

Harvard, MA Public Library

BLUEPRINT

for Better Building Performance

FALL 2016 – SNAPSHOT

October , 2016

PEREGRINE 
FOCUS

Introduction

This report presents our Fall 2016 snapshot report for Harvard's energy monitoring and building performance initiative at **Harvard Public Library**. The report builds on our May 11, 2016 initial report and updates our original findings and recommendations.

The report starts with a short update on the building's overall electricity and gas use in fiscal year 2016 (FY2016) compared to the baseline use in fiscal year 2015 (FY2015), as reported by the utility meter. The report then drills down into more detail about energy use based on monitoring data. Following are the key observations that we made as a result of reviewing both utility and monitoring data for winter energy use:

- **Electricity use at Harvard Public Library has decreased by about 8%.** Most of the electricity savings occurred during the winter. Installing a new variable speed drive appears to have been a major source of the energy savings. Warmer weather this winter may have also contributed to these energy savings.
- **Natural gas use at Harvard Public Library has decreased by about 16%.** The weather-adjusted gas use increased about 2%. The winter was significantly warmer in FY2016 than the base year FY2015.

RECOMENDATIONS

The following graphs and charts report identify equipment that can potentially be scheduled more aggressively. Harvard should continue to review opportunities to turn off or turn down this equipment. The following charts and graphs highlight recommendations to reduce energy use for:

- a) Major air handling equipment
- b) Boiler operation
- c) Lighting
- d) Plug loads

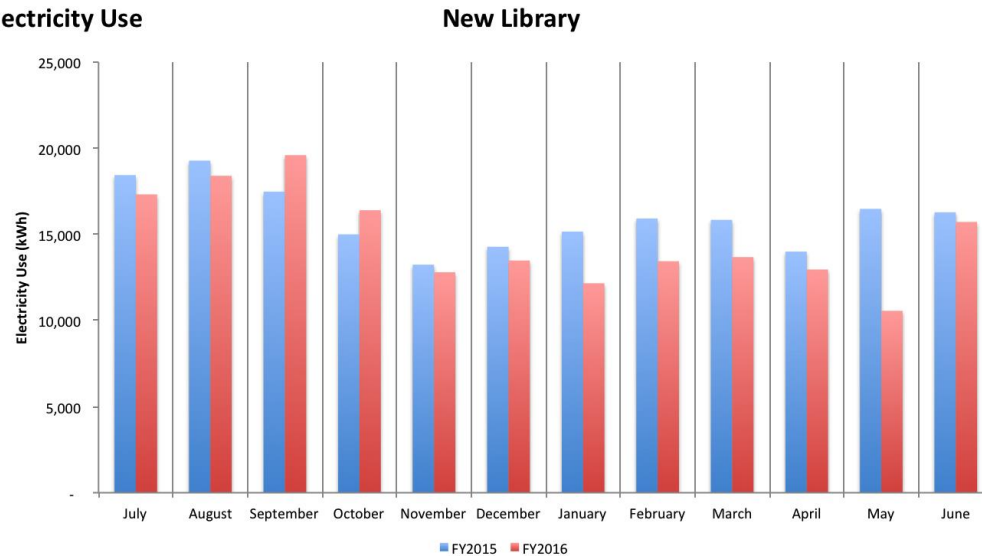
APPENDICES

At the end of the report we include one appendix titled **Appendix A Monthly Electricity Use Grouped by Major Categories**. Appendix A lists each circuit organized by major category group and subgroup. The charts include total electricity use per month per circuit from January 1, 2016 to September 30, 2016.



Utility Data: Total Electricity and Natural Gas Use

Electricity Use

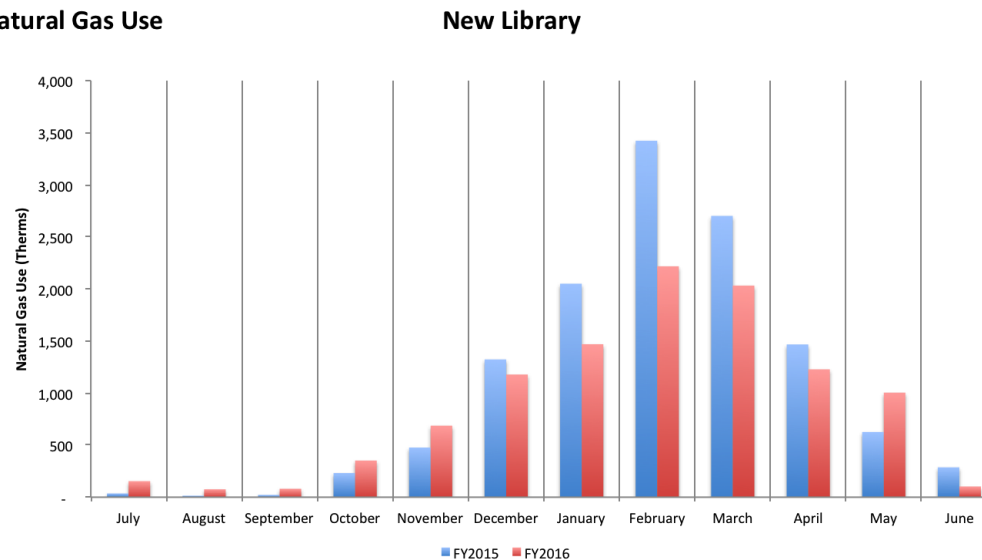


Electricity Use Table

Month of Date	Use (kWh)		Change (%)
	FY2015	FY2016	FY2016
July	18,440	17,320	-6%
August	19,280	18,400	-5%
September	17,480	19,600	12%
October	15,000	16,400	9%
November	13,240	12,800	-3%
December	14,280	13,480	-6%
January	15,160	12,160	-20%
February	15,920	13,440	-16%
March	15,840	13,680	-14%
April	14,000	12,960	-7%
May	16,480	10,560	-36%
June	16,280	15,720	-3%
Grand Total	191,400	176,520	-8%
2015/2016 12-month Target		171,570	-5%
Energy Intensity			
kBtu/ Square Foot	29.7	27.4	-2.3

This page presents electricity (top) and gas (bottom) use for the entire building as measured by the utility meters and compares energy use for FY2016 with FY2015. At the bottom of each table, the FY2016 target savings are visible in grey, just below the actual savings. Electricity use shows improvement with a target savings of 5% and actual savings of 8%. While actual gas use appears as a 16% decrease, the weather-adjusted performance sits at the very bottom of the Natural Gas Use table and shows a slight 2% increase in gas use. The energy monitoring initiative did not begin until January, 2016.

Natural Gas Use

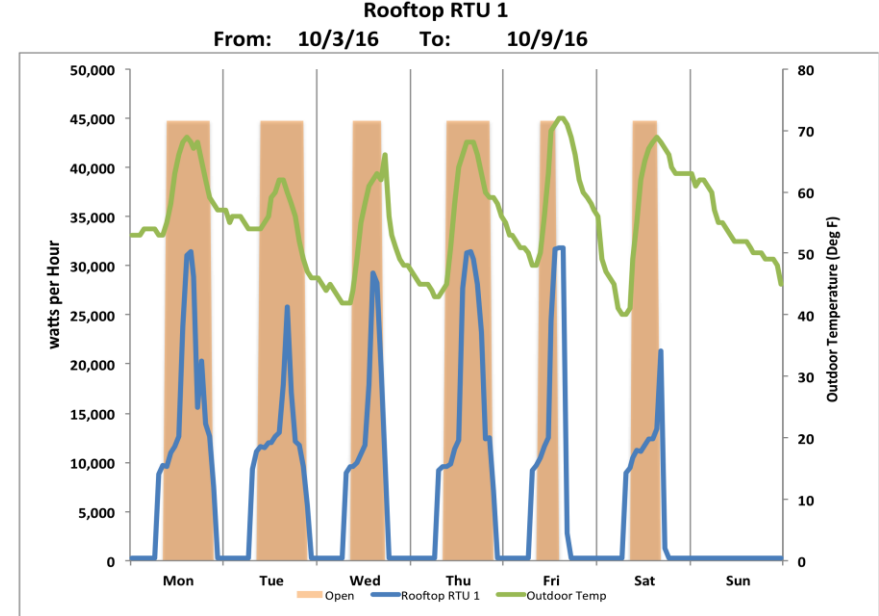
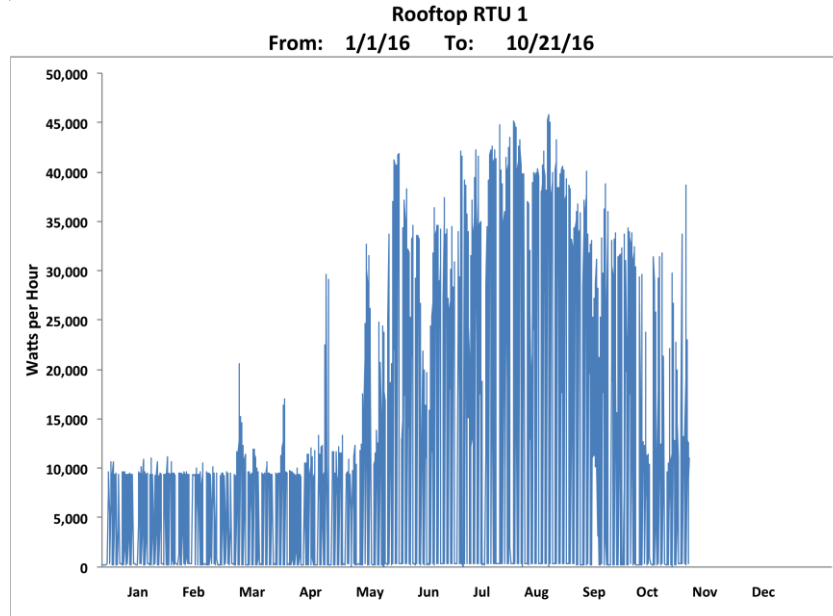


Natural Gas Use Table

Month of Date	Use (Therms)		Change (%)
	FY2015	FY2016	FY2016
July	36	154	
August	2	76	
September	22	81	
October	232	352	52%
November	477	687	44%
December	1,323	1,178	-11%
January	2,050	1,469	-28%
February	3,423	2,217	-35%
March	2,701	2,032	-25%
April	1,467	1,228	-16%
May	626	1,004	60%
June	287	103	-64%
Grand Total	12,646	10,581	-16%
2015/2016 12-month Target		12,030	-5%
Energy Intensity			
kBtu/ Square Foot	57.5	48.1	-9.4
Weather Adjusted Energy Performance			
Heating Deg Days	6,705	5,526	
BTU/SF/Deg Day	8.6	8.7	2%



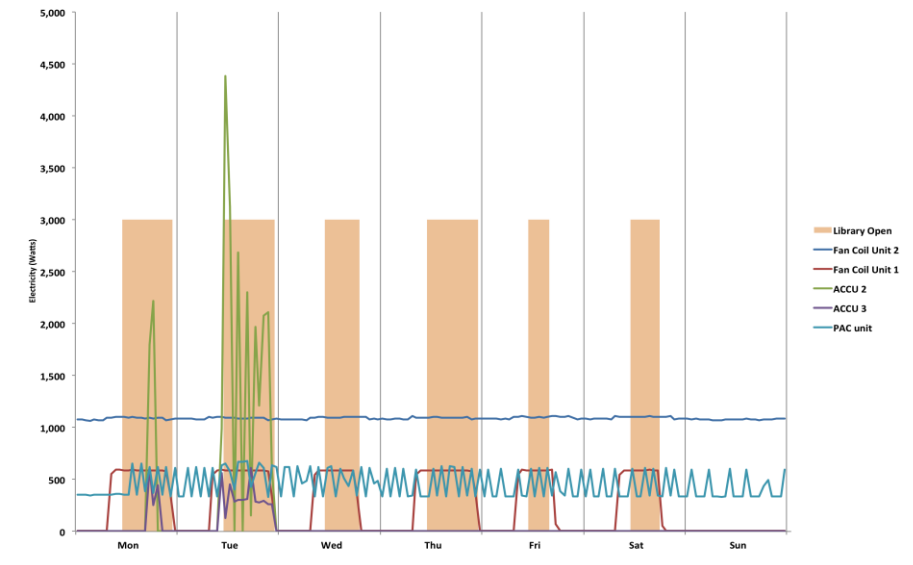
Major air handling equipment



These charts summarize electricity use for the four major heat/cooling distribution systems in the Library rooftop unit 1 (RTU1), Fan coil units 1&2, and a packaged air conditioner (PAC) unit. The two charts above are for RTU1. The chart to the right is for the fan coil units, their associated air cooled chiller units (ACCU), and a PAC unit.

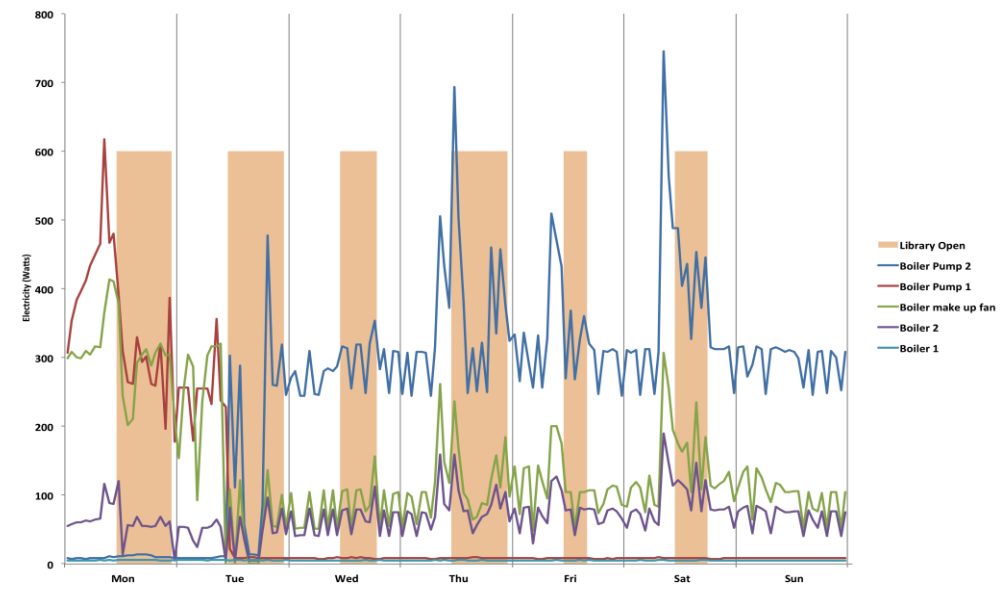
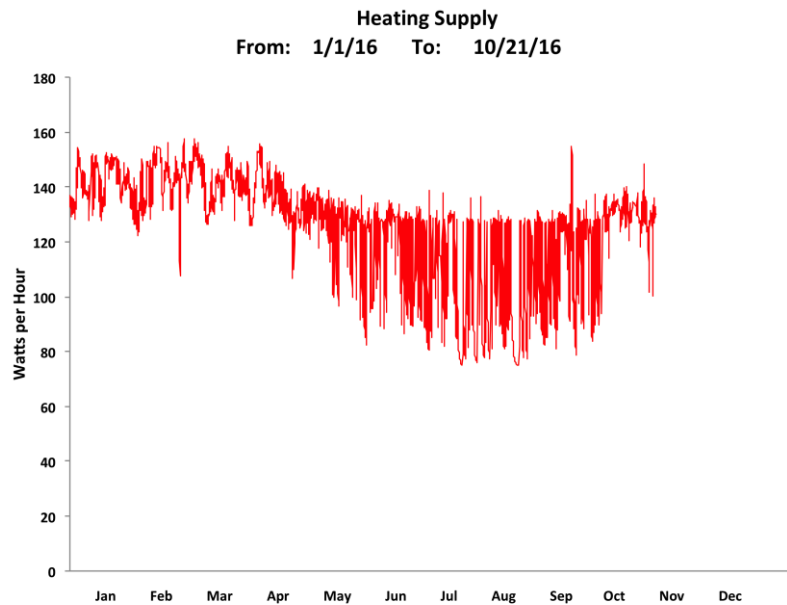
Baseline energy use for RTU1 is about 10,000 watts when the fan is on. Energy use above this level indicates that the condenser has turned on to provide air conditioning. Building management system (BMS) optimum start stop software will provide the best opportunity to reduced energy use by RTU1.

Fan coil Unit 1 follows the building schedule relatively closely. Fan coil 2 and the PAC unit appear to run independently of the library's schedule. Can Fan coil 2 and the PAC unit be turned off when the library is closed?



Boiler operation

2

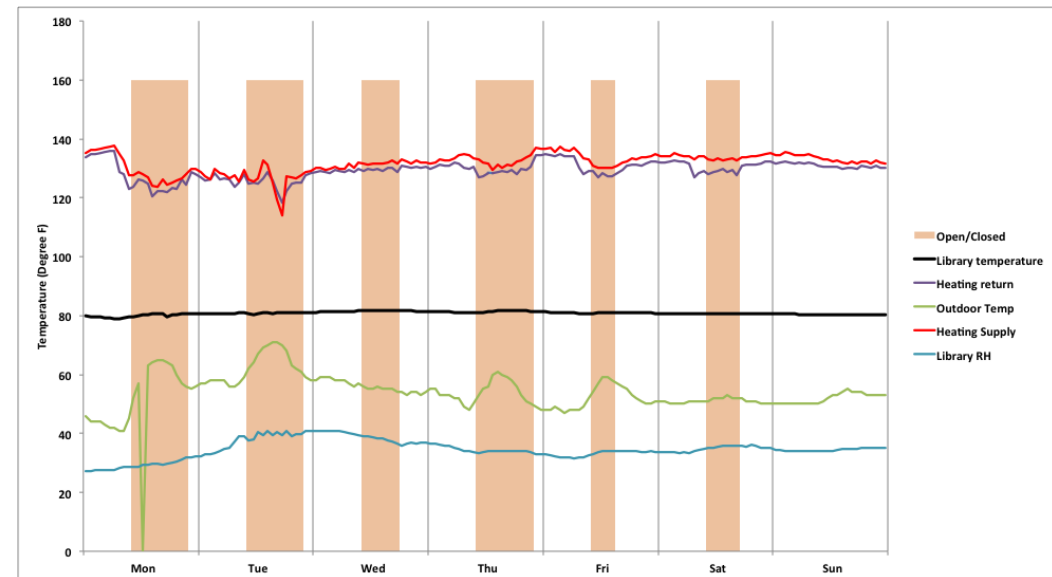


These charts summarize the performance of the boilers and related heating equipment. The chart directly above is the boiler system supply temperature. High supply water temperatures in the summer indicate that the boilers run year round either for DHW or supplemental heating.

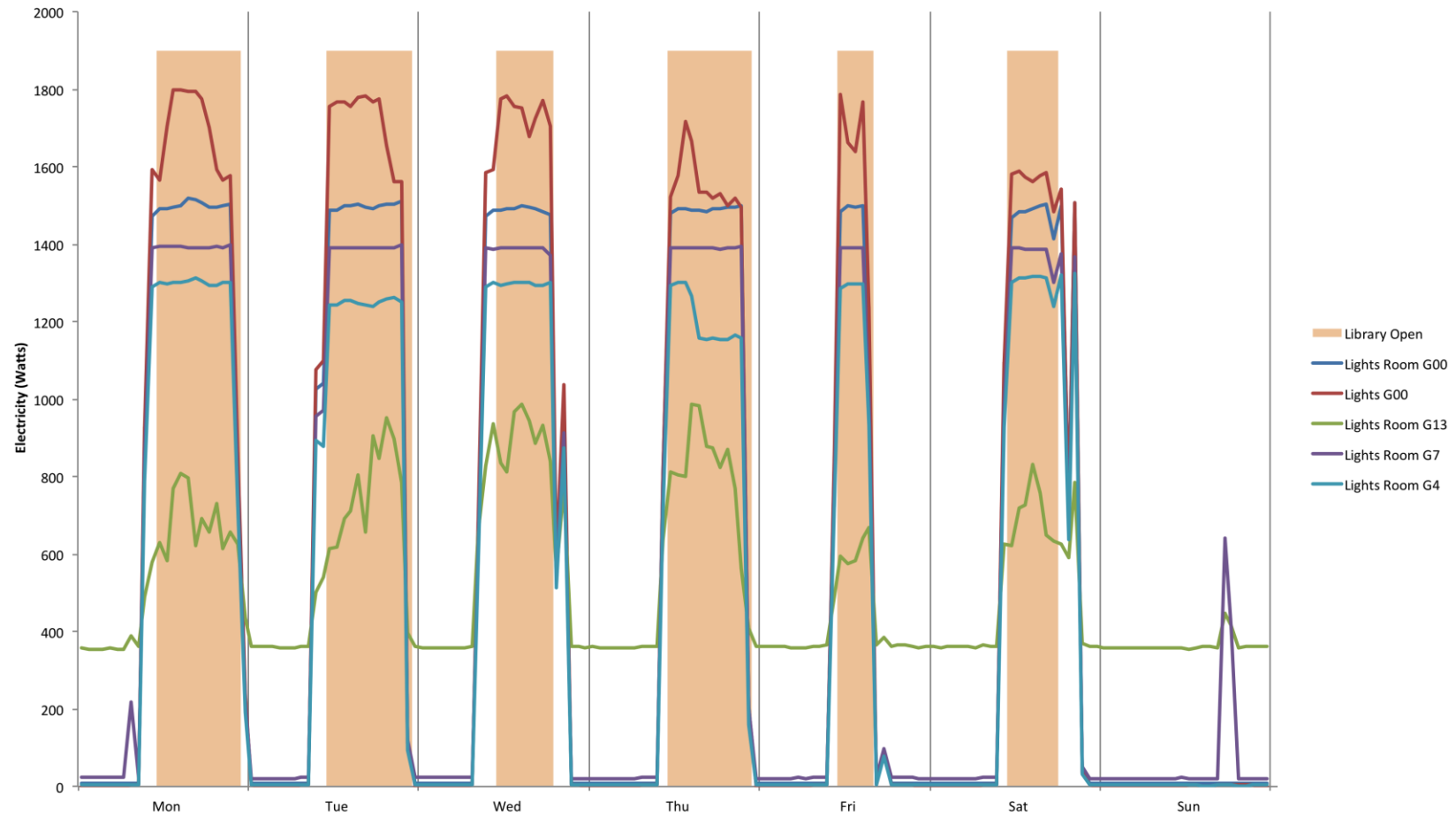
The chart above and to the right summarizes hourly electricity use for the major boiler system components the week of September 26. The pumps, boilers, and make up air fan are all variable speed and appear to be function properly. Can the boilers be turned off when the library is closed?

The chart to the right summarizes hourly average temperatures and relative humidity the week of September 26. If the room sensor hasn't been moved from the boiler room yet it should be moved to document the accuracy of the BMS temperature control settings.

Three fan-assisted unit heaters that we're monitoring consume a minimal amount of electricity.



Lighting

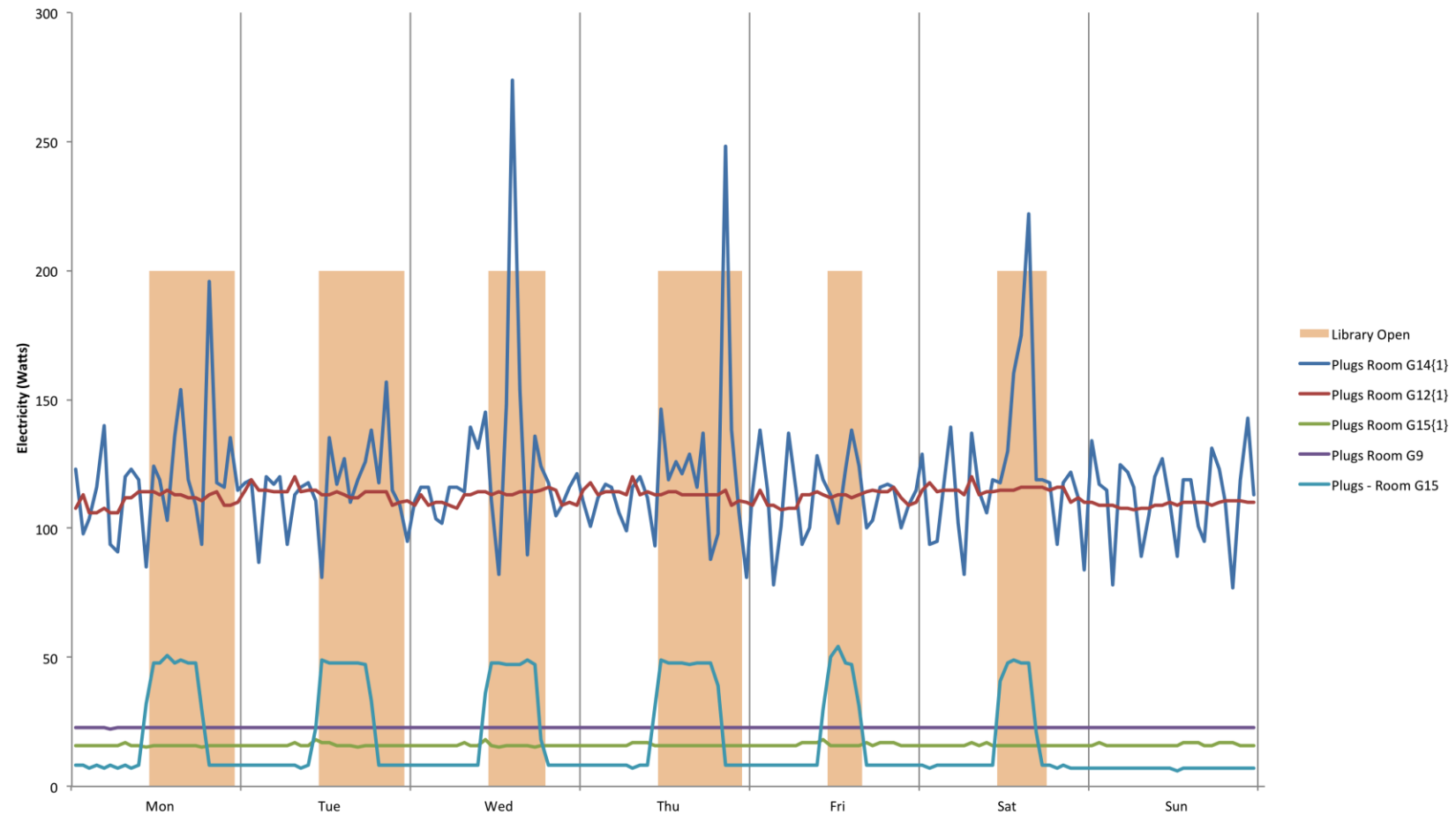


This chart summarizes energy use for five electrical circuits with the highest energy use for lighting during the week of September 26, 2016. Please refer to Appendix A for a full list of the lighting circuits and monthly energy use. With one exception these lighting circuits follow the building's occupancy very closely and turn off when the building closes. Several lights in room G13 remain on when the library closes potentially for security reasons. The lights in stair 2 and room G10 remain on at night as well.

One exterior light labelled "exterior lighting" in Appendix A appears to be on constantly 24/7. Can this light be turned off during the day?



Plug Loads



This chart summarizes energy use for five electrical circuits with the highest energy use for plug loads during the week of September 26, 2016. Plug loads include energy used for electrical outlets, computers, and minor appliances. Please refer to Appendix A for a full list of the plug load circuits and monthly energy use. The scale of energy use by plug loads is significantly lower than energy use by lighting electrical loads. As time permits, library staff can investigate the floor plug loads that have constant energy use or otherwise remain on when the building is closed. Some electric outlet loads can potentially be turned off or plugged into occupancy sensor controlled outlet strips.

Special purpose loads on five circuits are minor with average electricity use of 30 watts or less.



Appendix A Monthly Electricity Use Grouped by Major Categories

The following chart summarize monthly electricity use between January 1, 2016, and September 30, 2016 grouped by major categories and sub-categories. The charts include all the electrical circuits that are being monitored at the Library. Energy use for individual months are color coded by sub-category. Months with higher electricity use are highlighted in red and months with lower electricity use are highlighted in green.

HVAC

Description	Category	Sub Category	January kWh	February kWh	March kWh	April kWh	May kWh	June kWh	July kWh	August kWh	September kWh	Total kWh
Rooftop RTU 1	HVAC	Rooftop Unit	3,132	3,336	3,459	3,494	5,945	8,723	11,783	11,700	8,361	63,129
Fan Coil Unit 2	HVAC	Fan Coil Unit	627	506	471	385	352	393	714	711	757	5,439
Fan Coil Unit 1	HVAC	Fan Coil Unit	250	210	235	205	193	189	179	207	192	1,973
ACCU 2	HVAC	ACCU	79	74	79	76	87	435	1,119	1,076	501	3,592
ACCU 3	HVAC	ACCU	2	2	0	3	37	110	121	146	92	533
PAC unit	HVAC	Packaged AC Unit	266	249	264	260	346	468	830	973	643	4,516
Boiler Pump 2	HVAC	Heating Pump	519	416	411	314	29	96	46	39	50	2,045
Boiler Pump 1	HVAC	Heating Pump	519	478	290	171	183	28	29	34	120	1,896
Boiler make up fan	HVAC	Make Up Air Fan	366	309	233	219	165	46	31	33	109	1,586
Boiler 2	HVAC	Boiler	211	114	62	94	44	26	16	15	27	644
Boiler 1	HVAC	Boiler	10	100	111	4	4	4	4	4	4	248
Boiler shutdown relay	HVAC	Boiler Relay	7	7	7	7	7	7	7	7	7	70
Vestibule heater	HVAC	Cabinet Heater	146	131	25	9	0	0	1	1	0	312
CUH	HVAC	Cabinet Heater	31	27	14	8	1	0	0	0	7	101
Electrical room unit heater	HVAC	Electric Unit Heater	16	15	16	16	16	16	16	16	16	155
Building automation	HVAC	BMS	84	77	87	85	88	85	88	88	85	824
Ground floor bath exhaust	HVAC	Bath Exhaust	43	46	45	42	43	41	44	44	48	422
DHW Heater	HVAC	DHW heater	89	90	107	78	95	75	67	75	77	810
DHW recirculation pump	HVAC	DHW recirc	11	11	11	11	2	0	0	0	0	46
Total			6,409	6,196	5,927	5,482	7,637	10,741	15,097	15,170	11,098	88,343

Lighting

Description	Category	Sub Category	January kWh	February kWh	March kWh	April kWh	May kWh	June kWh	July kWh	August kWh	September kWh	Total kWh
Lights Room G00	Lighting	Indoor	391	382	458	373	426	410	343	412	399	3,594
Lights G00	Lighting	Indoor	436	377	401	294	343	376	349	435	431	3,441
Lights Room G13	Lighting	Indoor	367	335	337	319	326	344	345	365	359	3,097
Lights Room G7	Lighting	Indoor	424	340	294	251	274	330	317	419	393	3,041
Lights Room G4	Lighting	Indoor	356	319	340	264	286	275	231	347	344	2,762
Lights Room G00{1}	Lighting	Indoor	317	303	326	253	284	293	266	325	313	2,681
Stair 2 lights	Lighting	Indoor	280	262	279	255	274	282	272	286	278	2,468
Lights Room G4{1}	Lighting	Indoor	277	245	253	204	235	267	251	309	295	2,336
Lights Room G15	Lighting	Indoor	185	184	214	171	183	190	141	162	163	1,593
Lights Room 112	Lighting	Indoor	143	141	167	147	148	149	113	108	97	1,214
Lights Room 111	Lighting	Indoor	138	140	168	134	136	142	118	101	87	1,164
Lights - Room G10	Lighting	Indoor	73	68	72	70	72	71	75	75	71	648
Lights Room 2008	Lighting	Indoor	59	52	68	51	123	20	21	113	109	615
Lighting Room 208	Lighting	Indoor	51	51	93	46	109	17	19	107	97	591
Lights Room G4{2}	Lighting	Indoor	58	52	60	49	56	54	45	55	53	482
Lights Room G01	Lighting	Indoor	43	32	37	24	35	24	27	23	19	264
Exterior lighting	Lighting	Outside	104	97	104	101	106	103	107	106	101	930
Exterior lights	Lighting	Outside	30	26	27	23	24	25	25	28	27	234
Pole light	Lighting	Outside	23	18	14	9	5	4	4	6	11	95
Lighting control panel	Lighting	Control	26	25	27	25	27	26	26	27	26	234
Total			3,782	3,450	3,738	3,063	3,473	3,403	3,096	3,808	3,673	31,486



Plug Loads

Description	Category	Sub Category	January kWh	February kWh	March kWh	April kWh	May kWh	June kWh	July kWh	August kWh	September kWh	Total kWh
Refrigerator Room G14	Plug Loads	Appliance	37	34	40	38	42	40	39	41	43	354
Dishwasher Room G14	Plug Loads	Appliance	13	12	13	13	13	13	13	13	13	115
Water cooler	Plug Loads	Appliance	2	2	3	3	3	4	4	4	4	29
Plugs Room G14{1}	Plug Loads	Outlets	88	82	88	83	86	83	84	85	83	763
Plugs Room G12{1}	Plug Loads	Outlets	10	10	10	10	14	68	85	84	83	374
Plugs Room G15{1}	Plug Loads	Outlets	39	37	23	20	22	17	16	18	16	210
Plugs Room G9	Plug Loads	Outlets	17	16	17	17	17	16	17	17	17	151
Plugs - Room G15	Plug Loads	Outlets	12	11	13	12	11	11	10	12	12	103
Plugs Room G08{1}	Plug Loads	Outlets	8	11	9	10	12	12	8	10	9	89
Plugs Room G14	Plug Loads	Outlets	2	2	3	2	5	3	2	3	3	25
Plugs Room G15	Plug Loads	Outlets	10	9	1	0	0	0	0	1	0	21
Plugs Room G08	Plug Loads	Outlets	12	9	0	0	0	0	0	0	0	20
Plugs Room G12	Plug Loads	Outlets	1	2	1	1	1	1	1	1	1	9
Plugs Room G08{2}	Plug Loads	Outlets	6	1	1	1	0	0	0	0	0	9
Total			257	237	221	209	225	269	279	289	285	2,273

Special Purpose

Description	Category	Sub Category	January kWh	February kWh	March kWh	April kWh	May kWh	June kWh	July kWh	August kWh	September kWh	Total kWh
Fire Alarm Auxiliary Power	Special	Fire Alarm	26	25	27	26	27	25	26	27	26	235
Security panel	Special	Emergency	25	23	25	24	25	25	26	26	25	223
Trap primer	Special	Trap Primer	14	13	14	14	14	14	14	14	14	126
Sewer Pump	Special	Sewer Pump	11	10	10	9	10	8	9	10	10	86
Sprinkler compressor	Special	Compressor	1	0	0	0	0	0	0	1	1	4
Total			77	71	76	73	77	73	76	77	74	674

