

## State Department Case Study:

# *Elihu M. Harris State Office Building*

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### **Background**

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- Type of Facility: Department of General Services state office building
- Location: Oakland
- Size: 1,800 staff occupants; 542,000 conditioned square feet, 200,000 unconditioned
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### **Summary**

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In June 2000, the Elihu Harris Building's average peak kilowatt (KW) demand was 1,416 KW. Between June 2000 and 2001, the facility implemented conservation improvements amounting to 387 KW reductions in lighting, heating, ventilating and air conditioning (HVAC) and plug-in loads. In addition to the conservation improvements already implemented, the Peak Load Reduction (PLR) plan identified an opportunity for 346 KW additional curtailments for a total 733 peak KW reduction by June 2001.

Referenced in State Government Guide:

- #1, "Reduce Energy Use in State Facilities Through Conservation Measures"

### **Plan**

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Elihu Harris' chief engineer and engineering staff, with assistance from a Johnson Controls Service technician, gathered information on motor and lighting loads, utility bills and variable air volume (VAV) programming data through equipment surveys, fixture audits, building automation system (BAS) data and the utility website. The staff used the information to assess the feasibility, cost and return on investment of various energy projects.

The Elihu Harris engineering staff, led by the chief engineer and assisted by the Johnson Controls Service technician, managed all energy conservation projects for the building.

Gov. Davis' executive order requested that all state agencies reduce energy consumption by 20 percent through conservation and 20 percent when called on by the California Independent System Operator (ISO) during electrical emergencies.

Elihu Harris financed projects with operating funds and consulted Johnson Controls Service for technical support. Projects were to be implemented as soon as possible and completed by the beginning of the third quarter of 2001. Most were completed in the early summer.

### **Programs: Conservation**

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#### ✓ HVAC:

- Maintained interior air temperature set points between 68 and 78 degrees F in all 730 zones. When the outside air temperature was low enough and the chiller was not on, cooling was allowed below 78 degrees F. When the chiller was needed, set points were automatically reset to 68 for heating and 78 for cooling.
- Used outside air for cooling instead of operation chillers or compressors to optimize compressor startups in all HVAC systems.
- Set domestic hot water temp at 105 degrees F or less.
- Maintained HVAC operation while reducing it to minimum levels for safety and health (during Stage 2 and 3 emergencies only) by changing the building's zone set points to a wider "deadband" (from 70 and 74 degrees F to 68 and 78 degrees F).
  - If a temperature in a zone falls within the deadband, the building's VAV system delivers a minimum allowable volume of air to that zone. This action economizes the building's air usage, which lowers the speed of the fan motor and thereby lowers energy usage.
- Set the operating temperature of boilers to lower as the outside air (OSA) temperature increased; boilers shut off when the OSA temperature reached 65 degrees F. Two heating hot water (HHW) boilers were used in specific zones to

“reheat” cold air in some areas of the building on mild days.

✓ **HVAC controls:** Johnson Controls Service designed the BAS process for automation

✓ **Lighting:**

- Enabled occupancy sensors in an estimated 20 percent of its space.
- Turned off overhead lighting and used task lighting in 50 percent of the building during Stage 2 and 3 emergencies only.
- Turned off lighting, during normal business hours:
  - 300 hallway fixtures
  - 75 percent of atrium lighting fixtures
  - 30 fixtures near windows in café and dining room
- Kept on “Emergency only” lighting circuits in hallways at all times.
- Removed one lamp in every stairwell light fixture; stairwell ballasts were capable of operating with one fluorescent tube instead of two.

✓ **Lighting controls:** Used General Electric’s “Total Lighting Control” (TLC) software and networked lighting control panels to turn on/off an estimated 80 percent of the building’s lighting. Circuits were switched off in 60 percent of the building’s office space during Stage 2 and 3 emergencies only.

✓ **Work schedules:** Implemented the “team cleaning” program during Stage 2 and 3 emergencies only and required custodial personnel to turn on lights only while cleaning and to turn lights off after cleaning.

✓ **Computer/office equipment:**

- Identified at least one essential computer and e-mail server for communications. Turned off unnecessary PCs and monitors when not in use.
- Set all video monitors and computers to power down after five minutes of non-operation.
- Identified and turned off nonessential duplicating systems and equipment, copiers, printers, scanners and faxes during Stage 3 only.
- Enabled power-save mode on printers. Turned off single workstation printers when not in use, but network printers or batch job printers had to always be “ready.”

✓ **Building plug-in loads:**

- Unplugged space heaters and nonessential devices.

- Unplugged or disconnected drinking fountains with water coolers. Reduced the number of coffee pots and cooking devices used in break rooms. Limited the use of nonessential appliances, coffee machines, microwaves or coolers for bottled water (during Stage 2 and 3 emergencies only).

✓ **Employees:**

- Informed of and in some cases responsible for implementing changes to systems operation. E-mails and memos asked tenants to support conservation efforts. A charted report of the building’s energy consumption was posted in the main lobby.
- Reminded all tenants to close blinds on all exterior windows.

### **Programs: Efficiency**

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✓ **Lighting:** Changed 26 light fixtures in the auditorium from 150-Watt (W) ‘A’ bulb to 90-W halogen spot lights.

### **Budget and Finance**

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The projects were financed by the operating budget. Funds were administered by the building manager.

The following are the costs of each program:

- Thermostat programming and automated BAS process: Cost \$9,139.
- Reduced lighting in hallways, atrium and near windows: \$864.
- Removed every other stairwell light fixture: \$1,600.
- Retrofit auditorium lighting: \$853.
- Total: \$12,456.

### **Results**

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Elihu Harris staff relied on usage and demand data from energy bills to determine energy savings and to assess the effectiveness of its projects. The staff did not have time to monitor and trend all power data through its BAS and Internet-accessible power meters. Ideally, this data in addition to weather condition data could be used to evaluate the actual savings.

In June 2000, Elihu Harris’ total peak KW load was 1,416 KW (based on combined calculations of the average peaks for June/July/August season and the total load on the building during the time the building was closed – about 50 percent of each weekday). In June 2001, total peak KW load was 2,015 during normal operations and 1,300 during

Stage 2 or 3 electrical emergencies. Between June 2000 and June 2001, Elihu Harris realized:

- 387 KW reductions in lighting, HVAC and plug-in loads, or 13 percent.
- 346 KW in additional curtailments during Stage 2 and 3 electrical emergencies, or 12 percent.

Below are the estimated annual energy and financial savings of each of the 2001 projects:

- Thermostat programming and automated BAS process: 260,000 kWh and \$380/day (@ \$0.19/kWh) x 130 days of chiller use = \$49,400. at a

cost of \$4,843. Automation saved approximately 550 KW off total building load over the first two to three hours and approximately 200 to 400 KW thereafter. Payback required fewer than 45 days of process usage.

- Reduced lighting in hallways, atrium and near windows: 16,660 kWh and \$18,365.
- Removed every other stairwell light fixture; 64,605 kWh and \$12,275.
- Retrofit auditorium lighting: 1,872 kWh and \$355.
- Total: 423,137 kWh and \$80,395.