Energy and water efficiency standards have changed radically since the Provo Area Office of the Bureau of Reclamation was built in 1984. The idea of managing a building to meet energy efficiency goals was a couple of decades in the future and architecture trumped energy efficiency for the Provo Area Office. The building roofline—designed to represent waves symbolizing Reclamation’s mission of managing water in the West—was inefficient because it allowed warm air to rise into the peaks, making it difficult to keep the occupied space comfortable.
It also was common practice to install water-intensive landscaping around buildings in the West despite the fact that western states are among the driest in the nation. Since 1984, cultural attitudes have changed as well: reduce, reuse, recycle is now visible from fast food restaurants to corporate offices.

When a sustainable building assessment was conducted on the Provo Area Office in 2010, Reclamation staff enthusiastically accepted the opportunity to bring the building into compliance with the Guiding Principles for Federal Leadership in High Performance and Sustainable Buildings. They were ready to make their office building work more harmoniously with its environment while reducing operating costs.

The 2010 assessment found this single-story modular building to be about 42 percent compliant with the Guiding Principles. When compared with similar buildings using ENERGY STAR benchmarking tools, it received a rating of only 19, meaning that 81 percent of similar buildings performed better than the Provo Area Office.

Integrated operation and maintenance, energy performance and efficient water use were three areas identified by the assessment that needed significant improvement. From 2010 through 2016, Provo Area Office staff worked hard to implement recommendations for improving the building’s performance resulting in significant reductions in water and energy consumption.

**PROJECT CONCESSION**

In 2010, Reclamation had sustainable building assessments conducted on 19 of its buildings. The Provo Area Office assessment found opportunities for significant energy reductions as well as good potential for complying with the Guiding Principles. First established as a Memorandum of Understanding between key Federal agencies in 2006, the Guiding Principles are a common set of sustainable principles for integrated design, energy performance, water conservation, indoor environmental quality, and material use. A series of Executive Orders, the most recent...
being EO 13693, require that Federal agencies ensure at least 15 percent of their building inventory greater than 5,000 gross square feet meet 100 percent of the Guiding Principles. Of the 19 buildings assessed, the Provo Area Office had the greatest energy saving potential and already had some retrofits in the works that could be leveraged to meet the targets in the Guiding Principles cost effectively.

The assessment of the Provo Area Office identified improvements in several areas including water use, energy performance, integrated operation and maintenance, sustainable sites, materials selection, and indoor environmental quality. Funding for the improvements came from Reclamation’s Working Capital Fund with some sustainability project seed money made available by Policy and Administration. By the end of 2014 Provo Area Office staff had implemented 70 percent of the recommendations from the building assessment, including some innovative new technologies and creative solutions for building operations.

SAVING WATER

Protect and conserve water is one of the Guiding Principles and meshes nicely with Reclamation’s mission to manage, develop and protect water resources in the interest of the American public. The measures implemented to reduce water use at the Provo Area Office are projected to reduce consumption by approximately 50 percent.

Reducing outdoor water consumption

The landscaping around the Provo Area Office was out of sync not only with the Guiding Principles but also with the local climate and Reclamation’s mission. Provo has more than 220 sunny days per year and an average rainfall of 20 inches (compared to the national average of 37 inches). To conserve water, much of the grass around the Provo Area Office was removed and replaced with drought-tolerant native plants and rock mulch. The sprinkler system in these areas was replaced with drip irrigation controlled by water sensors. This xeriscaping not only reduced water consumption but also reduced the amount of labor needed for maintenance.
Provo Area Office staff also implemented a rainwater harvesting system that would feed into the drip irrigation system and reduce the amount of city water used for landscape irrigation. They designed a system that collects rain from the roof into two interconnected underground 1,500 gallon tanks. The stored water is pumped into the irrigation system which is regulated by a soil moisture sensor, a flow meter, and a computer, ensuring that the plants are watered only as needed. The pumping system is solar powered (with battery storage) so that water savings do not come at the expense of increased energy use.

Many states in the West have laws on the books restricting property owners from diverting water that falls on their buildings and land. Years of drought and public interest in water conservation helped change those laws in Utah in 2010, making it possible for the Provo Area Office to install their rainwater harvesting system. During the 2015 watering season, no city water was used to irrigate the portion of the xeriscape served by the rainwater harvesting system.

**Reducing indoor water consumption**

The Provo Area Office houses offices for both Reclamation and Department of Agriculture staff and a concrete and soils testing laboratory. In addition to typical water use for offices, water is used to humidify the lab’s fog room for curing concrete. Thanks to a recirculating system, much of the water that is used to humidify the fog room is now recycled and reused. Other indoor water reduction measures implemented included replacing inefficient faucets in the restrooms with efficient, low-flow Watersense fixtures.

**SAVING ENERGY**

The design of the Provo Area Office in itself proved challenging for reducing energy use. Due to the wave design of the roofline, in winter there could be a temperature differential of up to 20 degrees between the floor and the peak of the ceilings where the warm air collected.

Provo staff worked to address this problem by improving the insulation on portions of the roof and installing ceiling fans to better mix the warmer and colder air. They hope to achieve additional energy reductions by insulating the sloped peaks of the roof and sealing the building envelope.

A major project to reduce energy use was an overhaul of the HVAC system. First, the pneumatic controls for the system were replaced with a direct digital control system. This opened the door for energy-saving control strategies that were not easily done with pneumatic controls, like using carbon dioxide sensors to control outside ventilation air and occupancy sensors to control temperature and lighting. The boilers were replaced with high-efficiency boilers. The water cooled chiller was replaced with an air cooled chiller. Although air cooled chillers are generally less efficient than water cooled chillers, new air cooled chiller technology is as efficient as the older water cooled technology and electricity consumption remained steady. A big benefit of the new chiller was water savings: eliminating the cooling tower removed its demand for water as well as eliminated the associated maintenance cost for water treatment. High efficiency, variable speed motors were installed on all HVAC

**Energy efficiency upgrades dramatically reduce energy consumption and PV installation reduces the amount of electricity purchased from the utility.**
fans and water pumps—a dramatic improvement over the outmoded ones that ran continuously at full speed. Now, numerous sensors monitor system performance and the intuitive software interface allows staff to adjust the heating, cooling, and airflow to meet the varying needs of the building occupants—including running it at a limited capacity when the building is unoccupied.

Controls were also part of the solution for reducing both interior and exterior lighting energy use. A new state-of-the-art control system was installed, replacing the old time clock system. The new system uses ultrasonic and infrared occupancy sensors to operate the lights only when needed. When there is adequate daylight, the system can override the occupancy sensors, keeping lights off until there is no longer enough ambient lighting. The exterior lights are now triggered by sunrise and sunset rather than a basic timer—ensuring that they are off during all daylight hours.

The lighting efficiency project initially had enough budget to replace the lighting control system only. Replacing the fluorescent lighting in the office with LEDs was the second phase of the project begun in late 2015 and completed in spring of 2016. LED lighting is inherently dimmable and ties into the new lighting control system, allowing the electric lighting to be dimmed based on natural light levels, as well as the exact lighting levels that occupants need for their tasks in certain areas. Exterior lights have been replaced with LEDs as well.

A unique feature of both the HVAC and lighting controls is their ability to work together. The lighting control system’s software is compatible with the software that controls the HVAC system. The HVAC controls are connected to the VAV box in each zone allowing air flow, heating and cooling to be regulated. The lighting and HVAC software compatibility means that when occupancy sensors detect someone in an area, both the lights and the HVAC turn on for that space only; if no occupants are detected both remain off. This feature is especially useful on weekends when some employees may be working but are not using the entire facility. It also allows facility management staff to fine-tune HVAC system operation based on occupancy during normal working hours.

ADDING ENERGY FROM THE SUN

Provo averages about 222 sunny days annually making it an ideal place to incorporate solar electric technology. The Provo Area Office site had enough space to install 108 solar photovoltaic panels on a racking system on the south side of the building. The system inverts the DC power to 3-phase AC power for use in the building and compatibility with Provo Power’s grid. Its maximum capacity of 24.8 kilowatts AC is just shy of the 25 kilowatt...
AC amount allowed by the city. But thanks to the reduction in energy use from the HVAC and lighting improvements, this system provides up to 25 percent of the electricity needed in the building.

SUCCESS BY THE NUMBERS

The 2010 ENERGY STAR benchmark score for the Provo Area Office was 19—a number that indicated significant improvements were needed to bring the building up to even average performance. By the end of 2015, that score had risen to 70—it now performs better than 70 percent of buildings of similar age and in similar climates. With the additional lighting improvements completed in 2016, the ENERGY STAR score is expected to go higher still.

SUSTAINABILITY PROJECTS DRIVE CULTURAL CHANGE

The team responsible for implementing the sustainability projects at the Provo Area Office didn’t neglect the people side of the equation. While many of the projects were about technology change—new HVAC system and controls, lighting controls and solar electric power—the team also gave presentations at staff meetings so staff would understand and support the changes. As a result, staff actively engage in conservation: turning off and unplugging electronics when not in use, recycling paper and using reusable water bottles instead of buying bottled water.

The sustainability achievements at the Provo Area Office are a model for other Reclamation offices as well. Provo staff has shared the project achievements with all employees in the Region through articles in the Upper Colorado Region newsletter and presentations to the Regional Leadership Team, which impressed and intrigued other area managers. Provo Area Office’s success has contributed to a rising culture of sustainable building operations in the Upper Colorado Region which now boasts Reclamation’s highest number of existing buildings in compliance with the Guiding Principles. Provo has also shared the successes and challenges of its efforts Reclamation-wide through webinar presentations.

Commercial office buildings can have a lifespan of nearly 100 years. The creativity and leadership of Reclamation staff in the Provo Area Office show that a 32-year old building can be cost-effectively retrofitted, making it an attractive, functionally efficient space for its full useful life.