MDMS UPDATE

~ METER DATA MANAGEMENT SYSTEM ~

US Army Corps of Engineers®

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FROM THE PROGRAM MANAGER

Welcome to our October - November 2022 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.

This issue focuses on our newest module within MDMS: the Scatter Plot Modeling Tool. While the MDMS Outreach Team uses scatter plots extensively in many of the benchmarking and advanced analytics training courses, these scatter plots have been generated manually thus far. This new tool will generate the scatter plot for you automatically, including the corresponding pie chart of usage breakdown, within an Excel spreadsheet. Read on to learn more about this exciting new tool and how it can help in your energy management analysis.

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: cehnc-army-meter-help@usace.army.mil

SCATTER PLOT MODELING TOOL

There's a new tool in MDMS and it's revolutionary! The newly added Scatter Plot Modeling Tool allows Energy Managers (EMs) and Resource Efficiency Managers (REMs) to better understand energy used in buildings and why systems behave a certain way. In other words, this tool provides a quick and effective way to allocate energy into the appropriate uses. Things that traditionally take a week of analysis — approximately 40+ hours of an EM's/REM's time — for a building analysis can now be achieved in a few minutes. All the energy used in buildings are broken into 4 primary systems:

- Plug loads
- Lighting systems
- Fan/pump systems
- Air Conditioning systems

The scatter plot establishes a relationship between the Cooling/Heating Degree Days (CDD/HDD) against the energy usage for the building, thus allowing a quick analysis for projections and/or comparisons. The report output is an Excel template that involves complex rules and customizations that allocate the usage into energy subsets based on the time it occurs. We find that energy subsets like non-duty hours limits the system that can be on during that period.
The current implementation allows for the selection of a calendar year (2017-2022). The analysis is applied per building for the Electric commodity. Once the year and building selections are made, the "Export to Excel" button generates the analysis along with the scatter plots so you can visually evaluate the distribution of energy usage. The following tabs are created in the Excel export:

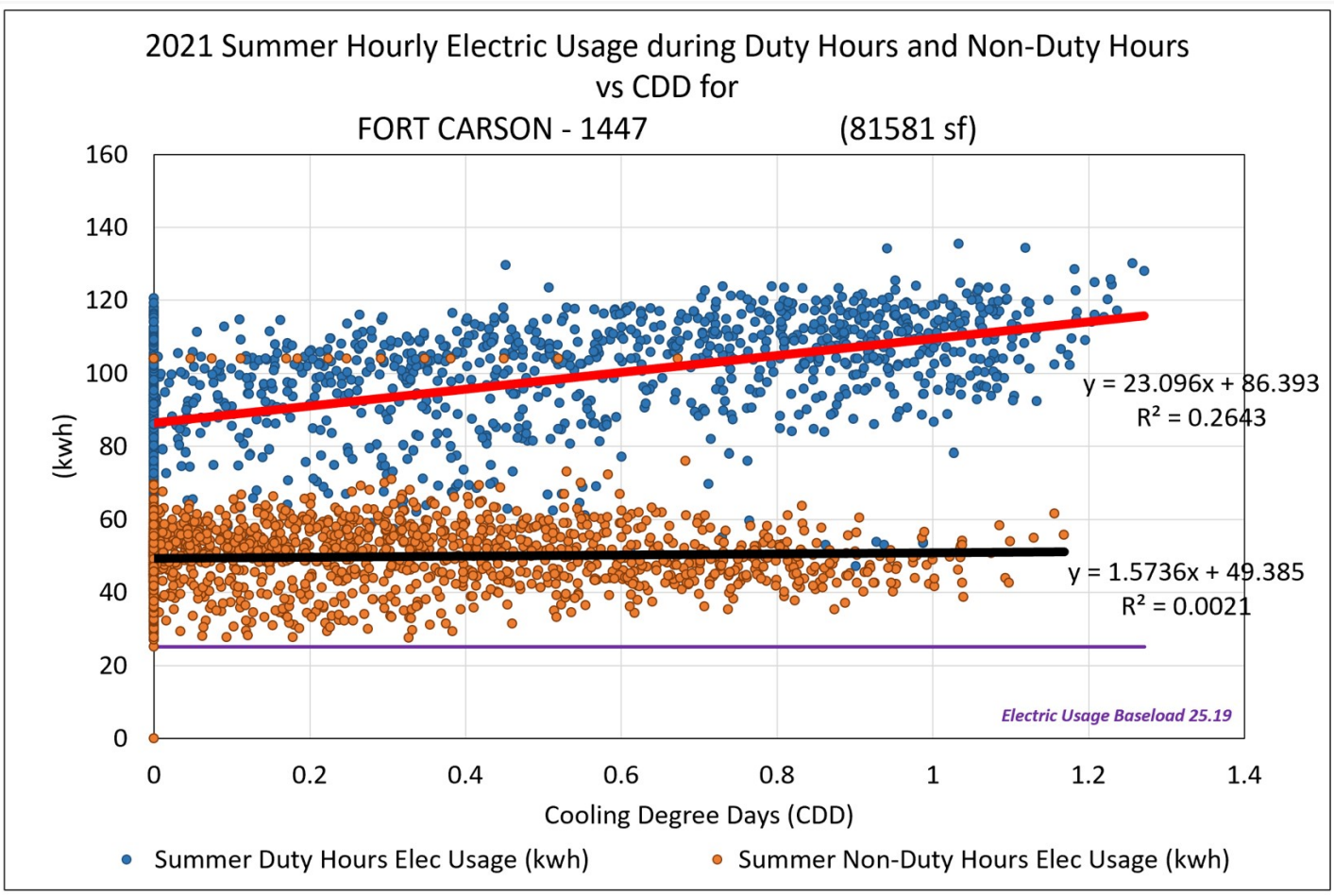
- Calculations Sheet
- Summer Holidays
- Winter Holidays
- Hourly Data
- Summer All Hours Data
- Summer Duty Hours Data
- Summer Non-Duty Hours Data *(Continued on pg. 2)*

SCATTER PLOT MODELING TOOL (CONT. FROM PG. 1)

- Summer Combined Hrs Chart
- PIE Chart
- Winter All Hours Data
- Winter Duty Hours Data
- Winter Non-Duty Hours Data
- Winter Combined Hrs Chart
- Winter Non-Duty < 45 Data
- Inputs
- All Data (incl missing rows)

Below is an example of the Summer scatter plot, found on the "Combined Hrs Chart" tab, which includes the duty (blue points) and non-duty (orange points) hours. Our example shows Fort Carson building 1447 for Summer 2021. The graph shows usage in kwh on the left axis and CDD along the bottom axis. The baseload for the electric usage is plotted along the bottom of the graph in purple which is the minimum non-variable usage of the orange points. The baseload is shown at 25.19 kwh for our example. The usage for duty hours is shown in blue dots, with a corresponding red trend line, and the orange dots represent the usage during non-duty hours with a corresponding black trend line.

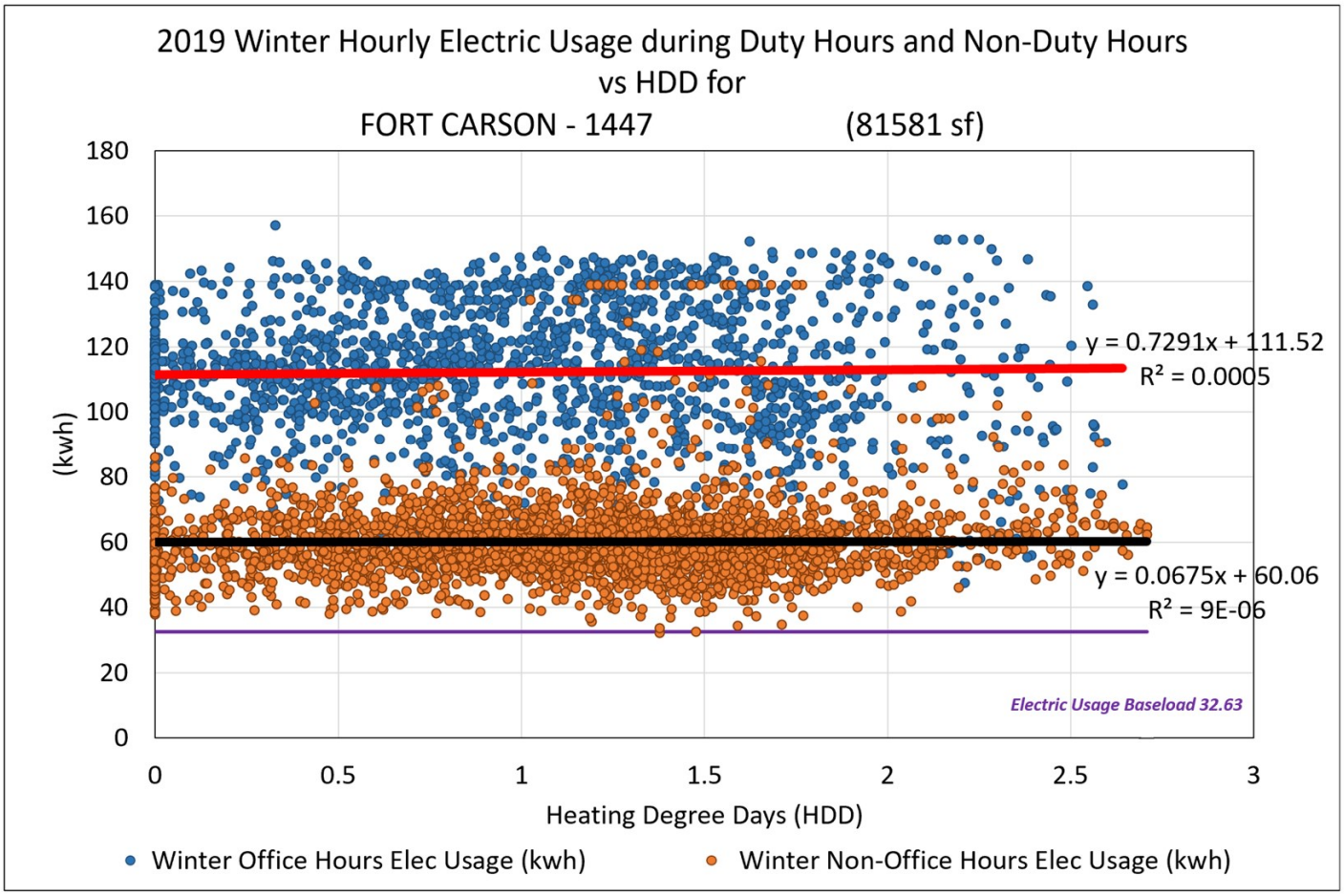
The formulas are shown for the best fit for the duty and non-duty points. The formulas indicate the slope and intercept of each set of points and those are important in the analysis. The R2 is the correlation which doesn't need to predict where a point will be but that the systems are responding or not responding to Outside Air Temperature (OAT). The R2 for this example would not normally show correlation for predictive purposes but for our purposes is does show response to a rise in CDD (or OAT). *(Continued on pg. 3)*



SCATTER PLOT MODELING TOOL (CONT. FROM PG. 2)

The blue points that show in the non-duty are where people come into the office late or left the office early. The orange points in the duty area are where they came in early or left late. The orange points above the purple line indicates that the system(s) were left running during non-duty hours. This indicates a potential savings if you can get the system under control. A system working correctly will have the orange points coincide with the purple line.

This next scatter plot is for Winter and can be found on the "Winter Combined Hrs Chart" tab and also includes the duty and non-duty hours. This example shows Fort Carson building 1447 Winter 2019. All the areas of the chart (kwh, baseload, duty and non-duty usage hours, etc.) are the same as previously discussed. The difference here is there are HDD along the bottom axis to correspond with Winter, so the increasing HDDs are colder weather. The duty hours have a slight slope that only reacts slightly in winter due to HDD. So, electricity is slightly driven by the HDD vs the other requirements. For the non-duty hours there is no slope and the R2 shows no correlation to HDD. This indicates electricity is balanced on systems in winter and driven equally by all usages.

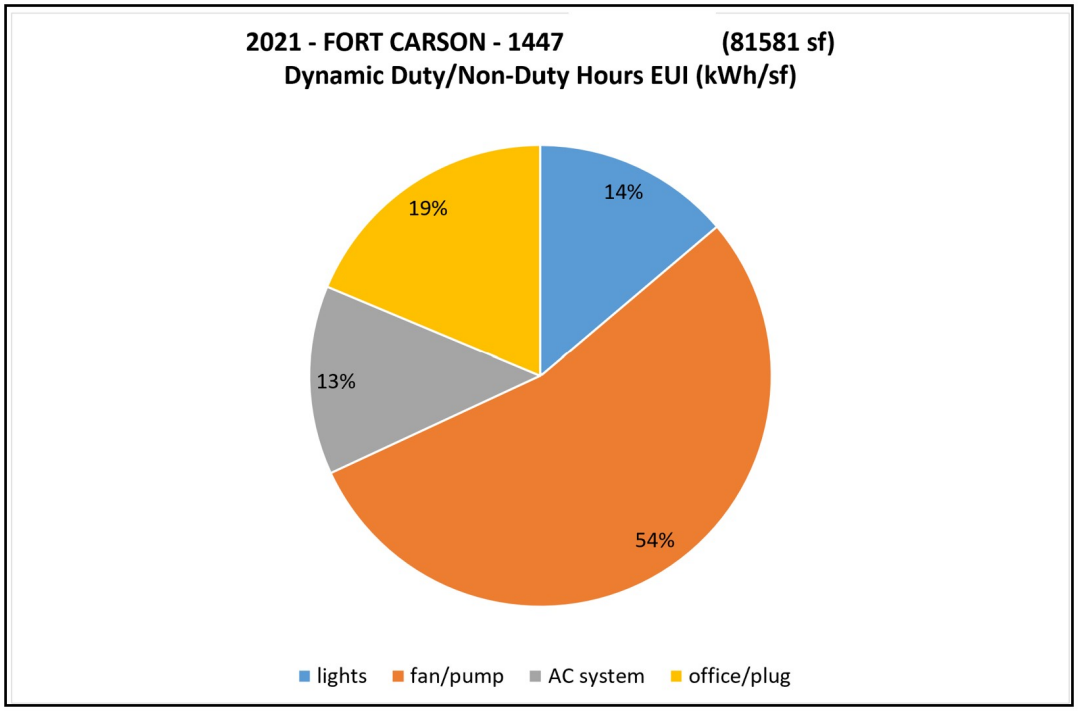


The input to this report is the hourly usage data, including temperatures, for the year selected. This can be found on the "Hourly Data" tab and also incorporates holidays from the "Summer Holidays" and "Winter Holidays" tabs. These inputs are used for the calculation of Summer/Winter Duty/Non-Duty Hours and base load for lights, fan/pump systems, AC systems, and plug load to ensure points are in the correct duty/non-duty hour grouping and energy subset.

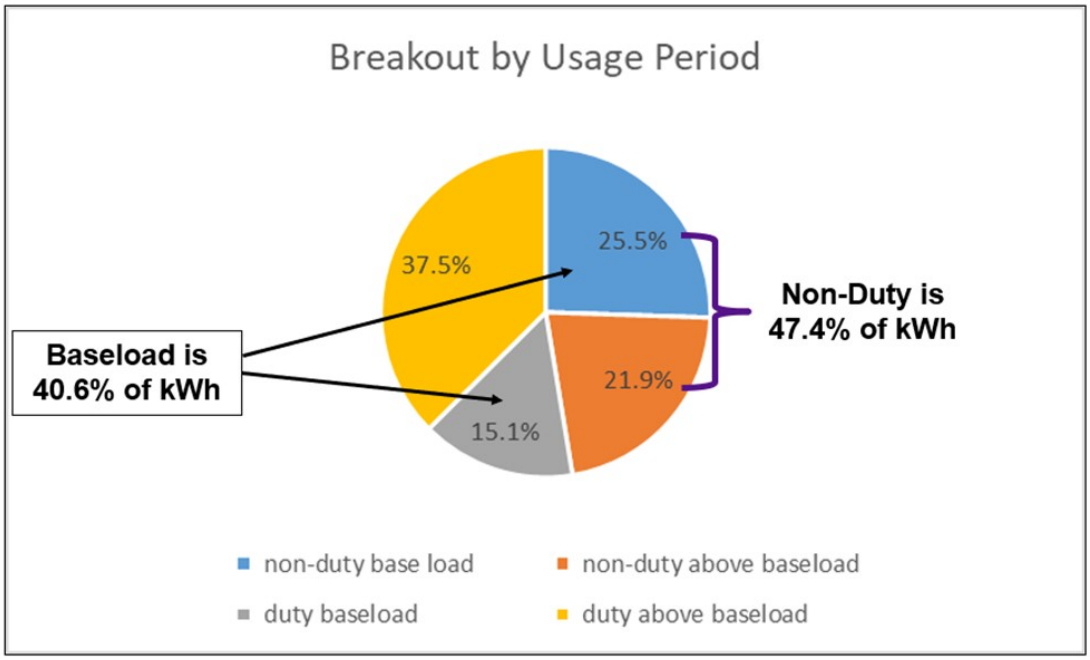
The final output is the "Calculations Sheet" that generates the annual analysis for the 4 primary systems of the building selected.

Below is an example of the pie chart generated for Fort Carson building 9090 for 2021 showing the four major components of usage: lights, fan/pump systems, cooling/AC systems, and the office/plug load. *(Continued on pg. 4)*

SCATTER PLOT MODELING TOOL (CONT. FROM PG. 3)



The scatter plot is the only way to run the calculations to show the energy usage in the duty and non-duty subsets as broken down in the chart below. Since there is a large percent of energy shown in this figure during the non-duty time (47.4%), that is a lot of potential savings. We have found that a properly run facility only needs between 12-20% of energy during non-duty hours depending on the climate zone. In general, the Army runs between 40-55% of the energy during the non-duty hours indicating a large savings potential. That means there is--in most situations--between 20-40% savings potential available in Army buildings.



To learn more about the Scatter Plot Modeling Tool, reach out to the AMSD to schedule a one-on-one session with your MDMS Outreach Team.