Oversized Systems Hamper Ability to Control Utility Costs

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By operating in buildings with oversized HVAC and electrical systems many companies today miss out on opportunities to reduce utility costs.

A little history is helpful to understand this problem. The proliferation of the desktop computer, laser printer and fax machine in the early 1980s overwhelmed the mechanical and electrical capacity of the typical office building. Systems designed for the electric typewriter on a receptionist's desk could not meet the demands of a desktop computer appearing on every desk. Clearly, additional mechanical and electrical capacity was needed for the increasing amount technology that poured into the office environment.

Today, a plug load capacity of 4 to 6 watts per square foot is not an uncommon requirement for tenants seeking new space. Buildings with only 3 watts per square foot of plug load capacity are often eliminated from consideration. The irony is that it is difficult to exceed a plug load of 1.5 watts per square foot because the typical office building has a plug load of about 1 watt per square foot.

While architects, designers and developers were busy increasing the mechanical and electrical capacity of office buildings to meet the demands of increased technology, the high-tech industry was reducing the power consumption of its equipment. The early desktop computers consumed several hundred watts. By the early 1990s, power consumption for the typical computer was roughly 120 watts.

Introduction of the Energy Star program in 1993 helped reduce power use by encouraging the development of the "sleep mode." This feature allowed a computer and monitor to consume only 75 watts and 12 watts respectively, when in the sleep mode. The potential for savings is enormous. Just consider that the average desktop computer is on for seven hours per day but used for four hours and 30 percent of computers are left on overnight. The city of San Francisco saves about $150,000 each year through a program of encouraging city employees to use the sleep feature and turn off equipment before leaving the office.

The use of the laptop computer as a replacement for the traditional desktop makes a dramatic impact on power consumption and heat load. At 15 watts or less when in use, laptop computers offer a 90 percent reduction in power consumption without a loss in computing power and the added benefit of mobility. Continued improvement in efficiency and power management may reduce their power needs to less than 5 watts.

Power consumption for lighting also dropped dramatically during the last 20 years. Improvements in lighting technology suggest the trend will continue. As lighting controls become more common further reductions in the heat load on the mechanical system will be possible. For example, in 1980 the typical lighting load for office space was three watts per square foot. Ten years later it was 1.5 watts per square foot at peak use. By 2000, peak lighting load had dropped to 1 watt or less per square foot, with the best class of buildings at .75 and .50 watts per square foot.

As a result, many office buildings now have HVAC and electrical systems 300 percent to 400 percent larger than needed. Typically, oversized systems must operate under partial load conditions that create up to a 60 percent penalty in operating efficiency. The potential for savings in both initial construction costs and operating costs is tremendous.

Rather than use 4-to-10 watts per square foot for lighting and plug load, a more sensible standard would be 1.5 watts for plugs and 1 watt for lighting. While still conservative, this allows the mechanical systems to run more efficiently, thereby reducing first costs, operating costs and pollution.

A reduction in the mechanical system load of 2.5 tons or more of cooling per 1,000 square feet is possible. This translates into savings of four dollars per square foot in initial construction costs and 50 cents per square foot in annual operating costs. Plus, you benefit by eliminating 10 pounds of CO_2 gases generated annually per square foot of building size.

The financial impact of this on investment-grade office buildings is dramatic. Office buildings are typically valued by the income capitalization method. Using this approach, the net operating income (income minus expenses but not including debt service) is divided by a capitalization rate to establish the building's value. A reduction in annual operating costs of 50 cents per square foot at 8.5 percent capitalization rates would increase the building's value by $5.88 per square foot. Stated another way, a developer could reduce initial construction costs by four dollars per square foot and increase building value by $5.88 a square foot. Even more dramatic is the impact on a company that owns or triple net leases its buildings. Using a price earnings ratio of 22 for every 50 cents per square foot reduction in operating costs adds $11 to the company's value.

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