MelRok Case Study: Pomona College

Towards Carbon Neutrality with Self Driving Buildings™

MelRok's First Mission at Pomona: Supporting Carbon Neutrality

MelRok's journey with Pomona College started in the fall of 2015. At the time, Pomona College was embarking on its mission towards achieving Carbon Neutrality by 2030. Nestled in the foothills of the San Gabriel Mountains, Pomona College (rated #1 in the US by Forbes magazine in 2015) consists of some 65 buildings totaling 1.86M ft^2 of space and spread across 140 acres. It is home to about 1700 students.

Achieving carbon neutrality starts with accurate and detailed visibility into energy usage on campus. Pomona College's energy management team requested MelRok's help to obtain visibility into the energy usage on campus and deploy the needed technology to monitor the progress towards carbon neutrality. Pomona College had more than 60 energy meters, of different make, model and generations already deployed across the campus, with limited access to the meters' data. MelRok deployed its Touch Gateway and connected to all the existing meters on campus, effectively turning old low-tech energy meters into smart meters with minute-by-minute real time visibility into energy use across the campus.

MelRok's work not only allowed Pomona College staff to accurately track their progress towards carbon neutrality, it also gave them the tools to accurately measure and verify savings from energy improvement measures, in addition to automated fault detection of abnormal energy usage on campus.

Pushing the Envelope

In 2016, Pomona College was ready for the next step in energy management: the optimization of their buildings' energy management systems. Conventionally referred to as retro-commissioning, the art of 'tuning' a building to identify defective systems and improve energy efficiency is a one-time effort conducted by expensive energy professionals, and one that relies on manual data logging and analysis.

Pomona College did not want to follow convention. They desired a sustainable and automated way of continuously optimizing buildings to ensure that buildings never 'drift' from their optimum settings once they have been retro-commissioned.

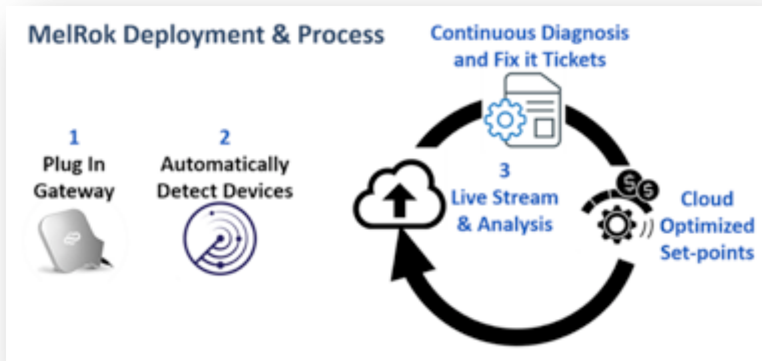
Pomona's needs coincided with the release of a solicitation by the California Energy Commission (CEC) requesting proposals for projects to deploy new energy-saving technologies. MelRok teamed up with Pomona

College, Lawrence Berkley National Lab, E3 Inc. and the Zero Net Energy (ZNE) Alliance to propose the deployment of MelRok's platform for the Automated Cloud-based Continuously Optimizing Building Energy Management Systems – ACCO BEMS. The team won the competitive solicitation and was awarded a CEC contract to deploy MelRok's Self Driving Buildings™ platform in 10 buildings at Pomona College, with the goal of reducing energy by 20%.

New Approach to Commissioning

The first step in the ACCO BEMS project was the retro-commissioning of the buildings using a data-driven approach. The MelRok platform connected to the energy management systems in the buildings, logged all points, and analyzed the data for defective sensors, systems and control logic. The findings were used to drive targeted retro-commissioning efforts, saving time and money in identifying and fixing issues. Most importantly, the platform delivered continuous performance assessment to ensure old issues do not resurface, and to quickly identify and diagnose new ones.

Deployment of the platform started with the installation of the plug & play MelRok Touch Gateway. Once installed, the Gateway scanned the network for EMS controllers and uploaded the controller metadata to the cloud. The cloud automatically registered the devices and enabled the Touch to initiate communication with the controllers. At that point, all energy management system data (inputs, outputs, set-points, thresholds and control variables) started streaming to the cloud for analysis and storage.



Up to 40% Savings Delivered

	Start Date	End Date	Daily kWh	Peak kW
1st Period	Fri 6/1/2018	Sat 6/30/2018	1,822.1	142.0
2nd Period	Sat 6/1/2019	Sun 6/30/2019	1,118.6	79.5
Change			-703.5	-62.5
% Change			-38.6	-44.0

To date, the MelRok platform has identified dozens of critical issues at Pomona College and led to savings of up to 40% year-over-year in some buildings.

A specific example is Thatcher Hall, where the year-over-year monthly savings ranged between 30 to 40%. The table shows 39% kWh savings for June 2019 vs. June 2018.

Solving the Toughest Challenge First

What separates the MelRok platform from being just a fault detection and energy optimization software - and what makes it powerful - is the fact that at its core, it solves the toughest challenge of energy management: *reliable and hi-definition data collection.* It does it without taxing the existing energy management system infrastructure.

The three pillars of the platform are:

- **Integrated data collection** in real-time from all points every minute – independent of EMS settings

- **Out-of-the-box smarts** that start analyzing the data and looking for faults without the need for expensive consultants or add-on services

- **Continuous learning** and knowledge sharing capabilities of the platform. The software is continuously learning from deployments around the world and the collective knowledge is used for the benefit of each customer.

MelRok Energy IoT™

Sample Findings

The savings realized at Pomona College resulted from a variety of findings. The faults are automatically detected and reported by the MelRok platform in a dedicated ‘Issues’ page. A sample of findings and detected faults is presented here.

Simultaneous Heating and Cooling

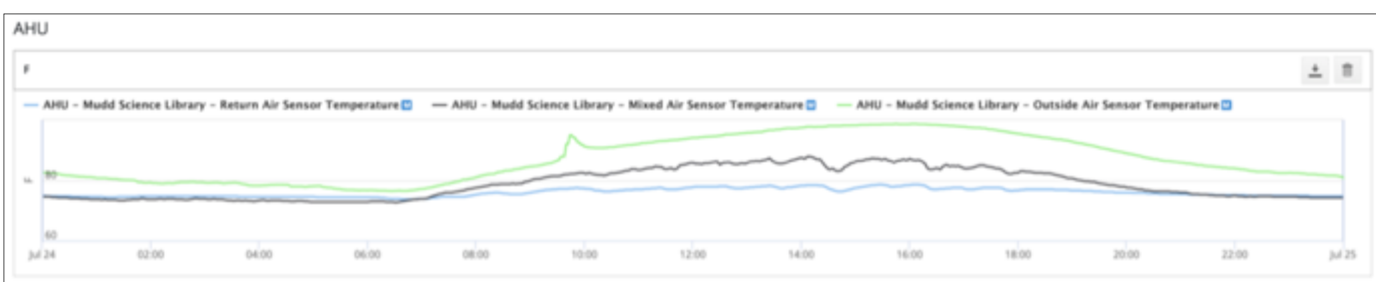
This inefficiency was observed in almost 2 out of every 3 college buildings in a study conducted by LBNL. At Pomona College, heating and cooling were observed to occur simultaneously, or within minutes of each other, as illustrated here. This results in wasted cooling and heating energies.

Over Cooling

In between streaks of hot and dry weather, faulty controls kept a chiller on 24/7 for days at a time, supplying chilled water to the building at 42F. This caused the cooling tower fan to also be ON 24/7, and the associated air handlers to supply over-cooled air as low as 55F.

Stuck Outside Air Dampers

When outside air temperatures reach 100F, outside air dampers are set to their lowest position to minimize intake of hot air. However, stuck dampers result in a larger amount of hot air drawn into the building, increasing unnecessarily the building’s cooling load.



The rapid cycling of a chiller was going un-detected when logged at 15-minute intervals (top image). MelRok's minute-by-minute measurements shed light on the chiller's real behavior (bottom image), where it was powering its compressor ON and OFF every few minutes. This operational mode is not recommended by the manufacturer and is detrimental to the lifetime of the chiller.

Non-Detectable and Detrimental Equipment Cycling

Equipment cycling is a common fault in buildings and practically impossible to detect without high-resolution data. Energy Management Systems typically log, or 'trend', data of critical points every 15 minutes at best. The point logged is specified to be the average, max or min of the values in every 15-minute period. When an equipment cycles every few minutes, as shown for a chiller above and an air handler's cooling coil valve below, its 15-minute average value conveys a false sense of normalcy, while the minute-by-minute measurements shed light on the true and detrimental cyclic behavior of the system. Cycling of electro-mechanical systems that were not meant to operate in such conditions leads to *inefficient operations and a reduction in the equipment's lifetime.*

Rapid cycling of a large air handler's chilled water control valve. The air handler uses the valve to control the amount of chilled water going through the coils cooling the supply air. This valve, like many electro-mechanical systems, was not designed to operate in short cycles for long periods of time. Such operation can decrease the lifetime of the valve and cause it to fail resulting in continuous flow of chilled water to the air handler, or no flow at all. Both outcomes result in occupant discomfort. The rapid cycling is not detected by energy management systems and software solutions using 15-minute data (top image).