Lowering Energy Costs at Airports

Reducing energy costs can help airports compete for scheduled flights by lowering the gate and landing fees charged to airlines. At the same time, airline passengers are becoming more concerned about the environmental impacts associated with travel, and increasing numbers of airports are responding by incorporating green design and efficient energy use into the architecture.

The best bets for lowering energy costs are to install more efficient lighting, baggage, and HVAC systems. Low-cost energy savings options are also appropriate for use in offices and facilities that are closed to the public.

Henry Oberholster, the energy and utilities manager at Toronto Pearson International Airport—which won the Institute of Transport Management's 2006 global Airport of the Year award—says "We've completed about 100 efficiency projects including efficient lighting and daylighting, and are saving around 2 million dollars [Canadian] per year."

Energy-Efficiency Solutions

Airports are energy-intensive operations that can considerably lower costs by investing in energy-efficient technologies. The biggest opportunities are in improved lighting, mechanical, and HVAC systems. There are also ways for airports to ensure a steady and reliable supply of power without wasting additional energy (see sidebar).

Lighting Technologies and Controls

Lighting is the largest opportunity for saving energy in airports. Long operating hours mean that lights may be on nearly all of the time, providing an excellent return on investments in efficient lighting. One airport facilities manager noted that, "some lights are on all night when there are few passengers in the terminal because we want to look open for business." The following are some areas that provide energy-saving opportunities for lighting.

Daylighting. The elongated structure of airport terminals that is needed for airplane gate access is excellent for daylighting because much of the space is in the perimeter zone and easily illuminated by daylight. Airport design is increasingly making use of daylighting to improve the ambiance of the terminals and reduce lighting costs. Typical buildings that take advantage of daylight are able to save 40 to 60 percent of the energy used for lighting. Because sunlight produces less heat per lumen of light, better daylighting decreases air-conditioning costs and may allow for a smaller (and less expensive) HVAC system. Using low-emissivity window glazing reduces both glare and solar gain. Translucent roofing material, such as that used in the construction of Denver International Airport, can also be incorporated during new construction (see **Figure 1**).

Figure 1: Daylighting at Denver International Airport
Translucent roofing material and abundant windows at Denver International Airport provide natural daylighting.

Courtesy: Denver International Airport

To get energy benefits from daylighting, it is necessary to use controls that adjust electric lights in response to the amount of daylight available. These systems may use either dimming ballasts or switching schemes that turn off all or some of the lights depending on how much daylight is available.

Interior lighting. Replacing T12 lamps and magnetic ballasts with T8 lamps and electric ballasts is relatively simple and can reduce energy consumption by 35 percent. High-performance T8s, also known as super T8s, are a newer generation of lamps with 23 to 31 percent energy savings over conventional T8s. These improved lamps also have a longer life and better lighting quality. Even considering energy savings alone, it often makes financial sense to replace standard T8s with their high-performance cousins. T5 lamps are another efficient option, but they use a different socket than T8 lamps. T5s in direct/indirect fixtures can be a good choice during renovation or new construction. Also, compact fluorescent lamps (CFLs) consume between two-thirds and three-quarters less energy than incandescent bulbs. Common applications for CFLs are in airport offices and employee areas.

Many airport areas are lit to higher levels than necessary, and when this is the case, delamping can save significant money. Toronto airport, for example, was able to reduce by 40 percent the amount of light in its terminal by removing one T8 bulb from every two-lamp fixture. This eliminated 2,000 bulbs and did not trigger any customer complaints about inadequate lighting.

Occupancy sensors and timers can reduce lighting-energy consumption by up to 50 percent in offices and other areas not open to the public, and they may be a good choice in areas with little traffic. Timers may be the best bet for energy savings in areas with higher occupancy but predictable schedules. The energy-management system at Port Columbus International Airport in Columbus, Ohio, is programmed to turn off lighting and mechanical systems in gate areas where no flights are scheduled so that energy is not wasted on unoccupied areas of the building.

Exterior lighting. Airfield lighting uses a significant amount of energy—around 15 percent of an airport's total load, by one estimate. In 2007, the Honolulu International Airport's incandescent taxiway lamps were replaced with 1-watt, high-intensity light-emitting diode (LED) lamps, resulting in annual savings of approximately 300,000 kilowatt-hours (kWh) and $27,000. These lamps also lead to lower maintenance costs because they have an expected life of around 200,000 hours—far greater than the lamps they replaced. Nearly 300 taxiway guidance signs were also replaced with signs lit by CFLs, resulting in an additional $27,000 annual savings (at nine cents per kWh).

Most parking areas are designed with far more lighting than is recommended. For example, once the Toronto Pearson International Airport was discovered to have too much light in the parking garage, the amount was reduced by one-fourth. Over-lit parking areas not only waste energy—they can actually be dangerous if drivers have trouble adjusting their eyes between highly lit and dark areas. In parking lots, fluorescent, high-efficiency metal halide or high-pressure sodium lights use less energy and last longer than incandescent bulbs. Choosing appropriate pole height and spacing during new parking lot construction will also lower energy costs.

Baggage Conveyors and Other Motorized Systems

Baggage systems consist of hundreds of motors and belts. Together these motors constitute a large electric load, and upgrades can create significant energy savings. Using efficient motors on escalators can also reduce maintenance and lead to energy savings.

Baggage systems. The most comprehensive and cost-effective ways to save energy for mechanical system upgrades is through a whole-system approach. Efficient belt systems have teeth instead of relying on friction

to hold the belts, saving energy and resulting in fewer bearing failures because less lateral force is placed on the drive. In addition to cutting down on energy costs, an efficient driveline may reduce initial costs by allowing a smaller motor size.

Variable-frequency drives (VFDs) can result in significant energy savings when the baggage conveyors are not required to operate at full speed. Upgrading to VFDs should not be done in isolation. It is important to think about the whole system—speed controls will only provide full potential savings if all elements of the system are specified for variable-speed operation.

Energy-management systems are another way to reduce energy costs from motors. Baggage-handling systems at the Toronto and Columbus airports have been separated into energy-management zones that can be shut down if the gates they serve are not in use.

Escalators and walkways. Voltage controllers and soft-start controls can reduce energy consumption and maintenance costs by varying the voltage to the motor during startup and according to the load. They are especially effective when motors run for long periods with minimal load. Honolulu International Airport installed soft-start controls on 56 escalators and saved 281,921 kWh per year. This translated into annual cost savings of $525 for each "up" escalator and $496 per "down" escalator (at eight cents per kWh).

Heating, Ventilation, and Cooling

Efficient HVAC systems that are properly sized and maintained can reduce costs considerably.

Ventilation. In cooler climates, economizers can improve indoor air quality and result in "free" cooling by increasing the inflow of outside air. As another option, heat recovery units use heat pumps to capture energy in ventilated air and heat or cool the building. This provides energy savings because that thermal energy is used by the HVAC system instead of being exhausted outside.

Adjustable-speed drives. VFDs can be added to pumps and fans in the HVAC system, saving energy by allowing motors to adjust their output to the fluctuating heating and cooling needs.

Environmental Solutions

Airports can make a positive—and visible—impact on the environmental issues associated with air travel. There is a clear, growing interest in green goals, and LEED (Leadership in Energy and Environmental Design) certification is becoming a starting point for new construction at many airports. Absorbing between 50 and 80 percent of airport construction costs, airlines have not always been enthusiastic about costly projects—however, this may change for initiatives promoting the industry's green efforts.

Reliability

A power outage can lead to a costly cascade of security delays, missed flights, shut-down reservation systems, and baggage-handling delays. An easy rule that ensures a reliable power supply is that more redundancies are better. In addition to installing multiple electrical feeds, there are a number of ways for airports to maintain a reliable power supply while saving money and meeting other goals.

Coordinate backup-generator maintenance with your utility. Many utilities provide incentives for reducing energy use during peak periods of demand. Most generators must be activated monthly for maintenance, and there may be incentives for coordinating this with your utility. In competitive markets, maintenance could be scheduled to correspond with high wholesale electricity prices.

Consider cogeneration. In 2005, responding to blackouts in the Northeast that followed electric industry restructuring, Toronto Pearson International Airport installed a 117-megawatt, on-site, combined-cycle, gas cogeneration plant. The plant has two turbines whose capacity more than doubles the airport's peak load. This provides a backup should one turbine shut down and allows the airport to sell about half of the electricity it generates into the grid. The Toronto airport saves money by diverting some steam to offset boilers to run efficient, steam-charged chillers.

On-site renewable energy. The abundance of empty land at many airports is compatible with photovoltaic (PV) solar-array installations that can generate a significant amount of energy. Denver International Airport is installing a 2-megawatt solar PV system that should generate around 3.5 million kWh of electricity annually.

Parking lots in hot, sunny areas are good places for PV panels because they can do double duty by providing shade for cars while producing electricity. In some cases, installing a small PV array and battery to power an obstacle beacon may be less expensive than burying electrical wires.

Electric vehicles. Converting the fleet of airport vehicles from gas to electric demonstrates a commitment to the environment and local air quality. When possible, all electric-battery vehicles should be charged at night during off-peak hours—and it may be possible to coordinate this with the utility.

Resources

Organizations

Airport Cooperative Research Program of the National Academies

U.S. Environmental Protection Agency, Airport Strategies

Publications

Model for Improving Energy Use in U.S. Airports

Going Green: Minimizing Aviation's Environmental Footprint at Airports