



OFFICE BUILDING DESIGN CONSIDERATIONS

- ▶ DESIGN FROM A WHOLE-BUILDING PERSPECTIVE RATHER THAN INDIVIDUAL SYSTEMS.
- ▶ CONSIDER ENERGY AND SUSTAINABLE DESIGN OPTIONS EARLY IN THE PROCESS.
- ▶ INCLUDE ENERGY EFFICIENCY AND SUSTAINABLE DESIGN EXPERTS ON THE PROJECT TEAM.
- ▶ TAKE ADVANTAGE OF PROGRAMS LIKE THE LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED) GREEN BUILDING RATING SYSTEM® AND SAVINGS BY DESIGN.
- ▶ PROMOTE THE RESULTS TO OTHER BUILDING OWNERS AND DESIGN TEAMS.



Advanced Office Building Design

Considerations

For a typical office building, energy may comprise up to 30 percent of the operating costs representing the property's single largest operating expense. That is why it is important for owners and design teams to consider energy-efficient and sustainable design strategies from the moment the decision is made to construct an office building. The evaluation of strategies during the early days or the design intent phase of a project provides the best opportunity to take a broad perspective, from a building as a whole structure rather than individual components. With this approach, design teams are able to evaluate key initial decisions such as the size of the building footprint, the composition of the building envelope, or the building orientation that will affect subsequent decisions. For instance, the seemingly simple decision of deciding which direction a building faces may impact many downstream decisions such as the appropriate type and amount of glazing, heating and cooling requirements, and daylight harvesting opportunities. Incorporating energy-efficient and sustainable design strategies early in the design process and ensuring the installed measures are properly commissioned will result in reduced operating costs for electricity, gas, and water, and a quality work environment.



INLAND EMPIRE UTILITIES AGENCY
ADMINISTRATIVE HEADQUARTERS

Because of the nature of office buildings, both opportunities and challenges exist for selecting and successfully implementing cost-effective strategies. Building owners and design teams desire attractive structures, which may include a significant number of windows creating potential glare and solar gain issues in offices. Design teams also may opt for walk-in lobbies or atrium spaces with high ceilings and glass perimeters that demand substantial heating and cooling. Though individual comfort levels differ, building occupants typically want outdoor views from their desks, and comfortable temperatures and light levels throughout the year. In response, design teams will include windows, lighting, and heating and cooling systems that often conflict with each other and have limited control options. For example, one floor may include perimeter offices with windows and cubicle non-perimeter office spaces, yet only one thermostat is provided for controlling the heating and cooling system for the entire floor. As a result, either the perimeter or cubicle areas may experience uncomfortable temperatures depending on the location of the thermostat and the time of year. Also, engineers may design ambient or overhead lighting systems without accounting for individual task lighting, creating overlit workspaces. Office buildings also tend to have a multitude of desktop computers and servers, copiers, and other office equipment that increase the heat load within the building. These loads should be properly accounted for in the heating and cooling calculations. Finally, office buildings typically follow a routine occupancy schedule for weekdays, weekends, and holidays, which provides an excellent opportunity for scheduling and sequencing of energy-consuming systems.



For design teams and owners, energy design strategies worth consideration for office buildings include the following:

- Lower ambient lighting power densities and create task/ambient environments, where appropriate, and use natural daylight in perimeter spaces to supplement electric lighting.
- Evaluate glazing quantities and options to reduce glare and solar gain in offices and common building areas, selecting the appropriate type of glazing for different use areas.
- Increase the efficiency of cooling and heating equipment as well as pumps and fans, and consider multiple smaller units rather than one or two large systems.
- Sequence lighting and HVAC (heating, ventilation, and air conditioning) systems to match building loads and schedules, and segment into multiple zones to allow more controllability.
- Insist on commissioning of key building systems.

"THE MOST INNOVATIVE AND EFFECTIVE GREEN DESIGN IS BEST ACCOMPLISHED BY ASSEMBLING THE FULL PROJECT TEAM EARLY IN THE PLANNING PROCESS."

SEAN McCOURT,
CHAIRMAN OF FORD LAND,
THE REAL ESTATE ARM OF
FORD MOTOR COMPANY

Sustainable design strategies worth considering include the following:

- Use of recycled content or the reuse of building materials for office furniture, carpet, cubicle panels, wood flooring, and concrete to reduce waste streams.
- Consider high-efficiency water faucets and toilets along with control sensors to reduce water use.
- Evaluate using natural vegetation around the building perimeter to mitigate water use and minimize maintenance.
- Capture rainwater run-off or consider gray-water systems for supplemental or substitute irrigation sources.

The benefits of incorporating energy-efficient and sustainable design strategies are becoming well documented. Two examples, Premier Automotive Group Headquarters and Inland Empire Utilities Agency (IEUA) Facility, were designed and built using some of the above-mentioned strategies and both projects are now showing significant results.



PREMIER AUTOMOTIVE GROUP'S
GREEN ROOF CONTRIBUTES TO THE
INVITING WORK ENVIRONMENT FOR
APPROXIMATELY 850 EMPLOYEES.

Tale of Two Office Buildings

For two design teams and two building owners, the goal was the same – provide a quality work environment that is energy-efficient and environmentally responsive, yet affordable. Though the details of how each group designed and built the individual projects are different, the stories are fundamentally the same. Each leveraged the resources and expertise of a multi-disciplined team to establish a comprehensive and integrated approach. Both teams evaluated and judiciously selected the energy-efficient and sustainable design strategies appropriate for their project.

Premier Automotive Group Headquarters

Located in Irvine, California, the Premier Automotive Group Headquarters consists of an office tower and product development building that are connected and house the four major Ford Motor Company automobile brands—Aston Martin, Jaguar, Land Rover, and Volvo. The 300,000-square foot facility includes offices, a precision industrial space, vehicle display and exhibit areas, conference rooms, and a fitness center and cafeteria. Occupied in August 2001, the building is LEED (Leadership in Energy and Environmental Design) certified at the basic level. It also qualified for incentives under the California Savings By Design Program.

“As the Premier Automotive Group headquarters was Ford’s first attempt at seeking LEED certification, employing sustainable design and energy-efficient principles was extremely important,” said Sean McCourt, Chairman of Ford Land, the real estate branch of Ford Motor Company. Designed by LPA, Inc. and constructed by Koll Construction, the Ford Motor Company involved William McDonough +



THE PREMIER AUTOMOTIVE GROUP
FACILITY FEATURES 'GREEN' TRELLISES
TO HELP INSULATE AND RETURN
DISPLACED VEGETATION.

Partners as environmental design consultants and CTG Energetics for sustainable design, LEED, and commissioning services.

Overall, the design for the Premier Automotive Group Facility exceeded a baseline building designed to ASHRAE 90.1 1999 energy standards by 40 percent and California Title 24 energy standards by 18 percent. Specific energy efficiency measures included the following:

- A glazing system for the office tower designed with laminated low-E bronze tint, and insulated low-E clear and bronze.
- Lighting using direct/indirect pendant fixtures with T-5 lamps designed to maintain lighting power densities of .84 watts per square foot.
- High-efficiency chillers, with one chiller having a variable speed drive significantly increasing the part load efficiency.
- A digital control system for the heating, cooling, and lighting systems.
- Under-floor air distribution with raised floor access and an under-floor air plenum. The system allows for a reduction in the air supply temperature due to the floor-level air delivery and increases the number of hours that the economizer can be used due to the higher supply temperatures.

The sustainable measures for the Premier Automotive Group Facility included the following:

- A natural gas fuel cell with heat recovery to supplement up to 25 percent of the building's power and provide hot water.
- Toilets that use reclaimed water, lowering the sewage impact by more than 50 percent.
- A green roof on the product development building featuring more than 30 vegetation types insulates the top of the structure and saves on roof costs. Green trellises are employed to shade and insulate the facility.
- Recycled and recyclable materials in the carpet and parts of the furniture.
- Recycling of more than 50 percent of the construction material.



INLAND EMPIRE UTILITIES AGENCY HEADQUARTERS USED TILT WALL CONSTRUCTION AND CREATED BRIGHT WORKSPACES FOR THEIR EMPLOYEES.



“BY 2006, IEUA’S ADMINISTRATIVE HEADQUARTERS WILL BE 100% SELF-SUFFICIENT THROUGH A COMBINATION OF ENERGY CONSERVATION AND POWER GENERATED BY SOLAR PANELS LOCATED ON THE FACILITIES ROOF AND BY THE METHANE GAS GENERATED BY THE ANAEROBIC DIGESTION PROCESS AT OUR WASTEWATER TREATMENT PLANT LOCATED ADJACENT TO THE HEADQUARTERS.”

JOHN L. ANDERSON
IEUA BOARD PRESIDENT

Energy use savings for the Premier Automotive Group were projected to be 18 percent per year with the enhanced equipment and design. Based on three years of usage data, actual energy use savings are tracking at 35 percent. Lighting and cooling design strategies account for the majority of the savings. Gas usage also is significantly lower than original estimates.



THE IEUA FACILITY INTEGRATED THE ELECTRIC LIGHTING SYSTEM WITH SKYLIGHTING AND HIGH PERFORMANCE GLAZING.

FOR MORE INFORMATION, VISIT WWW.IEUA.ORG/LEED.HTML

Inland Empire Utilities Agency Facility

Located in Chino, California, the IEUA Headquarters consists of two 33,000 square foot single-story office buildings. The agency is a municipal water district providing water and wastewater services to more than 700,000 customers. The project team included the prime contractor, TG Construction, Inc., and CTG Energetics for sustainable design and commissioning services. The building qualified for LEED Platinum rating and received the Governor's Environmental and Economic Leadership Award, California's highest award for environmental stewardship. It also received incentives under the Savings By Design Program.

Overall, the design for IEUA exceeded a baseline building designed to ASHRAE 90.1 1999 standards by 40 percent and California Title 24 2001 standards by 66 percent. Aggressive strategies such as recovering waste heat from the water treatment plant and the use of solar panels account for a significant portion of the savings. Energy efficiency measures included in the building are:

- Integration of natural light from skylights and windows with high performance glazing combined with light sensors are used throughout both buildings to supplement electric lighting.
- Waste heat recovery from the water treatment process provides cooling and heating needs for both buildings.
- Separation of work spaces into 27 control zones with carbon dioxide sensors provides better management of occupant comfort and system performance.

The sustainable measures for IEUA included the following:

- Recycled materials in carpet tiles, wall coverings, and partitions, and low emitting paints, carpets, and adhesives.
- High efficiency plumbing fixtures, and low-flow and dual- flush toilets.
- Use of recycled water from the water treatment plant that meets 100 percent of the irrigation and building non-potable water needs.
- Solar roof panels to supplement almost 25% of the utility-supplied electricity.

Electricity and gas savings for the IEUA administrative headquarters were estimated to be approximately \$35,000 per year. Actual savings are on track to meet projections.

Commissioning was a key component for both projects, which ensured the major building systems were installed properly and perform as intended, and guaranteed training for facility staff. The commissioning process and the use of control systems have improved the operability and performance of the complexes. For both projects, non-energy benefits include a comfortable and pleasant work environment for employees with the societal benefit of reduced environmental impact.

Other Considerations

Though integrating energy-efficient and sustainable design strategies into owner-occupied buildings appears to provide more direct incentives to owners by lowering operating costs and promoting employee well-being, tenant-occupied office buildings share the same advantages plus additional benefits for developers. A higher asset value is assigned typically to high performance buildings and there are distinct marketing advantages with tenant companies wanting to work in quality work environments. Lower operating costs also translate into more competitive lease rates. Finally, developers building or renovating their office building portfolio and including energy-efficient and sustainable strategies show long-term environmental commitment and corporate stewardship that provides immeasurable value.

By using a multi-disciplined team of experts, judiciously evaluating and implementing strategies, requiring commissioning of the key building systems, and taking advantage of federal, state, and regional incentive programs and services, owners and design teams can cost effectively design high performance office buildings with quality work environments.



THE SAVINGS BY DESIGN PROGRAM OFFERS SERVICES AND INCENTIVES TO ARCHITECTS AND BUILDING OWNERS TO HELP THEM RAISE THE BAR REGARDING A BUILDING'S ENERGY PERFORMANCE. BENEFITS OF PARTICIPATING INCLUDE LONG-TERM SAVINGS ON OPERATING COSTS, MONETARY INCENTIVES TO DESIGN TEAMS AND BUILDING OWNERS, AND ASSISTANCE IN EVALUATING VARIOUS ENERGY EFFICIENCY DESIGN STRATEGIES.

THIS PROGRAM IS FUNDED BY CALIFORNIA UTILITY CUSTOMERS AND ADMINISTERED BY PACIFIC GAS AND ELECTRIC COMPANY, SAN DIEGO GAS AND ELECTRIC, SOUTHERN CALIFORNIA EDISON COMPANY, AND THE SOUTHERN CALIFORNIA GAS COMPANY.

FOR MORE INFORMATION, VISIT WWW.SAVINGSBYDESIGN.COM.



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