

ZERO NET ENERGY VERIFIED CASE STUDY



Borrego Springs Library | Borrego Springs, CA
Credit: Jeff Durkin, Bread Truck Films

OVERVIEW FACTS

Building size: 13,165 sf

Location:
Borrego Springs, CA

Construction Type:
New Construction

Building Type:
Government Building—
Library

Construction Year:
October 2017

Occupied Date:
December 2018

California Climate Zone: 15

**Measured Site Energy Use
Intensity (EUI):**
41.4 kBtu/sf-yr

Net EUI:
-0.1 kBtu/sf-yr

Borrego Springs Library

The new public library and community room in the small desert community of Borrego Springs, about 40 miles south of Palm Springs, responds to the community's deep appreciation for the distinctive ecosystem with a highly energy efficient design.

The sustainable structure not only withstands the harsh desert climate but also allows visitors to absorb and immerse themselves in the surrounding beauty. The building features many energy-saving principles, including solar shading, significant daylight harvesting and an energy efficient and durable building envelope.

Planning and Design Approach

During the ten-month design phase, Roesling Nakamura Terada Architects (RNT) worked with the community, encouraging participation and incorporating input early and throughout the process. The community comprises a diverse population, including seasonal and year-round residents living in semi-rural to rural lands. Community involvement during design benefits public building projects because it leads to better-designed projects and improves the match between community needs and the result.

Physical daylight model placed on site. As built, the library is at least three times this big.
Credit: Jeff Durkin, Bread Truck Films



The extreme climate meant that careful envelope, shading, and daylighting design was critical to deliver light and views without driving high cooling loads.

Energy Modeling

RNT developed a physical model and two digital models to study different elements of the building. RNT and energy consultant Stok created an energy model, which allowed them to plan and track various stages in the building's lifecycle. This led to the decision to include a second corten steel skin on the building's south side, which turns rust red as it weathers, further blending into the landscape.

Energy modeling is essential for optimizing sustainable design measures, but physical models can provide insights that digital models can't. On top of energy simulation modeling, the team used an on-site physical model to examine late-afternoon solar radiation patterns close to the summer solstice. The study showed RNT just how far the sun reached around the north side of the building, highlighting the need to reconsider façade shading treatments at the northwest corner curtain wall.

PROJECT TEAM

Project Team Owner/s: County of San Diego

Architect: Roesling Nakamura Terada Architects

Contractor: BNBuilders

Energy Consultant: Stök

MEP Consultant: MA Engineers

Civil Engineer: WSP

Commissioning Agent: 3Qc



Energy Efficiency Strategies and Features

BUILDING ENVELOPE

Due to Borrego Springs' extreme climate and fragile ecosystem, designing and delivering a high-performance building envelope was a critical part of the project's success. The amount of intense radiant sun that the building would endure daily was a major concern. The team carefully optimized the building's orientation, working with the sun rather than against it. A highly reflective cool roof deflects heat away from the structure. Calculated, carefully placed overhangs prevent direct sunlight from striking the building's façade during hot seasons.

High-performance insulation encapsulates the entire structure. The curtain wall includes insulated glazing units to support a comfortable environment. A ventilated double-skinned system on the south façade dissipates heat from the most severe heat conditions. The weathered steel cladding panel is extended 1" from the rigid insulation and is vented on the top and bottom, allowing the natural chimney effect of heated air to exhaust at the top.

AWARDS:

LEED Gold

2019 AIA San Diego,
Architectural Merit Award

2019 AIA San Diego, Energy
Efficiency & Integration Award

2019 Orchids and Onions San
Diego, Orchid Award

2019 American Society of Civil
Engineers, San Diego Chapter,
Project Award

Living Building Challenge, Zero
Energy Certified



LIGHTING AND DAYLIGHTING

The building orientation was specifically designed to work with the sun to allow for daylighting and reduce the need for artificial lighting while minimizing heat gain. The North façade is primarily glazed and shaded by the roof, providing indirect daylight deep into the interior spaces. The limited south façade windows direct occupants' attention to fun architectural details like circular windows. This design limits solar heat gain, increases thermal comfort, and reduces heating and cooling.

When and where artificial lighting is needed, high-quality LED fixtures maintain high energy efficiency and occupancy sensors minimize energy waste. Borrego Springs is a Dark Sky Community, meaning it is a city that has shown exceptional dedication to the preservation of the night sky through a quality outdoor lighting ordinance, dark sky education, and citizen support of dark skies. The design team worked hard to promote responsible indoor and outdoor lighting and Dark Sky Stewardship.





The building works with the sun: daylight fills the space, heat is reflected or shaded, and solar panels provide onsite renewable energy.

HEATING, VENTILATION, AND AIR CONDITIONING (HVAC)

The team prioritized including an ultra-efficient and highly durable HVAC system, not only to optimize energy performance but also because the library serves as an emergency cooling zone. The variable refrigerant flow (VRF) HVAC system optimizes energy usage by enabling heat sharing across the building: the system uses refrigerant to shift heat across building zones, delivering high energy efficiency while simultaneously heating and cooling. Outdoor condensing and heat recovery units are hidden from view behind a parapet adjacent to the tower.

Distributing HVAC in the ceiling plenum provides unobstructed views that direct occupants to enjoy the architecture. Each room has its own zone, allowing the rooms to be set to different temperatures, allowing for optimal efficiency with minimal energy loss. For example, if the library is closed, but the meeting room is occupied, only the meeting room zone needs to be conditioned to human thermal comfort ranges.

The building's HVAC system may be out of sight of the occupants, but it was far from out of mind for the designers.

“The County opened its third zero net energy library at Borrego Springs in December 2018 to provide the community with a valued facility asset to meet its needs. This beautiful building is also environmentally responsible, achieving LEED Gold certification and Zero Energy petal certification through ILFI.”

Susan Freed, Project Manager, Energy, and Sustainability Division
at the County of San Diego

Exterior view from the park
Credit: Jeff Durkin, Bread Truck Films



California Energy Design Assistance (CEDA) Program

Public buildings such as the Borrego Springs Library are eligible for design assistance through the CEDA program. CEDA provides complimentary custom energy modeling to analyze energy efficiency options and potential energy savings for new construction and major alteration projects. Based on these projected energy savings, projects can qualify for financial incentives to offset the costs of energy-saving measures.

Contact
ceda@willdan.com
for more information.

MONITORING AND CONTROLS

The HVAC, lighting, plug loads, and solar photovoltaic systems are sub-metered, allowing accurate, real-time energy monitoring to help better understand their energy profile performance, increase reliability, and realize potential energy savings. All systems are integrated into the County's central control server. This allows for equipment monitoring, building diagnostic information, and energy analytics to be accessed by staff at any time to diagnose issues if they arise. Commissioning agents were engaged early in the project to provide construction insights and offer system controls integration services, which provided a smoother construction hand-off experience and ensured that the building's systems are well-integrated and can operate at peak efficiency.

System submetering and real time monitoring allows remotely located county staff to maintain the building's high levels of energy efficiency over the long term.



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