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UNDERSTANDING A LOAD STUDY

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DETERMINING YOUR RETURN ON INVESTMENT (ROI) WITH AN ENERGY LOAD STUDY:

Understanding an energy load study

By Gregg Wong, Technical Product Trainer, and Sean Silvey, Sales Application Engineer
AEMC® Instruments

INTRODUCTION

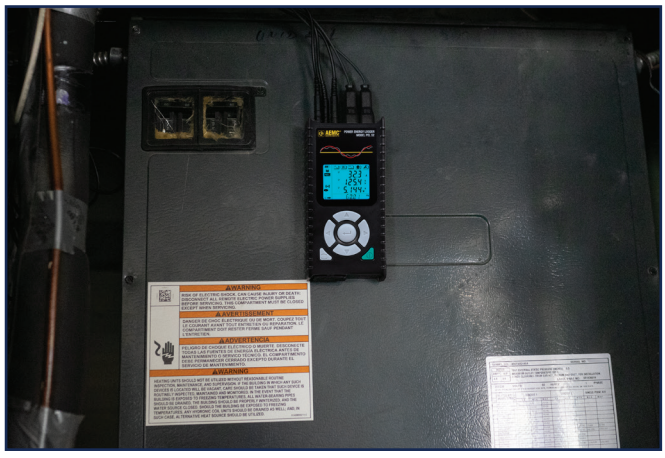
It seems various new energy saving technologies are announced almost daily. From sleek refrigerators and energy-efficient LED lighting to state-of-the-art geothermal air conditioning systems, we're constantly presented with possibilities. But is the investment in upgrading worth it? One way to ascertain the Return on Investment (ROI) is through an energy load study, comparing the efficiency of the older system with the specifications of the newly installed one. By conducting a pre-installation and post-installation load study analysis, we can evaluate the results comprehensively.

WHAT IS A LOAD STUDY?

An energy load study, also known as a load analysis, is a process of assessing and analyzing the energy consumption patterns and demands of a specific system. It involves studying how energy is used over time, understanding the load profile, and identifying opportunities for energy optimization and efficiency improvements. The primary goal of an energy load study is to gain insight into the energy requirements and usage patterns of a system.

With the example above, let's conduct an energy load study on the HVAC system for a multi-family dwelling. It involves analyzing the energy consumption and load profile of the current system. This study helps to understand the energy requirements and efficiency of the air handler, or furnace unit, and the outside condenser. It can provide insights into optimizing energy usage and reducing costs.

In this study, the load analysis was conducted using the AEMC® Instruments PEL 52. To secure the device in place during the week-long testing period, two powerful magnets on the casing allow it to be easily attached to the flat metallic surface of the HVAC system.



KEY STEPS INVOLVED IN CONDUCTING A LOAD STUDY ON A MULTI-FAMILY HVAC SYSTEM:

1. **Data collection:** Gather information about the system, including its capacity (typically measured in tons or BTUs), make, model, age, and specifications. Obtain energy consumption data for the unit, either from utility bills or using a smart energy meter if available. Note down the time and duration of HVAC usage.
2. **Load profiling:** Analyze the energy consumption patterns of the HVAC system. Identify the peak load periods, average load, and fluctuations in energy usage throughout the day, week, or month. This information helps determine the system's efficiency and identifies opportunities for load optimization.
3. **Building characteristics:** Assess the characteristics of the building or residence, such as its size, insulation levels, number of occupants, window types, and orientations. These factors influence the HVAC load by affecting heat gain and loss within the home.
4. **Environmental factors:** Consider external factors that impact the HVAC system, such as outdoor temperature, humidity levels, and solar radiation. These variables affect the cooling demand and energy consumption of the A/C system.
5. **Equipment efficiency:** Evaluate the energy efficiency rating (EER) or seasonal energy efficiency ratio (SEER) of the A/C system. Higher EER or SEER values indicate greater energy efficiency. Compare the system's efficiency with current industry standards to assess its performance.
6. **Air distribution system:** Examine the ductwork and air distribution system to ensure optimal airflow and minimize losses. Check for any leaks, obstructions, or poorly insulated ducts that may impact the HVAC system's efficiency.
7. **Energy-saving measures:** Identify potential energy-saving measures to reduce the load on the system. This may include adjusting thermostat settings, using programmable thermostats, implementing setback or scheduling strategies, adding temperature sensors and air balancing, improving insulation in the building envelope, sealing air leaks, shading windows, or upgrading to a more efficient HVAC system.
8. **Cost analysis:** Calculate the energy costs associated with operating the HVAC system based on local electricity rates. Assess the financial implications of implementing energy-saving measures and determine the payback period for any necessary upgrades or modifications. Rebates may also be available for system replacements from the utility.
9. **Recommendations and optimization:** Based on the study findings, provide recommendations to optimize the A/C system's energy usage. This may include adjusting temperature setpoints, optimizing equipment scheduling, improving maintenance practices, or upgrading to a more efficient system.

CONFIGURING THE TEST

Before we connect a logger to the system, we need to configure the unit based on the parameters we want to capture.

What is the nominal voltage and current of the system? Are we measuring single phase 2-wire with a current sensor, single phase 3-wire, two voltages in phase with two current sensors or two-phase (split phase) 3-wire, two voltages in opposite phase with two current sensors? HVAC systems are almost always split phase, but there are larger systems that are three phase. Only on smaller units, would you have a single phase to be logged.

What mode of measurement are we trying to capture? In a measurement mode, the voltage, current, active power, reactive power, apparent power, frequency, power factor, and phase shift are displayed instantaneous. In an energy mode, the active energy, reactive energy, and apparent energy are displayed and captured. This would be the capture of the total energies of the source or of the

load. In a maximum mode of measurement, the maximum values, maximum aggregated values of measurement and energy are captured. Our configuration is monitoring the energy consumption, so we will configure a logger in a energy mode.

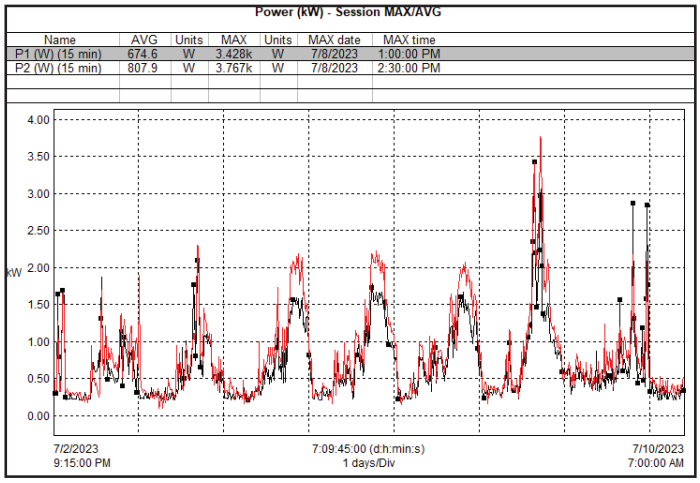
How long do we want to log? 24 hours, 48 hours, 2 weeks, a month? Do we capture data at 1 second, 1 minute, 15 minutes, or 1 hour? **What is the aggregation period?** Data aggregation is the process of summarizing a large amount of data for analysis.

These parameters and configurations will help determine the load study for analysis on the older air conditioning system or on the newly installed unit.

The Results

The results obtained from a load study can provide valuable insights and information that help in various aspects of the air conditioning system. Based on the load study, we have detailed recording and analytics of the system. This information is used to understand the varying load demands we recorded through the week. We were able to capture the peak demand periods, low demand periods, and identified reoccurring patterns. This information has now aided in determining if the system's capacity and operation are optimized.

Configuration	
Database File Name	Main distribution panel_17.dvb
Recording status	
Session name	Main distribution panel
Recording start	7/2/2023 9:00:00 PM
Recording end	7/10/2023 7:00:00 AM
Recording duration	7 days, 10:00:00 (h:min:s)
1 s trend	No
Instrument ID	
PEL model	PEL52
PEL serial number	153355XFH
PEL name	PEL52-QA
PEL location	Eng / Tech
Firmware microprocessor version	1.04
Measurement configuration and status	
Aggregation period	15 min
Electrical hook-up	2-phase 3-wire (2 current sensors)
Nominal frequency	60 Hz
Current sensor I1	MA193/MA194/A193/A196
Current sensor I2	MA193/MA194/A193/A196
Line flexible sensor range	3,000 A
Line flexible sensor wraps	1



Be sure to utilize energy loggers that come equipped with software for configuring your energy measurement tests and generating insightful reports for ROI analysis.

Overall, an energy load study provides a comprehensive understanding of energy consumption, facilitates energy management decisions, and helps optimize energy resources for improved efficiency, cost savings, and sustainability. It's worth noting that conducting a load study may require specialized knowledge and equipment knowledge. It is recommended to consult with a professional energy auditor or HVAC specialist to ensure accurate measurements and comprehensive analysis of your system.

We've tried to present the information in this white paper as clearly as possible. However, there's no denying that comprehending energy studies can be intimidating! If you require additional details regarding the concepts presented here or need assistance in initiating your load studies testing, please don't hesitate to contact us.

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Tel (800) 343-1391 | Fax (603) 742-2346