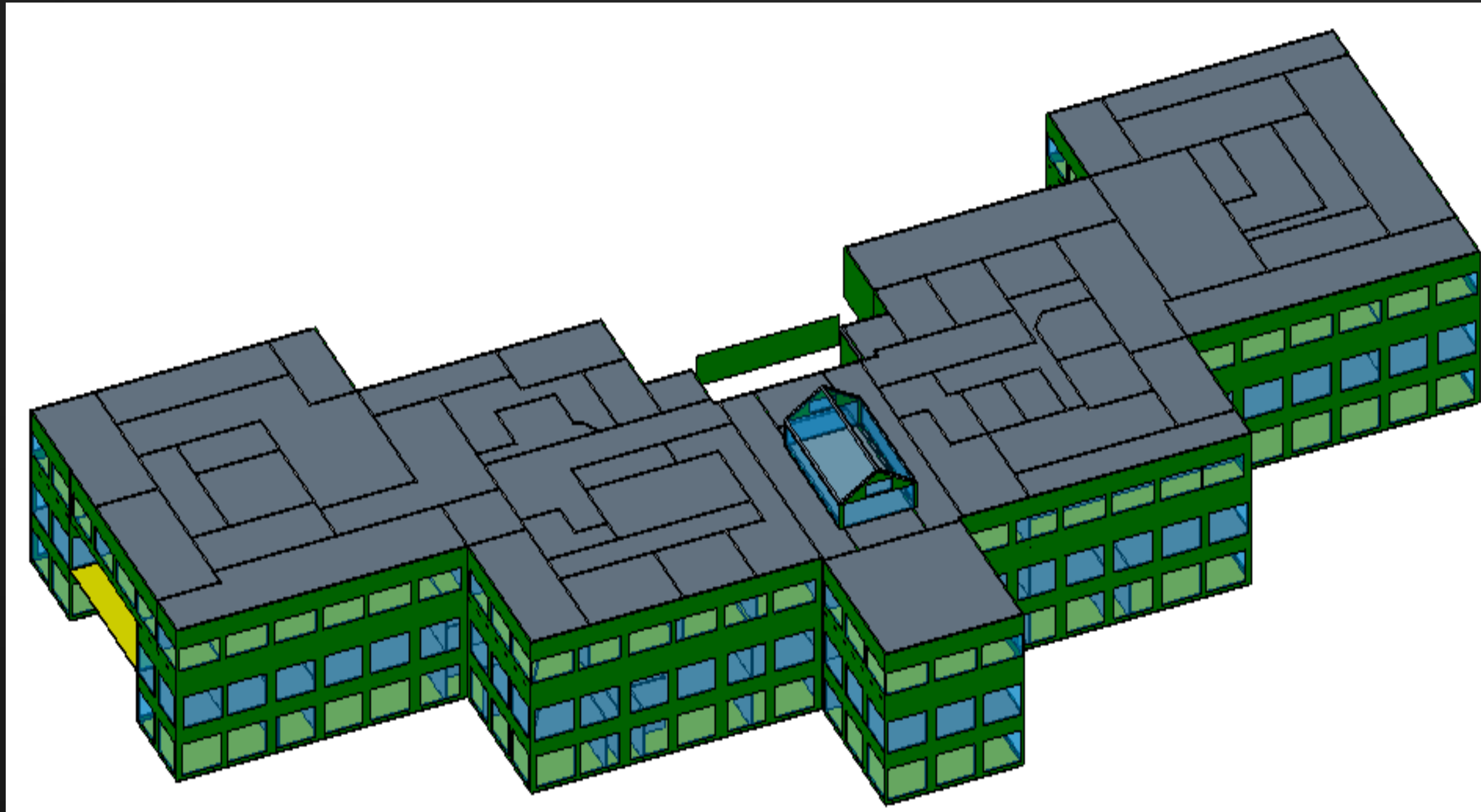
Detailed Energy Modeling

What do we need to build and calibrate a detailed energy model?

- Autodesk® Revit – Build 3D geometry and create .gbxml file
- Autodesk® Green Building Studio (GBS) – Check for major errors and convert our model into DOE-2 or Energy Plus
- eQuest/DesignBuilder/IES/etc – Perform energy simulation
- Microsoft® Excel – Create spreadsheets and generate graphs to better organize data
- Building End-Use Energy Data (trended BMS data/utility bills) – Represent how the building is actually performing

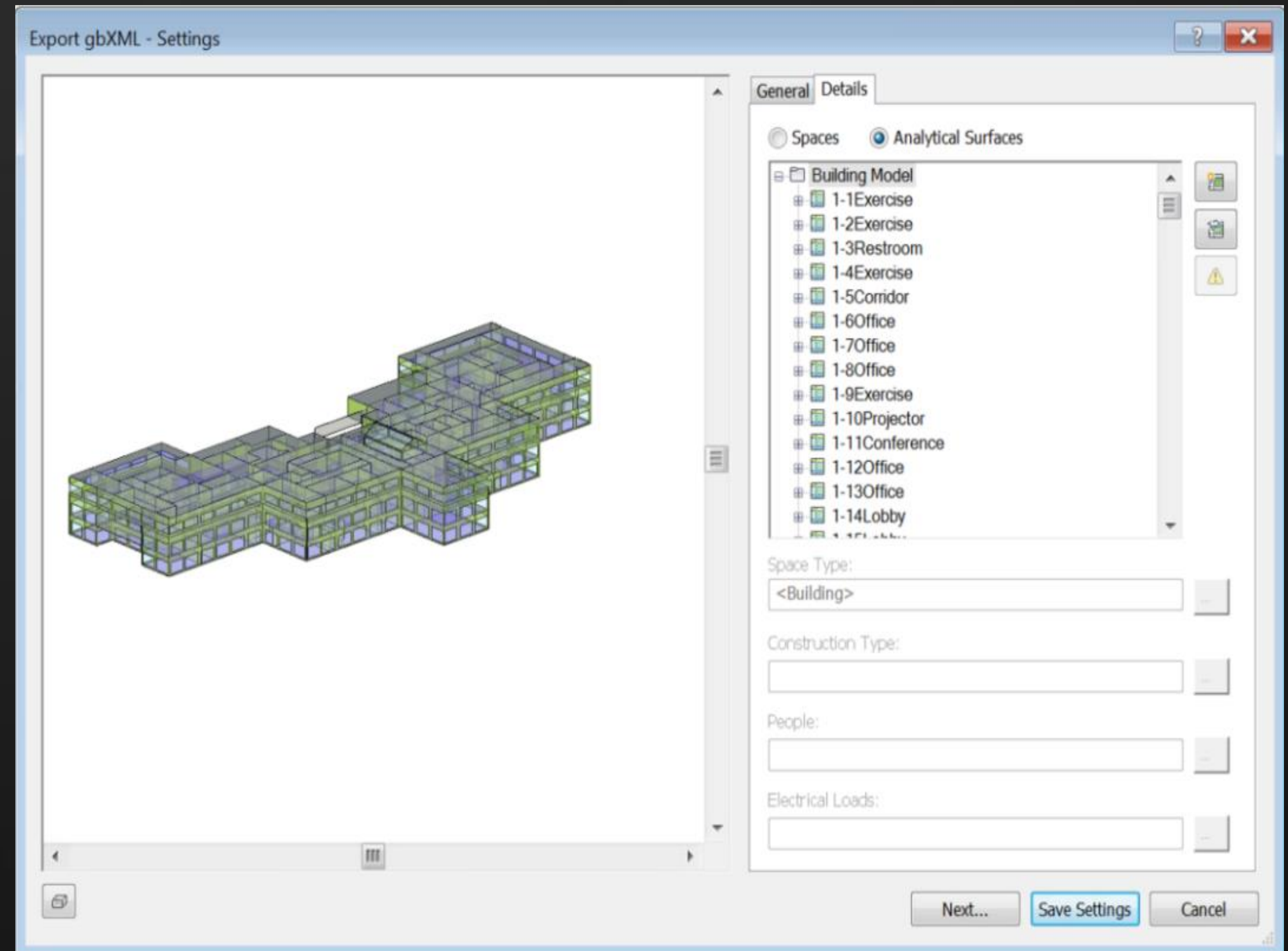
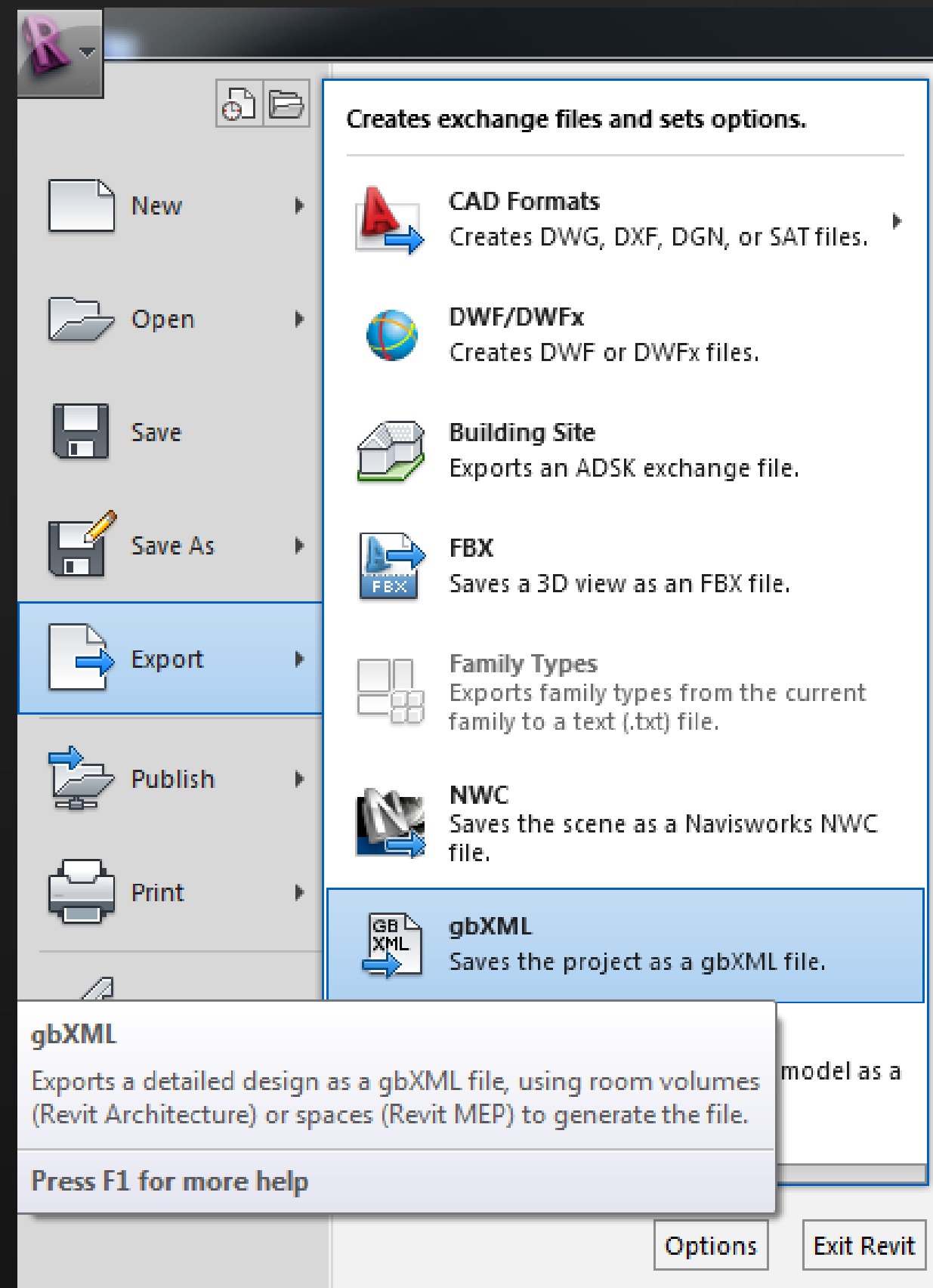
Create a Base Energy Model

Autodesk® Revit



To learn how to create building geometry in Revit for energy models, attend the AU class [MP7120 – Creating BIM for Energy Analysis](#) by Aryn Bergman on Thursday morning from 8-930am

Autodesk® Revit



Autodesk® Green Building Studio

Autodesk Green Building Studio

My Projects Dashboards My Profile My Account

My Projects > 111 McInnis Detailed Energy Model

Run List Run Charts Project Defaults Project Details Project Members Utility Information Weather Station

Actions

- Upload gbXML File (Creates a base run) ...
- Export run list to Excel (CSV file format) ...
- Create a Design Alternative ...
- Hide
- Delete ...

	Date	User Name	Floor Area (ft²)	Energy U
Base Run			--	
111 McInnis practice.xml	11/14/2012 12:57 PM	Aryn.Bergman@autodesk.com	116,447	
Base Run				
111 McInnis Vasari Model v1.2.xml	11/3/2012 6:25 PM	Aryn.Bergman@autodesk.com		
Base Run				
111 McInnis Energy Analysis Model v1.1.xml	11/3/2012 1:21 PM	Aryn.Bergman@autodesk.com		

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Run List Run Charts Project Defaults Project Details Project Members Utility Information Weather Station

Run Name: 111 McInnis practice.xml

Energy and Carbon Results US EPA Energy Star Water Usage Photovoltaic Analysis LEED Daylight 3D VRML View **Export and Download Data Files**

Export and Download Data Files

[gbXML File](#)
Eliminate plan take-offs by importing this file into TRACE 700.

[VRML File](#)
Open this file in your web browser to visually inspect your model in 3D (download required).

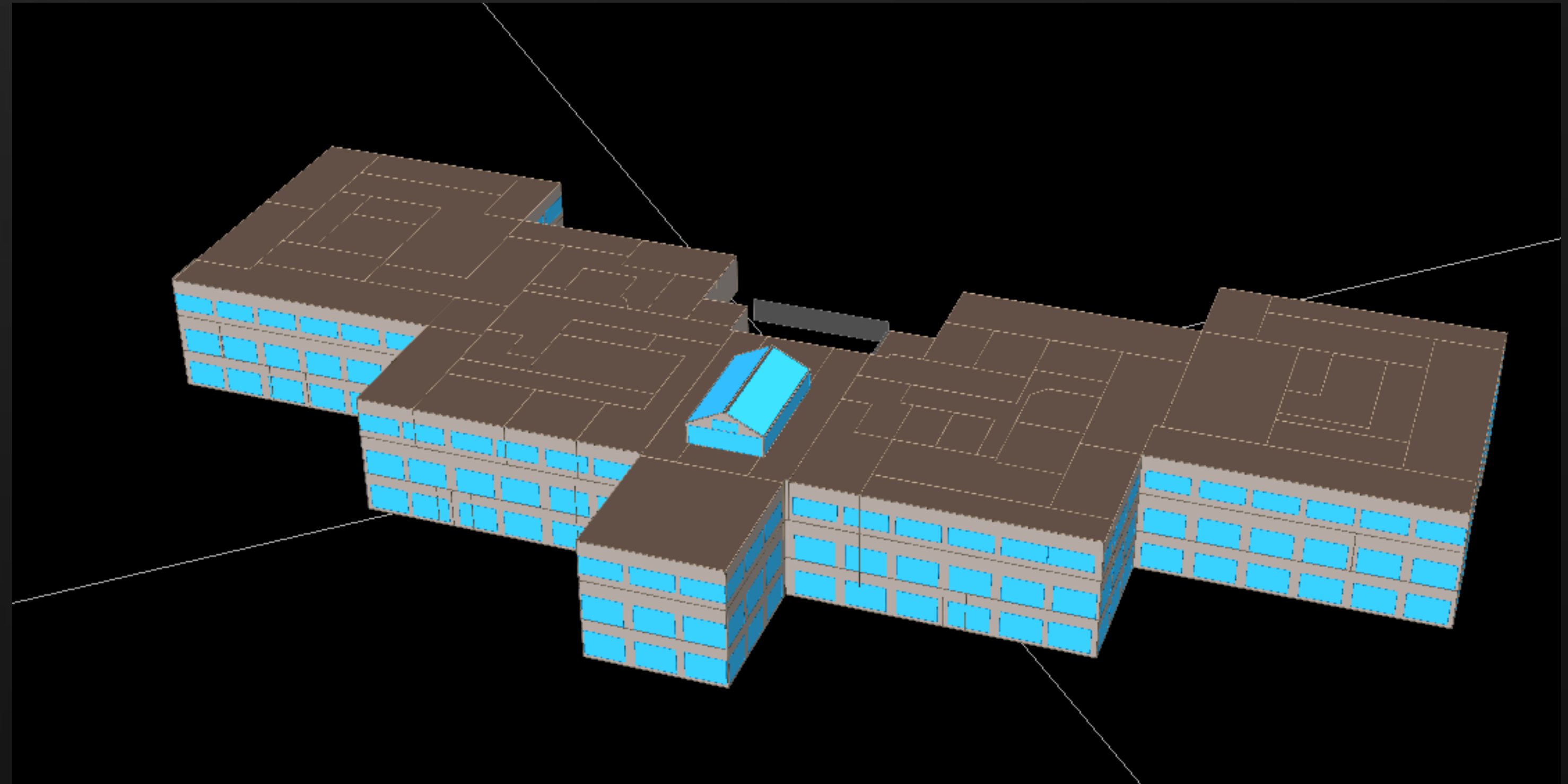
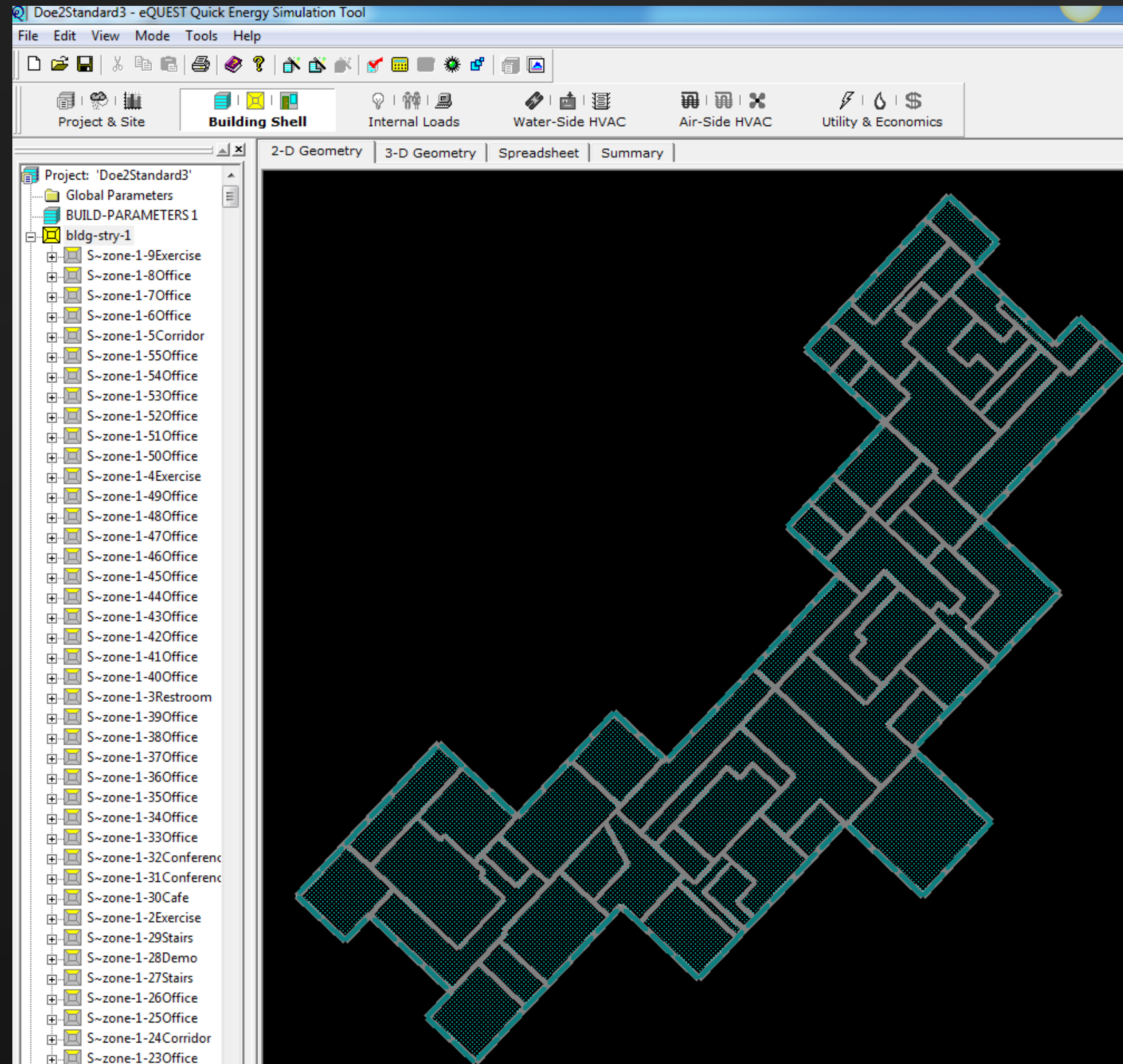
[DOE-2 File](#)
For more advanced analysis, open this file in eQUEST ?

[EnergyPlus File](#)
This file is ready for analysis using EnergyPlus.

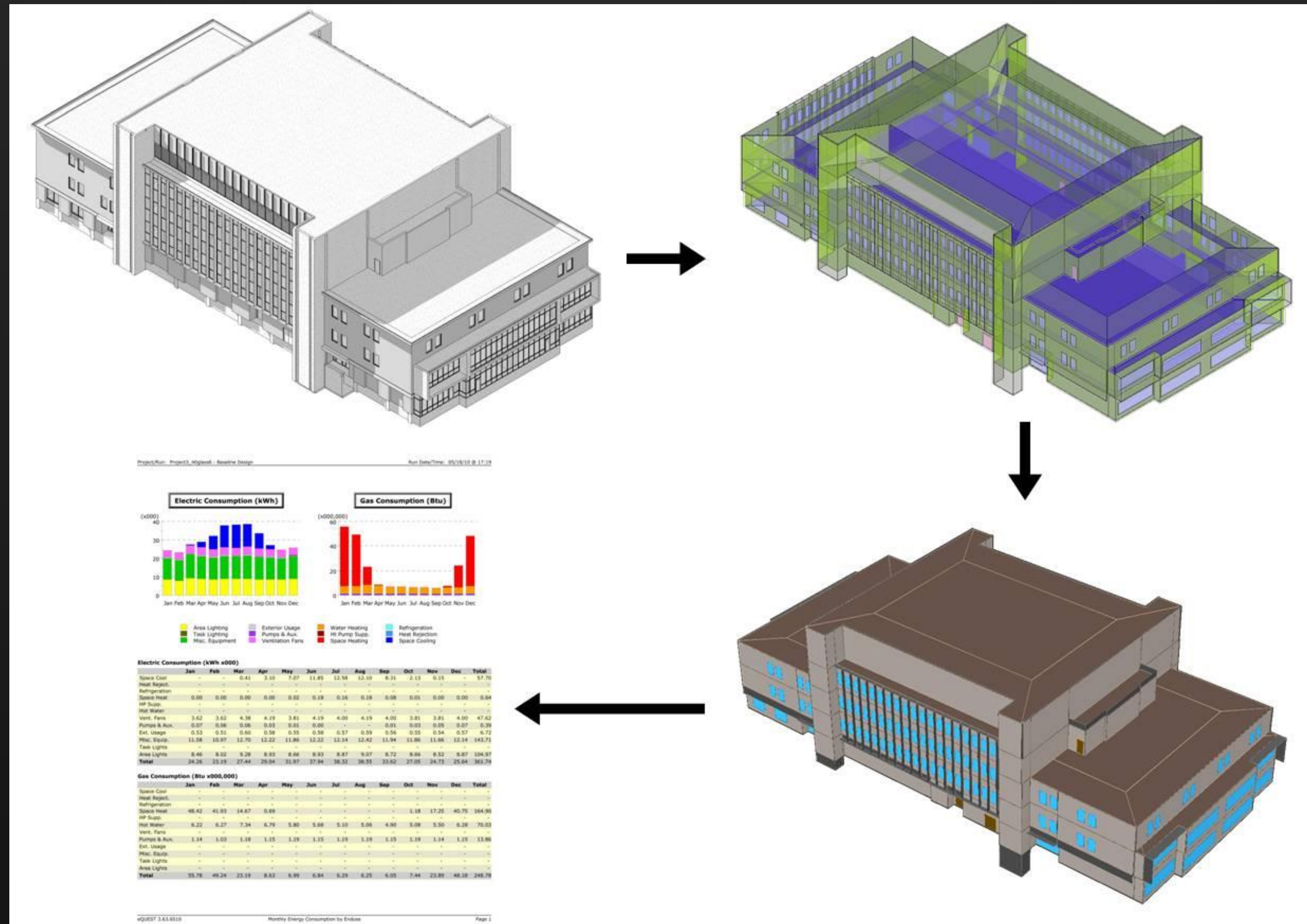
Weather Data
Weather data files are available for download in the [Weather Station](#) section.

<https://gbs.autodesk.com>

eQUEST



Revit to GBS to eQUEST



Organize Trended Data

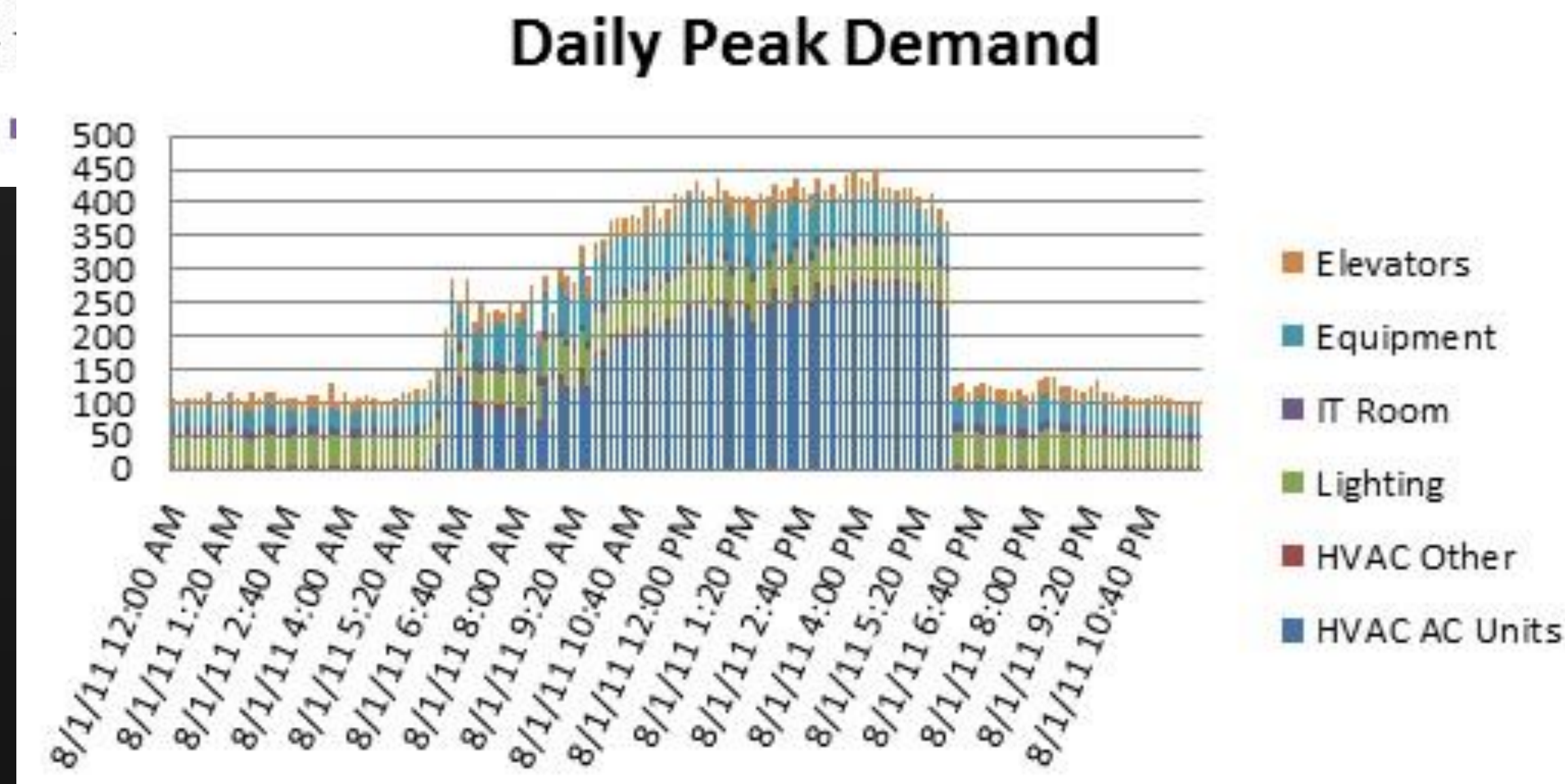
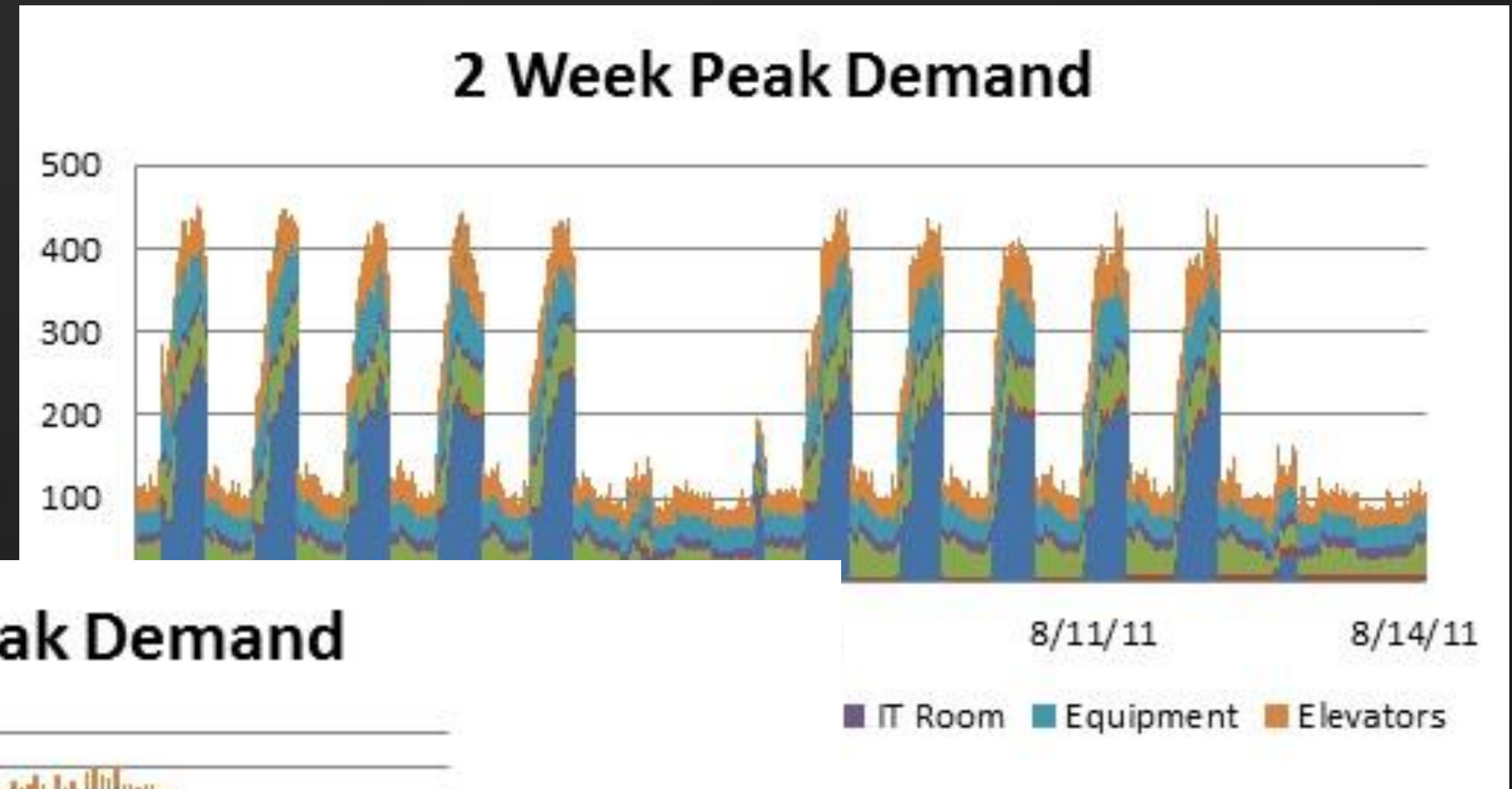
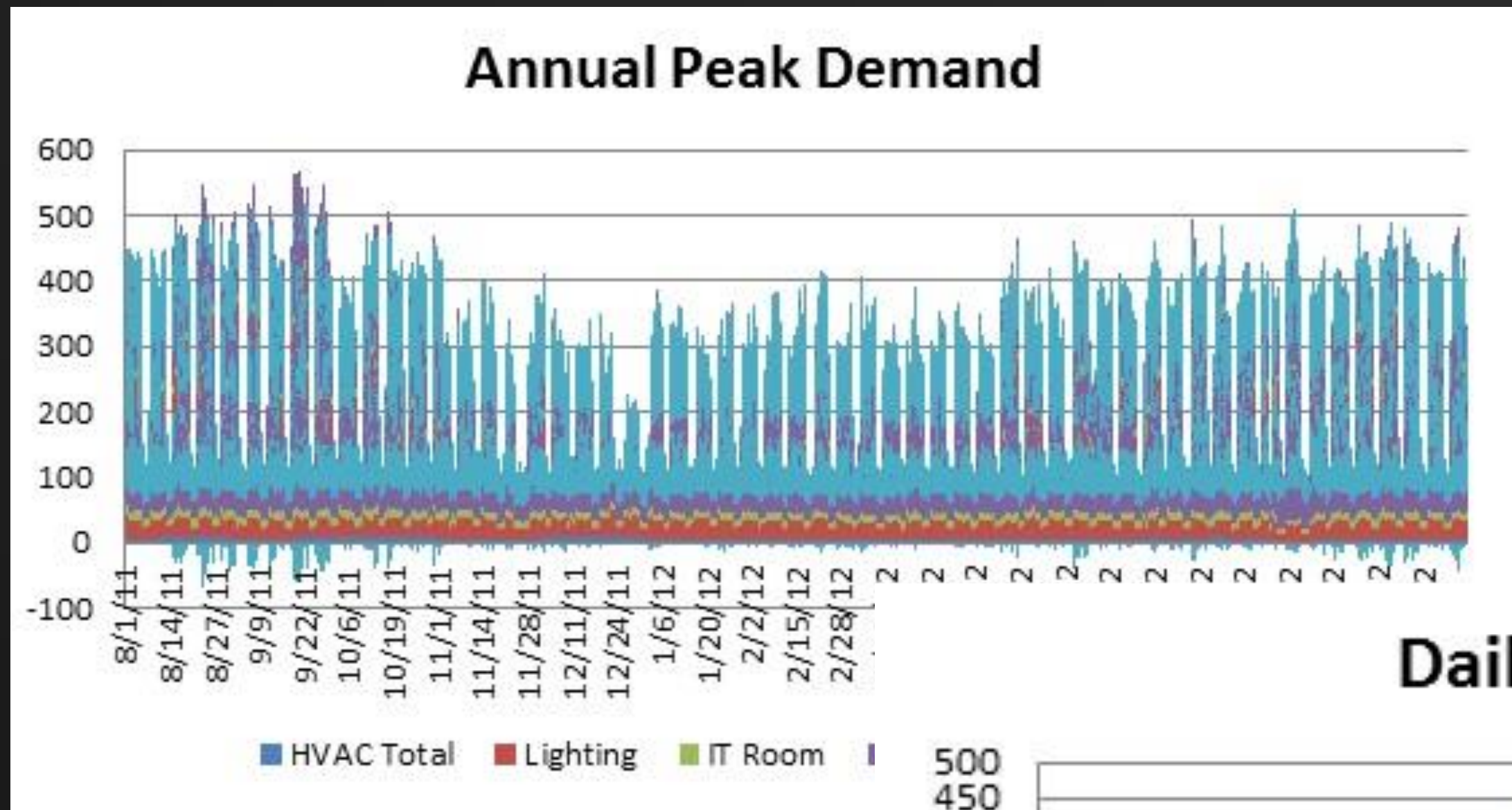
Trended Data

111 McInnis Peak Demand - Trended Data - Microsoft Excel non-commercial

FileHomeInsertPage LayoutFormulasDataReviewView

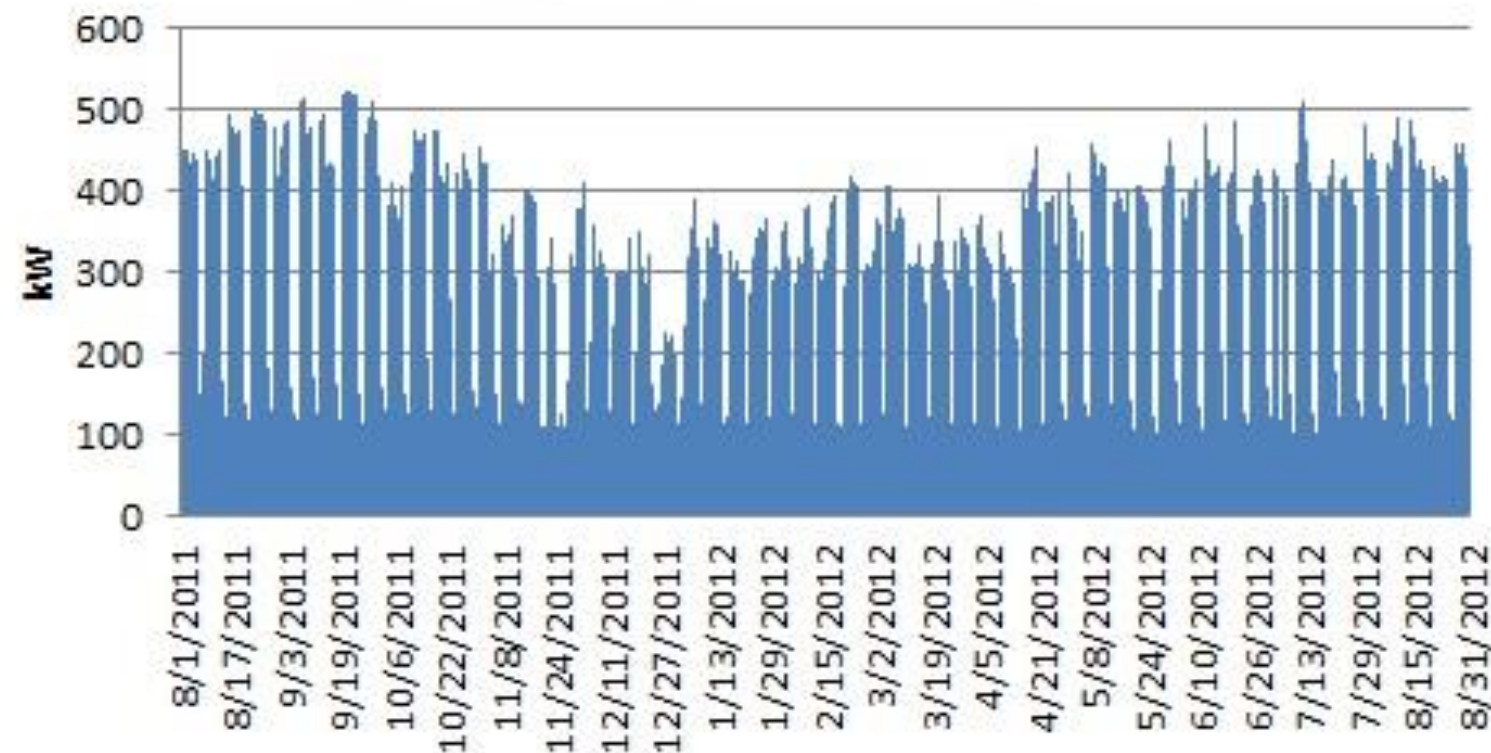
<

Create Energy Consumption Graphs

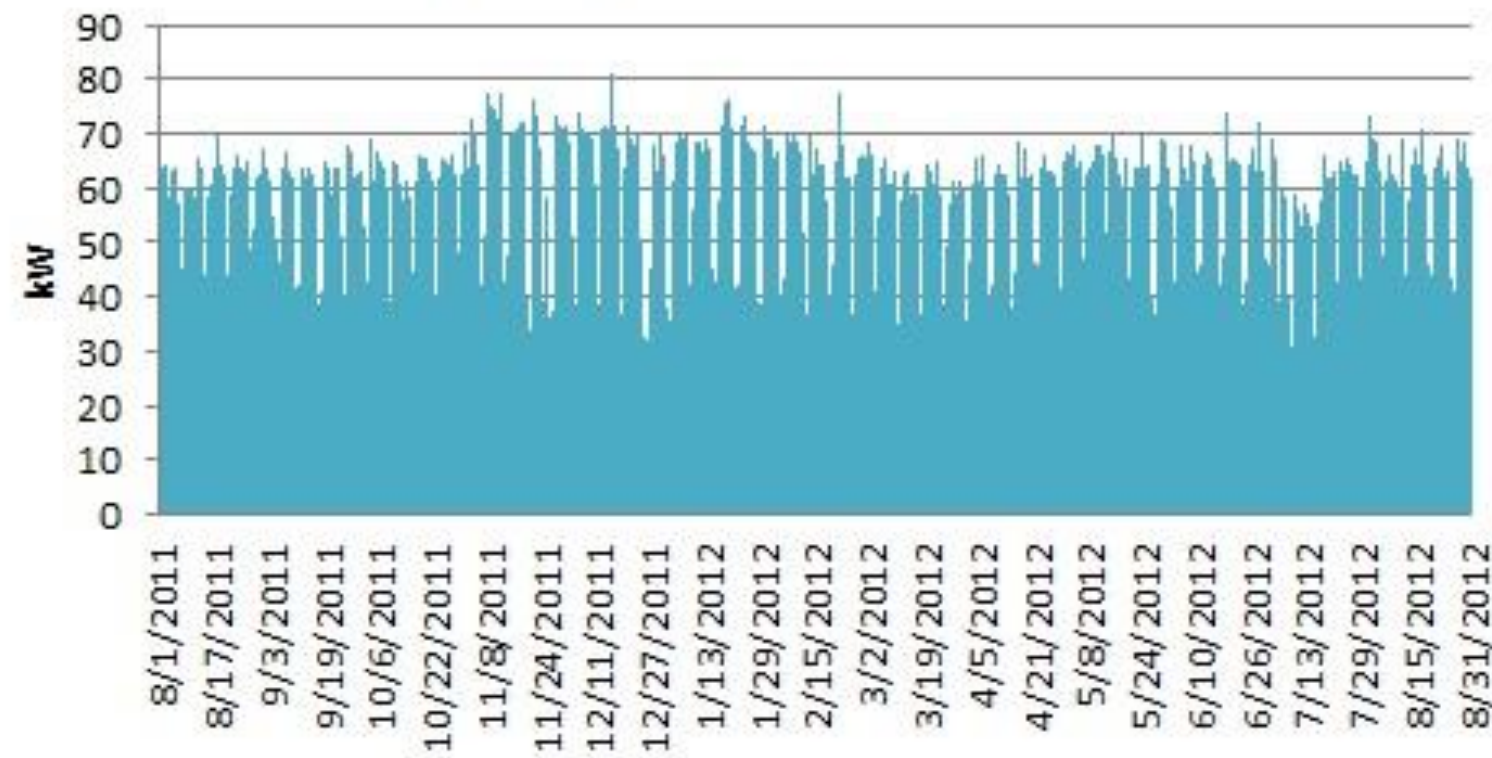


Create Energy Consumption Graphs

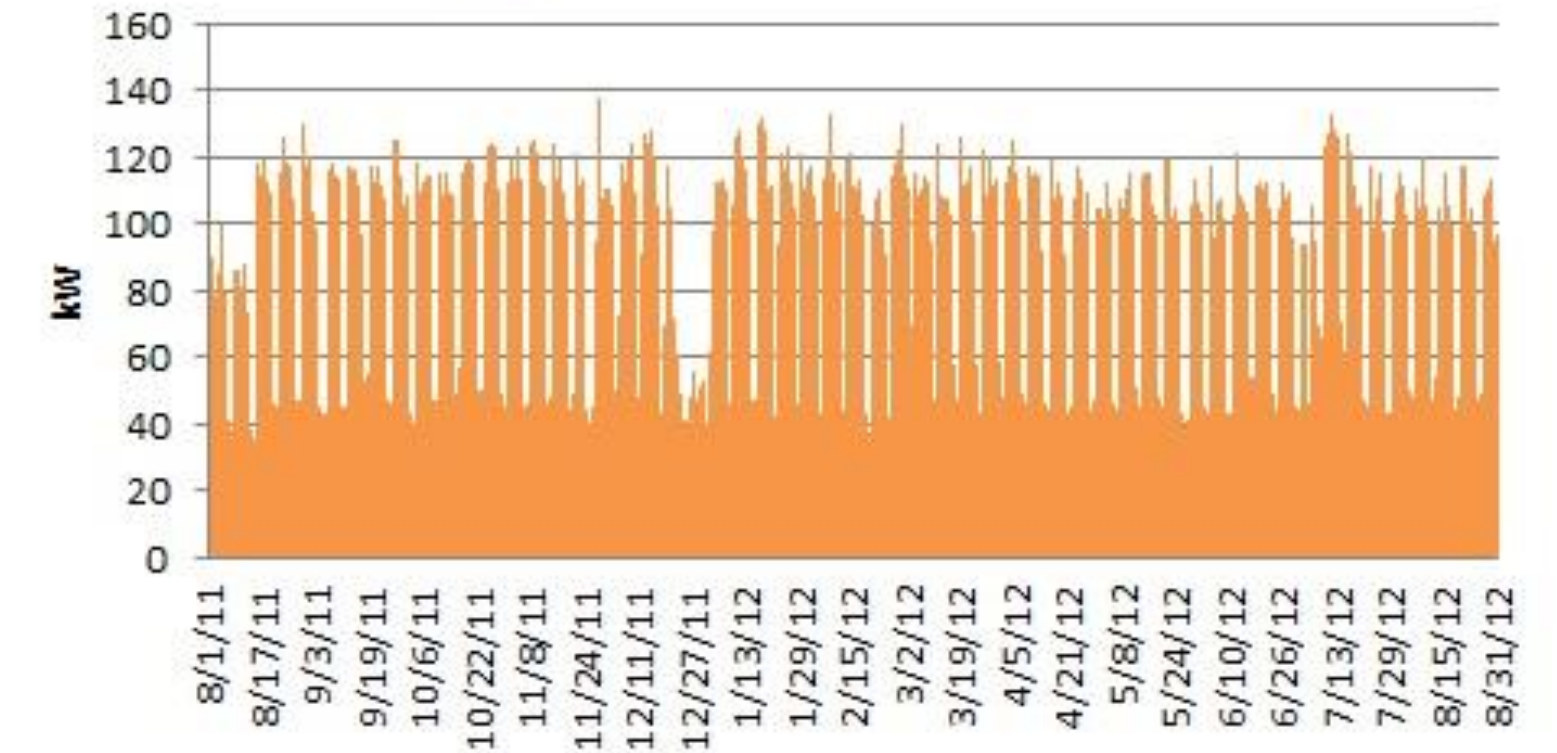
Building Total Peak Demand



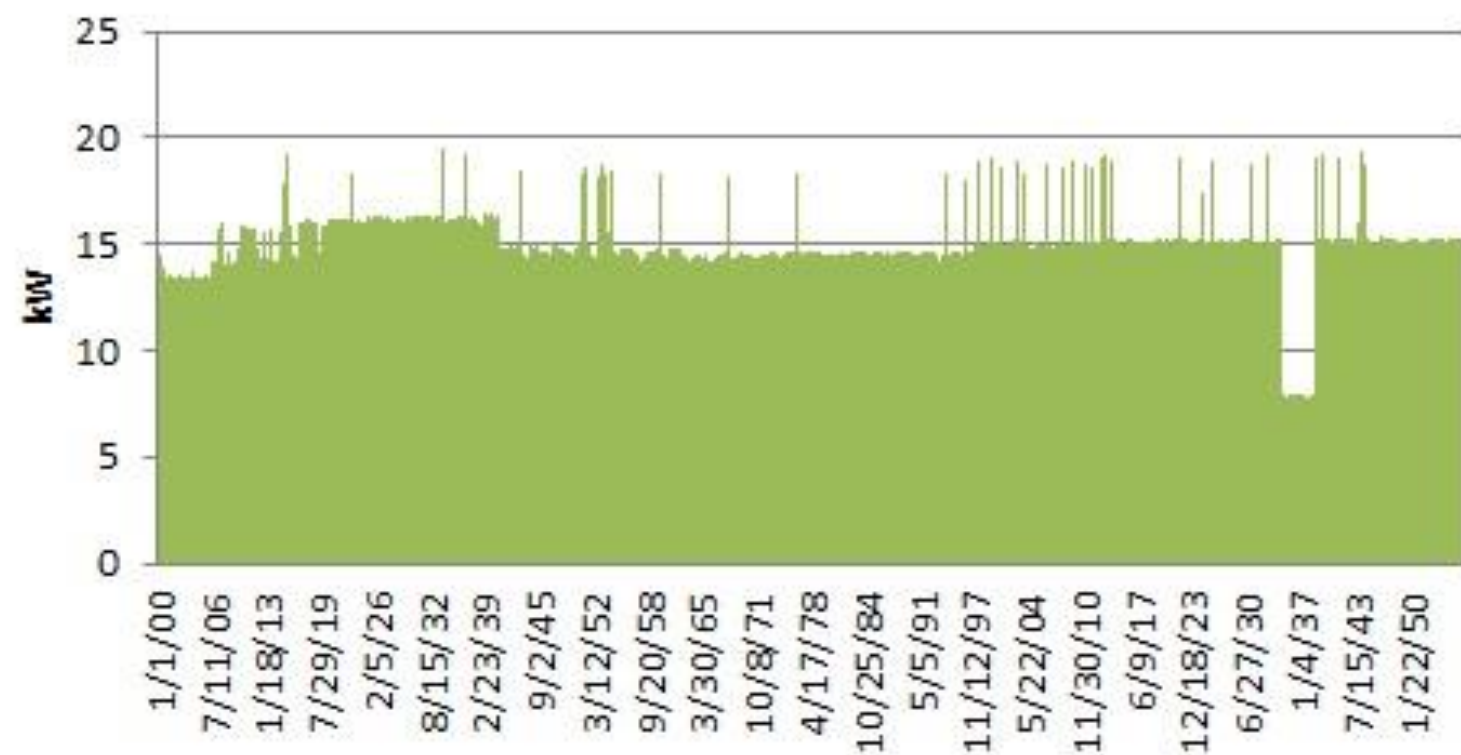
Lighting Peak Demand



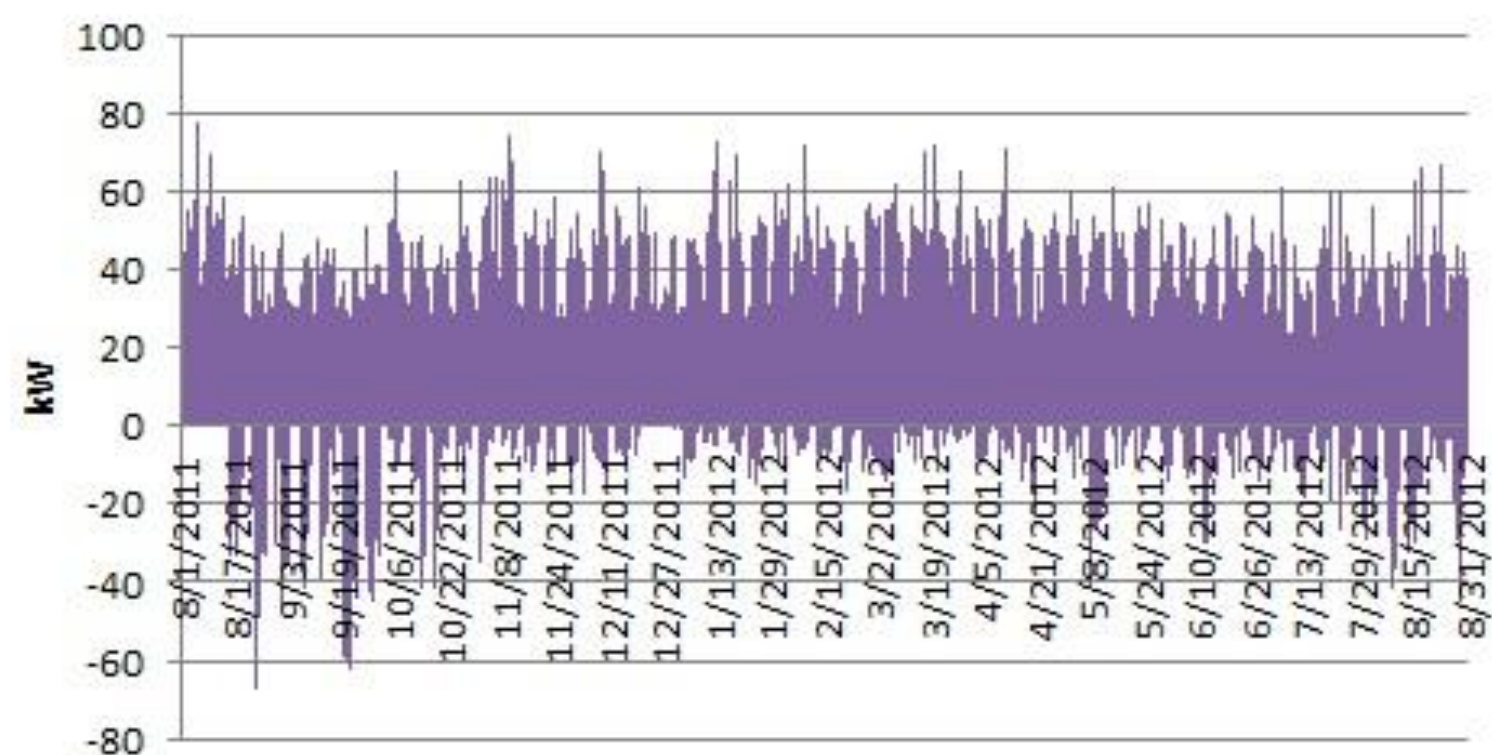
Equipment Peak Demand



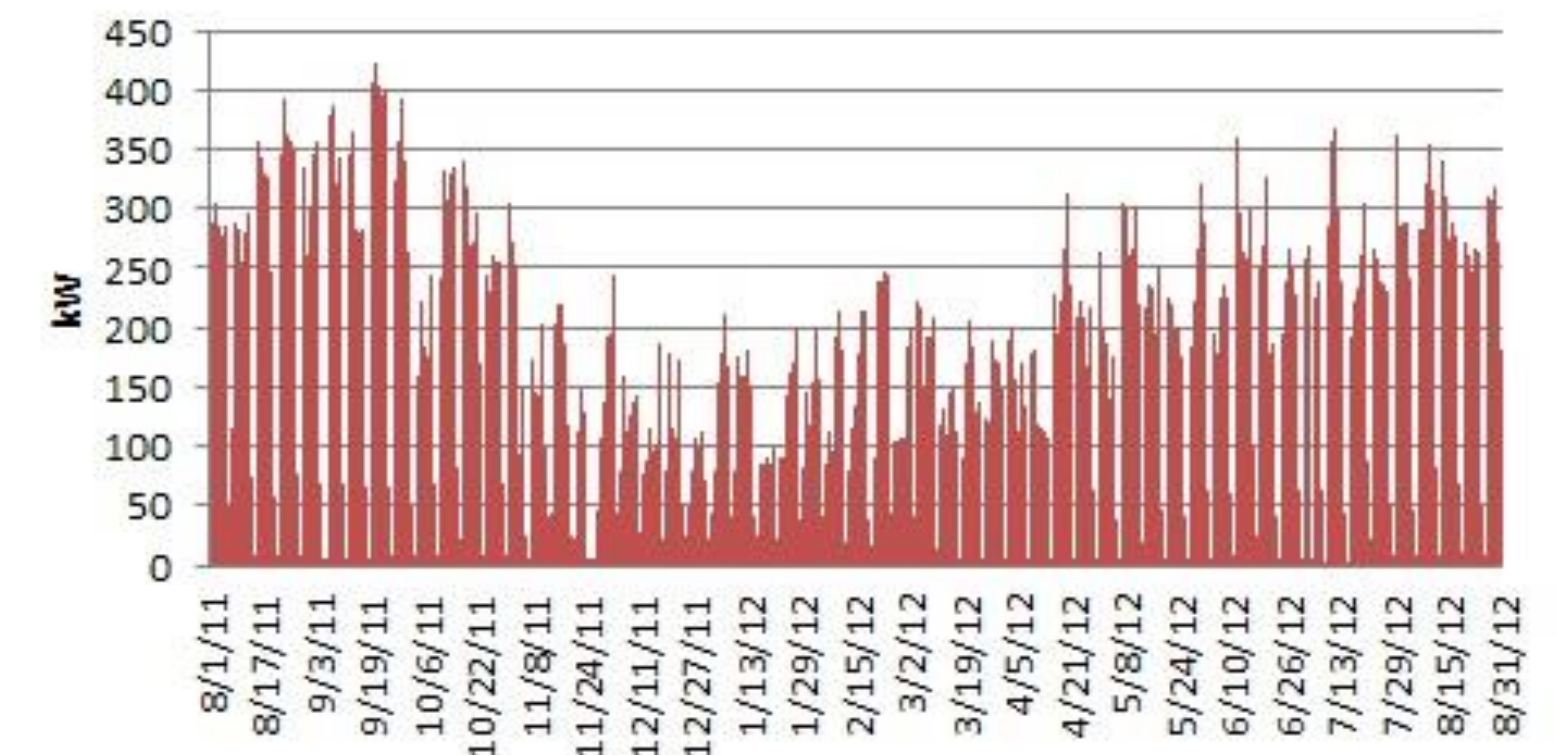
IT Room



Elevators Peak Demand

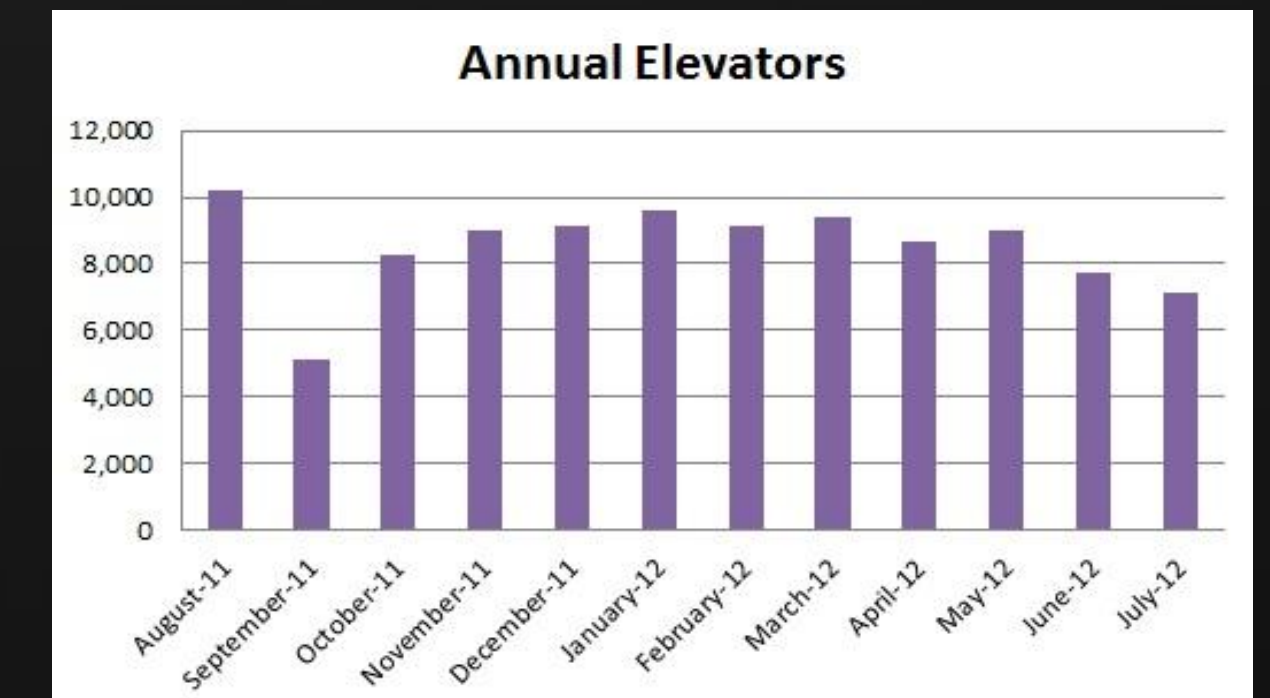
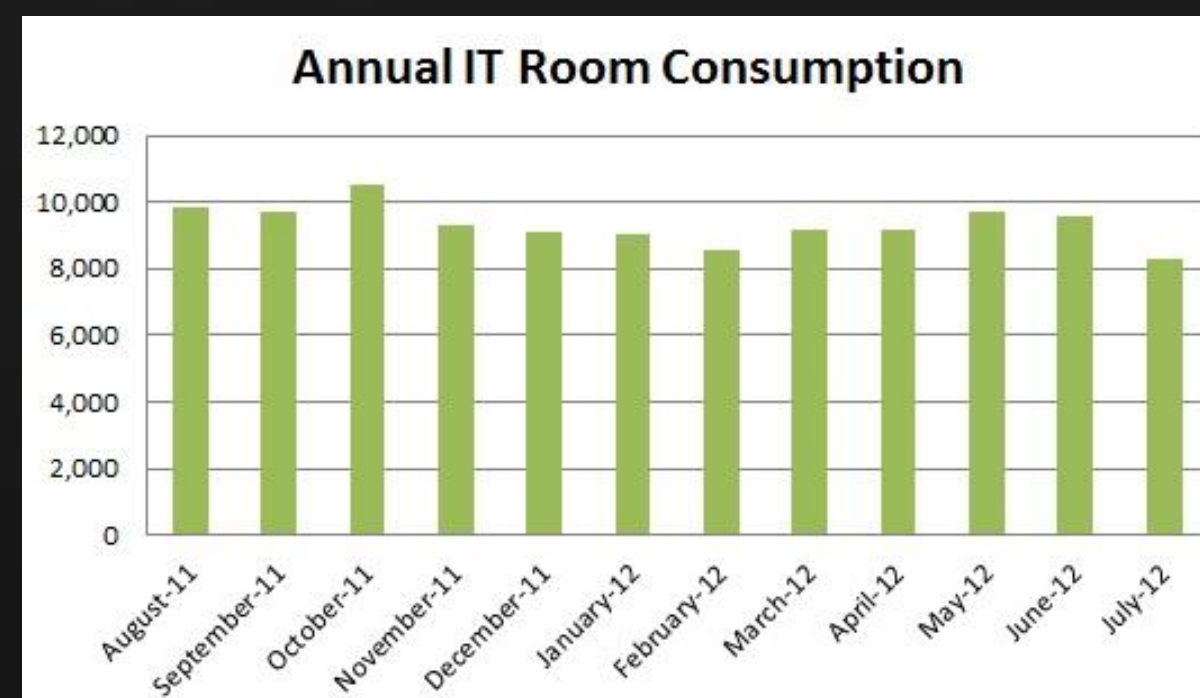
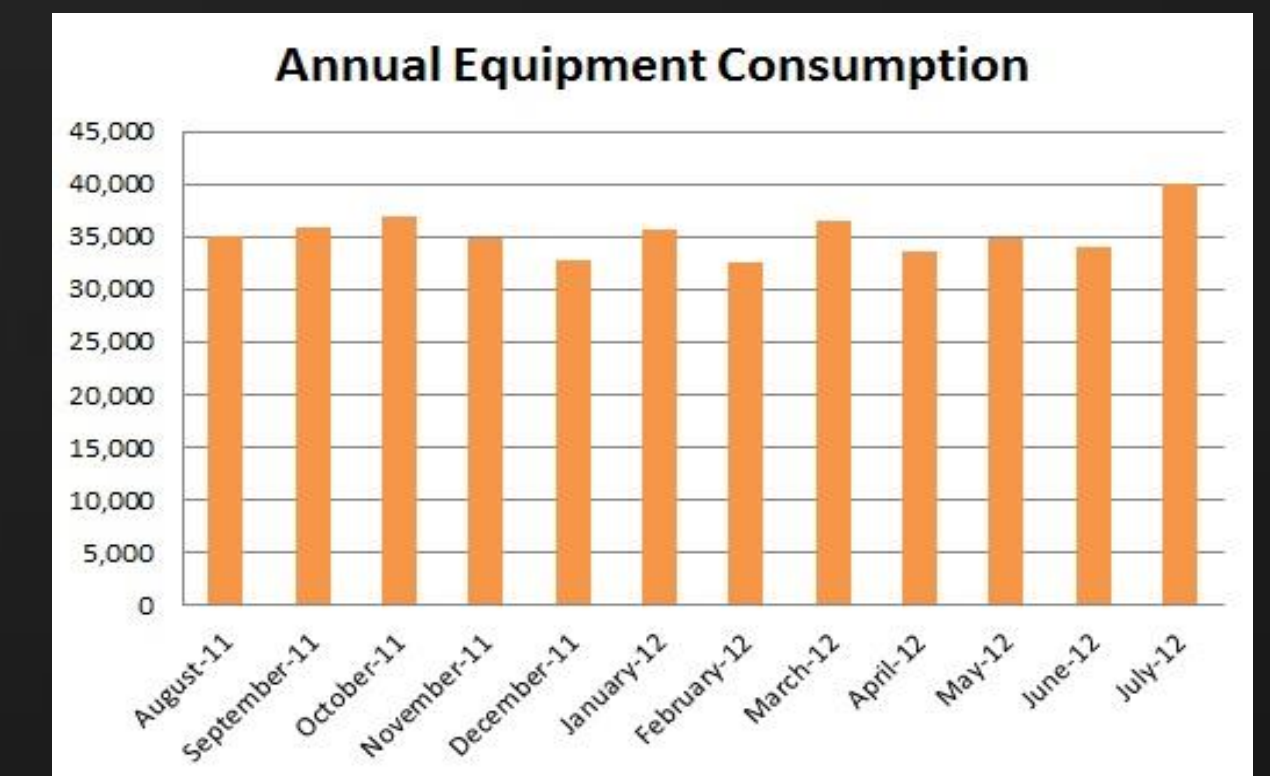
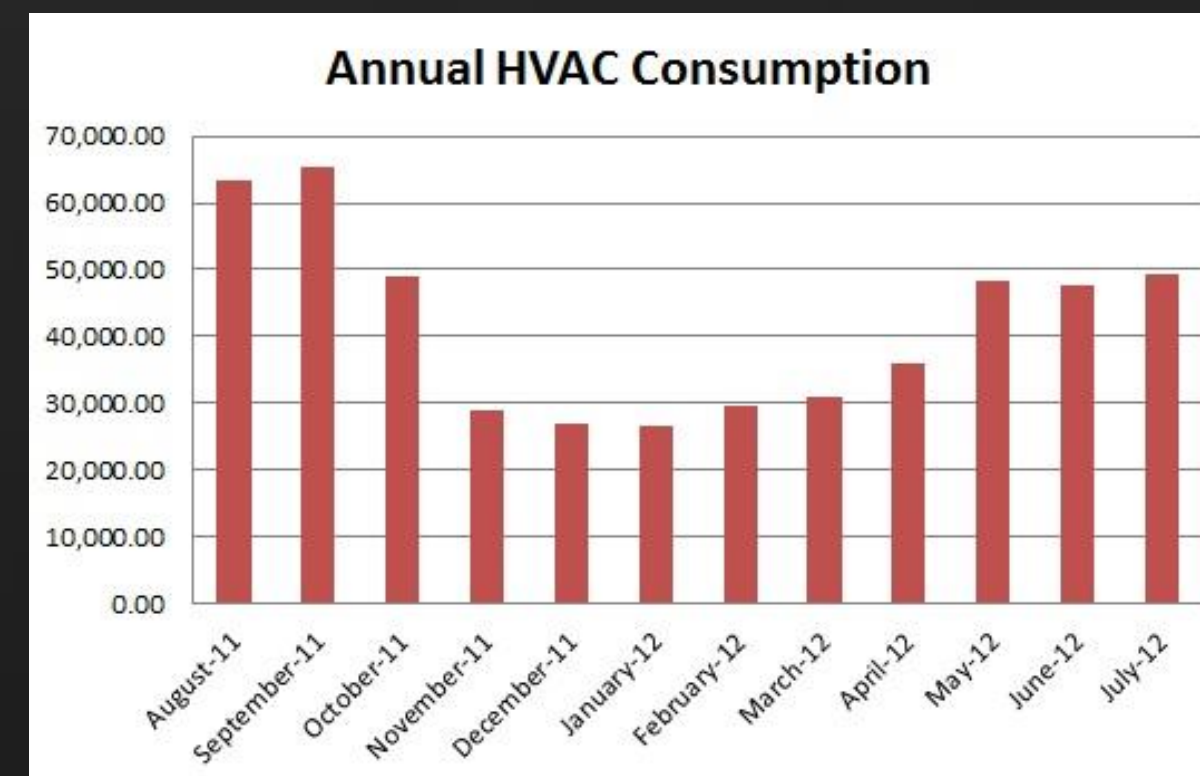
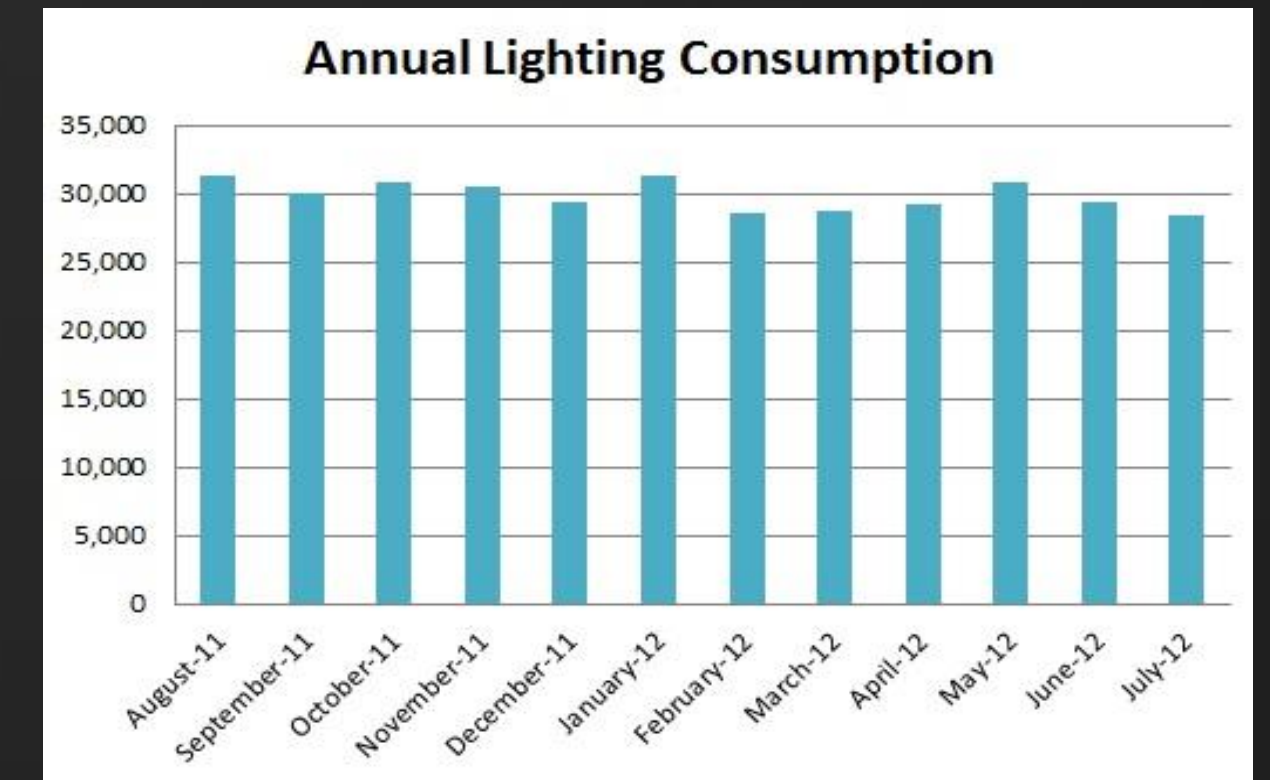
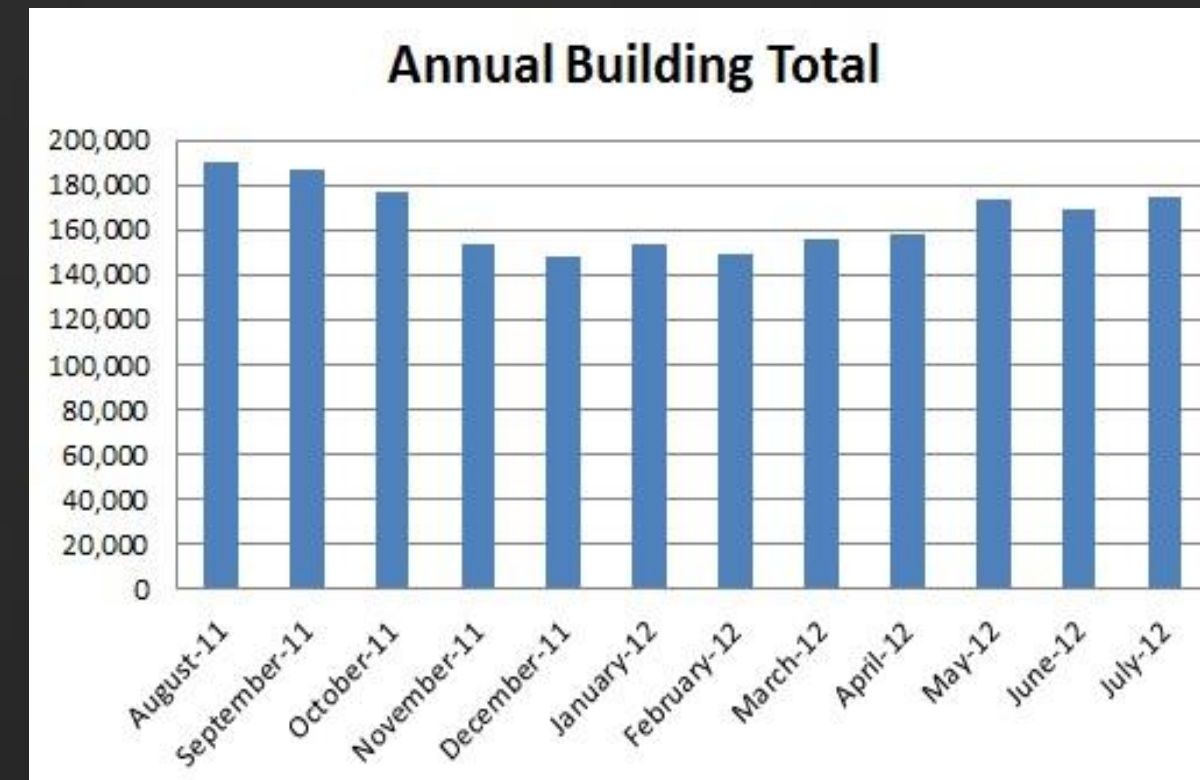


HVAC Total Peak Demand



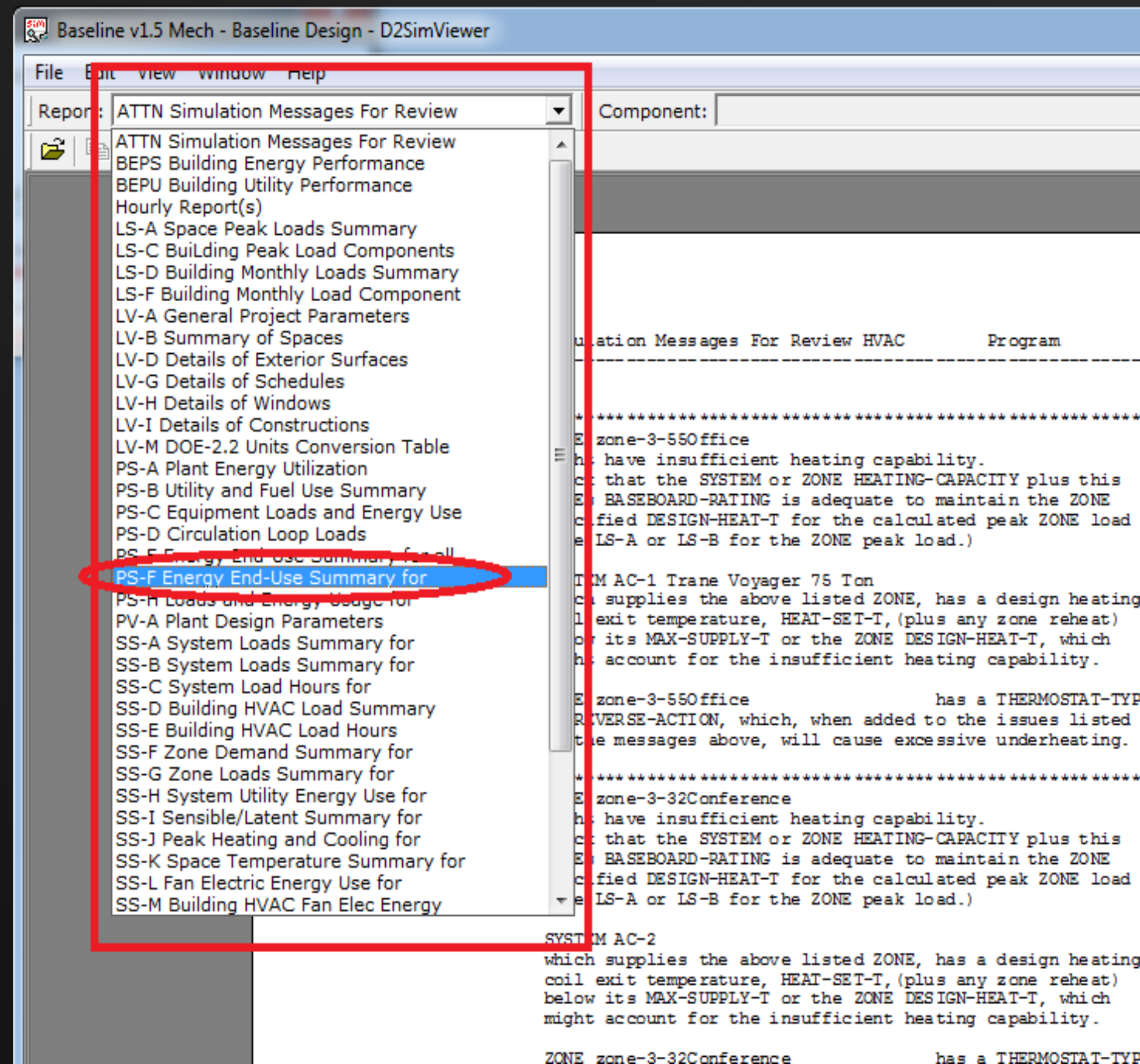
Monthly Graphs

111 McInnis - Comparison Chart								
	A	B	C	D	E	F	G	H
1	Annual Electrical Consumption							
2	Trended							
3								
4	Month	Month	Lighting	Misc Equip	IT	Elevators	HVAC	Building Total
5	Aug-11	40756	31,329.07	35,118.18	9,812.04	10,223.72	63,287.49	190,526.49
6	Sep-11	40787	30,012.88	35,909.94	9,716.40	5,138.40	65,501.51	187,066.13
7	Oct-11	40817	30,806.88	36,983.63	10,532.33	8,250.47	48,982.83	176,373.14
8	Nov-11	40848	30,473.01	34,825.10	9,297.76	9,024.82	28,815.22	153,283.90
9	Dec-11	40878	29,386.62	32,755.55	9,131.97	9,123.53	27,007.59	148,283.26
10	Jan-12	40909	31,343.87	35,613.66	9,053.00	9,629.70	26,644.08	153,193.32
11	Feb-12	40940	28,485.92	32,514.37	8,543.99	9,128.99	29,672.81	149,286.07
12	Mar-12	40969	28,795.72	36,411.73	9,165.61	9,430.38	30,802.14	155,574.58
13	Apr-12	41000	29,223.80	33,583.91	9,187.36	8,658.94	36,014.17	157,668.17
14	May-12	41030	30,846.60	34,786.66	9,711.53	8,976.60	48,259.16	173,610.55
15	Jun-12	41061	29,407.74	33,964.05	9,591.13	7,724.42	47,717.10	169,465.45
16	Jul-12	41091	28,379.75	39,932.97	8,317.86	7,122.50	49,243.33	174,087.42
17	Annual Total		358,491.86	422,399.75	112,060.97	102,432.49	501,947.41	1,497,332.48
18								



Create Comparison Charts

Bringing PS-F Data to Excel from eQUEST

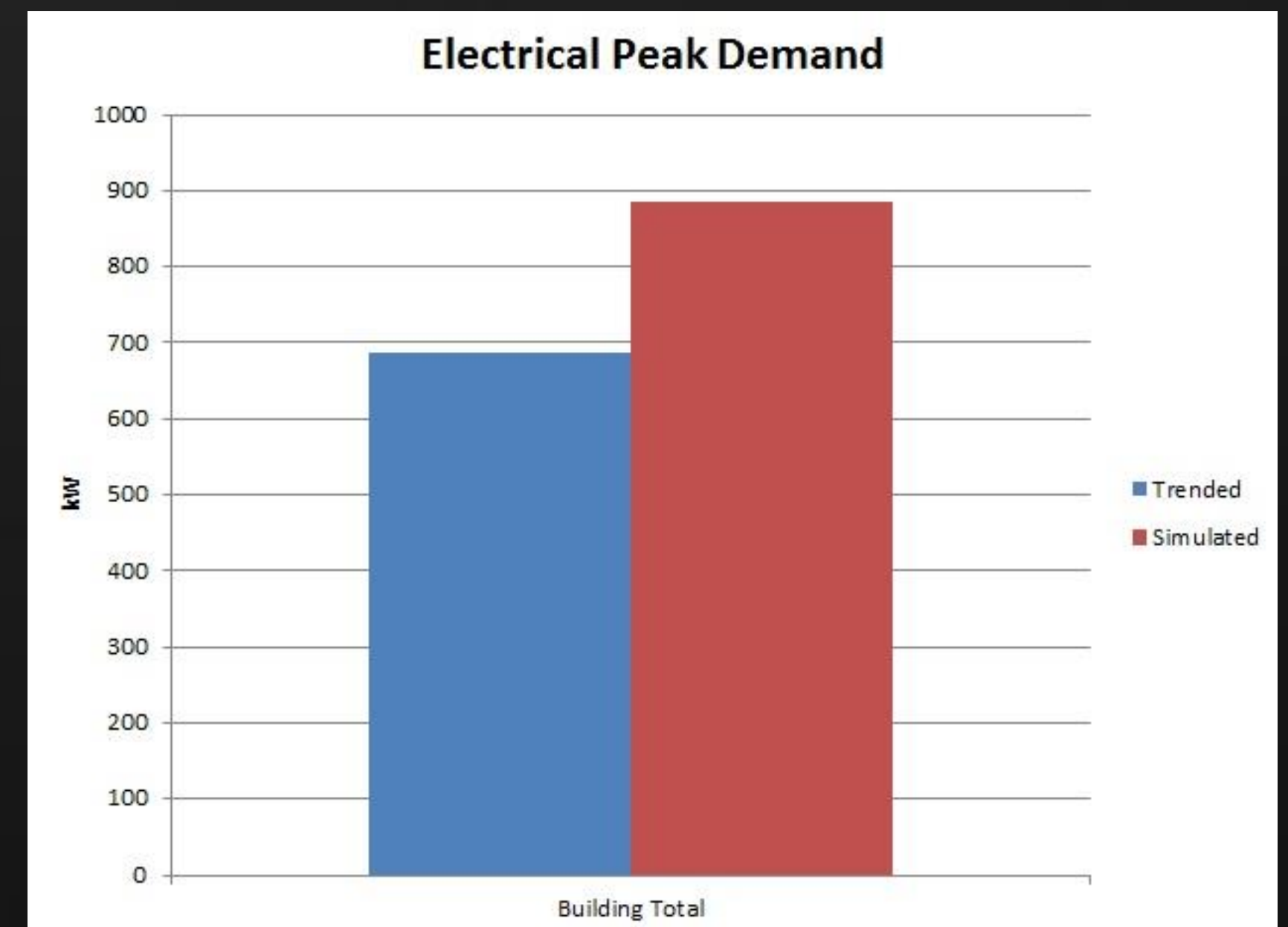
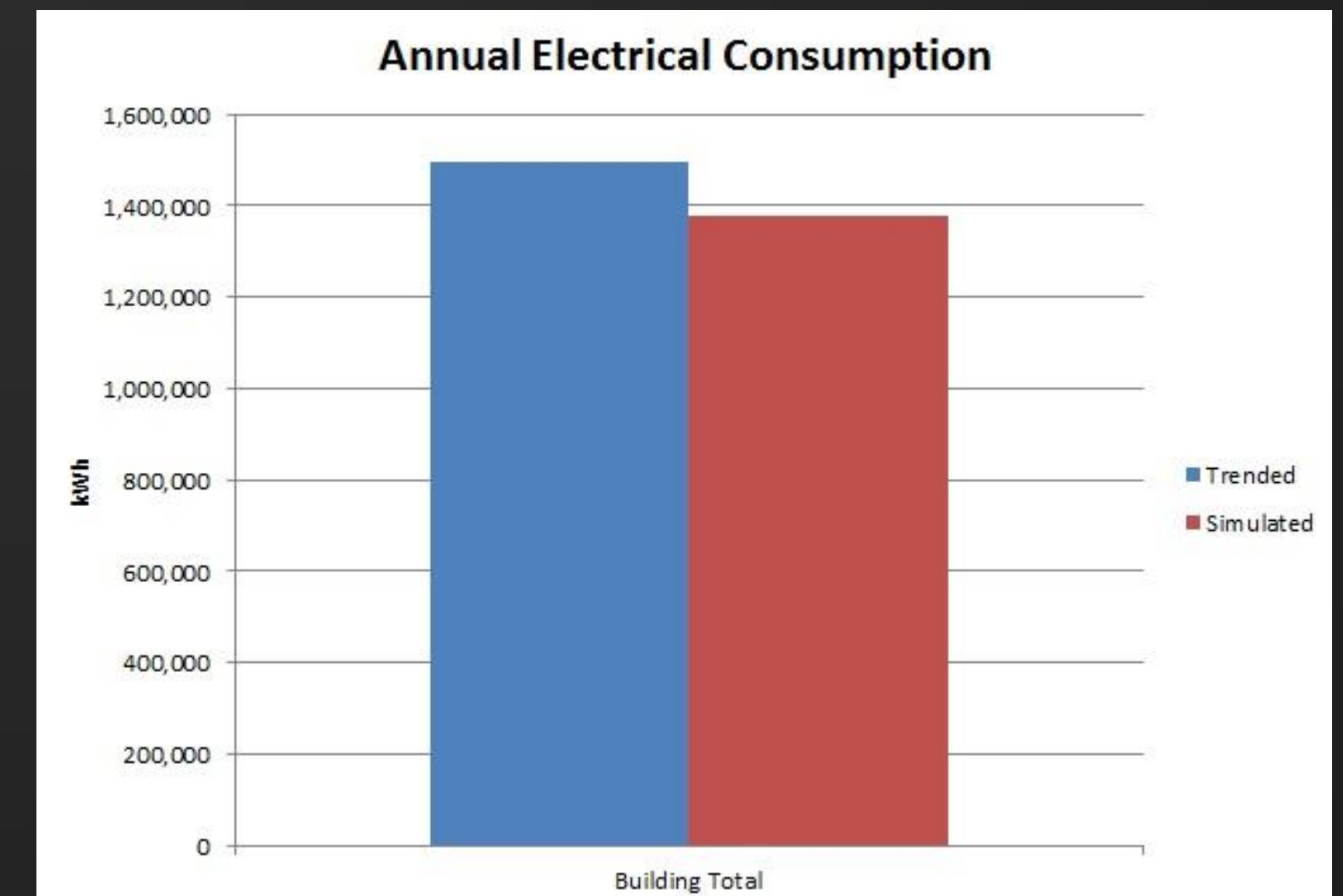


The screenshot shows the Microsoft Excel interface with the 'Text to Columns' feature being used to split data from the eQUEST report. The 'Data' tab is active, and the 'Text to Columns' button is highlighted. A tooltip explains the feature: 'Separate the contents of one Excel cell into separate columns. For example, you can separate a column of full names into separate first and last name columns. In Word, use this feature to convert the selected text into a table, splitting the text into columns at each comma, period, or other character you specify. Press F1 for more help.'

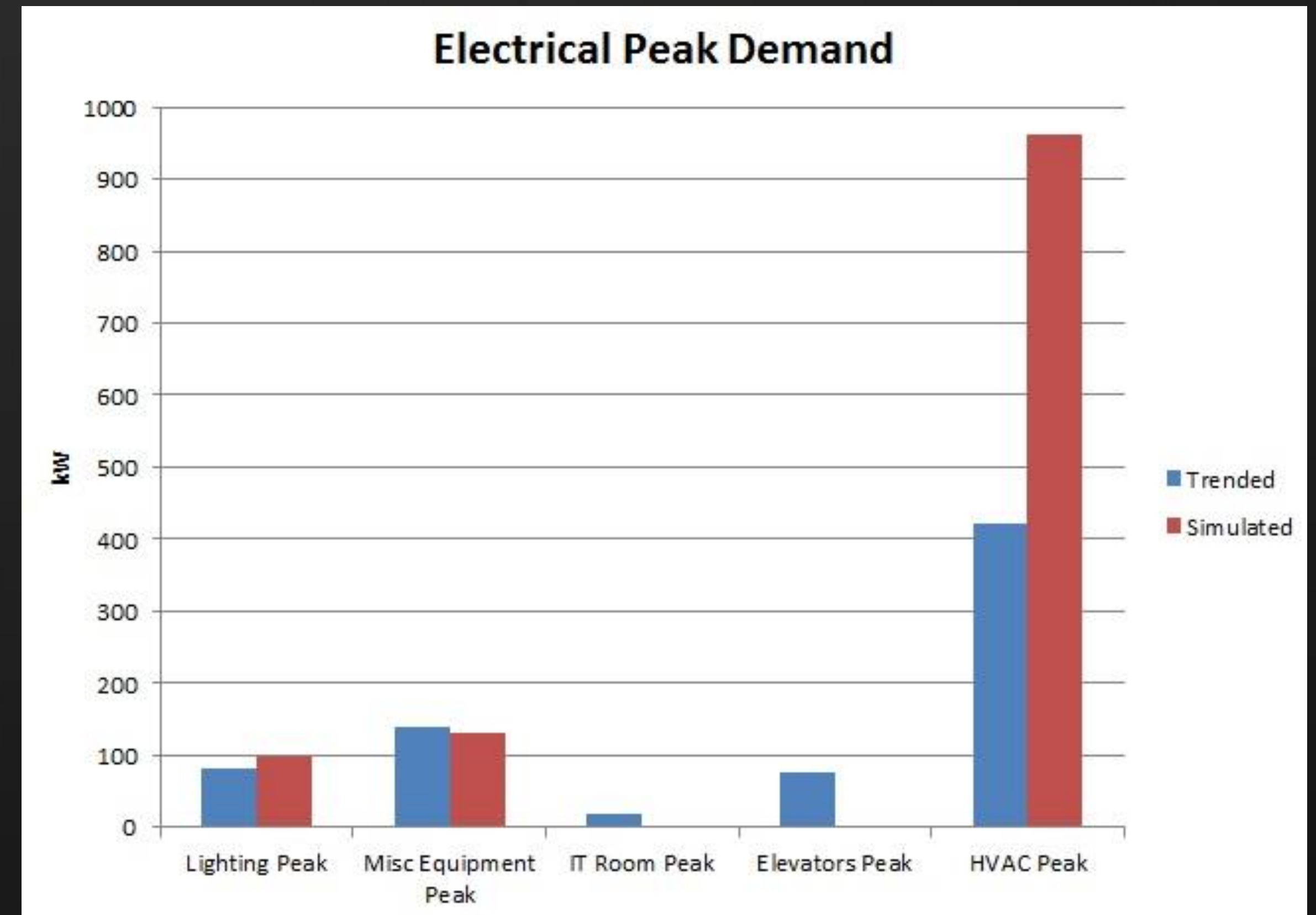
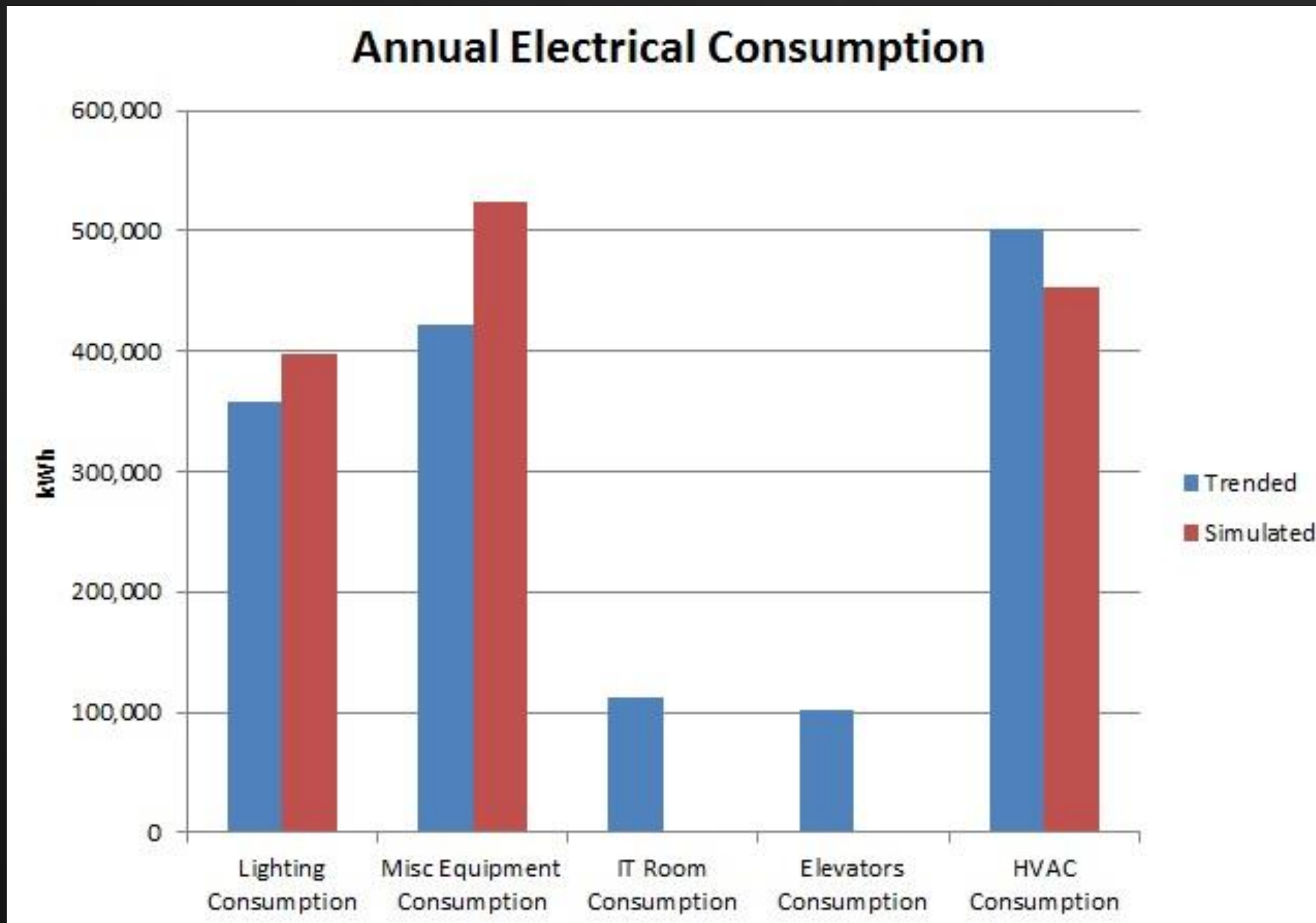
	A	B	C	D	E	F	G	H	I
1	REPORT- PS-E	Energy E	nd-Use Summary for all Elec	tric Meter s					
2	-----	-----	-----	-----	-----	-----	-----	-----	-----
3									
4			TASK	MISC	SPACE	SPACE	HEAT	PUMPS	VENT
5			LIGHTS	LIGHTS	EQUIP	HEATING	COOLING	REJECT	& AUX
6			-----	-----	-----	-----	-----	-----	-----
7									
8	JAN								
9	KWH	33850	0	44470	41032	1586	0	155	
10	MAX KW	99.266	0	130.493	631.819	68.099	0	1.15	27.956
11	DAY/HR	9-Jan 0/0		10-Feb	9-Feb	13-Nov 0/0		1-Jan	15-Nov 0/0
12	PEAK ENDUSE	99.266	0	129.528	631.819	0	0	0	25.148
13	PEAK PCT	11.2	0	14.6	71.3	0	0	0	2.8
14									
15	FEB								
16	KWH	30574	0	40167	25992	2553	0	106	4030
17	MAX KW	99.266	0	130.493	489.983	86.036	0	1.15	33.583
18	DAY/HR	9-Jan 0/0		10-Jan	9-Jul	15-Dec 0/0		1-Jan	16-Dec 0/0
19	PEAK ENDUSE	99.266	0	129.528	489.983	0.104	0	0	17.652

Comparison Charts

	A	B	C	D	E	F	G	H
1	Annual Electrical Consumption							
2	Trended							
3	Month	Month	Lighting Consum	Misc Equipment	IT Room	Elevators	HVAC Consumption	
4	Aug-11	40,756	31329.06686	35118.17563	9812.04	10223.72	63,287.49	
5	Sep-11	40,787	30012.88066	35909.93671	9716.4	5138.404	65501.50812	
6	Oct-11	40,817	30806.88463	36983.63066	10532.3	8250.47	48982.83081	
7	Nov-11	40,848	30473.00502	34825.10207	9297.76	9024.821	28815.21508	
8	Dec-11	40,878	29386.62351	32755.55267	9131.97	9123.53	27007.58727	
9	Jan-12	40,909	31343.87414	35613.66263	9053	9629.705	26644.07692	
10	Feb-12	40,940	28485.91647	32514.36575	8543.99	9128.994	29672.80619	
11	Mar-12	40,969	28795.71659	36411.73491	9165.61	9430.379	30802.13986	
12	Apr-12	41,000	29223.79924	33583.90541	9187.36	8658.942	36014.17129	
13	May-12	41,030	30846.60265	34786.66192	9711.53	8976.598	48259.1568	
14	Jun-12	41,061	29407.74202	33964.05199	9591.13	7724.423	47717.09924	
15	Jul-12	41,091	28379.75239	39932.97327	8317.86	7122.502	49243.33128	
16	Annual Total		358,492	422,400	112,061	102,432	501,947	
17								
18	Simulated							
19	Month	Month	Lighting Consum	Misc Equipment	IT Room	Elevators	HVAC Consumption	
20	Aug-11	40,756	33,850	44,470			46,617	
21	Sep-11	40,787	30,574	40,167			32,681	
22	Oct-11	40,817	33,850	44,481			36,083	
23	Nov-11	40,848	32,758	43,043			30,058	
24	Dec-11	40,878	33,850	44,481			31,985	
25	Jan-12	40,909	32,758	43,043			36,951	
26	Feb-12	40,940	33,850	44,470			45,987	
27	Mar-12	40,969	33,850	44,492			50,982	
28	Apr-12	41,000	32,758	43,021			37,405	
29	May-12	41,030	33,850	44,481			31,714	
30	Jun-12	41,061	32,758	43,032			28,651	
31	Jul-12	41,091	33,850	44,459			44,687	
32	Annual Total		398,556	523,640	0	0	453,801	
33								



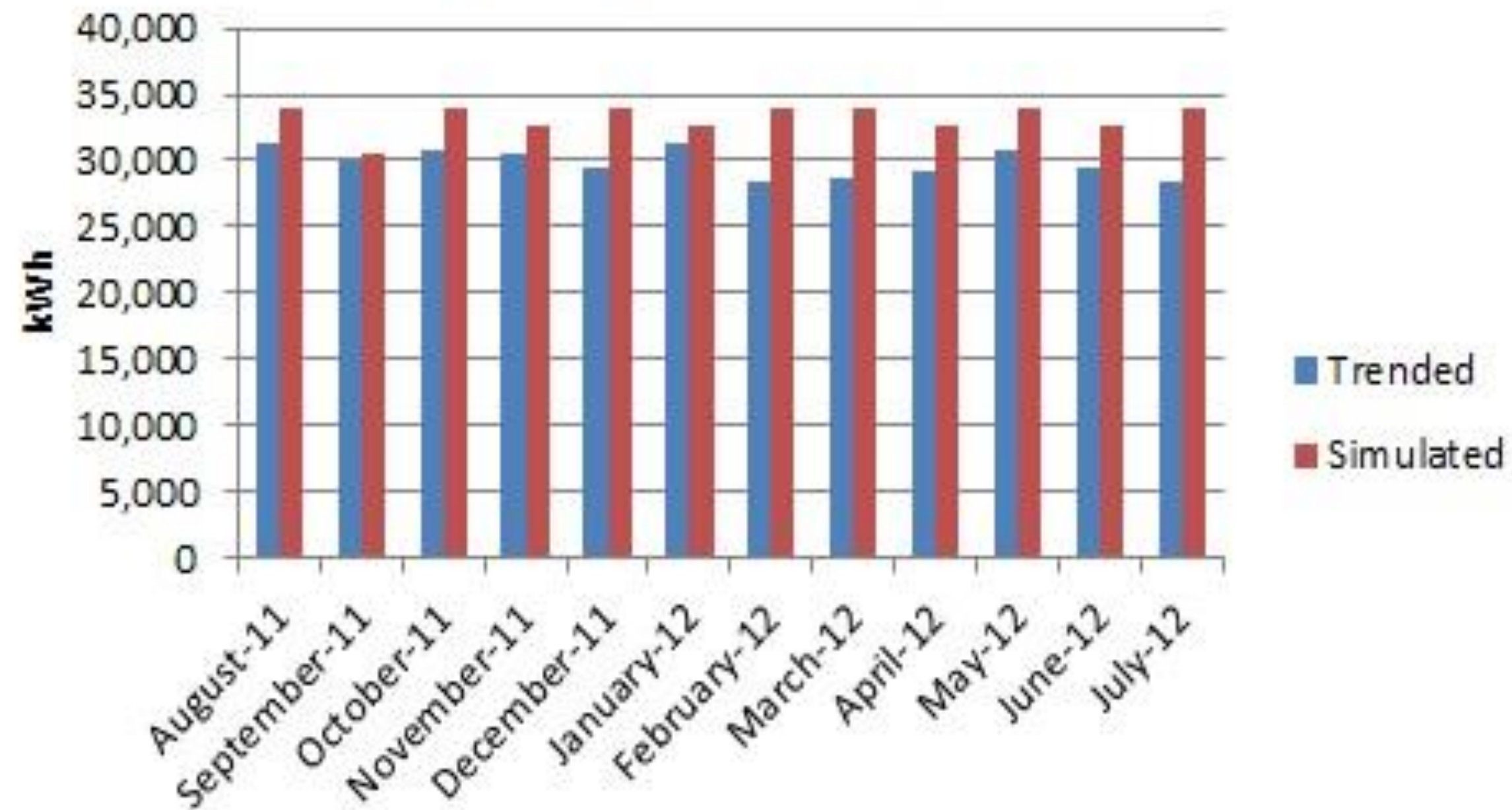
Comparison Charts



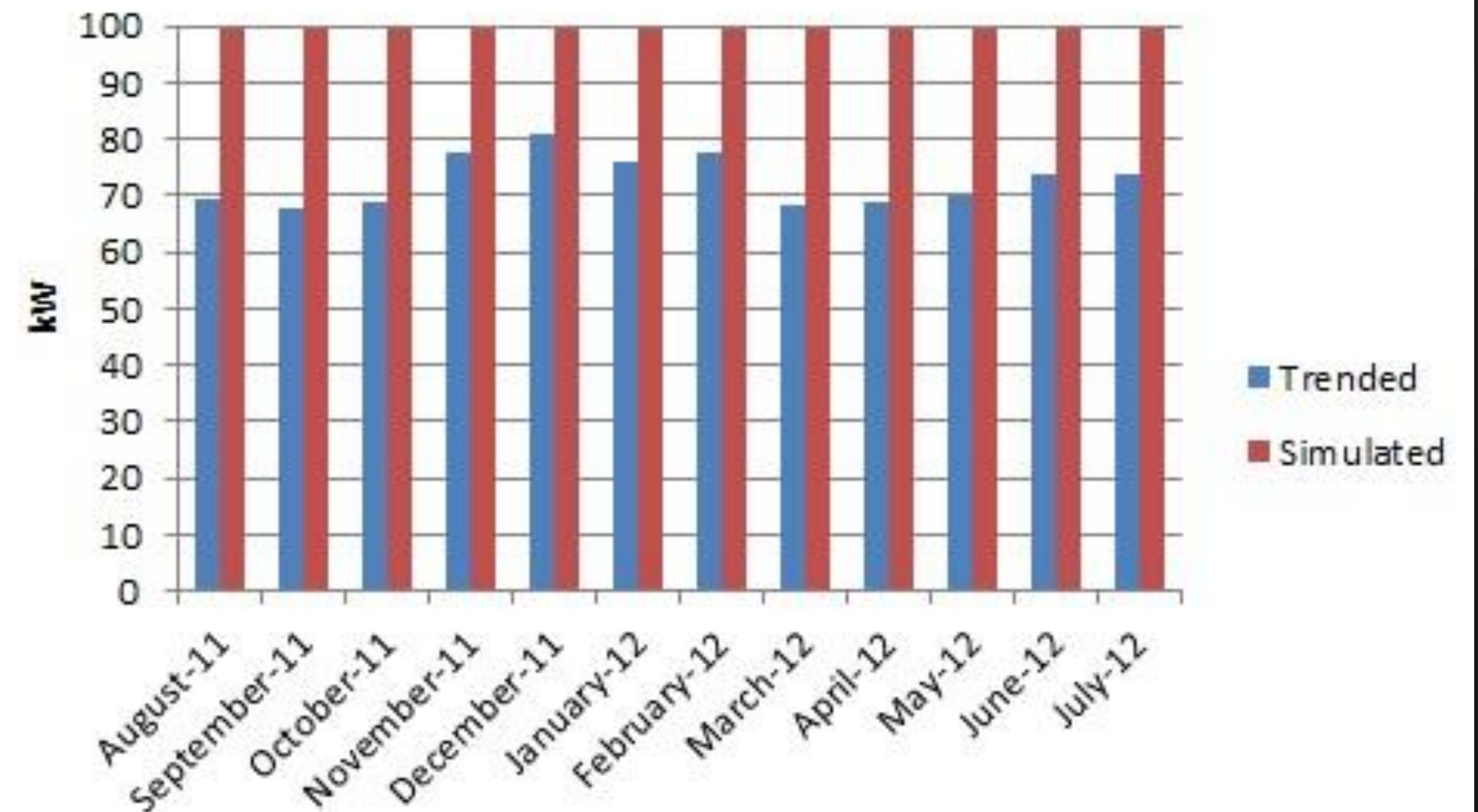
Calibrate the eQUEST Model

Lighting – Initial Comparison Charts

Lighting Consumption



Lighting Peak



Develop Accurate Lighting Schedules

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Week Schedule: **wk-schdl-1** Type: Fraction

Week Schedule Name: **wk-schdl-1**
Type: **Fraction**

Daily Schedule Assignments

Monday:	dy-schdl-1
Tuesday:	dy-schdl-1
Wednesday:	dy-schdl-1
Thursday:	dy-schdl-1
Friday:	dy-schdl-1
Saturday:	dy-schdl-1
Sunday:	dy-schdl-1
Holidays:	dy-schdl-1
Heating Design Day:	dy-schdl-1
Cooling Design Day:	dy-schdl-1

Done

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Week Schedule: **Lighting Weekly** Type: Fraction

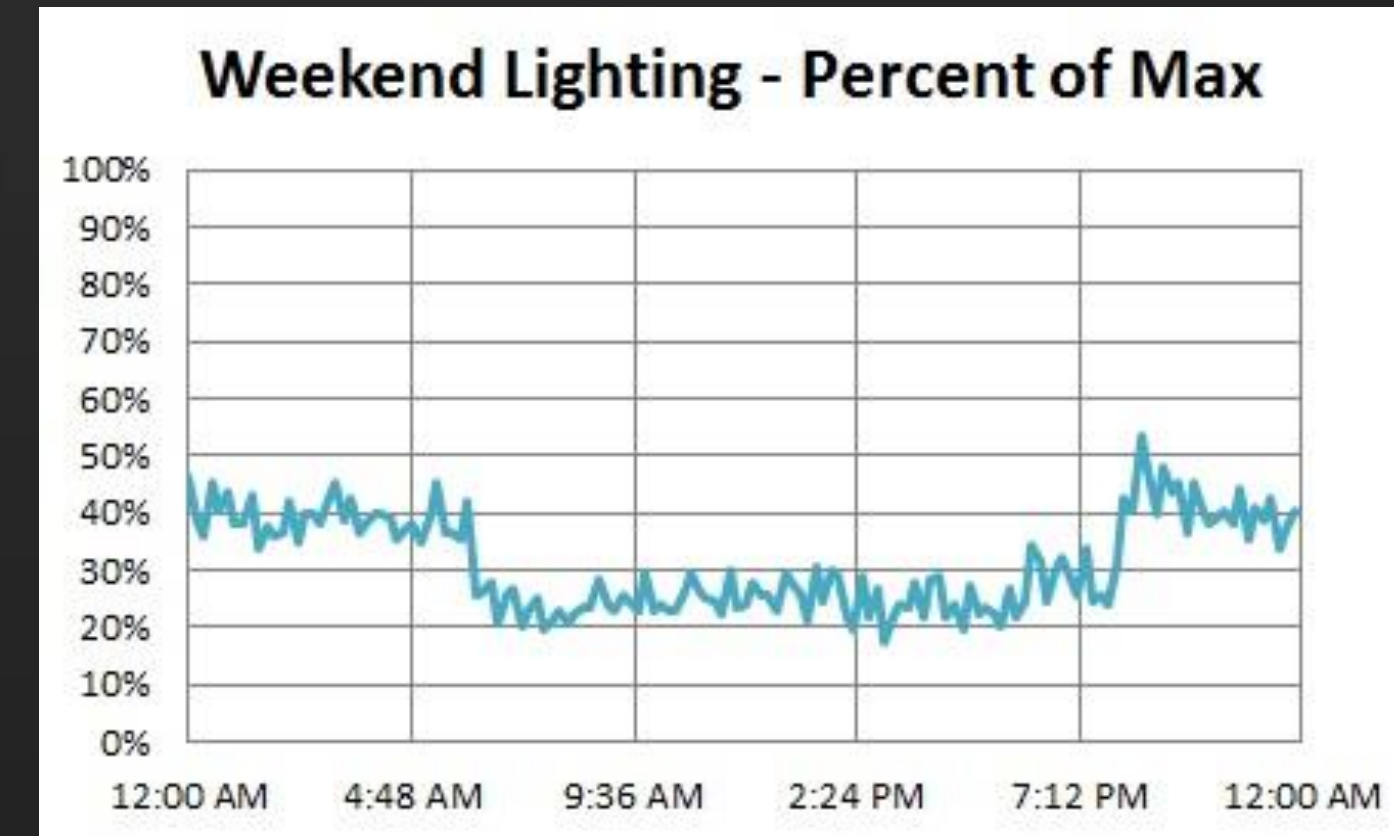
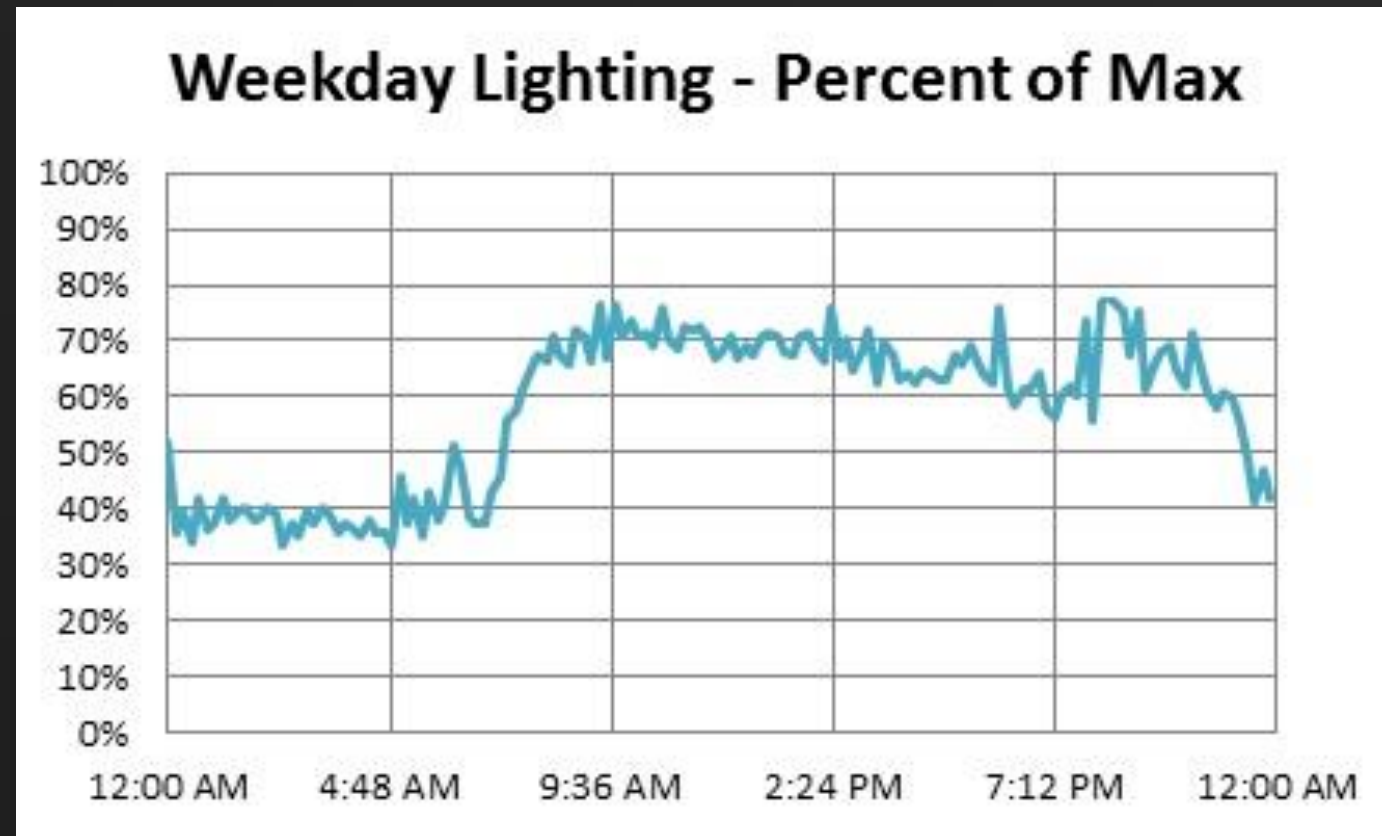
Week Schedule Name: **Lighting Weekly**
Type: **Fraction**

Daily Schedule Assignments

Monday:	Lighting Weekday
Tuesday:	Lighting Weekday
Wednesday:	Lighting Weekday
Thursday:	Lighting Weekday
Friday:	Lighting Weekday
Saturday:	Lighting Weekend
Sunday:	Lighting Weekend
Holidays:	Lighting Weekend
Heating Design Day:	Lighting Weekday
Cooling Design Day:	Lighting Weekday

Done

Develop Accurate Lighting Schedules



Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: **Lighting Weekday** Type: Fraction

Day Schedule Name: **Lighting Weekday**
Type: **Fraction**

Hourly Values

Mdnt - 1:	0.4400 ratio	8-9 am:	0.6000 ratio	4-5 pm:	0.7000 ratio
1-2 am:	0.2000 ratio	9-10 am:	0.7000 ratio	5-6 pm:	0.6000 ratio
2-3 am:	0.2000 ratio	10-11 am:	0.7000 ratio	6-7 pm:	0.6000 ratio
3-4 am:	0.2000 ratio	11-noon:	0.7000 ratio	7-8 pm:	0.7000 ratio
4-5 am:	0.2000 ratio	noon-1:	0.7000 ratio	8-9 pm:	0.5000 ratio
5-6 am:	0.3000 ratio	1-2 pm:	0.7000 ratio	9-10 pm:	0.4000 ratio
6-7 am:	0.6000 ratio	2-3 pm:	0.7000 ratio	10-11 pm:	0.4000 ratio
7-8 am:	0.6000 ratio	3-4 pm:	0.7000 ratio	11-Mdnt:	0.4000 ratio

Done

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: **Lighting Weekend** Type: Fraction

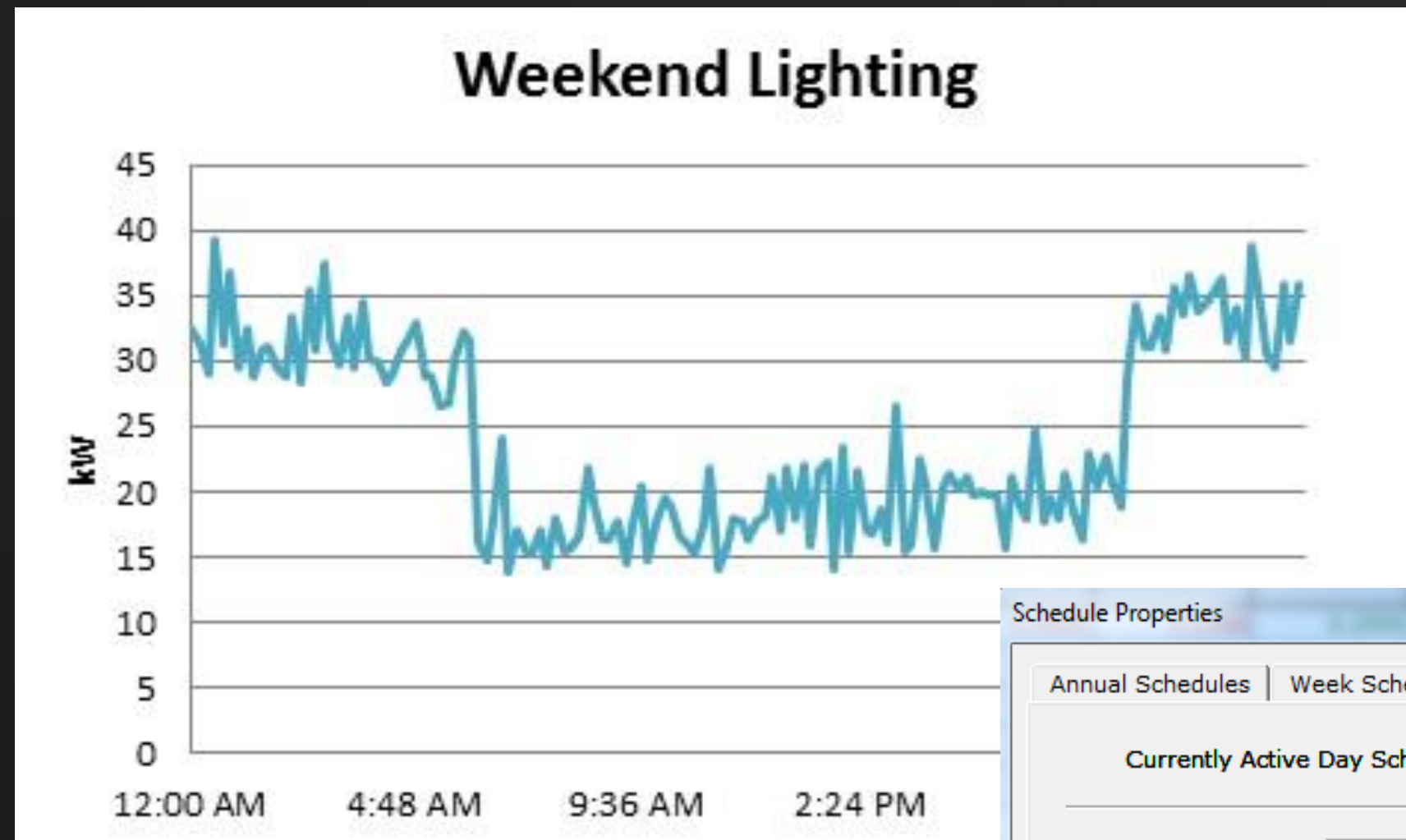
Day Schedule Name: **Lighting Weekend**
Type: **Fraction**

Hourly Values

Mdnt - 1:	0.2000 ratio	8-9 am:	0.2000 ratio	4-5 pm:	0.2000 ratio
1-2 am:	0.2000 ratio	9-10 am:	0.2000 ratio	5-6 pm:	0.2000 ratio
2-3 am:	0.2000 ratio	10-11 am:	0.2000 ratio	6-7 pm:	0.2000 ratio
3-4 am:	0.2000 ratio	11-noon:	0.2000 ratio	7-8 pm:	0.2000 ratio
4-5 am:	0.2000 ratio	noon-1:	0.2000 ratio	8-9 pm:	0.2000 ratio
5-6 am:	0.2000 ratio	1-2 pm:	0.2000 ratio	9-10 pm:	0.2000 ratio
6-7 am:	0.2000 ratio	2-3 pm:	0.2000 ratio	10-11 pm:	0.2000 ratio
7-8 am:	0.2000 ratio	3-4 pm:	0.2000 ratio	11-Mdnt:	0.2000 ratio

Done

Incorporate Exterior Lighting



Project: 'Baseline v1.5 Mech3'

- Global Parameters
- Utility Rates
- Block Charges
- Ratchets
- MASTER-METERS 1
 - Electric Meters
 - EM1
 - EM2 IT
 - Fuel Meters
 - FM1
 - Steam Meters
 - CHW Meters
 - BASELINE 1

Utility & Economics

Electric Meter Properties

Currently Active Electric Meter: EM1 Type: Utility

Basic Specifications | Building and/or Submeters | **Direct Loads**

Interior Direct Loads

	Load (kW)	Schedule	Enduse
1	n/a	n/a	n/a
2	n/a	n/a	n/a
3	n/a	n/a	n/a
4	n/a	n/a	n/a

Exterior Direct Loads

	Load (kW)	Schedule	Enduse
1	10.00	Ext Lighting Ann	Ambient Lighting
2	n/a	n/a	n/a
3	n/a	n/a	n/a
4	n/a	n/a	n/a

Refrigeration Direct Loads

Load (kW) Schedule

Done

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: Exterior Lighting Day Type: Fraction

Day Schedule Name: Exterior Lighting Day

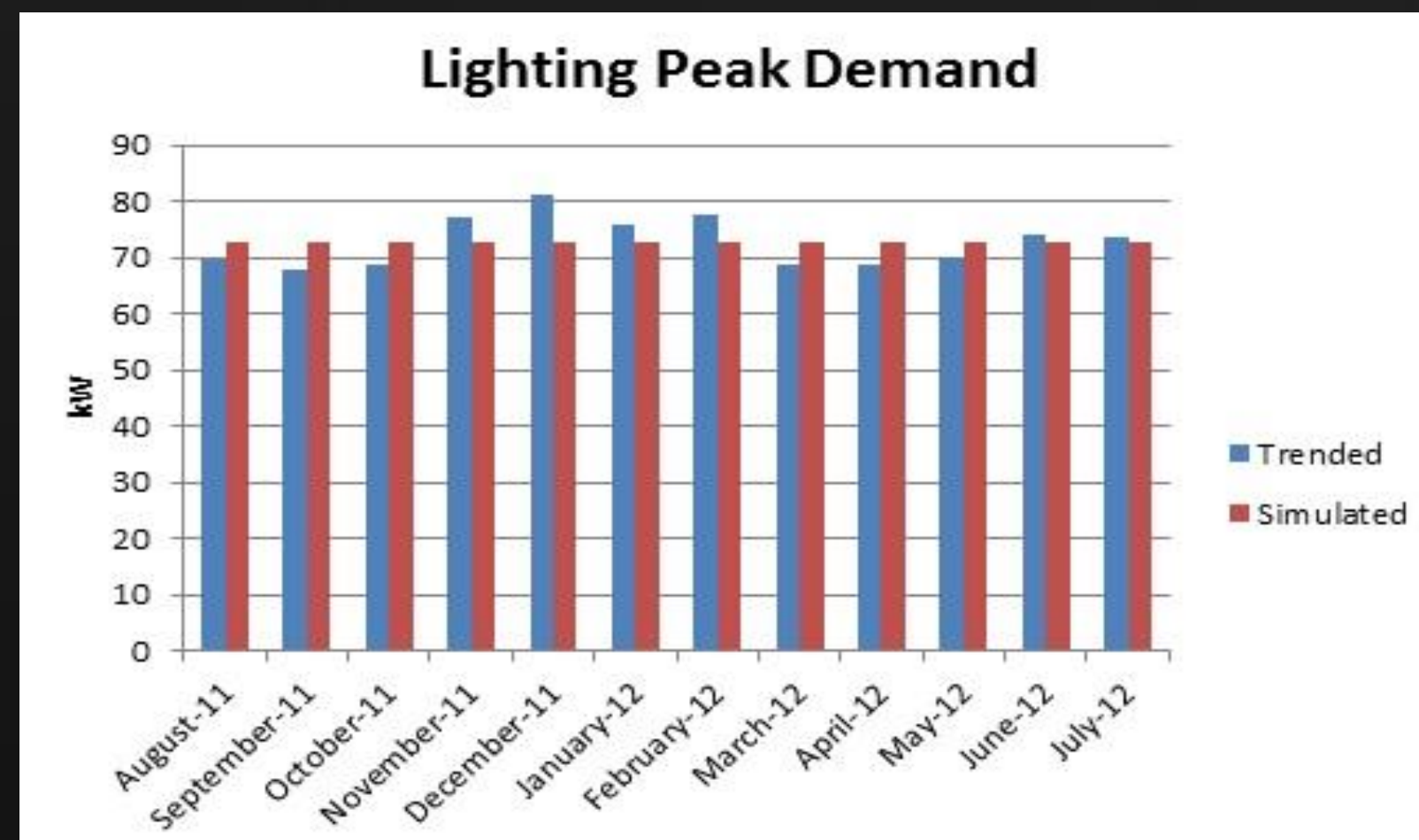
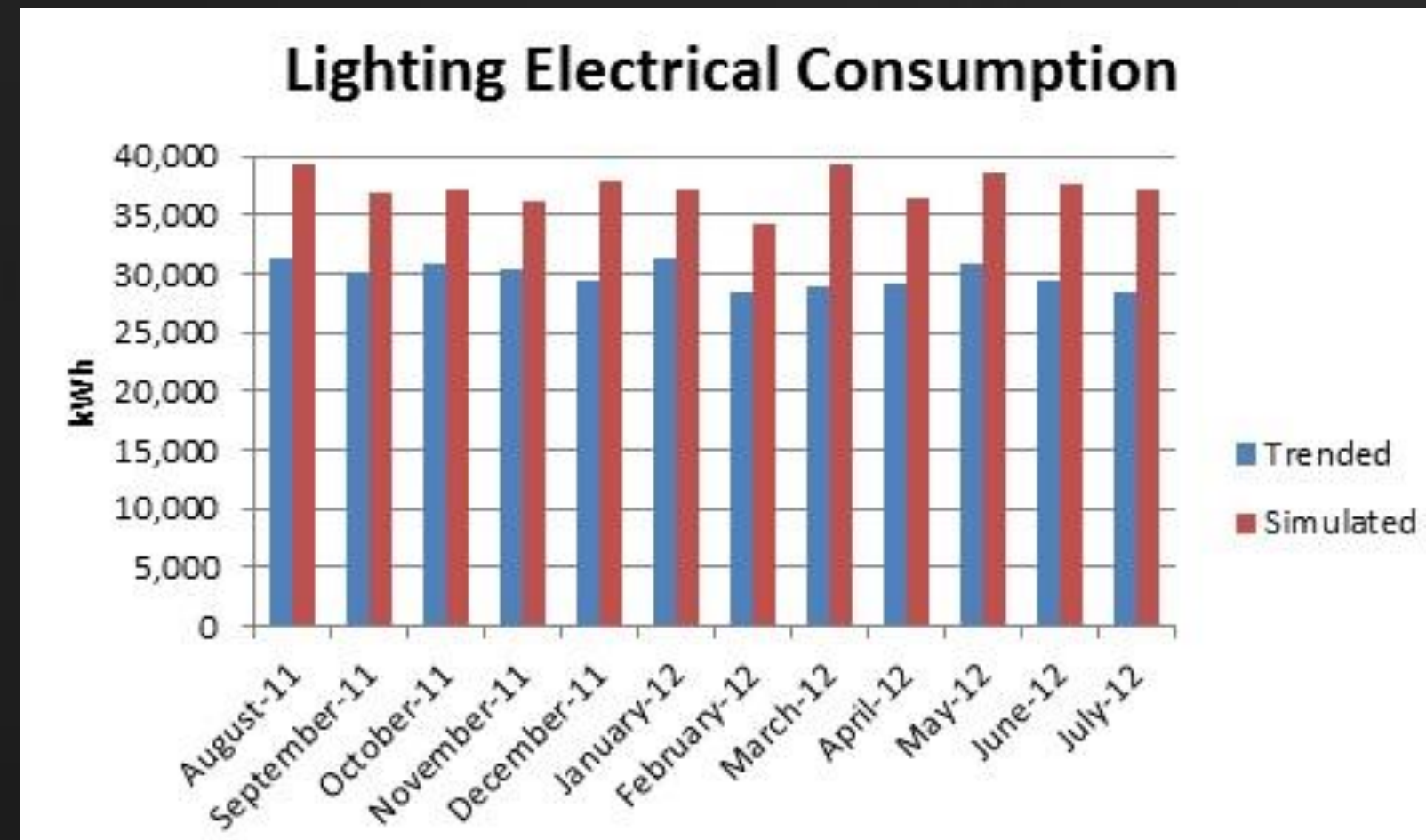
Type: Fraction

Hourly Values

Time	Value	Ratio
Mdnt - 1:	1.0000	ratio
1-2 am:	1.0000	ratio
2-3 am:	1.0000	ratio
3-4 am:	1.0000	ratio
4-5 am:	1.0000	ratio
5-6 am:	1.0000	ratio
6-7 am:	0.0000	ratio
7-8 am:	0.0000	ratio
8-9 am:	0.0000	ratio
9-10 am:	0.0000	ratio
10-11 am:	0.0000	ratio
11-noon:	0.0000	ratio
noon-1:	0.0000	ratio
1-2 pm:	0.0000	ratio
2-3 pm:	0.0000	ratio
3-4 pm:	0.0000	ratio
4-5 pm:	0.0000	ratio
5-6 pm:	0.0000	ratio
6-7 pm:	0.0000	ratio
7-8 pm:	0.0000	ratio
8-9 pm:	1.0000	ratio
9-10 pm:	1.0000	ratio
10-11 pm:	1.0000	ratio
11-Mdnt:	1.0000	ratio

Done

Modify LPD



Software interface showing the 'Internal Loads' tab. The 'Display Mode' is set to 'Lighting'. A table lists spaces and their lighting parameters. A 'User-Defined Default' dialog box is open, showing the 'User-Defined Default Value' for 'LIGHTING-W/AREA[0]' is 0.90 W/ft2.

Space Name	Parent Floor	Activity Desc.	Lighting W / Area 1 (W/ft2)	Lighting kW 1 (kW)	Lighting Schedule 1
S~zone-1-9Exercise	bldg-stry-1	(no default)	0.90		Office Lighting Ann
S~zone-1-8Office	bldg-stry-1	(no default)	0.90		Office Lighting Ann
S~zone-1-7Office	bldg-stry-1	(no default)	0.90		Office Lighting Ann
S~zone-1-6Office	bldg-stry-1	(no default)	0.90		Office Lighting Ann
S~zone-1-5Corridor	bldg-stry-1	(no default)	0.90		Office Lighting Ann
S~zone-1-55Office	bldg-stry-1	(no default)	0.90		Office Lighting Ann
S~zone-1-36Office	bldg-stry-1	(no default)	0.90		Office Lighting Ann
S~zone-1-35Office	bldg-stry-1	(no default)	0.90		Office Lighting Ann

User-Defined Default for Space 'S~zone-1-9Exercise', LIGHTING-W/AREA[0]:

☒ Use DOE-2 Default

☒ User-Defined Default Value: 0.90 W/ft2

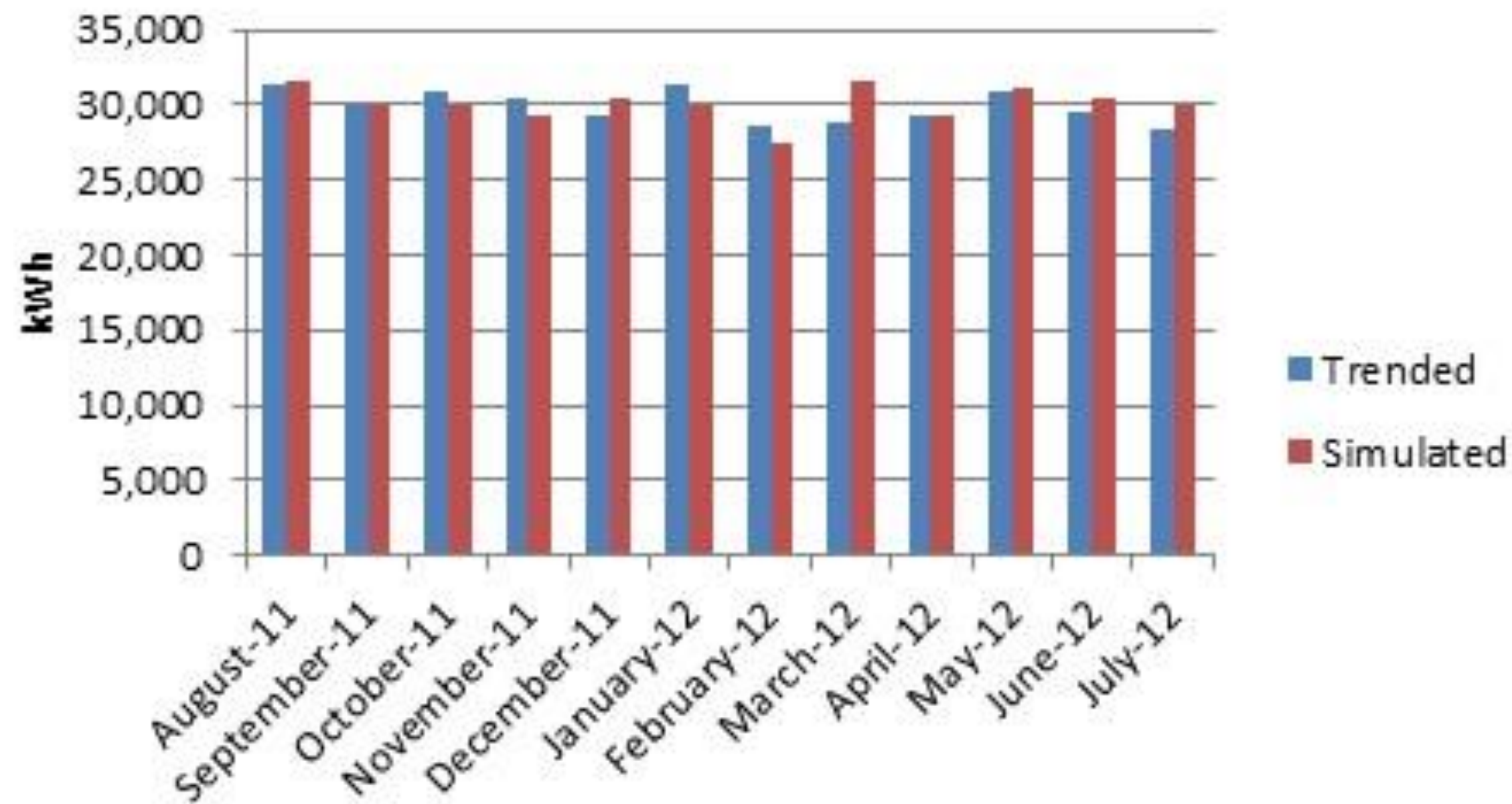
☐ User-Defined Default Expression:

Install Expression From DOE-2 Default

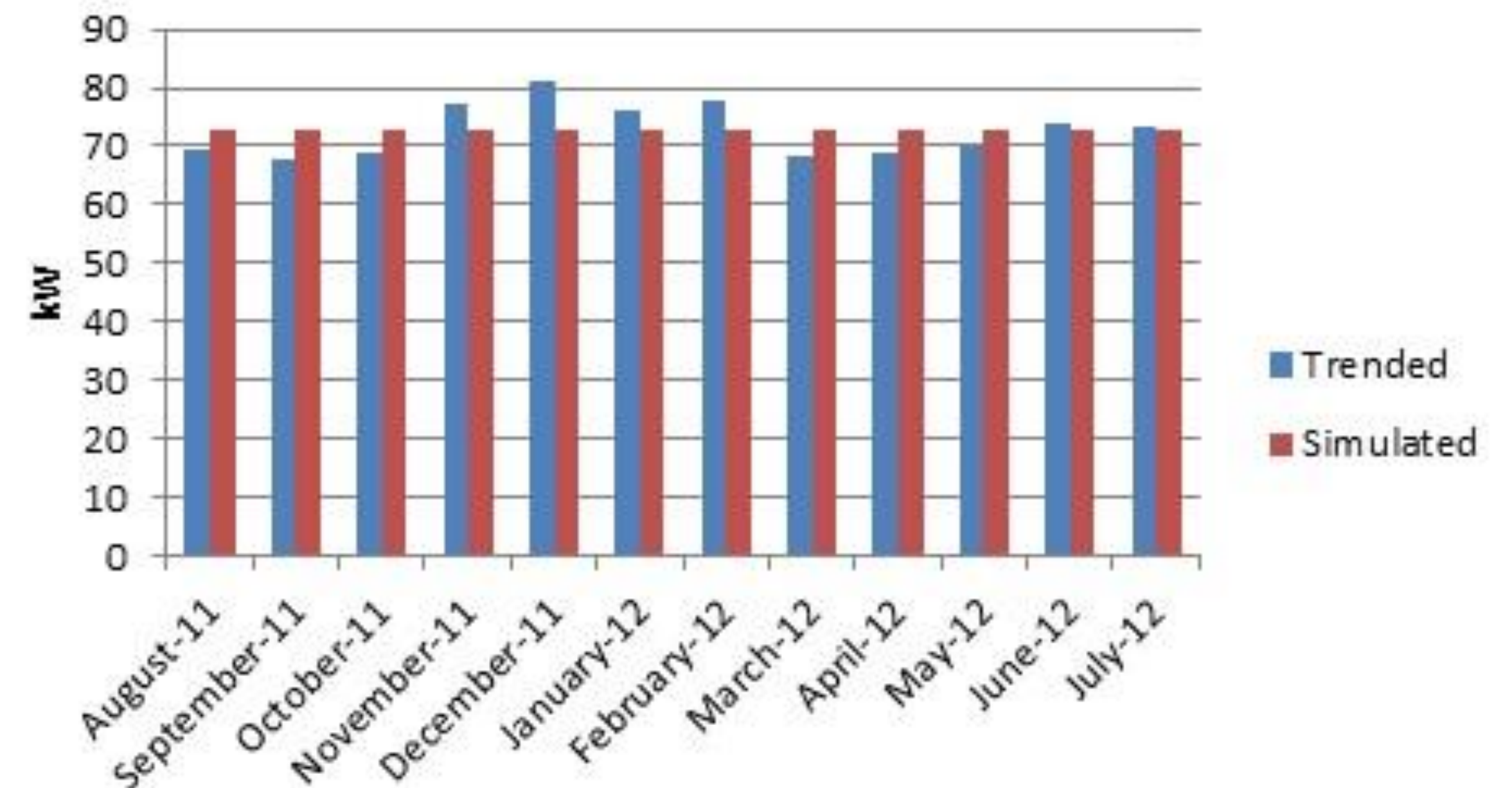
OK Cancel

Lighting – Final Comparison Charts

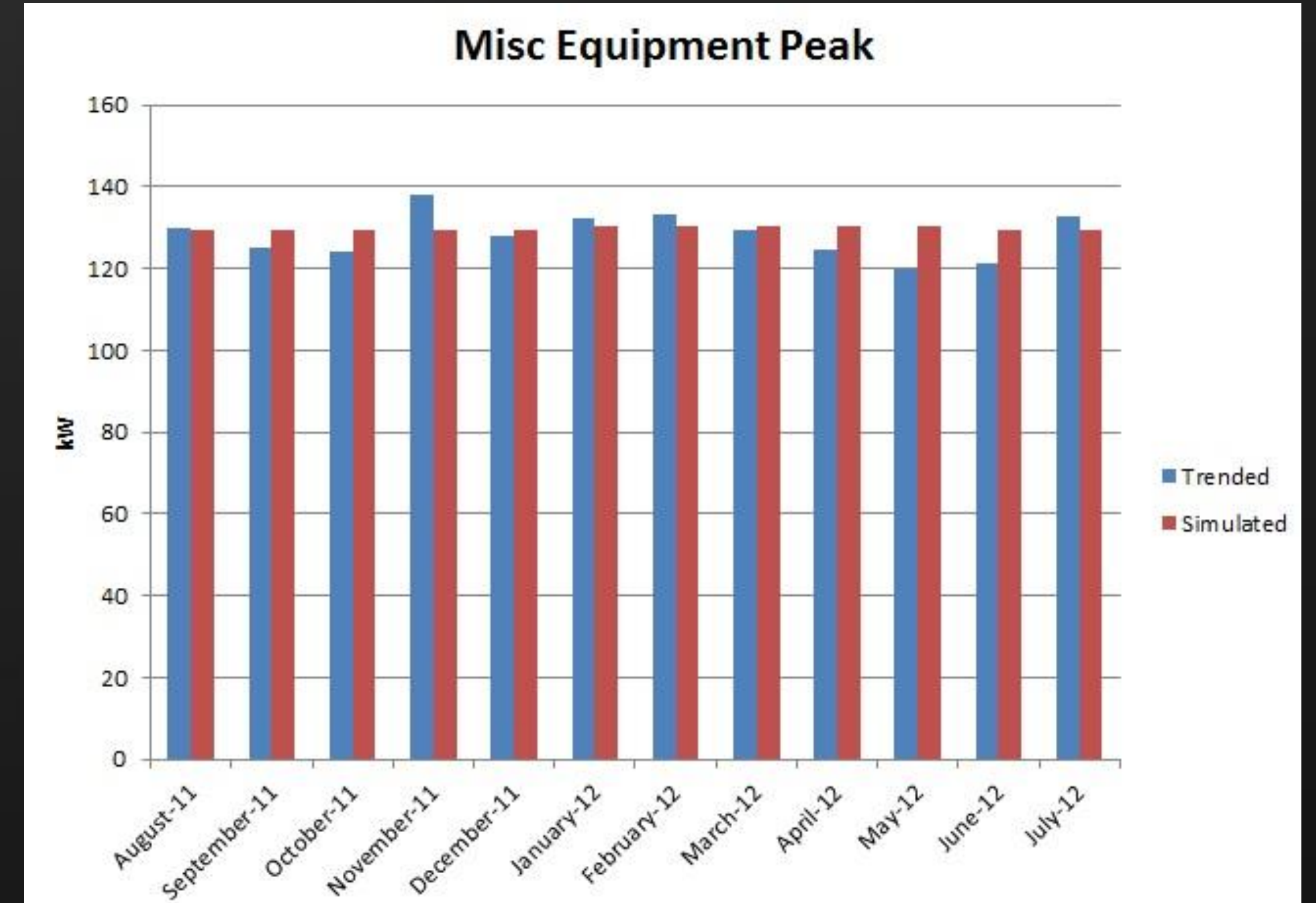
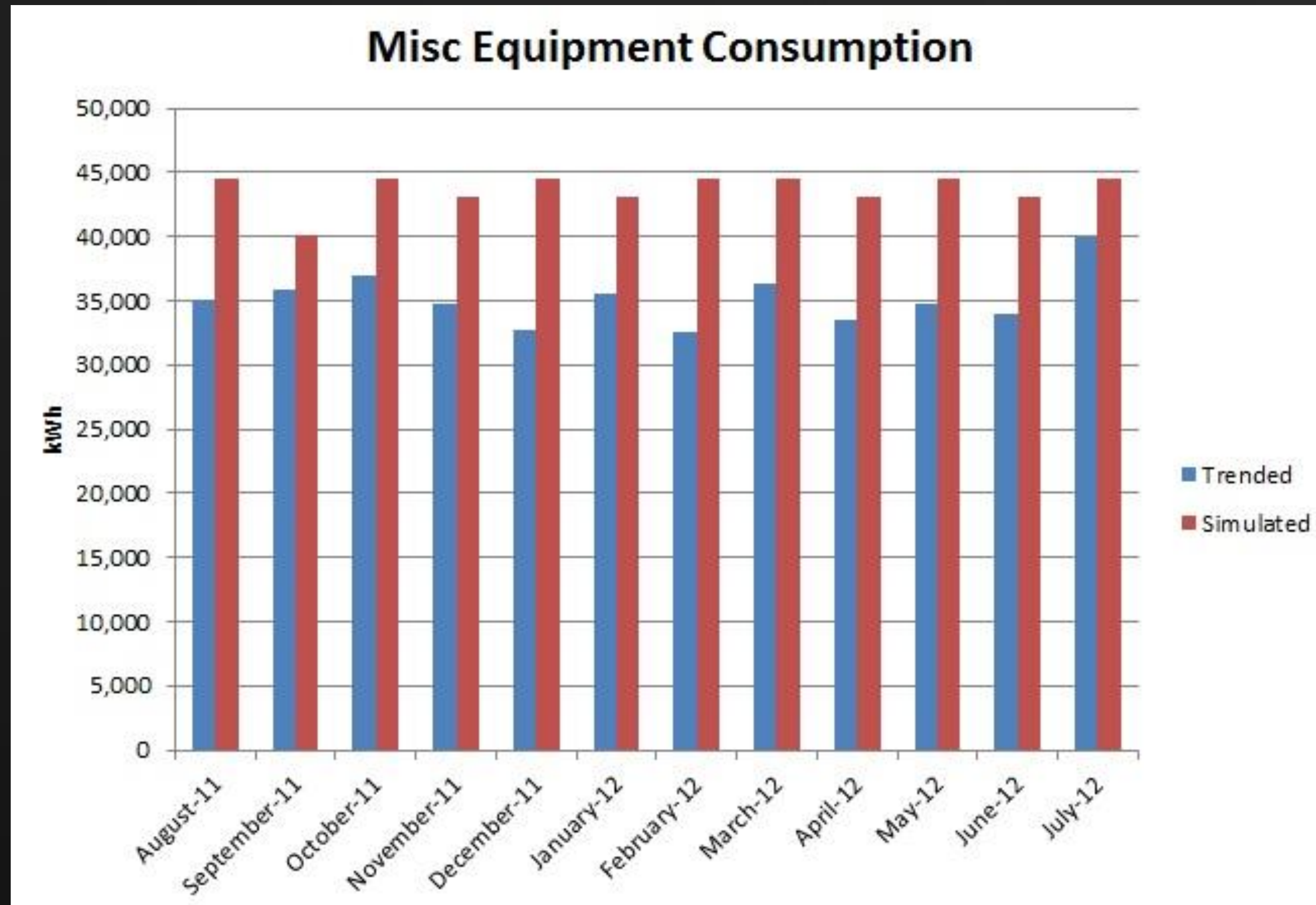
Lighting Electrical Consumption



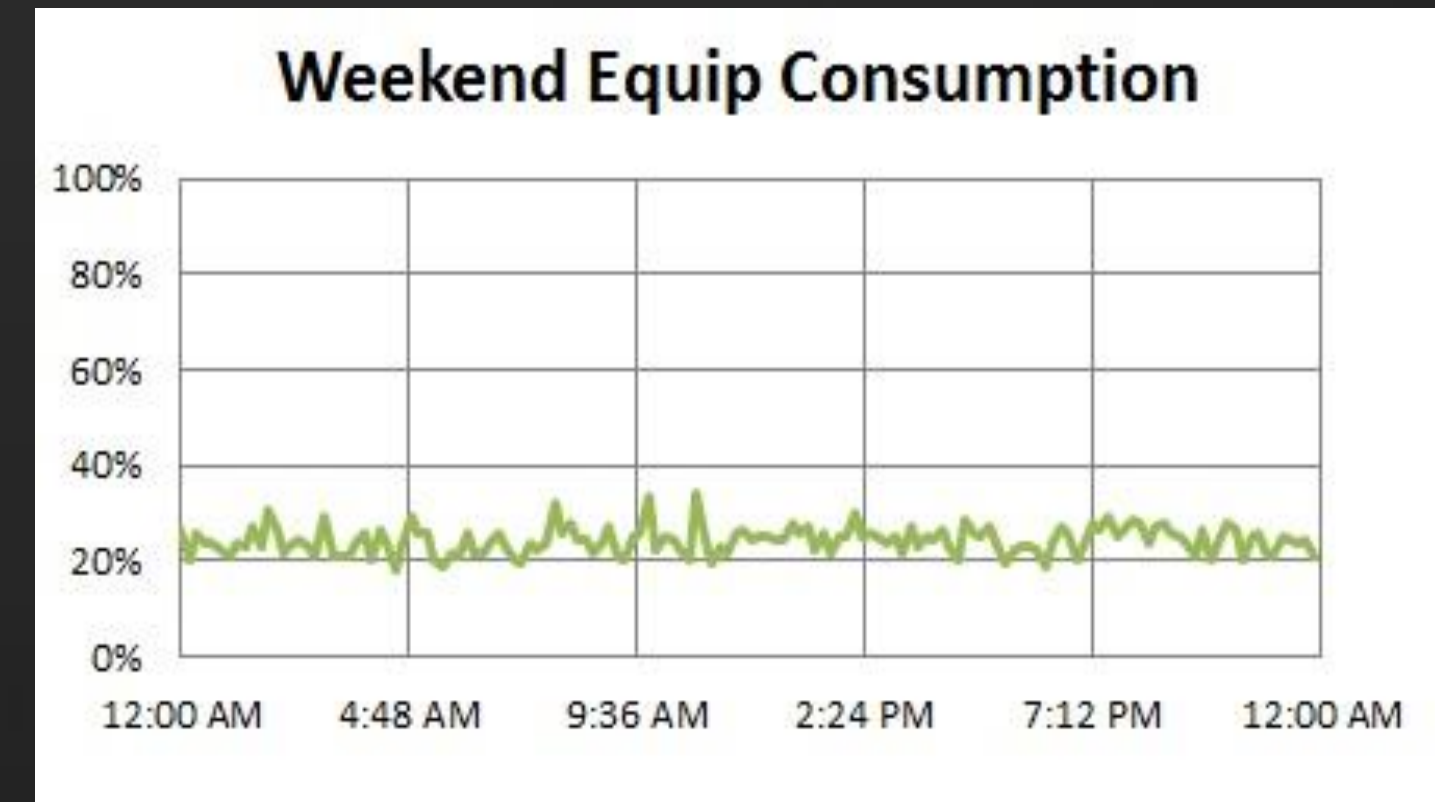
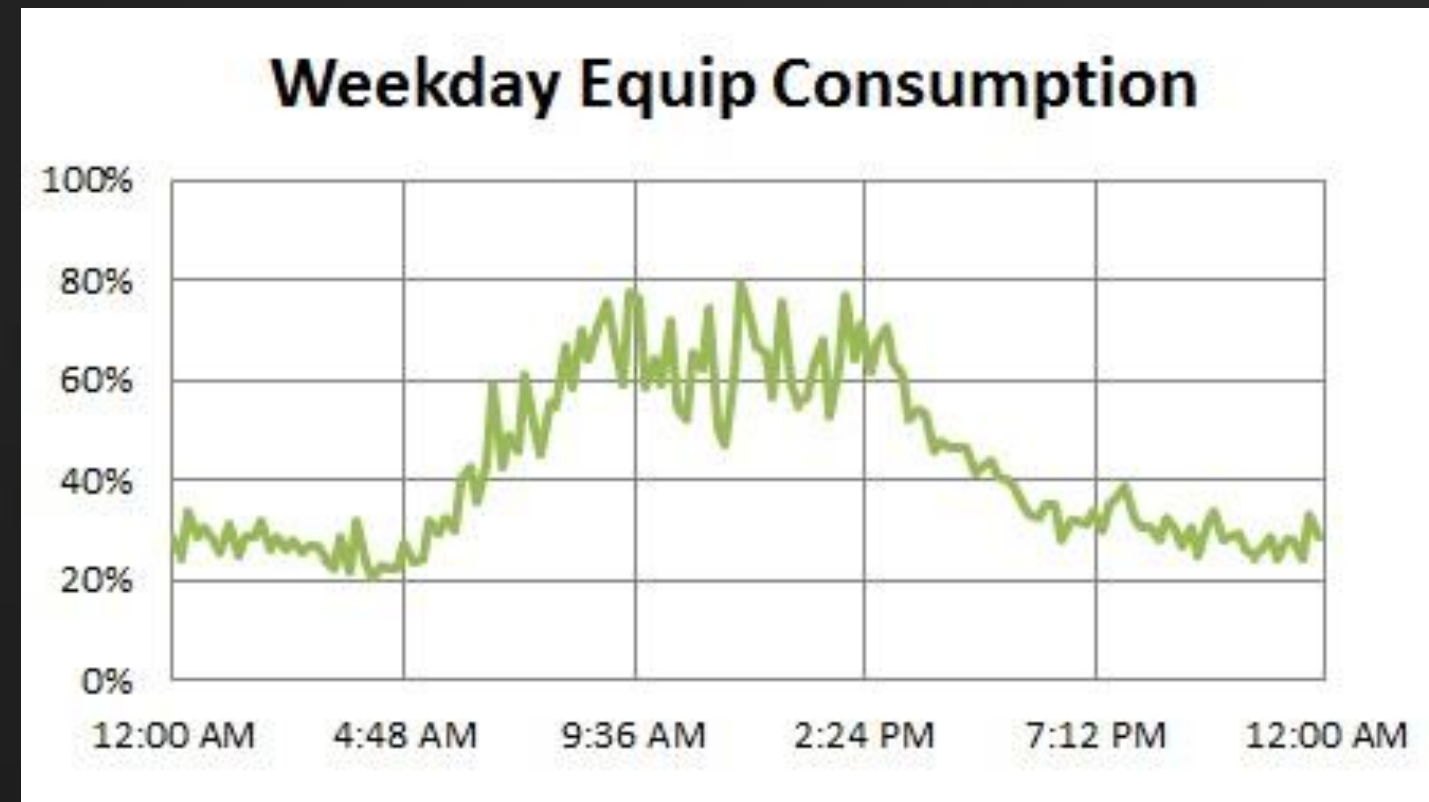
Lighting Peak Demand



Equipment – Initial Comparison Charts



Develop Accurate Equipment Schedules



Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: **Equipment Weekday** Type: Fraction

Day Schedule Name: **Equipment Weekday**
Type: **Fraction**

Hourly Values

Mdnt - 1:	0.2000 ratio	8-9 am:	0.7000 ratio	4-5 pm:	0.4000 ratio
1-2 am:	0.2000 ratio	9-10 am:	0.7000 ratio	5-6 pm:	0.3000 ratio
2-3 am:	0.2000 ratio	10-11 am:	0.8000 ratio	6-7 pm:	0.3000 ratio
3-4 am:	0.2000 ratio	11-noon:	0.9000 ratio	7-8 pm:	0.3000 ratio
4-5 am:	0.2000 ratio	noon-1:	0.7000 ratio	8-9 pm:	0.3000 ratio
5-6 am:	0.2000 ratio	1-2 pm:	0.8000 ratio	9-10 pm:	0.2000 ratio
6-7 am:	0.4000 ratio	2-3 pm:	0.7000 ratio	10-11 pm:	0.2000 ratio
7-8 am:	0.5000 ratio	3-4 pm:	0.5000 ratio	11-Mdnt:	0.2000 ratio

Done

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: **Equipment Weekend** Type: Fraction

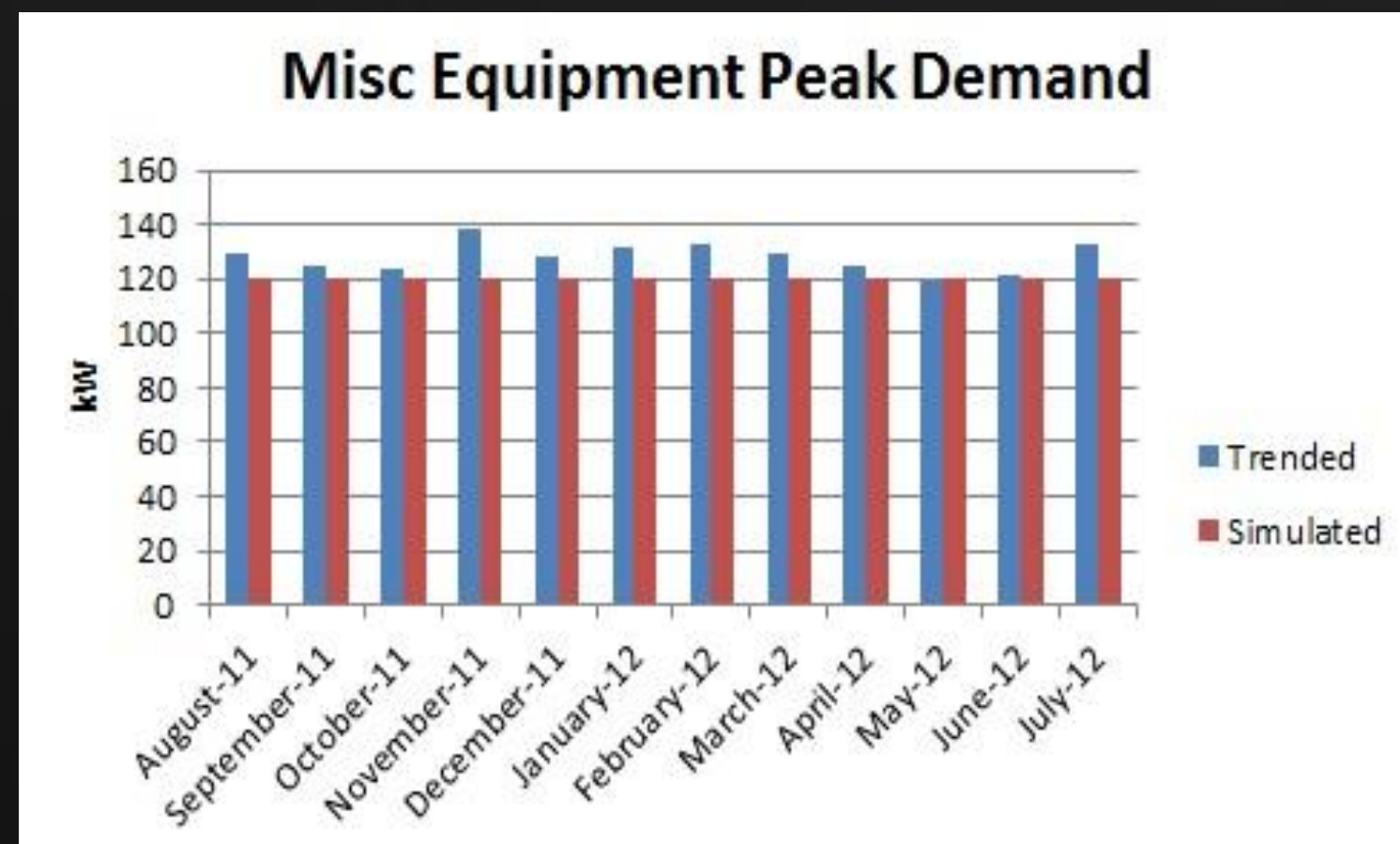
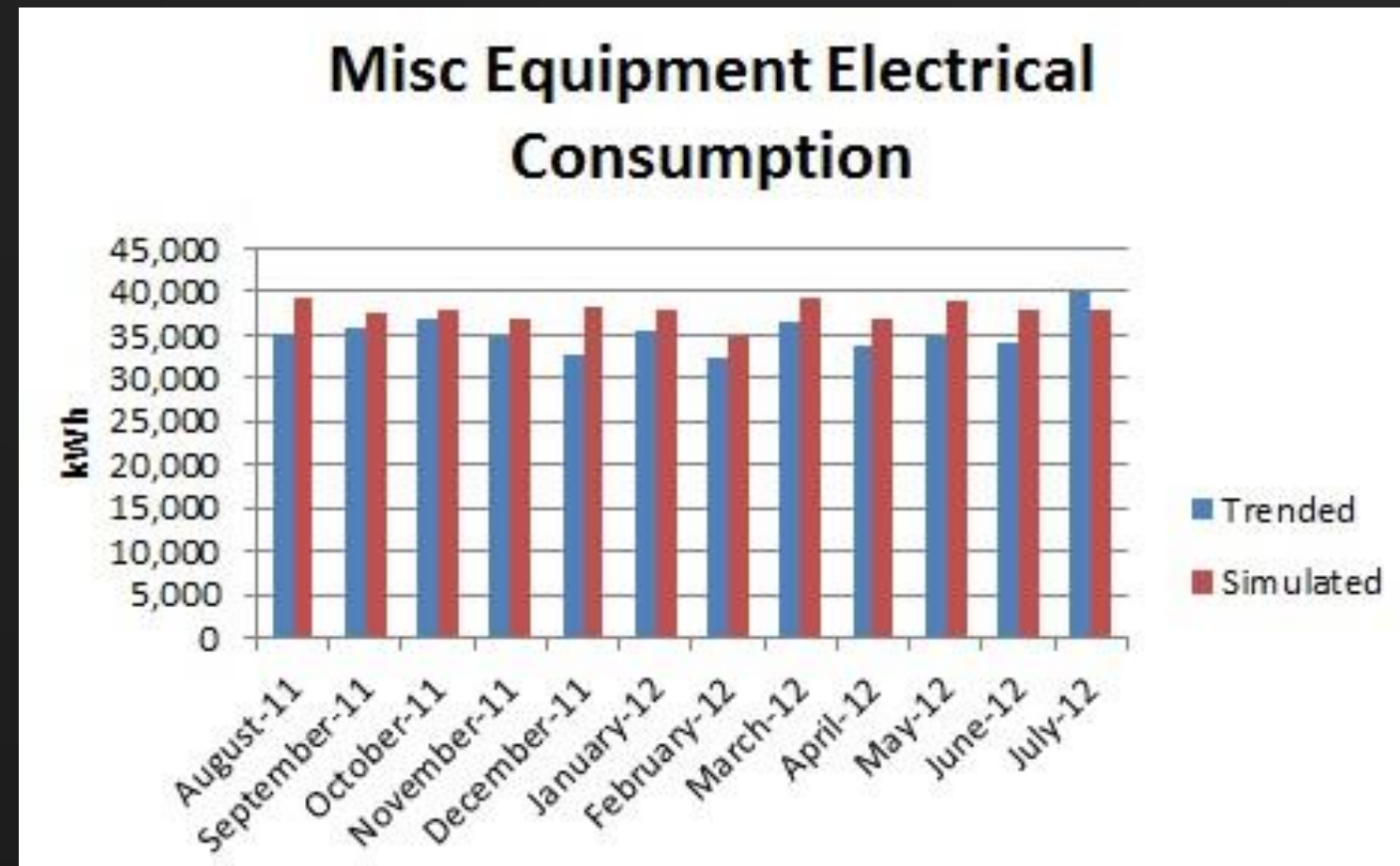
Day Schedule Name: **Equipment Weekend**
Type: **Fraction**

Hourly Values

Mdnt - 1:	0.2500 ratio	8-9 am:	0.2500 ratio	4-5 pm:	0.2500 ratio
1-2 am:	0.2500 ratio	9-10 am:	0.2500 ratio	5-6 pm:	0.2500 ratio
2-3 am:	0.2500 ratio	10-11 am:	0.2500 ratio	6-7 pm:	0.2500 ratio
3-4 am:	0.2500 ratio	11-noon:	0.2500 ratio	7-8 pm:	0.2500 ratio
4-5 am:	0.2500 ratio	noon-1:	0.2500 ratio	8-9 pm:	0.2500 ratio
5-6 am:	0.2500 ratio	1-2 pm:	0.2500 ratio	9-10 pm:	0.2500 ratio
6-7 am:	0.2500 ratio	2-3 pm:	0.2500 ratio	10-11 pm:	0.2500 ratio
7-8 am:	0.2500 ratio	3-4 pm:	0.2500 ratio	11-Mdnt:	0.2500 ratio

Done

Modify EPD



Site Building Shell **Internal Loads** Water-Side HVAC Air-Side HVAC Utility & Econ

Internal Loads Spreadsheet Summary

Display Mode: **Equipment**

	Space Name	Parent Floor	Activity Desc.	Equipment Schedule 1	Equip W / Area 1 (W/ft2)
1	S~zone-1-9Exercise	bldg-stry-1	(no def	Office Equip Ann	1.100
2	S~zone-1-8Office	bldg-stry-1	(no def	Office Equip Ann	1.100
3	S~zone-1-7Office	bldg-stry-1	(no def	Office Equip Ann	1.100
4	S~zone-1-6Office	bldg-stry-1	(no def	Office Equip Ann	1.100
5	S~zone-1-5Corridor	bldg-stry-1	(no def	Office Equip Ann	1.100
6	S~zone-1-55Office	bldg-stry-1	(no def	Office Equip Ann	1.100

User-Defined Default

User-Defined Default for Space 'S~zone-1-9Exercise', EQUIPMENT-W/AREA[0]:

☐ Use DOE-2 Default

☒ User-Defined Default Value: W/ft2

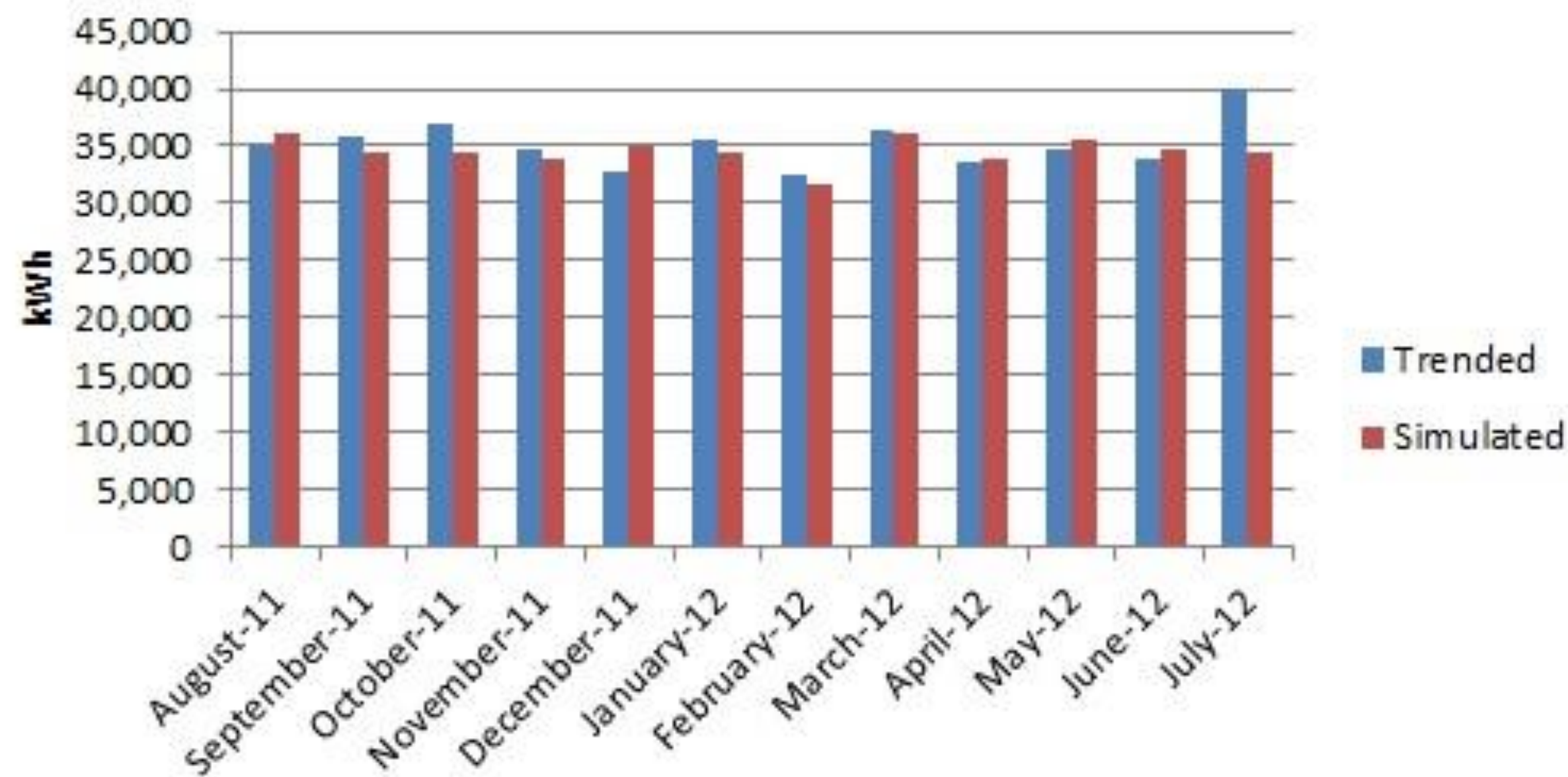
☐ User-Defined Default Expression:

Install Expression From DOE-2 Default

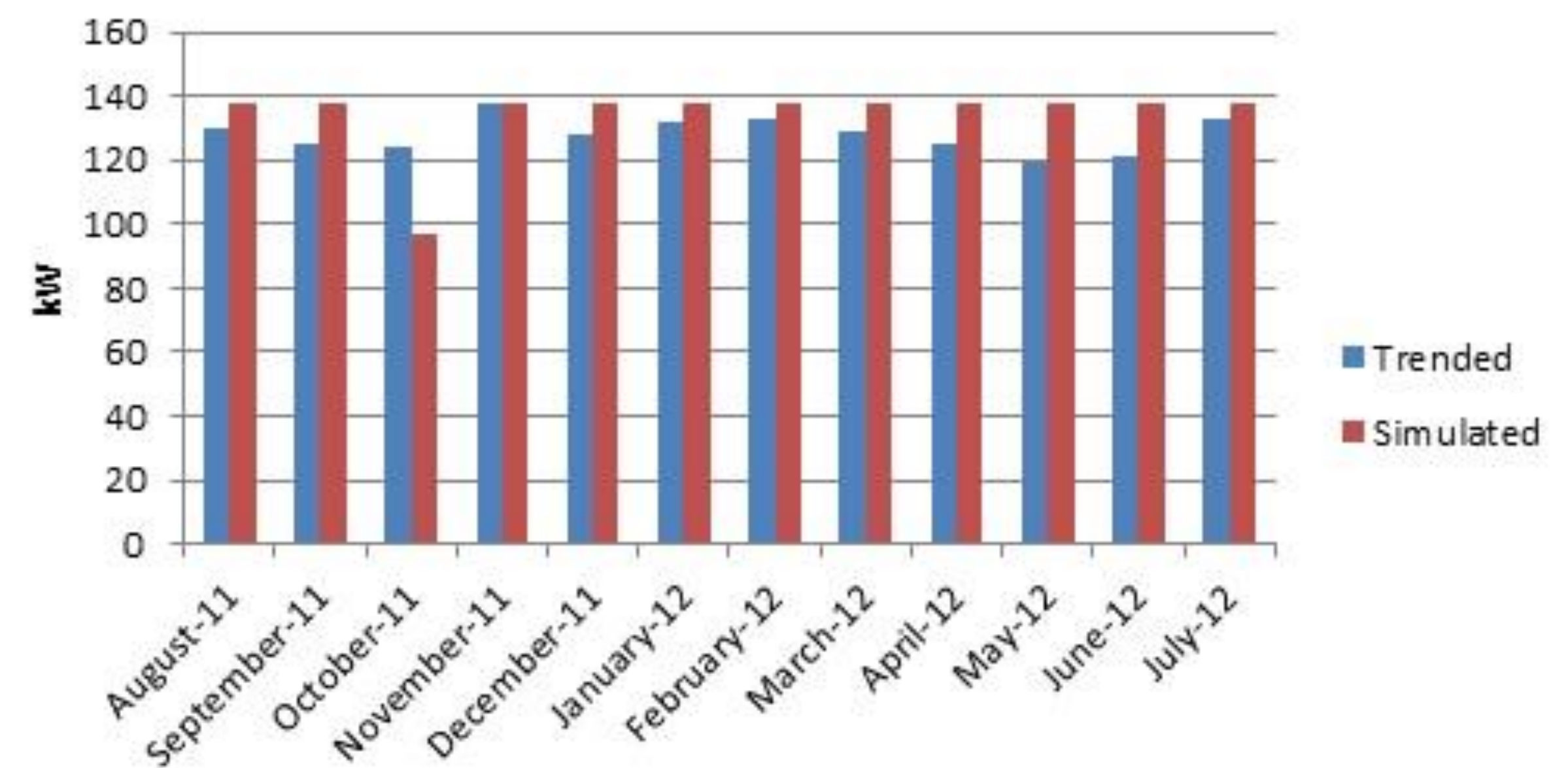
OK Cancel

Equipment – Final Comparison Charts

Misc Equipment Electrical Consumption



Misc Equipment Peak Demand



IT Room

Internal Loads						
Internal Loads Spreadsheet Summary						
Display Mode: Equipment						
	Space Name	Parent Floor	Activity Desc.	Equipment Schedule 1	Equip W / Area 1 (W/ft2)	Equip 1 (kW)
73	S~zone-2-42Conference	bldg-stry-2	(no defa	Equipment Annu:	1.100	
74	S~zone-2-41Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
75	S~zone-2-40Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
76	S~zone-2-39Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
77	S~zone-2-38Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
78	S~zone-2-37Corridor	bldg-stry-2	(no defa	Equipment Annu:	1.100	
79	S~zone-2-36Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
80	S~zone-2-35Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
81	S~zone-2-34Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
82	S~zone-2-33Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
83	S~zone-2-32Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
84	S~zone-2-31 IT	bldg-stry-2	(no defa	Equipment Annu:	1.100	
85	S~zone-2-30Storage	bldg-stry-2	(no defa	Equipment Annu:	1.100	
86	S~zone-2-29Office	bldg-stry-2	(no defa	Equipment Annu:	1.100	
87	S~zone-2-28Corridor	bldg-stry-2	(no defa	Equipment Annu:	1.100	
88	S~zone-2-27Open	bldg-stry-2	(no defa	Equipment Annu:	1.100	
89	S~zone-2-26Open	bldg-stry-2	(no defa	Equipment Annu:	1.100	
90	S~zone-2-25Corridor	bldg-stry-2	(no defa	Equipment Annu:	1.100	
91	S~zone-2-24Stairs	bldg-stry-2	(no defa	Equipment Annu:	1.100	
92	S~zone-2-23Stairs	bldg-stry-2	(no defa	Equipment Annu:	1.100	

IT Room Weekday



IT Room Weekend



IT Room

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: IT Room Daily Type: Fraction

Day Schedule Name: IT Room Daily Type: Fraction

Hourly Values

Mdnt - 1:	1.0000 ratio	8-9 am:	1.0000 ratio	4-5 pm:	1.0000 ratio
1-2 am:	1.0000 ratio	9-10 am:	1.0000 ratio	5-6 pm:	1.0000 ratio
2-3 am:	1.0000 ratio	10-11 am:	1.0000 ratio	6-7 pm:	1.0000 ratio
3-4 am:	1.0000 ratio	11-noon:	1.0000 ratio	7-8 pm:	1.0000 ratio
4-5 am:	1.0000 ratio	noon-1:	1.0000 ratio	8-9 pm:	1.0000 ratio
5-6 am:	1.0000 ratio	1-2 pm:	1.0000 ratio	9-10 pm:	1.0000 ratio
6-7 am:	1.0000 ratio	2-3 pm:	1.0000 ratio	10-11 pm:	1.0000 ratio
7-8 am:	1.0000 ratio	3-4 pm:	1.0000 ratio	11-Mdnt:	1.0000 ratio

Done

IT Room - eQUEST Quick Energy Simulation Tool

File Edit View Mode Tools Help

Project & Site Building Shell Internal Loads Water-Side HVAC Air-Side HVAC Utility & Economics

Internal Loads

Display Mode: Equipment

	Space Name	Parent Floor	Activity Desc.	Equipment Schedule 1	Equip W / Area 1 (W/ft2)	Equip kW 1 (kW)	Equip Sen (ratio)
82	S~zone-2-34Office	bldg-stry-2	(no defa	Equipment Annu	1.200		
83	S~zone-2-33Office	bldg-stry-2	(no defa	Equipment Annu	1.200		
84	S~zone-2-32Office	bldg-stry-2	(no defa	Equipment Annu	1.200		
85	S~zone-2-31 IT	bldg-stry-2	(no defa	IT Room Annual	14.000		
86	S~zone-2-30Storage	bldg-stry-2	(no defa	Equipment Annu	1.200		
87	S~zone-2-20Office	bldg-stry-2	(no defa	Equipment Annu	1.200		
88	S~zone-2-29Corridor	bldg-stry-2	(no defa	Equipment Annu	1.200		
89	S~zone-2-28Open	bldg-stry-2	(no defa	Equipment Annu	1.200		
90	S~zone-2-27Open	bldg-stry-2	(no defa	Equipment Annu	1.200		
91	S~zone-2-26Corridor	bldg-stry-2	(no defa	Equipment Annu	1.200		

IT Room - eQUEST Quick Energy Simulation Tool

File Edit View Mode Tools Help

Project & Site Building Shell Internal Loads Water-Side HVAC Air-Side HVAC Utility & Economics

Air-Side HVAC System Spreadsheet Summary

Variable Air Volume

Air-Side HVAC Zone Parameters

Currently Active Zone: zone-2-31 IT Zone Type: Conditioned

Basic Specifications Air Flow Outdoor Air Cooling Heating Meters Refrigeration Sun Space

Zone-Level Meter Assignments by End-Use:

Electric

Master Elec Meter: - undefined -

Area Lighting: EM1 Heat Rejection: EM1

Task Lighting: EM1 Pumps and Misc: EM1

Elec Equipment: EM2 IT Ventilation Fans: EM1

Source Elec: EM1 Refrigeration: EM1

Space Heating: EM1 Supplemental Heat: EM1

Space Cooling: EM1 Domestic Hot Water: EM1

Fuel

Master Fuel Meter: - undefined -

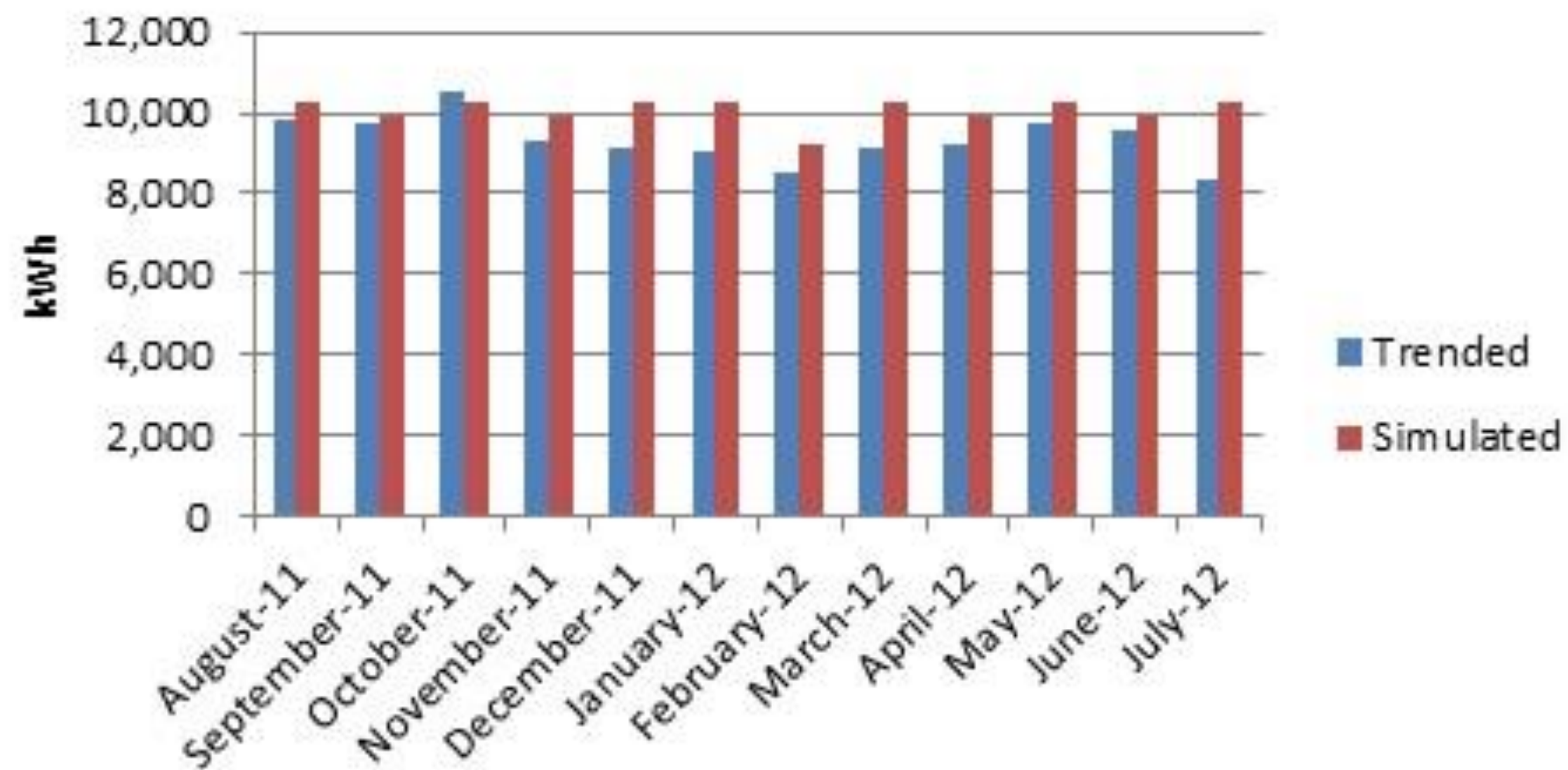
Source Fuel: FM1 Supplemental Heat: FM1

Space Heating: FM1 Domestic Hot Water: FM1

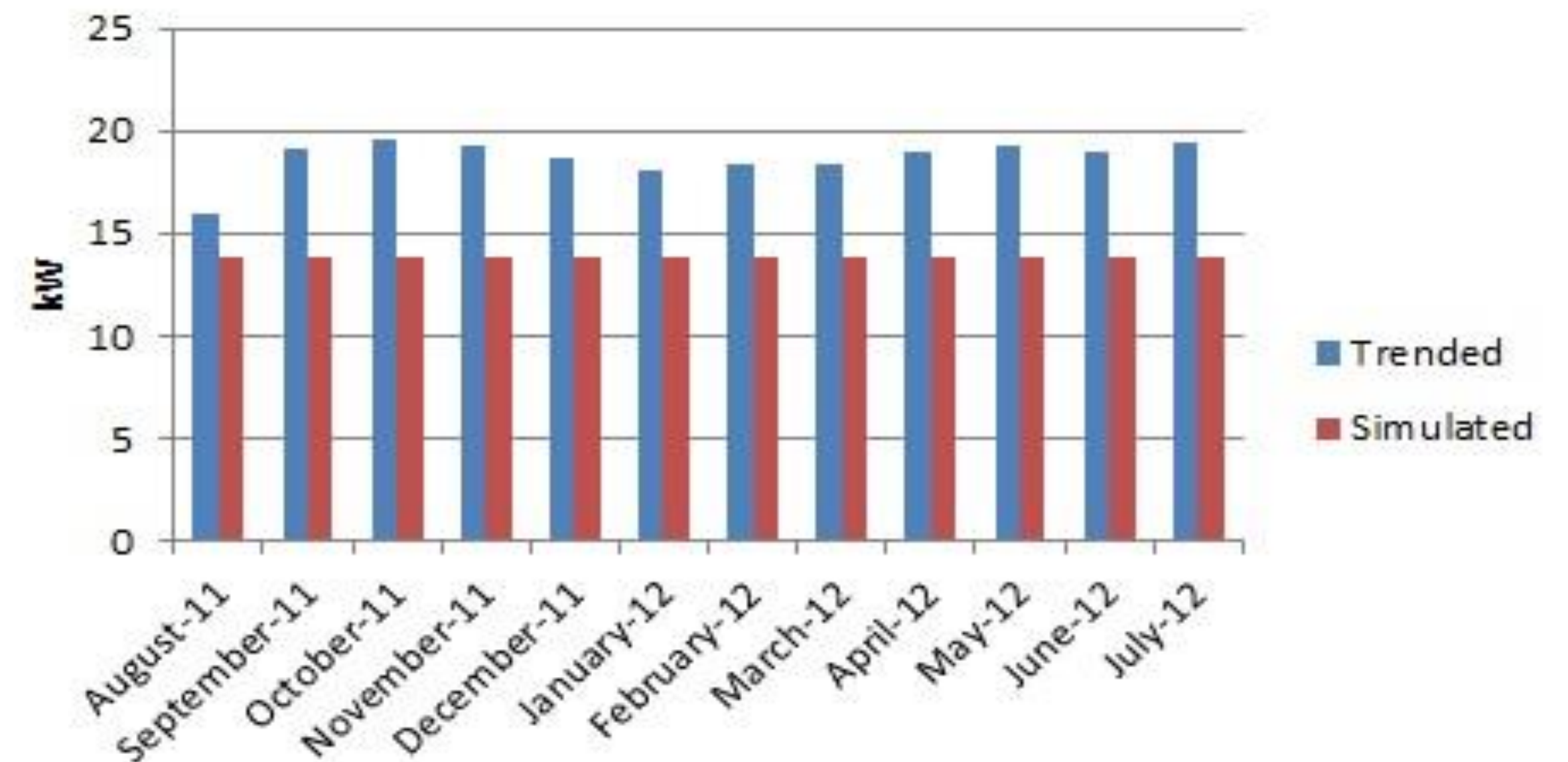
Space Cooling: FM1

IT Room – Initial Comparison Charts

IT Electrical Consumption

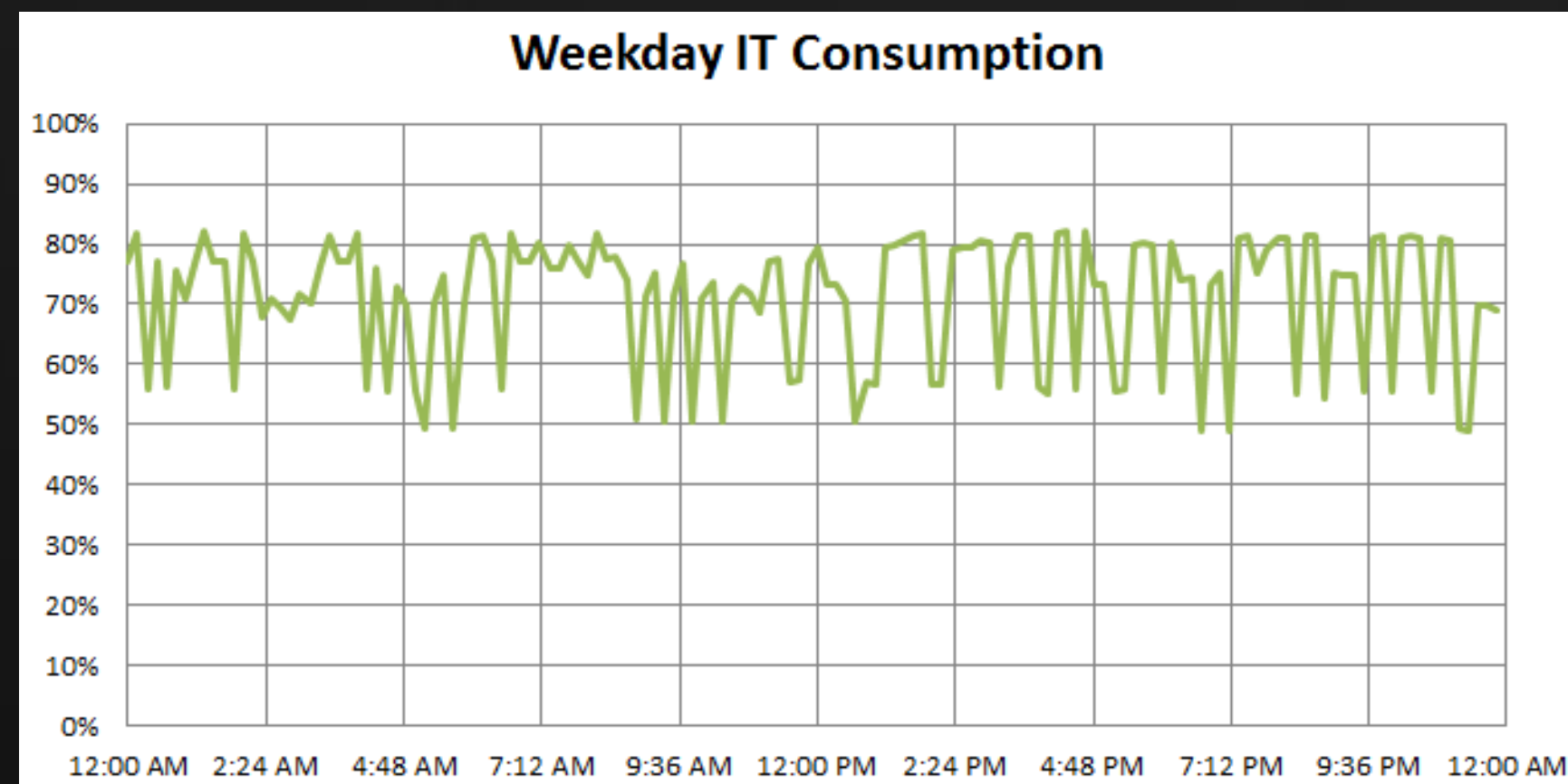


IT Peak Demand



IT Room Calibration

Enduse	Peak Demand [kW]
Building Total	521.22
HVAC Total	422.41
HVAC AC Units	412.31
HVAC Other	17.75
Lighting	80.98
IT Room	19.57
Low Voltage	138.02
Elevators	77.31



Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: **IT Equip Schedule** Type: Fraction

Day Schedule Name: **IT Equip Schedule**
Type: **Fraction**

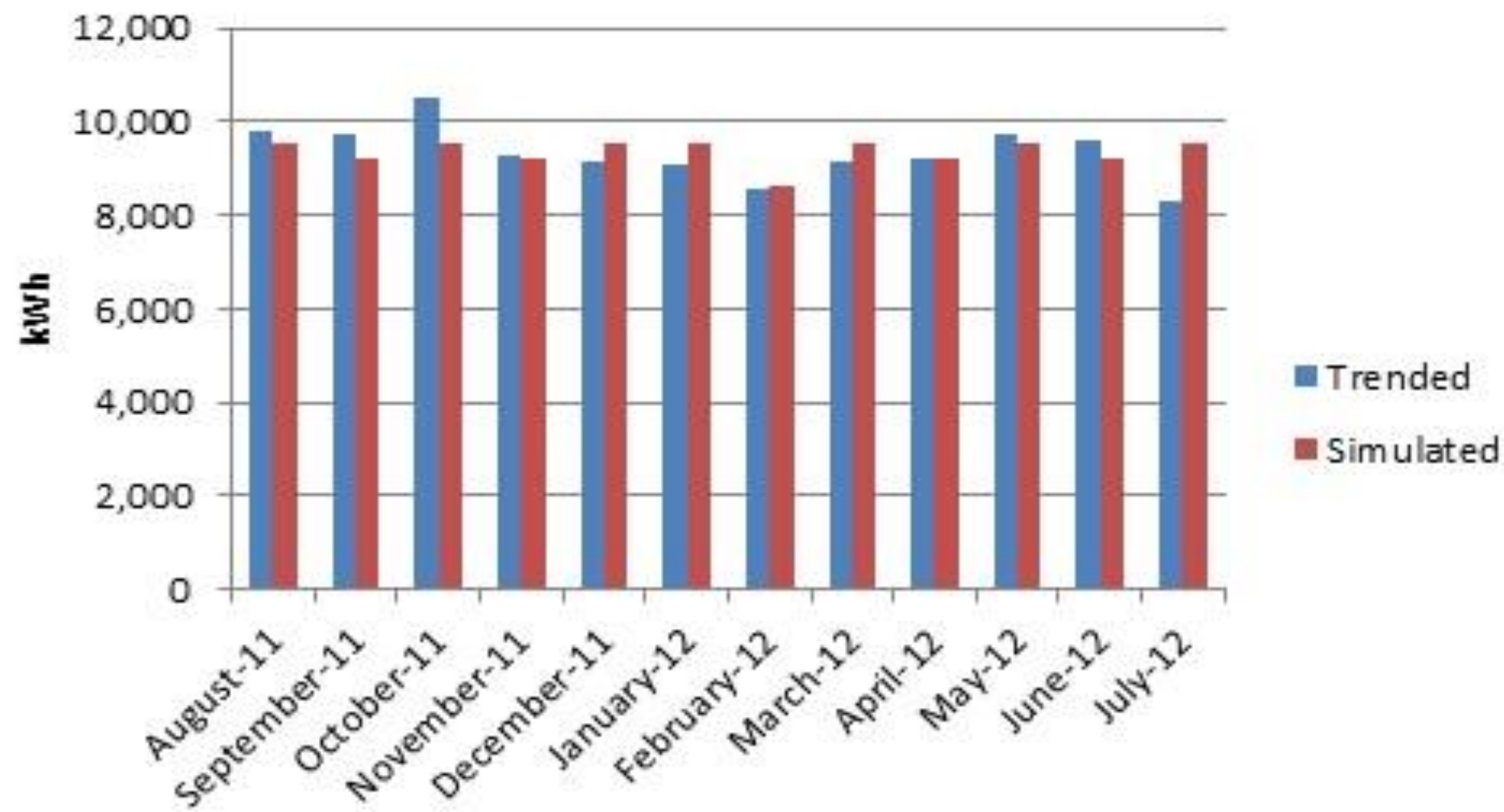
Hourly Values

Mdnt - 1:	0.5000	ratio	8-9 am:	0.5000	ratio	4-5 pm:	0.8000	ratio
1-2 am:	0.5000	ratio	9-10 am:	0.5000	ratio	5-6 pm:	0.8000	ratio
2-3 am:	0.5000	ratio	10-11 am:	0.5000	ratio	6-7 pm:	0.8000	ratio
3-4 am:	0.5000	ratio	11-noon:	0.5000	ratio	7-8 pm:	0.8000	ratio
4-5 am:	0.5000	ratio	noon-1:	0.8000	ratio	8-9 pm:	0.8000	ratio
5-6 am:	0.5000	ratio	1-2 pm:	0.8000	ratio	9-10 pm:	0.8000	ratio
6-7 am:	0.5000	ratio	2-3 pm:	0.8000	ratio	10-11 pm:	0.8000	ratio
7-8 am:	0.5000	ratio	3-4 pm:	0.8000	ratio	11-Mdnt:	0.8000	ratio

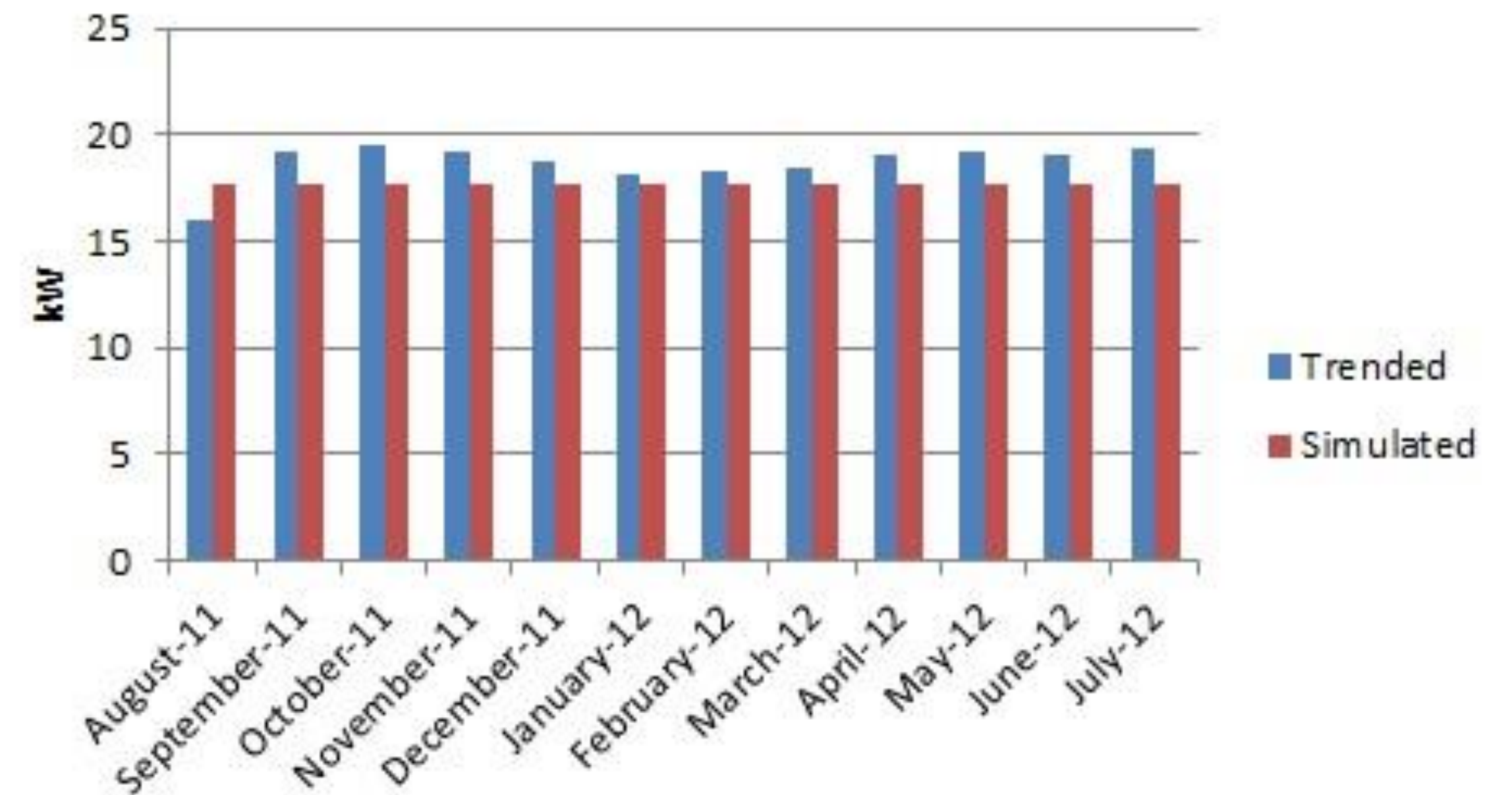
Done

IT Room – Final Comparison Charts

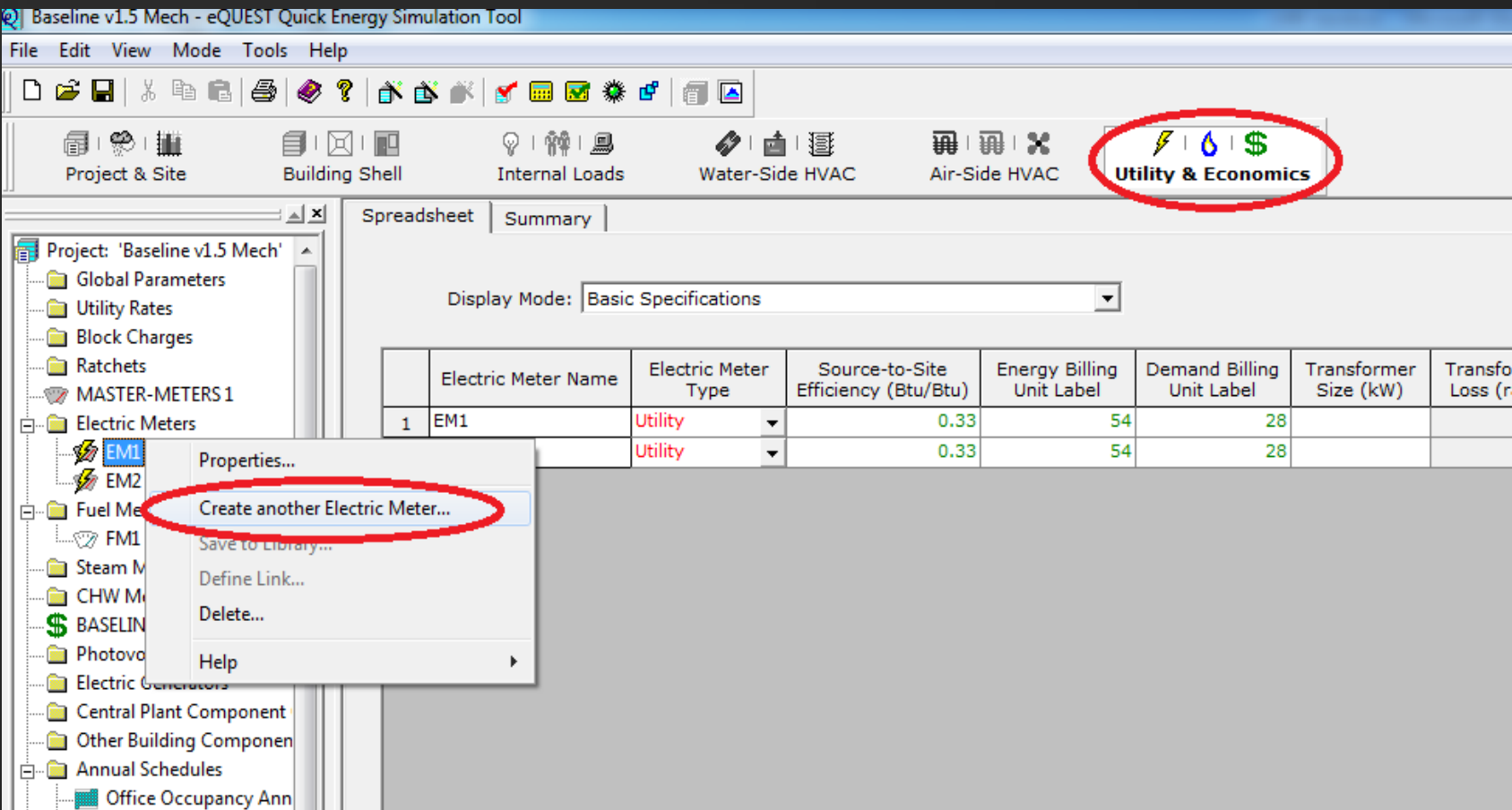
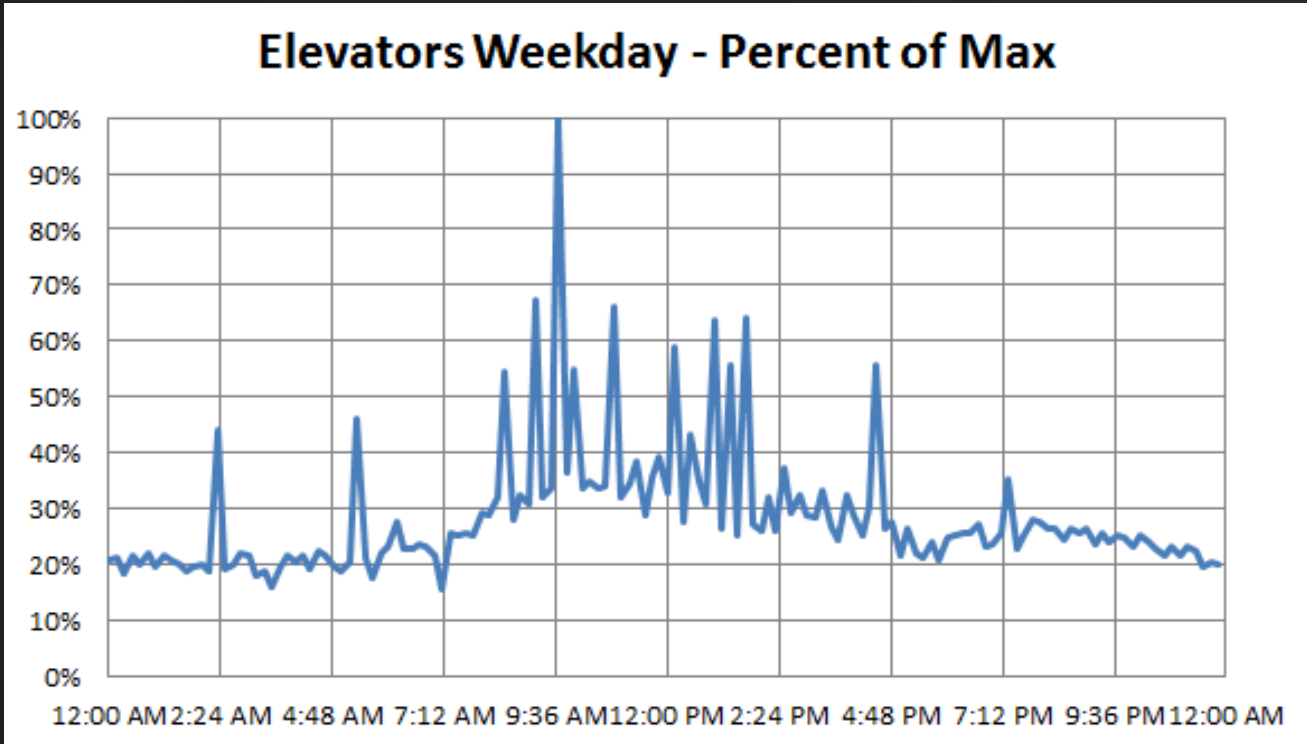
IT Electrical Consumption



IT Peak Demand



Elevators



Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: **Elevators Daily** Type: Fraction

Day Schedule Name: **Elevators Daily**
Type: **Fraction**

Hourly Values

Hour	Value	Type
Mdnt - 1:	0.0000	ratio
1-2 am:	0.0000	ratio
2-3 am:	0.0000	ratio
3-4 am:	0.0000	ratio
4-5 am:	0.0000	ratio
5-6 am:	0.1000	ratio
6-7 am:	0.2000	ratio
7-8 am:	0.4000	ratio
8-9 am:	0.8000	ratio
9-10 am:	0.4000	ratio
10-11 am:	0.2000	ratio
11-noon:	0.2000	ratio
noon-1:	0.5000	ratio
1-2 pm:	0.2000	ratio
2-3 pm:	0.2000	ratio
3-4 pm:	0.2000	ratio
4-5 pm:	0.2000	ratio
5-6 pm:	0.6000	ratio
6-7 pm:	0.3000	ratio
7-8 pm:	0.1000	ratio
8-9 pm:	0.1000	ratio
9-10 pm:	0.0000	ratio
10-11 pm:	0.0000	ratio
11-Mdnt:	0.0000	ratio

Done

Enduse	Peak Demand [kW]
Building Total	521.22
HVAC Total	422.41
HVAC AC Units	412.31
HVAC Other	17.75
Lighting	80.98
IT Room	19.57
Low Voltage	138.02
Elevators	77.31

Electric Meter Properties

Currently Active Electric Meter: **EM3 Elev** Type: Utility

Basic Specifications | Building and/or Submeters | **Direct Loads**

Interior Direct Loads

	Load (kW)	Schedule	Enduse
1	n/a	n/a	n/a
2	n/a	n/a	n/a
3	n/a	n/a	n/a
4	n/a	n/a	n/a

Exterior Direct Loads

	Load (kW)	Schedule	Enduse
1	77.31	Elevators Annual	Misc. Equipment
2	n/a	n/a	n/a
3	n/a	n/a	n/a
4	n/a	n/a	n/a

Refrigeration Direct Loads

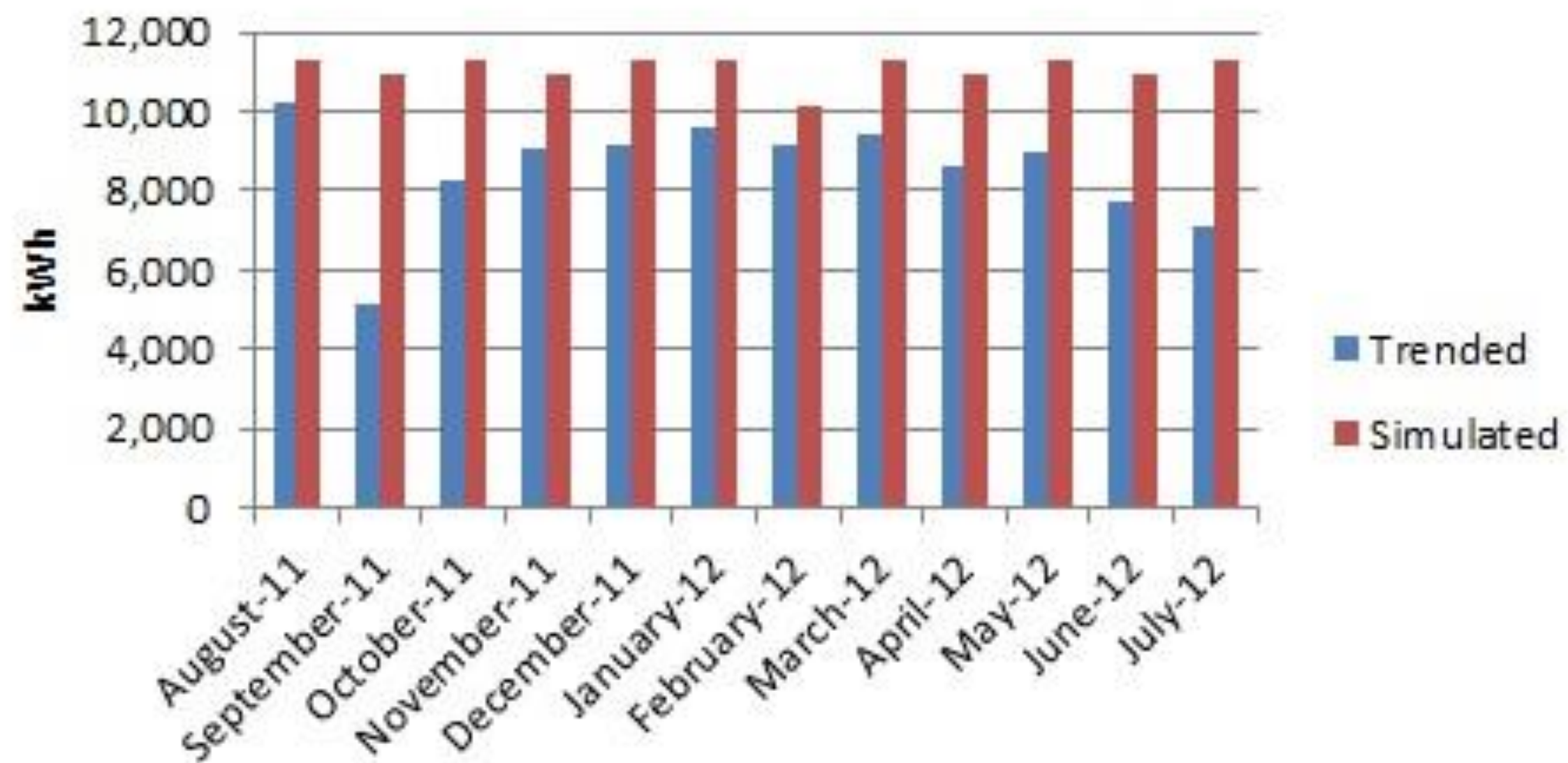
Load (kW) Schedule

n/a

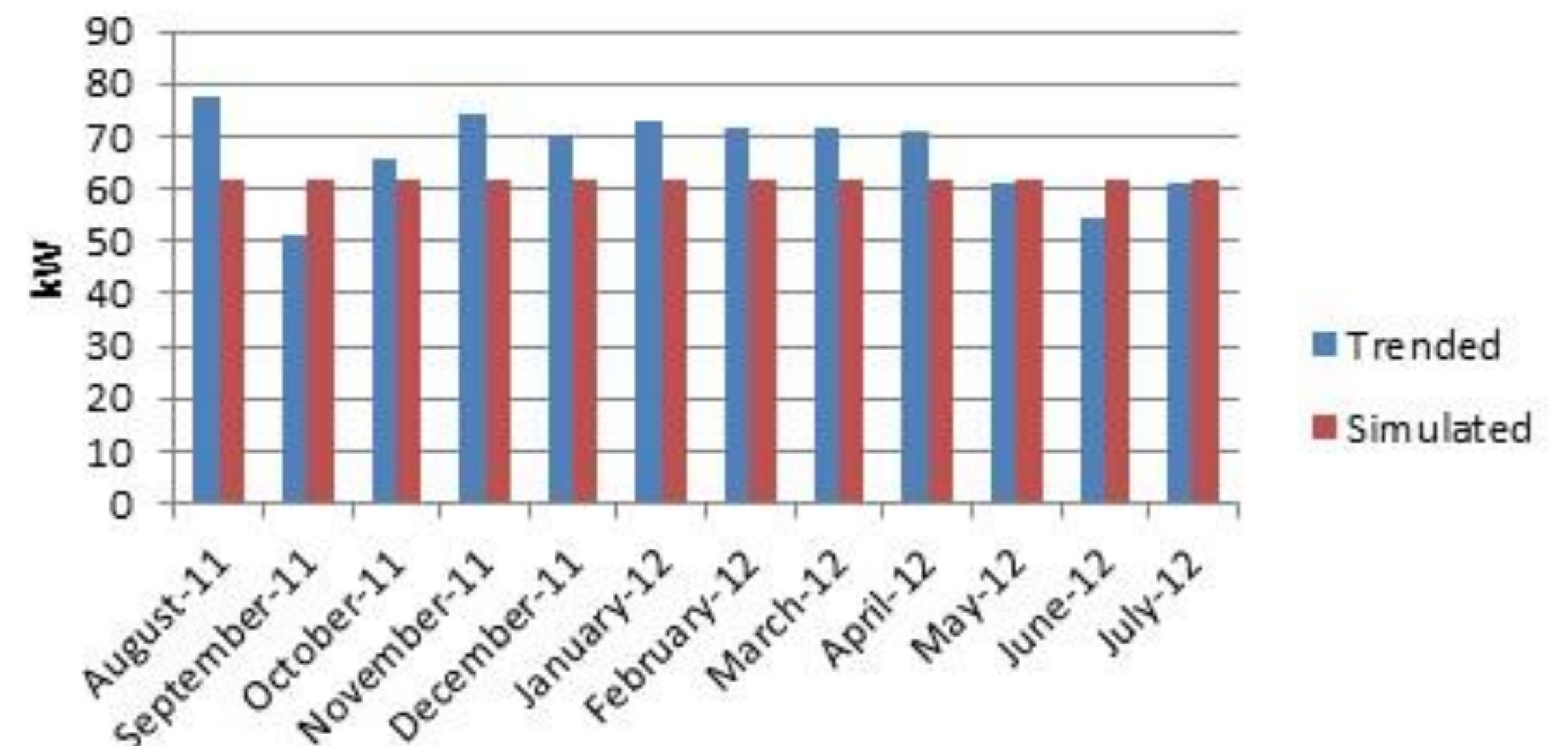
Done

Elevators – Initial Comparison Charts

Elevators Electrical Consumption

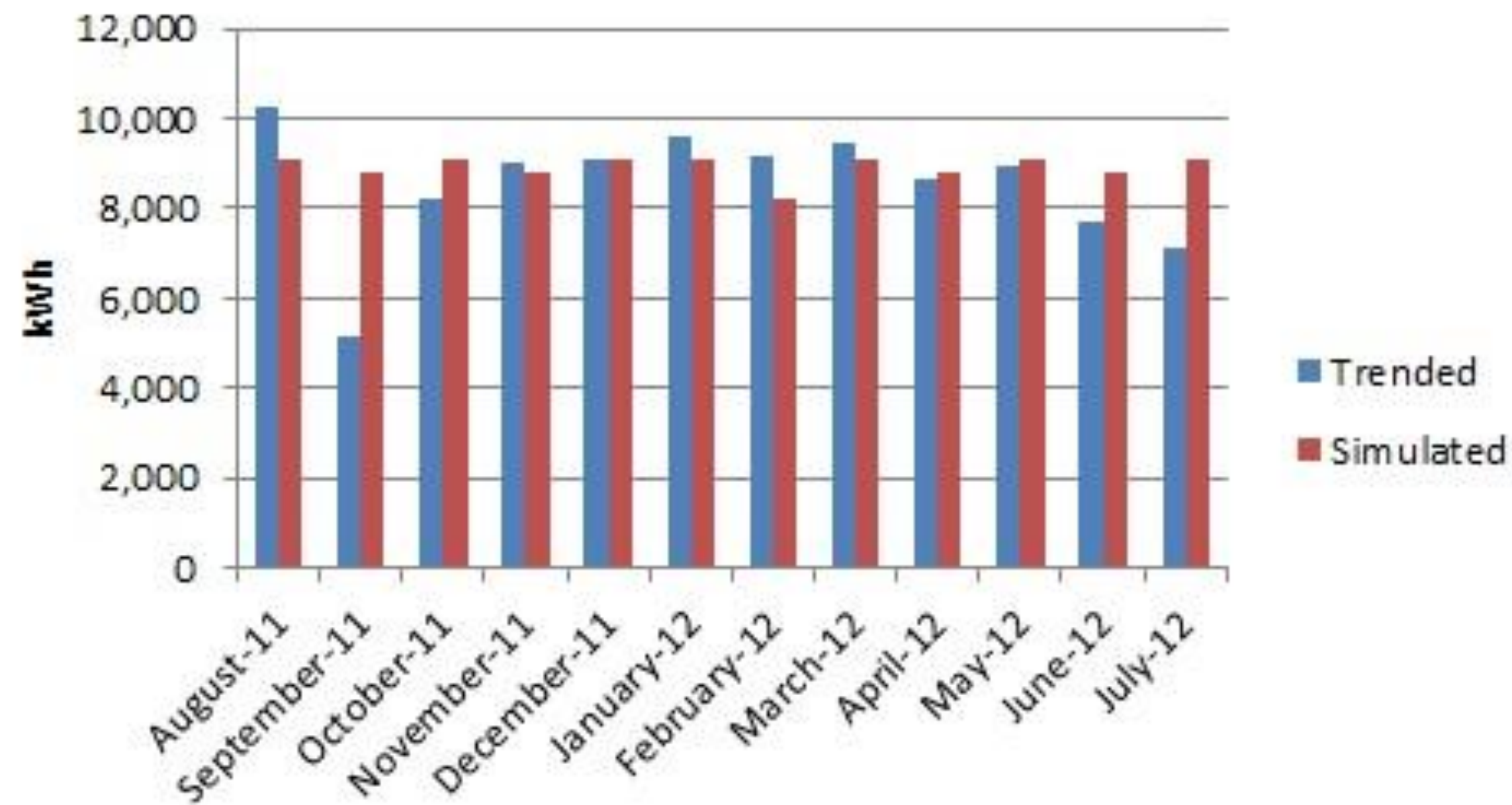


Elevators Peak Demand

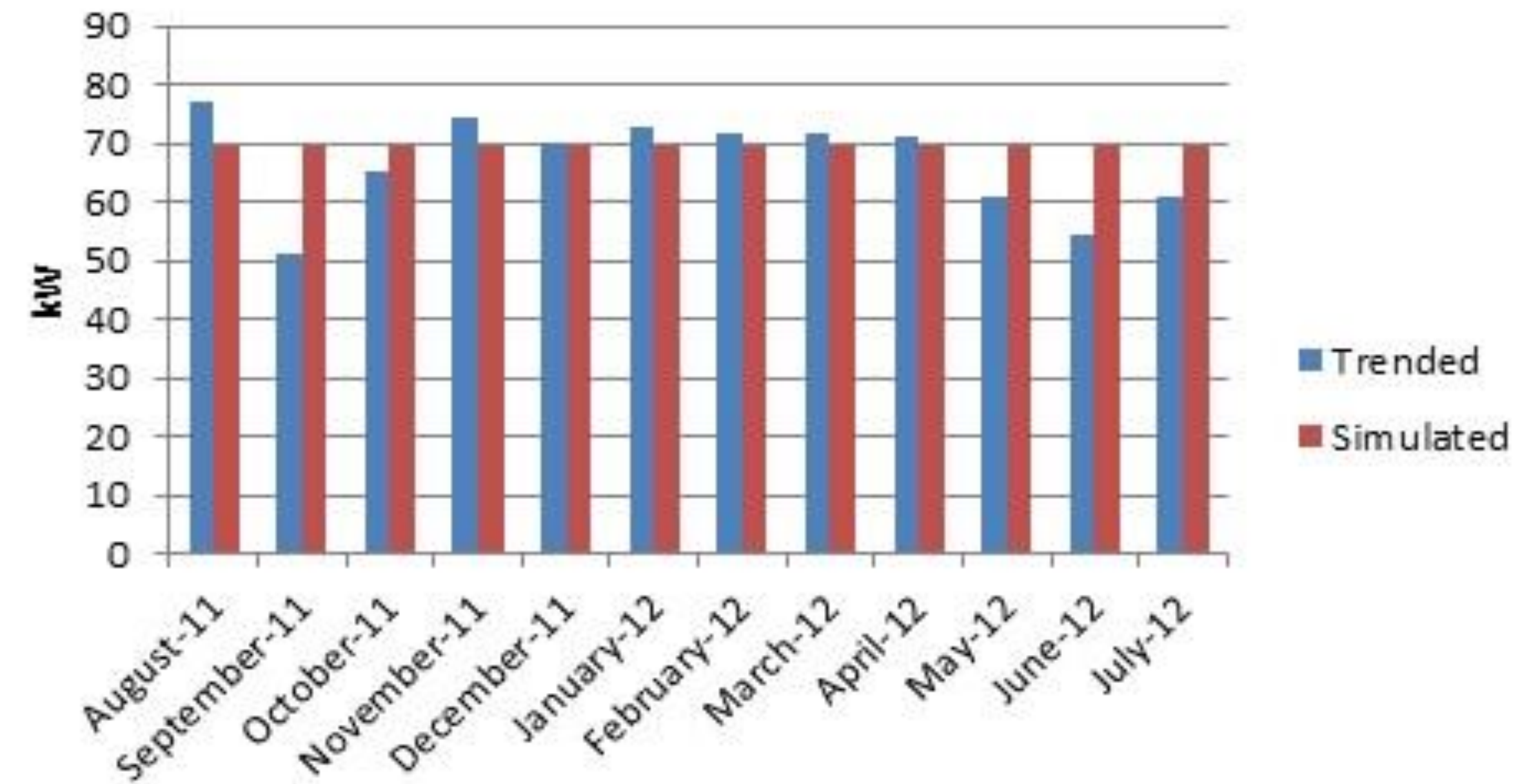


Elevators – Final Comparison Charts

Elevators Electrical Consumption



Elevators Peak Demand



HVAC

Unlike the other end-uses, the HVAC system has multiple variables that must be established prior to calibration:

- Occupancy Schedules
- Building Envelope
- HVAC System and Components
- HVAC Zoning
- Infiltration
- Heating/Cooling Schedules

HVAC – Occupancy Schedules

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Week Schedule: **Office Occupancy Weekly** Type: Fraction

Week Schedule Name: **Office Occupancy Weekly**
Type: **Fraction**

Daily Schedule Assignments

Monday: **Office Occupancy Weekday**
Tuesday: **Office Occupancy Weekday**
Wednesday: **Office Occupancy Weekday**
Thursday: **Office Occupancy Weekday**
Friday: **Office Occupancy Weekday**
Saturday: **Office Occupancy Weekend**
Sunday: **Office Occupancy Weekend**
Holidays: **Office Occupancy Weekend**
Heating Design Day: **Office Occupancy Weekday**
Cooling Design Day: **Office Occupancy Weekday**

Done

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: **Office Occupancy Weekday** Type: Fraction

Day Schedule Name: **Office Occupancy Weekday**
Type: **Fraction**

Hourly Values

Mdnt - 1:	0.0000 ratio	8-9 am:	0.9000 ratio	4-5 pm:	0.9000 ratio
1-2 am:	0.0000 ratio	9-10 am:	0.9000 ratio	5-6 pm:	0.5000 ratio
2-3 am:	0.0000 ratio	10-11 am:	0.9000 ratio	6-7 pm:	0.3000 ratio
3-4 am:	0.0000 ratio	11-noon:	0.9000 ratio	7-8 pm:	0.3000 ratio
4-5 am:	0.0000 ratio	noon-1:	0.8000 ratio	8-9 pm:	0.1000 ratio
5-6 am:	0.0000 ratio	1-2 pm:	0.9000 ratio	9-10 pm:	0.0000 ratio
6-7 am:	0.1000 ratio	2-3 pm:	0.9000 ratio	10-11 pm:	0.0000 ratio
7-8 am:	0.3000 ratio	3-4 pm:	0.9000 ratio	11-Mdnt:	0.0000 ratio

Schedule Properties

Annual Schedules | Week Schedules | Day Schedules

Currently Active Day Schedule: **Office Occupancy Weekend** Type: Fraction

Day Schedule Name: **Office Occupancy Weekend**
Type: **Fraction**

Hourly Values

Mdnt - 1:	0.0000 ratio	8-9 am:	0.0000 ratio	4-5 pm:	0.0000 ratio
1-2 am:	0.0000 ratio	9-10 am:	0.0000 ratio	5-6 pm:	0.0000 ratio
2-3 am:	0.0000 ratio	10-11 am:	0.0000 ratio	6-7 pm:	0.0000 ratio
3-4 am:	0.0000 ratio	11-noon:	0.0000 ratio	7-8 pm:	0.0000 ratio
4-5 am:	0.0000 ratio	noon-1:	0.0000 ratio	8-9 pm:	0.0000 ratio
5-6 am:	0.0000 ratio	1-2 pm:	0.0000 ratio	9-10 pm:	0.0000 ratio
6-7 am:	0.0000 ratio	2-3 pm:	0.0000 ratio	10-11 pm:	0.0000 ratio
7-8 am:	0.0000 ratio	3-4 pm:	0.0000 ratio	11-Mdnt:	0.0000 ratio

Done

HVAC – Occupancy Schedules

Elevators 75 w Schedules - eQUEST Quick Energy Simulation Tool

File Edit View Mode Tools Help

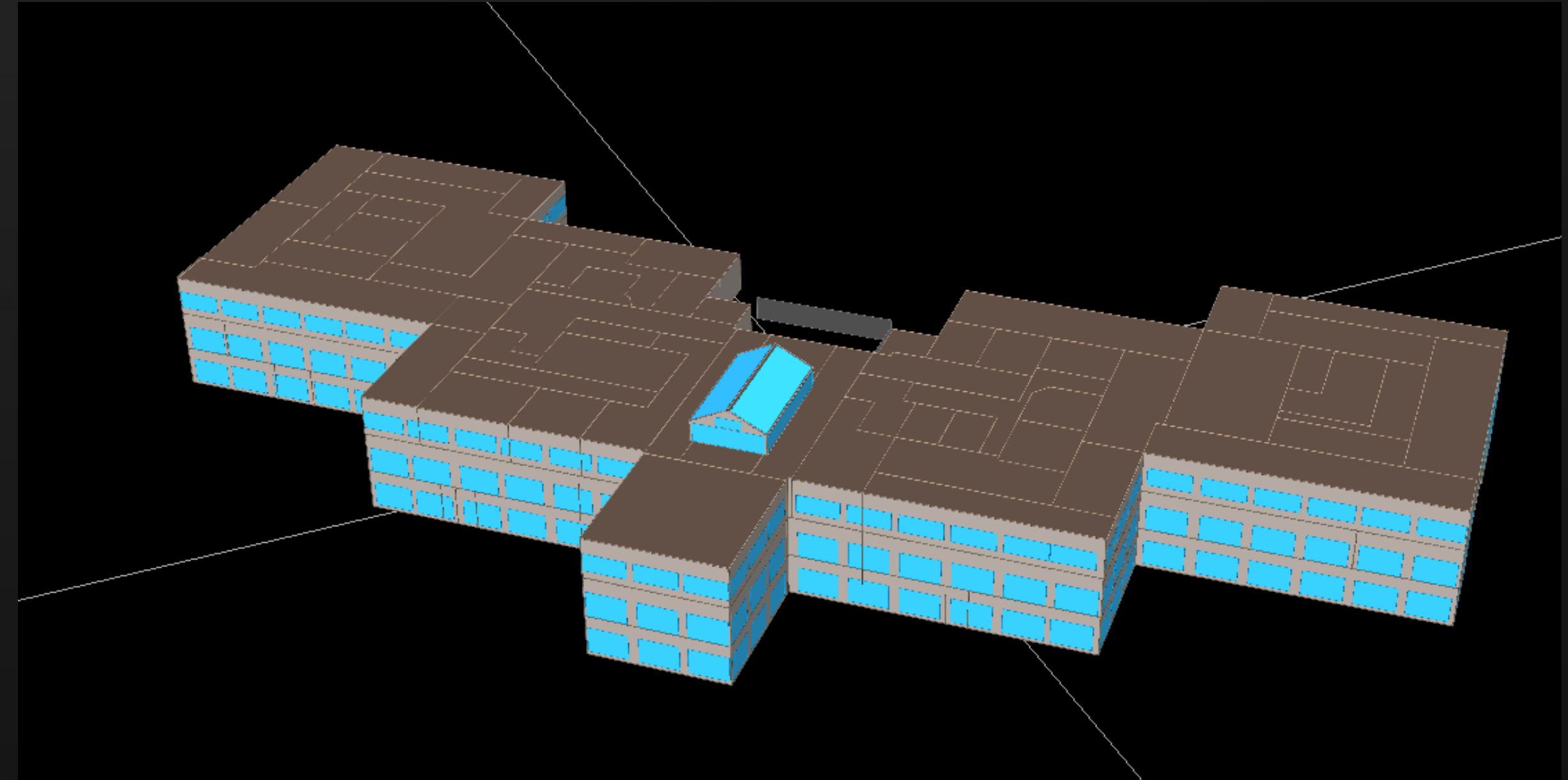
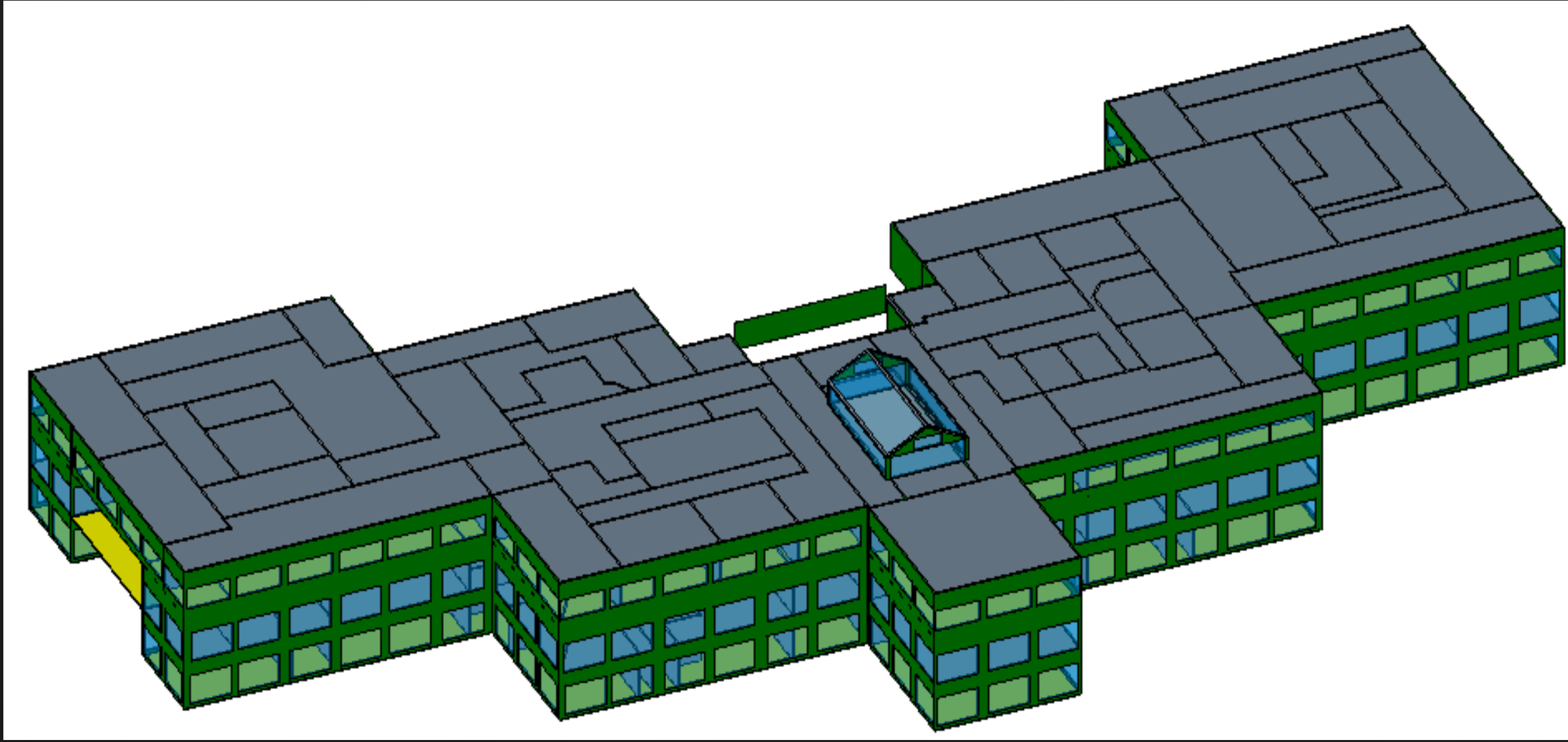
Project & Site Building Shell **Internal Loads** Water-Side HVAC Air-Side HVAC Utility & Economics

Internal Loads **Spreadsheet** Summary

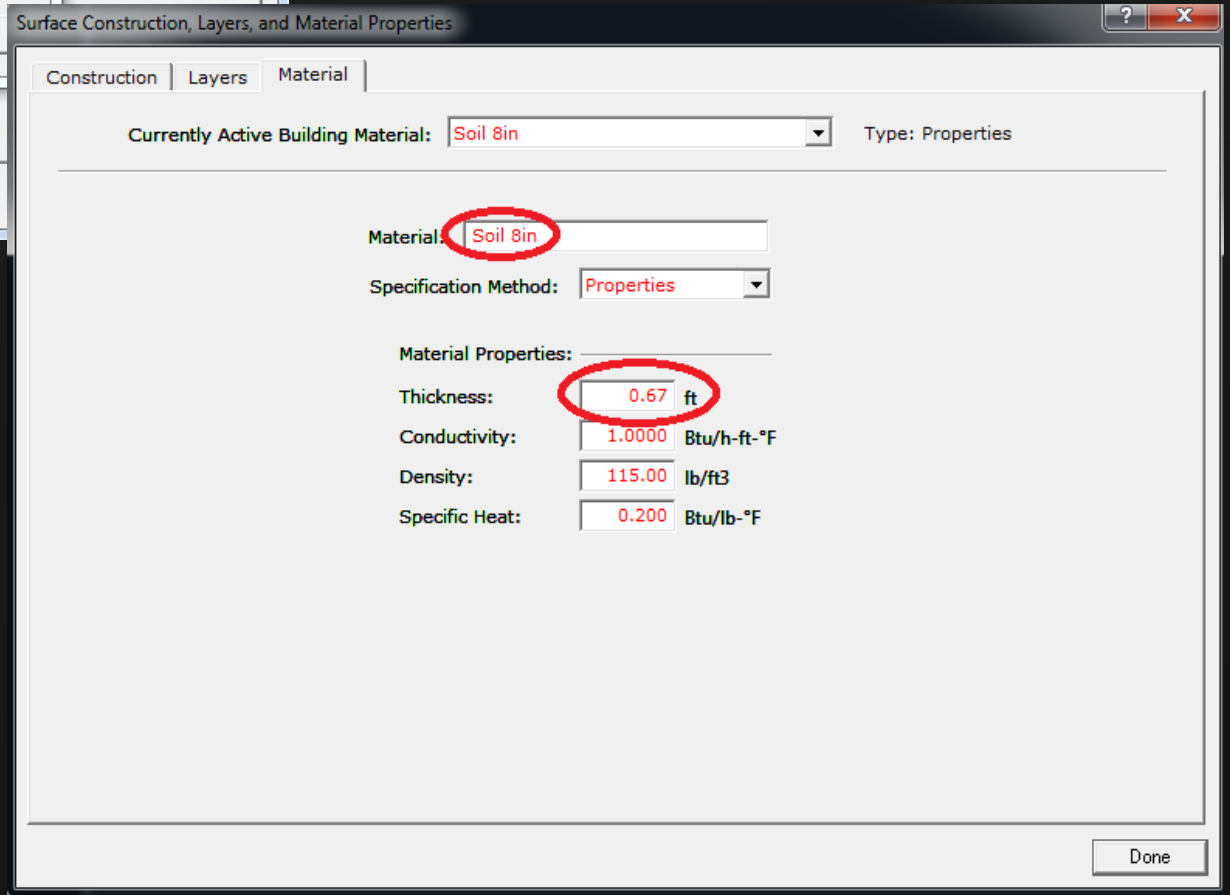
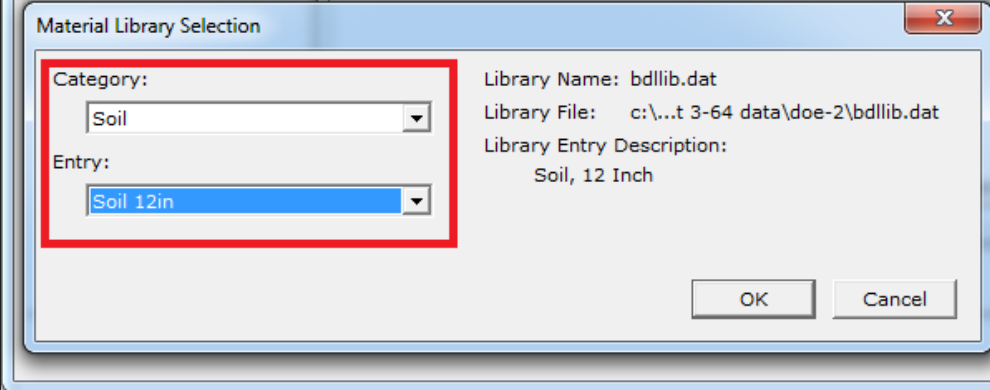
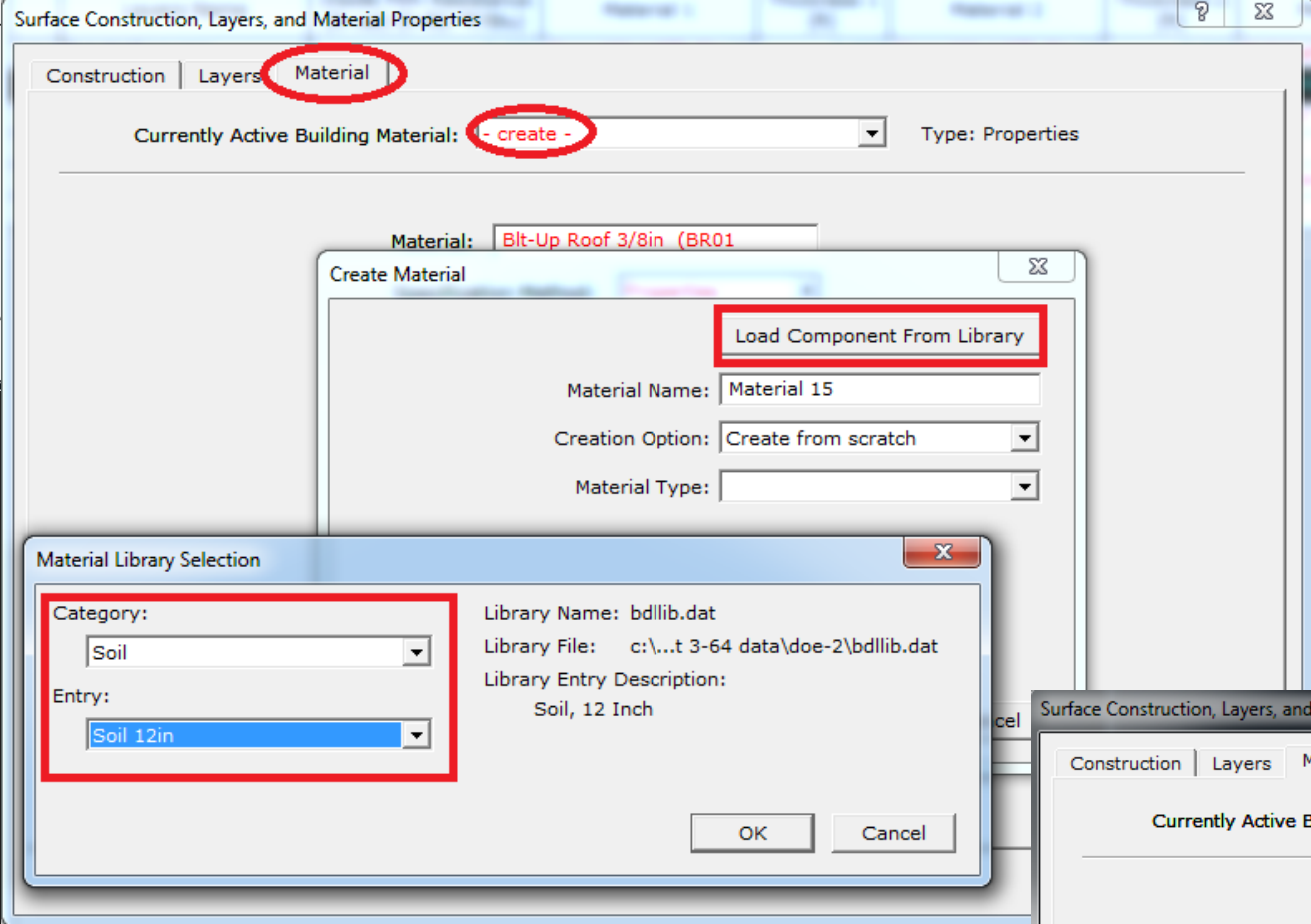
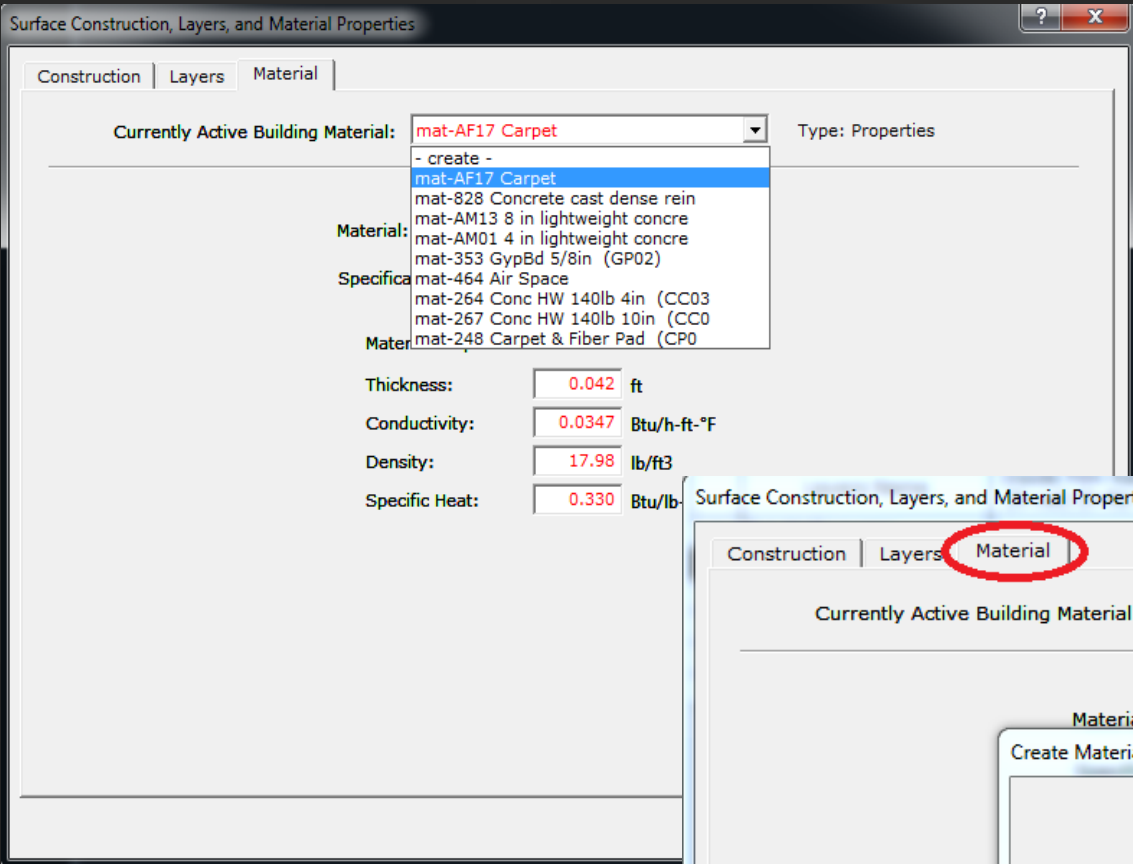
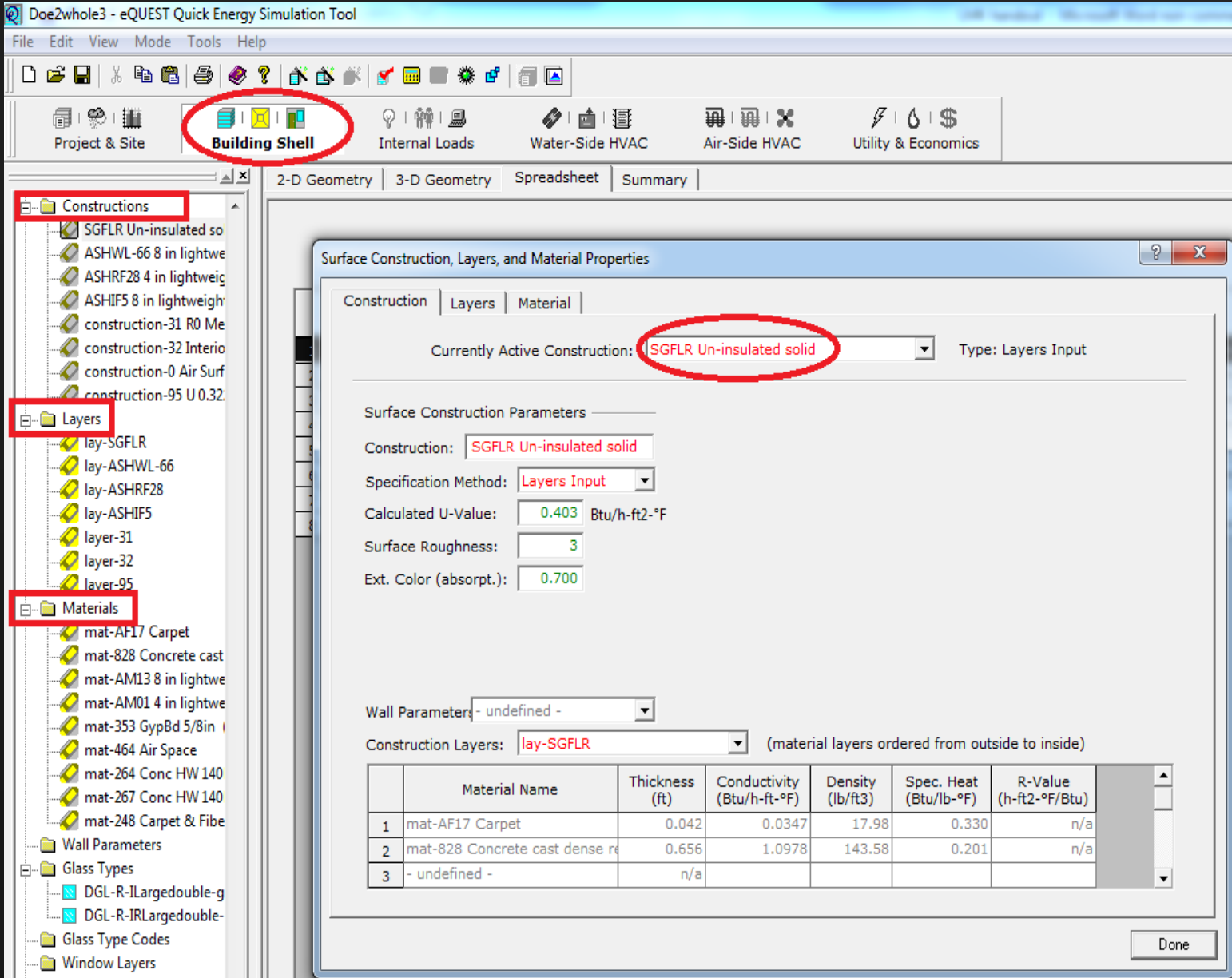
Display Mode: Occupancy

	Space Name	Parent Floor	Activity Desc.	Occupancy Schedule	Area/Person (ft2)	Numb Peo
1	S~zone-1-9Exercise	bldg-stry-1	(no default)	Office Occupancy	100	
2	S~zone-1-8Office	bldg-stry-1	(no default)	Office Occupancy	100	
3	S~zone-1-7Office	bldg-stry-1	(no default)	Office Occupancy	100	
4	S~zone-1-6Office	bldg-stry-1	(no default)	Office Occupancy	100	
5	S~zone-1-5Corridor	bldg-stry-1	(no default)	Office Occupancy	100	
6	S~zone-1-55Office	bldg-stry-1	(no default)	Office Occupancy	100	
7	S~zone-1-54Office	bldg-stry-1	(no default)	Office Occupancy	100	
8	S~zone-1-53Office	bldg-stry-1	(no default)	Office Occupancy	100	
9	S~zone-1-52Office	bldg-stry-1	(no default)	Office Occupancy	100	
10	S~zone-1-51Office	bldg-stry-1	(no default)	Office Occupancy	100	
11	S~zone-1-50Office	bldg-stry-1	(no default)	Office Occupancy	100	
12	S~zone-1-4Exercise	bldg-stry-1	(no default)	Office Occupancy	100	
13	S~zone-1-49Office	bldg-stry-1	(no default)	Office Occupancy	100	
14	S~zone-1-48Office	bldg-stry-1	(no default)	Office Occupancy	100	
15	S~zone-1-47Office	bldg-stry-1	(no default)	Office Occupancy	100	
16	S~zone-1-46Office	bldg-stry-1	(no default)	Office Occupancy	100	
17	S~zone-1-45Office	bldg-stry-1	(no default)	Office Occupancy	100	
18	S~zone-1-44Office	bldg-stry-1	(no default)	Office Occupancy	100	
19	S~zone-1-43Office	bldg-stry-1	(no default)	Office Occupancy	100	
20	S~zone-1-42Office	bldg-stry-1	(no default)	Office Occupancy	100	
21	S~zone-1-41Office	bldg-stry-1	(no default)	Office Occupancy	100	
22	S~zone-1-40Office	bldg-stry-1	(no default)	Office Occupancy	100	
23	S~zone-1-3Restroom	bldg-stry-1	(no default)	Office Occupancy	100	
24	S~zone-1-39Office	bldg-stry-1	(no default)	Office Occupancy	100	
25	S~zone-1-38Office	bldg-stry-1	(no default)	Office Occupancy	100	
26	S~zone-1-37Office	bldg-stry-1	(no default)	Office Occupancy	100	

HVAC – Building Envelope



HVAC – Building Envelope



HVAC – Building Envelope

Surface Construction, Layers, and Material Properties

Construction Layers Material

Currently Active Layers: **Slab on Grade Layers**

Layers: **Slab on Grade Layers**

Inside Film Resistance (R-val): **0.920**

Material Layers (ordered from outside to inside):

	Material Name	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft3)	Spec. Heat (Btu/lb-°F)	R-Value (h-ft2-°F/Btu)
1	Soil 8in	0.670	1.0000	115.00	0.200	n/a
2	Conc HW 140lb 10in (CC0)	0.833	0.7576	140.00	0.200	n/a
3	Carpet & Fiber Pad	n/a	n/a	n/a	n/a	2.080
4		n/a				
5		n/a				
6		n/a				
7		n/a				
8		n/a				
9		n/a				
10	n/a	n/a				

Done

Surface Construction, Layers, and Material Properties

Construction Layers Material

Currently Active Construction: **Slab on Grade Construction** Type: Layers Input

Surface Construction Parameters

Construction: **Slab on Grade Constructio**

Specification Method: **Layers Input**

Calculated U-Value: **0.210** Btu/h-ft2-°F

Surface Roughness: **2**

Ext. Color (absorpt.): **0.700**

Wall Parameters: - undefined -

Construction Layers: **Slab on Grade Layers** (material layers ordered from outside to inside)

	Material Name	Thickness (ft)	Conductivity (Btu/h-ft-°F)	Density (lb/ft3)	Spec. Heat (Btu/lb-°F)	R-Value (h-ft2-°F/Btu)
1	Soil 8in	0.670	1.0000	115.00	0.200	n/a
2	Conc HW 140lb 10in (CC0)	0.833	0.7576	140.00	0.200	n/a
3	Carpet & Fiber Pad	n/a	n/a	n/a	n/a	2.080

Done

HVAC – System & Components

Air-Side

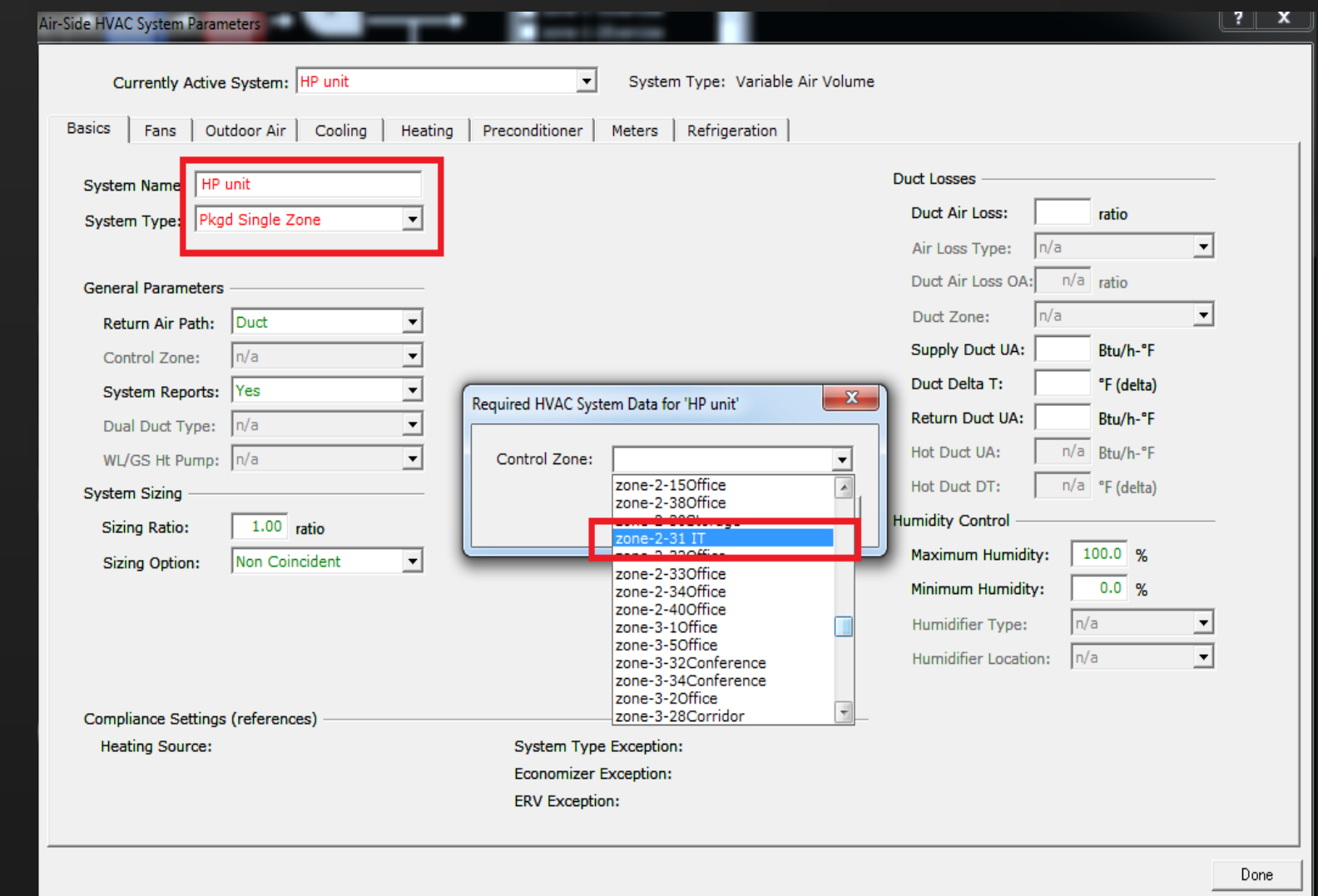
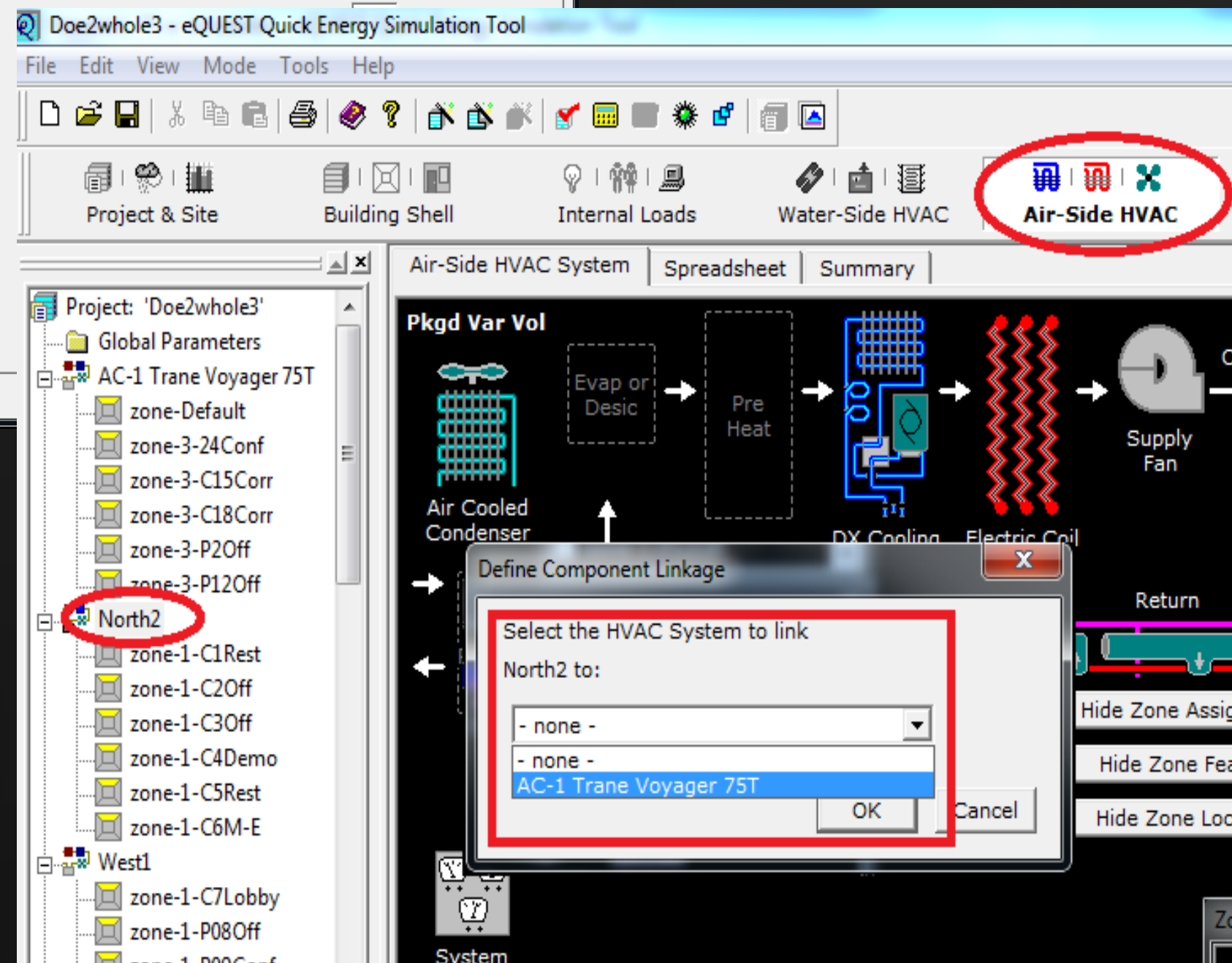
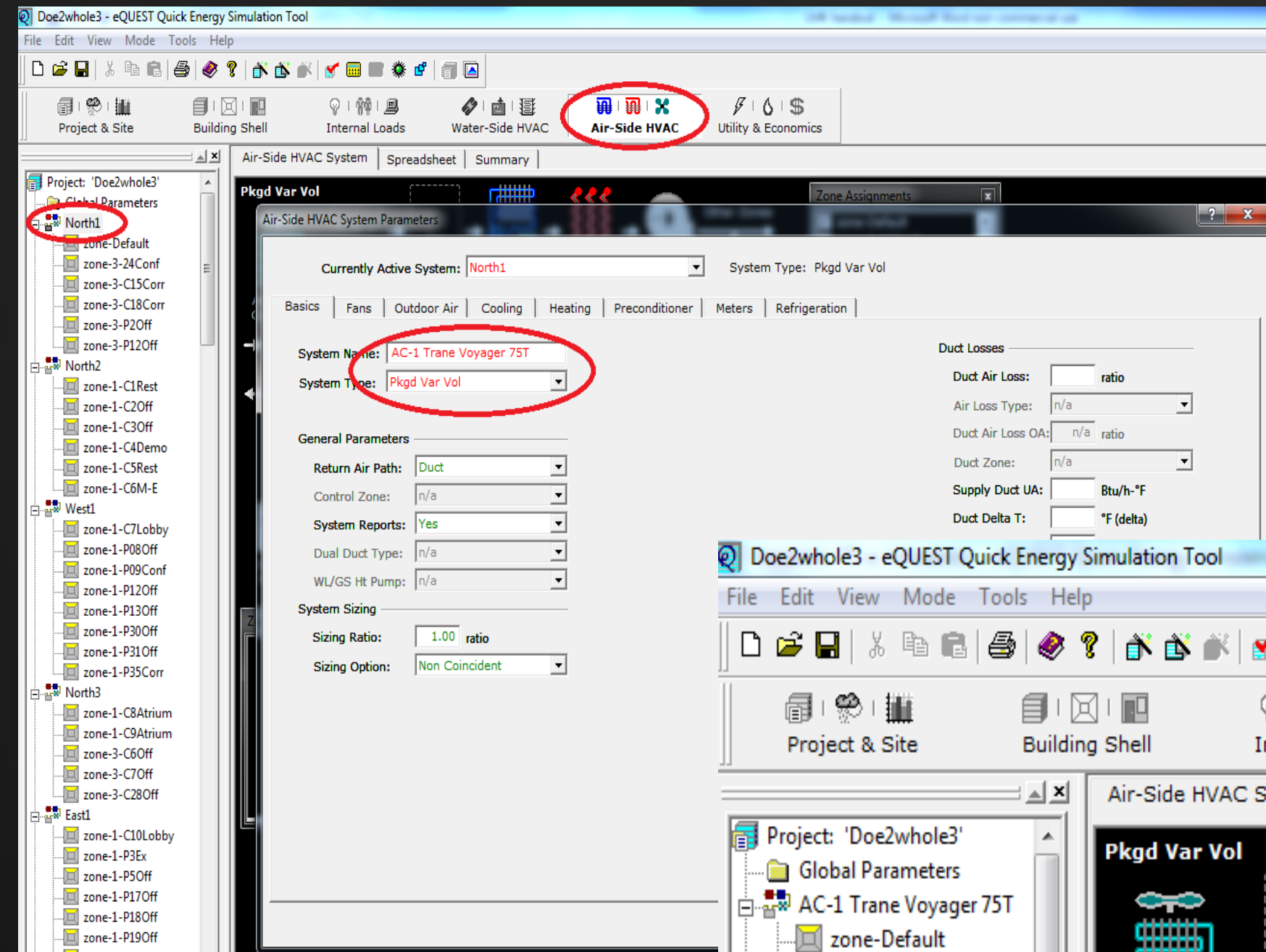
- (4) 75 Ton Packaged Rooftop VAV Air Units
- (1) 15 Ton DX Unit
- (1) Heat Pump Unit

Water-Side

- (1) Hydronic Boiler
- (1) Domestic Hot Water Boiler



HVAC – Air-Side Components



HVAC – Zoning



HVAC – Zoning

Elevators 75 w Schedules - eQUEST Quick Energy Simulation Tool

File Edit View Mode Tools Help

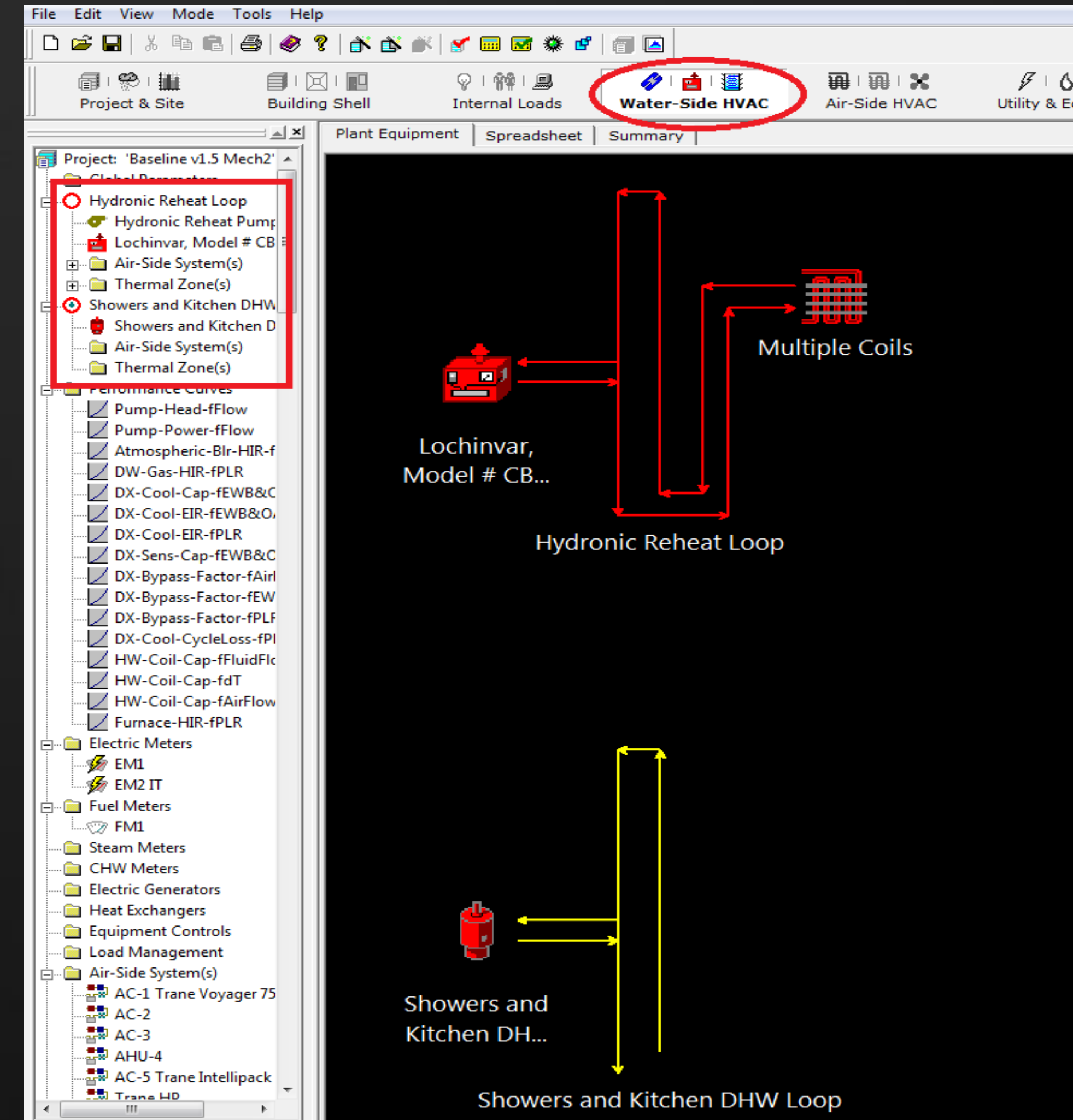
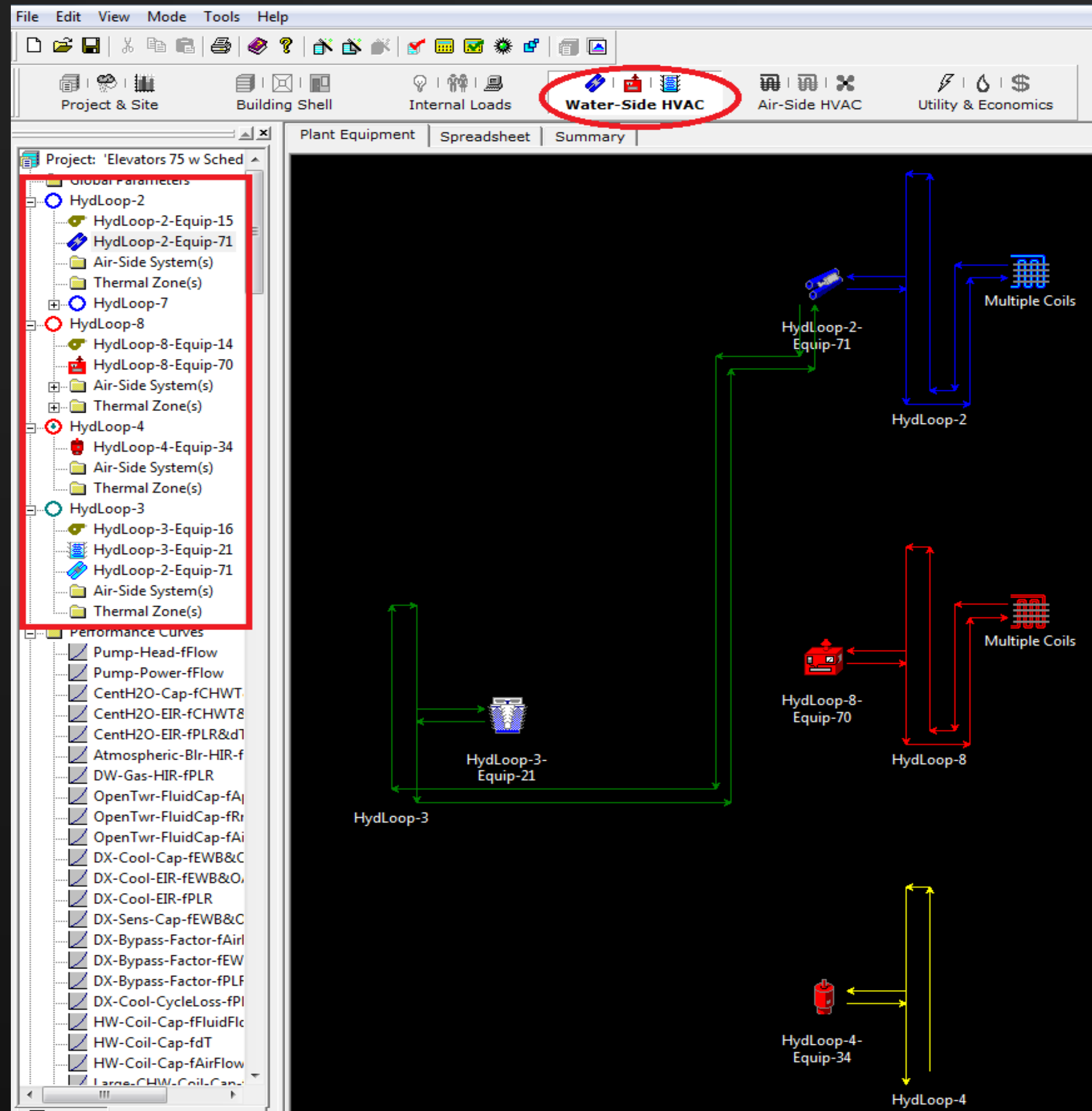
Project & Site Building Shell Internal Loads Water-Side HVAC **Air-Side HVAC** Utility & Econom

Air-Side HVAC System **Spreadsheet** Summary

Display Mode **Basic Specifications**

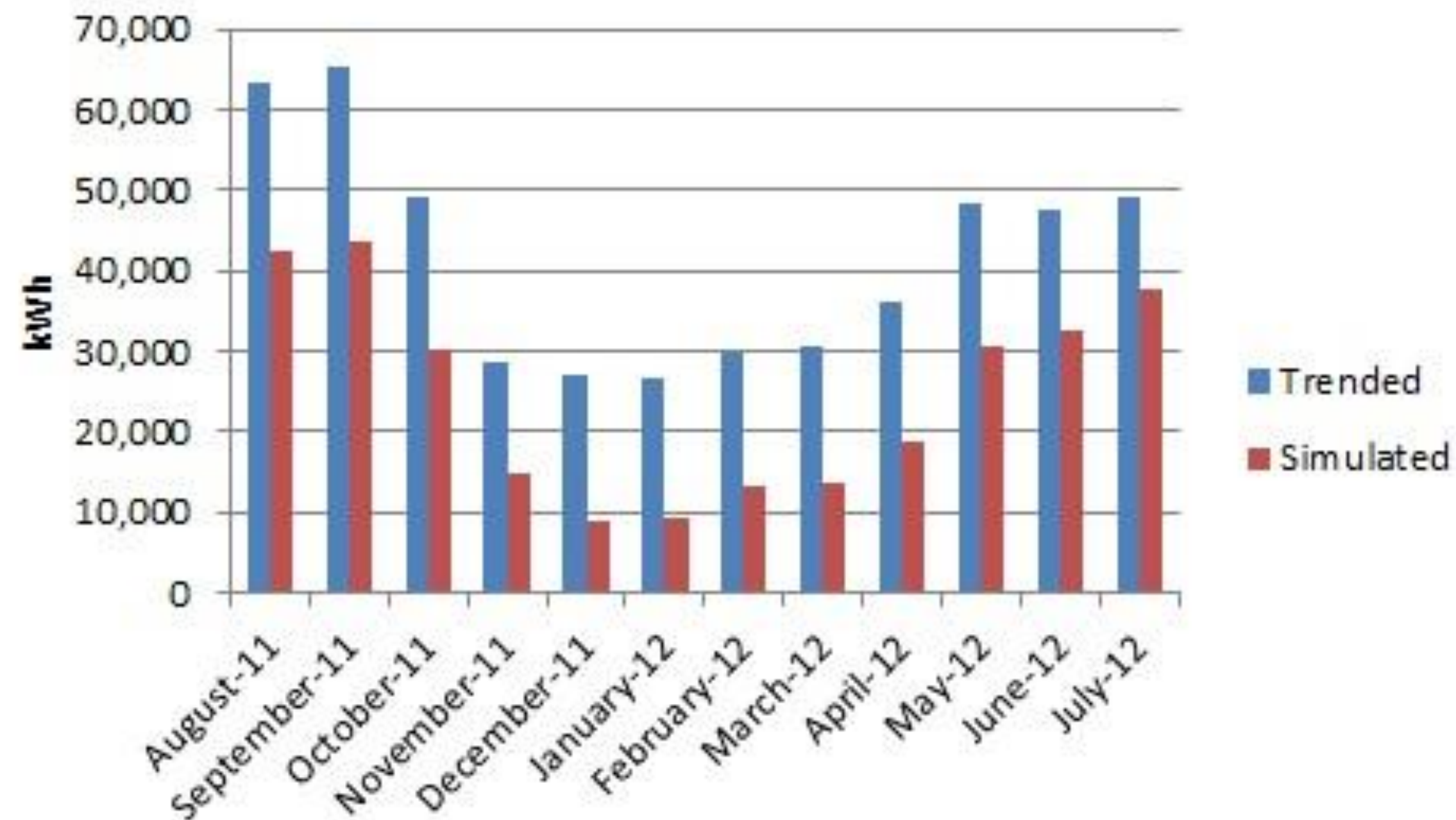
	Zone Name	Parent System	Space	Zone Type
1	zone-1-1Exercise	AC-1 75T	zone-1-1Exercise	Conditioned
2	zone-1-2Exercise	AC-1 75T	zone-1-2Exercise	Conditioned
3	zone-1-7Office	AC-1 75T	zone-1-7Office	Conditioned
4	zone-1-14Lobby	AC-1 75T	zone-1-14Lobby	Conditioned
5	zone-1-15Lobby	AC-1 75T	zone-1-15Lobby	Conditioned
6	zone-1-32Conference	AC-1 75T	zone-1-32Confe	Conditioned
7	zone-1-33Office	AC-1 75T	zone-1-33Office	Conditioned
8	zone-1-41Office	AC-1 75T	zone-1-41Office	Conditioned
9	zone-1-42Office	AC-1 75T	zone-1-42Office	Conditioned
10	zone-1-43Office	AC-1 75T	zone-1-43Office	Conditioned
11	zone-1-3Restroom	AC-2 75T	zone-1-3Restroc	Conditioned
12	zone-1-16M-E	AC-2 75T	zone-1-16M-E	Conditioned
13	zone-1-4Exercise	AC-3 75T	zone-1-4Exercise	Conditioned
14	zone-1-8Office	AC-3 75T	zone-1-8Office	Conditioned
15	zone-1-18Lobby	AC-3 75T	zone-1-18Lobby	Conditioned
16	zone-1-28Demo	AC-3 75T	zone-1-28Demo	Conditioned
17	zone-1-40Office	AC-3 75T	zone-1-40Office	Conditioned

HVAC – Water-Side Components

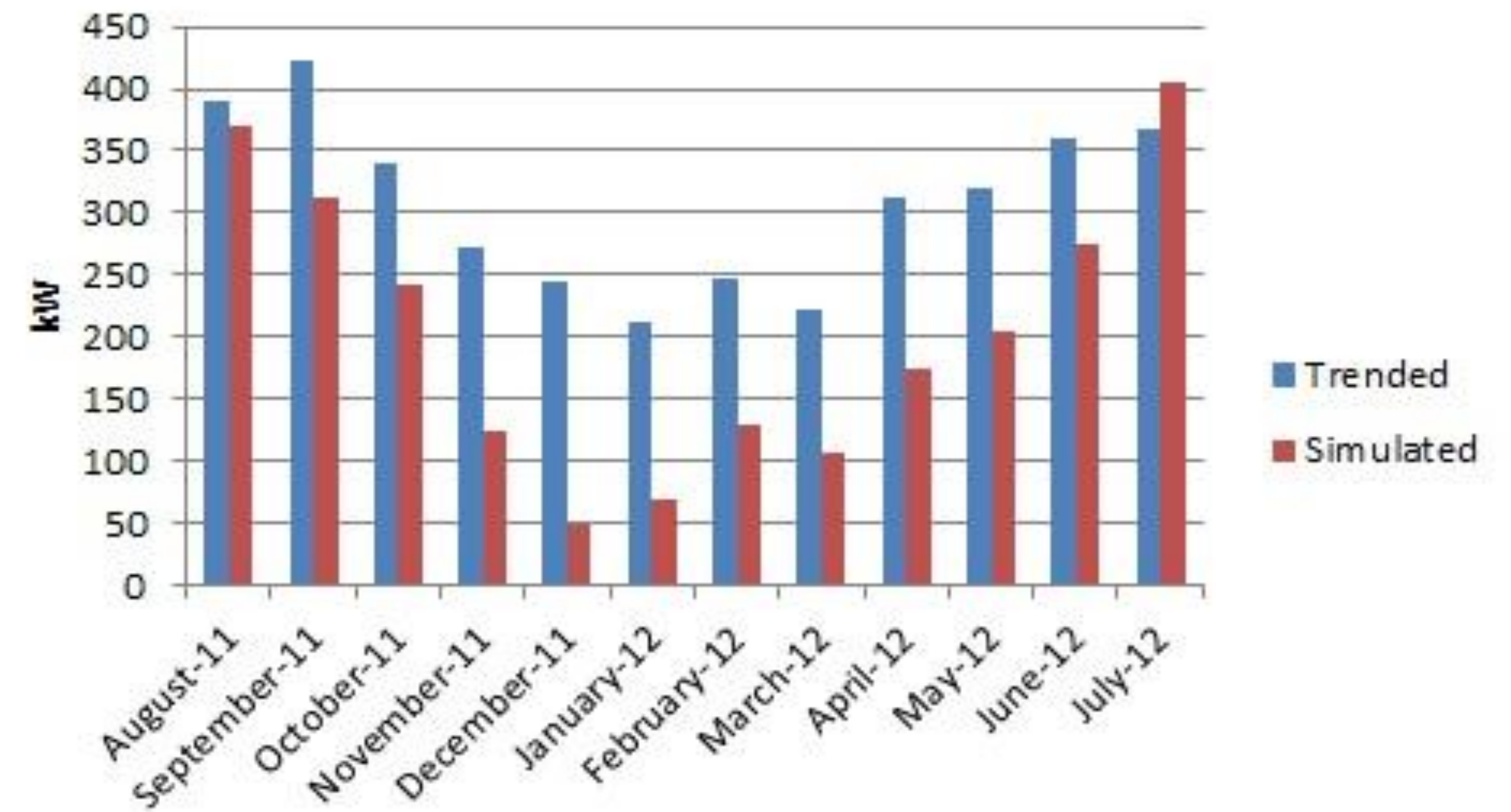


HVAC – Initial Comparison Charts

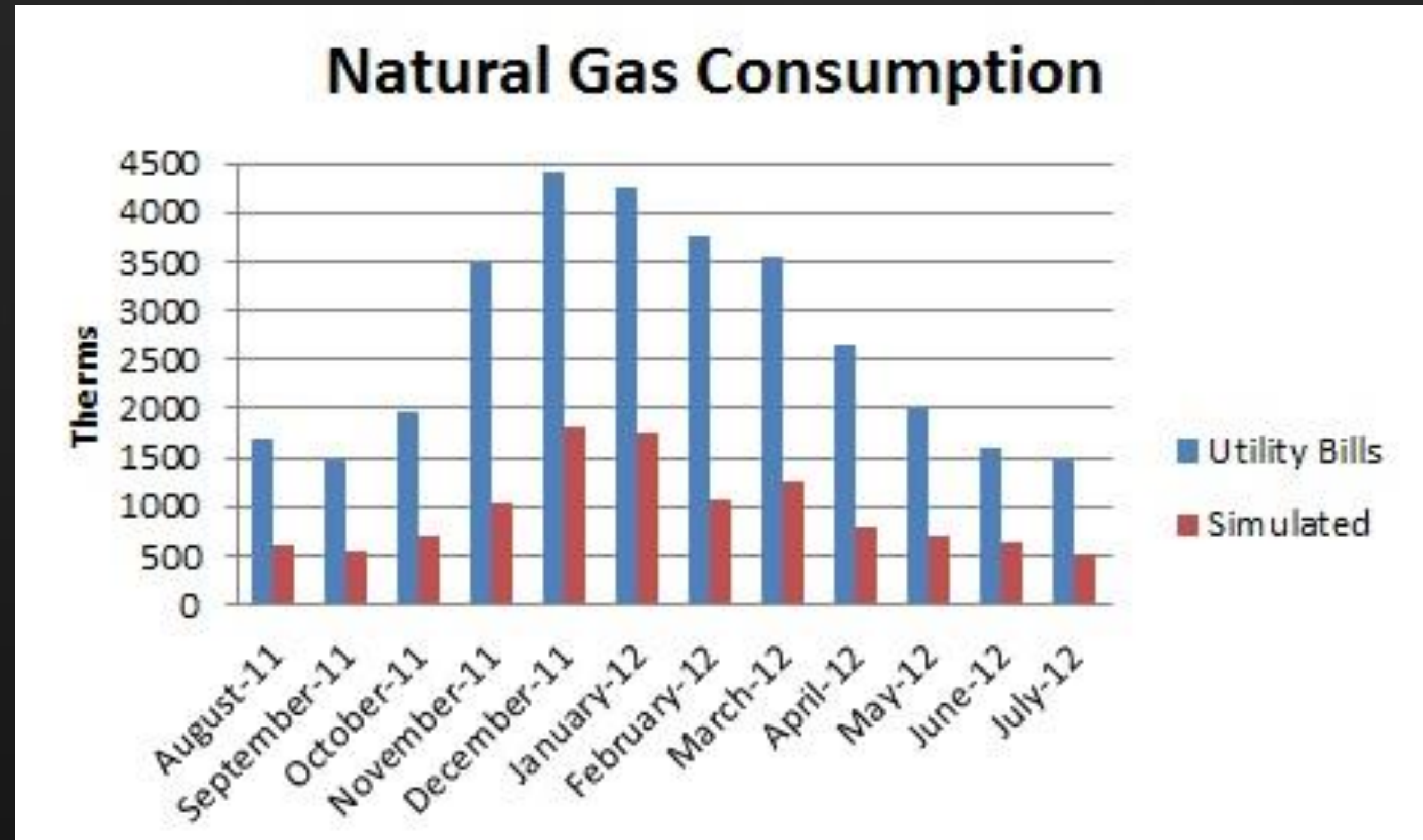
HVAC Electrical Consumption



HVAC Peak Demand



HVAC – Initial Comparison Charts



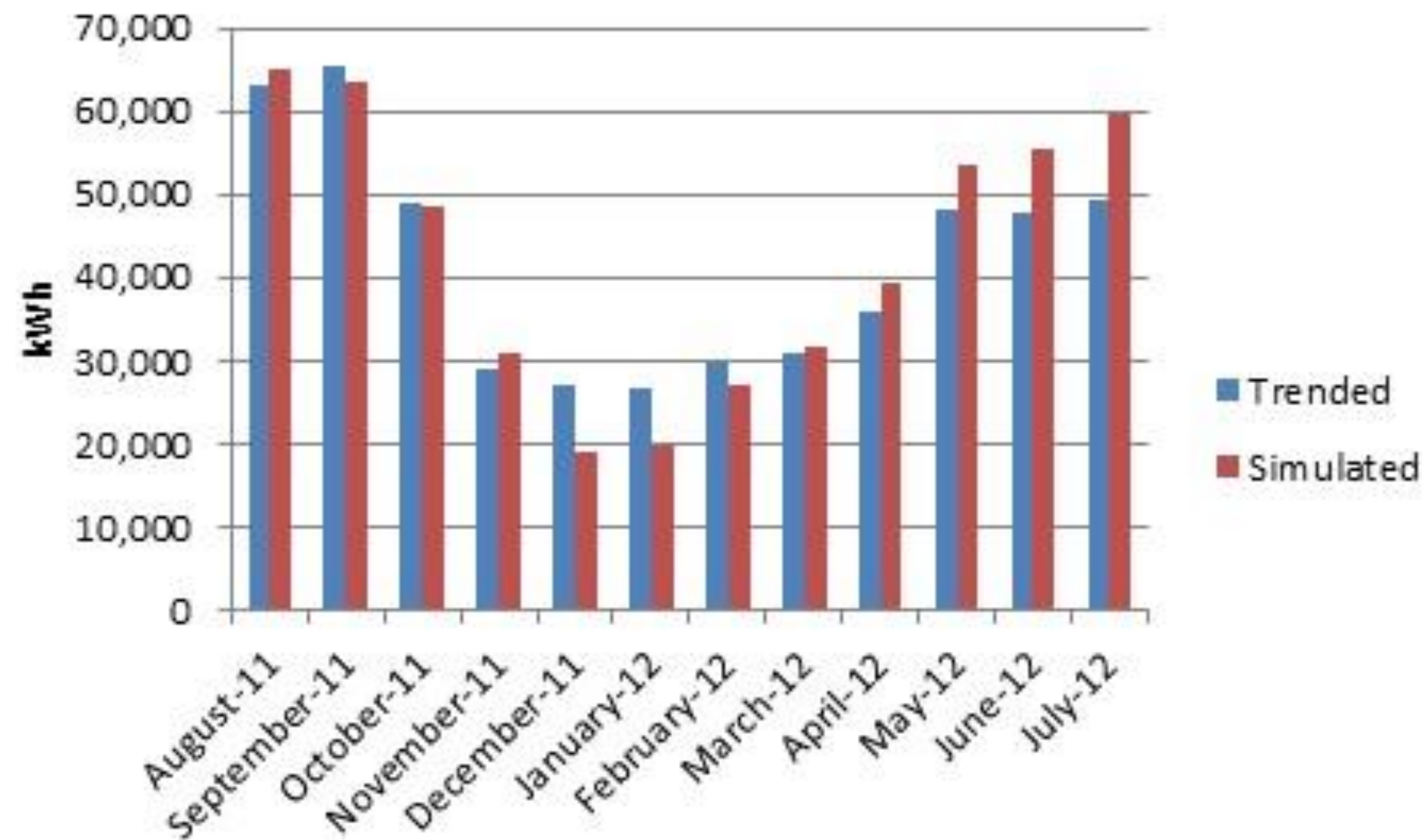
HVAC – Calibration

Within the HVAC system, you can make modifications to:

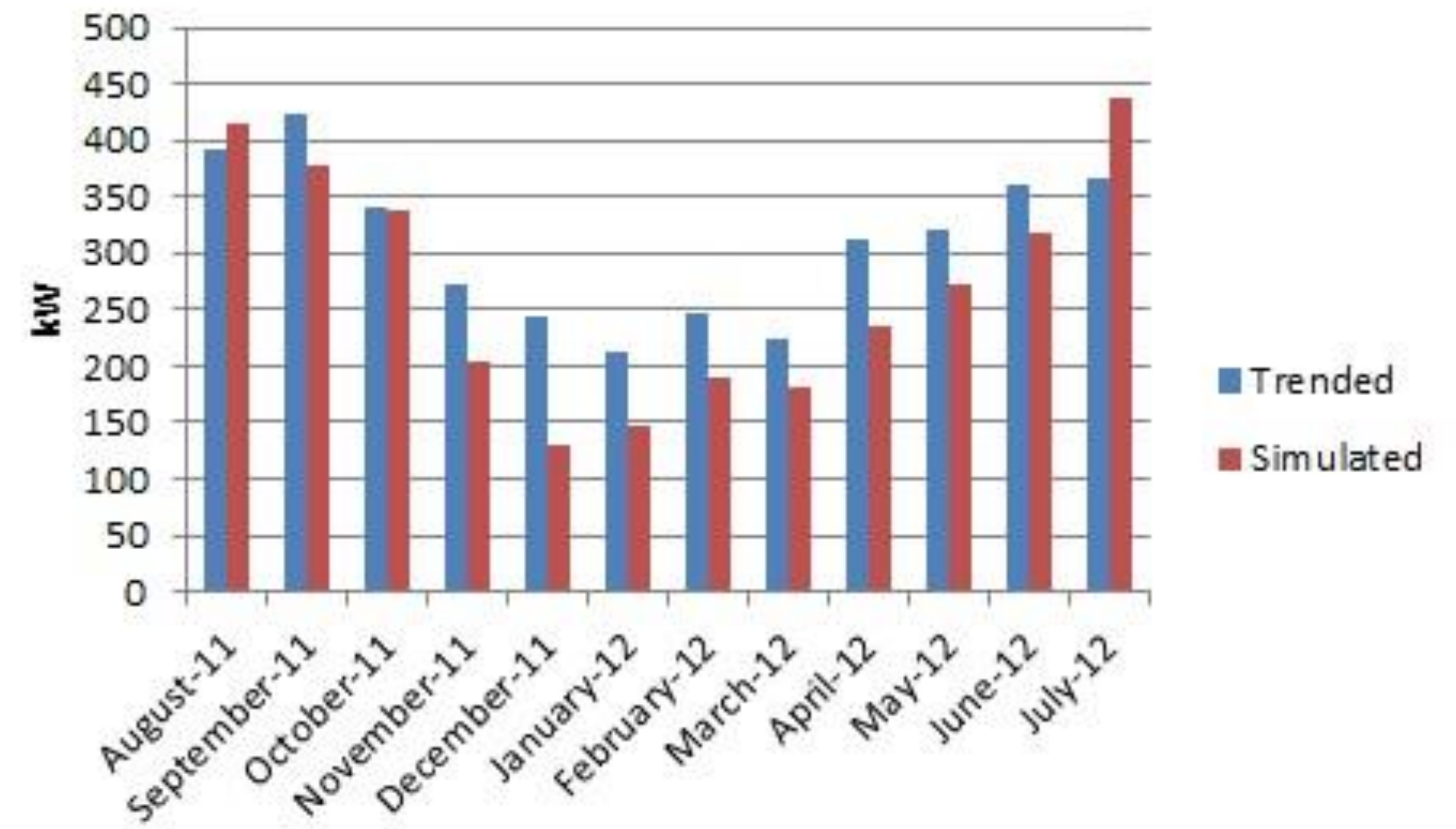
- Heating/Cooling Schedules
- Heating/Cooling Temperature Setpoints
- Equipment Efficiencies
- Infiltration Quantity/Schedules
- Economizer Function/Outdoor Air Fraction
- DHW Flow

HVAC – Final Comparison Charts

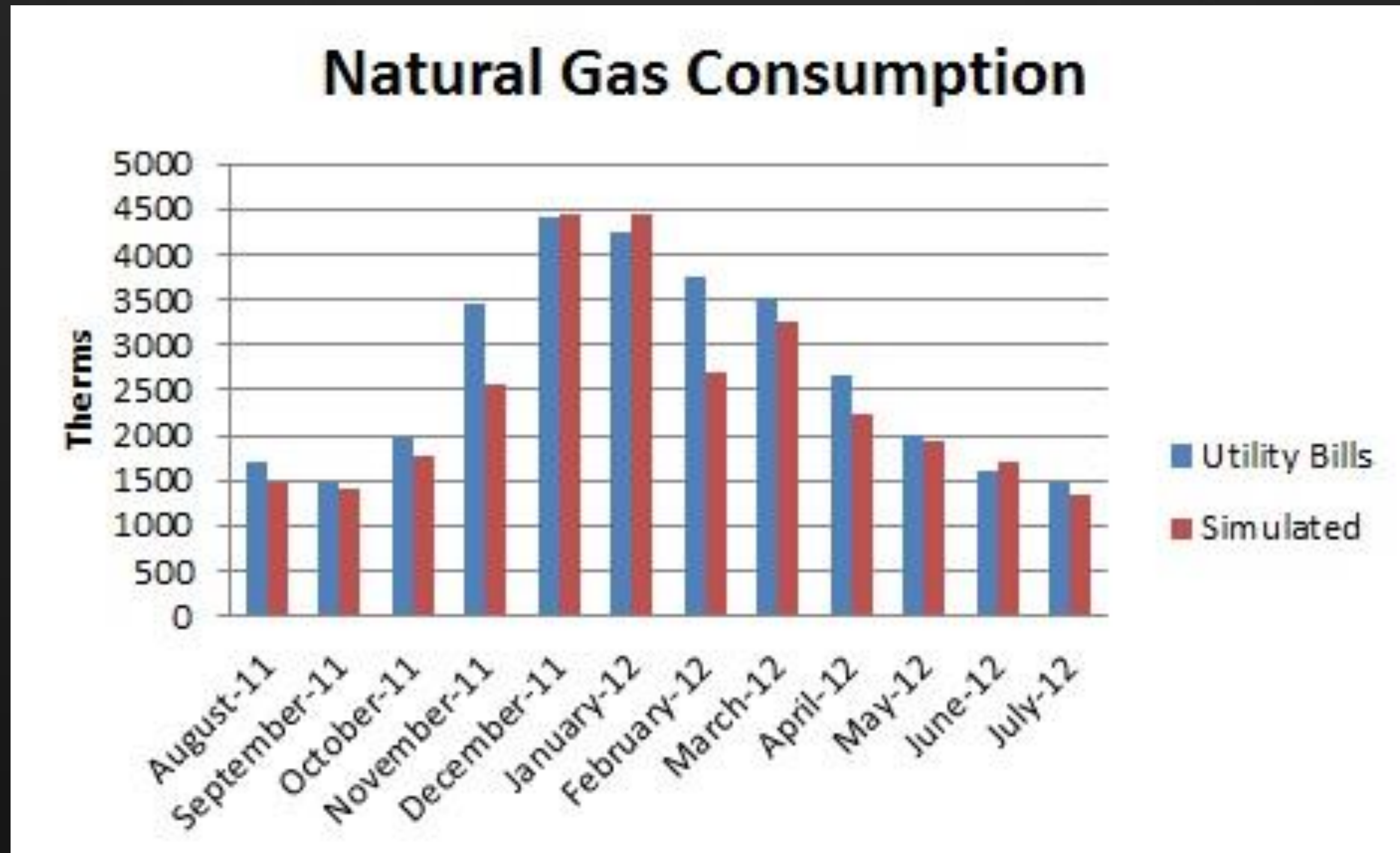
HVAC Electrical Consumption



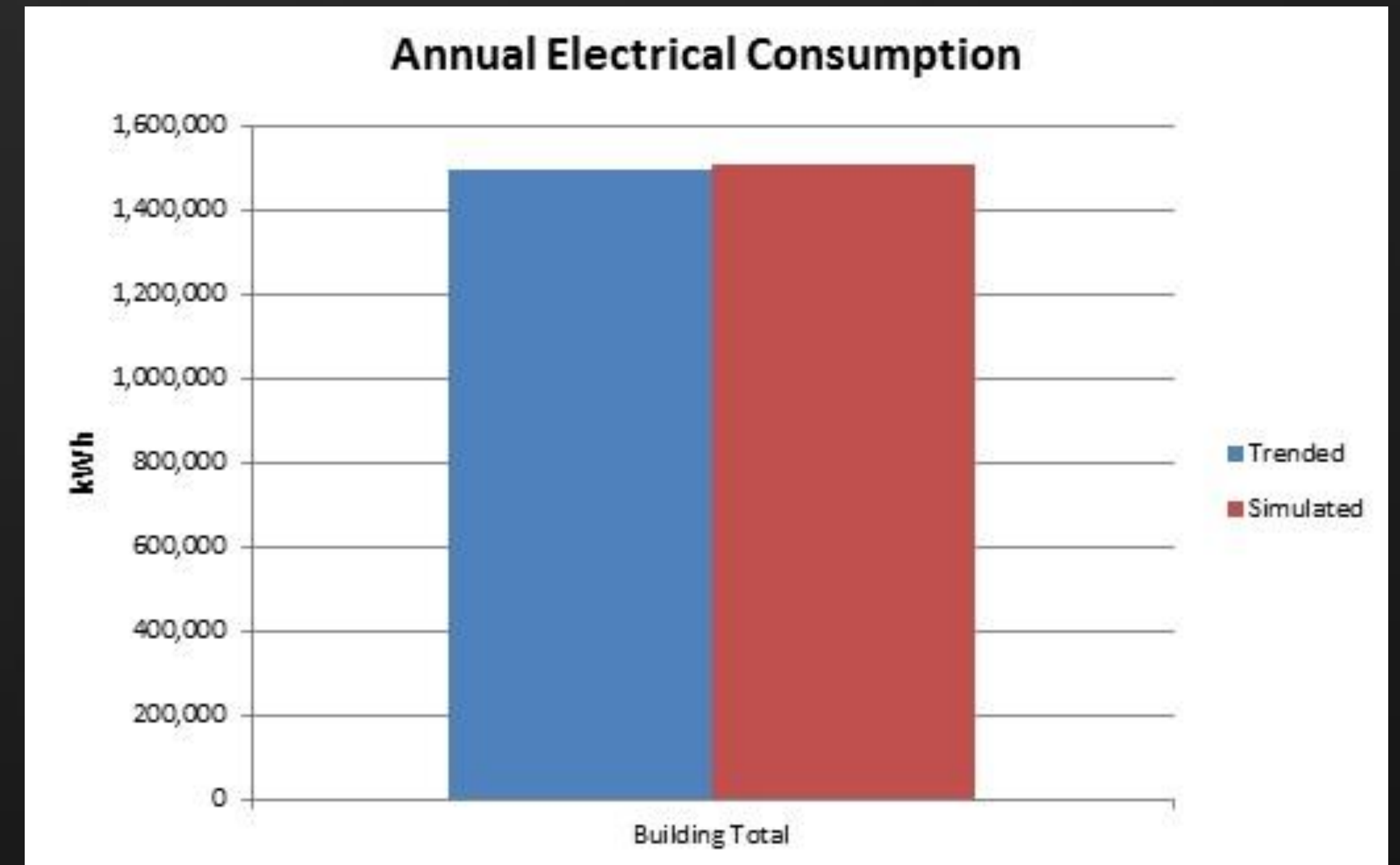
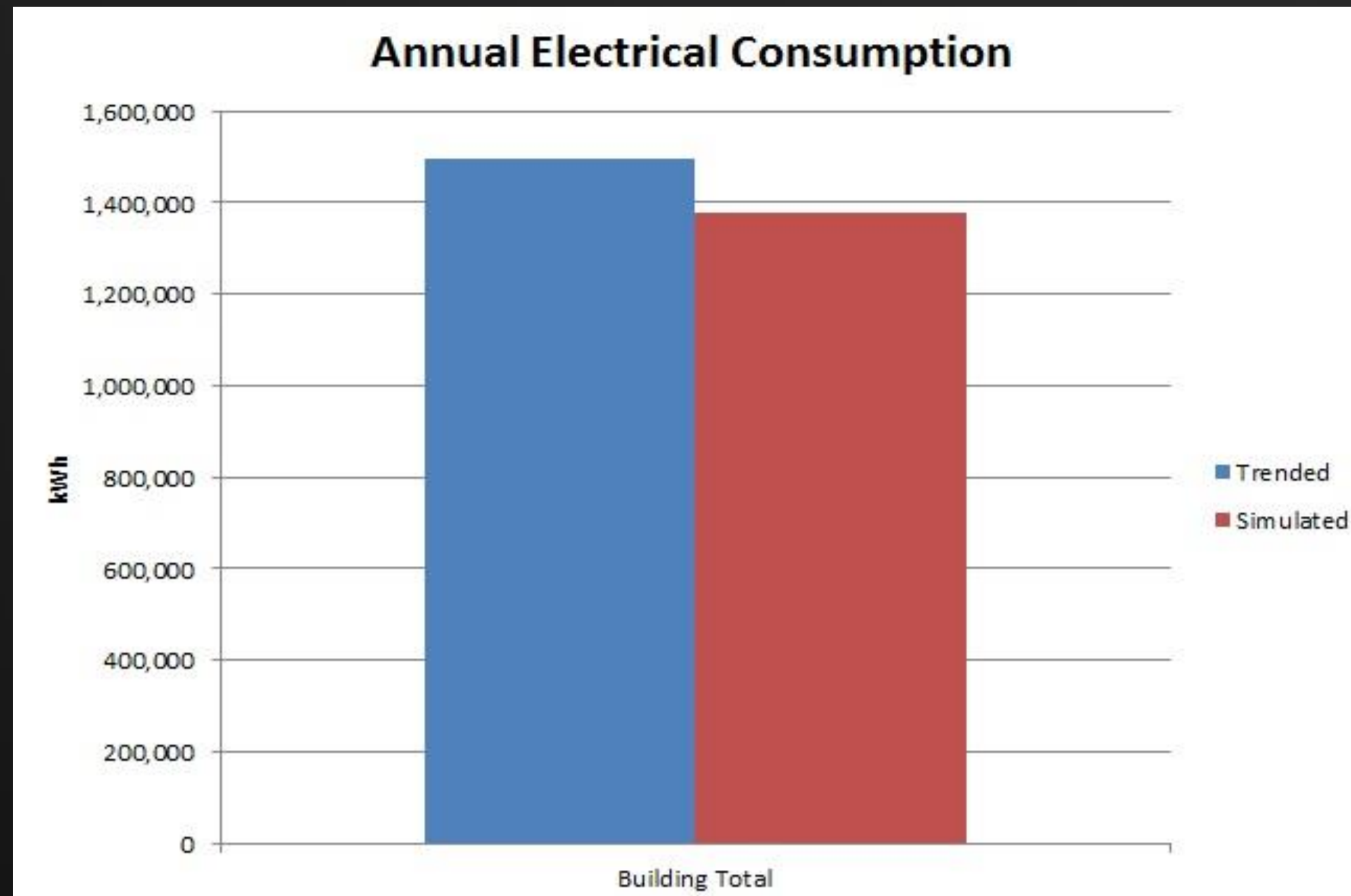
HVAC Peak Demand



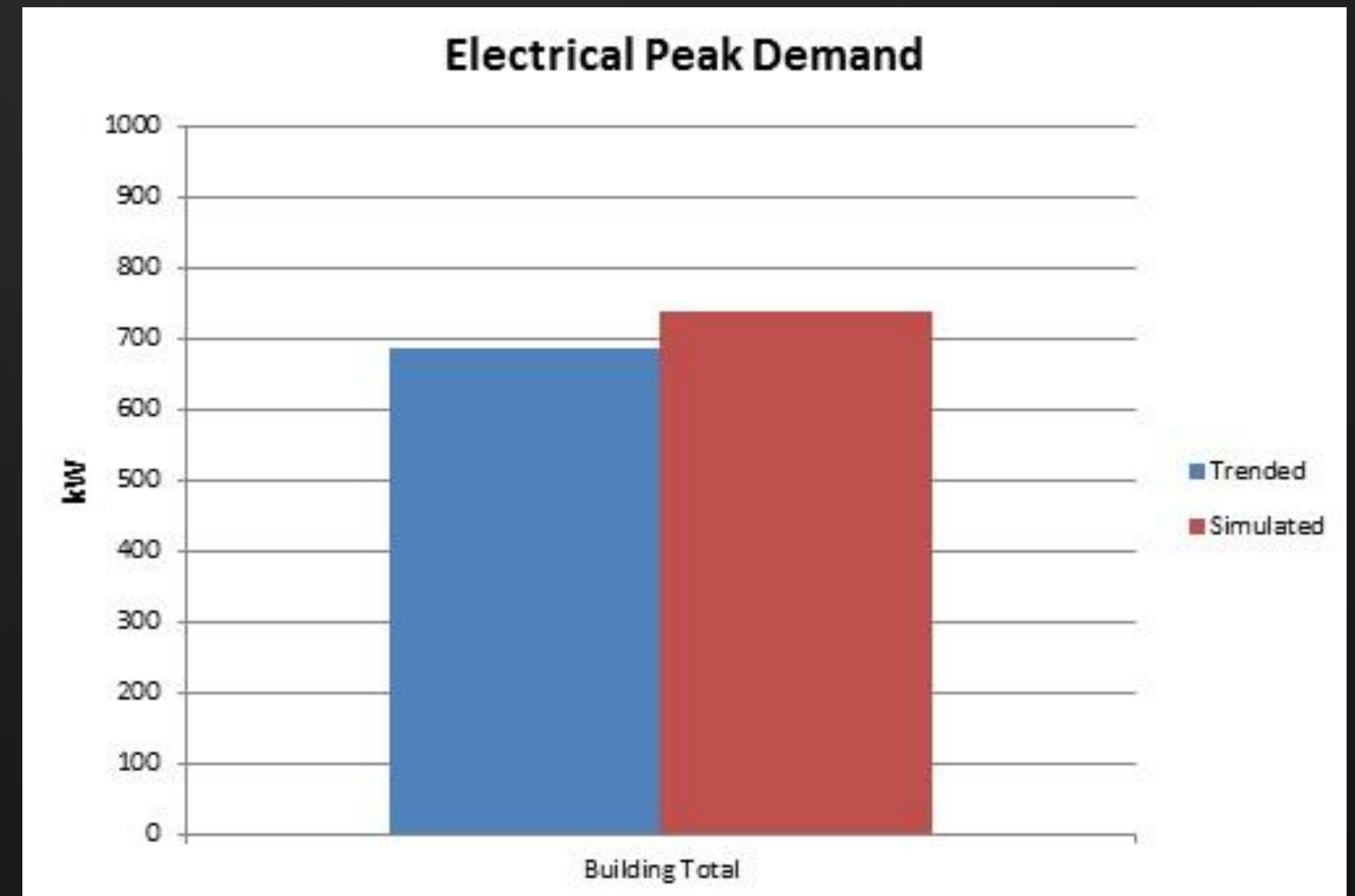
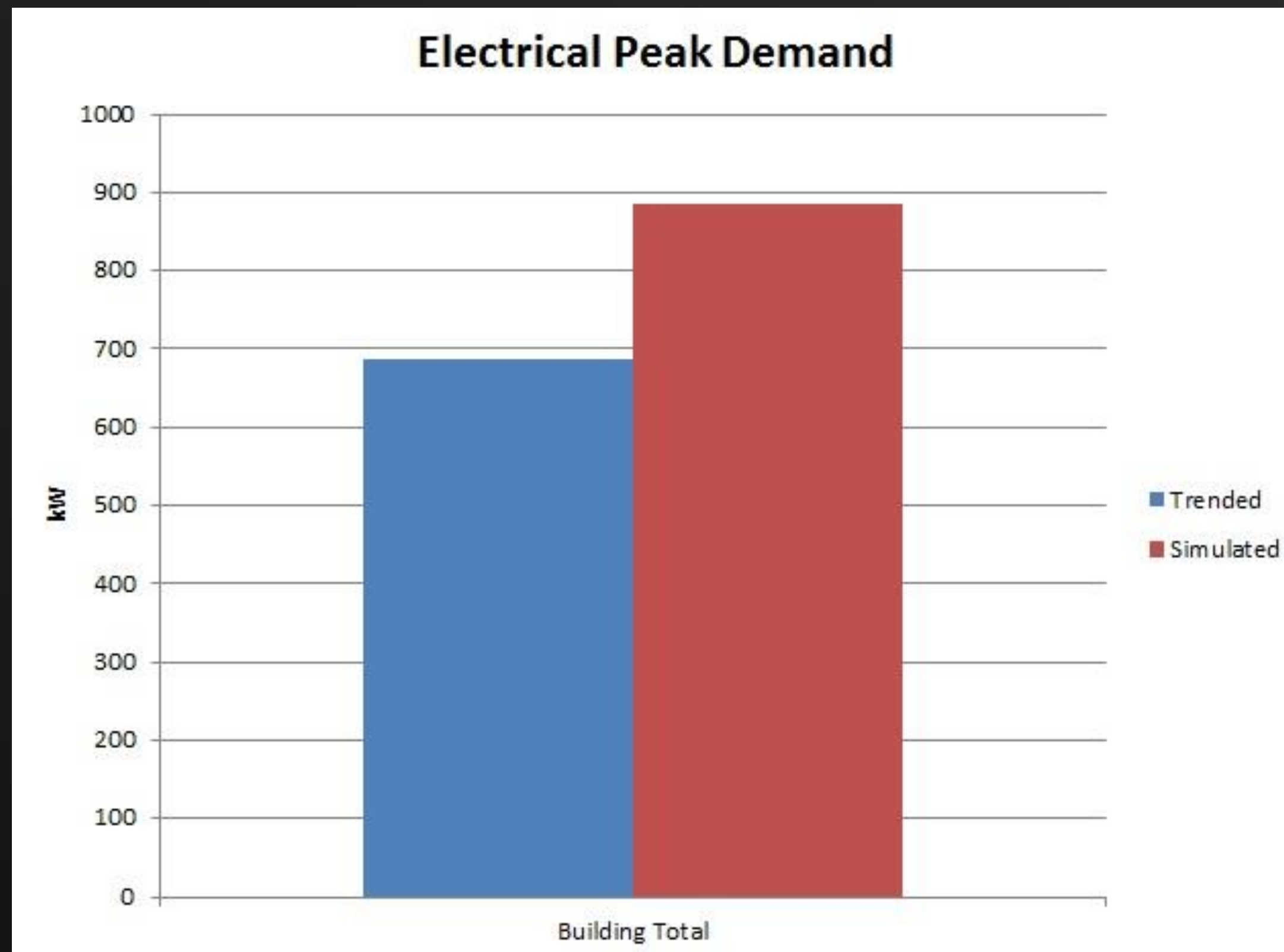
HVAC – Final Comparison Charts



Final Results – Total Building Consumption

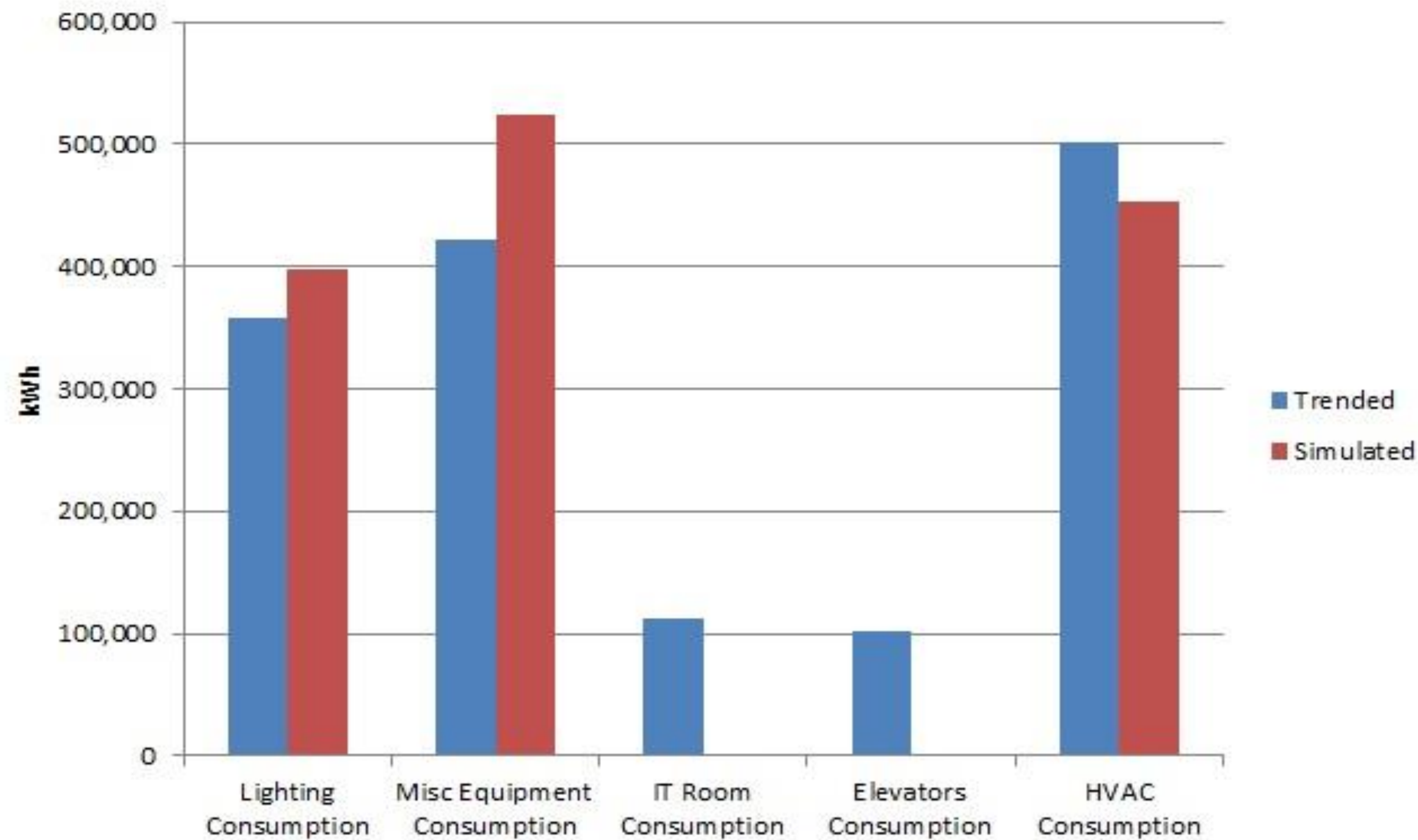


Final Results – Total Building Peak

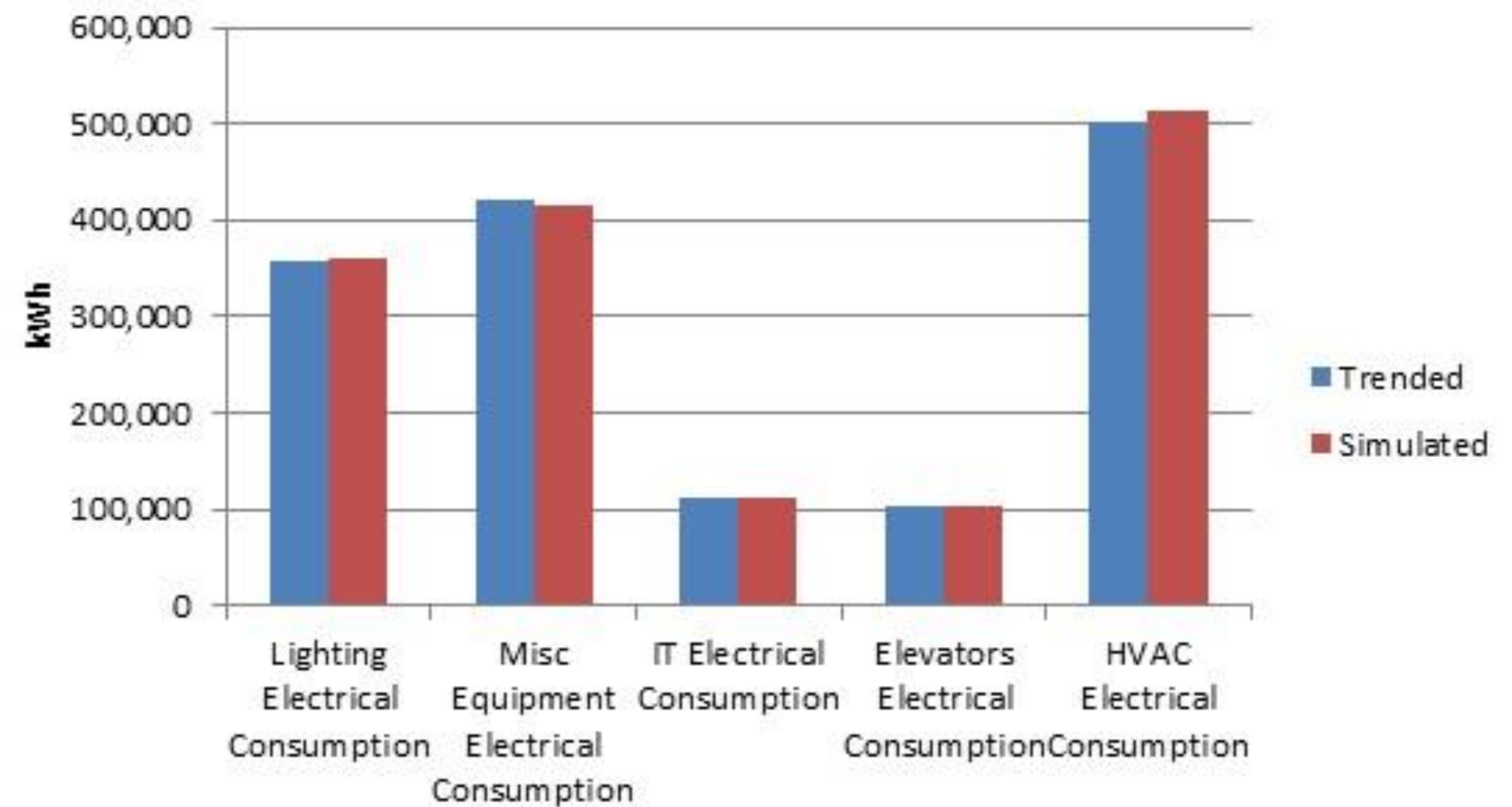


Final Results – End Use Electrical Consumption

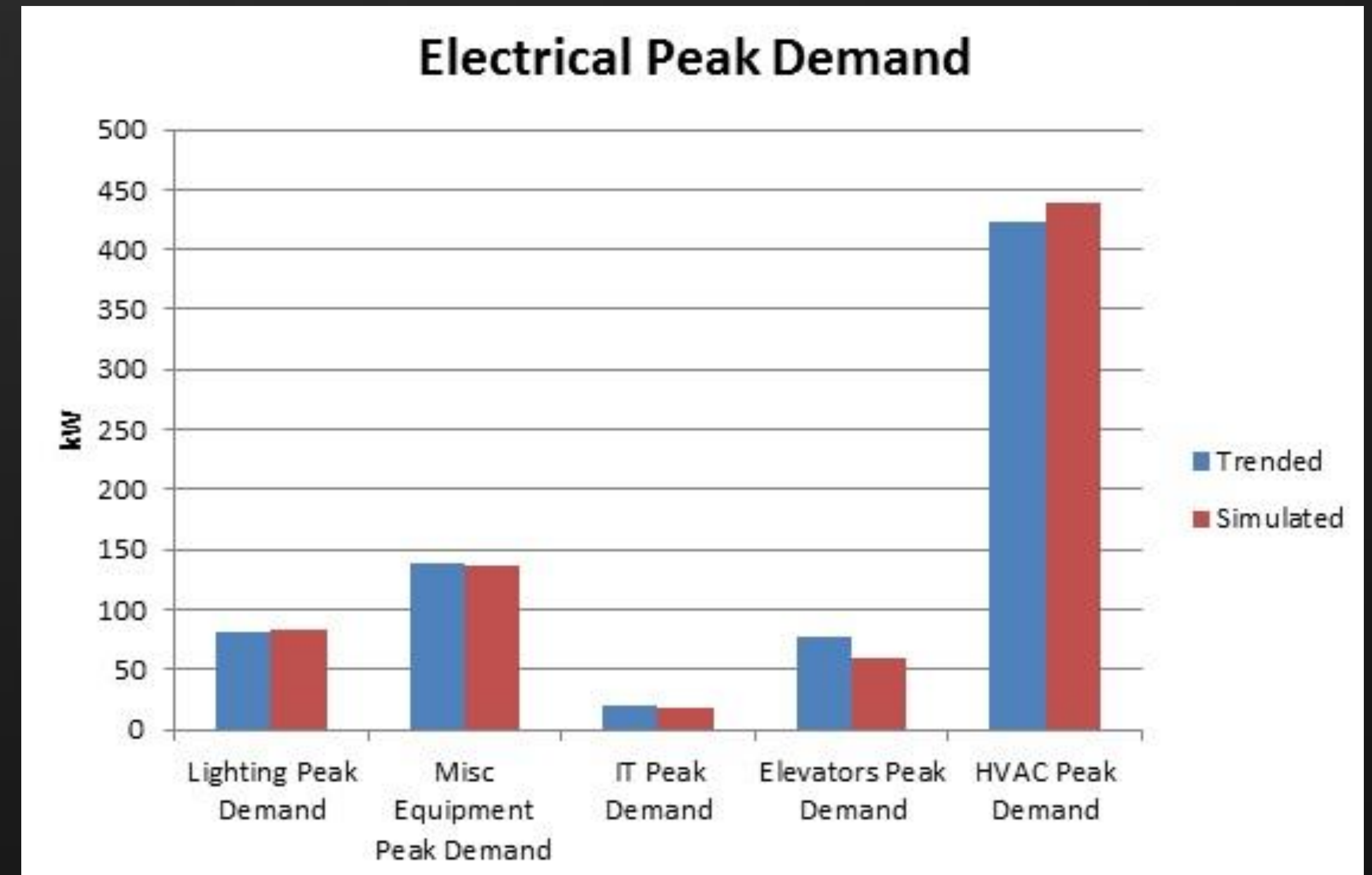
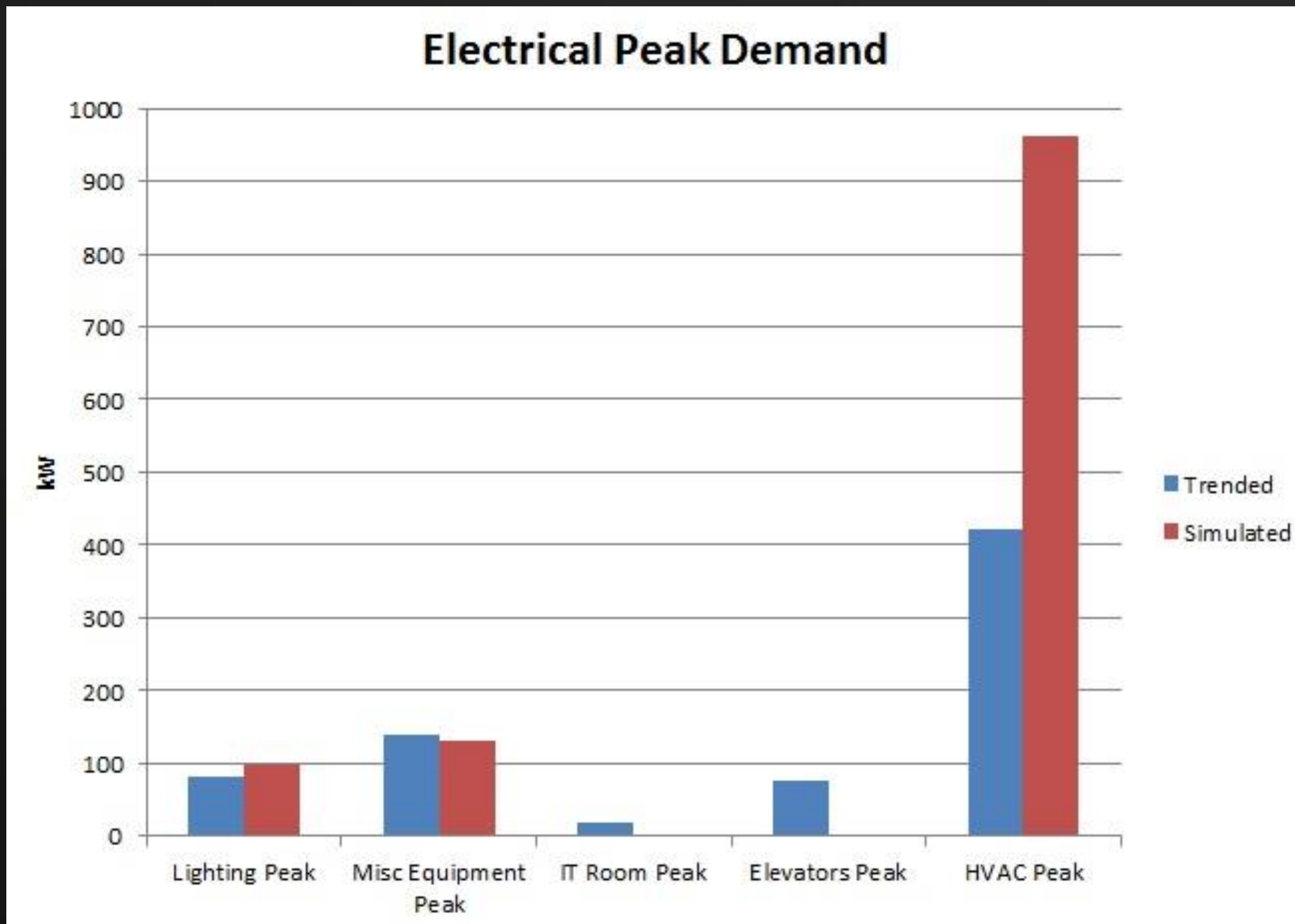
Annual Electrical Consumption



Annual Electrical Consumption

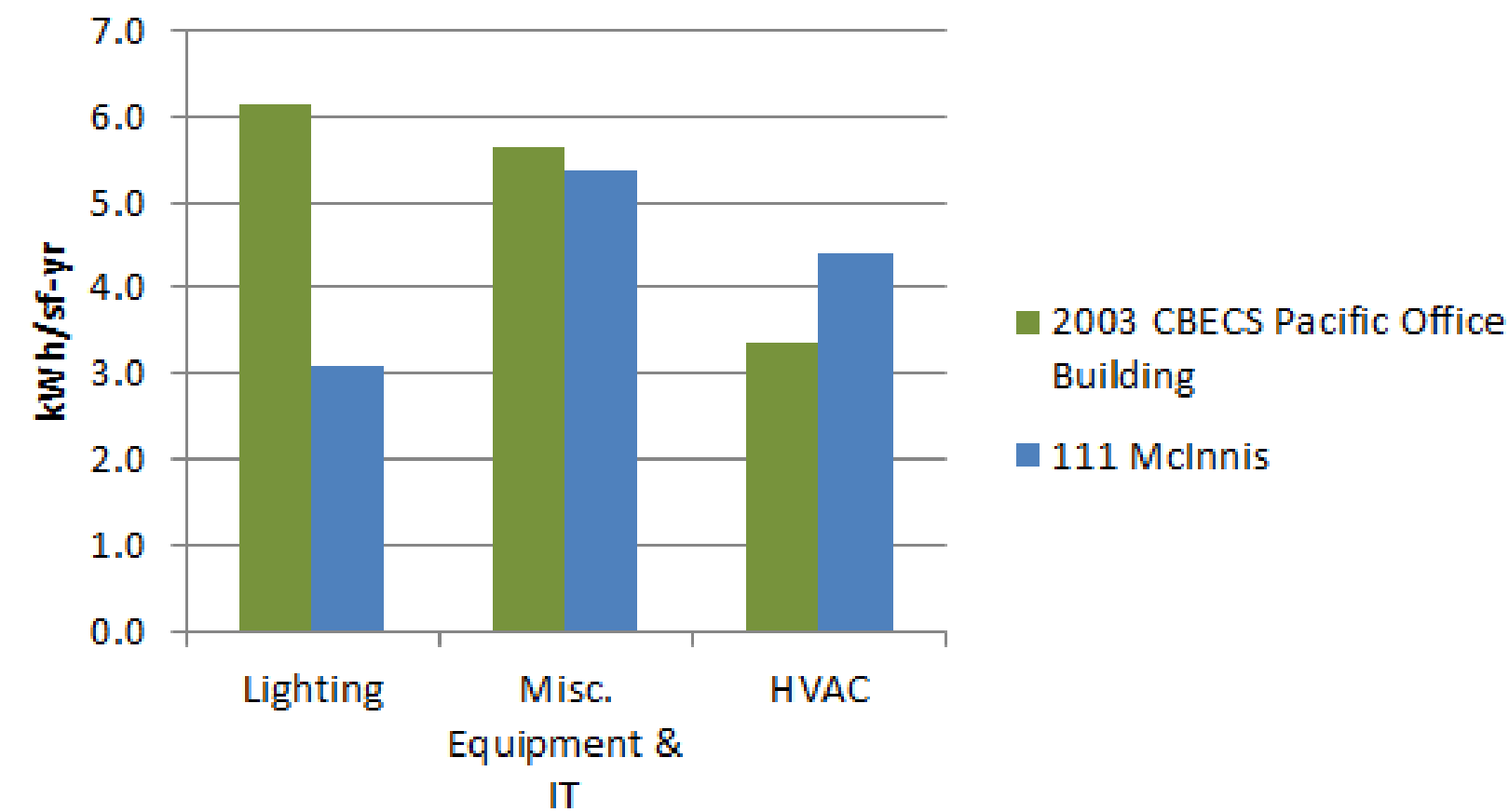


Final Results – End-Use Electrical Peak Demand

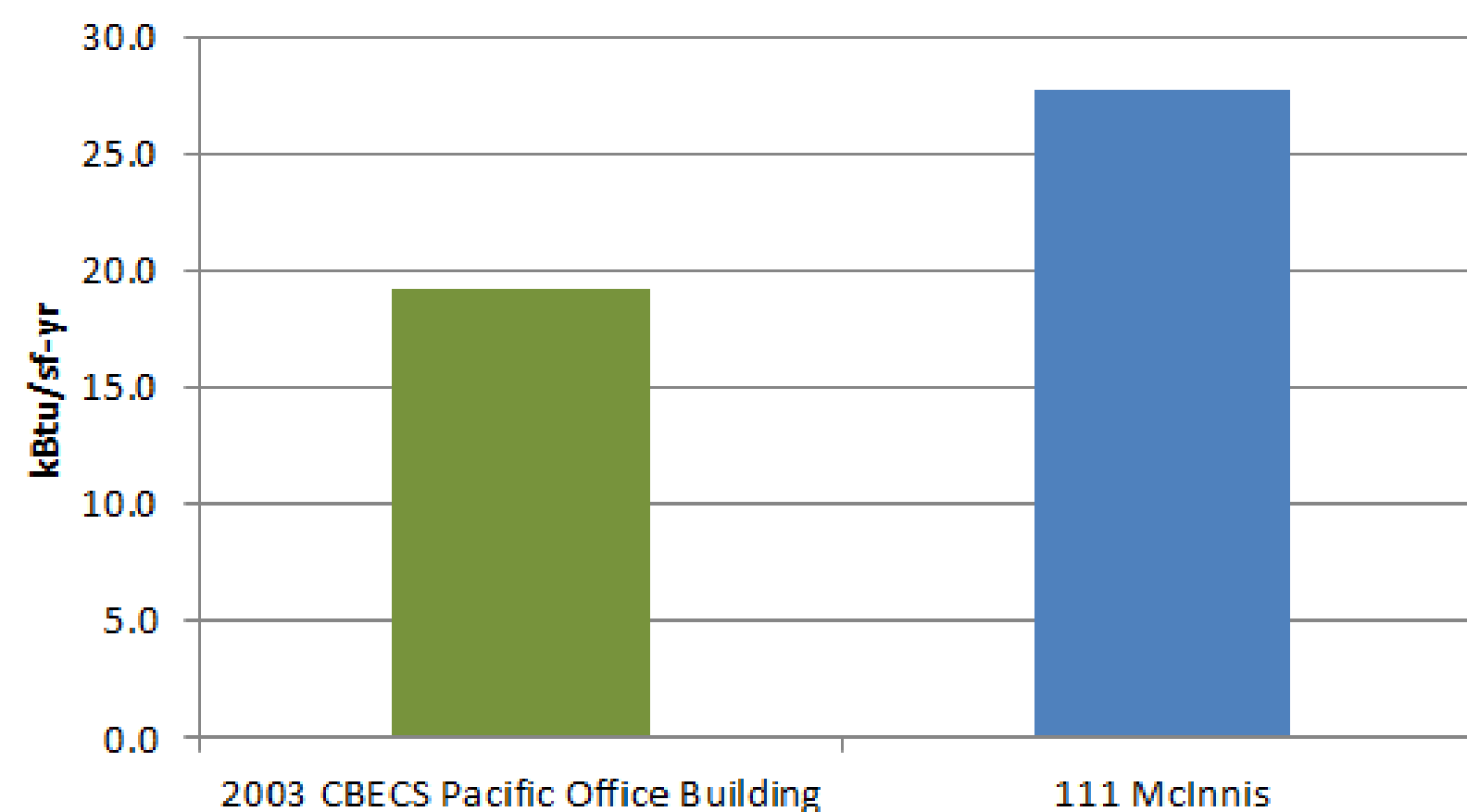


Comparing Building Energy Use to CBECS Surveyed Data

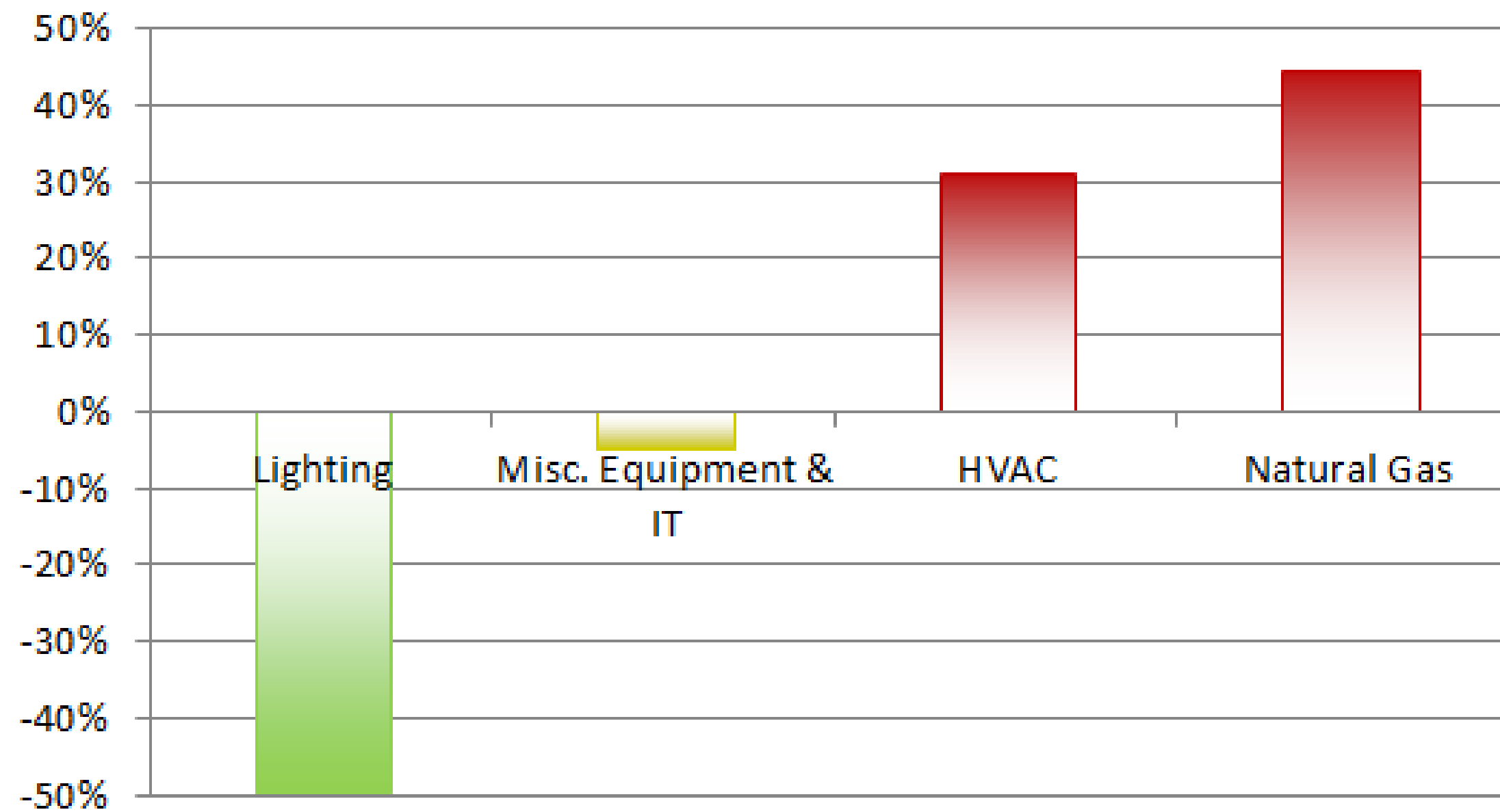
Electricity EUI Comparison



Natural Gas EUI Comparison



Percent Difference in EUI



ECM Recommendations

- Investigate window improvements to reduce thermal losses during high utility tariff rate time periods
- Install a combination of solar panels, better insulation and/or a cool roofing system when the current roof reaches its end of life
- Retro-commission the HVAC system
- Retro-commission or replace the IT HVAC system
- Implement a program to encourage employees to put their computers to sleep after hours
- Investigate the necessity other miscellaneous equipment being left on after hours
- Reduce exterior lighting by using more efficient lighting, occupancy sensors, and control strategies
- Evaluate the size and efficiency of the commercial kitchen equipment

