MDMS UPDATE

~ METER DATA MANAGEMENT SYSTEM ~

US Army Corps of Engineers®

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FROM THE PROGRAM MANAGER

Welcome to our October - November 2020 issue of the *Meter Data Management System Update (MDMS),* designed to keep you informed on the growth and latest developments of the Meter Data Management System and the Army Metering Program.

We have added the MDMS Update Newsletter archive to the MDMS Library on the Newsletters page. Also added to the MDMS Library are the training webinar presentations and several other key presentations, such as the Trail of Champions. These can be found on the Presentations/Briefings page in the MDMS Library.

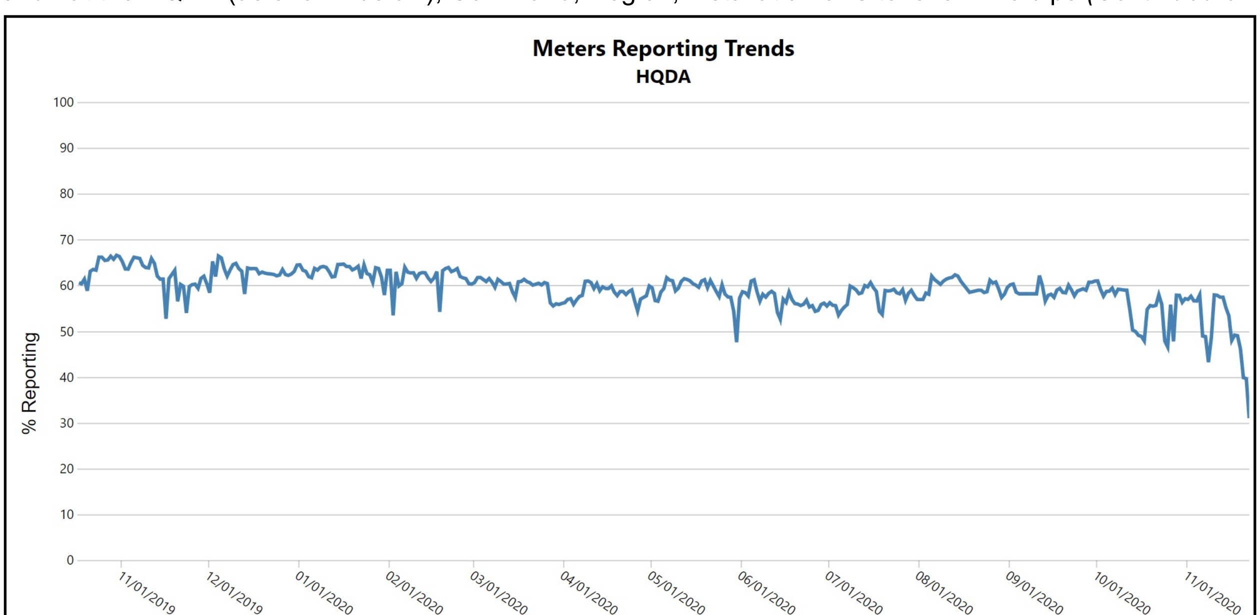
Our first article in this issue covers yet another new module in MDMS. The Meters Reporting Trends report. As briefed below, this report generates a graphical view of meter reporting trends for the selected organization over time. We show several examples here.

The 4th Level Benchmarking training course was first offered at the end of September and continues to be offered in the training webinar rotation. On pages 3-7, we detail this course and how we benchmark the last system, Air Conditioners (AC). This course includes scatter plots to talk about the usage components, new metrics for AC efficiency to help derive AC load, and AC usage trends. With this approach, our goal is to determine the impact of the equipment over time.

As always, our mission is to improve the MDMS experience for end users. Your input is valuable, and we welcome your feedback via the Army Meter Service Desk (AMSD) at: usarmy.coe-huntsville.cehnc.mbx.armymeterhelp@mail.mil

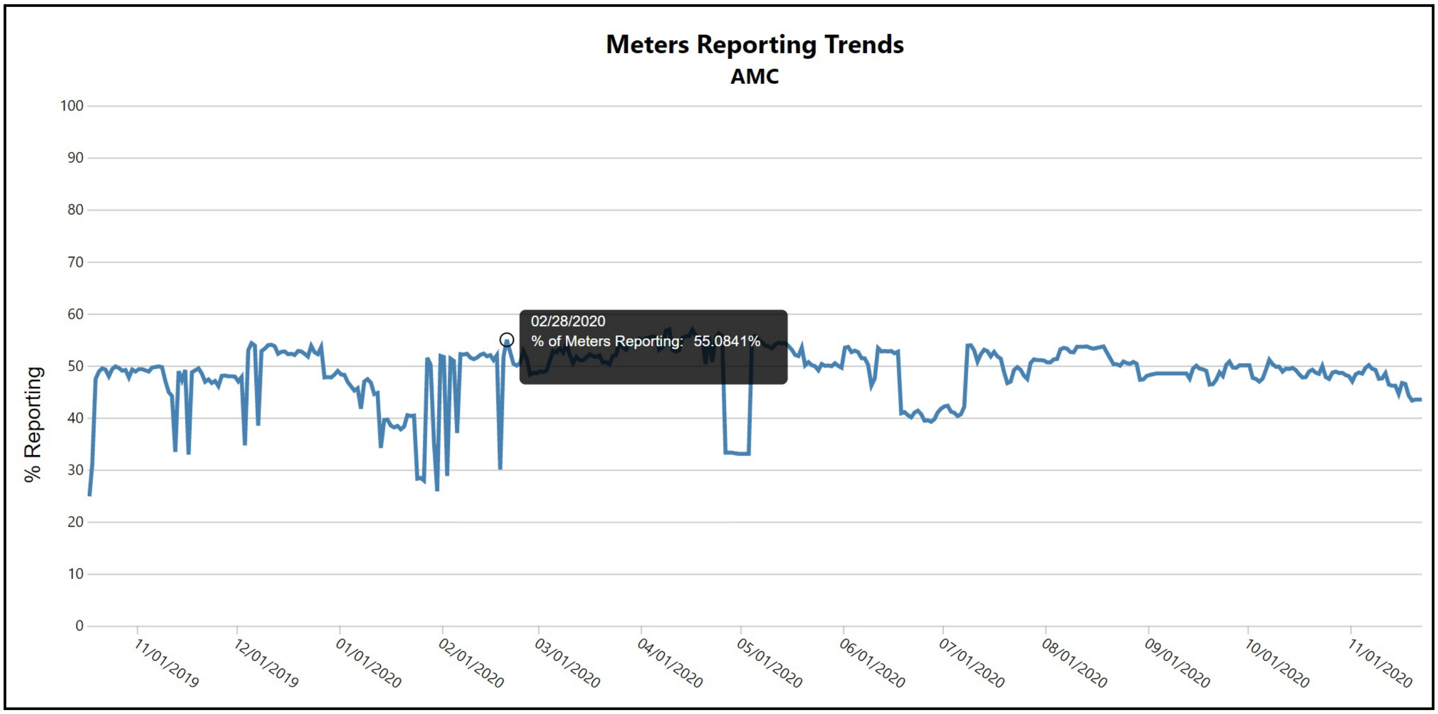
METERS REPORTING TRENDS

The Meters Reporting Trends report generates a graphical view of meter reporting trends for the selected organization over time. This data is sourced from daily snap shots of the meter status rollup captured since October 2019. This report may be run at the HQDA (as shown below), Command, Region, Installation or Site level. The dips *(Continued on pg. 2)*

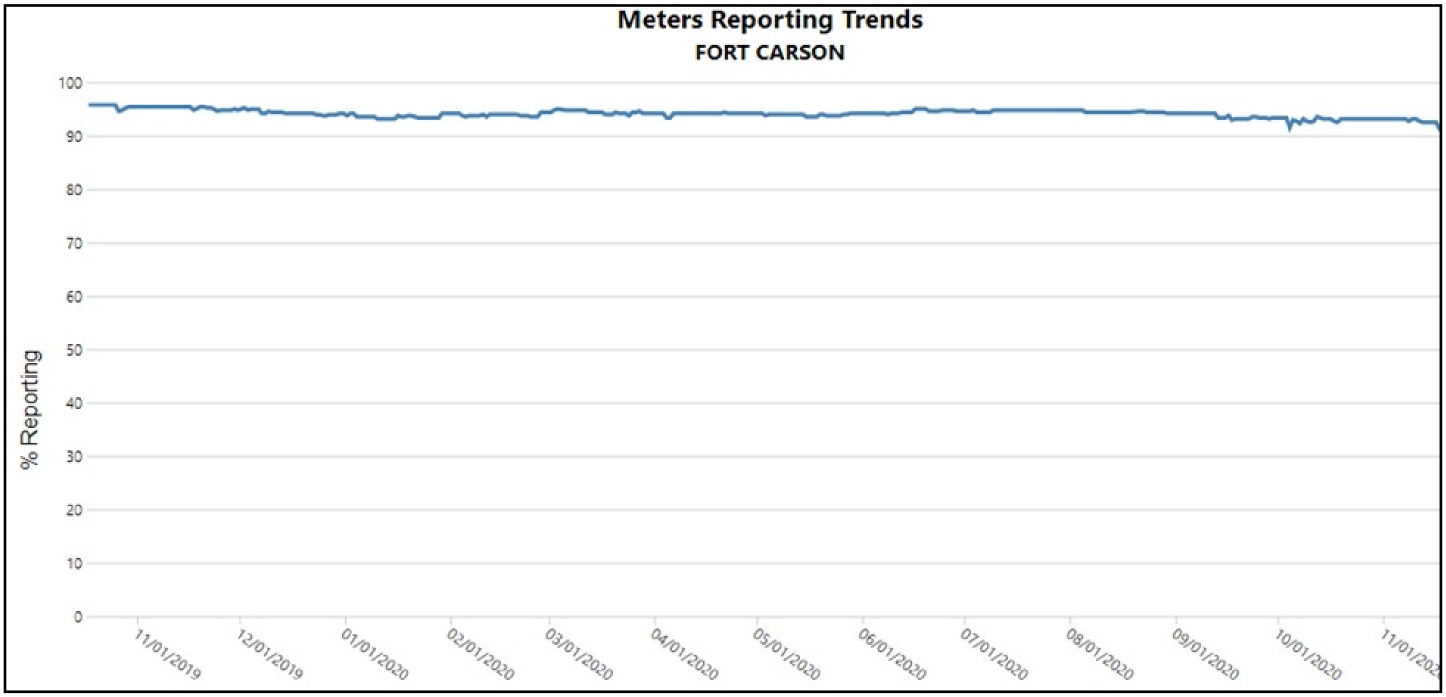


METERS REPORTING TRENDS (CONT. FROM PG. 1)

in October and November were caused by Fort Bragg taking down their system for maintenance. Hovering the mouse over particular points in the graph will provide a popup with the actual percentage of meters reporting for that date, as shown in the AMC example below. Using the roller wheel of the mouse allows users to zoom in and out of the graph.



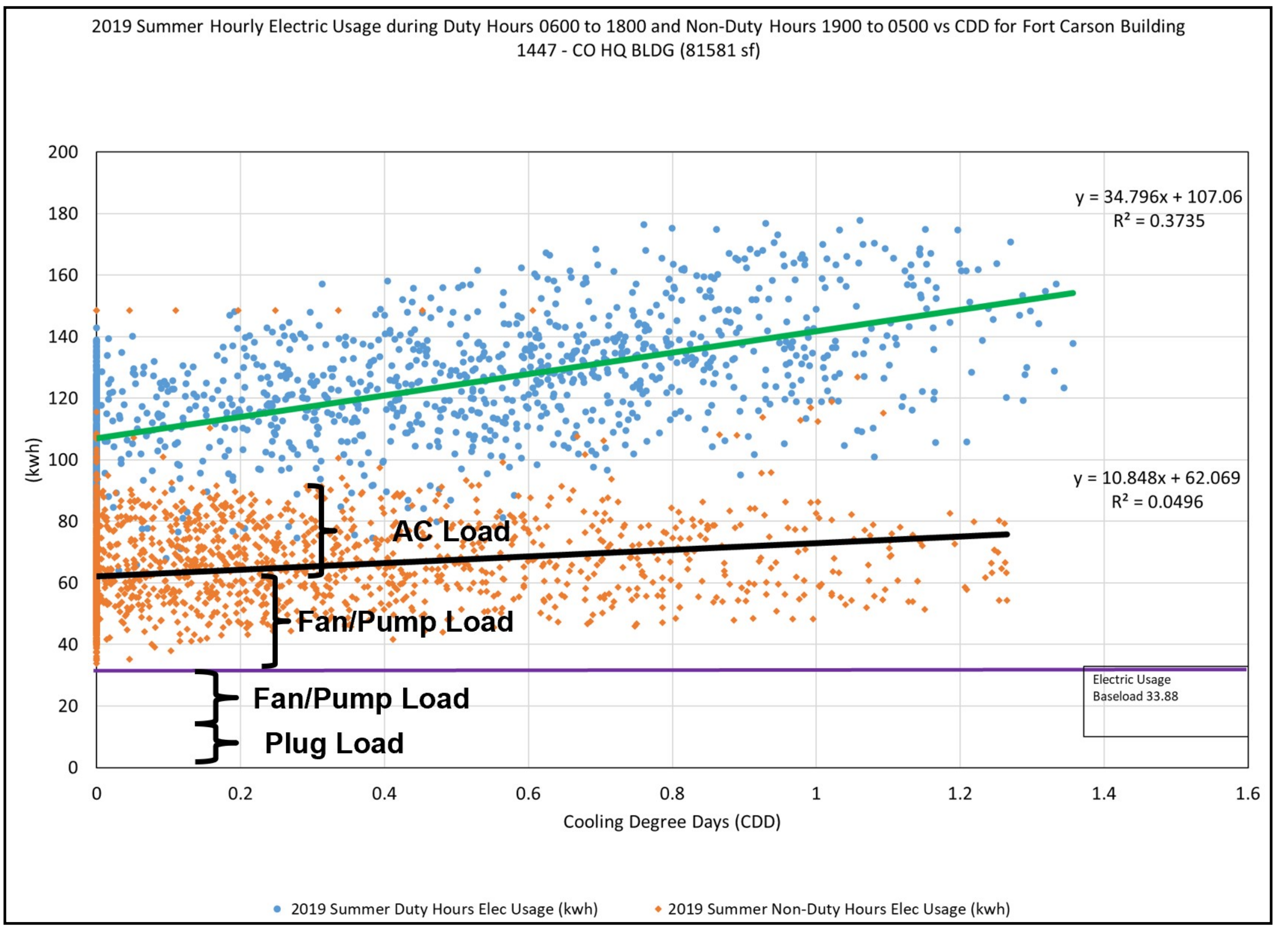
The below example is from Fort Carson. Note that their percentage of meters reporting has stayed consistently above 90%, actually at the 93-95% range. Kudos to Fort Carson!



4TH LEVEL BENCHMARKING

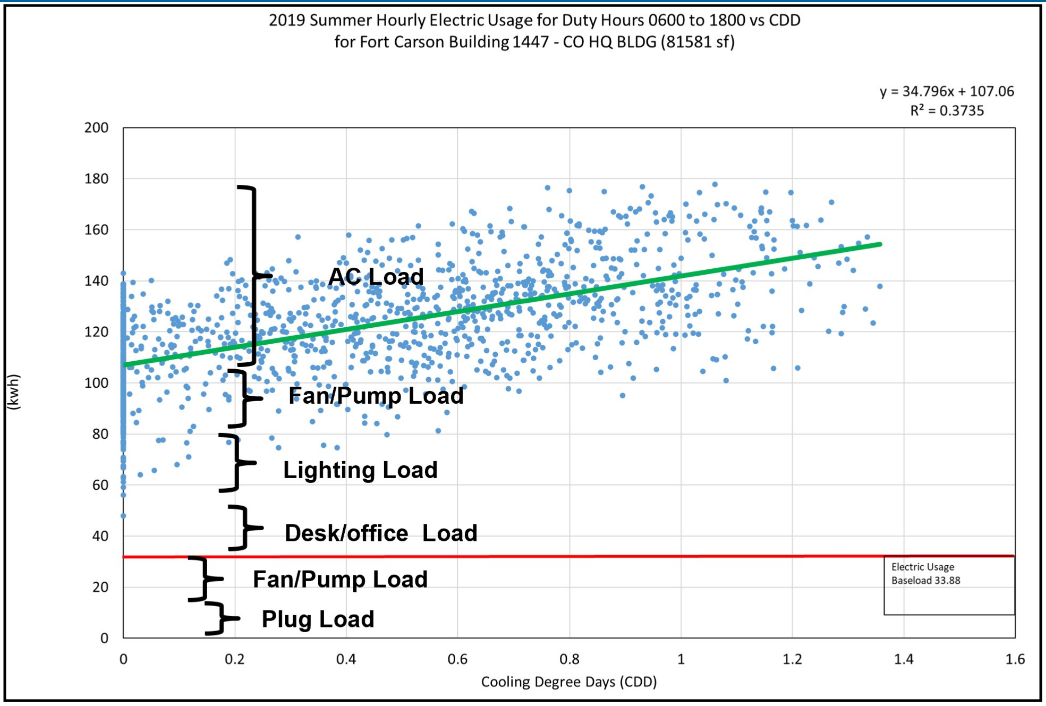
The 4th Level Benchmarking training class was first offered at the end of September and continues to be offered in the training webinar rotation. This class covers benchmarking the last system, Air Conditioners (AC). In this course we use the scatter plots of the hourly intervals to generate the waterfall of values for each system during duty and non-duty hours. These show the impact of the air-conditioning systems on the energy usage. We can benchmark those systems to determine the efficiency of those AC systems over their life and compare them to similar systems across the Army.

Because benchmarking is so critical to everything we do from an energy management perspective, we go through all the different aspects of benchmarking in our training courses. The 4th Level Benchmarking course is the final stage in our benchmarking methods. Our goal in this course is for you to go away understanding how to compare efficiency of your AC systems, and how and when they provide cooling to your building. We continue to use the pie chart showing the major components of usage so that you can visualize the biggest culprits of energy usage, with fans and pumps continuing to show over 50% of the annual usage because we leave those systems running constantly in the building during off-duty hours. We then dive into the scatter plot analysis of breaking out each system load during both non-duty and duty hours. One example is shown below, which is a CO HQ BLDG with over 81,000 SQFT from Fort Carson, with the base load shown as a purple line across the bottom. Then we've called out both the fan/pump and AC loads during the non-duty hours.

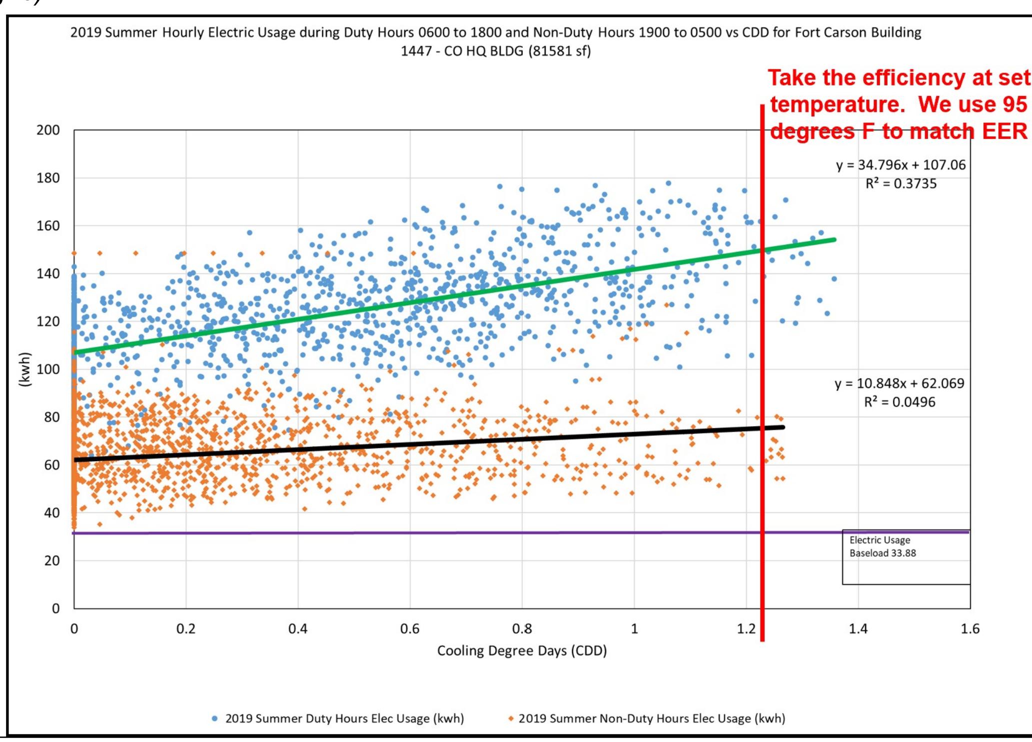


Our AC load is primarily coming on during the duty hours, as shown in the chart below. *(Continued on pg. 4)*

4TH LEVEL BENCHMARKING (CONT. FROM PG. 3)



So, how do we determine AC efficiency? While the traditional Coefficient of Performance (COP) and Energy Efficiency Ratio (EER) are interrelated, they both use the output of the system to determine efficiency. We don't have the system output, but we do have the usage in kilo-Watt hours (kWh) at a set temperature or Cooling Degree Day (CDD). So, we create our own efficiency benchmark: System Efficiency (SysE) in watts per SQFT (watts/sf) required to satisfy the Outside Atmospheric Temperature (OAT) at a specific temperature (i.e., 95 degrees Fahrenheit). This establishes a benchmark for the AC system for the overall building as long as every comparison is at the same temperature. The system includes all the AC associated components, such as the chiller units, fan, and coil or all the fan coils or a combination of all the systems. So, to determine our meter derived efficiency, we use our formula SysE = Watts input at 95 degrees F = 1.843 watts/sf. As opposed to EER, in this case the lower the number the more efficient the system. *(Continued on pg. 5)*



4TH LEVEL BENCHMARKING (CONT. FROM PG. 4)

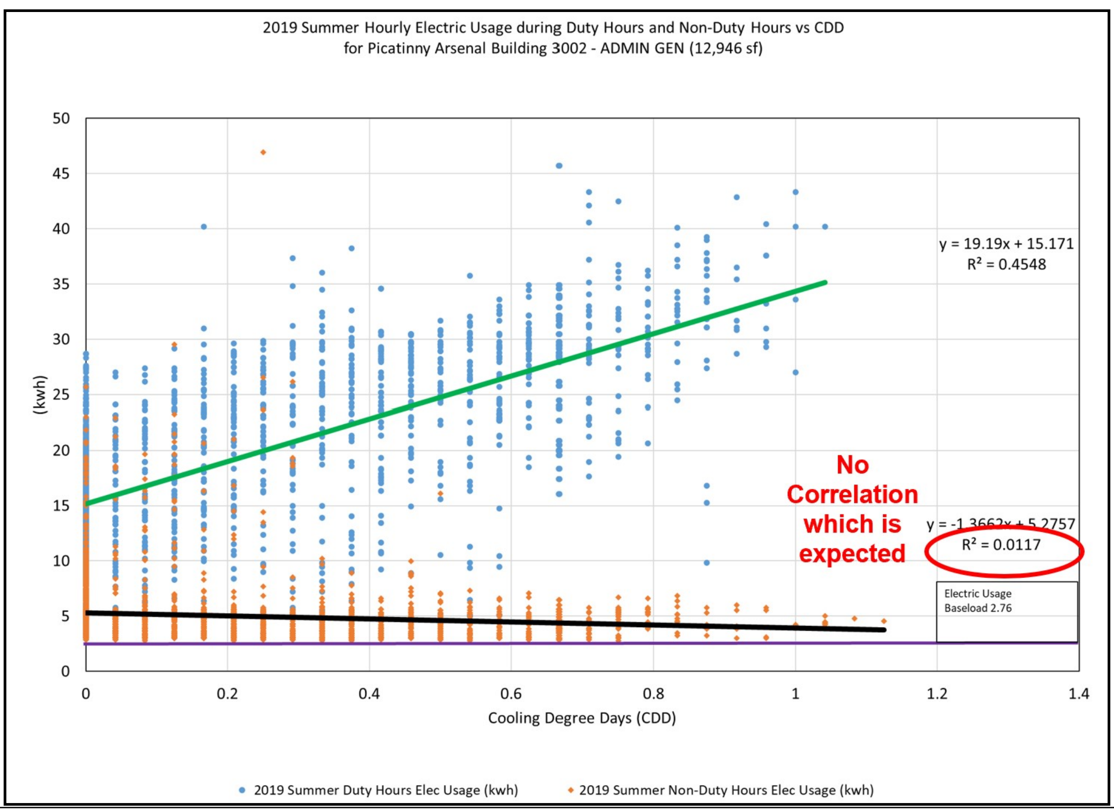
That set temperature gives you a different SysE for duty and non-duty hours. That's an important differentiator that will be broken down as follows. As you look at this chart at the top right, you see the SysE for both the duty and non-duty hours for building 1447. You see 0.925 in the bottom row, right column for non-duty hours last year versus 1.843 during duty hours last year. The difference between duty and non-duty is going to have one real variable, solar, and the rest are direct calculations—people, office equipment—which is close to the non-duty plug load—and OAT, where OAT is normalized because we are comparing it against the same CDDs.

Carson Bldg 1447	Duty Hours			Non-Duty Hours
Year	2017	2018	2019	2019
SysE watts/sf	2.021	1.924	1.843	0.925

So, how do we define these impacts? Generally, for people in the building office space, rule of thumb is 100 watts/person. Obviously the type of work that they are doing will alter that, but most of our people are sitting in the office in an administrative type of operation. 80-90% of the Army's buildings will fall into that category. So, with 100 watts/person as the rule of thumb, we ran this for Fort Carson and the average is 400 sf/person for those administrative spaces. That gives us 0.25 total watts/sf. Office equipment is a straight calculation based on your kW and you just apply that across to the AC. That gives us 0.07 total watts/sf during non-duty hours and 0.20 total watts/sf during duty hours. Now let's take away the people and plug loads and you can see what we have in the table to the right. That gives us 1.39 watts/sf for duty hours and 0.855 watts/sf for non-duty hours. If we take the difference of those two, we get 0.54 watts/sf which will be attributed to the impact of solar loading.

Carson Bldg 1447	Duty Hours			Non-Duty Hours
Year	2017	2018	2019	2019
SysE watts/sf	2.021	1.924	1.843	0.925
People			0.25	
Plug			0.20	0.07
Difference			1.39	0.855
Difference Solar			0.54	

We remind you that you can have a negative slope in the scatter plot when comparing kWh to temperature. If your system is not responding to temperature, then you have no correlation. In the example below, note the red circle shows 0.0117 for the correlation coefficient, which essentially indicates no correlation. During non-duty hours, you don't want to correlate the temperature. This means that you have the system schedule and controls working correctly and not responding to outdoor temperature. On the heating side, if you did this for winter, you would want it to respond to temperature, but only when the temperature drops below 45 degrees Fahrenheit. Now, there are two important questions to ask yourself when you are looking at scatter plots: 1) what is it showing me overall? and 2) why does it respond in this manner? *(Continued on pg. 6)*



4TH LEVEL BENCHMARKING (CONT. FROM PG. 5)

Now, we dive into the waterfall charts. First we look at the breakdown of the fan and pump for summer. In our chart below, you can see the AC (chiller) load above baseload during non-duty hours at 54,675.09 kWh used. That same load during duty time is 51,533.43 kWh used. This tells us that we've used the AC more during non-duty hours versus duty hours, and that's potential savings. That is the significant impact by breaking down these metrics.

Summer			#	%			
non duty	base load	plug	15,915.93	20.48%			
non duty	base load	fan/pump	61,804.79	79.52%			
non duty	base load	chiller	-	0.00%			
non duty	base load	subtotal	77,720.72	100.00%	77,720.72		
non duty	base load						
non duty	above baseload	fan/pump	14,636.11	21.12%			
non duty	above baseload	chiller	54,675.09	78.88%			
non duty	above baseload	office					
non duty	above baseload	subtotal	69,311.20	100.00%	69,311.20		
non duty	total		147,031.92		147,031.92	147,031.92	
duty	base load	plug	9,465.05	20.27%			
duty	base load	fan/pump	37,221.59	79.73%			
duty	base load	chiller	-	0.00%			
duty	base load	subtotal	46,686.64	100.00%	46,686.64		
duty	above baseload	lights	43,061.16	35.95%			
duty	above baseload	fan/pump	6,249.88	5.22%			
duty	above baseload	chiller	51,533.43	43.03%			
duty	above baseload	office	18,930.10	15.80%			
duty	above baseload	subtotal	119,774.57	100.00%	119,774.57		
duty	total				166,461.21	166,461.21	
total							313,493.13

The result of this process is establishing two hard-to-establish values: system efficiency and usage.

We then do further analysis at the individual building level across several years. Our first example is building 1447 which, as we can see in the chart below, decreased in system efficiency signaling better maintenance. Annual usage was a lot higher in 2017 than it was in 2018, which it shouldn't be, as 2018 was a heavier cooling degree day for everyone. So we should be seeing a little higher in 2018 than 2017. We know that it's not a piece of equipment that was changed out because the system efficiency is going down. Therefore, a system was left on in 2017. This is when we started the Monitoring Commissioning (MCx) Process with this installation. Most likely they discovered a system being left on at night, fixed the schedule, thus resulting in the change in annual usage. Those are the kinds of things this type of analysis can tell you and why we show you this process. *(Continued on pg. 7)*

Building 1447: Benchmark Categories	2017	2018	2019
SysE rating Watts/sf	2.021	1.924	1.843
Annual usage/sf kWh/sf/yr	2.176253	1.246283	1.341073

4TH LEVEL BENCHMARKING (CONT. FROM PG. 6)

Our next example, shown below, is building 7450, where you can see system efficiency going down over the 3 years. We see two large jumps, so this could be either project related or a sign of better maintenance. However, we see system usage increasing a lot, but not due to the 2018 CDD spike. This most likely indicates system schedules being overridden for some systems from 2017 to 2018, and perhaps an additional system or systems in 2019.

Building 7450: Benchmark Categories	2017	2018	2019
SysE rating Watts/sf	3.573	2.826	2.274
Annual usage/sf kWh/sf/yr	1.072949	1.868179	2.511417

And our last example shown below, is building 7464, where you can see very consistent efficiency ratings. It also has good annual usage, with the exception of the last year. Again, this most likely indicates a system schedule being overridden and this needs to be looked into.

Building 7464: Benchmark Categories	2017	2018	2019
SysE rating Watts/sf	1.527	1.537	1.544
Annual usage/sf kWh/sf/yr	1.042837	1.081459	1.572003

In summary, the course takes you through all the stages of benchmarking and shows how each stage builds up. We essentially take the basic building blocks approach. We then show how to use the scatter plots in each of those to talk about the impact of those components. To derive the AC load, we established new metrics for AC efficiency. We then present usage trends for the AC unit. With this approach, we are able to determine the impact of the equipment on usage over time.

In our next issue of the newsletter, we will cover the next advanced analytics course: Advanced Metrics for Systems. The Advanced Metrics for Systems course was first offered at the end of September 2020 and continues to be offered in the MDMS training webinar rotation. This class builds upon what is covered in the Evaluating the Energy Use Intensity (EUI) Report and Comparing EUI to Other Metrics courses. It combines a series of three metrics together into a stop-light chart. Each chart is tied to a category code for the 30 largest category codes in the Army. Then the charts are color-coded for each of the three metrics to show where they fall compared to their peers. There is an if-then logic for each category to tell you if your meter is bad, where you stand against other buildings i.e. top 25% or bottom 25 %, etc. So stay tuned!