“...CREATE THE MOST EFFICIENT AND ENVIRONMENTALLY INTELLIGENT FACILITY POSSIBLE...”

The built environment has a profound impact on our natural environment, economy, health, and productivity.
Southern California Edison’s (SCE) ultimate goal was to design and construct a benchmark model of a sustainably-designed data center. This building would be showcased to its large commercial clients to encourage them to likewise incorporate energy efficiency and environmental design measures into their data center projects. The SCE Data Center was intended to be an educational benchmark for SCE’s customers.

SCE’s vision was to achieve substantial operational benefits by consolidating various inefficient existing data center operations into a single facility, designed to accommodate IT equipment growth over the next 20 years. The benefits include efficient use of IT space, an energy cost reduction of 40%, maintenance and operation labor cost reductions of 30%, and infrastructure systems design to expand modularly to meet the growth needs. Consistent with their corporate values, SCE’s goal was to create the most efficient and environmentally intelligent facility possible within the economic parameters set for California utilities. The facility eliminated the traditional need for batteries for backup power thereby avoiding the presence of toxic lead-acid on site. The site was selected to also meet these goals, as it is a remediated brownfield and the first new facility on a soon-to-be revitalized commercial masterplan. The SCE Data Center is a demonstration of SCE’s commitment to Green Building; SCE will continue to pursue LEED Certification on future construction projects.
"LEED...IS AN INTERNATIONALLY RECOGNIZED MARK OF EXCELLENCE."

THE LEED PROGRAM

LEED™, or Leadership in Energy and Environmental Design, is an internationally recognized mark of excellence from the U.S. Green Building Council. LEED provides building owners and operators with a framework for identifying and implementing practical and measurable green building design, construction, operations, and maintenance solutions.

LEED certification provides independent, third-party verification that a building was designed and built using strategies aimed at achieving high performance in key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality.
The LEED Scorecard identifies the credit strategies pursued. Every LEED project must meet all eight prerequisites as part of the certification process.

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Total points toward LEED 'Gold': 67
Community Connectivity

In addition to redeveloping an existing site, part of the motivation for redeveloping the Southern California Edison SCE Campus was its close proximity to daily need amenities and a dense residential community. This site location encourages pedestrian access to these local resources, such as restaurants, shops, fitness centers, etc., and further reduction of greenhouse gas emissions by lessening the need for single-occupancy vehicles.

Making best use of existing infrastructure was another significant motivation. The previously developed site was also an EPA-designated Brownfield. SCE invested in the remediation and redevelopment of this property, making it a viable alternative to a greenfield site.

SCE encourages alternative transportation over single-occupancy vehicles by promoting bicycle commuting through the provision of on-site bicycle racks and shower facilities. They also encourage carpooling and use of low-emitting vehicles by offering preferred parking for employees that use these alternative methods for commuting to work.

Prior to redevelopment, the project site was completely paved over and had no vegetation. The new plan now provides 21.08% permanently installed vegetated open space and SCE has committed to keeping this open space for the life of the building.

2 MILLION ACRES OF OPEN FARMLAND IS DISAPPEARING EACH YEAR IN THE U.S. DUE TO BUILDING DEVELOPMENT (AN AREA 2X THE SIZE OF RHODE ISLAND)

PROJECT SITE:

Site Selection and Brownfield Redevelopment

Making best use of existing infrastructure was another significant motivation. The previously developed site was also an EPA-designated Brownfield. SCE invested in the remediation and redevelopment of this property, making it a viable alternative to a greenfield site.

Alternative Transportation

SCE encourages alternative transportation over single-occupancy vehicles by promoting bicycle commuting through the provision of on-site bicycle racks and shower facilities. They also encourage carpooling and use of low-emitting vehicles by offering preferred parking for employees that use these alternative methods for commuting to work.

Mitigating Stormwater

The project site reduces the quantity of stormwater run-off by 37.14% by using a variety of green building strategies including a: roof-top rainwater harvesting that redirects water to a 2,000-gallon tank and reused for toilet flushing, increased pervious surfaces through vegetated open space, and use of a bio-retention ponds to treat 100% of on-site stormwater.

Heat Island Effect

To reduce the ambient temperature of the site, a light-reflective white membrane roof with an SRI of 96 was installed to the entire roof to reflect the sun’s heat and lower the cooling load.

Vegetated Open Space

Prior to redevelopment, the project site was completely paved over and had no vegetation. The new plan now provides 21.08% permanently installed vegetated open space and SCE has committed to keeping this open space for the life of the building.
“ONE FIFTH OF THE PROJECT SITE IS NOW PERMANENT OPEN SPACE (21.08%) FOR BIRDS AND NATURAL HABITAT FROM WHAT WAS PREVIOUSLY A PAVED SITE.”

SCE’s location is ideal for its close proximity to local amenities and alternative transportation, encouraging biking and walking as alternative modes of transportation.
WATER EFFICIENCY

WATER CONSERVATION

Water-Use Reduction/ Rainwater Harvesting

The Data Center uses a combination of strategies to reduce the potable water use in the building. Low-flow faucets and shower heads and low-flush urinals and toilets were selected to reduce water use by 33% (34,730 gallons) annually. In addition, 34,000 square feet of the roof is used for rainwater harvesting, which redirects rainwater to a 2,000-gallon underground storage tank. The water is then pumped through a filtration system and purified with ultraviolet light, then redirected with double piping to the toilet rooms for flushing saving 21,604 gallons of water annually. The combined rainwater harvesting system and low-flow fixture reduce water use by 53.2% (56,334 gallons) annually.

Efficient Landscaping

The landscape combines native and drought tolerant plants and trees with an irrigation system that uses both drip and water conserving rotating sprinklers. The “smart” irrigation controller automatically adjusts daily based on climate and site conditions, thus providing the precise amount of water to plants. The result of these combined strategies reduces the potable water use for the landscape irrigation at the Data Center by 67.48% (100,621 gallons) annually compared to a traditional landscape. The landscape not only conserves water, but the attractive natural landscape palette provides habitat and food for local birds and serves as a piece of nature for employees to enjoy in this highly urbanized environment.

IN THE UNITED STATES ALONE, BUILDINGS CONSUME 14% OF POTABLE WATER: 5 BILLION GALLONS ARE USED TO FLUSH TOILETS DAILY.
Rainwater is harvested and treated at the data center using a filtration system with ultraviolet light for disinfecting the filtered water. The harvested water is reused for toilet flushing, reducing potable water by 67% (46,884 gallons) annually.

“SCE DATA CENTER REDUCES POTABLE WATER USE BY 156,955 GALLONS A YEAR.”
Commissioning

An extensive commissioning plan (both fundamental and enhanced) was employed throughout the design and construction process. Major systems and controls were thoroughly tested and corrected as required to ensure the building is functioning at optimal performance as designed. Thorough training was provided to SCE’s facility team as part of the commissioning process to ensure continued performance after the hand-off of the building to SCE.

Optimize Energy

According to the EPA’s Target Finder Score, the SCE Data Center reduces CO₂ emission by 38% or 5,226 metric tons annually compared to a data center designed to baseline code standards. Enhanced Refrigerant Management

The refrigerant R410-A, a low-ozone depletion and global warming potential refrigerant, was used for the data center HVAC&R equipment to further reduce potential harm to the ozone layer.

INNOVATIVE APPROACH

Data centers are historically energy-intensive facilities. This is due to traditional parameters requiring very narrow temperature and humidity control limits in the computer rooms. For this facility, SCE chose to take advantage of the new developments in computer equipment and ASHRAE standards, and will operate the facility based on an outside air cooling system that requires no refrigeration over 90% of the year. In addition, the electrical distribution system was designed to minimize power transformation and conditioning steps, which eliminated transformers, toxic batteries, and switching equipment. The remaining equipment was selected for highest possible efficiency ratings.

Commissioning

An extensive commissioning plan (both fundamental and enhanced) was employed throughout the design and construction process. Major systems and controls were thoroughly tested and corrected as required to ensure the building is functioning at optimal performance as the design intended. Thorough training was provided to SCE’s facility team as

part of the commissioning process to ensure continued performance after the hand-off of the building to SCE.

Optimize Energy

According to the EPA’s Target Finder Score, the SCE Data Center reduces CO₂ emission by 38% or 5,226 metric tons annually compared to a data center designed to baseline code standards.

In addition, the SCE Data uses 35.35% less electricity than the baseline case (9.2 million kWh of energy use annually). The Energy Use Intensity (EUI) for the final design shows 927.774 kBtu per square foot. This equates to a cost savings of approximately $1.15 million annually (based on U.S. Department of Energy, EIA cost information).

The data center is primarily conditioned through indirect evaporative cooling air handling units. Scavenger air is drawn through the inside of the tubes by a secondary air fan. Outdoor air entering the building is sensibly cooled by the exterior surface of the tubes, which are chilled by water evaporating off their interior surface. In the final stage, the supply air passes through a DX cooling coil (if necessary) to bring the temperature down to the required supply air temperature of 70°F with a relative humidity between 25% and 75%, in accordance with ASHRAE space cooling. This strategy reduced the cooling load by 81%, or 36 million kWh of electricity annually compared to a baseline case. In addition, Multiple Variable Frequency Drive supply fans are staged to condition the space using 81% less energy than baseline systems with constant volume fans. This is equivalent to approximately 5.5 million kWh saved.

Large windows in the front of house occupied areas and clerestory windows in the corridors provide natural daylight reducing the building’s lighting load. Occupancy sensors are used throughout the facility allowing the data center’s interior lighting to use 29% less energy.

Waste heat from the Computer Lab is reused to heat the Front of House perimeter where the data center employees reside.

IN THE UNITED STATES ALONE, BUILDINGS ACCOUNT FOR 72% OF ELECTRICITY CONSUMPTION

BUILDINGS PRODUCE 30% OF THE TOTAL U.S. GREEN HOUSE GAS EMISSIONS
“THE SCE DATA CENTER REDUCES CO₂ EMISSIONS BY 5,226 METRIC TONS ANNUALLY.”

The facility will operate on an outside air cooling system that requires no refrigeration over 90% of the year.
Materials and Resources

Addressing Waste Concerns

Recyclables

SCE’s Waste Not recycling program was first implemented in 1993. Championed by SCE’s Brad Nelson, the program focuses on waste prevention. The Waste Not recycling program goes beyond the LEED prerequisite requirements to also include: reuse of surplus office supplies (including furniture, task lights, hole puncher, etc); small electronics; used printer cartridges; and document shredding. As a result, Southern California Edison prevents 80% of surplus materials from ever reaching our landfills.

Construction Waste Management

Fifty percent of landfill waste comes from construction sites. To mitigate this the building contractor used a co-mingled strategy for recycling construction waste at the project site for the duration of the construction phase. As a result, the contractor (with careful coordination with its hauler) diverted almost 90% or 475 tons of construction waste from landfills for this project.

Implementing Positive Resource Practices

Recycled Content

Giving preference to products with recycled content (both post-consumer and pre-consumer) reduces the impact of resource depletion on virgin materials. The SCE project Team set a goal for at least 20% of the total construction hard costs for the Data Center at SCE going toward recycled content materials. This goal was incorporated in the specifications and carried out during the construction phases.

Regional Materials

The intent of using products with contents harvested and manufactured within a 500-mile radius of the project is two fold: support the local economy by using products that are extracted and manufactured locally and thereby reduce greenhouse gas emissions in transporting these materials. Like the recycled content, the SCE project Team set a goal for 20% of the total construction hard costs for the Data Center going toward locally sourced materials, as recommended by LEED.

Certified Wood

Irresponsible forest practices can have negative environmental impacts including forest destruction, loss of wildlife habitat, soil erosion and stream sedimentation, water and air pollution, and waste generation. By promoting purchase of wood products from environmentally-responsible forests certified by the Forest Stewardship Council (FSC), the team reduces these impacts while also preventing resource depletion and the harvest of endangered or old growth timber. The team set a goal of using FSC-Certified wood products for a minimum 50% of the purchase of all new wood products.

IN THE UNITED STATES ALONE, BUILDINGS ACCOUNT FOR 40% OF RAW MATERIALS USE. 50% OF OUR LANDFILLS ARE FILLED WITH CONSTRUCTION WASTE - $136 MILLION TONS ANNUALLY.
“...USING PRODUCTS WHOSE CONTENTS ARE HARVESTED AND MANUFACTURED WITHIN A 500-MILE RADIUS OF THE PROJECT.”

Almost 90% of the construction waste (475 tons) was diverted from landfills and recycled.
Minimum Indoor Air Quality (IAQ) / Increased Ventilation

Providing a minimum indoor air quality performance improves occupancy comfort, well-being, and productivity compared with buildings with poor IAQ performance. Under-ventilated buildings can be stuffy, odorous, uncomfortable, and/or unhealthy for occupants. In the case of the SCE Data Center, the design went beyond the minimum IAQ performance to provide 30% more outdoor air than code requires to ensure occupant comfort and health.

Environmental Tobacco Smoke Control

The SCE Data Center is a non-smoking facility. To protect employees from the exposure to environmental tobacco smoke, SCE set a policy increasing the distance required for smoking to 25 feet from building entrances over the 20 feet required by California State Smoking Ordinance in order to meet the LEED prerequisite. In addition, SCE Corporate facilities team is exploring the possibility of making the entire SCE campus a non-smoking campus. For now, a designated smoking location has been identified on the project site to keep smokers away from building openings.

Outdoor Air Delivery Monitoring

The SCE Data Center is equipped with CO₂ monitoring equipment that alerts facility staff through the building automation system should the CO₂ increase more than 10% beyond the design thresholds. This is especially important in areas where large populations of people might congregate.

IAQ before and during occupancy

Good construction practices entails a clean construction site that reduces exposure to harmful chemicals and VOC’s, improves air quality by protecting ducts and HVAC systems from dust and particulates, and protects new materials from water damage and potential for mold and mildew. The SCE Data center implemented a rigorous daily checklist to ensure these requirements were met throughout the construction phases. Prior to occupancy, the construction team implemented a flush-out to further reduce exposure to VOC’s to new occupants.

“AMERICANS SPEND AN AVERAGE OF 90% OF THEIR TIME INDOORS, SO THE QUALITY OF THE INDOOR ENVIRONMENT IS VITAL”
“Providing optimal indoor air quality performance improves occupancy comfort, well-being, and productivity...”

All categories of the low-emitting materials were achieved in addition to pursuing an innovation credit for low emitting systems furniture and seating.
Low-Emitting Materials
The team pursued all four credits for low-emitting materials to continue to mitigate occupant exposure to dangerous off-gassing of volatile organic compounds (VOCs). This specifically addresses products in the following categories: Adhesives and Sealants; Paints and Coatings; Flooring Systems; and Composite Wood and Agrifiber Products. All products for these four categories were carefully specified to not exceed their designated thresholds of VOCs and/or contain no added urea formaldehyde, particularly for the flooring systems and wood products. The contractor team adhered to the architectural specifications and validated that these products met the LEED criteria and various industry standards for measuring VOCs.

Lighting Systems Control
To provide greater control of the lighting conditions, 100% of the employee occupants are provided with individual task lighting to reduce the potential for visual fatigue and enhance workstation conditions. Careful selection of quality LED task lighting fixtures provide sufficient illuminance levels and save energy. Shared spaces, such as conference rooms, also provide lighting controls to provide adjustments as needed.

Thermal Comfort Design and Verification
Thermal comfort of occupants ultimately affects their productivity and level of comfort in the space. The mechanical ventilation systems were designed to maintain the thermal comfort of the data center occupants by addressing environmental conditions (air temperature, radiant temperature, humidity, and air speed) and personal factors (metabolic rate, clothing, and preference) to develop a strategy that meets the ASHRAE Standard 55 for thermal comfort and their specific conditions. To ensure continued occupant comfort well after occupancy, the team elected to develop and implement an occupant survey for the data center employees to be administered a year after their move-in. The survey is intended to measure or verify the satisfaction with the current thermal comfort conditions and provide corrective measures should 20% or more occupants report being dissatisfied with existing conditions.

INDOOR ENVIRONMENTAL QUALITY
CONTINUED...

“THE STUDY BY ‘GREEN BUILDING AND THE BOTTOM LINE’ HIGHLIGHTS HOW IMPROVED INDOOR ENVIRONMENTAL QUALITY INCREASED WORKER PRODUCTIVITY BY 16%, NETTING A RAPID PAYBACK ON THE CAPITAL INVESTMENT.”

SOURCE: ROCKY MOUNTAIN INSTITUTE
“100% OF THE EMPLOYEE OCCUPANTS ARE PROVIDED WITH INDIVIDUAL TASK LIGHTING.”

100% of the new systems furniture and seating purchased for the project is Greenguard certified.
High-Performance Green Cleaning

It is SCE’s policy to maintain the Data Center using a high-performance green cleaning program that continues to address the health of the indoor environment for its occupants well after the end of construction. The green cleaning program meets the intent and requirements of LEED Existing Building Operations and Maintenance (EBOM) for using cleaning products, equipment, and methodologies that are safe to occupants. The Green Cleaning provider has earned their CIMS-Green Building Certified designation from ISSA Cleaning Industry Management Standard (CIMS) Green Building Criteria.

Low Emitting Furniture Systems and Seating

This innovation goes beyond the four low-emitting material credits to also address the VOC content in all systems furniture and seating being specified and purchased for use at the SCE Data Center. All qualifying furniture specified for the project meets the third-party certification Greenguard that ensures these products do not exceed set VOCs levels and don’t contain any added urea formaldehyde. Almost half of the wood products used in the furniture is FSE-Certified.

Ergonomics Strategy

SCE launched their ergonomics program, Ergo 123, a firm-wide ergonomics program in 2006. Their program closely matched the intent and requirements of the newly released LEED Pilot Credit – Ergonomics Strategy (PC #44). This credit focuses on enhancing health and comfort during daily activity for at least 75% of workers. The project successfully earned this credit by working closely with SCE’s Ergonomics Program Director, Kai Chiu, to provide a detailed overview of SCE’s Ergo 123 program and occupant survey. This program surpasses the LEED requirement by addressing 100% of all SCE employees at the SCE Data Center and again demonstrates the commitment of SCE to provide a healthy working environment for employees. The Data Center was one of the first projects to earn this LEED Pilot Credit.

Green Building Education

This case study along with a video presentation about the Green building attributes has been developed for SCE to communicate to the Data Center occupants, SCE Employees, SCE’s customers, and community its commitment to green building and helping to educate others about energy and environmental measures incorporated into this facility.
“THE ERGO 123 PROGRAM SURPASSES THE LEED REQUIREMENT BY INVOLVING 100% OF ALL SCE EMPLOYEES AT THE SCE DATA CENTER...”

SCE Data Center also earned an innovation point for exemplary performance for water use reduction (WEc3) by 53.2%
DATA CENTER

GREEN BUILDING EDUCATION: A CASE STUDY
SOUTHERN CALIFORNIA EDISON
DATA CENTER
PROJECT TEAM

Owner: Southern California Edison
Rosemead, California
Corporate Facilities Management

Owners Representative: ARCADIS
SCE, California

Contractor: Turner Construction Company
Anaheim, California

Architect: Callison Design LLC
Seattle, Washington

Architect (Building Enclosure/Site): Richard Yen Associates
San Diego, California

Mechanical, Electrical, Plumbing & Lighting: Glumac
Silicon Valley & San Francisco, California

Civil Engineering: RBF Consulting
Irvine, California

Landscape Architect: In-Site Landscape Architecture, Inc.
San Diego, California

Structural Engineer: Saiful/Bouquet Structural Engineers
Irvine, California

Commissioning Agent: Facility Management Solutions
Sacramento, California

BIBLIOGRAPHY


SOUTH CALIFORNIA EDISON
DATA CENTER
GREEN BUILDING EDUCATION: A CASE STUDY