Electric utilities in the United States implement demand response (DR) programs to provide financial incentives for building owners to reduce energy consumption during peak use periods, thus helping reduce constraints on the electricity grid. This measure is a preferred alternative to building more power plants and infrastructure, which are expensive and entail lengthy permitting processes.

This customer, a regulated electric utility, serves one of the most populated and most visited cities in the southwestern U.S. Its administrative offices are located in a 270,000 ft$^2$ (25,084 m$^2$) commercial office building situated in a desert climate where averages highs reach 101° F to 104° F (38° C to 40° C), and sometimes rise to over 110° F (43° C) during summer months.

**The Challenge**
The customer wanted to implement an energy efficiency pilot program to demonstrate reduced energy consumption and peak-power demand management, or demand response (DR). Project stakeholders agreed on a plan to optimize energy use while incorporating a number of demand response parameters into the system settings. The customer required high levels of IT security, and insisted on maintaining occupant comfort throughout the optimization and DR events.

**Overview**
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**CUSTOMER BENEFITS**

**Energy Efficiency & Optimization Increased**
- Up to 20% daily reduction in total HVAC energy use

**Demand Response (DR) Results**
- 13.7% demand response savings; 12% to 15% load shed expected during summer months

**Occupant Comfort Maintained**
- Internal average temperature throughout the building did not exceed 74° F to 75° F (23° C to 24° C)

**PROJECT AT A GLANCE**

Location
Las Vegas, NV

Facility
Office Building (270,000 ft$^2$; 25,084 m$^2$)

Monitored Systems
Building Management System

Setup Costs
$10,000 (€7,510)

Maintenance Cost
$38,000 (€28,530)

Projected Annual Savings
At least $45,000 (€33,790) or 449,851kWh

Software Installed
Building Optimization

Installation
2012

Make the most of your energy™
The building’s characteristics include:

- Commercial peak energy rate in 2012: $0.09 (€0.07) USD/ kWh.
- Historical peak load: 1.76 MW
- Building control system: third party
- Last substantial plant/controls upgrade: 2011
- Thermal plant: two high-load centrifugal chillers
- Heating: electric hot water boilers with local VAV reheat in perimeter zones (via direct digital controls)
- Air handling: three heat/cool AHUs per floor
- M&V procedures: IPMVP and NAESB protocol

**The Solution**

Building Optimization software was installed and interfaced to the existing building management system (BMS) using BACNet over IP. The system interfaces to the client’s Alstom Grid Demand Response Automation Server (DRAS) via the Open Auto Demand Response (OpenADR) standard. Building Optimization and the existing BMS are located on virtual servers in the corporate data center.

The Building Optimization solution uses existing building data, weather forecasts, energy tariffs, demand response signals, and proprietary algorithms to continuously optimize HVAC energy use. This is completed automatically once the system was configured—no new sensors or building data were required. Demand response event parameters are entered into the Building Optimization system the day before the event and incorporated into the system’s predictive modeling. The parameters include:

- Peak day pricing
- Maximum demand caps
- Specific kW load shedding during typical peak hours

On the day of the event, the system manages energy use in the building throughout the day and minimizes energy use during the stated event period to satisfy DR parameters. Building Optimization manages and controls HVAC settings in real time, and updates both the commands and the building model to respond to changes in conditions. Energy use, temperatures and other building operations are also reported.

**The Bottom Line**

The demand response solution using Building Optimization has been successful in reducing energy use during peak performance without adverse impact on occupant comfort. Specifically:

**Energy Efficiency & Optimization**

Building Optimization has provided up to 20 per cent daily reduction in total HVAC energy use in the building, delivering on average an 11 per cent reduction over a seven month run period. On an annualized basis, this represents a projected annual energy savings of 449,851 kWh or $45,000 (€33,790).

**Demand Response**

The building showed a demand response savings of 13.7 per cent of chiller load during moderate ambient conditions (outdoor air temperatures of 88°F and 96°F (31°C to 35°C). Warmer conditions would result in higher DR results (these were not tested due to the timing of the trial). During the hottest summer months, load shed is expected to reach 12 to 15 per cent.

**Occupant Comfort**

Building Optimization demonstrated significant energy savings without adverse effects on occupant comfort. During the pilot tests, maximum internal average temperature throughout the building did not exceed 74°F to 75°F (23°C to 24°C).