



Business Case Study:

Lockheed Martin Missiles and Space

Background

- Type of Business: Manufacturing/aerospace
- Location: Sunnyvale, Calif.
- Size: 8,500 employees, 5.2 million square feet
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Summary

Lockheed Martin has 8,500 employees and occupies more than 5 million square feet of space in the Bay Area. In light of unexpected energy surcharges, the company forecast an 84 percent increase in electricity costs in 2001 compared with 2000. The forecast, along with the need to secure a reliable source of energy and the desire to help the state weather the energy crisis, led to a comprehensive energy-management and reduction plan. Lockheed Martin's participation in the California Independent System Operator (ISO) Demand Reduction Program, pursuit of lighting retrofits, an employee awareness campaign, and other projects, resulted in an average energy-use reduction of 15 megawatts (MW), \$489,000 in rebates from the 20/20 and Demand Relief programs, \$156,000 in rebates for energy improvement projects and a \$4.8 million cost avoidance.

Update: Lockheed Martin continued its efforts to reduce energy consumption and energy costs by participating in the Compressed Air Management Program (CAMP) in 2003. CAMP offers no-cost assessments to eligible Pacific Gas & Electric (PG&E) customers. By implementing CAMP's recommendations for improving the efficiency of a single compressed air system, Lockheed Martin saved 84 kW and more than \$71,000/year in energy costs, while receiving a simple payback in less than a month.

Referenced in Business Guides:

- #2, "Reduce Energy Use in Industrial and Manufacturing Facilities Through Conservation and Efficiency Measures"
- #3, "Target Business Employees for Energy Conservation in the Workplace"

Plan

Lockheed Martin's energy team reviewed log sheets, utility bills, historical databases and schedules; performed walk-around audits of equipment use; and conducted in-person surveys with employees.

Gathered data included electrical usage data from two meters; utility bills; historical data from a computer monitoring system; amperage readings on centrifugal chillers and selected buildings; air handler time schedules; automated lighting systems performance; and manufacturing/test equipment use. Audits of non-automated lighting systems and computer monitors were conducted to provide information on employee usage.

Lockheed Martin's technical maintenance manager appointed and led an energy team made up of an energy coordinator, heating, ventilating and air conditioning (HVAC) supervisor, energy-management system (EMS) manager, HVAC analyst and two industrial electronic technicians. The technical maintenance manager oversaw all energy projects.

Audits and data analyses led to the following assumptions:

- The largest consumers of energy are: HVAC systems (10.5 MW for a cost of \$6.3 million or 35 percent of total energy costs); lighting (9 MW, \$5.4 million or 30 percent of total costs); production equipment (6 MW, \$3.6 million or 20 percent of total costs); and office equipment (4.5 MW, \$2.7 million or 15 percent of total costs).
- Therefore, the main targets of Lockheed's 2001 energy-management plan were HVAC systems, lighting, computers and manufacturing/test equipment.
- The energy team prioritized projects based on required investment and level of payback. The priorities were: no-cost employee actions (turning off lights and computers); no-cost operational changes (altering temperatures/time schedules); low-cost solutions such as deferred maintenance; and capital solutions with payback of two years or less (lighting upgrades).
- The goals were to reduce electricity and gas usage by 20 percent and save \$5 million in costs.

Lockheed Martin partnered with a lighting service company to delamp and upgrade lighting. With no contractual obligation, the contractor provided lamp and ballast counts, prepared a financial package, co-managed installation and helped to confirm the project with PG&E.

Programs: Conservation

✓ **HVAC:**

- Changed thermostats from 75 to 78 degrees F for cooling and from 70 to 68 degrees F for heating. Purchased small fans for employees to ease discomfort of lower A/C setting.
- Turned off HVAC boilers during summer.
- Reset main chiller temps from 40 to 45 degrees F in office areas.
- Reset HVAC time schedules to 6 a.m. to 4 p.m. instead of 6 a.m. to 6 p.m.
- Shut down centrifugal chillers serving office buildings at 7 p.m.
- Replaced failed HVAC controls with digital controls in a 100,00-square-foot building.
- Installed sensors and controller and software logic to control six 1,000 centrifugal chillers serving nine buildings with differing loads. Previously, chillers were turned on/off manually. The new system staged the chillers based on chilled-water set point, demand senses from the chillers and appropriate time delays to prevent cycling.

✓ **Lighting:**

- Delamped common areas and corridors of a 560,000-square-foot building.
- Delamped parking lots to city standards, from a 30-foot candle to a minimum required of a 22-foot candle.
- Posted “Lights out” stickers on light switches.
- Calibrated motion sensors.
- In-house technicians designed and installed a new lighting control system that enabled personnel to program the hours in which lights were turned on/off. Personnel could manually override the programming.

✓ **Alternative and/or renewable energy sources:** Used generators to offset peak hours, in support of PG&E’s OBMC program. The OBMC program required curtailment of 15 percent of energy use in 15 minutes. The program was suspended mid-year when the State notified the company of compliance to new air quality restrictions.

✓ **Work schedules:** Janitors started work before peak (5 a.m.) so that their hours – and thus lighting usage – over-

lapped with that of other employees who started at 6 a.m. Generally custodians left the workplace at 1:30 p.m.

Manufacturing groups moved work-shift start times from 6 a.m. to 5 a.m. and, in some instances, 4 a.m. The Test Services organization moved start-up times of large vacuum pumps and other large horsepower equipment to before peak hours, thus reducing peak costs.

Programs: Efficiency

✓ **Boilers:** Installed two high-efficiency 9.9 million BTU boilers and two high-efficiency 8 million BTU boilers. This is 8 percent of the total boiler capacity.

✓ **Lighting:**

- Upgraded magnetic ballasts and T12 lamps to electronic ballasts and T8 lamps in nine buildings.

✓ **Weatherization:** Replaced all weather stripping on exit doors in the 450,000-square-foot, five-story building.

✓ **Motors:** Upgraded motors, an ongoing project. Failed motors are replaced with energy-efficient motors only.

✓ **Maintenance programs:** Increased frequency of preventative maintenance on the 15,000-point energy-management system from annual to semi-annual.

Programs: Employee Outreach

✓ **Energy teams:** Lockheed Martin president and executive vice president (VP) of Quality and Operations division started an energy council made up of company VPs to discuss employee schedules; HVAC temperature changes; and other global initiatives and their associated cost savings. The technical maintenance manager served as technical support.

The executive VP then assigned each vice president a chunk of buildings (dubbed “Chunker”) whose energy conservation he/she was responsible for. The VPs formed an energy team among employees in each Chunker to develop and implement a conservation plan for their respective buildings.

✓ **Communications:** Used e-mail, newsletters, posters, the company website and 10-second spots on its internal TV network to educate about conservation. The technical maintenance manager worked with the video production department on the 10-second spots as well as on a two-minute video, which was broadcast on the company TV.

✓ **Reminders:** Received “lights out” stickers from PG&E. Swing-shift energy auditors and employees posted the stickers.

✓ **Recognition:** Recognized employee efforts at meetings; 20 staff meetings were held in a two-month period and then monthly at the executive staff meetings.

✓ **Energy fairs:** Held an energy fair in July 2001. Home Depot, G.E. Lighting and other businesses set up booths to demonstrate the latest technology for home lighting control, fluorescent lights, insulation, windows and other items. Employees received posters, coffee cups and mouse pads.

✓ **Energy conservation contest:** Under the “Dining in the Dark” campaign, employees were asked to send to the company’s energy website a conservation idea for home or work. Their names were automatically entered into a contest to win a \$100 candelabra. Two candelabras were given away through a random drawing. Five more winners, picked randomly, received coffee cups, shirts with the logo “LM energy team,” mouse pads and a lunch with the executive vice president of Quality and Operations department.

Budget and Finance

The budget was \$1.134 million, along with \$500,000 in deferred maintenance/administration projects and an additional \$70,000 for program administration costs. Programs were financed by the operations budget and administered by the accounting department.

The approximate cost of all efficiency programs was \$1.27 million. Rebates totaled \$233,000. All conservation measures cost at least \$75,200, with \$489,000 in rebates from 20/20 and Demand Relief Programs. Turning off boilers in the summer cost an estimated \$30,000/year for in-house labor. Informational website design cost \$100.

Results

Lockheed Martin measured monthly gas and electric usage in its Sunnyvale and Palo Alto facilities, and compared the data with 2000 usage. With the exception of two main meters Lockheed Martin did not have electrical usage meters in its 82 buildings, but the energy team was able to measure energy usage and conservation success at the end of each quarter by:

- Switching and isolating 12KV feeders (each 12KV feeder can have several buildings or a large building connected to it). This enabled staff to take snapshot readings of the buildings on a particular feeder by reading the meter at the 12KV switch. This required considerable manpower, so it was done judiciously;

- Conducting audits of HVAC system time schedules and of lights, office equipment and computer monitors left on between 6 p.m. and 12 a.m.; and
- Comparing kWh usage in 2001 with prior year utility bills.
- Turning off HVAC boilers cost savings estimated at \$834,000/year.
- Reset chiller temperature estimated energy cost savings was \$500,000/year.

Lockheed Martin’s energy efficiency and conservation efforts were a success. Between January 2000 and January 2001, Lockheed Martin consumed 273,058,816 kWh, compared with 235,917,974 kWh between January 2001 and January 2002 – for energy savings of 37,140,842 kWh, or 13.6 percent.

Other achievements included:

- 14 million kWh/year saved as a result of efficiency programs.
- At least 23.5 million kWh/year saved as a result of conservation actions.
- Energy use reductions/savings of 75 MW daily.
- \$4.8 million/year cost avoidance/financial savings.
- Reliable energy in 2001.
- Less energy waste.
- 17.3 percent natural gas savings in 2001.
- Winner: Flex Your Power Energy Conservation Award (2002)
- In 2003, by implementing recommendations from CAMP, Lockheed Martin saw measured energy savings that equate to an electrical cost savings of \$71,600/year. The company received the standard CAMP incentive, capped at 60% of implementation cost, which brought the simple payback down to less than one month. For more information about CAMP, visit <http://www.sbw-consulting.com/CAMP.htm>.

Lessons Learned

Lockheed Martin learned that HVAC maintenance should be a priority and lighting upgrades should be incorporated into renovations.

The company also found that energy conservation programs need constant visibility and auditing to remain effective. Most employees wanted to help, but it was difficult to keep them focused on energy management. Lockheed Martin recommends making executives accountable for conservation in specific buildings.