CASE STUDY

Demonstrating Effective Pathways to Achieve Zero Net Energy in Existing Municipal Buildings

Center for Sustainable Energy®

Integration of demand-side energy management with renewable energy generation, energy efficiency upgrades and enhanced building automation to deeply reduce building energy use and offset carbon emissions

THE CHALLENGE

California has set aggressive goals to reduce energy use in residential, commercial and government facilities by developing and promoting zero net energy (ZNE) buildings that generate as much on-site renewable energy as they consume each year. All new residential construction must be ZNE now, and by 2030, new commercial buildings must be ZNE. But the majority of California buildings already exist, so to be more effective, 50% of renovations of state buildings will be required to be ZNE by 2025 and 50% of all existing commercial buildings must be ZNE by 2030. That means hundreds of thousands of buildings will need extensive energy upgrades over the next decade.

The San Diego Libraries ZNE and Integrated Demand Side Management (IDSM) Project, known as SD ZN3, is designed to establish a blueprint for maximizing energy efficiency and reducing the carbon footprint of municipal and small commercial buildings. With a $2.7 million grant from the California Energy Commission and in partnership with the City of San Diego; Mazzetti, Inc.; M+NLB Construction Services, Inc.; San Diego Green Building Council and San Diego Gas & Electric , the Center for Sustainable Energy (CSE) conducted retrofit demonstrations at three existing San Diego branch libraries. Each was outfitted with LED lighting, building automation and control systems, and plug load management devices through the grant, and solar panels were installed by the City of San Diego through a power purchase agreement.

BUILDINGS ARE MAJOR ENERGY USERS

Residential, commercial and government buildings account for nearly 70% of California's electricity consumption and 55% of natural gas consumption. About half of existing buildings were built before California Building Energy Efficiency Standards were established in 1978.

GOALS FOR SD ZN3

Achieve ZNE or near-ZNE at three existing San Diego public libraries

Achieve maximum energy efficiency savings through cost-effective demand-side management, technology testing and building monitoring

Create a replicable blueprint for other municipalities

KEY SUCCESSES

Energy Efficiency Savings

To gain confidence in accelerating the transition to clean and renewable energy technologies, local government officials, policymakers and utility executives need validation from successful projects that demonstrate technology integration and associated revenue models. The SD ZN3 project estimates a reduction in electricity consumption at the three libraries of approximately 239,704 kilowatt hours and 84 kilowatts. That amounts to about $33,655 in savings per year, not including solar generation savings. Savings were also evaluated for demand response capabilities of the new on-site technologies and their potential to create revenue streams in wholesale energy markets.

Technology Testing and Monitoring Results

Energy efficiency upgrades were installed to optimize equipment operation, reduce energy consumption, improve occupant comfort, reduce building maintenance and extend equipment life. Upgrades included:

LED lighting retrofits – reducing total wattage and increasing lifespan

Advanced lighting controls – providing additional efficiency and automation

HVAC controls and whole-building automation – supplying control sequences, such as equipment scheduling and occupancy and demand-side management capabilities additional efficiency and automation

Plug load management devices – giving central control of each library's plug load devices such as copiers and printers

To measure if technologies are operating as planned, the project team conducted pre- and post-construction surveys of library staff and nine months of post-retrofit measurement and verification. Ongoing data collection of building and system performance will help achieve maximum energy savings, enable optimal demand shifting and shedding, and reveal the need for ongoing retrocommissioning.

Knowledge Transfer

The project engaged and educated city staff, library volunteers, and community members through interactive library kiosks that provide information on ZNE and IDSM strategies, sustainable energy and associated environmental benefits. Policymakers and building industry stakeholders were engaged through a dedicated project website, webinars and conference presentations.

CSE welcomes the opportunity to explore how our experience with SD ZN3 can be applied to your community's ZNE building goals.

To learn more, visit EnergyCenter.org/sdzn3

Center for Sustainable Energy®

Center for Sustainable Energy® is a nonprofit with one simple mission–decarbonize. We offer clean energy program administration and technical advisory services, working nationwide with energy policymakers, regulators, public agencies, businesses and others as an expert implementation partner and trusted resource.

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