

control and allowed individual treatment rooms to maintain environments matching particular clients' preferences. In addition, an ERV enthalpy wheel was used to exchange heat/humidity between the outgoing exhaust stream and the incoming outside airstream and a humidifier was added in the outside air FCU to add humidity to all rooms. ASHRAE 90.1-2001 has a lighting allowance of 1.9 W/ft² for retail areas. Using this lighting design achieved 1.3 W/ft², roughly 30% lower than the standard requirements. Because of the high hot water demand for the spa, a large hot water storage tank was installed coupled with an 84% efficient noncondensing boiler. This is the highest efficiency that can be achieved without utilizing a condensing boiler.

Throughout the space, eco-friendly strategies are used, including local and regional materials, FSC-certified and reclaimed wood, rapidly renewable materials, low-emitting materials, recycled materials, and energy-efficient lighting and HVAC systems. Exceptional finishes were also installed throughout, including ceramic and glass tiles, fabrics, wood floors, and millwork. An 11 ft tall wall of oak boards milled from reclaimed structural timbers defines the separation between public and private spaces.

The following how-to tips were implemented in this project: QA1, QA3, QA8A, QA16, EL1, EL2, EL3, EL5, HV5, HV7, HV13, HV14, WH1, WH2, and WH3.

NUSTA SPA	
Processes for Achieving Energy Savings	Description of Project Elements
Envelope	
<i>This was a building commercial interiors retrofit</i>	No change, existing envelope.
Lighting	
<i>Electric Lighting Design</i>	ASHRAE 90.1-2001 had a lighting allowance of 1.9 W/ft ² for retail areas; this lighting design achieved 1.3 W/ft ² , roughly 30% lower than the standard requirements.
HVAC	
<i>Equipment</i>	A 20 ton air-cooled chiller and associated horizontal FCUs with electric heat, an enthalpy wheel to exchange heat/humidity between the outgoing exhaust stream and the incoming outside airstream, and a humidifier in the outside air FCU.
<i>Ventilation</i>	Ventilation system configured so that one FCU provided outside air to the entire tenant space; FCU also has variable-speed capability to adjust the outside air delivered to the space based on the average CO ₂ reading in the spa, which limited the ventilation air heating and cooling loads on the system to those necessary to keep the occupants comfortable, as opposed to the maximum required per code.
<i>Controls</i>	Each FCU was provided with a digital microprocessor control thermostat that enables individual clients to adjust the temperatures of the spaces to their preferences. The controllers also have four separate time-of-day settings that allow the spa to have a night setback, an occupied mode, and "swing" periods for warming up the spa in the morning and cooling it off at night (see above section for description of CO ₂ control).
Service Water Heating	
<i>SWH</i>	250 gal hot water storage tank coupled with an 84% efficient noncondensing boiler.

CLIMATE ZONE 5—ZION NATIONAL PARK VISITOR CENTER AND BOOKSTORE SPRINGDALE, UTAH

The Visitor Center Complex at Zion National Park in southwestern Utah is located in a dry region of climate zone 5. The 8,800 ft² complex contains a retail bookstore, visitor orientation and support areas, and a 2,756 ft² restroom facility. It incorporates energy-efficient features such as clerestory daylighting, enhanced envelope, occupancy sensors, solar load control with engineered overhangs, and computerized building controls. Daylighting is provided by south- and east-facing clerestories and north-view glass. The lighting density in the bookstore is 0.9 W/ft². The energy management system controls the lights by turning off lamps in response to available daylight. Motion sensors in the offices and support areas turn on the lights when these spaces are occupied. Envelope features include 6 in. steel-stud walls with R-21 expanding blown-in-place foam insulation and exterior 1.5 in. continuous insulating extruded foam and a roof of structural-insulated panels with a continuous R-value of 30.9. Overhangs shade south and east glass from the high sun and shield the facility from unnecessary solar gains during the summer months.

Additional Features

The innovative heating and cooling systems eliminate all ductwork and on-site fuel storage. Passive solar heating and trombe walls augment localized electric heating systems to meet the heating needs. The electric heating systems are controlled to purchase electricity when demand charges will not be incurred. In addition, the energy manage-



Photograph courtesy of DOE/NREL

Figure 4-11. Zion National Park Visitor Center and Bookstore entryway showing the downdraft cooltowers and overhangs.



Photograph courtesy of DOE/NREL

Figure 4-12. Zion Bookstore showing daylighting and 0.9 W/ft² of electrical lighting.