Case study

TRI-CITIES REGIONAL AIRPORT

Blountville, TN

Northeast Tennessee regional airport discovers significant energy savings with an Energy Audit.

TRI is a regional airport, serving the Tri Cities area of Northeast Tennessee (Bristol, Kingsport, and Johnson City) including Southwest Virginia. TRI's property covers approximately 1,300 acres, and provides commercial passenger service on: Delta, American Airlines and Allegiant Air.

Tri Cities Airport was originally constructed around 1937, with major remodeling of the terminal/gate area around 1968 and 2000. The airport covers approximately 75,000 square feet of floor space, including: the main terminal level, lower level including concourse, lower and main level restaurants, and the executive and administrative offices.

Tri Cities Airport Authority decided in the fall of 2014 to have a comprehensive energy audit performed at the facility. The goal of the energy audit was to identify energy reduction costs associated with electrical and natural gas consumption at the airport, in addition to water cost savings associated with the cooling towers.

The energy audit included the following areas and building systems:

- Main Terminal Building
- Executive and administrative offices
- All interior and exterior lighting systems
- Electrical distribution transformers
- All HVAC equipment and systems
- Cooling tower water consumption
- Builidng Automation System (BAS)
- Building Envelope

TECHNICAL APPROACH OF THE ENERGY AUDIT

Prior to starting field visits, the Audit Team collected historical energy data for TRI. Twenty four months of utility data (electricity and natural gas) was compiled and analyzed to establish an energy baseline. The most recent 12 months of data was then used to establish the energy baseline.

Detailed information was then collected on; mechanical systems, lighting, escalators, as well as occupancy, building use patterns, maintenance procedures and equipment operating schedules. Areas of the airport were identified that could be scheduled to an unoccupied mode through the Building Automation System (BAS). The building management staff provided valuable information regarding equipment maintenance. Ultimately, the implementation cost for each recommendation was estimated and energy savings and payback calculated.

The general technical approach used to perform the energy audit at TRI is described by ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers) *Procedures for Commercial Building Energy Assessments, 2011*, Second Edition.

In addition to the procedures described by ASHRAE for a Level II energy audit, actual operational kW measurements were made in the field for all pump and fan motors 5 hp and larger. Total fan pressures were measured for AHU-1, 2 and 4 in the field, along with other operating parameters such as fan RPM. This information was used to estimate the performance of equipment operation, and identify potential ECMs. A survey was performed on the lighting system, along with a detailed analysis of the Building Automation System (BAS), HVAC system and building envelope.

AVAILABLE INCENTIVES, GRANTS AND LOW-INTEREST FINANCING

Research was performed to identify available Incentives, Rebates, Grants and Low-Interest Financing that would help fund the implementation of recommended Energy Conservation Measures (ECM). Research identified the following information:

- Incentives are available from TVA's Energy Right Solutions Program, $0.10 per kWh reduction
- Clean Tennessee Energy Grant Program for energy conservation projects, up to $250,000 grants
- Tennessee Energy Efficiency Loan Program (EELP) provides 2% interest energy loans for up to five years, and 5% interest energy loans for up to ten years

KEY AUDIT FINDINGS

- The annual energy cost at TRI for electricity and natural gas was $323,146 (Baseline 12 month period of Nov 2013 through Oct 2014)
- (18)Energy Conservation Measures (ECM) were identified
- (11) Low cost (< forty-eight month simple payback) ECM were identified
- Estimated annual energy savings for all low cost ECMs totals $53,397; 16.5% reduction in energy costs
- Estimated annual energy savings for all ECMs totals $143,553; 44% reduction in energy costs
- Fifteen year cumulative cash flow for all ECMs (including potential incentives) exceeds $1,700,000
- Fifteen year cumulative cash flow for all ECMs (excluding potential incentives) exceeds $1,500,000
- Potential incentives (for all ECMs) from TVA's Energy Right Solutions Program is: $149,779

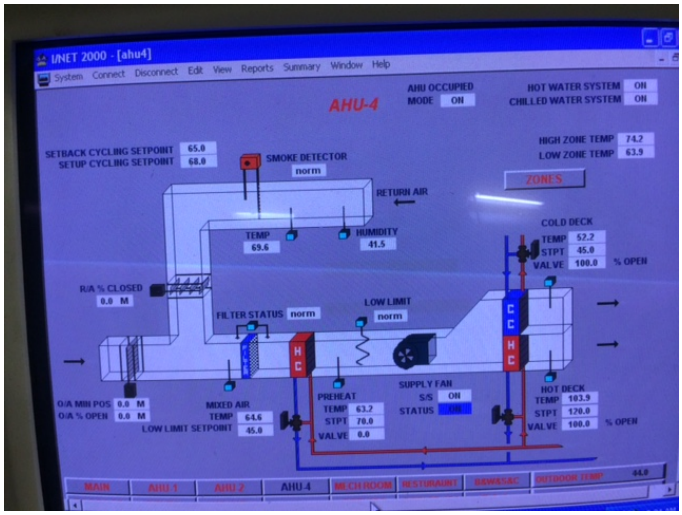
SUMMARY OF RECOMMENDED ENERGY CONSERVATION MEASURES (ECM)

The table below summarizes the ECM recommendations that were developed from the energy audit at Tri Cities Regional Airport. The final Energy Audit Report includes the following additional information:

- Estimated cost to implement each measure
- Estimated energy savings for each measure
- Estimated utility incentive for each measure
- Net Present Value (NPV) for each measure
- Internal Rate of Return (IRR) over the estimated life for each measure
- Simple Pay Back (SPB) for each measure

ECM-1	Schedule AHU-1,2 & 4 to a temperature setback mode during unoccupied hours, and implement optimal start/stop control strategy.
ECM-2	Program a discharge air temperature reset schedule on AHU-1,2 & 4.
ECM-3	Reduce airflow for AHU-1, zone-1 serving the Mezzanine Administrative offices.
ECM-4	Check outside air dampers on AHU-1, 2 & 4 for proper operation from controls to actuator, adjust linkage as necessary to verify that the dampers stroke freely and close completely. Install damper blade seals on outside air dampers for AHU-1, 2 & 4.
ECM-5	Perform a combustion efficeincy test and tune up of the boiler.
ECM-6	Install economizer kit on 20 ton Trane RTU serving the Baggage Claim area.
ECM-7	Schedule a 1.5 ton split system that serves a small office located in a basement storage area that is unoccupied.
ECM-8	Interlock the primary chilled and condenser water pumps with the appropriate chiller.
ECM-9	Reset condenser water supply temperature to optimize chiller operation.
ECM-10	Install Aircosaver Controller on Baggage Claim RTUs.
ECM-11	Control lighting in the first floor (ground level) equipment room area.
ECM-12	Right size the secondary chilled water pump for the load, and convert the secondary pumping loop to variable flow.
ECM-13	Convert AHU-1, 2 & 4 from constant volume Multi-zone to Variable Air Volume (VAV).
ECM-14	Install waterside economizer (plate & frame heatexchanger) Free Cooling.
ECM-15	Upgrade exterior lighting to LED.
ECM-16	Upgrade interior lighting to LED.
ECM-17	Installation of window film treatment in TSA Checkpoint and Lower Concourse.
ECM-18	Install chemical-free water treatment on condenser water system side of chillers.

The Building Automation System (BAS) at Tri Cities Regional Airport was used extensively to identify opportunities that would optimize the current control sequences. This graphic screen indicates an opportuity to reset the cold-deck and hot-deck leaving air temperature set-points on AHU-4.



The existing Building Automation System (BAS) at Tri Cities Regional Airport is an older system and has limited local technical support. Many of the ECMs listed above rely heavily on a robust BAS that has the ability to perform programming changes as required to effectively control and manage energy use at the airport. Upgrading the BAS at Tri Cities Regional Airport was determined to be a high priority. The investment of a new BAS will be paid for through the energy savings that the control related ECMs generate.

FINANCIAL CASH FLOW MODELS

A presentation was made by the energy audit team to Tri Cities Airport Authority in August of 2015. The financial cash flow models of the report summarize the engineering calculations, and converts kWh, therms and british thermal units into what really matters...dollars and cents.

FINANCIAL CASH FLOW MODEL WITH INCENTIVES

Project Input		
Initial Investment	$	1,101,698.00
Total Incentives(Rebates, tax credits, etc.)	$	149,779.00
First year energy savings	$	143,553.00
Assumed energy cost inflation		3%
Time Period for analysis (0 to 30 years)		15
Customer Discount Rate		4%

Project Financials		
Simple Payback Period w/o energy inflation		6.6 years
Simple Payback Period with energy inflation		6 years
Discounted CF Payback Period		6.9 years
NPV	$	984,840.61
ROI		15%

The energy audit at TRI was a great success. The final report included existing energy efficiency usage, detailed recommendations for improvements, estimated energy savings, project cost estimates, possible available utility incentives and funding options. Scott Gordon is extremely knowledgeable and was a pleasure to work with. The airport could not have gotten a better qualified person to perform the energy audit.

David W. Jones
Director of Operations
Tri-Cities Regional Airport

FINANCIAL CASH FLOW MODEL WITH INCENTIVES & GRANTS

Project Input		
Initial Investment	$	1,101,698.00
Total Incentives(Rebates, tax credits, etc.)	$	399,779.00
First year energy savings	$	143,553.00
Assumed energy cost inflation		3%
Time Period for analysis (0 to 30 years)		15
Customer Discount Rate		4%

Project Financials		
Simple Payback Period w/o energy inflation		4.9 years
Simple Payback Period with energy inflation		4.5 years
Discounted CF Payback Period		5 years
NPV	$	1,234,840.61
ROI		22%

Tri Cities Regional Airport leadership and the energy audit team evaluated the final energy audit report and recommended ECMs. A bundle of measures were identified, and are planning to be funded next year. An accurate energy audit is the roadmap that leads the way for an organization to make sound financial business decisions.

Scott Gordon, President of EBCx Services performed the Energy Audit at Tri Cities Regional Airport. At the time, Scott Gordon was employed by Atkins North America.