

About the Project

An energy savings project is making a major impact at one of the most prominent federal buildings in the nation's capital. The Theodore Roosevelt Federal Building (TRFB), owned by the General Services Administration, is an office complex occupying a full city block in downtown Washington D.C. The building serves as headquarters for the United States Office of Personnel Management (OPM). Built in 1959, the building supports management of the government's civilian workforce and houses significant mission infrastructure, including a data center, situation room, and sensitive compartmented information facility. Within this governmental establishment, an enormous undertaking by OPM's facilities management team contributes to energy savings with a project on a lighting system upgrade and HVAC integration.

OPM is working with CEG Solutions to complete a comprehensive Energy Savings Performance Contracts (ESPC) project and integrate lighting with heating, ventilation, and air conditioning (HVAC) controls.

This case study describes phase one and two of the project. The third phase is currently underway. The first phase included seven separate energy conservation measures, including cooling tower controls, chiller plant upgrades, air handling unit (AHU) controls, water and sewer, lighting, and domestic and irrigation water. The second phase focused on the boiler plant, AHU replacement, and airside retro commissioning. Both phases included lighting controls and integrated lighting.

In this case study, OPM's facilities management team gives perspective on the successes, challenges, and lessons learned.

Project Goals

The primary goal across both phases of the project on lighting system integration was to reduce energy consumption during periods of low or no occupancy, while maintaining and contributing to occupant comfort.



United States Office of Personnel Management
Headquarters-Theodore Roosevelt Building

PROJECT QUICK FACTS

- ▶ 2,000 daily occupants pre-COVID
- ▶ 50,000 square feet of training facilities
- ▶ Project was completed with an ESPC
- ▶ Phase one funding from American Recovery and Reinvestment Act (ARRA)
- ▶ DC Sustainable Energy Utility provided incentives

KEY STRATEGIES AND OUTCOMES

- ▶ OPM employs the following **lighting and integration strategies**:
 - ▶ Hybrid approach fixture upgrades
 - ▶ Full-scale HVAC upgrade
 - ▶ HVAC and lighting integration
- ▶ Integrated lighting resulted in several positive **outcomes** for OPM:
 - ▶ Considerable energy savings
 - ▶ Improves occupant comfort

Lighting and Integration Strategies

OPM's facilities management team, in coordination with CEG Solutions, employed several strategies to achieve the desired outcomes.

- ▶ **HYBRID APPROACH.** The team did not initially upgrade all fixtures to light-emitting diodes (LEDs). Instead, they upgraded certain fluorescent fixtures depending on the space type and the useful life of existing fixtures remaining in place. However, the fluorescent fixtures are addressable and dimmable.
- ▶ **FULL-SCALE HVAC UPGRADE.** Lighting and HVAC controls are integrated with Building Automation Control networks (BACnet) to automatically modify the HVAC system's settings. The HVAC and lighting efficiency upgrade was a full-scale modernization and included:
 - ▶ Removed six AHUs with 150-horsepower motors and upgraded to FANWALL TECHNOLOGY®
 - ▶ Installed gas-fired boilers.
 - ▶ Over 900 variable air volume (VAV) boxes mapped to occupancy sensors. Exchanged constant volume with VAV setbacks.
 - ▶ 3,800 Lutron addressable and dimmable ballasts.
 - ▶ Installed over 1,000 daylighting and occupancy sensors.
 - ▶ Adjusted luminaires high-end trim.
- ▶ **INTEGRATED LIGHTING.** OPM's facilities management team integrated the Lutron Quantum networked lighting controls system with the Siemens Insight HVAC controls system to improve HVAC efficiency. CEG Solutions built a robust infrastructure of sensors that control groups of

"It takes a concerted effort for decision-makers to fully understand and appreciate the benefits of pursuing an ESPC project to achieve greater energy efficiency," said an OPM facilities team member.



In the cafeteria, the HVAC is automatically set back when spaces are unoccupied thanks to a network of occupancy sensors and lighting controls.

fixtures. For example, in some open office areas, one sensor can control more than 10 fixtures. These integrated lighting controls span all office areas, the cafeteria, and all conference rooms and meeting areas except the auditorium. Lighting and HVAC controls are integrated with BACnet to automatically set back HVAC when spaces are unoccupied.

Outcomes

Investing in lighting system upgrades resulted in significant energy and non-energy benefits for OPM.

- ▶ **ENERGY SAVINGS.** Addressable lighting infrastructure with occupancy zones and a successful HVAC integration facilitates additional energy savings. The integration of the HVAC system with the occupancy sensors increases the area and amount of time for which spaces have setbacks. Additionally, automating the setbacks reduces the likelihood of manual overrides. Savings were calculated using a calibrated eQuest model combined with the results of various performance tests. The model incorporates the following changes to HVAC/lighting operations that relate to the integrated lighting controls. During the first phase, OPM reduced energy consumption by 965,979 kWh, resulting in annual savings of \$94,000. During the second phase, they estimate that at least another 35,000 kWh were cut, which results in another \$7,000 in annual savings.

► **OCCUPANT COMFORT.** The building occupants experienced a noticeable improvement in overall comfort. Better LED lighting improved the visibility and overall usability of the spaces on the lower three floors of the building, and occupants on the upper levels embraced daylight harvesting. “Lower levels are now a nice place to be,” said an OPM facilities management team member.

Lessons Learned

The challenges with the lighting integration project are notable. However, the facilities management team accept the challenges as an opportunity to learn and improve. Here are some lessons to consider from the facilities management team.

► **CHECK SYSTEM COMPATIBILITY.** While trying to integrate Lutron with the Siemens HVAC system, there were challenges getting the systems to communicate because the HVAC controls are on the local area network (LAN) and the Lutron system is cloud-based. The workaround can be inconvenient but is resolvable. This requires a hardwire to the Lutron server, housing it in an office, and programming all the changes in a selected location. Future recommendations include checking system compatibility and network requirements before making the investment.

► **PARTNER WITH IT TEAM.** Compatibility challenges are prevented by establishing a partnership with the Information Technology team at the onset of the project. To achieve a seamless integration, IT built two new servers and installed two network interface communication cards in each server to allow communication between the LAN networks.

► **GET TENANT BUY-IN.** OPM’s facilities management team recommends keeping tenants informed of decisions, overall project progress, and how it affects them. The greater their involvement, the greater the success of the project.

► **FIND THE RIGHT CONTRACTOR.** For government buildings, OPM’s facilities management team suggests finding a contracting officer familiar with ESPC. The team recommends using the Department of Energy’s Golden Field Office as a resource.

About the ILC

The Integrated Lighting Campaign (ILC) is a program designed to help facility owners and managers take advantage of savings opportunities and benefits of advanced lighting controls and of integrating lighting systems with other building or business systems in their facilities. The ILC serves as a resource for relevant research regarding new advanced lighting controls and integrated lighting systems and provides a platform to recognize exemplary projects shared by ILC participants and supporters.



To learn more and join, visit <https://integratedlightingcampaign.energy.gov>

To learn about Better Buildings Technology Campaigns and join, visit <https://betterbuildingsolutioncenter.energy.gov/alliance/tech-campaigns>

ILC Organizing Partners

This effort is a collaboration between the DesignLights Consortium® (DLC), Illuminating Engineering Society (IES), the International Facility Management Association (IFMA), interNational Association of Lighting Management Companies (NALMCO), the Lighting Controls Association (LCA), U.S. General Services Administration (GSA), and the U.S. Department of Energy.

