

# Energy Efficiency and Renewable Energy



Tim Street Porter

Buildings account for 70 percent of the nation's electricity use, and electric power plants, which burn coal to generate electricity, are the main source of global warming. Power plants cause other environmental and health problems, including acid rain, smog, and mercury poisoning in lakes and rivers. We can reduce these hazards by curbing energy use through sustainable building technologies, such as solar and wind power generation, and efficient design.

With its energy-efficient design, The Robert Redford Building uses over 60 percent less energy than a typical U.S. office of the same size. Moreover, it produces no carbon dioxide emissions, a major element of global warming, by meeting its electricity needs with rooftop solar panels and purchased wind certificates.

If all commercial buildings in the United States were as efficient as ours, the country could cut energy production enough to meet 70 percent of the requirement of the Kyoto Protocol, the international pact to reduce the greenhouse gas emissions that cause global warming.

# Renewable Energy Generation

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## Solar Power

### Solar Array

About 20 percent of the building's electricity is generated by a PowerLight 7.5 kW solar electric array. This system produces up to 37.5 kWh of electricity daily and is connected to the grid, our local electric utility infrastructure. When the building's electricity consumption is low, the system funnels clean power back into the grid, running our electricity meter in reverse. PowerLight, Berkeley, California: 866-737-6527; [www.powerlight.com](http://www.powerlight.com).



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PowerLight does not provide residential service. A residential (and business) buyer's guide to renewable energy businesses and organizations worldwide can be found through the Source for Renewable Energy: <http://sourceguides.com>. Consumers may find contractors in their area through the Solar Energy Industries Association: [www.seia.org](http://www.seia.org).

The Database of State Incentives for Renewable Energy (DSIRE) is a comprehensive source of information on state, local, utility, and federal incentives that promote renewable energy: [www.dsireusa.org](http://www.dsireusa.org).

### Solar Array Design

The solar array was designed by Solar Design Associates, which provides design, engineering, construction management, and technical support for residential and commercial buildings. Solar Design Associates, Cambridge, Massachusetts: (978) 456-6855; [www.solardesign.com](http://www.solardesign.com).

### Solar Array Installation

The solar array was installed by Solar Webb, which provides solar electric generation systems for homes and businesses. Solar Webb, Arcadia, California: 888-786-9322; [www.solarwebb.com](http://www.solarwebb.com).

## Wind Power

### Wind Certificates

To supplement the electricity from our solar panels, we buy “renewable energy generation credits,” also called wind certificates, from the Bonneville Environmental Foundation. This means that we pay for clean, renewable electricity generated by off-site windmills, rather than using supplemental electricity from coal-fired power plants. Bonneville Environmental Foundation, Portland, Oregon: 503-248-1905; [www.b-e-f.org](http://www.b-e-f.org).

## Energy and Water Saving Appliances

The refrigerator, microwave, range, and dishwasher in our building's Dorothy M. Wood Room all carry the Energy Star rating. Energy Star is a partnership among appliance and equipment manufacturers, the U. S. Environmental Protection Agency (U.S. EPA), and the U.S. Department of Energy to manufacture appliances that exceed government energy efficiency standards by 10 to 25 percent. Refrigerator, microwave, and range purchased from General Electric: [www.geappliances.com](http://www.geappliances.com). The dishwasher, which uses about half as much water (five gallons) as most U.S.-made dishwashers, was manufactured by Eurotech, a division of AM Appliance Group, Richardson, Texas: 800-898-1879; [www.eurotechappliances.com](http://www.eurotechappliances.com).

## Lighting

In commercial buildings, more energy is used for lighting than for anything else. Our building was strategically designed to dramatically reduce artificial lighting demand. Sunlight reaches every story through three light wells, extending from ground floor to roof, and through windows on both sides of the building. Daylight sensors dim hallway lights when sufficient daylight is present, and occupancy sensors turn office lights off when rooms become vacant. The office fixtures, suspended from the ceiling, project light up and down, allowing 90 percent of the light to be utilized (which is about 50 percent better than typical



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systems) with reduced glare. All offices and conference rooms have interior windows facing the hallways. Translucent glass, used for the terrace restroom windows and terrace skylight, and clerestories afford privacy while diffusing natural light throughout the building.

### Low-Mercury Fluorescent Light Bulbs

Lighting in all of the enclosed offices is provided by low-mercury Philips ALTO T-8 lamps. Standard fluorescent bulbs, considered hazardous waste by the U.S. EPA after their use, contain three times as much mercury. Combined with energy-efficient lighting design, the bulbs reduce the building's average annual mercury waste by 600 milligrams, compared to that of a standard project. The amount of mercury eliminated by NRDC would be toxic to over 2,000 people each year. Philips Lighting Co., Somerset, New Jersey: 800-555-0050; [www.lighting.philips.com/nam/feature/alto/tech.php](http://www.lighting.philips.com/nam/feature/alto/tech.php).

### Office Ceiling Lights

These suspended fixtures project light up and down, allowing 90 percent of the light to be utilized (which is about 50 percent better than typical systems) with reduced glare. The Sonata model by Ledalite, Langley, British Columbia, Canada: 604-888-6811; [www.ledalite.com](http://www.ledalite.com). Please see photograph of enclosed employee offices, page 34.

### Occupancy and Daylight Sensors

Occupancy sensors throughout the building turn lights off when rooms are vacated. The Watt Stopper Corporation, Santa Clara, California. 408-988-5331; [www.wattstopper.com](http://www.wattstopper.com). All but the building's emergency lights go off automatically every evening and may be turned on manually when needed. The building's emergency lights, located in corridors and stairways, remain illuminated around the clock, however, they are linked to sensors and dim when enough daylight is present. Daylight sensors provided by Lutron; lighting control system provided by Lutron Microwatt. Both companies are based in Coopersburg, Pennsylvania, 800-523-9466; [www.lutron.com](http://www.lutron.com).



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## Rooftop Skylight

Two pieces of half-inch-thick glass fused together make this skylight sturdy enough to be walked on. The skylight's exterior surface is sandblasted so that it doesn't become slippery when wet. Additionally, it contains two thin, translucent inner layers of low E (low Emissivity) glass, which block heat flow, thus reducing energy needed for cooling or heating. The skylight's translucence affords privacy while allowing light to penetrate the building. Giroux Glass, Los Angeles, California: 213-747-7406.



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## Emergency Exit Signs

Energy-efficient exit signs throughout the building use flat, one-quarter-watt, solid-state electroluminescent light "bulbs" or lamps. LightPanel Technologies, West Lebanon, New Hampshire: 888-298-8133; [www.lightpanel.com](http://www.lightpanel.com).

## Recycled Lighting Fixtures

Previously used lighting fixtures throughout the building were generously donated to NRDC by Warner Bros. Entertainment, Inc.

## Windows

All of the exterior windows are made with low-E (low Emissivity) glass. Eastern- and western-facing windows with direct exposure to the sun are double-pane "super-windows." These windows allow visible light in—reducing the need for artificial lighting—but have a reflective coating to keep heat inside when it's cool outside. This coating also prevents excess heat from overheating the interior when it's warm outside. Both types of glass are supplied by most window manufacturers.

## Cooling and Heating

In summer, cities can be six to eight degrees warmer than rural areas because of what scientists call the urban heat island effect. Heat islands occur when vegetation is replaced by asphalt and concrete, which typically absorb the sun's heat, then radiate it back into the air. The scarcity of trees and shrubs in cities also reduces shade and the natural evaporative cooling that plants provide.



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NRDC's building uses plantings and light-colored roofing to reduce heat islands. Natural ventilation cools the building through transoms and operable windows in every office, and rooftop monitors use louvers and fans to draw warm air up and expel it outside. Many spaces, including our rooftop conference rooms, rely on such natural ventilation exclusively. In other areas, peak-load cooling is supplied by high efficiency air conditioning units that use outside air only and a non-ozone-depleting refrigerant. This cooled air is delivered through floor-level plinths that provide cool air only where it is needed—to occupants—rather than pushing cold air downward through hot, still, polluted air that accumulates at the top of a room. Such displacement ventilation systems improve air quality and save energy by leveraging natural forces.

Every individual office has a heating convector that turns off (as does air conditioning) if the nearest window is opened, thereby using energy only when needed. Each office also has its own thermostat so that occupants may control their own office temperature. In conventional buildings, all individual offices are wastefully heated or cooled to the same temperature, even if rooms are vacant or occupants have different preferences. All the air and water in our building is heated with natural gas.

### Heating and Cooling Units

Each enclosed office has its own heating and cooling plinth diffuser. Each plinth acts as an air distribution and cooling device and houses a heating convector. Trox USA, Inc., Alpharetta, Georgia: 770-569-1433; [www.troxtechnik.com](http://www.troxtechnik.com). Rooms that rely exclusively on natural ventilation for cooling are outfitted with heating convectors by Myson, Inc., Colchester, Vermont: 800-698-9690; [www.mysoninc.com](http://www.mysoninc.com).



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## Air Conditioning

Cool air is provided by a high efficiency system that uses outside air only and a refrigerant that does not deplete the ozone. Carrier Corporation, Endicott, New York: 800-827-7435; [www.global.carrier.com](http://www.global.carrier.com).

## Environmental Action Center Air Distribution

The DuctSox air distribution system in The David Family Environmental Action Center employs a fabric alternative to metal ductwork. This disperses cool or warm air uniformly along the length of the duct. With conventional systems, air is directed to specific zones, resulting in a less efficient mixing of air. DuctSox also blocks the introduction and spread of indoor pollutants and reduces noise. DuctSox Corporation, Dubuque, Iowa: 563-589-2777; [www.ductsox.com](http://www.ductsox.com).



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## Ceiling Fans

Adjustable, multispeed ceiling fans throughout the building aid natural ventilation. The fans' blades are designed to mimic the aerodynamic performance of aircraft propellers to improve air movement downward. Hampton Bay brand, purchased through Home Depot: [www.homedepot.com](http://www.homedepot.com).



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## Weather Station

This weather station, installed and sponsored by Southern California Edison, is part of an elaborate system that monitors the building's energy savings. It measures air temperature, humidity, and solar radiation and is linked to a touch-screen display in The David Family Environmental Action Center that shows our energy savings in real time. The information the station collects is also used to satisfy the building's ongoing LEED measurement and verification requirements. Designed by Southern California Edison: [www.sce.com/showcasing-energy-efficiency](http://www.sce.com/showcasing-energy-efficiency). Built by ASW Engineering Consultants, Inc., Tustin, California: 714-731-8193; [www.aswengineering.com](http://www.aswengineering.com).



## Water Heater

The building's tankless water heaters conserve energy by burning gas on demand, only when hot water is needed. Two of these units are provided for space heating, and one serves hot water needs. The system eliminates heat loss associated with conventional storage tanks and the need to continually heat a large tank of water. Takagi Industrial Co., Irvine, California: 888-882-5244; [www.takagi.com](http://www.takagi.com).

## Roof

The roof is covered with light-colored material that reflects the sun's heat. It carries the Energy Star rating. GAF Materials Corporation, Fontana, California: 909-360-4200; [www.gaf.com](http://www.gaf.com).