Promoting Energy Efficiency In Airports

Shirley Jean Bergman, C.E.M, C.M.V.P

ABSTRACT

Traditional energy services providers have largely underserved airports. This is especially true for small to mid-size facilities and general aviation sites. Reasons for this include the complexity of airport ownership and management, strict FAA (Federal Aviation Administration) oversight, and the availability of funding paths for capital improvements. This article is intended to educate the energy services professional to the basic terminology specific to airport facilities and identify some typical opportunities for energy efficiency improvements.

TYPES OF AIRPORTS

Airports are classified according to their role and the number of enplanements. Enplanements are the number of passengers boarding the aircraft on departing flights at an airport. This is an important metric to airport managers. The airport roles are: commercial service—primary, more than 10,000 annual enplanements; commercial service—non-primary, more than 2,500 but fewer than 10,000 enplanements; reliever airports that reduce congestion at commercial service airports; and general aviation, which is everything else. General aviation, the largest group of airports in the U.S., supports business, personal and instructional flying, agricultural spraying, air ambulances, and charter aircraft services. All types of facilities are good candidates for energy efficiency services, with general aviation being the largest and most accessible.

AIRPORT OWNERSHIP AND MANAGEMENT

Airports are most commonly owned by a city or county, or by a special entity such as transportation authority. Other airports are

privately owned. Less common are military and Native American owned aviation facilities. Airport staff typically include an airport manager who oversees airport operations and maintenance. Facility maintenance staff vary greatly depending on the size of the facility. There may be a dedicated facility maintenance manager who reports to the airport manager, with maintenance support provided through the owner's central staff. Many airports have contracts with design engineers and HVAC contractors to assist with capital projects and maintenance issues.

AIRPORT CONFIGURATION AND STRUCTURES

The airport consists of the airside and the landside. The airside includes all areas accessible to aircraft: runways, taxiways, heliports and all areas of the terminal past the security checkpoint. Operations on the airside are highly regulated by the FAA. Everywhere else in the airport is the landside, which includes the terminal, parking lots and other airport buildings. There are opportunities for energy savings on both sides, but special expertise is required to work on the airside, which limits most energy service professionals to landside improvements.

The terminal building includes passenger areas with long hallways called concourses, and off the concourses are the gates to access aircraft. Many terminal and concourse designs incorporate ground transportation and retail areas and have large expanses of glass for aesthetic reasons. Typically, airport management offices also are located in the terminal. There are some FAA controlled areas, including the control tower and offices. Airlines lease their space in the terminal building from the owner to be used for ticketing, baggage inspection and handling.

Other buildings at the airport may include: the SRE (snow removal equipment) which may also house deicing equipment; and the ARFF (airport rescue and fire fighting) which may include conference rooms, offices, and landside security monitoring. Smaller airports may have a combined SRE/ARFF building. An FBO (fixed base operator) may operate hangars for instruction schools, aircraft maintenance, airfreight, and private or corporate aircraft. Many hangars have offices attached that are typically of metal or masonry construction.

AIRPORT FUNDING

There are five major sources of airport capital development funding: AIP (airport improvement program) including VALE (voluntary airport low emissions program), PFCs (passenger facility charges), state and local grants, tax exempt bonds, and general airport operating revenue. The AIP provides for the planning and development of public-use airports that are included in the national plan of integrated airport systems (NPIAS). The NPIAS details five-year estimates of required capital costs for each airport, and is provided to congress for federal budgeting. To compile these estimates, each airport conducts a five-year master plan detailing infrastructure needs, costs to bring the facility to current design standards and to add capacity if needed. Projects not included in the five-year master plan are not eligible to apply for AIP funding. The actual AIP funding is dispersed using a complex formula, consisting of entitlements based on the number of passengers boarding, plus discretionary funding made available by the FAA. For projects at small airports, the federal share is 95% and the airport needs to come up with a 5% match, typically 2.5% from the state, and 2.5% from the owner. For large airports the FAA cost share is 75% with a 25% match. The federal funding for the AIP is collected from taxes imposed on passenger tickets, jet fuel and general aviation gasoline taxes, a frequent flyer award tax, international arrival and departure tax, and tax on cargo waybills. AIP projects typically include construction or improvements related to aircraft operations—runways, taxiways, aprons, noise abatement, land purchase, and safety, emergency, or snow removal equipment.

VALE, a national program intended to reduce ground emissions at commercial airports that are located in designated air quality nonattainment and maintenance areas, is an important part of the AIP. The VALE program allows airports to use AIP to finance low emission vehicles, refueling and recharging stations, gate electrification, and other airport air quality improvements.

Another source of funding is PFC. Individual airports are allowed to impose PFCs of up to $4.50 per departure, with a maximum of four fees per round-trip ticket. PFCs are typically used for passenger terminal improvements and as a local match for AIP projects, and are the most accessible source of funding for energy assessments. State and local grants are commonly used for airport improvements. These grants, often announced by state congressional representatives, can

also include economic development grants. Larger airports can access tax-exempt bonds as well as general airport operating revenue. Smaller airports tend to be more dependent on AIP funding, because they don't have as large a passenger base to generate revenue from PFCs and can't access the bond market as easily as medium or large airports. Small airports also tend to have lower operating revenue. Large airports average 16% AIP funding for capital projects, while small and non-hub airports average 89-94% AIP grants.

Traditional sources of energy efficiency funding are utility funded demand-side management (DSM) programs and state energy agencies. Airport owners and managers are generally unaware of these funding sources and do not know how to access them. Energy services providers familiar with these programs can offer a valuable service to airports by assisting them with projects that are eligible for utility or state energy agency funding. PFCs can be used for grant matching if needed. ESCO contracts are often not permitted due to airport ownership/corporate structure.

STRATEGIES FOR REACHING AIRPORTS

One approach to promoting energy efficiency in airports is to contact the building owner directly with your proposal for an energy study. This is often a county executive or authority executive director. If an organization manages many facilities that could benefit from energy audits, consider offering a comprehensive energy management strategy. A proposal that includes energy benchmarking of all county-owned buildings—a package price for energy audits and energy management software that simplifies energy accounting and bill payment—may be very attractive to an executive director. In the case of smaller or privately owned facilities, offering a free benchmarking service and identifying a few potential energy efficiency measures as observed in a walk-through can be an effective "foot in the door." Enlisting the help of the airport manager and facility manager if possible will help the effort, but it may also be necessary to educate staff on the benefits of energy efficiency for their facility.

An effective way for energy service companies to access airports is to partner with an engineering firm that has a term contract with an airport. Rather than requiring the airport owner to contract with a new

organization, an engineering firm can develop a task order to present to the airport to perform the energy audit work. The engineering firm can also assist in the design and cost estimating, as required when energy conservation measures are identified, and assist in gaining access to restricted airport areas. Some engineering firms that work in aviation have their own energy services group, but many do not.

A typical approach to implementing an energy efficiency program is to first tackle the "low-hanging" fruit, track the post-improvement cost avoidance, and bank these "savings" to use for implementing the next phase of energy conservation measures. This is not the best approach to use in airports. Because airports work on a five-year planning cycle, it is advantageous to propose a complete package of measures, including everything from re-lamping to renewables and generation, to be included in the five-year master plan.

PREPARING FOR AN AIRPORT AUDIT

Pre-audit preparation is important whenever an ASHRAE Level 2 energy assessment is being performed, but for airport audits pre-planning is essential. It may take a significant amount of time and effort to gain permission to access all areas of the facility, especially the FAA-occupied areas such as the control tower. The systems and controls in these areas are often contractually required to be maintained within specific setpoints with limited deviation. Energy efficiency measures such as heating and cooling setbacks must be able to exclude the FAA occupied areas. Other tenants may have similar contractual agreements that must be reviewed with airport management prior to the on-site assessment. It is advantageous to interview tenants at the time of the audit. An understanding of system operations such as baggage handling, gate operations, and ticketing procedures may help identify ways to gain efficiencies through batch processing and equipment idling.

A set of current facility building plans will help to pre-inform the energy auditor and assist in compiling a list of potential energy conservation measures. Lamp and fixture types, existing HVAC equipment, and system configuration and envelope can be evaluated for energy efficiency potential. There are often no plans for hangars, and arrangements for invasive testing of envelope construction should be made with facility maintenance personnel.

Energy use benchmarking and utility bill analysis should always be completed prior to the Level 2 assessment. EPA Portfolio Manager software can be used to calculate weather-normalized, per-square-foot energy consumption and cost. Airport facilities fall under the "other" building type, which makes it difficult to compare with similar facilities, so the team could consider asking other consultants to share their airport Portfolio Manager data for comparison. Utility bill management is often a challenge for airport management. County and transportation authorities manage the utility bills for many government and transportation buildings, typically using convoluted spreadsheets that track hundreds of meters and attempt to accurately distribute these costs to multiple tenants. Owners may be overpaying by thousands of dollars annually through meter charges for electric services that are no longer in use, incorrect rates charged by utilities, and improper tenant meter assignments. Providing a utility management solution using appropriate software tools can automate much of the AP and tenant chargeback tasks, greatly reducing processing hours while increasing billing accuracy. For the energy consultant, wading through the facility bills can be a time consuming process and incomplete data is common. In some cases, tenants pay hangar costs directly, and the tenant may not be willing to share this with the owner.

AREAS OF OPPORTUNITY

Lighting is traditionally one of the first energy reduction opportunities evaluated. The low capital cost of equipment, installation costs, and potential installation by in-house staff reduces the cost of these improvements, while promising significant energy reduction. In airports, both airside and landside lighting improvements should be evaluated. Airside lighting design is highly complex, and requires specialized electrical engineering expertise. It encompasses runway and taxiway lighting, as well as a variety of signage that provides traffic control and other information to pilots. The FAA has issued a variety of advisory circular (AC) and engineering brief (EB) documents to direct electrical engineers and airport lighting designers. The expertise required to design for the airfield is beyond the capability of most energy service providers, but is mentioned as a source of significant energy use reduction through the replacement of standard incandescent signage with LED. Although

the first cost of LED fixtures is greater, the much longer life of LEDs results in greatly reduced maintenance costs in addition to the energy savings. The FAA has spent significant effort in evaluating the safety of LED signage, and has a process in place to certify that new products meet strict performance requirements. It is anticipated that LED airport installations will provide important data on actual fixture life that will impact the adoption of LED technology in other aspects of the built environment. The energy services professional can work with the airport's contracted engineer to quantify potential airside energy reduction.

Landside lighting improvements, primarily in the terminal, can be evaluated similarly to commercial buildings. A common issue with typical pendant-mounted linear fixtures is dirt accumulation on the top surface, which reduces fixture efficacy. Typical perforated cover fixtures have similar light reduction issues. Group re-lamping ensures that lamps are changed before lumen degradation occurs. Implementing a maintenance program can have a significant positive impact on the terminal light quality, and allow the reduction of lamp wattage or numbers while maintaining required light levels for passenger comfort and safety. Specialty lighting such as lighted billboards and advertising signs, as well as accent lighting around display cases and airline ticketing counters that remain on at all times can often be reduced in wattage. Consider installing or re-commissioning an existing centralized lighting control system, using photocells to maximize daylighting in spaces with large window areas. Because airport terminals tend to incorporate large window areas, consider the benefits of installing daylight-sensor controlled automated window shades. These shading systems can significantly reduce cooling load from solar gains, while reducing occupant glare complaints.

Outside the terminal building, there are opportunities in hangars and other high-bay buildings. Lighting is commonly metal halide. Light levels may be insufficient for aircraft maintenance tasks, resulting in personnel's keeping the hangar doors open in all weather. High output T5 fixtures are ideal for this application, providing excellent light quality for a minimal investment. Insufficient insulation is often an issue, but the cost effectiveness of this measure depends on the amount of thermal conditioning of the hangar. Air sealing is often very effective, and hangar door seals should be carefully checked for gaps. Professional door seal replacement yields far superior results to installation by in-house staff. In buildings where there is office space connected to the

hangar space, the adjacent walls should be well-insulated and sealed, essentially assuming that the hangar space is unconditioned or there is a significant temperature difference between the offices and the hangar.

It has been suggested that airports' facilities are ideally suited for the adoption of renewable technologies due to their large, flat roof areas and open land space within airport boundaries. The FAA has encouraged exploration of innovative energy technologies through the funding of various pilot projects. When considering measures to evaluate, energy services providers should include screening studies of the costs and potential savings associated with implementing solar, wind, biomass, cogeneration plants, fuel cells and other emerging technologies. Airport management, with potential FAA backing, may be more open to implementing these projects than commercial building owners.

CONCLUSION

There are opportunities for energy efficiency in many airports. Energy services professionals can work with airport owners, management, and facility maintenance staff as well as contracted engineers in identifying and implementing these measures. Because of the five-year planning cycle for capital projects, it may take time for airport owners to procure funding for energy audits and to implement measures. When working with airports, pre-audit planning is crucial to obtain access to restricted areas and perform benchmarking and utility analysis. Present the owner with the full range of energy efficiency measures, from the "low hanging fruit" to cutting edge renewable technologies.

References for Additional Information

Airport Cooperative Research Program. ACRP SYNTHESIS 28 Investigating Safety Impacts of Energy Technologies on Airports and Aviation. Washington, D.C., 2011.

Airport Cooperative Research Program. ACRP SYNTHESIS 21 Airport Energy Efficiency and Cost Reduction. Washington, D.C., 2010.

Airport Cooperative Research Program. ACRP SYNTHESIS 35 Issues With Use of Airfield LED Light Fixtures. Washington, D.C., 2012.

ASHRAE. Publications: Procedures for Commercial Building Energy Audits. http://www.ashrae.org/resources--publications/bookstore/procedures-for-commercial-building-energy-audits (accessed September 2012).

Federal Aviation Administration. 2011-2015 NPIAS Report.http://www.faa.gov/airports/planning_capacity/npias/reports/(accessed September 2012).

—. Airport Improvement Program (AIP). http://www.faa.gov/airports/aip/(accessed September 2012).

Mouawad, Jad. Airports Focus on the Ground. June 15, 2012. http://www.nytimes.com/2012/06/15/business/building-boom-takes-hold-at-us-airports.html?pagewanted=all (accessed September 2012).

ABOUT THE AUTHOR

Shirley Jean Bergman, C.E.M, C.M.V.P, is a project manager at EnergyCAP, Inc., in State College, PA. Her experience in energy efficiency includes energy auditing, utility bill analysis, benchmarking, energy assessments, and post-construction verification analysis for thousands of square feet of commercial and multifamily building space. She is proficient in using building energy modeling and energy analysis software tools, including EPA Portfolio Manager, TREAT, and eQUEST. Additional experience includes working with NYSERDA residential and commercial programs and the PHFA preservation through smart rehab programs. Ms. Bergman is a BPI certified multifamily building analyst. She received a BS in mechanical engineering from Rensselaer Polytechnic Institute (Troy, NY) and an MBA from the Rochester Institute of Technology (Rochester, NY). Ms. Bergman can be contacted at sj.bergman@energycap.com or by phone (877) 327-3702 x49.