



IRVINGTON HIGH SCHOOL | CASE STUDY

Building system BACnet upgrade enables high school to centralize control and dramatically reduce energy consumption.

Irvington High School in Fremont, California, opened in 1961 with an enrollment of 1,450 students; today, the campus includes a 350-seat theater, two gymnasiums, two cafeterias, and 93 classrooms that host more than 2,000 students. Irvington is one of five high schools in the Fremont Unified School District, one of the largest school districts in San Francisco's Bay Area.

For years the high school students and faculty took formal measures to reduce waste and make the campus more green, including creating a green advisory committee that collects recyclable materials from all the rooms on campus every week. In 2009 the school was named the nation's greenest school in a nationwide essay contest sponsored by IC Bus, LLC, who awarded Irvington High School a \$200,000 hybrid electric school bus for winning the title.



BACtalk's vivid displays enable the staff at Irvington High School to quickly view the entire building automation system or a single component, such as the central plant, above.

As part of its continuing efforts to maximize efficiency, Fremont Unified School District elected to update its existing dial-up building automation system (BAS), so that it could leverage an existing wide-area network (WAN) to centralize control of all the heating, ventilating and air conditioning (HVAC) equipment on campus. The school chose an

Alerton building solution installed by Syserco, Alerton's San Francisco-based dealer.

There were two primary challenges with the update project. The first was converting from the existing dial-up system to a BACnet-based, direct digital controls (DDC) system. The inherent nature of a dial-up system required the district maintenance staff to communicate one-to-one with devices, so establishing separate schedules, for example, for different zones—and different schools, once they are all tied into the single BAS—was difficult.

The other challenge was using the BAS to administer scheduled load-shedding as part of the Critical Peak Pricing (CPP) program through Pacific Gas & Electric, the electric utility provider for northern and central California. The CPP program is designed to reduce electrical demand during high-peak periods, so a participating organization commits to trying to shed a certain percentage of its load. In return, the organization received reduced electrical rates for times during the program period when Pacific Gas & Electric does not call for a load reduction. Irvington High School's CPP program period includes 12 "event days" that fall between May 1 to October 31. From noon to 3:00 p.m., the electrical rate is three times the normal charge; during 3:00 and 6:00 p.m., rates are five times higher. Fremont Unified and Irvington High School were pioneers in Pacific Gas & Electric's CPP program, but needed to make sure its own BAS could respond effectively when the call came out to shed its load.

Syserco installed an Alerton BAS on the district's existing WAN that monitors and controls all the HVAC equipment on campus, and uses BACnet to execute multiple control strategies for automatic load-shedding. The high school's BAS includes operator workstations that

I just had an idea one day: Why can't we do [energy curtailment] electronically? And there happened to be a way to do it.

Gene Wheatley, Maintenance Manager, Fremont Unified School District



An air-handling unit (AHU) is tied into the HVAC system, which easily cycles it on and off during load-shedding periods to reduce energy consumption.

run Alerton's Envision™ for BACtalk® software, which manages all the building's functions. Syserco was able to leverage nearly all the school's existing legacy IBEX hardware, so only minimal replacements were necessary. Additional tasks included converting IBEX™ to BACtalk using an Alerton global controller with BCM-TUX modules, updating to the latest version of Envision for BACtalk, and

adding new screen graphics. All told, BACtalk controls the HVAC and exterior lighting at the high school, and implements the Auto Demand Response energy reduction.

The CPP program through Pacific Gas & Electric asks participants to commit to shedding a pre-determined percentage of their electrical load on pre-scheduled days between May 1 and October 31 each year. Irvington High School is currently enrolled with 12 automatic demand response (Auto DR) days during which Pacific Gas & Electric can call, 24 hours in advance, to prompt curtailment.

The high school sheds its load in two phases: Stage One cycles the HVAC equipment on and off starting at 12:00 p.m. through 3:00 p.m. Stage Two begins at 3:00 p.m. and ends at 6:00 p.m.—all units are shut down at 3:00 p.m. While most of the school is closed by 3:00 p.m., Wheatley and his staff can still override some selected areas that may be still occupied, such as the principal's office or a gymnasium.

A client logistic interface relay (CLIR) receives the signal from Pacific Gas & Electric through the Internet and passes it onto the BACtalk software to invoke the curtailment program. The CLIR features eight outputs that execute multiple control strategies. One output receives notice of the pending Auto DR day. The Irvington system displays a graphic of a red light so the operator knows the prompt will come in the next 24 hours. At noon on the Auto DR day, the operator reads the second output as an incoming dry contact and it implements the 12:00–3:00 p.m. load reduction, cycling four zones within the targeted area off and on for 15 minutes each. A third contact implements the 3:00–6:00 p.m. strategy for curtailment.

"Our goal is to use our energy as wisely as we can," said Gene Wheatley, maintenance manager for the Fremont Unified School District.

Syserco also integrated Irvington High School's exterior lighting. The parking lot lights are monitored and controlled by the Alerton

system instead of residing on pulled timers, making it easier for the school's maintenance staff to track the outside lighting system's energy consumption.

In return for decreasing its energy use through Pacific Gas & Electric's CPP program, Irvington High School pays a reduced rate for kilowatts. In addition to other school-wide energy-saving measures, the school was able to cut its energy consumption by 33 percent in a single year. The district-wide CPP program has saved approximately \$10,000 each year for the last three years, and is a significant achievement considering the annual electrical bill for entire district is \$2 million.

"We're able to enjoy a lot of cost avoidance just by using the BACtalk's capabilities," Wheatley said.

Irvington High School was able to standardize all the various building systems with the Alerton BAS and since it leverages the existing WAN, the staff now views data from multiple sites more quickly without having to individually dial up the data.

In addition to earning the award for being the greenest school in the nation, Irvington High School was named an Energy Star in 2007 by the U.S. Department of Education, and received California's Flex Your Power award for the energy savings it generated between 2006 and 2007.

With the Alerton BAS, Wheatley and his staff tied in 28 of the 42 schools in the Fremont Unified School District and other schools have already begun their own efforts to duplicate the success Irvington High School staff has had in increasing energy efficiency.

Currently six schools in the Fremont Unified School District participate in the CPP program and any one of them can opt out of a scheduled Auto DR day. Wheatley and his staff simply check a box on the BACtalk software display and the school systems remains online. The software also locks out overrides so that no school can keep the power on without Wheatley knowing about it. There are days when the high school doesn't wait for the Pacific Gas & Electric prompt; if the weather is warm enough in between Auto DR days, Irvington High School could manually trip the load shedding to save even more money.

Irvington High School and the school district's future plans to achieve even greater energy efficiency include installing wireless sensors, LED lights for the school's interior—which accounts for approximately 60% of the energy use—and solar panels. The envisioned installation would be the nation's largest K–12 solar project for a school and the electricity generated by the panels could power as much as 80% of a school's energy use. All of these systems would be integrated into and centrally controlled by the building automation system.

"That's the beauty of BACnet: it's all done electronically, so we don't have to do anything," Wheatley said.

