

Building Analytics Success Story

Macalester College



MACALESTER

Macalester College staff and student employees have an enthusiastic attitude when it comes to energy information systems (EIS), leveraging the college's internal resources to build their own EIS. Their Sustainability Office, Facilities Services, and IT staff have installed more than 50 web-based submeters that monitor electric consumption, wind and solar panels' electric production, steam condensate return, and heating plant natural gas consumption.

Since 2013, Kurt Miller from the Sustainability Office has installed on-campus submeters to gather utility data. Once the metering was in place, Macalester international student Tomas Panek, who has a computer science background, developed the EIS interface in partnership with campus stakeholders. The original version of the EIS was created in less than a year. New features are being continuously developed, and it presently has significant analytic functionality.

What is an EIS?

An EIS is a combination of software, data acquisition, and communication systems used to store, analyze, and display building energy meter data on an hourly or a more frequent basis. EIS is one type of energy management and information system (EMIS).

Macalester's EIS dashboard allows users to view all utility usage data, and with just a few clicks, to identify anomalies in the graphs and compare year-over-year weekly consumption. The energy manager uses the advanced charts and reports of the EIS to identify energy conservation opportunities and verify the savings from completed energy conservation initiatives.



Collaborating with our students on our energy program has been an excellent learning experience for everyone involved. The students have gained real-world experience, and we have greatly enhanced the value of our energy management information system.

- Mike Pumroy, Energy Manager

Quick Facts

Location: St. Paul, Minnesota

Building type: Office, classrooms, lab, residence

Floor area with EMIS: 1.3 million square feet

Total buildings with EMIS: 26

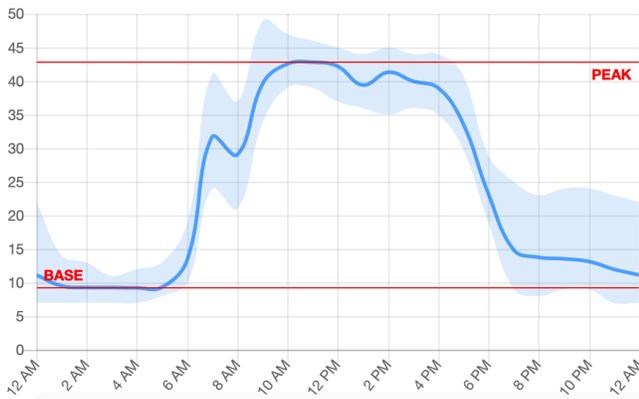
Energy savings: 5% electric savings

Energy Information Systems: In-house developed system using web-based submeters by MAMAC Systems, Inc.

Smart Energy Analytics Campaign: Recognition for Innovation Using an Energy Management System for a Portfolio

Macalester College was recognized by Lawrence Berkeley National Laboratory and the U.S. Dept. of Energy in May 2019 for their exemplary work to save energy using EMIS.

Average Day Pattern Weyerhaeuser Hall



BASE-PEAK CONSUMPTION RATIO:

0.2155

BASE CONSUMPTION:

9 kWh

PEAK CONSUMPTION:

43 kWh

MIN. CONSUMPTION TIME:

3 AM – 4 AM

MAX. CONSUMPTION TIME:

10 AM – 11 AM

Base to peak consumption ratio is benchmarked across buildings to identify high off-hours operation. Over a user-defined period, the blue line shows average consumption each hour, and the light blue band displays the minimum and maximum consumption.

Using the EIS to Find Opportunities

Macalester's EIS dashboard provides automated analysis for the submeters as follows:

- overview of total consumption for selected submeters
- load profile pattern analysis (one example screen shown above)
- benchmarking with per degree-day and per resident normalization
- heat map visualization (as shown to the lower right)

A review of the hourly electrical consumption data that was provided by the EMIS helped the college identify and quantify a significant energy savings opportunity. Through the EIS, a group of Macalester students found that the electric heating cables installed for snow removal on the roof of a campus building were consuming 500 kWh per day from November through April. Facilities Services staff used this information to make the business case for investing in new controls for the equipment. The electric heating cables are now operated by the campus building automation system only when it is snowing, resulting in a 90% reduction in equipment operation.

During the past heating season, Macalester used the EIS to calculate and display a correlation between heating degree days and the amount of condensate returned to identify mechanical problems with the condensate return equipment. In the past, these operational issues would likely have been noticed only after the condensate return equipment failed completely. The EIS also uses cooling degree-day data to assist in Macalester's evaluation of the campus central chiller plant efficiency.



A 'heat map' provides visualization of energy use over a 24-hour period (horizontal axis) for many days (vertical axis). Red is high energy use; green is low energy use.

The Smart Energy Analytics Campaign is a public-private sector partnership program focused on commercially available Energy Management and Information Systems (EMIS) and monitoring-based commissioning practices. The campaign couples technical assistance with qualitative and quantitative data collection to inform research, development, and field study priorities. Partnering participants are encouraged to share their progress and may receive national recognition for implementations that demonstrate exemplary practices.