

Big-Box Efficiency Project

Measurement & Verification Report

Q2: August 1, 2021 – September 30, 2021

Prepared for
California Energy Commission

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Introduction

Project Background

The Center for Sustainable Energy (CSE) developed this *Big-Box Efficiency Project Measurement & Verification Report: Q2 August 1, 2021 – September 30, 2021 (EPC-17-008)* to analyze a post-retrofit energy and water profile and compare to a 2017 baseline at Walmart Supercenter Store 2292 located in Covina, CA (Los Angeles County) as part of the California Energy Commission (CEC) Electric Program Investment Charge (EPIC) grant program (EPC-17-008). This project will lead to technological advancement and innovation by demonstrating the impact of an integrated suite of pre-commercial energy efficiency (EE) technologies in a large, existing, retail building located within a disadvantaged community. This site is in California Climate Zone 9 and Southern California Edison (SCE) and Southern California Gas Company (SoCalGas) territory, with water service provided through City of Asuza Water.

Measurement & Verification (M&V) began on June 1, 2021, after most pre-commercial energy efficiency installation activities had concluded at Store 2292 (some final lighting commissioning and schedule updates occurred in June 2021; see LED Lighting Upgrade for more details). For this report, interval energy and water data was collected from several sources to determine a second quarter August-September 2021 (Q2) energy and water profile for the purpose of evaluating if the installed technologies were on track to reduce 20% annual electric energy consumption at the whole building level. Electric savings realized by end-use for Q2 were identified and interpreted to the best of the project team's ability given data limitations such as submetering data reporting gaps, altered COVID-19 pandemic operations and technology implementation delays. Assumptions and other considerations regarding this data analysis are noted in each subsequent section of this report.

Purpose of Measurement and Verification

The purpose of this M&V process is for comprehensive collection of whole building and end-use data to evaluate project successes and/or deficiencies by each of the Energy Efficiency Measures (EEM) installed and if an electric energy savings (kWh) of 20% or greater was achieved at the whole building level. It should be noted that this project does not have savings targets per sub-system and that savings estimates per sub-system are provided to inform and identify systems that are over or under performing compared to the June-July 2020 energy submetering baseline for modeling calibration.

Reporting requirements, originally set by the CEC, were to provide a quarterly report over a one-year M&V period as well as an annual report using actual metered data (six months using actual utility data and six months using energy consumption projections). This timeline has been reduced due to various project delays such that the Annual Report will include at least the fourth quarter data estimated using the calibrated OpenStudio energy model. "Quarterly" reports as required will be produced every two months instead of three, due to project timing constraints.

Table 1 represents the installed EEMs and the anticipated individual measure savings as a percent of whole building reduction as well as kWh and cost savings on an annual basis.

Efficiency Measure	% kWh Savings	Energy Savings (kWh/Yr.)	Electrical Cost Savings (\$/Yr.)
Locbit IoT Platform	1.9%	64,405	\$2,848
i2Systems Lighting	10.9%	374,726	\$8,984
Turntide Smart Motors	6.1%	210,091	\$4,913
ICI DualCool Evaporative Pre-Cooling	2.8%	95,944	\$1,789
Total	21.7%	745,166	\$18,534

Table 1: Walmart Supercenter (Store 2292) Estimated EEM Savings

In addition to the technologies listed above, the project team also installed Saya Life smart water meters on each unit installed with DualCool to measure and manage water consumption used to drive energy savings from the DualCool evaporative precooling technology.

Installed Technology, Facility and Baseline Information

Refer to the *Q1 June-July 2021 Measurement & Verification Report (Q1 Report)*¹ for more details regarding the five installed technologies and for a detailed facility and store operations description including onsite equipment, business schedule, occupancy schedule and operations during the COVID-19 pandemic.

For the utility data baseline, the project team used February 2017 to January 2018 electric interval data from SCE. This baseline was then calibrated with interval whole building and submetering data from July 2020 and used to help complete energy model calibration during the initial stages of the project for determining EEM reductions. It will also be used in this report to compare to post-retrofit energy profiles to analyze the effectiveness of EEMs. Subsystem monitoring was implemented in May 2020. Also, refer to *Q1 Report* for more baseline energy information.

Summary of Q2 Findings

A summary of whole building and end-use savings can be found in Table 2 with an explanation of which baseline it was compared to. Overall, Q2 electric energy savings was 27.35%, which is over the 20% electric savings target.

¹ Vogel, C., A. Beach, J. Woolsey and R. Baptiste. Big-Box Efficiency Project Measurement & Verification Report: Q1 June 1, 2021 – July 31, 2021 (EPC-17-008). Center for Sustainable Energy, 2021. Available at https://sites.energycenter.org/sites/default/files/images/site/bigbox/pdf/M&V-Report-Q1_Final.pdf.

Electric Savings by End-Use	August Savings	September Savings	Q2 Savings
Whole Building Gross site consumption savings compared to 2017 Whole Building Baseline	99,477.53 kWh 29.11%	78,699.40 kWh 25.42%	178,176.93 kWh 27.35%
LED Retrofitted Lighting² Fixture consumption savings compared to 2020 Submetering Baseline	20,499.81 kWh 32%	16,814.96 kWh 30%	37,314.78 kWh 31%
HVAC Upgrades (DualCool & Turntide Motors) RTU & AHU consumption savings compared to 2020 Submetering Baseline	32,314.21 kWh 44.22%	34,025.87 kWh 58.38%	66,340.08 kWh 50.5%
Normalized HVAC Upgrades RTU & AHU consumption savings compared to 2020 Submetering Baseline and normalized to weather using Degree Days (kWh/DD)	35.83 kWh/DD 25.22%	48.56 kWh/DD 37.69%	41.07 kWh/DD 30.23%
Refrigeration Upgrades (Turntide Motors) Rack A through F consumption savings compared to 2020 Submetering Baseline	-4,050.18 kWh -7.22%	2,364.37 kWh 4.96%	-1,685.81 kWh -1.63%

Table 2: Summary of Q2 Electric Savings Findings

A detailed analysis of the results summarized above can be found in the Q2 Energy Performance Assessment section.

² Lighting savings do not include additional potential savings from running on full DC power. See the LED Lighting Upgrade section for more details.

Q2 Energy Performance Assessment

Data Collected & Analyzed

Energy consumption data was collected from the Locbit online platform to analyze Q2 M&V energy performance. The Locbit platform acts as a central portal for data collection, interpretation and visualization. A list of DENT metering points utilized for this report can be found in Appendix A of the *Q1 Report*. The following data points were pulled for August 1, 2021, through September 30, 2021, from the Locbit Platform.

Data Point	Unit	Interval	# Points
DENT Submetering	kW	15-minutes	25
SCE Utility Grid Consumption	kWh	15-minutes	1
Rainforest Device	kW	15-minutes	1
Greenbyte Solar PV Production Meter	kWh	15-minutes	1
SAYA AHU 2 Water Supply Meter	Gallons	15-minutes	1

Table 3. Q2 M&V Data Collected & Analyzed

Whole building Q2 Electric Consumption

Walmart Covina Store 2292 consumed 324,876.62 kWh from the SCE grid and produced 148,330.32 kWh from onsite PV for a Q2 gross site consumption of 473,206.94 kWh. Figure 1 represents Q2 monthly grid consumption, PV production, max demand, and peak PV capacity. These values will contribute to the annual consumption of the store at the whole building level and inform whether the project achieves the goal of at least 20% reduction in annual electric savings. It should be noted that there was a utility power outage at the store on the evening of August 17th into the morning of the 18th. The energy impacts of this event were minimal and only noted in this report as a reference.

Whole building Q2 Energy Goal Evaluation

The primary goal of this project is to demonstrate the ability of pre-commercial energy efficiency technologies to deliver deep electric energy savings in a big-box (retail plus grocery) environment. The target is to reduce electrical consumption on an annual basis by 20% from the baseline year of February 2017 through January 2018, which was 2,583,607 kWh. This would amount to a gross site consumption reduction of 516,721 kWh, at the whole building level, including solar PV generation consumed onsite. As per the figure below, the contribution of each installed measure can be seen as estimated by National Renewable Energy Lab (NREL) in the calibrated energy model outlined in the project's *Final*

Optimization Report³ to achieve a minimum of 20%. It should be noted that Locbit’s energy optimization strategies were not implemented at the time of this report, which accounted for 1.9% of the total 21.7% estimated by NREL’s model.

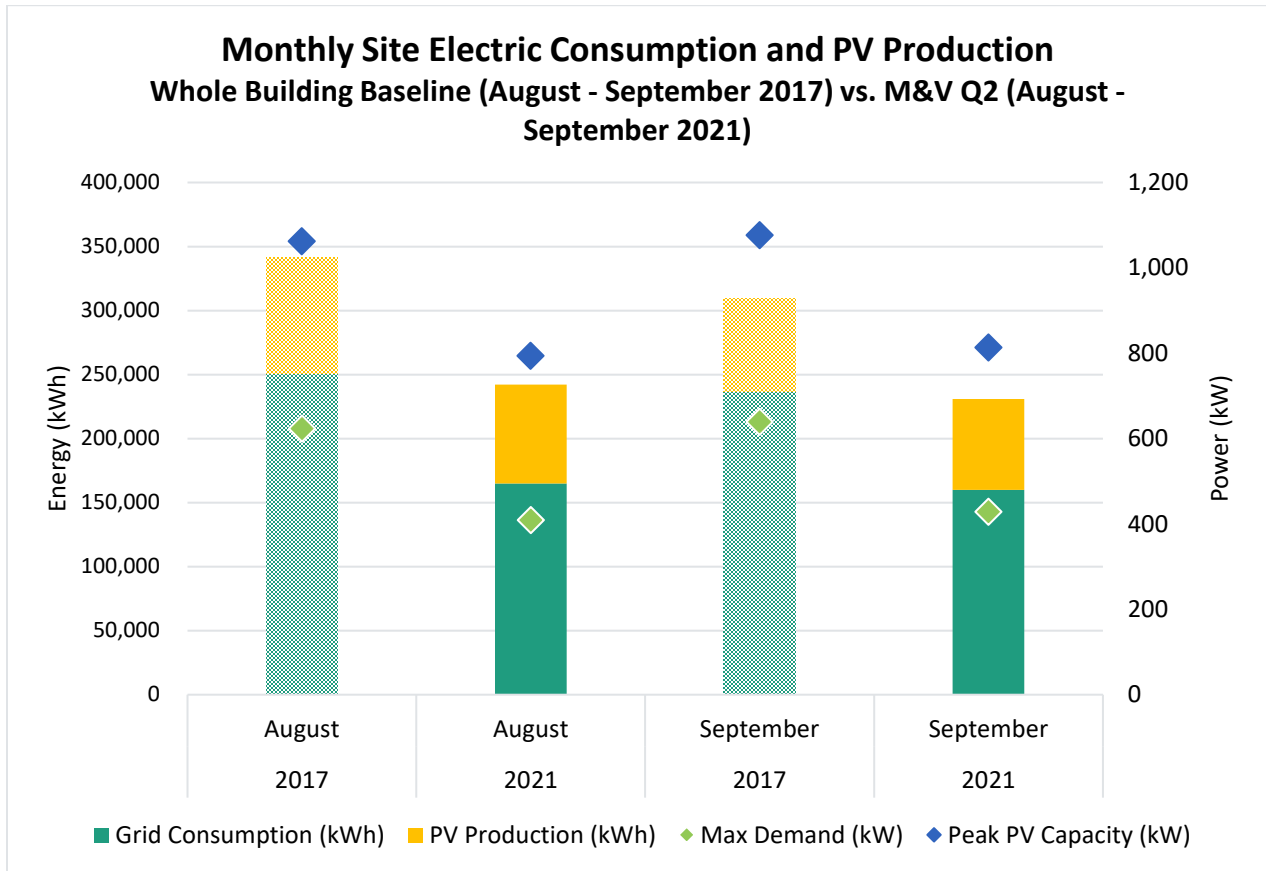


Figure 1. Q2 Monthly Gross Site Electric Consumption and PV Production (August – September 2021)

The second quarter findings for the months of August and September are represented below. It should be noted that the 20% energy savings will be based on an annual basis and project success will be evaluated in the final report. The month of August showed a reduction of 29.11% as compared to the baseline with a site consumption of 341,743.73 kWh and September showed a reduction of 25.42% with a site consumption of 309,640.14, kWh. The overall Q2 reduction in energy consumption was 178,176.93 kWh or 27.35%, above the expected 19.8% from NREL’s model, excluding Locbit’s optimization savings as described above.

³ Houssainy, Sammy, Khanh Nguyen Cu, and Ramin Faramarzi. 2020. *Final Optimization Report: Empowering Energy Efficiency in Existing Big-Box Retail/Grocery Stores*. Golden, CO: National Renewable Energy Laboratory. NREL/TP-5500-77695. <https://www.nrel.gov/docs/fy20osti/77695.pdf>.

These savings numbers are greater than what was expected in Q2 as compared to Q1, even considering the efficiency measures that were not fully commissioned in Q1. The lighting and HVAC system performance exceeded our expectations during Q2 which allowed the building to achieve much greater than 20% targeted savings as well as modeling expectations described above.

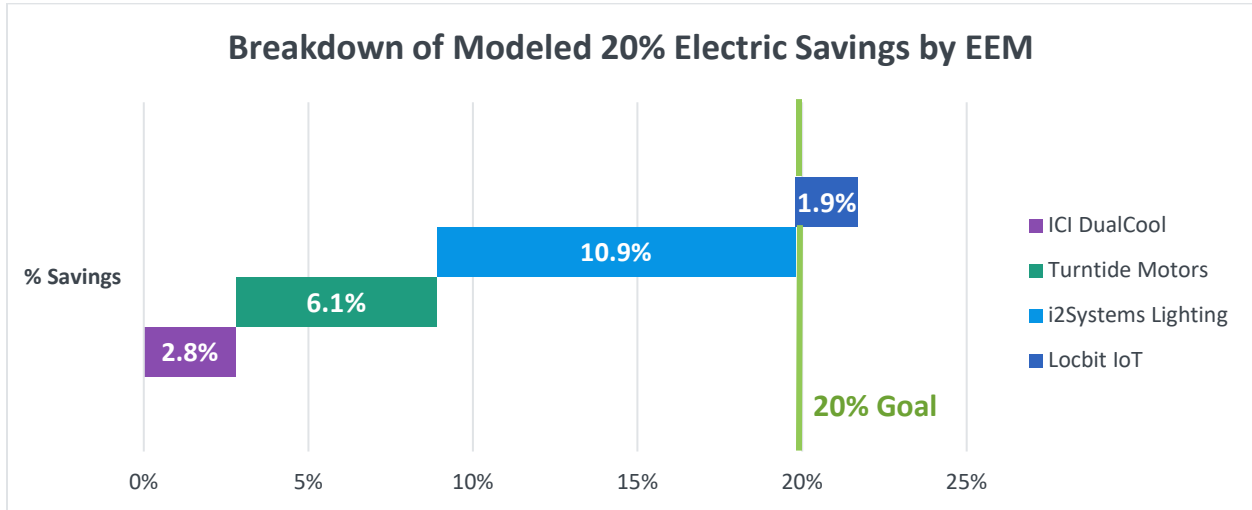


Figure 2. Estimated Electric Savings by EEM (Adapted from NREL Final Optimization Report Figure 25)

Figure 2 represents each month’s contribution in kWh savings, as well as a percent, of the annual target of 20% (689,592 kWh) of 2017 baseline whole building consumption. It should be noted that there were some minor changes to the store, from an energy perspective, between the baseline year and Q1 2021. Those of note are the addition of three sets of Hussman packaged food freezers in the stockroom, new LED lighting layout in the front produce section, self-checkout kiosks converted from standard checkout aisles and the curbside pickup staging room. These store modifications were not quantified or compensated for in the calculated Q2 energy savings but will be incorporated into the Q3/Annual Report as an adjustment factor for each quarter’s savings.

Whole building electric savings for Q2 are found in Figure 3.

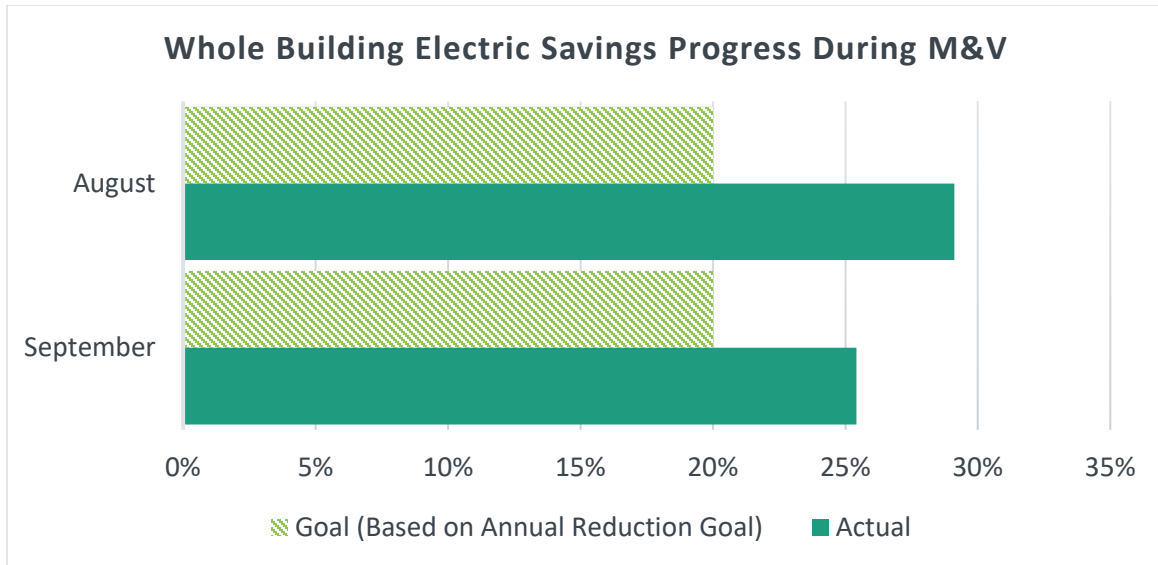


Figure 3. Progress of Energy Savings to Reach 20% kWh Reduction Goal

Whole building & HVAC Q2 Water Consumption

Due to the importance of curtailing water use considering drought conditions throughout the State of California, the project is also measuring whole building and HVAC related water consumption to evaluate the water consumption using the pre-commercial technology package, specifically DualCool’s evaporative cooling technology and the water consumed to achieve electric energy savings. Store 2292 is metered with three water meters by the local water utility and at each rooftop HVAC unit retrofitted with a DualCool evaporative cooler with SAYA metering devices. The water billing and consumption data for the whole building is delayed by two months from the utility and June-July 2021 results are represented below, while August-September results will be added to the Q3 report. The site consumed 256,581.8 gallons during June-July 2021, while it consumed 326,150.63 gallons in 2017 (Table 4 and Figure 4). There was a reduction 69,568.83 gallons (21%) on the main water meter.

Month	2017 Whole Building Baseline (Gallons)	2021 M&V (Gallons)	Reduction (Gallons)	Reduction (%)
June	176,540.25	129,412.98	47,127.27	27%
July	149,610.38	127,168.82	22,441.56	15%
Total	326,150.63	256,581.80	69,568.83	21%

Table 4. June-July 2021 Whole Building Water Consumption

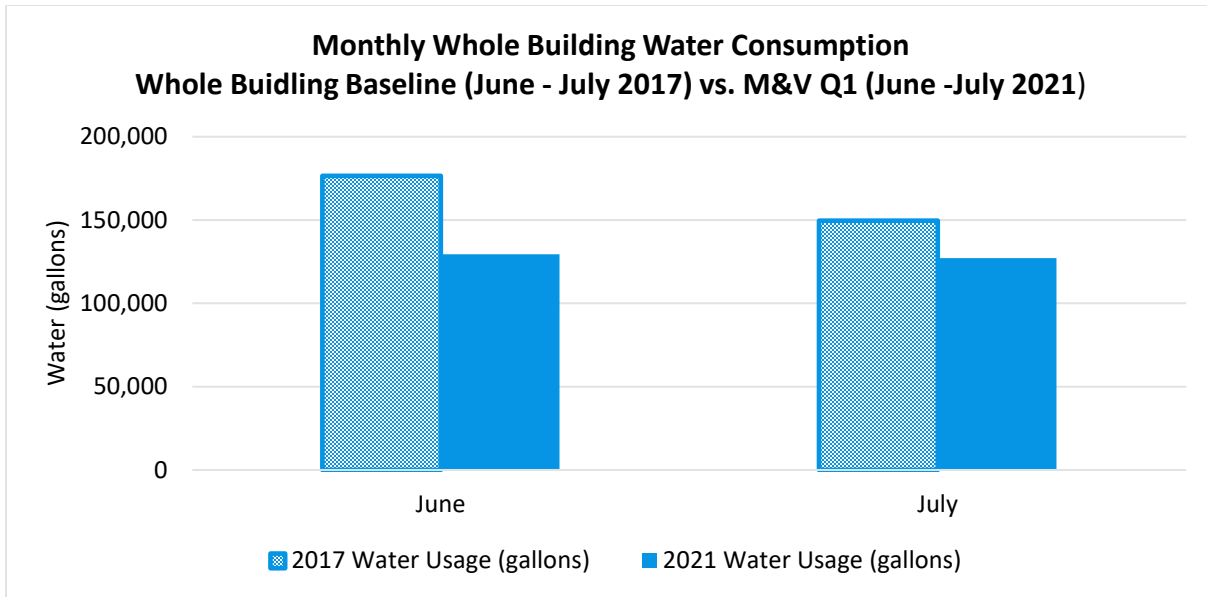


Figure 4. Monthly Whole Building Water Consumption (June – July 2021)

The project team pursued a water budget of 3.4 gallons consumed per kWh saved. The SAYA submetering water data measures all HVAC units from a single meter located at the main rooftop supply line as well as at each individual unit retrofitted with DualCool. To calculate this metric, data from both AHU1 and AHU2 would have been used since those are the only units with DualCool that are entirely separately submetered. However, for quarterly reporting, water consumption per kWh saved will only be evaluated for AHU2 starting in July 2020 because AHU2 was under repair until July 2, 2020. AHU1 was under repair throughout 2020 and therefore cannot be used for a comparison for the 2020 submetering baseline (Table 5 and Figure 5). Whole building metering will be used for evaluation in the annual report.

Month	2020 Submetering Baseline (kWh)	2021 M&V (kWh)	Reduction (kWh)	Gallons Consumed	Gallons/kWh Saved
August	8,048.92	1,115.38	6,933.54	182.27	0.03
September	6,888.59	939.86	5,948.72	151.11	0.03
Total	14,937.51	2,055.25	12,882.26	333.38	0.03

Table 5. Q2 AHU 2 Gallons Consumed per kWh Saved

Comparatively, August 2021 and September 2021 used significantly less kWh than August and September 2020 and in combination with August and September 2021 seeing very low water consumption, gallons per kWh was far below the targeted 3.4 gallons per kWh saved. June 2021 used more kWh than June 2020 and therefore the savings value for Gal/kWh was negative, for the reasons stated above and therefore excluded from the visual representation in Figure 5. July saw a low consumption of water per kWh consumed, resulting in a consumption value of 0.5 Gallons per kWh saved, well below the targeted water consumption per kWh saved (3.4 gallons per kWh saved).

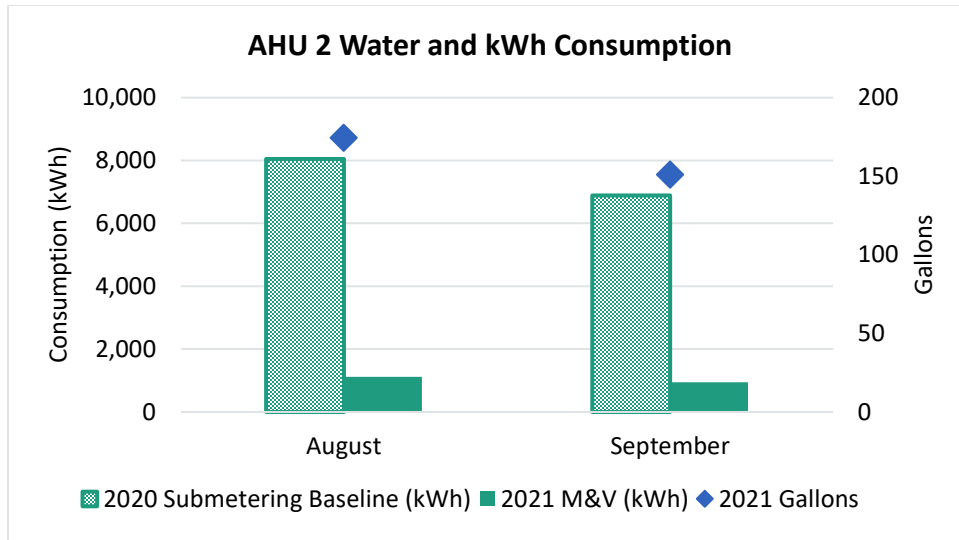


Figure 5. Q2 AHU2 Gallons and kWh Consumed

Estimated Savings by EEM

End-use energy consumption was measured through various metering equipment, data sources and calculations. DENT Metering devices measure consumption for refrigeration, lighting, and HVAC. This level of detail was required to verify performance and savings of installed EEMs, such as upgraded lighting. SAYA metering devices are measuring water consumption of installed DualCool evaporative coolers to determine gallons of water consumed per kWh saved, a required metric to report for this project.

LED Lighting Upgrade

The upgraded lighting installed by i2Systems at the store consisted of retrofitting over 1,000 existing 32W T8 linear fluorescent fixtures with 12W/ft LED fixtures and integrated wireless controls. This system can operate on both 277 VAC and 380 VDC to accommodate a direct power source from onsite battery energy storage but is currently served by a standard AC panel with future intentions to integrate directly to onsite renewable resources. The areas that were retrofitted include the main retail sales floor including the front vestibule, the stock room, employee breakrooms, offices and restrooms. Dimming controls have further reduced lighting energy requirements by operating the fixtures at 80% of full capacity throughout retrofitted spaces and still providing adequate lumens as per Walmart standards. A copy of the dimming schedule for Store 2292 can be found the *Q1 Report* in Appendix B, along with a map of dimming zones in Appendix C.

All lighting loads are served by two panels, Panel H1C1 and H1C2, which include both interior and exterior fixtures. These loads are measured through a single DENT metering point and accessible through the Locbit platform where data is collected for M&V purposes. Figure 6 represents Q2 lighting consumption for the entire store.

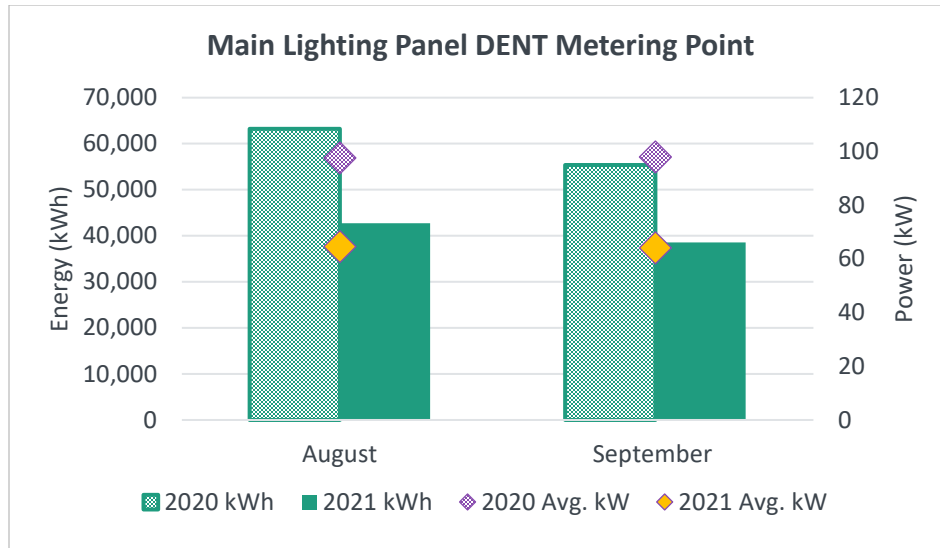


Figure 6. Q2 Main Lighting Panel Monthly Electric Consumption (kWh) (August – September 2021)

The data shows a significant reduction of 37,314.78 kWh (31%) in lighting consumption for Q2 as compared to August/September 2020. As per Table 6 below, the month of August yielded a 32% savings and the savings for September was 30%. This overall reduction in kWh consumption contributed to the whole building savings of 178,176 kWh or 27.35%, as highlighted in the Whole building Q2 Energy Goal Evaluation section of this report.

Month	2020 Submetering Baseline Consumption (kWh)	2021 M&V Consumption (kWh)	Reduction (kWh)	% Reduction
August	63,202.24	42,702.43	20,499.81	32%
September	55,382.73	38,567.77	16,814.96	30%
Total	118,584.97	81,270.20	37,314.78	31%

Table 6: Q2 Main Lighting Panel Energy Savings

In addition to these realized savings, the in-store demonstration of DC-driven LED lighting yielded a potential demand reduction of 9.3%, or 8.3 kW for all retrofitted interior lighting at Store 2292. These values were highlighted in the *Q1 June-July 2021 Measurement & Verification Report* and will be fully extrapolated in the Final Report for potential annual consumption savings.

HVAC Upgrades – DualCool evaporative coolers & Turntide motors and Controls

There were two HVAC measures installed at the site to address space cooling and heating as well as roof top units (RTU) serving refrigeration requirements. The evaporative pre-cooling system, known as DualCool from Integrated Comfort Inc. (ICI), was implemented on four RTUs and the two air handling units (AHU) serving the main retail area.

All HVAC loads are served by four panels, Panel H1A1, H1A2, HF1 and H4B1, monitored through six separate DENT metering points in and accessible through the Locbit platform. As per the DENT Metering

List found in the *Q1 Report* in Appendix A, three of the metering points include several HVAC units which will be represented by a cumulative energy consumption value. Budget and technical feasibility didn't allow for all 29 metered HVAC units to be measured individually through this project however, the data below is an accurate representation of HVAC energy savings.

Figures 7-11 represent the comparison of all 27 RTUs and AHU 2 between the submetered months of August/September 2020 used for model calibration and August/September 2021 for Q2 analysis. To effectively compare both time frames, the consumption (kWh) was normalized to weather using degree days to establish a kWh per degree day (kWh/DD) value.

It should be noted that AHU 1 experienced issues through 2020 and was excluded from the total HVAC savings results. The unit was recommissioned in May 2021 and its consumption for Q2 was 10,505.51 kWh. A comparative data point for expected savings for this unit would be AHU 2, which showed a Q2 energy reduction of 13% in Q1 and 86% in Q2 however the project team is not claiming this estimation as realized kWh savings.

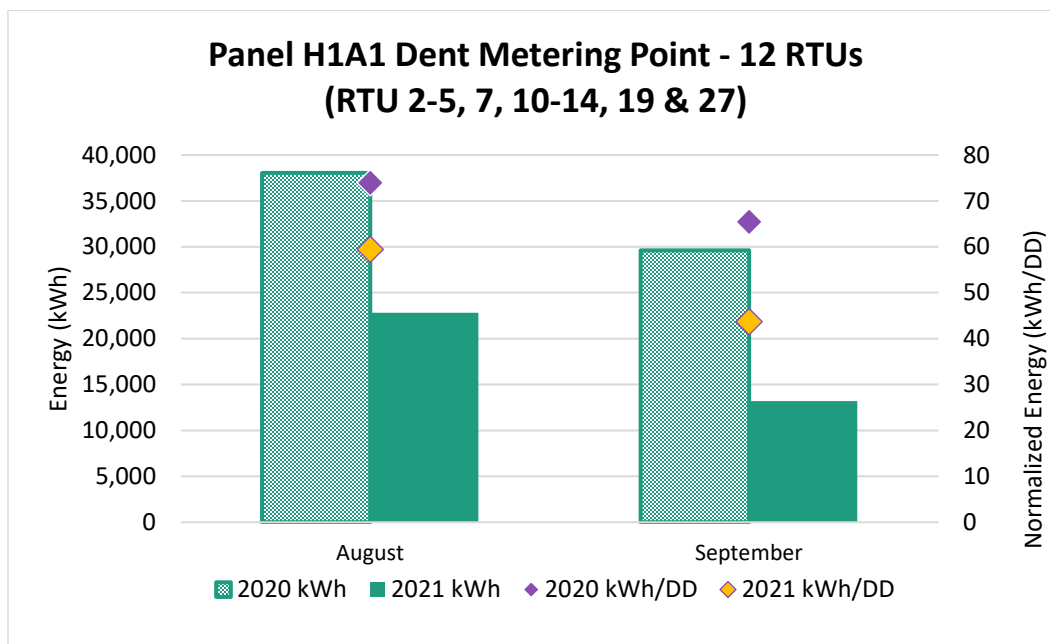


Figure 7: Q2 Panel H1A1 Monthly Electric Consumption (August – September 2021)

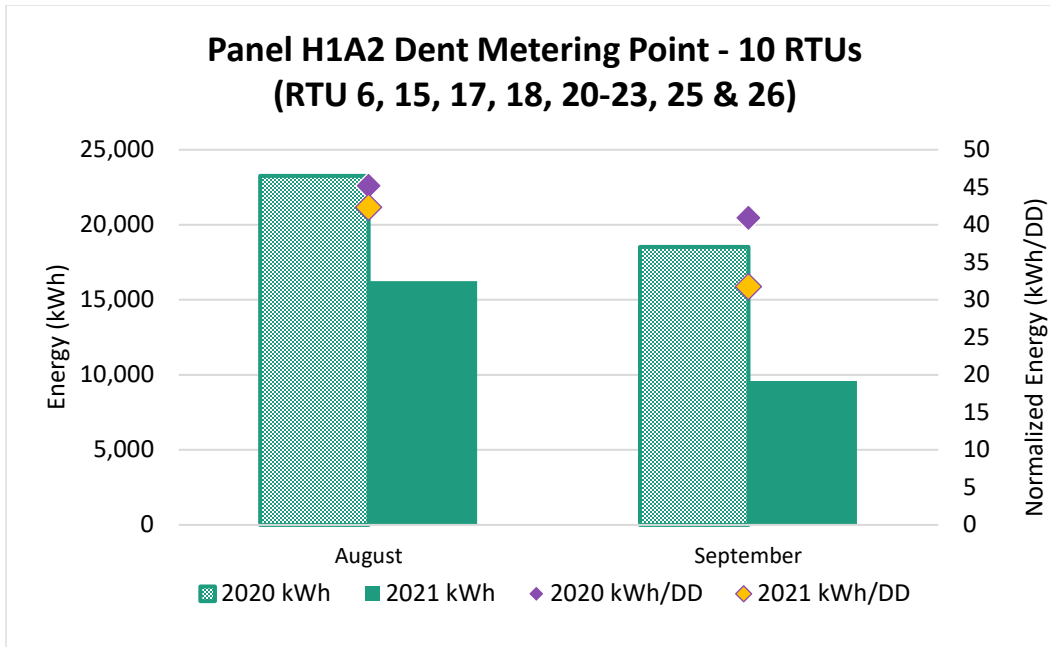


Figure 8: Q2 Panel H1A2 Monthly Electric Consumption (August – September 2021)

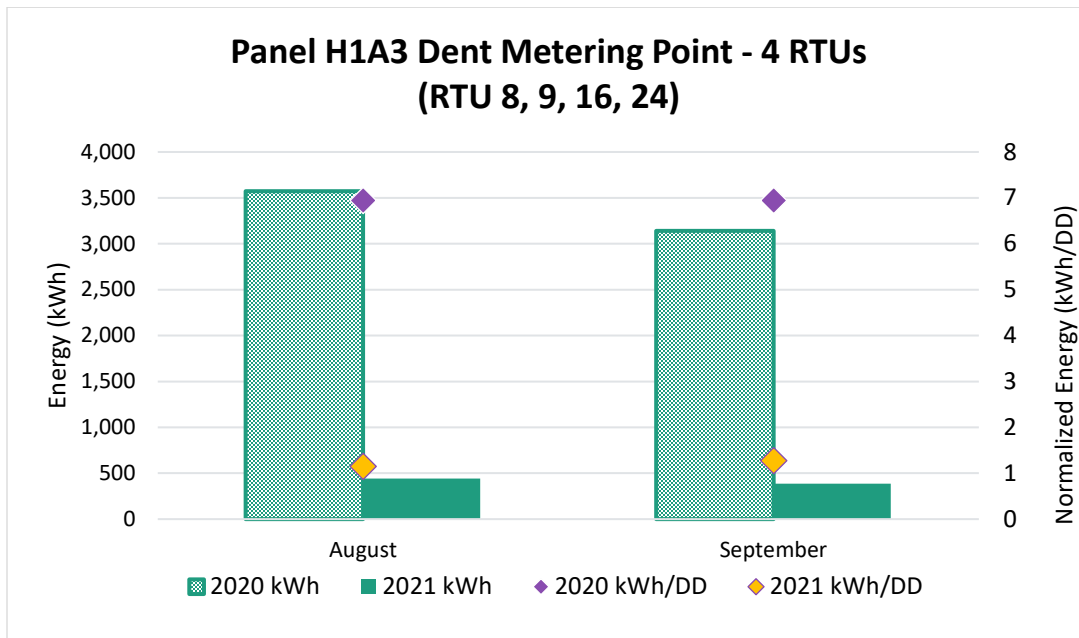


Figure 9: Q2 Panel H1A3 Monthly Electric Consumption (August – September 2021)

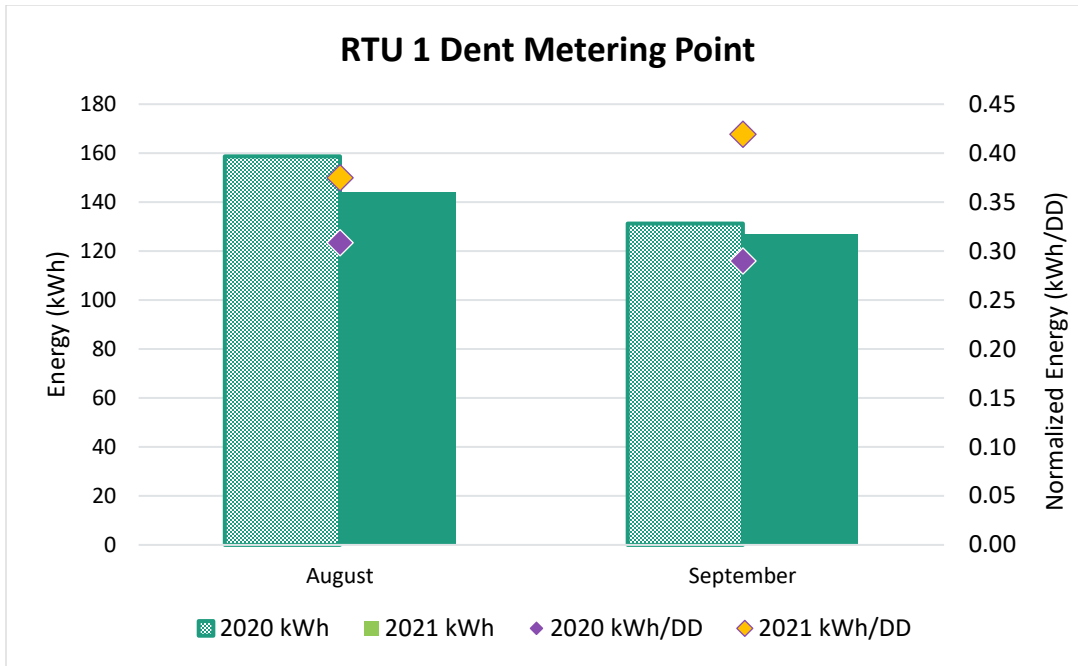


Figure 10: Q2 RTU 1 Monthly Electric Consumption (August – September 2021)

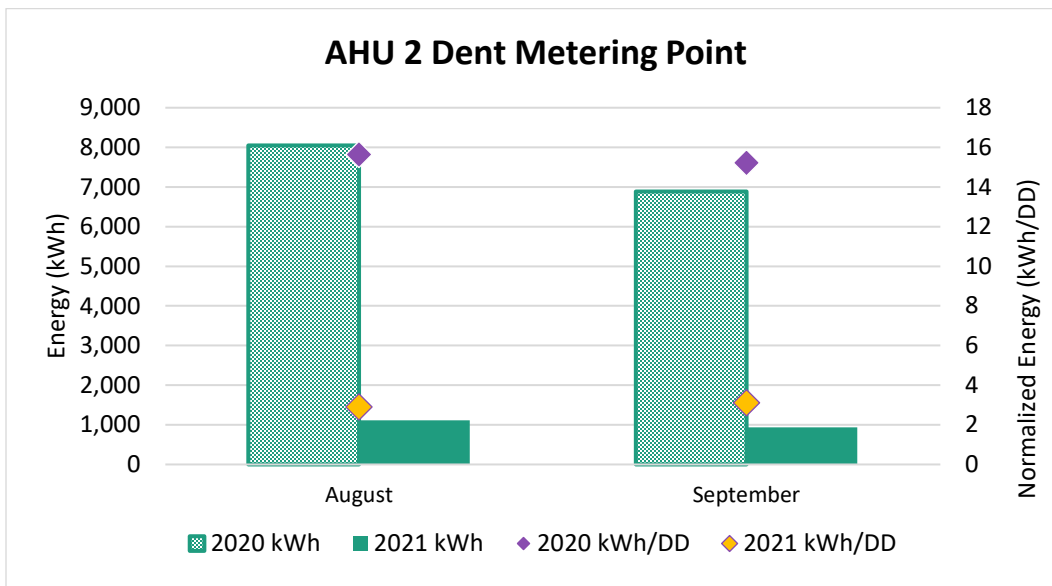


Figure 11: Q2 AHU 2 Monthly Electric Consumption (August – September 2021)

The data shows a normalized reduction in electrical consumption per degree day for Panels H1A1, H1A2, H1A3, AHU 2 and an increase in RTU 1, with an overall HVAC kWh per degree day reduction of 30.23% as shown in Table 7. This overall reduction in kWh consumption contributed to the whole building savings of 178,176 kWh or 27.35%, as highlighted in the Whole building Energy Goal Evaluation section of this report.

Panel	Unit	Aug/Sept 2020	Aug/Sept 2021	Savings (%)
RTU_H1A1	kWh	67,646.32	36,033.81	46.73%
	kWh/DD	69.96	52.53	24.92%
RTU_H1A2	kWh	41,779.52	25,837.61	38.16%
	kWh/DD	43.21	37.66	12.83%
RTU_H1A3	kWh	6,711.56	827.42	87.67%
	kWh/DD	6.94	1.21	82.62%
RTU_1	kWh	289.91	270.66	6.64%
	kWh/DD	0.30	0.39	-31.59%
AHU 2	kWh	14,937.51	2,055.25	86.24%
	kWh/DD	15.45	3.00	80.61%
Total	kWh	131,364.82	65,024.74	50.50%
	kWh/DD	135.86	94.79	30.23%

Table 7: Q2 HVAC Energy Savings

The estimated savings as per NREL's Optimization Report and supporting OpenStudio models for DualCool accounted for 2.8% and 6.1% for Turntide (SMC) motors and controls of the targeted 20% reduction for whole building energy use. It should be noted that normalized energy just based on weather only does not account for occupancy changes and lighting heat load.

During the HVAC data analysis for Q2, a small error in the savings calculations was realized for Q1 results. After correcting the isolated error, it was noticed that there was still a normalized savings of 14.46% for June/July 2021 compared to June/July 2020. The updated table with kWh and kWh/DD for Q1 is in Table 8.

Panel	Unit	June/July 2020	June/July 2021	Savings (%)
RTU_H1A1	kWh	44,684.41	34,270.09	23.31%
	kWh/DD	73.17	48.76	33.36%
RTU_H1A2	kWh	26,441.27	40,850.19	-54.49%
	kWh/DD	43.30	58.12	-34.25%
RTU_H1A3	kWh	5,890.10	1,407.15	76.11%
	kWh/DD	9.64	2.00	79.24%
RTU_1	kWh	257.65	336.82	-30.73%
	kWh/DD	0.42	0.48	-13.60%
AHU 2	kWh	6,912.91	6,013.60	13.01%
	kWh/DD	11.32	8.56	24.41%
Total	kWh	84,186.34	82,877.85	1.55%
	kWh/DD	137.85	117.93	14.46%

Table 8. Revised June - July 2021 HVAC Energy Savings

Refrigeration Upgrades – Turntide motors and controls

There are six refrigeration racks (Rack A through F) paired with six rooftop condenser units that serve the cooling needs of the refrigerated produce cases within the store. The fan motors on the condenser

units have been retrofitted with Turntide motors and controls to provide efficiency benefits in motor operation and variable speed controls. There are four 1-horsepower fan motors on each of the six condenser units.

The energy load of each refrigeration rack is being measured, which includes the compressor and pump, through six DENT metering points and accessible through the Locbit platform. These metering points will represent the bulk of consumption savings indirectly associated with the upgraded motor and controls of the corresponding condenser units. Each refrigeration rack has its own metering points. Savings will be realized through efficient cooling of the refrigerant by the upgraded condenser motors which in turn yields less work on the rack compressor and pump.

Figures 12 -17 represent the comparison of all six refrigeration racks between the submetered months of August - September 2020 used for model calibration and August - September 2021 for Q2 analysis. These findings were not reported in the Q1 report therefore we have added both June-July and August-September results below. It should be noted that this consumption was not normalized to weather (kWh/DD) because the refrigerated cases that these racks are serving are not affected by outside air temperature.

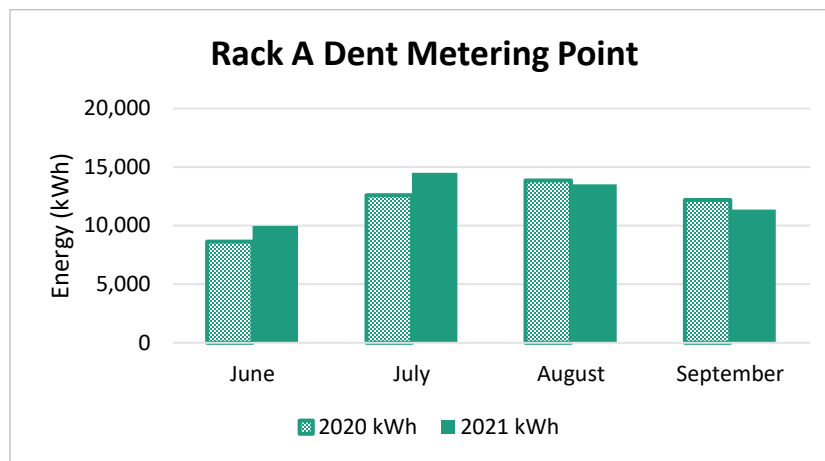


Figure 12. Rack A Monthly Electric Consumption (June - September 2021)

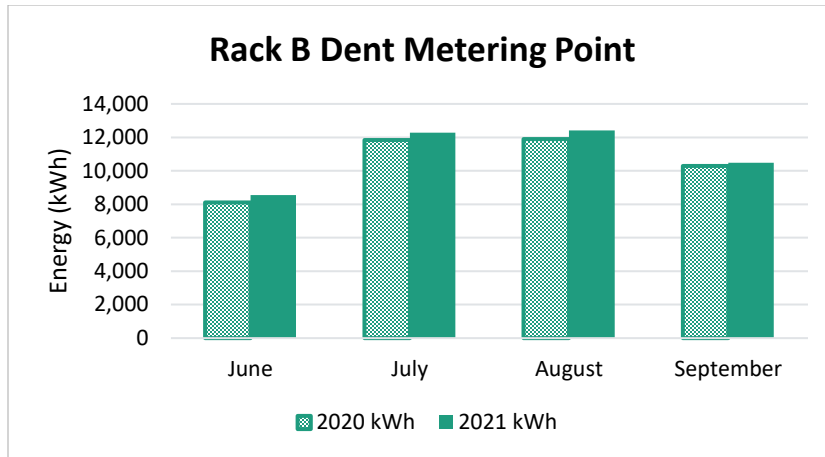


Figure 13. Rack B Monthly Electric Consumption (June - September 2021)

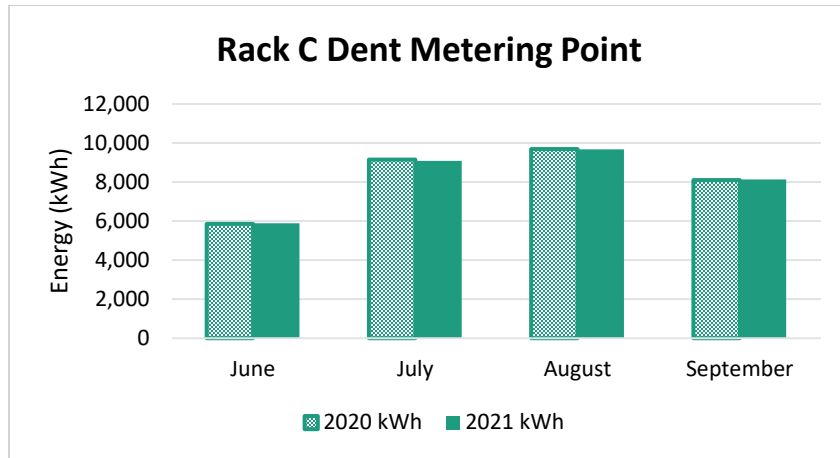


Figure 14. Rack C Monthly Electric Consumption (June - September 2021)

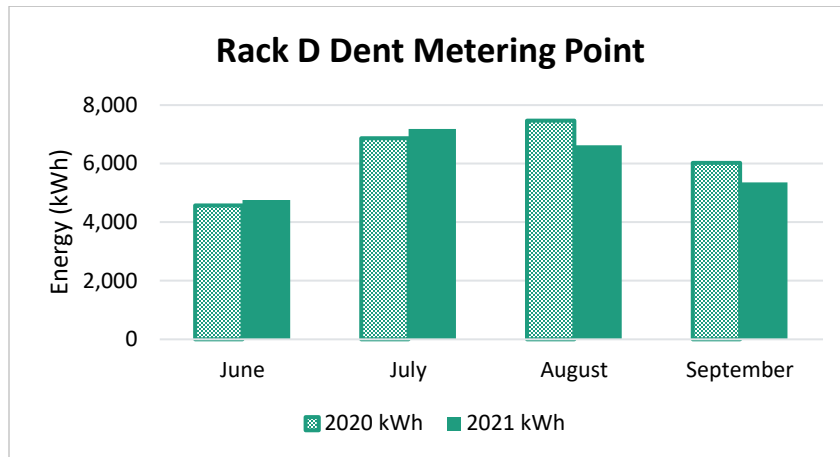


Figure 15. Rack D Monthly Electric Consumption (June - September 2021)

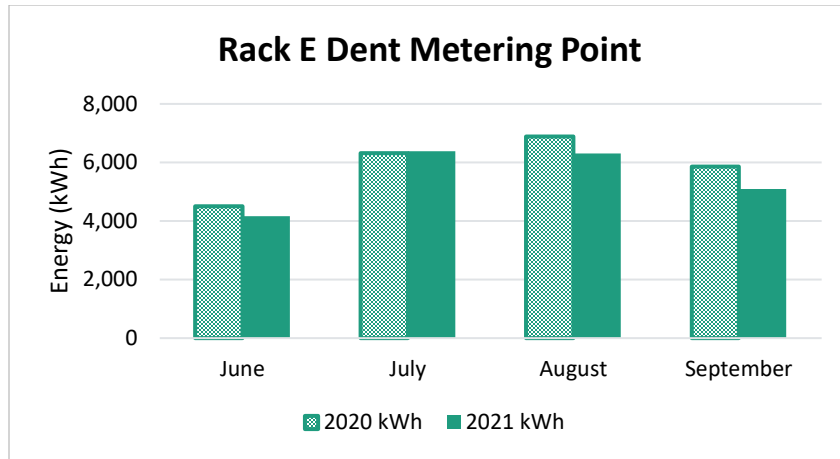


Figure 16. Rack E Monthly Electric Consumption (June - September 2021)

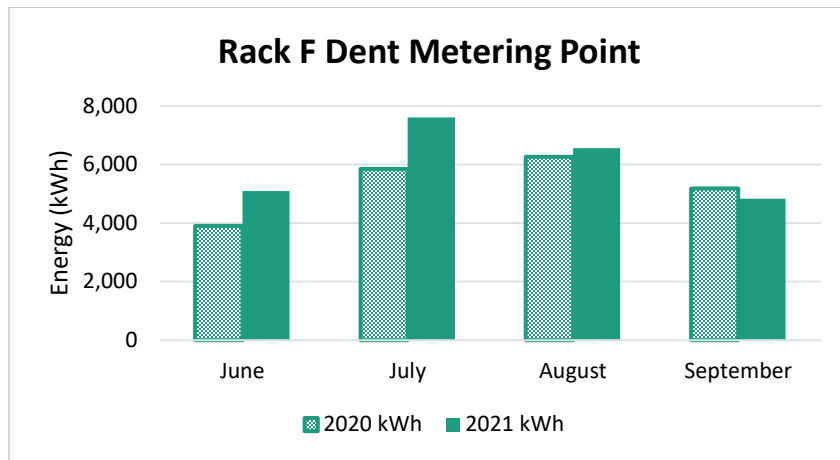


Figure 17. Rack F Monthly Electric Consumption (June - September 2021)

The data for June – July 2021 shows a reduction in electrical consumption for Racks C and E and an increase in Racks A, B, D and F. The reason for the significant increase for Rack F during Q1 can be attributed to a malfunctioning motor control which required the condenser unit to continuously run which yielded a higher consumption for that system. It is unknown at this time as to what was causing the increase on Rack A for June – July but it seems that the issue did not carry over into Q2 August - September.

In Q2, the data shows a reduction in electrical consumption for Racks A, D, E and F with an increase for Racks B and C (Table 9 and Table 10). It should be noted that refrigeration energy consumption is mostly tied to store occupancy and the frequency of access to the refrigeration cases, which is assumed to be lower during 2020 with the COVID pandemic. Outside of the anomalies mentioned above, we believe that the performance of the refrigeration racks in Q1 and Q2 are in line with our expectations. This overall reduction in kWh consumption contributed to the whole building savings of 178,176 kWh or 27.35%, as highlighted in the Whole building Energy Goal Evaluation section of this report.

Panel	June/July 2020 (kWh)	June/July 2021 (kWh)	Savings (%)
Rack A	21,249.51	24,496.34	-15.28%
Rack B	19,948.87	20,828.87	-4.41%
Rack C	15,008.55	14,970.62	0.25%
Rack D	11,437.41	11,950.07	-4.48%
Rack E	10,826.53	10,542.81	2.62%
Rack F	9,753.64	12,699.40	-30.20%
Total	88,224.50	95,488.12	-8.23%

Table 9. Q1 June-July 2021 Refrigeration Energy Savings

Panel	August/September 2020 (kWh)	August/September 2021 (kWh)	Savings (%)
Rack A	26,059.06	24,909.51	4.41%
Rack B	22,197.63	22,885.85	-3.10%
Rack C	17,797.66	17,810.87	-0.07%
Rack D	13,491.84	11,980.58	11.20%
Rack E	12,737.04	11,403.97	10.47%
Rack F	11,453.44	11,393.61	0.52%
Total	103,736.66	100,384.39	3.23%

Table 10. Q2 August – September 2021 Refrigeration Energy Savings

Locbit

Due to delays in the integration of the Walmart legacy control system (NOVAR) into the Locbit platform, Locbit did not contribute savings during Q2 of the M&V period.

Conclusion

The total realized whole building electric savings for Q2 (August - September 2021) as compared to corresponding baseline months in 2017 is 178,176 kWh or 27.35%. This is well above the annual project reduction goal of 20%. LED Lighting and HVAC upgrades had proven end-use Q2 savings to the magnitude of 31% and 30.2%, respectively. Despite the successes witnessed in Q2, there are a few notable items regarding energy at the site as it relates to this project.

- Rack F condenser fan controls were not working properly during a portion of Q1 which was reflected by the overconsumption of the system. This issue has since been resolved.
- Rack B is showing a large increase in energy consumption as compared to Q1 or comparative months in 2020. The appropriate technical project partners have been made aware of this concern and any findings will be noted in the Q3 M&V report.
- Locbit is continuing to work on Walmart legacy control system integration (NOVAR). As of this report, the system has been integrated; however, due to several project and team-related constraints, the team does not anticipate any direct measured savings from the Locbit system. A

detailed description of this result and projected potential savings will be included in the future *Technology Assessment Report* for this grant project.

- Various equipment has been added to the store since the 2017 baseline, including packaged food freezers as described in the *Q1 Report Whole building Goal Evaluation* section.

The project team estimates project savings have exceeded expectations with a high probability to meet annual targets. Both the lighting and HVAC efficiency measures are performing better than anticipated and have exceeded their average monthly savings expectations during Q2.

Finally, additional savings from fully DC-powered lighting were not able to be achieved outside of the testing area in the Garden Center as noted above. The Q3/Annual M&V report will include estimates of the additional annual savings that lighting powered from a DC-energy source, such as on-site battery energy storage, could provide.



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