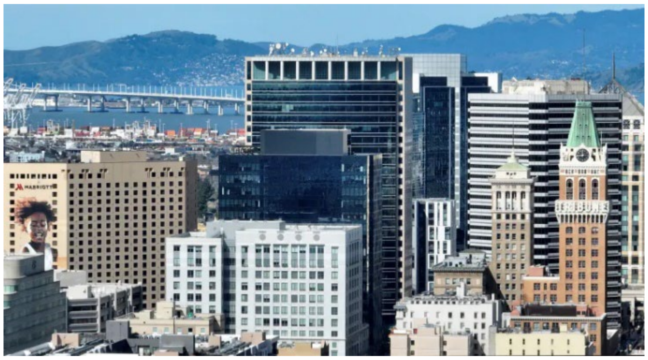
Office
Explainer



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Characteristics

Built during 1980s

Natural gas-based space heating and domestic water heating

Non-LED lighting

Envelope per 1980s building code

Energy Conservation Measures

Demand controlled ventilation

Space temperature setpoint and ventilation setbacks

Lighting upgrades

Load shifting opportunities

Smart plug load control

This report includes some considerations for energy and emissions savings measures that are unique to Bay Area office spaces. According to reported trends for Bay Area counties, around 60% of offices (on the basis of floor area) were constructed between 1960-2000 with approximately steady pace of construction through that time period. The 1980s show the highest prevalence of office buildings, with approximately 17% of all Bay Area office space being constructed during this decade. 65% of Bay Area office space is heated with fossil fuel space heating systems, while 44% of office space is served by fossil fuel DHW systems.

This document considers a prototypical office constructed during the most common time period (1980s) with fossil fuel-based space heating and water heating systems and a direct-exchange (DX) cooling system, non-LED lighting, and an envelope that adheres to thermal insulation requirements which were in place at the time of construction.

Demand-Controlled Ventilation
Implementing Demand Control Ventilation (DCV) systems in Bay Area office buildings can lead to significant energy savings and improved indoor air quality. Office spaces are particularly well-suited for DCV due to their variable occupancy patterns, with areas like conference rooms and auditoriums often experiencing fluctuating usage. By adjusting ventilation rates based on real-time occupancy data from CO_2 or occupancy sensors, DCV ensures that ventilation aligns with actual needs, reducing energy consumption associated with heating, cooling, and fan operations.

Temperature Setpoint and Ventilation Setbacks
Opportunities exist to reduce HVAC-associated energy by expanding setbacks (i.e., employing less stringent thermostat setpoint temperatures) and reducing ventilation rates during periods known to have little-to-no occupancy. This strategy will be especially impactful for buildings with high ventilation demands such as medical office buildings or laboratory/office sites.

Lighting Upgrades
After plug loads and HVAC, lighting is the next biggest energy consumer for offices buildings (about 15% of total energy for Bay Area offices). LED lighting retrofits offer a cost-effective way to improve energy efficiency in Bay Area office buildings, often leading to significant reductions in electricity use and maintenance costs. ComStock data suggests that nearly half of Bay Area office buildings have non-LED lighting fixtures, pointing to the potential for significant savings (up to 75% lighting energy savings).[1]

One of the simplest ways to implement these upgrades is through drop-in replacements, where existing fluorescent tubes (e.g., T8 or T12 fixtures) can be swapped for LED equivalents without requiring major electrical modifications. This approach minimizes labor costs and downtime, making it an attractive option for occupied office spaces.

However, the feasibility of drop-in LED replacements depends on building age and existing electrical infrastructure. In newer office buildings with standard T8 fixtures and electronic ballasts, LED tubes that are compatible with existing ballasts (Type A LED tubes) can be easily installed. Older buildings, particularly those with T12 fixtures and magnetic ballasts, may require ballast bypass LEDs (Type B) or complete fixture replacements to ensure compatibility and efficiency gains. Additionally, some older buildings may have outdated wiring or insufficient grounding, which can pose challenges for LED retrofits and require additional electrical upgrades.

Beyond basic replacements, networked LED lighting systems offer advanced controls like occupancy sensing and daylight harvesting, further enhancing energy savings. Integrating these features, however, may require updating lighting control systems, especially in older office buildings that rely on outdated dimming or switching mechanisms.

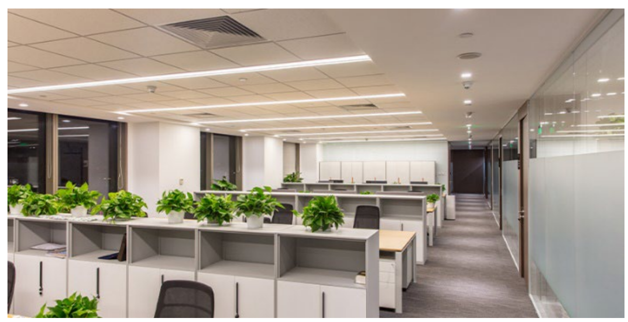

Figure 1: Drop-in LED tub lighting replacements (Source: Intelligent Energy Light and Power)

Load Shifting Opportunities
Given the predictable operational schedule of commercial office buildings, there are opportunities for pre-heating or pre-cooling an office building in early morning hours prior to peak occupancy in order to shift thermal loads (and consequently, electrical loads) to times of day with lower-cost electricity and lower emissions factors associated with grid electricity generation. Load shifting also supports grid resiliency and reliability by reducing

[1] https://www.facilitiesnet.com/lighting/article/Future-Proofing-the-Energy-Efficiency-of-New-LED-Lighting--20039

electrical demand during periods of grid alerts and peak demand events.

Strategies include pre-cooling a facility during morning and afternoon hours to reduce cooling load during peak consumption timeframe (typically 4-9pm); cooling system "coasting" by deactivating chillers and compressors sooner than normal to allow temperatures to gradually trend upward as occupancy dwindles; and turning off HVAC service to unoccupied spaces (where controls allow) such as conference rooms and assembly spaces.[2]

Landlord-Tenant Relationships

Implementing energy efficiency measures in tenant-occupied office buildings presents challenges due to the split incentive problem, where landlords bear the cost of upgrades while tenants benefit from lower energy bills. Additionally, variations in lease structures may limit a building owner's ability to enforce efficiency improvements, and tenant concerns about comfort or operational disruptions can further hinder adoption. One solution is implementing green leases, which align incentives by allowing cost-sharing mechanisms for energy upgrades. Another approach is providing real-time energy data and benchmarking tools to engage tenants in energy-saving efforts while demonstrating financial and sustainability benefits. Incentive programs for energy efficiency improvements can also help offset initial investment costs, making these retrofits more appealing for both landlords and tenants.

Equipment Loads in Select Office Types

For offices with a variety of energy intensive interior electricity-consuming equipment (called "plug loads"), smart control strategies such as scheduled equipment downtime, automatic sleep mode for select appliances after a period of non-use, and deactivation of unused appliances such as small refrigerators in office spaces can yield significant energy savings. The U.S. General Services Administration *Sustainable Facilities Tool* demonstrates that optimized plug load controls can achieve up to 43% reduction in equipment energy consumption for office spaces.[3]

Office buildings that cater to activities such as medical clinic or laboratory uses are likely to have high electricity consumption from miscellaneous indoor equipment (medical machinery, process hot water and steam generation). These energy end uses are likely to comprise a high share of overall building energy and are difficult to target with traditional energy conservation measures. For such building types, strategies should focus on automated plug load management for non-critical equipment (such as small kitchenette devices and computer monitors).

Figure 2: Typical variety of office plug loads including computers, monitors, and other desktop accessorie (Source: Utility Dive)

[2] https://www.dgs.ca.gov/OS/Resources/Page-Content/Office-of-Sustainability-Resources-List-Folder/Reducing-Energy-Use

[3] https://sftool.gov/learn/about/426/plug-loads#