California’s energy crisis of 1999–2001 challenged large consumers to reduce energy use by 10% in an attempt to keep demand from exceeding supply and taking down the grid. The managers of Adobe Systems Inc.’s three headquarters towers in San Jose were surprised to discover that their early efforts (primarily de-lamping, relamping with CFLs, and installing motion-activated power strips at every work station) achieved the goal quite easily, and so they began a search to improve efficiency across the full range of resources the buildings and occupants used.

San Jose HQ Towers
Some 2,350 Adobe employees plus 150 contract employees work in Adobe’s headquarters, which consists of three office towers rising from a shared sixth-floor rooftop patio and garden over the garage. The three buildings total 989,362 gross ft² (915,984 rentable ft²) atop a semi-enclosed garage totaling 964,692 ft².

The first five floors above ground and two floors below ground are a garage with continuous upgrading of all lamps at Adobe offices and garages as more efficient versions of resources the buildings and occupants used.

The building includes a full restaurant, a smaller “grab and go” café, a full fitness center, basketball court and bocce ball court, patio, rooftop garden and “edible garden” on the sixth floor. The buildings are open 24/7; principal work hours are 7 a.m. through 7 p.m., Monday through Friday.

Energy Conservation
One of the first, and still one of the most financially rewarding projects, involved the continuous upgrading of all lamps at Adobe offices and garages as more efficient versions of transformers became available. As labor cost is an important consideration. In cases where an elevator requires a hoist for repair, or where one of the first, and still one of the most financially rewarding projects, involved the continuous upgrading of all lamps at Adobe offices and garages as more efficient versions of transformers became available. As labor cost is an important consideration. In cases where an elevator requires a hoist for repair, or where street lamps require a hoist for repair, or where there are halogen lamps that burn out quickly, LED is the clear choice.

Motion sensors, daylight sensors, and other controls turn off lamps and VAV boxes in work spaces and power down monitors, task lamps, and other accessories when not in use. The managers of Adobe Systems Inc.’s three headquarters towers in San Jose were surprised to discover that their early efforts (primarily de-lamping, relamping with CFLs, and installing motion-activated power strips at every work station) achieved the goal quite easily.

Building at a Glance

<table>
<thead>
<tr>
<th>Name</th>
<th>Location</th>
<th>Owner</th>
<th>Principal Use</th>
<th>Employees/Occupants</th>
<th>Gross Square Footage</th>
<th>Net Square Footage</th>
<th>Occupancy</th>
<th>Gross Conditioned Space</th>
<th>Net Conditioned Space</th>
<th>Built</th>
</tr>
</thead>
</table>

Distinctions/Awards
- West Tower, Almaden Tower, East Tower LEED-EB Platinum, 2006
- International Facility Management Association Sheila Sheridan Award for Sustainable Design and Energy Efficient Projects, 2008
- BOMA Earth Award, 2007
- Sustainable Leadership Award for Design and Development, CoreNet Global, 2007
- Environmental Project of the Year, presented by the Association of Energy Engineers to Cushman & Wakefield for its work with Adobe Systems Incorporated, 2006
- Green Power Leadership Club for exemplary green power procurement, EPA Green Power Partnership, 2012

Cost Per Square Foot
- $95

Total Renovation Cost
- $5,000,000
use. These measures have not compromised illumination where work is being performed or where security is a consideration.

Lighting upgrades are incorporated, along with other system upgrades, into a sophisticated software-based monitor and control system. On display in the lobbies of Adobe's headquarters are large screens displaying the buildings' energy use, carbon emissions, and other operating data.

An array of submeters and other points—more than 30,000 in the San Jose buildings alone—are continuously monitored through the energy management system. The system tracks energy use and occupancy by building, floor, and individual clusters of desks known as "neighborhoods.

The system spots deviations from expected flows and writes its own work orders through the building’s CMMS (computerized maintenance management system), bringing them to the attention of building operators. For instance, the system monitors local weather forecasts, compares energy use with use on similar days, and alerts operators if use seems at variance.

Smart Floors, Smart Server Space
In most buildings, the majority of energy use takes place in the HVAC system. Once installed, these systems and their controls tend to be left in place and casually maintained, but...
A fuel cell is like a battery that always runs. It consists of three parts: an electrolyte, an anode, and a cathode. For a solid oxide fuel cell, the electrolyte is a solid ceramic material. The anode and cathode are made from special inks that coat the electrolyte. Unlike other types of fuel cells, no precious metals, corrosive acids, or molten materials are required. Next, an electrochemical reaction converts fuel and air into electricity without combustion.

A solid oxide fuel cell is a high temperature fuel cell. At a high temperature, warmed air enters the cathode side of the fuel cell and steam mixes with fuel to produce reformed fuel, which enters on the anode side. The chemical reaction begins in the fuel cell. As the reformed fuel crosses the anode, it attracts oxygen ions from the cathode. The oxygen ions combine with the reformed fuel to produce electricity, water, and small amounts of carbon dioxide (amount varies depending on the type of fuel used).

The water gets recycled to produce the steam needed to reform the fuel. The process also generates the heat required by the fuel cell.

As long as there’s fuel, air, and heat, the process continues producing energy. From Bloom Energy

---

**WATER AT A GLANCE**

- Annual Water Use: 15,928,410 gallons

**ENERGY AT A GLANCE**

- Annual Energy Use Intensity (EUI) (Site): 179.23 kBtu/ft²
- Natural Gas (Purchased from Utility): 56.6 kBtu/ft²
- Electricity (Purchased From Utility): 71.65 kBtu/ft²
- Electricity (Generated by Onsite Fuel Cells and Windspires): 50.98 kBtu/ft²
- Annual Source Energy*: 349.55 kBtu/ft²
- Biomethane Purchased for Fuel Cells (Not included in EUI or Source Energy): 79.08 kBtu/ft²
- Annual Energy Cost Index (ECI): $3.86/ft²

**ENERGY STAR Rating**

- West Tower: 100
- East Tower: 100
- Almaden Tower: 100

**Heating Degree Days (base 65°F)**

- 2,256

**Cooling Degree Days (base 65°F)**

- 959

**Average Operating Hours per Week**

- 60

---

**POWERING ADOBE’S FUEL CELLS**

Adobe purchases biomethane from a third-party provider that introduces it into the natural gas pipeline network where it is sourced from dairy farms and landfills. Adobe removes an equal amount of natural gas from the pipeline at its site to energize the fuel cells. Adobe pays for the use of the pipeline distribution costs and related taxes and fees. While Adobe considers the electricity to be renewable, it is still dependent on the pipeline system to transport the fuel. Natural gas/biomethane harnesses more energy than electricity, making the electricity generated from the fuel cells cheaper than the electricity from the grid.

---

**WHAT MAKES MULTI V III OUTPERFORM THE COMPETITION?**

LG

- Higher efficiency, bigger in capacity longer in piping

**HIGHER EFFICIENCY**

JEER 21.8

**LONGER PIPING**

3280 ft.

**BIGGER CAPACITY**

12 tons

© William Porter

**Type** embedded in the granite floor of West Tower’s first floor represents Adobe’s earliest products that included PostScript and digital fonts. The main lobby and reception desk are on the second floor.
with extensive collaborative space, reflecting the work style of today’s workforce. In the current configuration, the buildings can hold approximately 3,000 employees. Under the new open floor plan, the buildings will house about 5,000 employees.

At the neighborhood level, the energy management system monitors temperatures, humidity, airflow and energy use. When Adobe started this configuration change, the buildings already had some of the highest possible ENERGY STAR scores; energy use in the first of these renovations has since dropped by an additional 65%, even as the number of employees increased from 80 to 135 per floor. Annual energy use per person has dropped from 2,597 kWh to 1,073 kWh.

The reasons for this savings are several. Lamps, HVAC and plug load turn off automatically when there is no motion. The way the floor has been configured is another part: Open office space surrounded by windows doesn’t need as much artificial light. To take advantage of the buildings already had some of the highest possible ENERGY STAR scores; energy use in the first of these renovations has since dropped by an additional 65%, even as the number of employees increased from 80 to 135 per floor. Annual energy use per person has dropped from 2,597 kWh to 1,073 kWh.

The reasons for this savings are several. Lamps, HVAC and plug load turn off automatically when there is no motion. The way the floor has been configured is another part: Open office space surrounded by windows doesn’t need as much artificial light. To take advantage of

**KEY SUSTAINABLE FEATURES**

- **Water Conservation**: Waterless urinals, high efficiency flush toilets for men’s restrooms, dual high efficiency flush toilets for women’s restrooms, flow restrictors on all fixtures, low-flow shower heads, and evaporative cooling controllers for irrigation, which adjust irrigation automatically based on weather.
- **Recycled Materials**: Recycled content paper, paper towels, toilet tissue, copy paper, fabric, carpet, floor covering; reused furniture; used furniture no longer needed is reused through an organization called ReUse.
- **Waste Diversion**: Diverts 99% of solid waste from landfill through recycling and composting.
- **Landscaping**: Drought-resistant, native plants and edible garden (used in cafeteria). Lawn represents two very small areas. One is native red creeping fescue that does not need to be mowed. The other is on a rooftop garden that is mowed with mulching mowers, eliminating the need to haul away and dispose of clippings.
- **Individual Controls**: All private offices and conference rooms have individual thermostats. Open office areas have individual controls for each zone. HVAC, lighting and plug load are activated by a combination of semi-automated controls, motion sensors and daylight sensors.
- **Intelligent Building Interface System (IBIS)**: Building monitoring and control system that automatically generates work orders when operations vary from predictions.
- **Cyclon Sub-Cooling Circuit**: An air heater is used to warm the air before it enters the building, reducing the energy required to heat the air and improving indoor comfort conditions.
- **Longer Piping**: Longer piping reduces heat loss and improves efficiency.
- **Higher Efficiency**: Higher efficiency components reduce energy consumption.
- **Bigger Capacity**: Bigger capacity exchanges more air, improving indoor air quality.

**THE SECRETS ARE INSIDE: INNOVATION THAT OUTPERFORMS**

The Multi V’s Scroll Compressor provides higher efficiency by maintaining high performance, even in cold conditions. The sub-cooler reduces cooling capacity while improving energy efficiency, and the sub-cooler with the Scroll Compressor significantly reduces energy consumption. The external air unit provides increased efficiency, and the Multi V’s Scroll Compressor achieves high efficiency even at low outdoor temperatures.
There are interesting side benefits, too. By tracking carefully how and when spaces are used, the system highlights possible improvements in layout and scheduling; by ensuring that equipment does not run needlessly, it adds to the lifespan of computer monitors, light fixtures, and other equipment.

Energy Generation
Adobe continues to push forward for sustainability and recently delved into ways to generate sustainable energy of its own. The most striking signs of the effort at the San Jose campus are 20 Windspires; tubular, vertical-axis windmills that generate clean energy from the natural wind tunnel provided by the Adobe Towers configuration. Lined up on a sixth-floor rooftop garage, these minivan-sized boxes, installed in 2009, are energy servers from Bloom Energy. These minivan-sized boxes, installed in 2009, are energy servers.

They convert hydrocarbon fuels, in this case natural gas, into energy and water. The process also produces carbon dioxide. Although natural gas powers the fuel cells, Adobe purchases an equivalent amount of biomass and considers the fuel cells to be effectively operated by bio-methane gas (See Powering Adobe's Fuel Cells). Using biomass gas in fuel cell electricity generation produces only small amounts of carbon dioxide. Using natural gas in fuel cell electricity generation produces 773 lb/MWh of carbon dioxide, according to the manufacturer. These units deliver about 30% of the electricity used at Adobe's headquarters. Conservation and in-house energy generation combined have reduced or avoided carbon dioxide emissions for Adobe's facilities by 56%. While commendable, this is still a long way from carbon neutral, so Adobe makes up the difference by subsiding renewable energy production through the purchase of renewable energy certificates/credits (RECs) and verifiable emissions reductions credits (VERs). Adobe's energy and carbon credits subsidize energy from wind farms in Massachusetts and the burning of bio-methane from dairies in California to produce electricity for the energy grid.

Water Conservation
It has been quite a while since Adobe installed low-flow showerheads, low-flush toilets, and waterless urinals in men's restrooms. This last upgrade was particularly problematic, as the local codes did not allow waterless urinals. Adobe tested four
As energy-saving practices in the building operations industry become more sophisticated, a significant focus is being placed on net zero, in which buildings become self-sufficient, operating entirely on renewable energy. The California Energy Commission plans to require new commercial buildings to meet this standard beginning in 2030, and bills to the same effect have been introduced in Congress. In some respects, Adobe, working with its existing buildings, already meets the net zero requirement. 18 years ahead of schedule (if its subsidies for green power generation in the form of renewable energy credits (RECs) are taken into account).

RECs are certificates that represent the holder has purchased energy commodities from an eligible renewable energy resource. RECs can incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources. Per the Department of Energy, the owner of an REC can claim to have purchased renewable energy at the rate of 1 MWh per certificate.

Through its three towers, Adobe has become self-sufficient, operating entirely on the electricity it generates. Behind the scenes, we’ve joined at the first through sixth floors. Tower 1, looking northwest at twilight. All three towers have received the highest possible ENERGY STAR rating of 100. Adobe's world headquarters, Adobe Towers, looking northeast at twilight. All three towers have received the highest possible ENERGY STAR rating of 100. Tower 3, looking southeast at dusk. Adobe’s sky bridges connect the three towers’ 6th and 15th floors. The towers are also joined at the first through sixth floors.

As energy-saving practices in the building operations industry become more sophisticated, a significant focus is being placed on net zero, in which buildings become self-sufficient, operating entirely on renewable energy. The California Energy Commission plans to require new commercial buildings to meet this standard beginning in 2030, and bills to the same effect have been introduced in Congress. In some respects, Adobe, working with its existing buildings, already meets the net zero requirement. 18 years ahead of schedule (if its subsidies for green power generation in the form of renewable energy credits (RECs) are taken into account).

RECs are certificates that represent the holder has purchased energy commodities from an eligible renewable energy resource. RECs can incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources. Per the Department of Energy, the owner of an REC can claim to have purchased renewable energy at the rate of 1 MWh per certificate.

Adobe’s headquarters’ combined diversion rate—the percentage of the waste stream not sent to the landfill—is just a hair below 100%. Adobe San Jose is close to achieving a zero waste diversion rate. The company campaigns regularly to discourage excess use of paper and other materials. Printers default to two-sided copies, and employees are asked to avoid printing when they can. Copy paper purchases are down almost 60%. In bathrooms, compostable, roll-style paper towels have replaced individual sheets, reducing waste in conjunction with hands-free air dryers. Coffee machines use beans in bulk packaging. Bottled water disappeared from the beverage centers in 2008; instead, employees fill their bottles from filtered water dispensers. Adobe, and now the City of San Jose, has found recyclers for difficult materials such as shrink-wrap, bubble wrap, Styrofoam packaging, and even used-up disposable pens. One stubborn item is left: The Mylar bags used to package coffee beans, potato chips and candy bars. All electronic waste is recycled.

Many of the solid waste and emissions Adobe generates is invisible: packaging, fossil fuels used for use citywide; each unit saves 15,000 to 20,000 gallons annually. Toilets were recently upgraded again, with still more conservative, high-efficiency flush versions in men’s restrooms and automatic dual-high-efficiency flush models in women’s rooms, with devices that adjust the volume according to the length of the user’s stay. The landscaping features drought-tolerant native and local plants, and varieties that complement the adjoining Guadalupe River Park. drip irrigation is installed throughout the property. Evapotranspiration controllers adjust the amount of irrigation water used in real time, based on current precipitation, humidity, temperature, and wind conditions, as transmitted by wireless technology from the local weather station.

As energy-saving practices in the building operations industry become more sophisticated, a significant focus is being placed on net zero, in which buildings become self-sufficient, operating entirely on renewable energy. The California Energy Commission plans to require new commercial buildings to meet this standard beginning in 2030, and bills to the same effect have been introduced in Congress. In some respects, Adobe, working with its existing buildings, already meets the net zero requirement. 18 years ahead of schedule (if its subsidies for green power generation in the form of renewable energy credits (RECs) are taken into account).

RECs are certificates that represent the holder has purchased energy commodities from an eligible renewable energy resource. RECs can incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources. Per the Department of Energy, the owner of an REC can claim to have purchased renewable energy at the rate of 1 MWh per certificate.

PUSH FOR NET ZERO

As energy-saving practices in the building operations industry become more sophisticated, a significant focus is being placed on net zero, in which buildings become self-sufficient, operating entirely on renewable energy. The California Energy Commission plans to require new commercial buildings to meet this standard beginning in 2030, and bills to the same effect have been introduced in Congress. In some respects, Adobe, working with its existing buildings, already meets the net zero requirement. 18 years ahead of schedule (if its subsidies for green power generation in the form of renewable energy credits (RECs) are taken into account).

RECs are certificates that represent the holder has purchased energy commodities from an eligible renewable energy resource. RECs can incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources. Per the Department of Energy, the owner of an REC can claim to have purchased renewable energy at the rate of 1 MWh per certificate.

As energy-saving practices in the building operations industry become more sophisticated, a significant focus is being placed on net zero, in which buildings become self-sufficient, operating entirely on renewable energy. The California Energy Commission plans to require new commercial buildings to meet this standard beginning in 2030, and bills to the same effect have been introduced in Congress. In some respects, Adobe, working with its existing buildings, already meets the net zero requirement. 18 years ahead of schedule (if its subsidies for green power generation in the form of renewable energy credits (RECs) are taken into account).

RECs are certificates that represent the holder has purchased energy commodities from an eligible renewable energy resource. RECs can incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources. Per the Department of Energy, the owner of an REC can claim to have purchased renewable energy at the rate of 1 MWh per certificate.

As energy-saving practices in the building operations industry become more sophisticated, a significant focus is being placed on net zero, in which buildings become self-sufficient, operating entirely on renewable energy. The California Energy Commission plans to require new commercial buildings to meet this standard beginning in 2030, and bills to the same effect have been introduced in Congress. In some respects, Adobe, working with its existing buildings, already meets the net zero requirement. 18 years ahead of schedule (if its subsidies for green power generation in the form of renewable energy credits (RECs) are taken into account).

RECs are certificates that represent the holder has purchased energy commodities from an eligible renewable energy resource. RECs can incentivize carbon-neutral renewable energy by providing a production subsidy to electricity generated from renewable sources. Per the Department of Energy, the owner of an REC can claim to have purchased renewable energy at the rate of 1 MWh per certificate.
LESSONS LEARNED

Most of the energy and sustainability projects Adobe has undertaken have been successful. While Adobe did not set absolute criteria for acceptable payback on projects, most of the projects had a less than four-year payback, and the overall average simple payback was 1.1 years. Some projects were approved, even when there appeared to be little or no payback because they were the right thing to do.

Demand Response. When Adobe elected to participate in a demand response program, curtailing electricity use by up to 10% when demand on the grid approached too close to supply, they found it took almost an hour for three engineers to turn off overhead lighting in perimeter offices and 80% of the lighting in corridors and garages. In one building, the lighting zones, including perimeter and interior lighting, were on the same zone. To reprogram those zones and activate the system was estimated at $90,000, and the savings were perceived to be between $6,000 and $12,000 per year. As it turned out, the programmers improved as they progressed, so the project ended up costing just $17,504, and a $26,855 utility company rebate made the net cost $49,968. Adobe began curtailing on all hot days, not just when curtailment was called for, saving $25,829 per year, realizing a simple payback of just 1.7 years.

Windspires. Adobe's headquarter are at the edge of the Guadalupe River. The wind comes up river in the morning as warmed air rises inland, and it comes back down the river at night. The configuration of the three Adobe Towers contributes further to creating a Venturi effect, causing the wind to speed up as it squeezes between the towers. Accordingly, it is very windy much of the time. Wind turbines known as Windspires were finally settled on as the most viable candidates, and the initial cost-benefit projections seemed reasonable. If the wind turbines had been built on the ground, the cost-benefit projections might have been realized. But Adobe's buildings occupy almost the entire site footprint. The only viable location for the wind turbines was on the sixth floor deck, a rooftop porch and garden over a portion of the garage. Wind tests showed that the prevailing winds were more than adequate. But putting them on the deck involved using a crane to hoist them up to the sixth floor, developing special bracing, emptying the planters, installing them, re-waterproofing the planters, refilling them, and re-flee coating the underside of the deck. The final cost-benefit projections were well outside the original four-year payback period.

High-efficiency Toilets. Adobe's buildings were built in 1995, 1996 and 2003, just after new legislation was passed requiring all buildings to use 1.6 gpf toilets, phasing out the previous 3.5 gpf models. The solution at the time for toilets with automated flushometers, which Adobe has, is simply to remove the 3.5 gpf valve insert and install a 1.6 gpf valve in the flushometer. The problem was that they were using the same bowls that were designed for the 3.5 gpf in mind, so they didn't always flush efficiently. Recently, Sloan developed an automated, high-efficiency flush valve that used 1.28 gpf, and an automatic, dual-flush high-efficiency flush valve for women's rooms that used 1.5 gpf for short stays, and 1.6 gpf for longer stays. They also built a toilet bowl designed to operate with this lower volume of water. Even taking into account the savings in water and sewage treatment, the payback was still about eight years. Adobe decided to proceed anyway, reasoning that the retrofit was needed to provide a better level of service for their employees, and that the need to conserve water was that important.

Daylight Cleaning. One of the primary drivers for implementing daylight cleaning was to save energy. Adobe managers had considered daylight cleaning at various times, but because virtually all of Adobe's lights are activated by motion sensors, the electricity savings would only be about $15,000 per year, a small amount for a 1 million $2 building. Because many of the janitors had ties to their families or pledged to their families or shared parenting duties with a spouse who had a day job, Adobe managers did not want to disrupt their lives for that little saving. Over time, however, more and more janitors decided they would rather move to daylight cleaning. Finally, only two of the 27 janitors wanted to continue working at night, so Adobe decided to move forward with the transition to daylight cleaning, and worked with the janitors to help them transfer to those two janitors to other accounts. Daytime cleaning also allows Adobe to reduce day porter staffing. Adobe chose not to remove any of its janitorial staff, but simply eliminated two of the day porter staff through natural attrition. Annual labor plus electricity savings were total $75,000.

Supporting Sustainable and Local Agriculture

Cafeterias feature produce from the local region—even the edible garden on the terrace just outside the broad glass doors of the café is cultivated and used to supply the kitchen. Wood for furniture and design comes from sources approved by the Forest Stewardship Council.

Cleaning and Maintenance

In 2003, safer and less toxic chemicals, pre-mixed by machine, replaced the hand-mixed formulæ. Washable and reusable microfiber dust wipers and mop heads replaced disposable materials. Lightweight high filtration vacuum cleaners, carried on backpack straps, replaced heavier push models. When Adobe cleaning staff volunteered the new gear for two weeks, they did not want to return the test gear. Adobe has switched to cleaning during daylight hours, saving energy and improving custodial staff working conditions.

To improve air quality, paints and sealants are chosen for their low volatile organic compound (VOC) content and air fresheners release no VOCs. Integrated pest control keeps pesticide and air fresheners release no VOCs. Integrated pest control keeps pesticide and air fresheners release no VOCs.