

Executive Summary

University - Recreation Center, March 2021



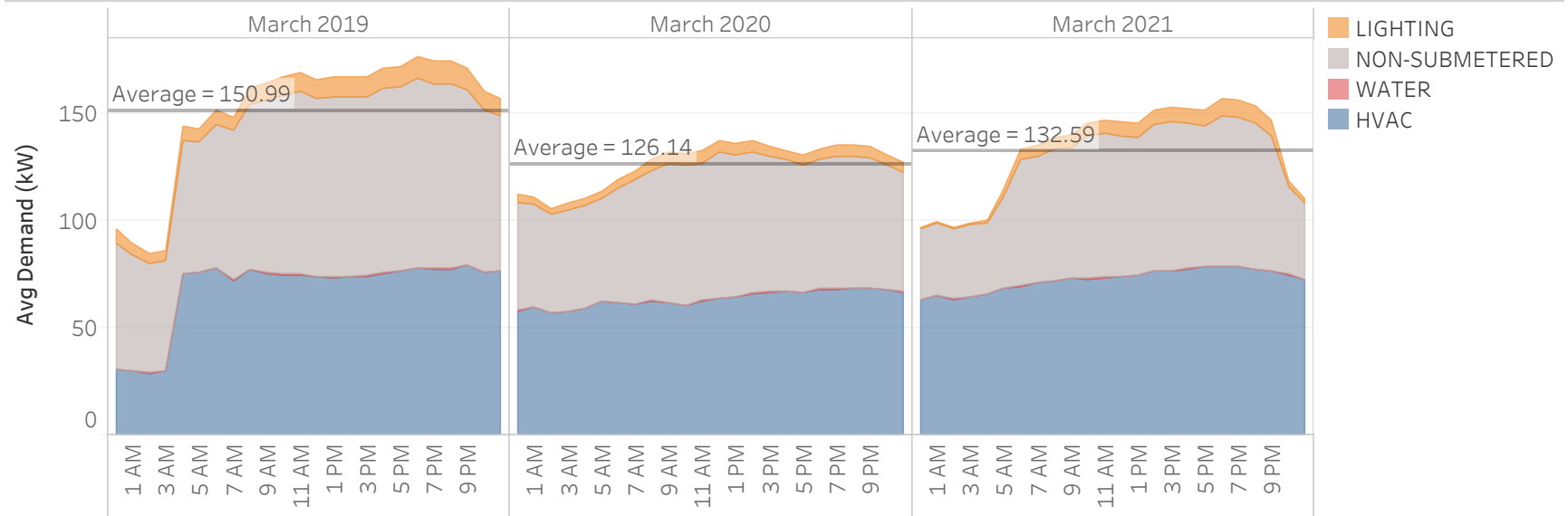
Analysis

This report presents the analyses and insights regarding the data collected in March 2021 in the New York Energy Manager platform for the University Recreation Center. It is important to notice that because of the social distancing measures implemented in NY state because of the COVID-19 pandemic, the usage and occupancy of the building were certainly much different than they were in March 2020. To illustrate that change, this report focuses on Year-over-Year comparisons of energy usage patterns and KPIs. The KPI table shows a 4% increase in the HVAC Intensity KPI, associated with a modest increase in the total HVAC load, and a slight increase in the total degree days. The Lighting intensity experienced a 8% increase in this period and the Average Demand increased 5%, and the Peak Demand had a slight decrease of 7%. The reductions on the AHU loads for this month were not included in the total savings coming from the ECM implementation back in February 2019, since those load reductions cannot, in any way, be attributed to the changes in schedules and set points implemented back then. The AHUs have not been operating on that schedule and their load reductions are just a consequence of the building remaining only partially occupied in this period and, more importantly, utilizing supplemental cooling, which is not included in the submetered HVAC loads.

KPI's Table - March 2021

	March-2021	March-2020	% Change
HVAC Electric Intensity (kWh/(1000sqft*DD))	0.905	0.872	3.74
Lighting Electric Intensity (kWh/(day*1000sqft))	1.403	1.304	7.64
Lighting Runtime (%ON)	39.3%	39.1%	0.49
Peak Demand (kW)	187.0	200.4	(6.67)
Average Demand (kW)	132.59	126.14	5.12
Load Factor (Average/Peak %)	0.71	0.63	12.68

Average Daily Load Profile Year over Year - March 2021



Total Consumption Overview

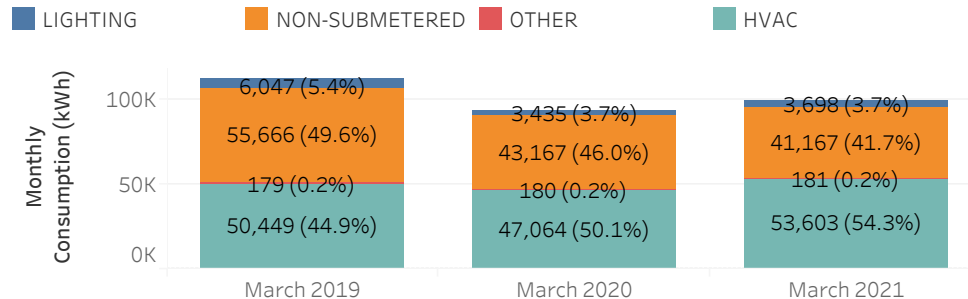
University - Recreation Center, March 2021



Analysis

In March 2021, 54% of the electricity consumption was attributed to submetered HVAC units, 4% to submetered lighting panels and the remaining 42% from non-submetered systems. HVAC loads had a 14% increase this month compared to March 2020. The non-submetered loads had a slight decrease of 5%, and the Lighting loads were increased by 8%. Altogether the total monthly consumption had a 5% increase in comparison to the previous year. On the asset level, 70% consuming units had a significant increase in consumption in the year over year comparison (up to 44%, 47% and 42% increase for UH_3_3, AHU 1 Supply, AHU 3 Return respectively). AHU 2 Return and AHU 2 Supply, had modest increases in consumption (19, 15% respectively). It is noteworthy that the reduction in the non-submetered portion of the load might be related to a lower overall occupancy this month, when compared to last year, because of the social distancing measures implemented to fight the COVID-19 pandemic.

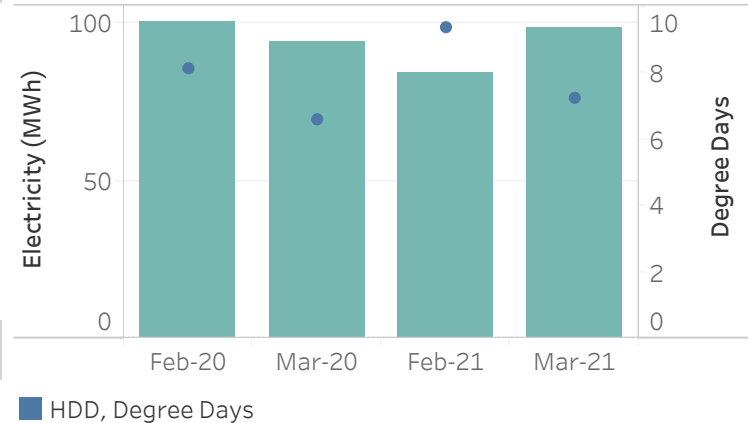
Electricity Breakdown



Top 10 Consumers - March 2021

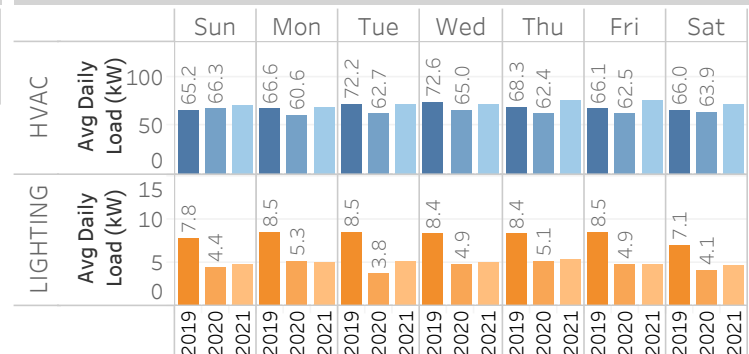
		Current Month Consumption (kWh)	Current Month Estimated Consumption Cost (\$)	Avg Daily kWh (Same Month Prior Year)	Avg Daily kWh (Current Month)	Avg YoY kWh Variance %
AHU 2 Supply	HVAC	8,110	949	228	262	14.75
AHU 3 Supply	HVAC	7,099	831	173	229	32.07
AHU MAC	HVAC	5,907	691	161	191	18.40
AHU 1 Supply	HVAC	4,507	527	99	145	46.72
AHU 3 Return	HVAC	4,207	492	95	136	42.36
AHU Gym	HVAC	3,927	459	188	127	(32.69)
AHU 2 Return	HVAC	3,452	404	94	111	18.95
UH_3_3	HVAC	2,639	309	59	85	43.95
AHU B Supply	HVAC	1,391	163	70	45	(36.03)
HWP 2	HVAC	1,073	126	79	35	(56.34)

Electricity and Heating/Cooling Degree Days



	Electricity (MWh)	Main Load Cost (\$)	CDD	HDD
Feb-20	100.56	11,766	0	782
Mar-20	93.76	10,970	0	635
Feb-21	84.04	9,833	0	901
Mar-21	98.53	11,528	0	697

Weekly Pattern - March 2021



ECM Tracking - AHUs Ramp Down

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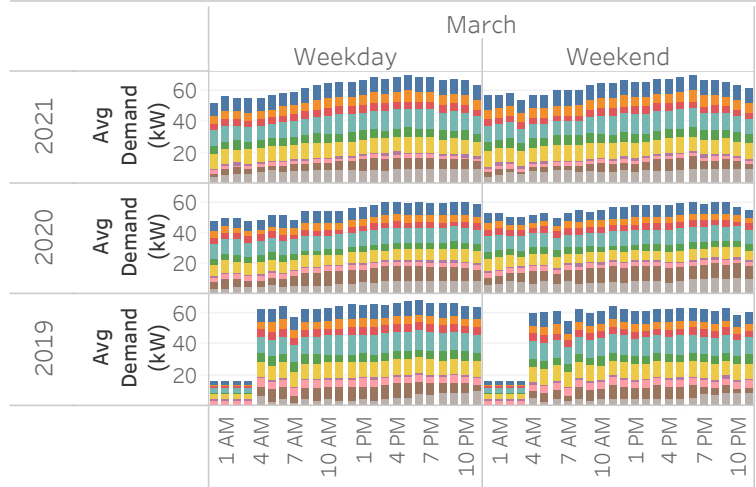


NY Energy Manager

Analysis

Phase 1 (from February to April 2019) and Phase 2 (starting in May 2019 and ongoing) of an Energy Conservation Measure (ECM) recommended by NYEM were implemented on all Air Handling Units in this facility. The ECM included changes on the AHUs schedules and certain set points. The chart on the right illustrates how the daily load curves of the AHUs have changed when comparing the periods before (2018) and after (2019, 2020, 2021) the ECM implementation. Over the course of this last month, when compared to the baseline of March 2019, these AHUs have saved an average of 168 kWh per day. AHUs Gym and MAC combined were responsible for 51% of that (85 kWh). Through the whole month of March 2020, keeping the baseline as the same month of 2019, the savings amounted to 5208 kWh. It is important to notice, though, that those savings were not added to the total ECM savings since, this month, they were a result of the changes in occupancy and operation due to the social distancing measures implemented to fight the COVID-19 pandemic.

Hourly Load by Asset



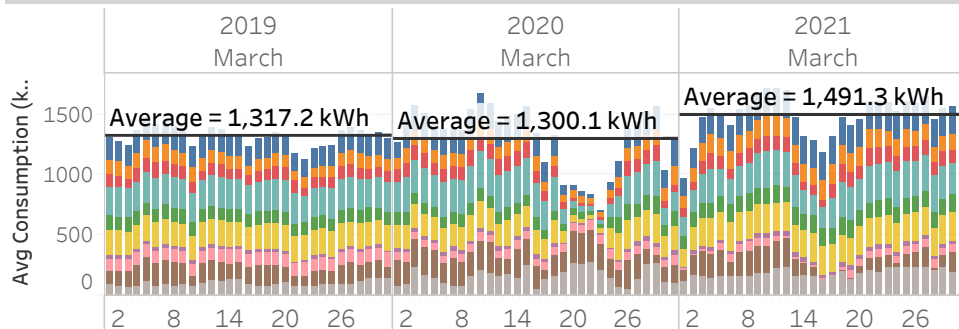
Savings Achieved - HVAC

	Electricity Saving..	Dollars Saved (\$)	Emissions Saving..
1st Year Post-ECM (Feb-19 to Jan..	164,503 kWh	\$19,247	195,101 lbs
Feb-20*	7,530 kWh	\$881	8,931 lbs
Mar-20**	10,736 kWh	\$1,256	12,733 lbs
Grand Total	182,770 kWh	\$21,384	216,765 lbs

* Savings could be overestimated due to operational changes related to the use of supplemental equipment.

** Savings calculations strongly influenced by social distancing measures to fight the COVID-19 pandemic.

Daily Consumption by Asset



AHU Savings Breakdown by Asset

	Daily Consumption (kWh)	Baseline Daily Consumption	Delta Daily Consumption - Savings kWh
AHU 1 Return	210	229	20
AHU 1 Supply	136	118	-17
AHU 2 Return	106	104	-2
AHU 2 Supply	228	276	48
AHU 3 Return	128	128	0
AHU 3 Supply	211	248	37
AHU B Return	32	31	-2
AHU B Supply	106	105	-1
AHU Gym	157	184	27
AHU MAC	142	200	58
Grand Total	1,456	1,624	168

Peak Load Analysis

University - Recreation Center, March 2021



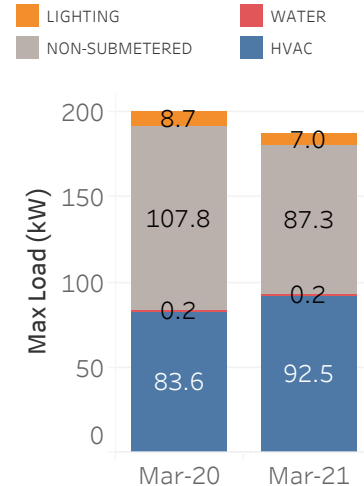
Analysis

This month's peak occurred on Friday, March 5th at 3:15 PM. The peak demand at that time was 200 kW and the main contributors to the peak load were UH_3_3, AHU Gym, AHU MAC, AHU 2 Supply, AHU 3 Supply, and AHU1 Return. These 7 assets together accounted for about 64% of the peak load.

This month the contribution to the total from the non-submetered portion of the peak load represented 47% of the total (87.3 kW), a 19% reduction in kW than in the previous year (107.8 kW).

The total peak load had a minor decrease in comparison to the previous year (7%), resulting mostly from the decrease on the non-submetered load on peak. It is noteworthy that while a lower occupancy due to the social distancing measures implemented in NY state could have contributed to a lower peak, the requirement of an increased outside air input for sanitary reasons might also have increased the building thermal load and, thus, the peak load.

Peak Breakdown by Categ..



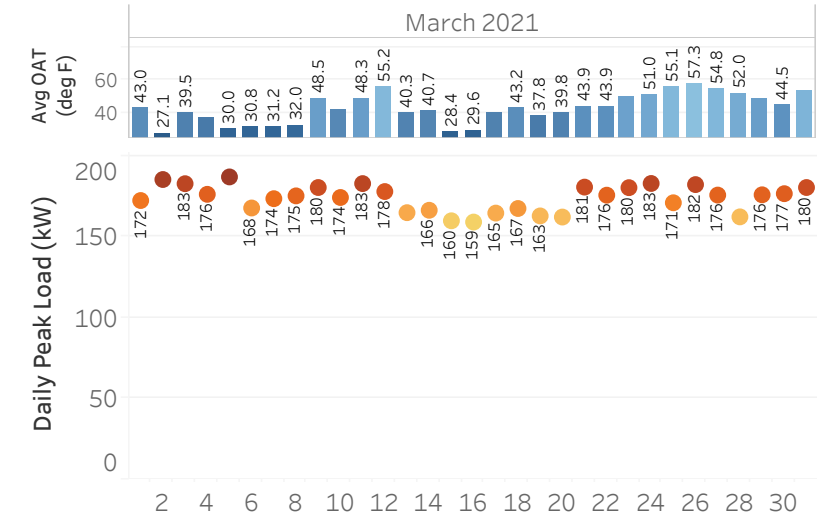
Top Contributors to the Peak

		Thu, 3/5/2020 9:30 PM		Fri, 3/5/2021 3:15 PM	
Main Load Peak (kW)		200.4		187.0	
Asset	% of Total		Load on Peak (kW)		
	Mar-20	Mar-21	Mar-20	Mar-21	
UH_3_3	2.15%	7.77%	4.31	14.53	
AHU 2 Supply	6.28%	6.60%	12.59	12.33	
AHU Gym	5.43%	5.72%	10.88	10.70	
AHU 3 Supply	5.00%	5.19%	10.01	9.70	
AHU MAC	5.46%	5.06%	10.94	9.47	
AHU 1 Return	4.83%	4.90%	9.68	9.17	
AHU 1 Supply	2.62%	3.49%	5.25	6.52	
AHU 3 Return	2.50%	3.22%	5.01	6.03	
AHU 2 Return	2.63%	3.11%	5.27	5.82	
AHU B Supply	1.45%	1.53%	2.91	2.87	
HWP 1	0.00%	1.35%	0.00	2.53	
Common Area Ltg	0.82%	0.88%	1.65	1.64	
AHU B Return	0.62%	0.81%	1.25	1.52	
Gym_Zone_1_Ltg	0.57%	0.61%	1.14	1.14	
HWP 2	1.28%	0.00%	2.56	0.00	

Peaks by Day and Hour (kW) - March 2021

	Sun	Mon	Tue	Wed	Thu	Fri	Sat
12 AM	145.38	138.35	145.39	155.77	151.67	155.40	141.31
1 AM	144.73	137.97	140.18	135.00	142.97	140.97	138.72
2 AM	139.64	138.60	146.86	139.93	143.34	156.22	145.38
3 AM	150.48	141.00	142.12	137.95	148.88	147.46	141.05
4 AM	152.52	135.83	150.10	140.18	155.02	145.33	151.77
5 AM	140.39	162.43	154.58	160.94	159.74	173.08	139.10
6 AM	149.38	175.19	172.62	178.49	188.54	172.10	134.24
7 AM	163.11	182.79	173.73	180.10	191.13	188.70	157.71
8 AM	173.58	176.86	182.78	186.71	176.48	188.91	160.46
9 AM	177.16	174.76	174.99	186.98	181.48	196.22	180.04
10 AM	176.16	173.20	191.79	189.74	184.60	197.47	185.64
11 AM	177.17	190.15	181.15	181.34	189.16	178.92	180.85
12 PM	188.85	189.91	185.92	182.84	182.24	175.89	164.19
1 PM	165.78	186.93	192.13	182.82	184.38	179.13	172.86
2 PM	193.19	186.30	183.78	184.14	178.14	185.33	172.68
3 PM	185.56	184.05	188.14	182.76	186.44	194.26	173.95
4 PM	206.53	188.87	187.82	188.75	197.55	185.82	177.54
5 PM	189.80	192.92	181.65	190.15	188.37	187.87	186.65
6 PM	180.69	189.28	194.92	190.49	196.13	211.94	197.79
7 PM	176.68	190.82	190.65	191.19	197.06	207.71	180.86
8 PM	188.14	193.03	214.98	181.15	197.93	199.56	183.06
9 PM	179.01	183.86	207.96	191.31	200.35	185.65	187.87
10 PM	158.40	194.80	198.87	211.48	197.66	158.52	157.92
11 PM	152.79	183.30	195.95	182.57	183.15	158.69	152.55

Peaks by Day



University - Recreation Center, March 2021

HVAC Dashboard Analysis

The highest HVAC loads in the building this month corresponded to the AHUs. This dashboard provides insights on which of those units were the highest energy consumers in this period, namely, AHUs 1 Return, AHU 2, 3 Supply.

For those and many other units we can see the temporal patterns by hour of day highlighting the percentage of total load by time interval as well as their daily and monthly consumption, the corresponding costs and CO₂ emissions. Most of the main AHUs have been operating with a practically constant load throughout the day, and implementing load variation ECM's could lead to significant savings.

Total Consumption HVAC Year over Year

	Avg. %On		kWh \$		lbs CO2 Emissi..		Avg Daily kWh		Total kWh	
Asset	Mar-20	Mar-21	Mar-20	Mar-21	Mar-20	Mar-21	Mar-20	Mar-21	Mar-20	Mar-21
AHU 2 Supply	73%	83%	\$827	\$949	8,382	9,618	228	262	7,067	8,110
AHU 3 Supply	70%	92%	\$629	\$831	6,375	8,419	174	229	5,375	7,099
AHU 1 Return	69%	91%	\$596	\$785	6,037	7,960	165	216	5,090	6,711
AHU MAC	58%	68%	\$584	\$691	5,916	7,005	161	191	4,989	5,907
AHU 1 Supply	60%	87%	\$359	\$527	3,643	5,346	99	145	3,072	4,507
AHU 3 Return	62%	87%	\$346	\$492	3,505	4,989	95	136	2,955	4,207
AHU Gym	69%	46%	\$683	\$459	6,920	4,657	188	127	5,834	3,927
AHU 2 Return	61%	72%	\$340	\$404	3,442	4,095	94	111	2,902	3,452
UH_3_3	17%	24%	\$214	\$309	2,174	3,130	59	85	1,833	2,639
AHU B Supply	34%	22%	\$254	\$163	2,579	1,650	70	45	2,175	1,391
HWP 2	43%	19%	\$288	\$126	2,915	1,273	79	35	2,458	1,073
AHU B Return	67%	73%	\$99	\$107	1,001	1,090	27	30	844	919
HWP 1	11%	23%	\$46	\$100	465	1,009	13	27	392	850
CWP 2	0%	18%	\$0	\$99	0	1,004	0	27	0	847
Grand Total	49%	58%	\$5,263	\$6,042	53,354	61,245	1,454	1,666	44,987	51,640

Savings per Daily Hour Off

Asset	Yearly kWh Reduction	Yearly CO2 Reduction	Yearly kWh Reduction \$
AHU 2 Supply	3,500	4,152	\$410
AHU 3 Supply	3,384	4,014	\$396
AHU 1 Return	3,114	3,693	\$364
AHU MAC	2,377	2,819	\$278
AHU 1 Supply	2,087	2,475	\$244
AHU 3 Return	2,027	2,404	\$237
UH_3_3	1,859	2,204	\$217
AHU 2 Return	1,464	1,736	\$171
AHU Gym	1,161	1,377	\$136
AHU B Supply	681	807	\$80
HWP 2	539	639	\$63
HWP 1	438	519	\$51
AHU B Return	429	508	\$50
HTHWP 1	389	461	\$45
Grand Total	23,447	27,809	\$2,743

HVAC Runtime by Hour of Day

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Lighting Dashboard

University - Recreation Center, March 2021



Analysis

Either directly or indirectly due to social distancing measures implemented in NY state because of the COVID-19 pandemic, which made the building only partially occupied in this period, and might have led to a stricter lighting schedule, most of the lighting circuits had significantly lower consumption this month in comparison to the previous year. Common Area, Weight and Fitness Area and Gym Zone 1, respectively, were the circuits with the highest consumption this month and overall, all circuits had a good load variation through the day. The Track Lighting 1st Floor continues to be a significant load and continues to behave as if the circuits/meters have been actually mislabeled and the labels for the Track lights on the 1st floor are actually swapped with Exterior lighting.

Total Consumption Lighting Year over Year

Asset	Avg. %On		kWh \$		lbs CO2 Emissions		Avg Daily kWh		Total kWh	
	Mar-20	Mar-21	Mar-20	Mar-21	Mar-20	Mar-21	Mar-20	Mar-21	Mar-20	Mar-21
Common Area Ltg	71%	67%	\$103	\$98	1,046	997	29	27	882	840
Exterior Lighting	63%	54%	\$6	\$5	58	50	2	1	49	42
Fitness Area Ltg	71%	65%	\$32	\$29	322	298	9	8	271	251
Gym_Zone_1_Ltg	25%	33%	\$45	\$59	452	594	12	16	381	501
Gym_Zone_2_Ltg	19%	25%	\$29	\$39	290	396	8	11	245	334
Gym_Zone_3_Ltg	27%	33%	\$38	\$47	390	478	11	13	329	403
MAC_Zone_1_Ltg	18%	21%	\$22	\$25	221	255	6	7	186	215
MAC_Zone_2_Ltg	16%	22%	\$21	\$28	215	282	6	8	181	238
Track Lighting 1st..	52%	51%	\$33	\$33	333	333	9	9	281	280
Track Lighting 2n..	3%	2%	\$1	\$1	8	7	0	0	7	6
Weight_Fitness Ltg	72%	68%	\$73	\$69	738	697	20	19	622	587
Grand Total	40%	40%	\$402	\$433	4,074	4,386	111	119	3,435	3,698

Savings Per daily hour off - Lighting

Asset	Yearly kWh Reduction	Yearly CO2 Reduction	Yearly kWh Reduction \$
Track Lighting 1st Flr	254.6	302.0	\$30
Common Area Ltg	95.2	113.0	\$11
Weight_Fitness Ltg	66.7	79.0	\$8
Gym_Zone_1_Ltg	59.7	70.8	\$7
Gym_Zone_3_Ltg	47.9	56.8	\$6
Gym_Zone_2_Ltg	40.4	47.9	\$5
MAC_Zone_2_Ltg	35.2	41.7	\$4
MAC_Zone_1_Ltg	33.2	39.4	\$4
Fitness Area Ltg	28.5	33.8	\$3
Exterior Lighting	5.3	6.3	\$1
Track Lighting 2nd Flr	1.6	1.9	\$0
Grand Total	668.2	792.5	\$78

Avg Lighting Time On by Hour of Day

Building Level	Asset	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	Max kW (100%)
Common Area	Common Area Ltg	1%	0%	0%	0%	0%	34%	73%	89%	98%	98%	98%	98%	97%	97%	97%	97%	97%	97%	97%	97%	95%	41%	16%	1.679	
Exterior	Exterior Lighting	1%	0%	0%	0%	0%	31%	64%	61%	72%	61%	65%	68%	69%	70%	68%	77%	86%	89%	89%	89%	89%	87%	35%	15%	0.105
Fitness & Weights	Fitness Area Ltg	1%	0%	0%	0%	0%	33%	71%	87%	95%	95%	95%	95%	95%	94%	94%	94%	94%	94%	94%	94%	92%	39%	15%	0.516	
	Weight_Fitness Ltg	1%	0%	0%	0%	0%	35%	73%	89%	98%	98%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	97%	49%	17%	1.166	
Gym	Gym_Zone_1_Ltg	0%	0%	0%	0%	0%	15%	41%	41%	41%	43%	50%	50%	50%	50%	50%	50%	50%	54%	55%	55%	41%	3%	2%	2.051	
	Gym_Zone_2_Ltg	0%	0%	0%	0%	0%	12%	31%	30%	30%	32%	38%	38%	38%	38%	38%	38%	38%	42%	43%	45%	33%	2%	2%	1.778	
	Gym_Zone_3_Ltg	0%	0%	0%	0%	0%	14%	40%	40%	40%	42%	49%	49%	49%	49%	49%	49%	49%	50%	53%	54%	54%	40%	3%	2%	1.668
Multi Activity Court	MAC_Zone_1_Ltg	7%	7%	7%	7%	7%	8%	5%	3%	5%	8%	19%	18%	18%	19%	35%	37%	45%	47%	46%	44%	46%	42%	10%	7%	1.405
	MAC_Zone_2_Ltg	7%	7%	7%	7%	7%	8%	5%	3%	5%	8%	20%	20%	20%	21%	36%	39%	47%	48%	47%	46%	47%	43%	11%	7%	1.488
Track	Track Lighting 1st Flr	98%	98%	98%	98%	98%	98%	76%	11%	0%	0%	0%	0%	0%	0%	0%	0%	0%	15%	54%	98%	98%	98%	98%	98%	0.736
	Track Lighting 2nd Flr	1%	1%	1%	1%	1%	2%	2%	2%	2%	3%	3%	4%	3%	2%	3%	4%	3%	4%	4%	5%	3%	3%	1%	1%	0.328

Lighting Recommendations

University - Recreation Center, March 2021



Analysis

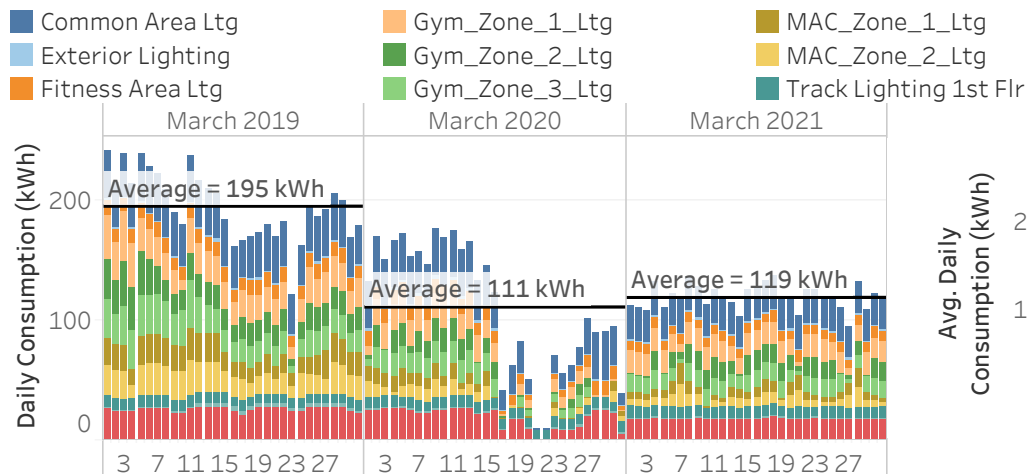
Due to the social distancing measures implemented in NY state because of the COVID-19 pandemic are still keeping the building only partially occupied during this period, but starting September the lighting usage seemed to have stabilized and stayed consistent across time. Since it wouldn't still be possible to separate the lighting savings resulting from the installation of LED lighting on the Gym from the portion coming from the partial occupation and stricter scheduling of the building, those savings were still not included on the total LED savings. On three years comparison chart for the Gym lighting circuits, it is possible to see that the consumption in 2021 was slightly higher than in 2020 (when the LEDs were already installed and the start of the pandemic), indicating that besides the savings due to the LED installation part of the reduction in consumption is probably related to the partial occupation and stricter schedule of the building. Further this is an indicator that post-COVID occupancy has not changed significantly a year on.

Savings Achieved - Lighting

	Electric Savings - kWh	Dollars Savings (\$)	Emissions Reductions (lbs CO2e)
Mar-19 to Feb-20	13,864	\$1,622	16,443
Mar-20 **	2,051	\$240	2,432
Grand Total	15,915	\$1,862	18,875

** Savings calculations strongly influenced by social distancing measures to fight the COVID-19 pandemic.

Lighting Monthly Load Pattern



Monthly Lighting Consumption in Unoccupied Hours (kWh)

Category	Asset	OCCUPIED	UNOCCUPIED	Total
LIGHTING	Common Area Ltg	1,416	306	1,723
	Exterior Lighting	72	19	91
	Fitness Area Ltg	428	94	522
	Gym_Zone_1_Ltg	831	52	882
	Gym_Zone_2_Ltg	544	34	578
	Gym_Zone_3_Ltg	686	46	732
	MAC_Zone_1_Ltg	352	49	401
	MAC_Zone_2_Ltg	366	52	419
	Track Lighting 1st Flr	248	314	561
	Track Lighting 2nd Flr	11	2	13
Grand Total		5,944	1,189	7,133

Lighting Savings Breakdown by Asset (kWh)

Asset	March 2020	March 2021	% Change
Gym_Zone_1_Ltg	12.300	16.168	(49.0%)
Gym_Zone_2_Ltg	7.895	10.760	(62.6%)
Gym_Zone_3_Ltg	10.603	12.998	(54.4%)

Savings from Lighting Retrofit - March 2021

