

CSU Fullerton's Titan Gym cuts lighting energy use 66% and advances climate goals with wireless lighting controls and fixture retrofits



CASE STUDY SNAPSHOT

Cal State Fullerton cut its lighting energy use by 66% through a lighting retrofit and wireless lighting controls installation in its Titan Gym.

Building type: Recreational Facility

Size: 16,600 square feet

Annual energy savings: 93,200 kWh

Peak load reduction: 15 kW

Project cost: \$70,100

Simple payback: 2.6 years

Benefits:

- Annual electricity bill savings \$11,700
- Greenhouse gas emission reduction of 40.7 metric tons of CO₂e annually
- Lighting energy use automatically adjusts based on occupancy and programmed schedules
- Improved lighting quality and sense of security
- Ability to participate in utility demand response peak load reduction programs
- Flexible lighting controls system

California State University Fullerton athletes are already Titans, but the campus aims to be a giant in the arena of sustainability as well. In 2011, California State University Fullerton's (Cal State Fullerton) President signed the American College and University Presidents' Climate Commitment, pledging that Cal State Fullerton would create a comprehensive plan for achieving climate neutrality. As part of the campus-wide effort towards reaching the climate neutrality goal, the University undertook a project in December 2011 to upgrade the lighting in its multi-use recreational facility, the Titan Gym.

By replacing light sources and installing a Lutron wireless control system Cal State Fullerton was able to reduce the gym's lighting energy use by 66%, cutting energy costs and greenhouse gas emissions while improving light quality and controllability. The project's impressive results have earned a resoundingly positive response from the athletics department as well as the broader campus community.

Facility Profile: Titan Gym

The 16,600 square foot Titan Gym has a maximum occupancy of 4,000 people on game days and is part of a larger, 139,000 square foot, physical education/kinesiology complex. The facility hosts Cal State Fullerton's NCAA Division I men's and women's basketball and volleyball teams. The gym is also used for sporting events, exercise classes, intramural sports, commencement ceremonies, and other special events, making it a high traffic space, with occupants coming in and out at all hours of the day.

Prior to the lighting retrofit, gym occupants used a single set of switches to control all lights. In practice, this single point of control frequently resulted in more lights being turned on than were needed for a given activity. With no timers or automation to



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Before the retrofit (photo left), the single source metal halide fixtures created shadows and glare, which distracted athletes on the court. After the retrofit (photo right) increased light levels and distribution minimize shadows, providing a much more even lighting experience.



turn the lights off again, the gym's 68 400-watt metal halide light fixtures were on an average of almost 16 hours per day, seven days per week during the academic year. With additional hours of operation during summer and winter breaks, the University was paying approximately \$17,500 annually in electricity costs.

In addition to their high costs and limited controllability, the aging metal halide fixtures presented other problems for users of the gym space. The single lamp metal halide fixtures created an uneven "cave" lighting effect, where portions of the gym that were not directly under a light source were darker than others. The aging fixtures also buzzed when turned on, producing harmonic distortion that distracted facility users.

The lighting controls and fixture retrofit presented an opportunity to reduce energy levels and maintenance costs, while at the same time providing a more pleasing environment for students and fans.

Lighting Retrofit & Controls Installation

Cal State Fullerton's lighting project included a lamp and ballast retrofit and the installation of a wireless lighting control system. Total project completion time from fixture installation to controls commissioning was under two weeks.

Retrofit: The project replaced 68 400-watt nominal metal halide fixtures (in practice, these fixtures operated at over 450 watts) with 68 4-lamp T5HO F54 216-watt XtraLight fixtures with Lutron EcoSystem H Series dimming ballasts.

Controls: The contractor installed Lutron's Quantum Total Light Management system, consisting of light controllers for each fixture, local controls, wireless

wall switches, wireless occupancy sensors, and web-based Quantum lighting management software.

As part of the installation, the contractor installed wireless light controllers on the retrofitted T5HO fixtures and installed wireless occupancy sensors in the gymnasium to automatically dim or turn lights off when areas are unoccupied. The contractor also installed wireless on/off and dimming control switches at various locations throughout the gymnasium to allow occupants to manually control the lighting.

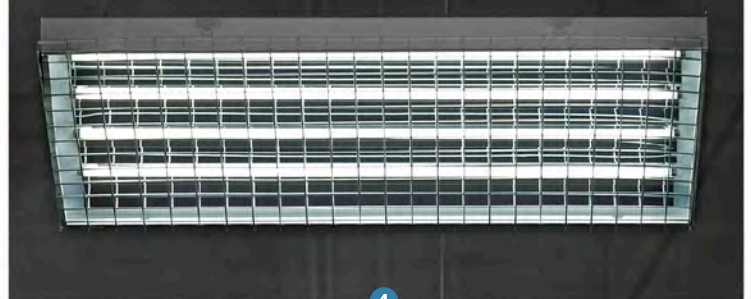
After the contractor completed installation, Lutron field services engineers configured and commissioned the entire system, programming lighting controls for the gym

Components of the wireless lighting control system

Lights are off when the gym is unoccupied. When someone enters the gym, the Lutron wireless occupancy sensors relay a signal to the Lutron Quantum Hub. The hub communicates to the Lutron EcoSystem H-Series digitally addressable dimming ballasts, installed in each fixture, to adjust light levels to 10% light output on six fixtures.

- ① Lutron wireless occupancy sensor
- ② Lutron Quantum Light Management Hub
- ③ Lutron wireless controller and 7 button scene selector
- ④ 216-watt 4-lamp T5HO F54 XtraLight fixture
- ⑤ Lutron EcoSystem H Series dimming ballast

Prior to the retrofit, the Titan Gym was lit with 68 400-watt metal halide fixtures.



“The new system saves us money out of our utility budget as well as our operation and maintenance budget. Energy conservation and decreasing our carbon footprint were obvious factors driving this project, but the operations and maintenance savings were also key considerations: maintaining high-bay lights is labor intensive, intrusive, and expensive; and the new fixtures will have much longer life cycles.”

Willem van der Pol, Director of Physical Plant, California State University, Fullerton

into separate zones for the main court, equipment area and bleachers. Lutron also trained University facility staff on how to operate the system and controls. When all sensors in a zone are vacant for 10 minutes, the lights in the zone dim to 50% light output for five minutes, then turn completely off. When someone enters one of the zones, the light levels are adjusted to 10% light output on six fixtures. Full light output is achieved through the wall controls in the gym or through the Lutron controls software. In addition, the University is using this project as a pilot study to integrate iPads and smartphones with the Lutron controls system.

Why Wireless Lighting Controls?

Lighting controls are an important tool for effective energy management. They enable a variety of energy saving strategies, such as daylight harvesting, automatic scheduling, task tuning, dimming, and occupancy sensing. Wireless lighting controls offer the same or better functionality as traditional wired controls systems at a lower cost and with less invasive, easier installation, because they do not require modifications to the existing electrical wiring or the

addition of new control wiring. Wireless controls can also be easily modified to adapt to changing space needs, schedules, or energy reduction strategies through re-programming instead of re-wiring.

Project Costs and Savings

The Gym's fixture retrofit alone is estimated to reduce annual electricity use by 67,600 kWh (48% of previous lighting electricity use) and peak demand by approximately 15 kW. In addition, Lutron's Quantum Total Light Management system is expected to reduce annual electricity use by 25,600 kWh (18% of previous lighting electricity use).

The full cost of the project was \$70,100 (36% labor, 64% equipment). The Energy Technology Assistance Program and Southern California Edison's UC/CSU-IOU Statewide Partnership Rebate Program covered 56% of the project cost. Taking into account these program rebates, the project will have a simple payback of just two and a half years. Cal State Fullerton utilized funding from their physical plant budget to complete the project.

Lutron Quantum Total Light Management System

Control and management of the lighting system is provided with Lutron's Quantum Total Light Management system, which monitors, controls, manages, and reports on all of the lights in a building, providing for the coordination of the lighting control functions through a single interface.

The core of the Quantum system is the Quantum Hub, which communicates wirelessly with the local controllers for each lighting section. The master hub integrates the inputs of all components, and controls the lighting environment to achieve desired light levels and maximize energy efficiency.

PROJECT DATA

PROJECT SUMMARY

Site: Titan Gym
Location: Cal State Fullerton
800 North State College Boulevard, Fullerton
Size: 16,600 square feet, single story
Built: 1965

ENERGY INFORMATION

Annual lighting electricity use before retrofit: 140,700 kWh
Annual electricity savings from fixtures: 67,600 kWh
Annual electricity savings from controls: 25,600 kWh
Total annual electricity savings: 93,200 kWh
Peak demand savings: 15.0 kW

PROJECT ECONOMICS

Annual electricity cost savings: \$11,700 or 66% of previous annual electrical lighting costs

Total project cost: \$70,100

Utility & CEC incentives:

- SCE UC/CSU-IOU Statewide Partnership Rebate Program - \$22,400
- Energy Technology Assistance Program Rebate - \$16,800

Simple payback: 2.6 years

EQUIPMENT INSTALLED

- 68 T5HO 4-lamp F54 XtraLight fixtures with Lutron EcoSystem H-Series dimming ballasts, and 272 GE T5HO 54 watt lamps
- 4 Lutron wireless occupancy sensors
- Lutron wireless wall station controls
- Quantum Light Management Hub
- Lutron Q-Admin Software and Server
- Lutron Green Glance Software

The Q-Admin software is a customized dashboard that allows facilities staff to control and monitor the lighting system by providing graphical and data screens showing each light and occupancy sensor. The software displays real-time energy use of a building's lighting as a whole and can also allow for analysis of individual fixtures.



The University is using this project as a pilot study to integrate iPads and smartphones with the Lutron controls system.

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T A K I N G T H E N E X T S T E P

Selecting a contractor

The California Advanced Lighting Controls Training Program (CALCTP) trains C-10 electrical contractors and state certified general electricians on the installation and operation of advanced lighting controls systems, including wireless controls. A list of CALCTP certified lighting contractors is available at www.calctp.org.

Additional case studies on wireless lighting control projects

- **ETAP Pleasanton Library Wireless Lighting Case Study**
<http://energy-solution.com/etap/case-studies/>
- **Pier Wireless Lighting Controls** www.aduratech.com/pdf/CEC-TB-38.pdf
- **Personal Controls Lighting Retrofit of an Open Plan Office Demonstration at Webcor Concrete Facility** www.aduratech.com/case-studies/webcor.php
- **PIER Wireless Integrated Photosensor and Motion Sensor Demonstration at UC Santa Barbara**
http://cltc.ucdavis.edu/images/documents/case_studies/Pier_UCSB_WIPAM.pdf
- **PG&E Emerging Technologies Assessment of Advanced Lighting Controls for Energy Efficiency**
http://aduratech.com/pdf/ETWirelessControl_EE.pdf
- **PG&E Emerging Technologies Assessment of Advanced Lighting Controls for Demand Response**
http://aduratech.com/pdf/ETWirelessControl_DR.pdf

Applicable utility incentives

Contact your utility representative for specific information for your utility. Incentives for wireless lighting controls projects may include:

- Fixture retrofit programs offering standard per-fixture rebates or incentives based on project energy savings.
- Demand response (DR) programs paying incentives based on the amount of kW load a building can shed when called upon to do so.
- Automated DR programs providing additional incentives for customers that automate their equipment's response to a requested load shedding event.

Financing assistance

- California Energy Commission low interest loans for energy efficiency projects
- Utility on-bill financing
- Financing from energy service companies (ESCO)

E N E R G Y SOLUTIONS

Energy Solutions is an energy efficiency consulting firm working to create large-scale environmental benefits by developing and implementing innovative, market-based approaches to increase sustainability through energy efficiency, water efficiency, and renewable energy initiatives. Energy Solutions developed and implements the Energy Technology Assistance Program (2010-2012). Funding has been provided by the American Recovery and Reinvestment Act of 2009 and is administered by the California Energy Commission.

