Appendix B

ASHRAE LEVEL II ENERGY AUDIT REPORT

CHANDLER MUNICIPAL AIRPORT CHD

CHANDLER arizona

Chandler Municipal Airport

Chandler, Arizona

ASHRAE Level II Energy Audit Report

Provided by

Quest energy group

June 2020

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Executive Summary

As part of the updated Master Plan for Chandler Municipal Airport, Quest Energy Group performed a comprehensive energy audit of selected buildings at the airport to assist in identifying and prioritizing potential energy conservation measures (ECMs).

This audit meets or exceeds the Level II requirements established by the American Society of Heating, Refrigeration, and Air-Conditioning Engineers (ASHRAE), which requires a historical analysis of all building utility consumption, efficiency improvement recommendations, and a detailed financial analysis recommendation. Above and beyond the requirements for an ASHRAE Level II Audit, Quest Energy Group developed a full scale energy simulation model using eQUEST software with International Performance Measurement and Verification Protocol (IPMVP) compliant baseline calibration in order to validate energy savings estimates.

Key Audit Findings

The Chandler Municipal Airport spent about $59,000 on electricity from January 2019 to December 2019. The results of the audit yielded the following findings listed below and are summarized in the following table and figure. Additionally, individual energy conservation opportunities are detailed within each individual building/area report following this Executive Summary.

- Incorporating all ECMs over a ten year timeline could reduce total energy costs by almost 38%. Incorporating a PV system to offset all energy usage onsite, would result in a payback of 13 years and make the Chandler Municipal Airport a Net-Zero Energy facility.
- Upgrading to LED fixtures and proper lighting controls results in an overall energy reduction of almost 6% with an overall simple payback close to 5.3 years.
- Small control upgrades to HVAC equipment in the Administration Building and ATCT would provide quick paybacks and reduce energy costs by 2.5%.
- Upgrading to a Variable Refrigerant Flow (VRF) system in the Administration building should be considered at the end of life of the current equipment. A VRF system could reduce total airport energy costs by up to 5%.
- LED upgrades to the airport landing lighting fixtures requires a significantly high first cost and results in an unfavorable economic return.
- Installing a solar PV system for individual buildings results in an average payback of about 16 years. This is mainly due to the Salt River Project (SRP) utility buyback rate of only $0.02-$0.03 per kWh instead of the full retail rate of $0.09 kWh (on average).

ECM	Measure Description	Estimated Initial Costs	Utility Cost Savings	Potential SRP Incentives	Simple Payback
ECM1	LED Lighting Upgrades	$13,400	$2,753	$2,280	4.0
ECM2	High Performance Lighting Controls	$7,250	$430	$1,450	13.5
ECM3	LED Exterior Lighting Upgrades	$51,040	$2,475	$1,500	20.0
ECM4	HVAC Controls Upgrades	$2,150	$1,351	$600	1.1
ECM5	HVAC Equipment Upgrades	$46,500	$2,953	$2,250	15.0
ECM6	Landing Lights LED Replacement	$110,000	$4,420	$4,000	24.0
ECM7	Instantaneous Hot Water Heaters	$2,425	$128	$99	18.2
ECM8	Receptacle Load Upgrades	$500	$336	$177	1.0
ECM9	Individual Solar PV Installations	$126,540	$7,873	$0	16.1

Figure 1 – Annual Financial Results Summary Table for Aggregated Measures (All Meters)

ECM	Measure Description	Electricity Usage (kWh/year)	Electricity Cost ($/year)	Percent Savings (%)
B0	Baseline Utility Usage	534,943	$58,928	0.0%
ECM1	LED Lighting Upgrades	513,653	$56,175	4.7%
ECM2	High Performance Lighting Controls	509,672	$55,744	5.4%
ECM3	LED Exterior Lighting Upgrades	482,814	$53,269	9.6%
ECM4	HVAC Controls Upgrades	470,672	$51,919	11.9%
ECM5	HVAC Equipment Upgrades	446,062	$48,965	16.9%
ECM6	Landing Lights LED Replacement	405,142	$44,545	24.4%
ECM7	Instantaneous Hot Water Heaters	403,999	$44,417	24.6%
ECM8	Receptacle Load Upgrades	401,201	$44,081	25.2%
ECM9	Individual Solar PV Installations	313,751	$36,208	38.6%

Figure 2 – Annual Results Breakdown for Aggregated Measures (All Meters)

Solar PV Discussion

The project team has indicated the area highlighted the image below as a potential location for a solar PV system. Based on the site visit, the following items need to be confirmed to determine whether the site could house a solar PV system:

- Federal Aviation Administration (FAA) regulations for glare and other flight impact issues.
- No underground piping or sewer systems that would require access
- Proper spacing between solar PV system and existing structures/roads/construction.

Figure 3: Potential Solar PV Location

Additionally, two major financial considerations need to be considered for the installation of a solar PV system:

1. In similar circumstances, other businesses have elected to form a power-purchase agreement (PPA) with a third-party developer. This would theoretically enable the airport to lease the land to a developer (solar services provider), who would build, own, and maintain the solar equipment. The solar services provider could then sell the produced energy back to the airport at a set rate. The

advantage of this approach is that the solar services provider could take advantage of any tax credits not available to City of Chandler, thus lowering the net cost of the project, while potentially avoiding or mitigating some of the barriers mentioned below.
    a. Taxpayer/ public approval of funding
    b. Utility connectivity issues and/or production arrangements
    c. Other airport operational constraints
2. SRP only offers about a $0.02-$0.03 per kWh credit for excess generation on an hourly basis. This means that if the PV system generates more energy than the property/building consumes, the project will only be credited $0.02-$0.03 per kWh instead of the retail rate of about $0.09 per kWh. Therefore, it is important to consider the installation of batteries for this project to store excess energy generation so that it can be used on site. SRP currently does not offer battery storage incentives to commercial customers, only to residential customers.

There are many potential options for installing solar PV at the Chandler Municipal airport. The following PV systems were evaluated with and without battery storage assuming that the airport enters into a power purchase agreement (PPA) with a third party developer and will not own their own system.

1. PV System to Offset All Airport Energy Usage
2. PV System to Offset Administration Building Energy Usage
3. PV System to Offset ATCT Energy Usage

The following table shows the financial results of the solar PV analysis including the following key metrics:

1. Internal Rate of Return - calculates the discount rate that results in the net present value of all cash flows for the project to equal zero over a 20 year period. This value can be used to compare investments and their profitability.
2. Straight Line Payback – the time required to earn back the amount invested in the project.
3. 20-year Cash Flow – the net amount of cash generated by the project over the 20-year period.

It should be noted that an hourly/daily analysis is needed to determine more specifically the first cost for battery storage and total excess generation from the PV system. Currently, conservative factors are being used, and further investigation into hourly loads could reduce the first cost and payback for the systems.

PV System Options without Battery Storage					
System Type	PV System Size	First Cost	Straight Line Payback (years)	Internal Rate of Return (IRR)	20-year Cash Flow
Offset all Airport Energy Usage	325 kW	$450,875	13.33	6.5%	$262,885
Offset Admin. Bldg Energy Usage	18 kW	$33,300	18.01	1.2%	$4,570
Offset ATCT Energy Usage	35 kW	$51,800	14.95	3.3%	$21,836

PV System Options with Battery Storage					
System Type	PV System Size	First Cost	Straight Line Payback (years)	Internal Rate of Return (IRR)	20-year Cash Flow
Offset all Airport Energy Usage	325 kW	$605,875	15.06	8.0%	$350,760
Offset Admin. Bldg Energy Usage	18 kW	$44,400	18.17	1.4%	$7,429
Offset ATCT Energy Usage	35 kW	$82,140	19.15	0.7%	$6,805

Methodology

The primary focus of the site audit performed was to survey the existing envelope, lighting, domestic hot water (DHW) and HVAC equipment in the buildings and provide a summary of condition, age and life of the units, and overall performance level. This audit is composed of a site visit conducted by John Daniels on May 19th, 2020 as well as conversations with site personnel.

Based on the information collected from the site audit, a detailed energy simulation model was developed using eQUEST (DOE2.2) software to analyze the baseline energy usage for the Administration Building at the airport. The collected information was also used to develop engineering grade spreadsheets of the remaining buildings and energy consuming equipment in scope: Air Traffic Control Tower, Maintenance Building, Hangars, Exterior Lighting, and Landing Lights. The methodology and assumptions in the energy modeling process are detailed below. A graphical depiction of the model is shown in each building report.

- A detailed energy model of the Administration Building was constructed based on drawings provided by airport personnel and field observations during the audit. Site inspections included verifying wall and roof constructions, glass types, lighting equipment, HVAC, DHW, and other major energy using equipment.
- Equipment operation schedules were based on operational, occupancy, and usage data and supplemented through interviews with the operations and maintenance staff and field observations.
- Lighting fixtures and schedules were input into the models based on field data and electrical drawings.
- HVAC and DHW equipment were added to the model according to drawings and field observations, and each zone was assigned to the appropriate HVAC system. Equipment efficiencies were based on nameplate data and/or mechanical plans. Operation schedules and controls were input according to maintenance staff interviews.

Project Information

Project Name & Location

Chandler Municipal Airport
Chandler, AZ 85286

Airport Contact

David Sorensen
Operations Supervisor
Chandler, AZ 85286
Phone: (480) 782-3543
Email: David.Sorensen@chandleraz.gov

Chris Andres
Airport Administrator
Chandler, AZ 85286
Phone: (480) 782-3543
Email: Chris.Andres@chandleraz.gov

Energy Auditor and Modeling Consultant

Quest Energy Group, LLC
Michael Ising
1620 W. Fountainhead Pkwy, Suite 303
Tempe, AZ 85282
Phone: 480-467-2480
Email: m.ising@questenergy.com

Quest Energy Group, LLC
John Daniels
1620 W. Fountainhead Pkwy, Suite 303
Tempe, AZ 85282
Phone: 480-467-2480
Email: john@questenergy.com

Baseline Utility Summary

Electricity bills from January 2019 to December 2019 were collected and analyzed for all utility meters in the scope. A summary of all utility meter annual electricity cost is provided below.

As shown below, the municipal airport spends about **$58,969 per year** on electricity at a unit cost of about **$0.11 per kWh.** The areas that account for the majority of electricity usage are the landing lights Air Traffic Control Tower (ATCT), and the Administration Building.

Utility Meter	Location	Electricity Usage	Unit Cost	Total Cost	% of Total
		kWh/year	$/kWh	$/year	Usage
117-280-004	Runway Lights	264,960	$0.11	$ 28,622	49.5%
858-480-004	ATCT	72,073	$0.09	$ 6,664	13.5%
036-390-004	Administration Bldg	69,560	$0.119	$ 8,280	13.0%
223-360-001	Exterior Lighting	45,200	$0.10	$ 4,632	8.4%
956-201-006	Unknown	35,004	$0.11	$ 3,749	6.5%
814-680-005	T-Hangars	27,596	$0.11	$ 2,926	5.2%
013-722-007	Maintenance Bldg	7,030	$0.15	$ 1,052	1.3%
402-980-004	Fuel Building	5,174	$0.17	$ 900	1.0%
863-754-006	Abandoned Bldg	4,000	$0.24	$ 960	0.7%
148-375-004	Unknown	2,969	$0.23	$ 671	0.6%
085-304-007	Unknown	1,377	$0.37	$ 513	0.3%
	Total	**534,943**	**$0.11**	$ 58,969	

Figure 4: Electricity Usage and Cost by Utility Meter

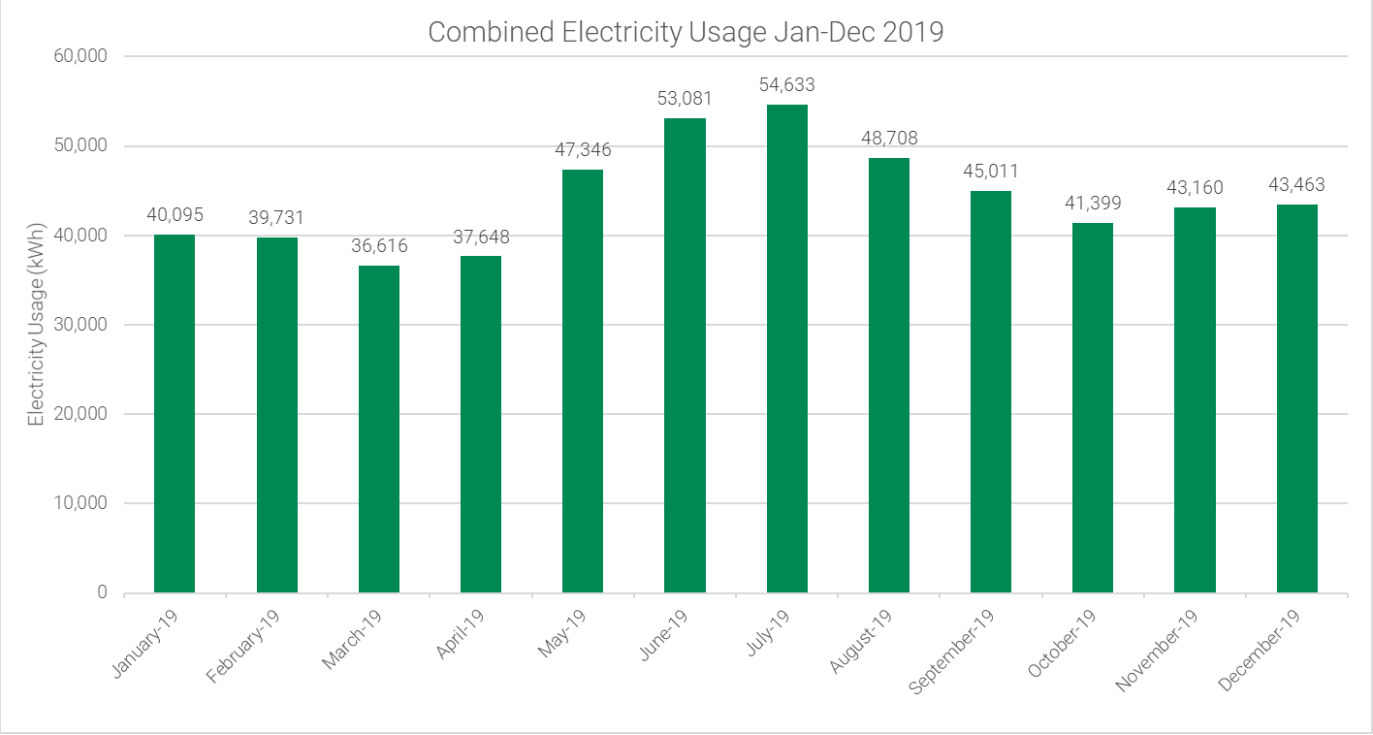


Figure 5 – Total Electricity Usage from Jan to Dec 2019

Baseline Model Calibration

Calibration Process

After a detailed baseline model is constructed for each utility meter, it is important to adjust and validate the accuracy of the model results by comparing it with the real-life building behavior. This process, known as calibration, is outlined in the paragraph and figure below.

Calibration of an energy model is initiated by running the model simulation using the actual weather data from the site over a one-year performance period. The simulated energy and power outputs are then compared to the historical utility data for the same period, and the model inputs are refined to make the simulated behavior match the actual data as closely as possible. Model input adjustments are typically made based on sub-metered data, trend data, and operational details provided by the building staff. This iterative process is repeated until the accuracy of the model is within reasonable tolerances (+/- 5% MBE as recommended by IPMVP).

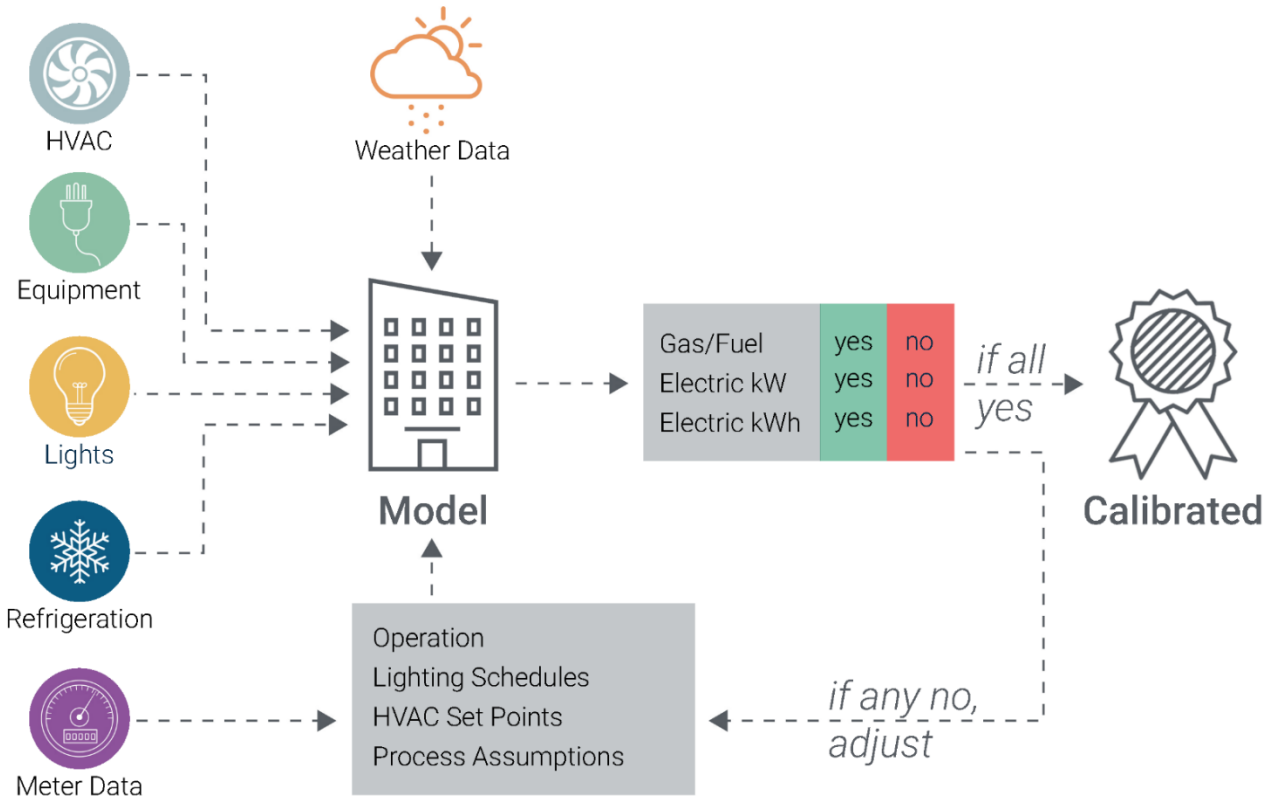
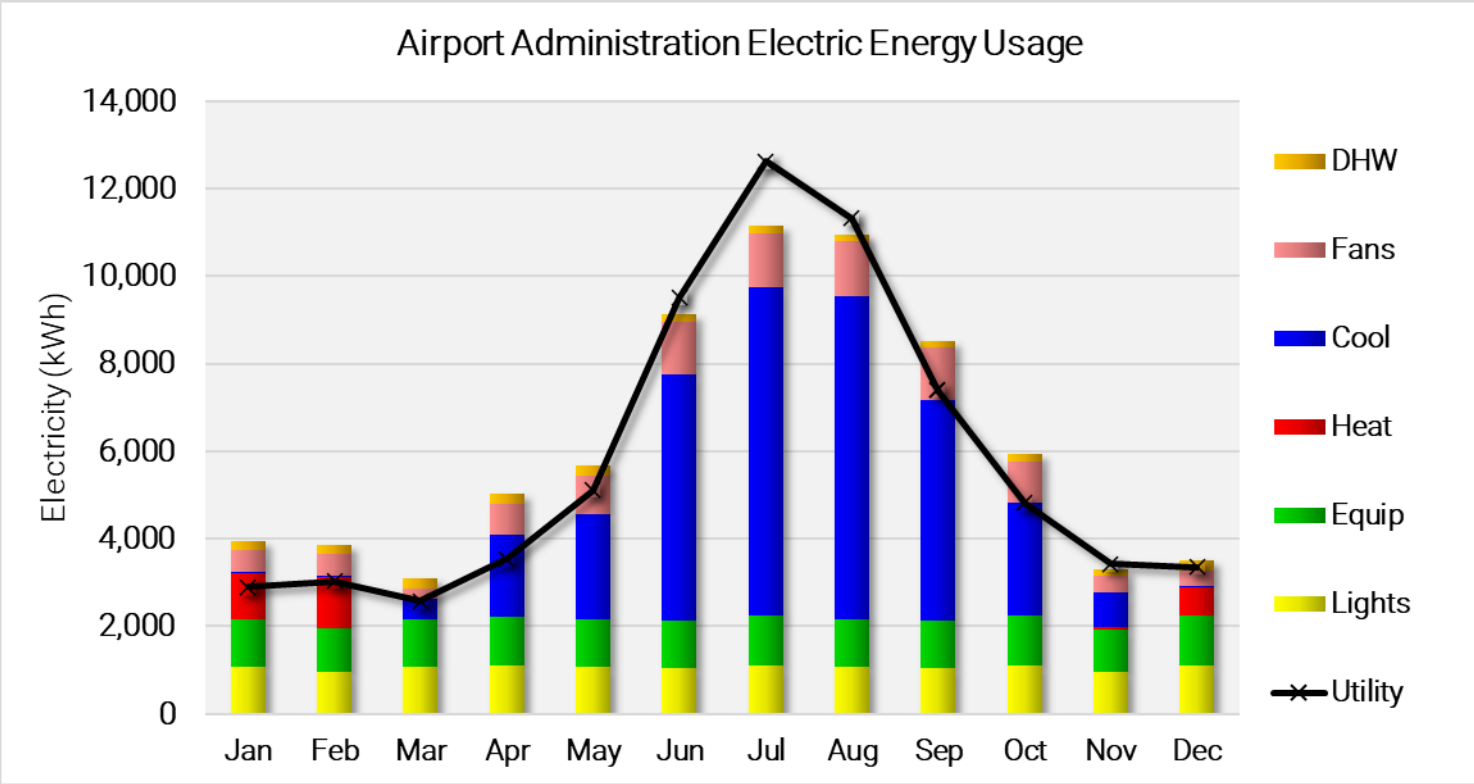


Figure 6 – Calibration Process Flowchart

Baseline Energy Use Analysis & Calibration

The building modeled and calibrated through eQUEST was the Administration Building. All other buildings/utility metered were calibrated utilizing engineering grade excel sheets. The figure below illustrates the simulated eQUEST electrical energy usage predicted throughout the one-year period (Jan 2019 – Dec 2019) as compared to the actual historical utility data. The black line represents actual building/utility data provided by each electrical meter. Most models were calibrated to within IPMVP guidelines for calibration (MBE <±5%, Cv(RSME) <15%).



Analysis Reports

Administration Building

Air Traffic Control Tower

Maintenance Building

T-Hangars A to I

Exterior and Canopy Lights

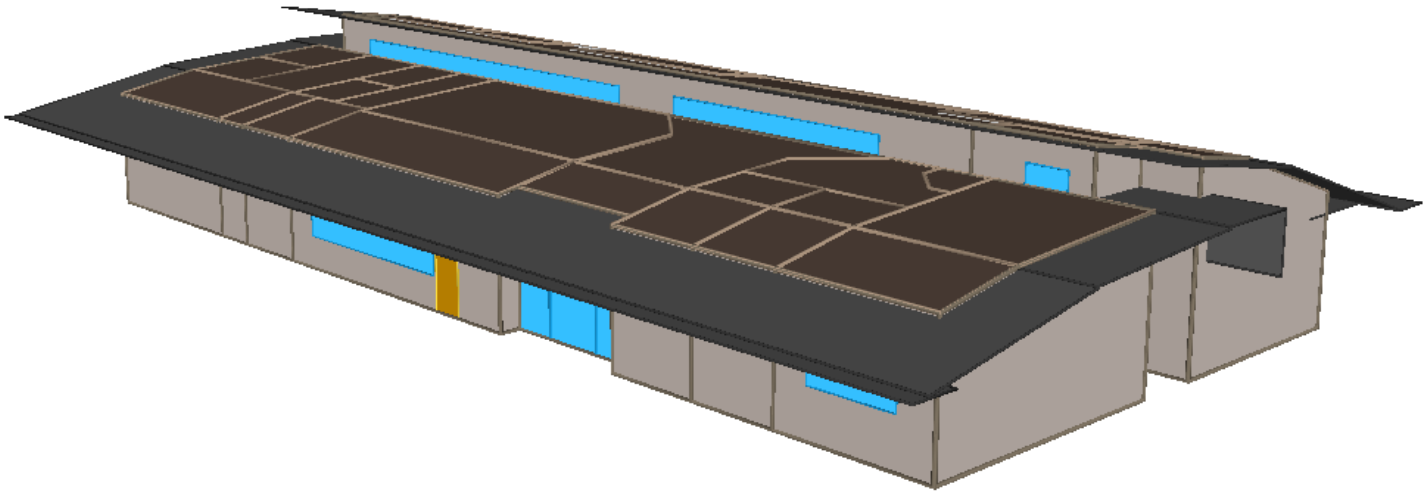
Runway and Taxiway Lights

Solar PV Analysis

Airport Administration Building

Building Description

The airport administration building is comprised of private office, meeting/conference, lobby, and amenity areas. The total square footage of the building is about 5,000 SF. A 3D eQUEST rendering of the building is shown in the figure below.



Operational Schedules

The airport administration building is expected to be occupied from 7AM to 5PM Monday through Friday. Based on conversation with facility personnel, when the airport gets busier, the occupancy schedule changes to 6AM to 9PM Monday through Friday.

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

AA1: Replace Linear and Compact Fluorescent Lamps with LEDs

Existing Condition

The airport administration building utilizes a mixture of 2-lamp, 4ft. T8 fluorescent fixtures and recessed incandescent 60W lamps throughout. Each fixture has the opportunity to be upgraded to LED lamps/fixtures that draw significantly less power while also providing similar/better lighting levels.

Figure 1: Fluorescent Lighting Fixtures in the Hallways

Recommended Action

Replace all fluorescent lamps with LED lamps. Use a 12W GE LED12ET8/g/4/840 linear LED lamp or similar to replace linear fluorescent lamps. Replace all 60W incandescent lamps with LED 9W lamp. It is important that the LED lamp is checked for ballast compatibility. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

Figure 2: Dark Walls and Ceiling in Pilot's Lounge

LED lamps output similar lighting levels as CFLs at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance and replacement costs. As a bonus, LED lamps contain no mercury, helping to streamline its recycling process.

It is also recommended that maintenance staff consider painting the walls to a brighter color (such as white) and replacing the old ceiling tiles with new, whiter ceiling tiles. Brighter colors have a higher reflectivity than darker colors meaning the brighter surfaces would reflect more light to the room. Less output from the lighting fixtures would be needed to provide the same lighting levels in the space. Thus, fewer fixtures would need to be installed, and it would require less energy to illuminate the space.

Energy and Cost Savings

Replacing all fluorescent and incandescent lamps with LED lamps would result in electrical savings of about 7,292 kWh per year. Total cost savings would be about $875 per year.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to $600 in incentive rebates.

It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended lamps, the implementation cost would be about $3,000, and the simple payback would be 2.7 years, including the incentive.

AA2: Install High Performance Lighting Controls

Existing Condition

Currently, only the bathrooms and conference rooms in the administration building utility occupancy sensors. Based on conversation with airport personnel and observations during the site visit, the building has highly variable occupancy and it was noticed that lights were left on in spaces that were unoccupied.

Figure 3: Occupancy Sensor in the Restroom

Additionally, spaces such as the conference rooms and offices utilize significant amounts of natural light. There is opportunity to utilize daylight harvesting controls to dim lighting fixtures when sufficient natural light enters the space.

Recommended Action

It is recommended to expand the installation of occupancy sensors to the whole building and install daylighting controls in perimeter spaces with large quantity of windows. The occupancy sensors should turn off lighting fixtures within 20 minutes of people leaving the room. Daylighting controls should automatically dim perimeter lighting fixtures near windows to maintain a constant lighting level of 30 fc (typical for office spaces).

There are numerous lighting control companies that offer occupancy and daylighting control solutions such as Lutron, Lithonia, Leviton, etc. This installation is best implemented at the same time as upgrading lighting fixtures to LED fixtures since many lighting companies will offer LED upgrades and lighting control upgrades as a packaged deal.

Energy and Cost Savings

Installing high performance lighting controls including occupancy and daylighting sensors would result in electrical savings of about 1,682 kWh per year. Total cost savings would be about $202 per year.

SRP offers a lighting rebate of $0.40 per watt controlled. It is therefore estimated that this recommendation could receive up to $750 in incentive rebates.

Based on RSMeans and manufacturing data, each occupancy and daylight sensor would cost about $250 to purchase and install. Utilizing this information, the implementation cost would be about $3,750, and the simple payback would be over 10 years, including the incentive. It is thus recommended that this ECM be coupled with ECM AA1. Combining the two ECMs, the simple payback would be closer to 5.0 years.

AA3: Replace Indirect Lighting and Optimize Natural Light in Corridors and Lobby

Existing Condition

The corridors and main lobby of the administration building have significant amounts of linear fluorescent fixtures that provide indirect lighting to illuminate the higher walls and ceiling. Additionally, there are windows located near the ceiling, as shown on the right, that provide natural lighting to illuminate the ceiling and upper walls. Small amounts of the indirect lighting actually reach the work plane making it an inefficient form of providing light to the space. Replacing the indirect lighting with direct lighting would provide a more efficient operation and the natural lighting would still illuminate the ceiling and high walls.

Figure 4: Indirect Lighting and Natural Lighting in the Lobby

Recommended Action

It is recommended to remove the indirect linear fluorescent lamps with direct linear LED fixtures. This can be accomplished by simply repositioning the lighting covers to direct the light towards the ground instead of the ceiling. Alternatively, linear fixtures could be installed and suspended from the ceiling (below the level of the windows) to direct light to the work plane. Either scenario would minimize the lighting output and energy usage to illuminate the space while also maintaining an illuminated ceiling.

This recommendation should be considered with ECM AA1 and AA2. Installing daylighting controls would maximize the usage of natural lighting from the windows and minimize the energy output of the lighting fixtures.

Energy and Cost Savings

Removing indirect lighting and optimizing natural lighting would would result in electrical savings of about 375 kWh per year. Total cost savings would be about $45 per year.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to $30 in incentive rebates.

It is assumed that this recommendation would be included in ECM AA1 LED upgrades. Based on RSMeans data, installing new ceiling hung fixtures would cost about $140 each. Each fixture would take about one hour to install at a labor rate of $125 per hour. Utilizing this information and cost data, the implementation cost would be about $800, and the simple payback would be over 10 years, including the incentive. Coupling this recommendation with ECM AA1 and AA2, the total simple payback would be closer to 5.5 years.

AA4: Install New Thermostats with Optimized Temperature Controls

Existing Condition

During the site visit, it was noticed that only two thermostats exist; however, there are four HVAC units serving the administration building. It is unclear how the two thermostats are controlling the four HVAC units. Additionally, it was noticed that the existing thermostats are very old and do not have the ability for scheduling or automatic controls, as shown on the right. Given that the building is not occupied 24/7, installing thermostats with scheduling and automatic controls would reduce heating, cooling, and fan energy by the HVAC units.

Figure 5: Thermostats in Administration Building

The cooling setpoints shown on the thermostats are around 71-72 °F. These cooling setpoint temperatures are very low and typical offices in Phoenix, Arizona maintain occupied cooling setpoint temperature around 74 °F.

Recommended Action

It is recommended that the existing thermostats be replaced with four, new thermostats so that each HVAC unit is served by its own thermostat. Each thermostat should have scheduling capability and controls that allow for automatic temperature setbacks overnight and during unoccupied times. Examples of companies that produce these thermostats would include Honeywell, Google, or Samsung. These thermostats can be found at Home Depot or Lowes.

Onsite personnel indicated that the office areas are occupied from 7AM to 5PM Monday through Sunday. Thus, it is recommended that the staff program the thermostats to be 70 °F for heating and 74 °F for cooling during occupied hours. Schedules should be implemented so that the setback temperatures are 82 °F for cooling and 60 °F for heating from 6PM to 6AM Monday through Friday and all day on Saturday and Sunday. These schedules can be adjusted during busier times of the year.

Energy and Cost Savings

Installing four new thermostats and programming setback schedules would result in electrical energy savings of about 8,270 kWh per year. Total cost savings would be about $992 per year.

SRP offers a smart thermostat rebate of $150 per thermostat. Thus, the total rebate would be $600.

Based on cost data from sources like Home Depot and Lowes, smart thermostats cost about $250 each. Each thermostat would take about one hour to install at a labor rate of $125 per hour. Utilizing this information and cost data, the implementation cost would be about $1,500, and the simple payback would be 0.9 years, including the incentive.

AA5: Replacing Existing Heat Pump Units with Ductless VRF System

Existing Condition

The administration building currently utilizes four, 7.5-ton RHEEM heat pump units that were installed around 2012. The published efficiency of the units is 11 EER for cooling and 3.3 COP for heating. Given the age of the equipment, it is expected that the efficiency of the units is closer to 10.5 EER and 3.0 COP, respectively.

Figure 6: One of four Condenser Units serving the Admin Building

The Air Traffic Control Tower building has upgraded their HVAC system to VRF units. There is opportunity in the administration building to upgrade the current equipment to a high efficiency VRF system.

Recommended Action

It is recommended that the existing HVAC system be replaced with a VRF system similar to the Air Traffic Control Tower. These systems utilize the inverter control technology to modulate the compressor and fans to meet part load conditions and eliminate the inefficiencies of cycling compressors. VRF systems have cooling and heating efficiencies up to 28 IEER and 4.2 COP and utilizing ductless VRF units could reduce fan energy usage by nearly 50%. Additionally, a VRF system is a zonal system so each room would have its own control over temperature setpoints and thermal comfort. This system type would allow for optimized HVAC controls to be able to implement temperature setbacks based on occupancy or time of day for each room in the building.

Energy and Cost Savings

Installing a VRF system to replace the existing heat pump units would result in electrical energy savings of about 24,610 kWh per year. Total cost savings would be about $2,953 per year.

SRP offers a $75 per ton rebate for installing multi-split variable refrigerant flow systems. Based on the current equipment tonnage, the rebate is estimated at $2,250.

Based on RSMeans cost data, each evaporator unit would cost about $2,650 and each condensing unit would cost about $20,000, for a total implementation cost of $46,500. The simple payback would be over 10 years, including the incentive.

AA6: Insulate Domestic Hot Water Pipes

Existing Condition

The administration building currently utilizes an electric domestic hot water (DHW) storage tank to provide hot water to restrooms and the pantry sink. During the site visit, it was noticed that all DHW pipes were uninsulated, as shown on the right. Uninsulated pipes result in significant heat loss in the distribution of hot water to the restrooms and pantry area.

Figure 7: Uninsulated copper DHW pipes

Recommended Action

It is recommended that 1”-1.5” insulation be installed on the DHW pipes to reduce distribution heat loss. Insulating DHW pipes not only reduces the energy consumed by the water heater, but also reduces the wait time for occupants wanting hot water at the pantry or restrooms.

Energy and Cost Savings

Installing DHW piping insulation would result in electrical energy savings of about 173 kWh per year. Total cost savings would be about $21 per year.

Based on typical cost data, it estimated the material cost to insulate DHW pipes would cost about $50. It is assumed that installing insulation would take about 30 minutes a labor rate of $25 per hour (which assumes internal staff). Using this cost data, total implementation cost would be about $75, and the simple payback would be 3.6 years, including the incentive.

AA7: Install Instantaneous, Tankless Electric Water Heaters

Existing Condition

The administration building currently utilizes a 30 gallon electric domestic hot water (DHW) storage tank to provide hot water to restrooms and the pantry sink, as shown on the right. While electric water heaters are about 97% efficient, there is significant distribution losses from the storage tank and uninsulated piping. Given that the only end uses for DHW are restrooms, shower, and a pantry sink, the 30 gallons storage tank seems unnecessary, and there is opportunity to pursue instantaneous, tankless electric water heaters.

Figure 8: 30 gal DHW Storage Tank

Recommended Action

It is recommended that instantaneous, tankless electric water heaters be installed 1) at the pantry sink and 2) in each restroom. Instantaneous water heaters eliminate tank storage heat losses and distribution piping heat losses.

Energy and Cost Savings

Installing instantaneous electric water heaters would result in electrical savings of about 663 kWh per year. Total cost savings would be about $76 per year.

SRP offers custom rebates of $0.10 per kWh saved, up to 60% of the implementation cost. This recommendation would qualify for a rebate of about $66.

Based RSMeans costs and cost from retail stores, the material cost for three instantaneous hot water heaters rated at 1.27 gpm would be about $170 each. Estimated installation cost would be about $300 per unit. Thus, the total implementation cost would be about $1,410, and the simple payback would be over 10 years, including the incentive.

AA8: Install Receptacle Load Controls to Turn Off Equipment

Existing Condition

The administration building utilizes a wide range of appliances such as printers/scanners, TVs, compact refrigerators, and more. Given that the building has variable occupancy, there are times when this equipment will remain on even when no one is present or utilizing the equipment. Based on previous project experience, as much as 50% of miscellaneous equipment can be left on overnight for a typical office space. Installing controls to automatically turn off TVs, computers, coffee makers, etc. could significantly reduce wasted energy usage.

Figure 9: Administration Pantry Area

Recommended Action

It is recommended that receptacle load controls be implemented for all office, pantry, copy room, and conference areas to turn off equipment overnight and during unoccupancy. Many lighting manufacturers have incorporated receptacle load controls into their lighting controls, and thus, this recommendation should be considered alongside ECMs AA1 and AA2.

Receptacle load controls can come in a variety of forms. New outlets can be installed that are separately circuited to include one outlet for equipment that can be turned off and another outlet that remains on. Another form of receptacle control is the use of power strips or wireless remote control plug-ins. The power strips and plug ins can be controlled directly from a lighting control system or simply from an App on your phone. These controls are typical for home retrofits but apply to small office spaces such as the administration building. The following link to The Home Depot website shows examples of these controls: https://www.homedepot.com/b/Electrical-Wiring-Devices-Light-Controls-Plug-Adapters/Remote-Control/N-5yc1vZcjvpZ1z0r7we.

Energy and Cost Savings

Installing receptacle load controls to turn off equipment during unoccupancy would result in electrical savings of about 1,771 kWh per year. Total cost savings would be about $213 per year.

SRP offers custom rebates of $0.10 per kWh saved, up to 60% of the implementation cost. This recommendation would qualify for a rebate of about $177.

Based on RSMeans data and retail store cost data, purchasing simple plug-in and power strip controls would cost about $500. Installing the equipment and programming could be completed in-house since it only requires the use of a smart phone. If so, the implementation cost would be about $500, and the simple payback would be 1.5 years.

AA9: Implement Policy to Purchase Energy Star Equipment

Existing Condition

The administration building utilizes a wide range of appliances such as printers/scanners, TVs, compact refrigerators, and more. Based on site observations, a number of these equipment were not Energy Star certified. These pieces of equipment are typically left on overnight or utilize significant amounts of power when not in use. Upgrading to Energy Star equipment would minimize usage during operation and non-operation.

Many corporations have begun instituting policies that require the purchase of Energy Star equipment. There is opportunity to implement similar practices across the airport buildings to minimize energy usage due to miscellaneous equipment.

Recommended Action

It is recommended that the airport implement a policy to purchase Energy Star equipment when purchasing new equipment or replacing existing equipment. All Energy Star rated equipment from office, pantry, and AV equipment can be found on the following website: https://www.energystar.gov/productfinder/. Many of the products found on this site can be purchased from local retail stores such as Home Depot, Lowes, Best Buy, etc.

Energy and Cost Savings

Implementing a policy to purchase Energy Star equipment would result in electrical savings of about 1,027 kWh per year. Total cost savings would be about $123 per year.

Based on the Energy Star website, the cost between standard and Energy Star equipment is negligible, and thus, there is no implementation cost and the simple payback is immediate.

Analysis Results

Economic Results Summary

The following table details the eQUEST outputs, energy savings, and cost savings for each ECM option evaluated. Key findings from the energy analysis include:

- Implementing all recommendations could reduce the total building energy usage by nearly 60% and reduce energy costs by more than 50%.
- Installing LED lighting and high performance controls can reduce electrical energy costs by 13% with a 5.5 year payback.
- Installing proper temperature controls and setpoints can reduce energy costs by about 11% with a very short payback.
- Replacing HVAC equipment should only be considered at the end of life. However, upgrading to a VRF system with optimized zone controls can reduce energy costs by nearly 33%.
- Utilizing instantaneous hot water heaters can reduce hot water energy usage by nearly 30%.
- Installing Energy Star equipment and providing optimized controls of plug loads can reduce energy cost by 4% with minimal implementation cost.

Chandler Aiport Administration Building									
#	Run				HVAC				Electric
		Ambient Lighting	Misc Equip	DHW Electric	Heating Electric	Cooling Electric	Vent Fans	Total HVAC	Total Electric
		(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)	(kWh)
0	Calibrated Model	12,750	13,015	2,495	2,921	33,717	9,381	46,019	74,319
AA1	0+Replace Fluorescents with LED Fixtures	6,375	13,015	2,496	3,502	32,316	9,281	45,099	67,027
AA2	L1+Install High Performance Lighting Controls	4,912	13,015	2,496	3,632	31,994	9,254	44,880	65,345
AA3	L2+Optimize Natural Lighting and Remove Uplighting	4,585	13,015	2,496	3,660	31,922	9,250	44,832	64,970
AA4	L3+Install New Thermostats with Temperature Setbacks	4,585	13,015	2,492	1,627	27,663	7,289	36,579	56,700
AA5	M1+Replace Heat Pumps with VRF System	4,585	13,015	2,492	1,032	8,023	2,916	11,971	32,090
AA6	M2+Insulate Domestic Hot Water Pipes	4,585	13,015	2,325	1,035	8,016	2,915	11,966	31,917
AA7	P1+Install Instantaneous Electric Water Heaters	4,585	13,015	1,693	1,035	8,016	2,915	11,966	31,284
AA8	P2+Install Receptacle Load Controls	4,585	11,346	1,693	1,064	7,904	2,894	11,862	29,513
AA9	R1+Install Energy Star Equipment	4,585	10,372	1,693	1,082	7,841	2,886	11,809	28,486
	Savings relative to Previous Measure								
AA1	0+Replace Fluorescents with LED Fixtures	6,375	-	(1)	(581)	1,401	100	920	7,292
AA2	L1+Install High Performance Lighting Controls	1,463	-	-	(130)	322	27	219	1,682
AA3	L2+Optimize Natural Lighting and Remove Uplighting	327	-	-	(28)	72	4	48	375
AA4	L3+Install New Thermostats with Temperature Setbacks	-	-	4	2,033	4,259	1,961	8,253	8,270
AA5	M1+Replace Heat Pumps with VRF System	-	-	-	595	19,640	4,373	24,608	24,610
AA6	M2+Insulate Domestic Hot Water Pipes	-	-	167	(3)	7	1	5	173
AA7	P1+Install Instantaneous Electric Water Heaters	-	-	632	-	-	-	-	633
AA8	P2+Install Receptacle Load Controls	-	1,669	-	(29)	112	21	104	1,771
AA9	R1+Install Energy Star Equipment	-	974	-	(18)	63	8	53	1,027
	Total Savings								
	Totals:	8,165	2,643	802	1,839	25,876	6,495	34,210	45,833
	Percent of Baseline:	64.0%	20.3%	32.1%	63.0%	76.7%	69.2%	74.3%	61.7%

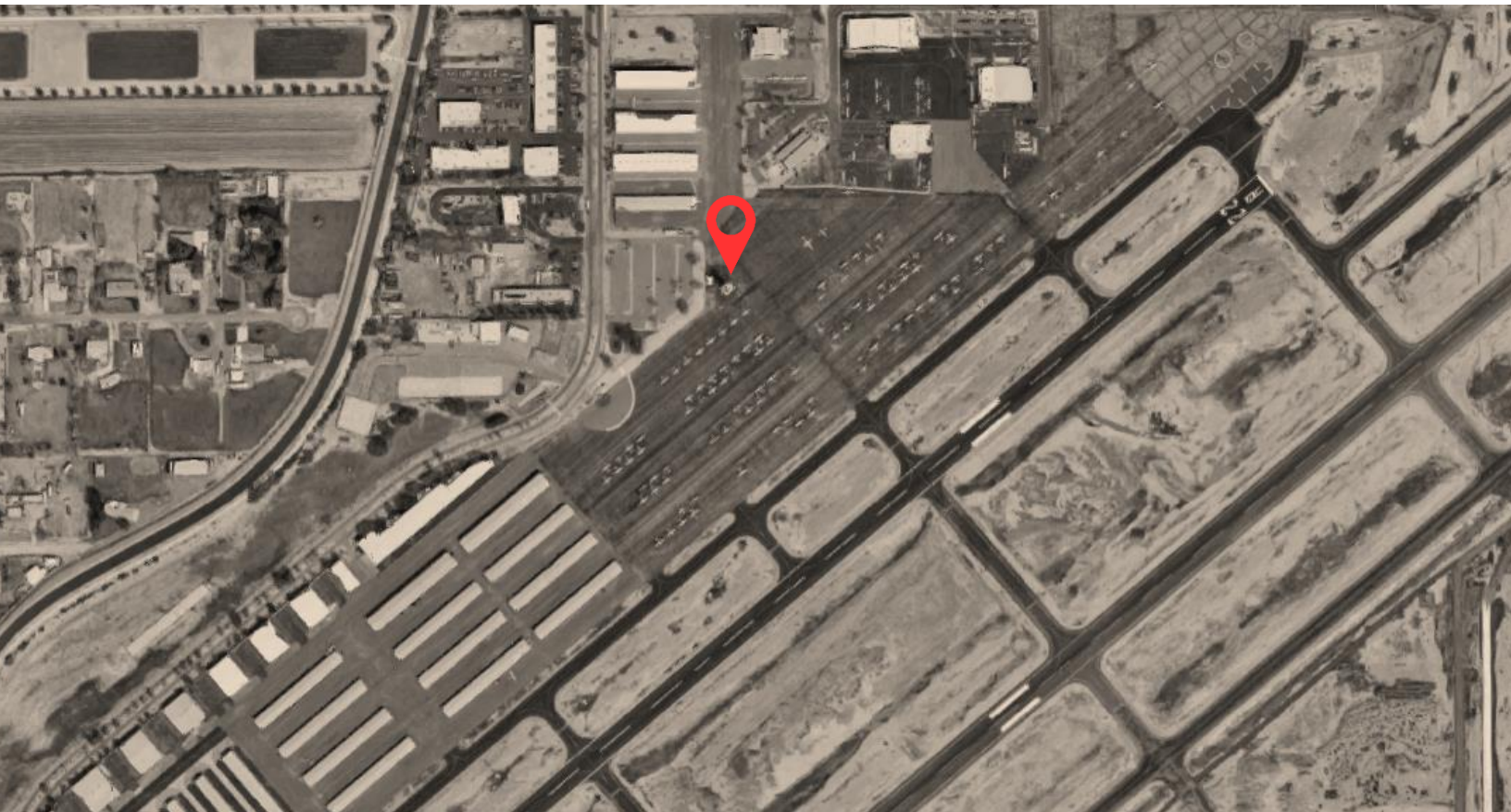
Figure 10: Energy and Cost Summary for Each ECM

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data and RSMeans data.

ECM	Measure Description	First Cost	Utility Cost Savings	SRP Incentive	Simple Payback
AA1	0+Replace Fluorescents with LED Fixtures	$3,000	$875	$600	2.7
AA2	L1+Install High Performance Lighting Controls	$3,750	$202	$750	14.9
AA3	L2+Optimize Natural Lighting and Remove Uplighting	$800	$45	$30	17.1
AA4	L3+Install New Thermostats with Temperature Setbacks	$1,500	$992	$600	0.9
AA5	M1+Replace Heat Pumps with VRF System	$46,500	$2,953	$2,250	15.0
AA6	M2+Insulate Domestic Hot Water Pipes	$75	$21	$0	3.6
AA7	P1+Install Instahot Water Heaters	$1,410	$76	$66	17.7
AA8	P2+Install Receptacle Load Controls	$500	$213	$177	1.5
AA9	R1+Install Energy Star Equipment	$0	$123	$0	Immediate

Figure 11 – Economic Results Summary

Air Traffic Control Tower



Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

AT1: Replace Linear and Compact Fluorescent Lamps with LEDs

Existing Condition

The air traffic control building utilizes a mixture of 2-lamp 4ft. T8 fluorescent fixtures and recessed incandescent 60W lamps throughout. Each fixture has the opportunity to be upgraded to LED lamps/fixtures that draw significantly less power while also providing similar/better lighting levels.

Figure 1: Fluorescent Lighting Fixtures in the ATCT

Recommended Action

Replace all fluorescent lamps with LED lamps. Use a 12W GE LED12ET8/g/4/840 linear LED lamp or similar to replace linear fluorescent lamps. Replace all 60W incandescent lamps with 9W LED lamp. It is important that the LED lamp is checked for ballast compatibility. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as CFLs at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance and replacement costs. As a bonus, LED lamps contain no mercury, helping to streamline its recycling process.

Energy and Cost Savings

Replacing all fluorescent and incandescent lamps with LED lamps would result in electrical savings of about **4,912 kWh per year.** Total cost savings would be about **$454 per year**.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to **$600** in incentive rebates.

It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended lamps, the implementation cost would be about **$2,500**, and the simple payback would be **4.2 years,** including the incentive.

AT2: Install High Performance Lighting Controls

Existing Condition

Currently, the air traffic control tower building does not utilize any occupancy sensors. Based on conversation with airport personnel and observations during the site visit, the building has highly variable occupancy on multiple floors and it was noticed that lights were left on in spaces that were unoccupied.

Figure 2: Lighting Fixture in Electrical Room

Recommended Action

It is recommended to install occupancy sensors throughout the building. The occupancy sensors should turn off lighting fixtures within 20 minutes of people leaving the room.

There are numerous lighting control companies that offer occupancy and daylighting control solutions such as Lutron, Lithonia, Leviton, etc. This installation is best implemented at the same time as upgrading lighting fixtures to LED fixtures since many lighting companies will offer LED upgrades and lighting control upgrades as a package.

Energy and Cost Savings

Installing high performance lighting controls including occupancy and daylighting sensors would result in electrical savings of about 1,403 kWh per year. Total cost savings would be about $130 per year.

SRP offers a lighting rebate of $0.40 per watt controlled. It is therefore estimated that this recommendation could receive up to $450 in incentive rebates.

Based on RSMeans and manufacturing data, each occupancy and daylight sensor would cost about $250 to purchase and install. Utilizing this information, the implementation cost would be about $2,250, and the simple payback would be over 10 years, including the incentive. It is thus recommended that this ECM be coupled with ECM AA1. Combining the two ECMs, the simple payback would be closer to 6.7 years.

AT3: Replace the HPS Beacon Light with LED Fixture

Existing Condition

The current beacon light draws about 2000W and is controlled by a photocell to operate from dusk till dawn. Similar to the other landing lights, there is opportunity to replace the beacon fixture with a more efficient LED fixture.

Figure 3: Beacon Light at top of ATCT

Recommended Action

Replace the 2000W beacon fixture with a 795W RBMI Rotating Beacon light, or similar. Based on FAA regulations, the whole fixture would need to be replaced, not just the lamps. Additionally, staff personnel should consider if the voltage between the new LED fixtures and old incandescent fixtures would change.

Energy and Cost Savings

Replacing the existing beacon fixture with a new, higher efficient light would result in electricity savings of about **4,380 kWh per year** and cost savings of about **$405** per year.

SRP offers custom rebates of $0.10 per kWh. This recommendation could qualify for **$438** in rebates.

Based on previous projects and manufacturing data, the expected cost for the beacon light would be about **$10,000**. The simple payback would be **over 10 years,** including incentives.

AT4: Program Thermostats with Optimized Temperature Setbacks

Existing Condition

During the site visit, each room in the ATCT utilizes the smart thermostat as shown on the right. However, it was noticed that the thermostats have not been programmed or scheduled. Additionally, the thermostats were locked from editing and were not able to be programmed during the visit. Given that the building is not occupied 24/7 and has variable occupancy, programming the thermostats for temperature setback modes would reduce heating, cooling, and fan energy by the HVAC units.

Figure 4: Existing Smart Thermostats in ATCT

Recommended Action

It is recommended that the existing thermostats be programmed with optimized schedules for temperature setbacks. Schedules should be implemented so that the setback temperatures are 82 °F for cooling and 60 °F for heating from 9PM to 6AM everyday of the week. These schedules can be adjusted during busier times of the year.

Energy and Cost Savings

Installing four new thermostats and programming setback schedules would result in electrical energy savings of about 2,880 kWh per year. Total cost savings would be about $266 per year.

It is estimated that an LG electrician would need about 30 minutes per thermostat to reprogram at a labor rate of $125 per hour. If so, the implementation cost would be about $500, and the simple payback would be 1.9 years, including the incentive.

AT5: Adjust Thermostat Setpoints to 74° F for Cooling in IT Rooms

Existing Condition

During the site visit, it was noticed that the IT rooms had cooling temperature setpoints between 68-70 °F, as shown in the image on the right. While IT rooms need to be conditioned to relatively cool temperatures, IT equipment can operate at temperatures up to 78 °F without malfunction or reduced speed. Setpoints of 68 °F are not needed and should be adjusted closer to 74 °F.

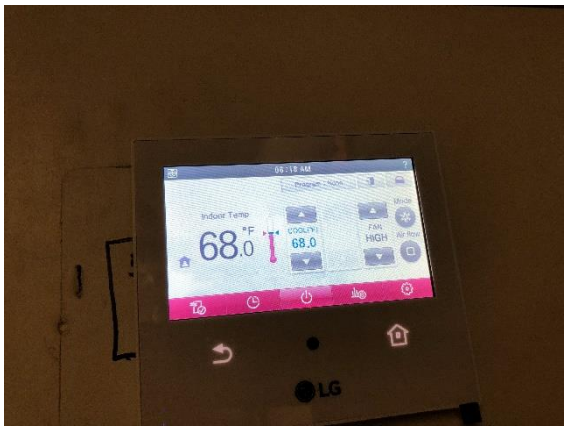


Figure 5: Thermostat in IT Room

Recommended Action

It is recommended that temperature setpoints in the IT rooms be adjusted from 68-70 °F to 74 °F. Increasing the temperature in the space to 74 °F does not hinder the function of the IT equipment and reduces cooling energy consumption considerably.

Energy and Cost Savings

Adjusting temperature setpoints in the IT rooms would result in electrical energy savings of about 561 kWh per year. Total cost savings would be about $52 per year.

Adjusting setpoints requires no implementation cost, and thus, the simple payback is immediate.

AT6: Remove Old AC Units and Insulate Walls

Existing Condition

There exist a number of old, AC units in the air traffic control tower as the one shown on the right. Given that all spaces now utilize newer VRF units, the old AC units can be removed so that the spot that once held the AC unit can be covered and insulated.

Figure 6: Window Unit in ATCT

Recommended Action

It is recommended that all old AC units be removed, and the wall be filled with at a minimum R-13 Batt insulation between 4in wood studs. Reducing the infiltration and heat transfer through the envelope reduces the cooling load on the VRF unit and results in significant energy savings.

Energy and Cost Savings

Insulating the wall to minimize infiltration and heat transfer would result in in electrical energy savings of about 432 kWh per year. Total cost savings would be about $40 per year.

Based on typical construction cost and RSMeans data, the cost to install R-13 batt insulation between 4in wood studs is about $5 per SF. It is estimated that a total of 15 SF would be needed to fully cover and insulate the holes in the wall. If so, the implementation cost would be about $150, and the simple payback would be about 3.8 years.

AT7: Install Instantaneous, Tankless Electric Water Heaters

Existing Condition

The air traffic control tower building currently utilizes a 6 gallon electric domestic hot water (DHW) storage tank to provide hot water to restrooms, as shown on the right. While electric water heaters are about 97% efficient, there is significant distribution losses from the storage tank and uninsulated piping. Given that the only end uses for DHW are restrooms and breakroom, the 6 gallon storage tank seems unnecessary, and there is opportunity to pursue instantaneous, tankless electric water heaters.

Figure 7: 6 Gallon DHW Storage Tank

Recommended Action

It is recommended that instantaneous, tankless electric water heaters be installed in each restroom. Instantaneous water heaters eliminate tank storage heat losses and distribution piping heat losses.

Energy and Cost Savings

Installing instantaneous electric water heaters would result in electrical savings of about 337 kWh per year. Total cost savings would be about $31 per year.

SRP offers custom rebates of $0.10 per kWh saved, up to 60% of the implementation cost. This recommendation would qualify for a rebate of about $33.

Based RSMeans costs and cost from retail stores, the material cost for two instantaneous hot water heaters rated at 1.27 gpm would be about $170 each. Estimated installation cost would be about $300 per unit. Thus, the total implementation cost would be about $940, and the simple payback would be over 10 years, including the incentive.

Analysis Results

Economic Results Summary

Energy results for each of the ECMs described above are shown in the table below. Key findings from the energy analysis include:

- Implementing all recommendations could reduce the ATCT energy usage by nearly 21%
- Installing LED lighting and high performance controls can reduce electrical energy costs by 15%.
- Installing proper temperature controls and setpoints can reduce energy costs by about 5% with a very short payback.
- Utilizing instantaneous hot water heaters can reduce hot water energy usage by nearly 30% and overall energy usage by about 0.5%.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	72,073	$6,664	0.0%	$0	0.0%
AT1	Replace Fluorescent Lamps with LEDs	67,161	$6,210	6.8%	$454	6.8%
AT2	Install High Performance Lighting Controls	65,758	$6,080	8.8%	$130	1.9%
AT3	Replace HPS Beacon Light with LED Fixture	61,378	$5,675	14.8%	$405	6.1%
AT4	Program Thermostats with Optimized Temperature Setbacks	58,498	$5,409	18.8%	$266	4.0%
AT5	Adjust Thermostat Setpoints to 74 °F in IT Rooms	57,937	$5,357	19.6%	$52	0.8%
AT6	Remove Old AC Units and Insulate Walls	57,505	$5,317	20.2%	$40	0.6%
AT7	Install Instantaneous, Tankless Electric Water Heaters	57,168	$5,286	20.7%	$31	0.5%

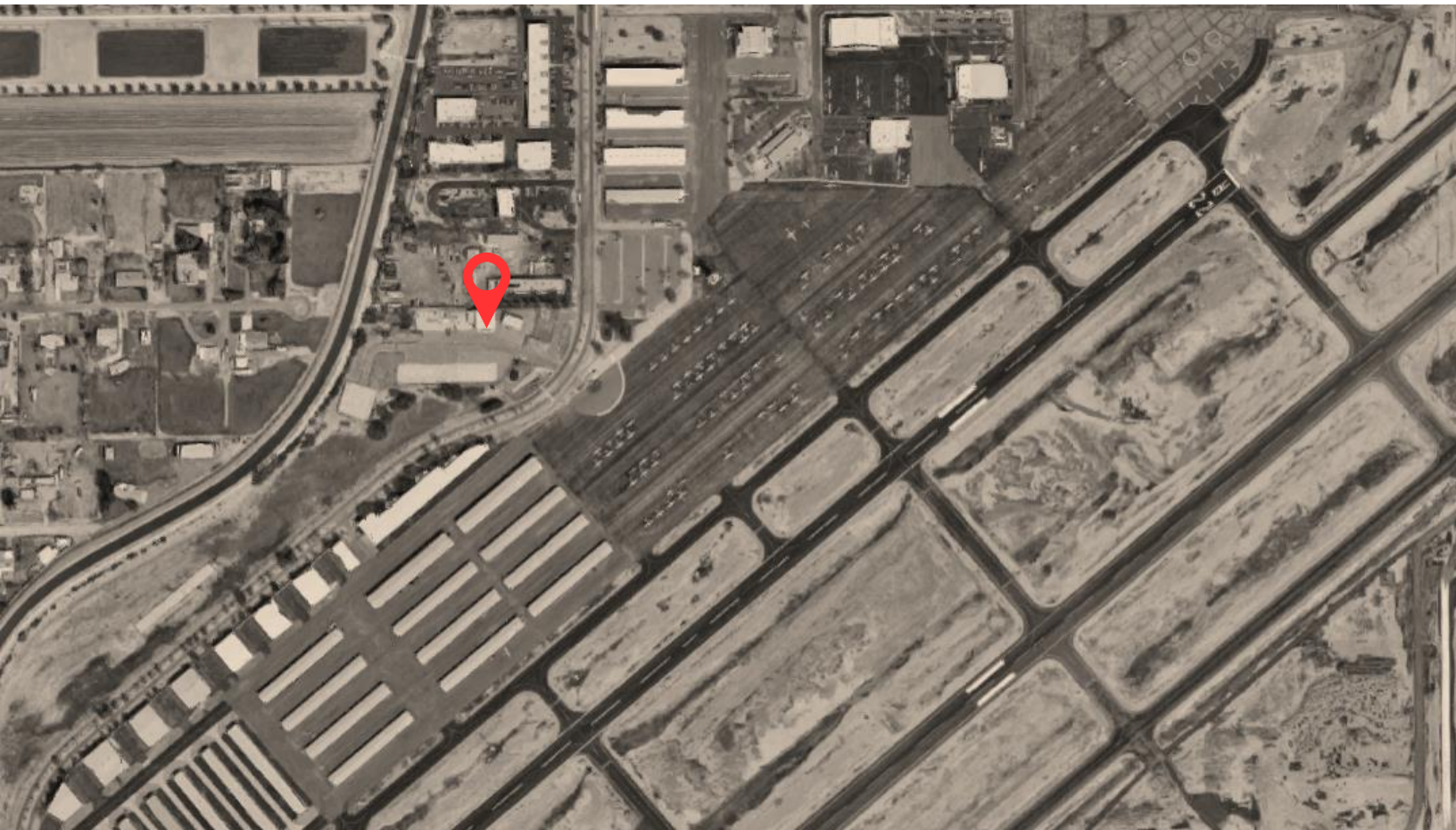
Figure 8: Energy and Cost Summary for Each ECM

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data and RSMeans data.

ECM	Measure Description	First Cost	Utility Cost Savings	SRP Incentives	Simple Payback (years)
AT1	Replace Fluorescent Lamps with LEDs	$2,500	$454	$600	4.2
AT2	Install High Performance Lighting Controls	$2,500	$130	$450	15.8
AT3	Replace HPS Beacon Light with LED Fixture	$10,000	$405	$438	23.6
AT4	Program Thermostats with Optimized Temperature Setbacks	$500	$266	$0	1.9
AT5	Adjust Thermostat Setpoints to 74 °F in IT Rooms	$0	$52	$0	Immediate
AT6	Remove Old AC Units and Insulate Walls	$150	$40	$0	3.8
AT7	Install Instantaneous, Tankless Electric Water Heaters	$940	$31	$33	29.1

Figure 9 – Economic Results Summary

Maintenance Building



Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis for interior and exterior lighting. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

M1: Replace All Linear Fluorescent Fixtures with LED Fixtures

Existing Condition

The airport maintenance facility utilizes a 4-lamp, 4-ft. T8 linear fluorescent fixtures. Each fixture has the opportunity to be upgraded to LED fixtures that draw significantly less power while also providing same/better lighting levels.

Figure 1: Interior Linear Fluorescent Fixtures

Recommended Action

It is recommended that each T8 lamp should be replaced with a 12W GE LED12ET8/g/4/840 linear LED lamp or similar. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as fluorescent fixtures at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing all linear fluorescent fixtures with LED fixtures would result in electrical energy savings of about 2,868 kWh per year and cost savings of about $316 per year.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to $150 in incentive rebates.

It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended lamps, the implementation cost would be about $1,100, and the simple payback would be 3.0 years, including the incentive.

M2: Install High Performance Lighting Controls

Existing Condition

Based on the site visit, the maintenance building currently does not utilize occupancy sensors to control lighting fixtures. Given that this building has low occupancy and high variability during the day, installing occupancy sensors can significantly reduce energy usage and run time for the lighting fixtures.

Additionally, the maintenance building utilizes significant amounts of skylights. There is opportunity to utilize daylight harvesting controls to dim lighting fixtures when sufficient natural light enters the space.

Figure 2: Linear Fluorescent Fixtures in the Maintenance Building

Recommended Action

It is recommended to install a couple of occupancy and daylighting sensors in the maintenance building to control lighting fixtures. The occupancy sensors should turn off lighting fixtures within 20 minutes of people leaving the space. Daylighting controls should automatically dim lighting fixtures near windows to maintain a constant lighting level of 40 fc (typical for warehouse/manufacturing spaces).

There are numerous lighting control companies that occupancy and daylighting control solutions such as Lutron, Lithonia, Leviton, etc. This installation is best implemented at the same time as upgrading lighting fixtures to LED fixtures since many lighting companies will offer LED upgrades and lighting control upgrades as a package.

Energy and Cost Savings

Installing high performance lighting controls including occupancy and daylighting sensors would result in electrical savings of about 896 kWh per year. Total cost savings would be about $99 per year.

SRP offers a lighting rebate of $0.40 per watt controlled. It is therefore estimated that this recommendation could receive up to $250 in incentive rebates.

Based on RSMeans and manufacturing data, each occupancy and daylight sensor would cost about $250 to purchase and install. Utilizing this information, the implementation cost would be about $1,000, and the simple payback would be 7.6 years, including the incentive. It is thus recommended that this ECM be coupled with ECM AA1. Combining the two ECMs, the simple payback would be closer to 4.1 years.

Analysis Results

Economic Results Summary

Energy results for each ECM described above are shown in the table below. Overall, replacing all lighting fixtures with high efficient LEDs and installing lighting controls could reduce total energy consumption for the Maintenance Building by **39%**.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	7,030	$1,052	0%	$0	0%
M1	Replace All Linear Fluorescents w/ LEDs	4,162	$736	30%	$316	30%
M2	Install High Performance Lighting Controls	3,265	$638	39%	$99	9%

Figure 3: Energy Results Summary

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data, conversations with facility personnel, and RSMeans data.

ECM	Measure Description	First Cost	Utility Cost Savings	SRP Incentives	Simple Payback (years)
M1	Replace All Linear Fluorescents w/ LEDs	$1,100	$316	$150	3.0
M2	Install High Performance Lighting Controls	$1,000	$99	$250	7.6

Figure 4 – Economic Results Summary

T-Hangars A Through I

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis for interior and exterior lighting. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

H1: Replace All Linear Fluorescent Fixtures with LED Fixtures

Existing Condition

The hangars utilize a mixture of linear fluorescent fixtures. Each fixture has the opportunity to be upgraded to LED fixtures that draw significantly less power while also providing same/better lighting levels.

Figure 1: Exterior T-Hangars

Recommended Action

It is recommended that each T12 fixture in the hangars be replaced with a Series SKD 8ft. 80W LED fixture or similar. Each T8 fixture should be replaced with a 12W GE LED12ET8/g/4/840 linear LED lamp or similar. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as fluorescent fixtures at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing all linear fluorescent fixtures in the hangars with LED fixtures would result in electrical energy savings of about **5,842 kWh per year** and cost savings of about **$643 per year**.

SRP offers a lighting rebate of $300 per kW of reduced installed demand for qualified interior LEDs. It is estimated that this recommendation could receive up to **$900** in incentive rebates.

It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended lamps, the implementation cost would be about **$6,000**, and the simple payback would be **7.9 years,** including the incentive.

H2: Replace All Exterior Lighting with LED Fixtures

Existing Condition

Based on the site visit, the hangars utilize 60-100W incandescent and halide exterior fixtures that are controlled by a photocell. Each exterior fixture has the opportunity to be upgraded to LED fixtures that draw significantly less power while also providing the same/better lighting levels.

Figure 2: Exterior Halide Fixture

Recommended Action

It is recommended that each exterior fixture be replaced with a 50W LED Flat Corn Light or similar. It is important that the LED lamp is checked for ballast compatibility. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as fluorescent fixtures at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing all exterior fixtures serving the hangars with LED fixtures would result in electrical energy savings of about **2,652 kWh per year** and cost savings of about **$292 per year**.

SRP offers an exterior lighting rebate of $200 per kW of reduced installed demand for qualified LEDs. It is estimated that this recommendation could receive up to **$400** in incentive rebates.

It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour (which assumes internal staff). Utilizing this information and cost data for the recommended lamps, the implementation cost would be about **$2,300**, and the simple payback would be **6.5 years,** including the incentive.

Analysis Results

Economic Results Summary

Energy results for each ECM described above are shown in the table below. Overall, replacing all lighting fixtures with high efficient LEDs could reduce total energy consumption for the Hangars by 32%.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	27,596	$2,926	0%	$0	0%
H1	Replace All Linear Fluorescents w/ LEDs	21,753	$2,283	22%	$643	22%
H2	Replace All Exterior Lighting w/ LEDs	19,101	$1,991	32%	$292	10%

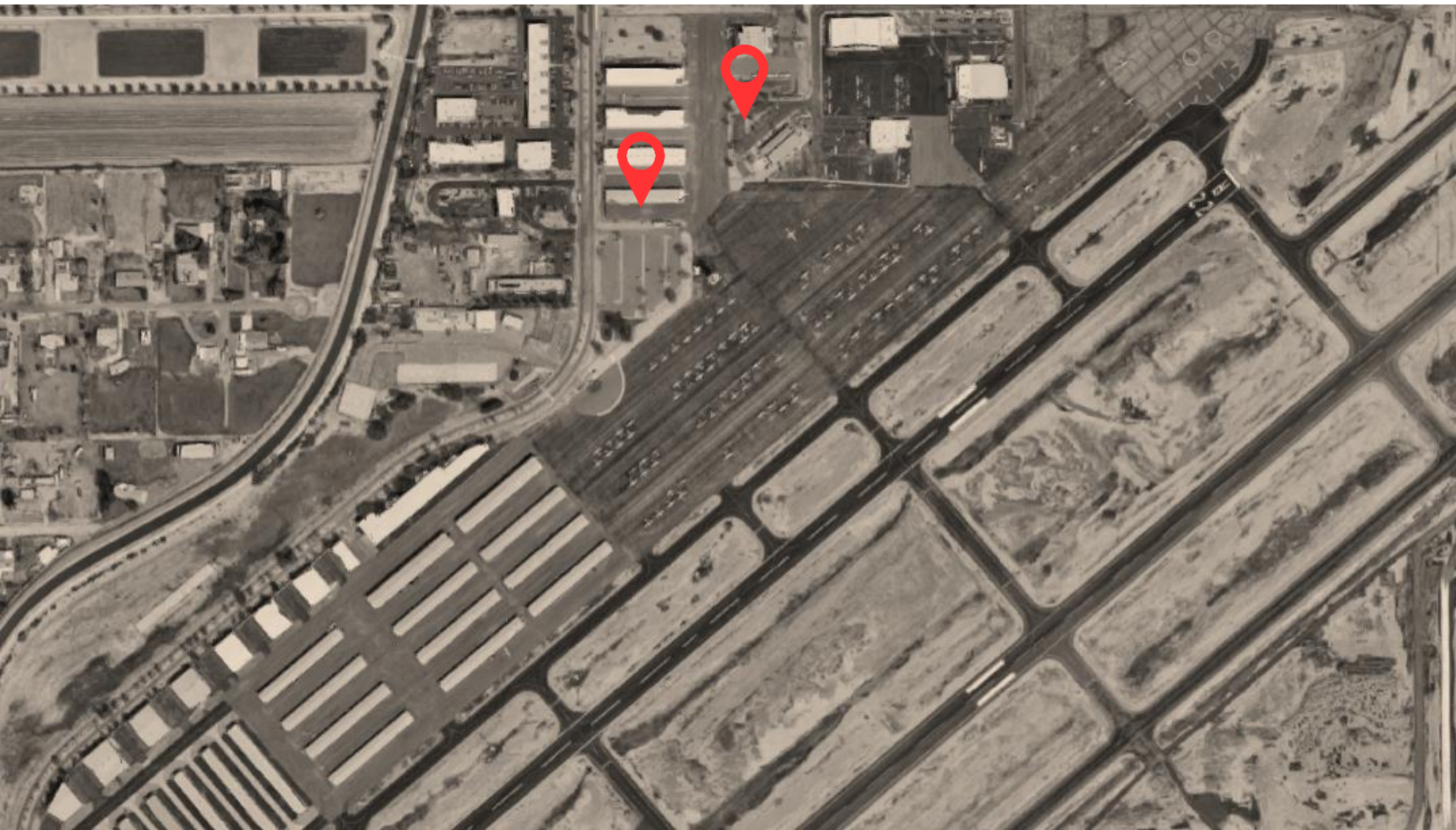
Figure 3: Energy Results Summary

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data, conversations with facility personnel, and RSMeans data.

ECM	Measure Description	First Cost	Utility Cost Savings	SRP Incentives	Simple Payback (years)
H1	Replace All Linear Fluorescents w/ LEDs	$6,000	$643	$900	7.9
H2	Replace All Exterior Lighting w/ LEDs	$2,300	$292	$400	6.5

Figure 4 – Economic Results Summary

Parking Lot and Canopy Lighting



Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

E1: Replace All 100W HPS Exterior Pole Fixtures with 50W LED Fixtures

Existing Condition

The parking lot for the airport administration building utilizes 12, 100W HPS exterior pole lights. Additionally, it is expected that all streetlights utilize inefficient halogen or HPS fixtures. The fixtures are controlled by photocells to turn on at dusk and turn off at dawn. The 100W pole lamps draw a significant amount of power, and there is opportunity to replace the current fixtures with 50W LED fixtures.

Figure 1: Exterior HPS Fixtures in Parking Lot

Recommended Action

It is recommended that all exterior pole fixtures be replaced with a 50W LED fixture or similar. It is assumed that the existing pole structure is in good shape and the LED fixture could be fastened to the existing pole.

LED lamps output similar lighting levels as CFLs at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance costs. As a bonus, LED lamps contain no mercury, helping to streamline the recycling process.

Energy and Cost Savings

Replacing the exterior pole fixtures with high efficiency LED fixtures would result in electricity savings of about 20,189 kWh per year and cost savings of about $2,019 per year.

SRP offers a lighting rebate of $200 per kW of reduced installed demand for qualified exterior LEDs. It is estimated that this recommendation could receive up to $1,000 in incentive rebates.

It is assumed that each fixture would take about one hour to replace the lamps at a labor rate of $125 per hour. Utilizing this information and cost data for the recommended lamps, the implementation cost would be about $48,500 and the simple payback would be over 10 years, including the incentive.

E2: Replace Incandescent Lamps with LED in Canopy Parking Area

Existing Condition

The canopy parking area currently utilizes about eight incandescent lamps to illuminate the area overnight. There is opportunity to replace these lamps with low wattage LED lamps.

Figure 2: Existing Canopy Lighting Fixtures

Recommended Action

Replace all 60W incandescent lamps with LED 9W lamp. It is important that the LED lamp is checked for ballast compatibility. Utilize new fixtures only when deemed aesthetically or electrically necessary. The recommended fixture specifications can be found in the Appendix.

LED lamps output similar lighting levels as CFLs at a reduced power draw; thus, minimizing lighting energy usage without compromising performance. Additionally, LED lamps have a longer lifespan minimizing maintenance and replacement costs. As a bonus, LED lamps contain no mercury, helping to streamline its recycling process.

Energy and Cost Savings

Replacing all fluorescent and incandescent lamps with LED lamps would result in electrical savings of about 1,647 kWh per year. Total cost savings would be about $165 per year.

SRP offers a lighting rebate of $200 per kW of reduced installed demand for qualified exterior LEDs. It is estimated that this recommendation could receive up to $100 in incentive rebates.

It is assumed that each fixture would take about 30 minutes to replace the lamps at a labor rate of $25 per hour. Utilizing this information and cost data for the recommended lamps, the implementation cost would be about $240 and the simple payback would be 0.8 years, including the incentive.

Analysis Results

Economic Results Summary

Energy results for each ECM described above are shown in the table below. Overall, replacing all lighting fixtures with high efficient LEDs could reduce total energy consumption for exterior lighting by 48%.

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	45,200	$4,632	0%	$0	0%
E1	Replace Exterior Street and Parking Lot Pole Lights w/ LEDs	25,011	$2,613	44%	$2,019	44%
E2	Replace Canopy Incandescents with LED Lamps	23,364	$2,448	47%	$165	4%

Figure 3: Energy Results Summary

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data, conversations with facility personnel, and RSMeans data.

ECM	Measure Description	First Cost	Utility Cost Savings	SRP Incentives	Simple Payback (years)
E1	Replace Exterior Street and Parking Lot Pole Lights w/ LEDs	$48,500	$2,019	$1,000	23.5
E2	Replace Canopy Incandescents with LED Lamps	$240	$165	$100	0.8

Figure 4 – Economic Results Summary

Runway and Taxiway Lights

Energy Conservation Measures

The following section describes in detail individual energy conservation measures resulting from the site visit and analysis for the runway lighting. Estimated energy savings, implementation cost, and simple payback are calculated for each conservation measure.

L1: Consider Replace Runway Fixtures with LED Fixtures

Existing Condition

The runway and taxiways currently utilize 30W halogen lamp to illuminate the paths. There is opportunity to replace the 30W halogen fixtures with LED fixtures that draw significantly less power while also provide the same/better lighting levels.

Recommended Action

It is recommended that the 30W halogen fixtures be replaced with the Navigate Series 861-L 20W LED fixtures, or similar. Based on FAA regulations, the whole fixture would need to be replaced, not just the lamp. Additionally, staff personnel should consider if the voltage between the new LED fixtures and old halogen fixtures would change. If so, it is possible the transformers would need to be replaced as well.

Energy and Cost Savings

Replacing the incandescent runway fixtures with LED fixtures would result in electricity savings of about 40,490 kWh per year and cost savings of about $4,420 per year.

SRP offers custom rebates of $0.10 per kWh. This recommendation could qualify for $4,000 in rebates.

Based on previous projects and manufacturing data, the expected cost for each runway fixture would be about $200. It is expected that there are over 500 fixtures installed. If so, the total implementation cost would be about $100,000. The simple payback would be over 10 years.

Analysis Results

Economic Results Summary

Energy results for each of the ECMs described above are shown in the table below. Overall, installing LED lighting for the landing lights could reduce costs by about 15%

ECM	Measure Description	Electricity Usage (kWh/year)	Utility Cost ($/year)	Percent Savings	Incremental	
					Cost Savings	Percent Savings
B0	Baseline Usage	264,960	$28,622	0%	$0	0%
L1	Replace Runway Lights with LED Fixtures	224,040	$24,202	15%	$4,420	15%

Figure 1: Energy Results Summary

Economic results are summarized in the table below. Estimated implementation costs for each measure were based on manufacturing data, conversations with facility personnel, and RSMeans data. Overall, replacing landing lights is not economically favorable and should only be considered when fixtures have to be replaced.

ECM	Measure Description	First Cost	Utility Cost Savings	SRP Incentives	Simple Payback (years)
L1	Replace Runway Lights with LED Fixtures	$100,000	$4,420	$4,000	21.7

Figure 2 – Economic Results Summary

Solar PV Potential

Background

The climate at Chandler Municipal Airport provides an ideal location for solar energy production. The project team has indicated the area highlighted in the image below as a potential location for a solar PV system. Based on the site visit, the following items need to be confirmed to determine whether the site could house a solar PV system:

- Federal Aviation Administration (FAA) regulations for glare and other flight impact issues.
- No underground piping or sewer systems that would require access
- Proper spacing between solar PV system and existing structures/roads/construction.

Figure 1: Potential Solar PV Location

Financial Cost Considerations

From a utility cost standpoint, SRP only offers about a $0.02-$0.03 per kWh credit for excess generation on an hourly basis. This means that if the PV system generates more energy than the property/building consumes, the project will only be credited $0.02-$0.03 per kWh instead to the retail rate of about $0.09 per kWh. Therefore, it is important to consider the installation of batteries for this project to store excess energy generation so that it can be used on site. SRP currently does not offer battery storage incentives to commercial customers, only to residential customers.

Additionally, in similar circumstances, other businesses have elected to form a power-purchase agreement (PPA) with a third-party developer. This would theoretically enable the airport to lease the land to a developer (solar services provider), who would build, own, and maintain the solar equipment. The solar services provider could then sell the produced energy back to the airport at a set rate. **The advantage of this approach is that the solar services provider could take advantage of any tax credits not available to the City of Chandler, thus lowering the net cost of the project**, while potentially avoiding or mitigating some of the barriers mentioned below.

- Taxpayer/public approval of funding
- Utility connectivity issues and/or production arrangements
- Other airport operational constraints

Potential Solar PV Installations and Financial Costs

There are many potential options for installing solar PV at the Chandler Municipal Airport. The following sections summarize the potential solar PV installations and financial costs with the following considerations:

1. PV systems serving specific buildings
2. PV system to serve all buildings in scope
3. Inclusion of Battery Storage

All options outlined below assume that airport will enter into a power purchase agreement (PPA) with a third party developer and will not own their own system. This allows the project to take advantage of the 26% federal tax credit.

PV System to Offset Energy Usage of All Buildings

Based on the potential location for a solar PV installation, there is sufficient area to generate 100% of the airport's energy needs, plus much more, potentially. However, a solar PV system can only be attached to one meter. Given that the airport has 10+ meters, coordination with SRP would be required to install a master meter and/or consolidate the multiple meters on site.

From the utility analysis, the municipal airport consumes about 534,943 kWh per year of electrical energy. A fixed tilt, ground mount PV system would produce approximately 1,650 kWh/kW of installed capacity per year. Therefore, to offset the total energy consumption for the municipal airport, a 325 kW solar PV array would need to be installed. The following map highlights the potential location and actual size of the 325 kW ground mount solar PV array.

Figure 2: Potential Location and Size for 325 kW Solar PV Array

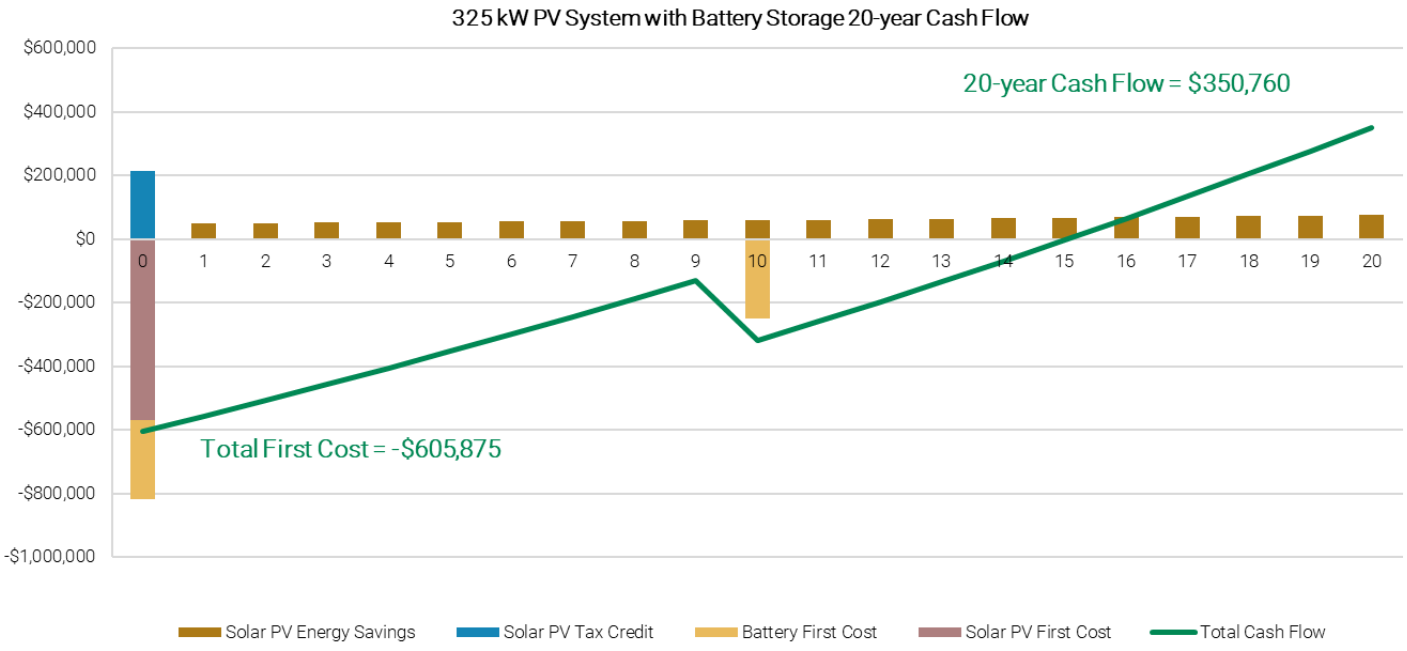
As mentioned previously, the buyback rate for excess energy generation is only a third of the retail rate, and thus, the potential for a battery storage system should be evaluated. The following table shows the financial inputs for the 325 kW ground mount solar PV system with and without a battery storage system. It is estimated that the cost of batteries is roughly $500 per kWh in addition to the cost of the PV system itself.

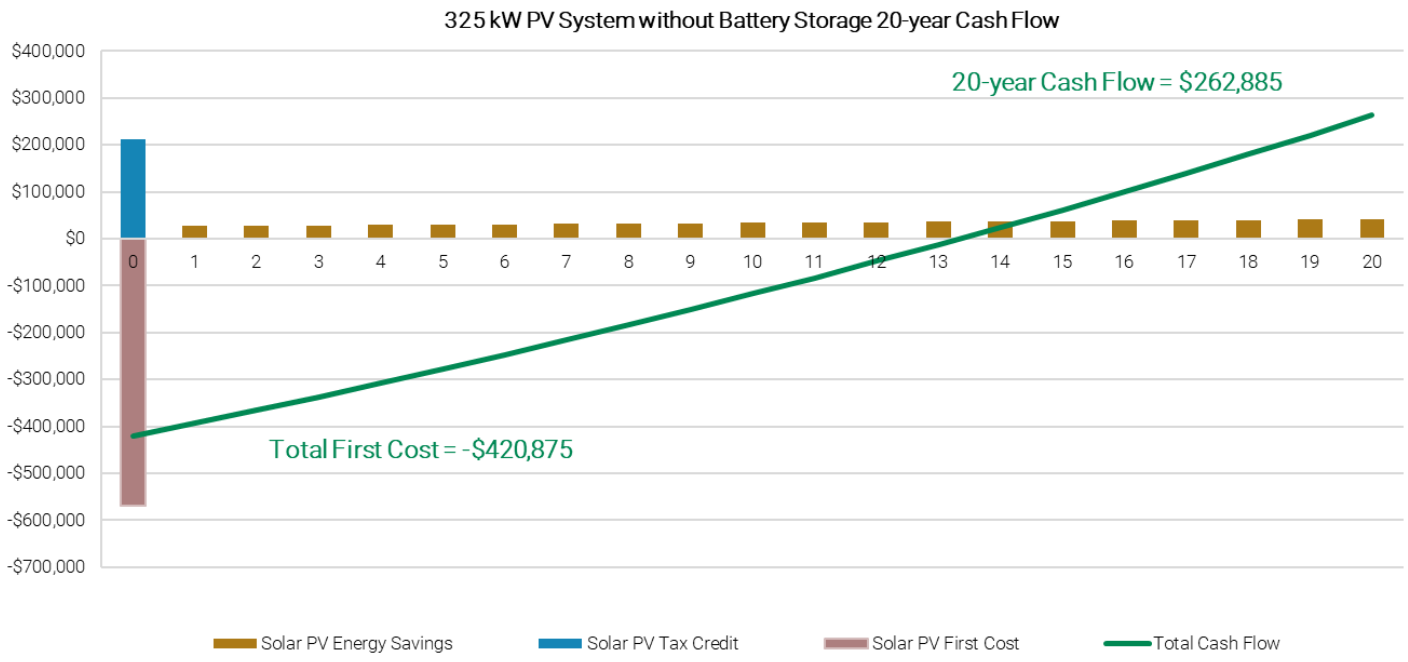
Solar PV Cost Inputs			
	w/ Battery	w/out Battery	
Solar PV First Cost	$1.75	$1.75	/Watt
Battery Storage First Cost	$500	N/A	/kWh
Federal Tax Incentive	26%	26%	-
Energy Escalation Rate	2.8%	2.8%	-
Solar PV Equipment Lifetime	20	10	years
Battery Equipment Lifetime	10	N/A	years
Solar Utility Rate	$0.09	$0.09	$/kWh
Buyback Rate	N/A	$0.03	$/kWh

The following table summarizes the financial results for both system options. As noted, both options result in a simple payback of over 13 years. The financial results are slightly more favorable to a solar PV system without batteries; however, the battery system results in a greater cash flow after 20 years.

Financial Results			
	w/ Battery	w/out Battery	
20-year NPV	$21,459	$30,319	-
Straight Line Payback	15.06	13.33	years
Year-1 ROI	8.0%	6.5%	-
IRR	4.4%	4.7%	-

The following graphs show the 20 year cash flow for the solar PV system with and without battery storage incorporating first cost, federal tax credit, solar depreciation, and cost savings.





PV System to Offset Administration Building Energy Use

If all ECMs for the administration building were to be implemented, the airport administration building would consume about **28,486 kWh per year** of electrical energy. Therefore, to offset the total energy consumption for the building, an **18 kW** solar PV array would need to be installed. At this size, it is possible to install a carport solar PV installation on the adjacent parking lot. The following map highlights the potential location and actual size of the 18 kW carport solar PV array.

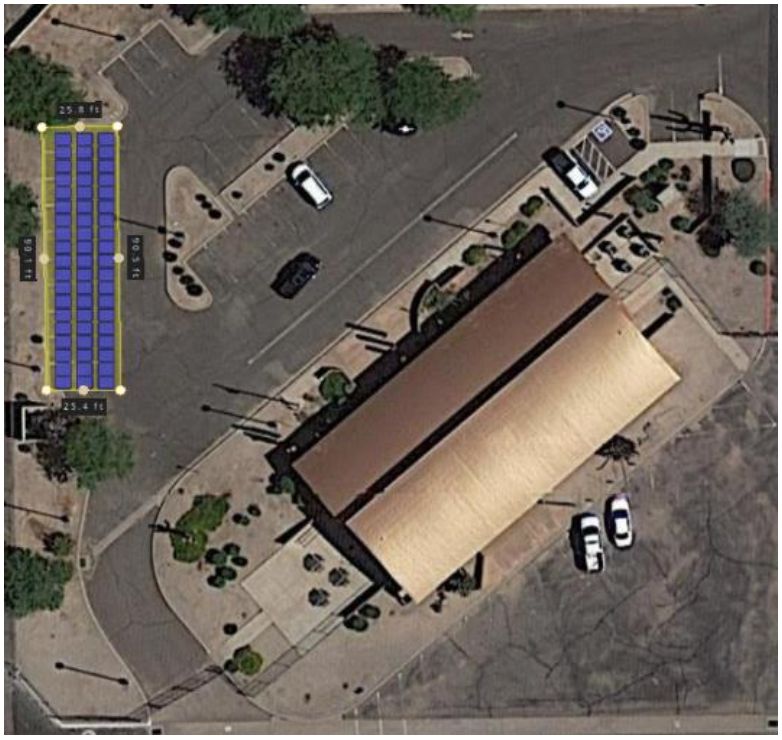


Figure 3: Potential Location and Size of 18 kW PV System

The following table shows the financial inputs for the 18 kW carport solar PV system with and without a battery storage system.

Solar PV Cost Inputs			
	w/ Battery	w/out Battery	
Solar PV First Cost	$3.00	$3.00	/Watt
Battery Storage First Cost	$500	N/A	/kWh
Federal Tax Incentive	26%	26%	-
Energy Escalation Rate	2.8%	2.8%	-
Solar PV Equipment Lifetime	20	10	years
Battery Equipment Lifetime	10	N/A	years
Solar Utility Rate	$0.09	$0.09	$/kWh
Buyback Rate	N/A	$0.03	$/kWh

The following table summarizes the financial results for both system options. As noticed, both options result in a simple payback of about **18 years**. The financial results are slightly more favorable to a solar PV system without batteries; however, the battery system results in a greater cash flow after 20 years.

Financial Results			
	w/ Battery	w/out Battery	
20-year NPV	-$10,435	-$8,311	-
Straight Line Payback	18.17	18.01	years
Year-1 ROI	6.0%	4.5%	-
IRR	1.4%	1.2%	-
20-year Cash Flow	$7,429	$4,570	-

PV System to Offset Air Traffic Control Tower Energy Use

If all ECMs for the air traffic control tower (ATCT) were to be implemented, the ATCT would consume about **57,168 kWh per year** of electrical energy. Therefore, to offset the total energy consumption for the building, a **35 kW** solar PV array would need to be installed. The following map highlights the potential location and actual size of the 35 kW solar PV array.

Figure 4: Potential Location and Size of 35 kW PV System

The following table shows the financial inputs for the 35 kW carport solar PV system with and without a battery storage system.

Solar PV Cost Inputs			
	w/ Battery	w/out Battery	
Solar PV First Cost	$2.00	$2.00	/Watt
Battery Storage First Cost	$500	N/A	/kWh
Federal Tax Incentive	26%	26%	-
Energy Escalation Rate	2.8%	2.8%	-
Solar PV Equipment Lifetime	20	20	years
Battery Equipment Lifetime	10	N/A	years
Solar Utility Rate	$0.09	$0.09	$/kWh
Buyback Rate	N/A	$0.03	$/kWh

The following table summarizes the financial results for both system options. As noticed, the system without battery storage results in a 15 year payback while the battery storage option is around a 19 year payback. This is mainly due to having to size the battery storage system larger to fully cover the large overnight loads from the IT rooms.

Financial Results			
	w/ Battery	w/out Battery	
20-year NPV	-$24,091	-$3,210	-
Straight Line Payback	19.15	14.95	years
Year-1 ROI	6.3%	5.7%	-
IRR	0.7%	3.3%	-
20-year Cash Flow	$6,805	$21,836	-

Appendix 1:
Equipment Specifications

GE
Lighting

Refit Solutions from GE

Application illustration only, subject lamps not used in photo.

Integrated LED Tubes - 2, 3 and 4 foot - Improved Lumens

Convert your existing linear fluorescent fixture to LED lighting without needing a comprehensive reinstall. LED tubes are ideal for those seeking high energy savings with minimal installation time. Each LED tube is operated by an internal GE Lightech™ driver. GE integrated LED tubes run on electronic T8 instant-start or programmed start ballasts.

FEATURES

- 2', 3' & 4' tubes
- 950 – 3,050 lumens
- >100 total system lumens per watt (LPW)
- Available in 3000K, 3500K, 4000K, and 5000K color temperatures
- 50,000-hour rated life
- Dimmable
- DLC listed (2ft. and 4ft.)
- UL and cUL listed
  – in compliance with UL 1598 certification
- Open or Enclosed Fixtures
- 5 year limited warranty

BENEFITS

- Fast and easy LED upgrade
- Low energy LFL replacement
- 66% longer life than LFL (50,000 vs. 30,000 hours)
- Better quality of light
  - no UV
  - instant on
- Shatter resistant
  - prevents breakage and downtime
- Easy disposal, non-hazardous waste

To learn more about saving money and energy, go to: **gelighting.com/ThinkLED**

When you Think LED lighting, Think GE.

ecomagination℠

imagination at work

Product Specifications

Integrated Refit LED Tubes

GE DLC Listed Code	Description	Bulb Shape	Base	Low BF Watts	Normal BF Watts	High BF Watts	Case Qty	Length (In)	Low BF Intital Lumens	Normal BF Initial Lumens	High BF Initial Lumens	Color Temp (°K)	CRI	Rated Life (L70)	DLC Listed
2ft LED Tube															
31557	LED9ET8/2/830	T8	Med Bi-Pin(G13)	8	9	13	25	24"	950	1100	1600	3000	80	50,000	Yes
26635	LED9ET8/2/835	T8	Med Bi-Pin(G13)	8	9	13	25	24"	950	1100	1600	3500	80	50,000	Yes
26648	LED9ET8/2/840	T8	Med Bi-Pin (G13)	8	9	13	25	24"	950	1100	1600	4000	80	50,000	Yes
26676	LED9ET8/2/850	T8	Med Bi-Pin(G13)	8	9	13	25	24"	950	1100	1600	5000	80	50,000	Yes
3ft LED Tube															
31554	LED12ET8/3/830	T8	Med Bi-Pin(G13)	10	12	16	25	36"	1150	1350	1800	3000	80	50,000	-
26544	LED12ET8/3/835	T8	Med Bi-Pin(G13)	10	12	16	25	36"	1200	1400	1900	3500	80	50,000	-
26625	LED12ET8/3/840	T8	Med Bi-Pin (G13)	10	12	16	25	36"	1200	1400	1900	4000	80	50,000	-
26627	LED12ET8/3/850	T8	Med Bi-Pin(G13)	10	12	16	25	36"	1250	1500	2000	5000	80	50,000	-
4ft LED Tube															
61218	LED12ET8/4/830	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1350	1550	2050	3000	80	50,000	Yes
61223	LED12ET8/4/835	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1400	1600	2150	3500	80	50,000	Yes
61271	LED12ET8/4/840	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1400	1600	2150	4000	80	50,000	Yes
61327	LED12ET8/4/850	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1500	1700	2250	5000	80	50,000	Yes
61329	LED12ET8/4/865	T8	Med Bi-Pin(G13)	10	12	15	25	48"	1400	1600	2150	6500	80	50,000	Yes
62339	LED15ET8/4/830	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1650	1850	2450	3000	80	50,000	Yes
62401	LED15ET8/4/835	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1750	1950	2600	3500	80	50,000	Yes
62402	LED15ET8/4/840	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1750	1950	2600	4000	80	50,000	Yes
62409	LED15ET8/4/850	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1800	2050	2700	5000	80	50,000	Yes
62410	LED15ET8/4/865	T8	Med Bi-Pin(G13)	13	15	21	25	48"	1750	1950	2600	6500	80	50,000	Yes
31550	LED18ET8/4/830	T8	Med Bi-Pin(G13)	15	18	23	25	48"	1950	2150	2850	3000	80	50,000	Yes
93133	LED18ET8/4/835	T8	Med Bi-Pin (G13)	15	18	23	25	48"	2050	2250	3000	3500	80	50,000	Yes
93135	LED18ET8/4/840	T8	Med Bi-Pin(G13)	15	18	23	25	48"	2050	2250	3000	4000	80	50,000	Yes
93140	LED18ET8/4/850	T8	Med Bi-Pin(G13)	15	18	23	25	48"	2100	2350	3100	5000	80	50,000	Yes

System Watts - Refit LED Tubes

Ballast Factor	LED18ET8/4/xxx Rated Lumens	LED Approx. System Watts per tube	F32T8 Approx. System Watts per lamp
L (232MAX-G-L)	2050	17	25
N (232MAX-G-N)	2250	20	28
H (232MAX-G-N	3000	27	37

Lumen and wattage numbers above are approximations that can be used for estimates only.
LED System Watts - Add 10%-12% to LED Tube wattage for driver losses.

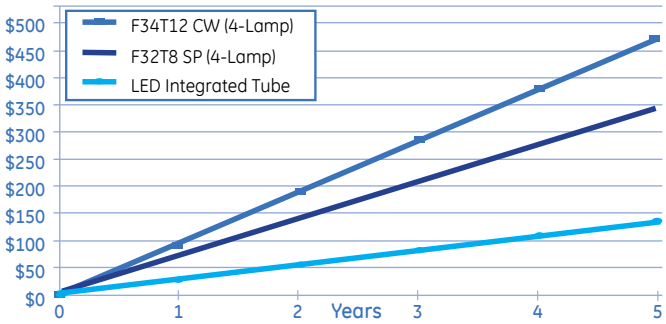
Savings Breakdown

Save 66% compared to standard T8 (4-lamp) light fixtures over a five-year period.

Provides 4400 lumens at 36W vs. 6600 lumens at 148W in a 4 lamp T12 system.

Check ballast compatibility at **www.gelighting.com/LEDTUBES-ballast-compatibility**

Cumulative Energy Costs - Cumulative Costs



Savings calculations are based on energy costs using $0.11 per kWh and 16 hours of daily operation.

ecomagination℠

Product is compliant with material restriction requirements of RoHS

www.gelighting.com

LEDL029 (Rev 5/27/16)

Series SKD

2"W Low Profile LED Surface Mount

FEATURES & SPECIFICATIONS

INTENDED USE

Full body micro silhouette makes a bold statement with a minimal design in brushed nickel powder coated finish (consult factory for other finishes). Scaled to the LED module the matte white diffuser surrounds the LEDs for soft lighting. Brushed nickel fixture can be surface mounted on wall or ceiling or pendant mounted with specially engineering cable mounting kit.

SIZE L x W x D in inches

- 22.5" or 46" or 92"L x 2"W x 2.6"D
- 22.5" or 46" or 92"L x 3"W x 3"D

MATERIALS & FEATURES

- Fully assembled housing is formed and welded, 22 gauge steel, chemically treated to resist corrosion and enhance paint adhesion
- Available in brushed nickel. Consult for other finishes
- Available with smooth frosted lens
- Clean body - No knock-outs on sides or ends
- Knock-outs on back accept standard electrical fittings (by others) Consult factory for other locations
- Dimming ballast options available (consult factory for availability and system compatibility)

MOUNTING

Surface mount or Pendant mount.
Horizontal or Vertical.

TYPICAL OPTIONS AND ACCESSORIES

Whips, hanging kits, and cord sets. See options page at the end of the T02Strip section, or contact factory for more details.

ACCESSORIES

SKD-HC301WH - 5'cable kit w/white canopy*
SKD-HC301BN - - 5'cable kit w/brushed nickel*
SKD-HC501BN - 4' Cable Mounting Kit*

*Includes canopy for cable only and a canopy for cable & power chord.

ORDERING INFORMATION

Example: **SKDFR24LE12W1200LDMV40KWH**

2FT - STANDARD

SKD | FR | 24L | E12W1200L | DMV | 40K | WH

Series
SKD Low Profile LED Surface Mount 2" Width Body

Width
24L 22.5"

Wattage and Lumen
E12W1200L 12 System Watts, 1200 Delivered Lumens

Lens
FR Frosted Smooth

Driver
DMV 0-10V Dimming *Field installed-Dimming Wire
DMVFID 0-10V Dimming *Factory installed-Dimming Wire

Color Temperture
30K 3000K
35K 3500K
40K 4000K
50K 5000K

Finish
WH White
BN Brushed Nickel
BK Black
BZ Bronze

Options
WP 6 ft. 3 wire 18 gauge whip
CS 8ft. 3/18 3 prong (5-15P) cord & plug

2FT - HIGH OUTPUT

SKD | FR | 24L | H18W1750L | DMV | 40K | WH

Series
SKD Low Profile LED Surface Mount 2" Width Body

Width
24L 24"

Wattage and Lumen
H18W1750L 18 System Watts, 1750 Delivered Lumens

Lens
FR Frosted Smooth

Driver
DMV 0-10V Dimming *Field installed-Dimming Wire
DMVFID 0-10V Dimming *Factory installed-Dimming Wire

Color Temperture
30K 3000K
35K 3500K
40K 4000K
50K 5000K

Finish
WH White
BN Brushed Nickel
BK Black
BZ Bronze

Options
WP 6 ft. 3 wire 18 gauge whip
CS 8ft. 3/18 3 prong (5-15P) cord & plug

SKD-HC301WH - 5'cable kit w/white canopy*
SKD-HC301BN - - 5'cable kit w/brushed nickel*
SKD-HC501BN - 4' Cable Mounting Kit*

*Includes canopy for cable only and a canopy for cable & power chord.

Intertek

Series SKD

3"W Low Profile LED Surface Mount

4FT - STANDARD

Example: **SKDWBMW48LE48W4800LDMV40KBN**

SKDWB | MW | 48L | E48W4800L | DMV | 40K | BN

Series
SKDWB Low Profile LED Surface Mount 3" Width Body

Size
48L 46"

Lens
MW White Lens
FR Frosted Lens

Wattage and Lumen
E32W3450L 32 System Watts, 3450 Delivered Lumens
E48W4800L 48 System Watts, 4800 Delivered Lumens
E57W5400L 57 System Watts, 5400 Delivered Lumens

Driver
DMV 0-10V Dimming *Field installed-Dimming Wire
DMVFID 0-10V Dimming *Factory installed-Dimming Wire

Color Temperture
30K 3000K
35K 3500K
40K 4000K
50K 5000K

Finish
WH White
BN Brushed Nickel
BK Black
BZ Bronze

Options
WP 6 ft. 3 wire 18 gauge whip
CS 8ft. 3/18 3 prong (5-15P) cord & plug

4FT - HIGH OUTPUT

SKDWB | MW | 48L | R72W7000L | DMV | 40K | BN

Series
SKDWB Low Profile LED Surface Mount 3" Width Body

Size
48L 46"

Lens
MW White Lens
FR Frosted Lens

Wattage and Lumen
R72W7000L 72 System Watts, 7000 Delivered Lumens

Driver
DMV 0-10V Dimming *Field installed-Dimming Wire
DMVFID 0-10V Dimming *Factory installed-Dimming Wire

Color Temperture
30K 3000K
35K 3500K
40K 4000K
50K 5000K

Finish
WH White
BN Brushed Nickel
BK Black
BZ Bronze

Options
WP 6 ft. 3 wire 18 gauge whip
CS 8ft. 3/18 3 prong (5-15P) cord & plug

8FT - STANDARD

SKDWB | MW | 96L | E114W10800L | DMV | 40K | BN

Series
SKDWB Low Profile LED Surface Mount 3" Width Body

Size
96L 92"

Lens
MW White Lens
FR Frosted Lens

Wattage and Lumen
H80W8000L 80 System Watts, 8000 Delivered Lumens
E114W10800L 114 System Watts, 10800 Delivered Lumens

Driver
DMV 0-10V Dimming *Field installed-Dimming Wire
DMVFID 0-10V Dimming *Factory installed-Dimming Wire

Color Temperture
30K 3000K
35K 3500K
40K 4000K
50K 5000K

Finish
WH White
BN Brushed Nickel
BK Black
BZ Bronze

Options
WP 6 ft. 3 wire 18 gauge whip
CS 8ft. 3/18 3 prong (5-15P) cord & plug

8FT - HIGH OUTPUT

SKDWB | MW | 96L | R144W14000L | DMV | 40K | BN

Series
SKDWB Low Profile LED Surface Mount 3" Width Body

Size
96L 92"

Lens
MW White Lens
FR Frosted Lens

Wattage and Lumen
R144W14000L 144 System Watts, 14000 Delivered Lumens

Driver
DMV 0-10V Dimming *Field installed-Dimming Wire
DMVFID 0-10V Dimming *Factory installed-Dimming Wire

Color Temperture
30K 3000K
35K 3500K
40K 4000K
50K 5000K

Finish
WH White
BN Brushed Nickel
BK Black
BZ Bronze

Options
WP 6 ft. 3 wire 18 gauge whip
CS 8ft. 3/18 3 prong (5-15P) cord & plug

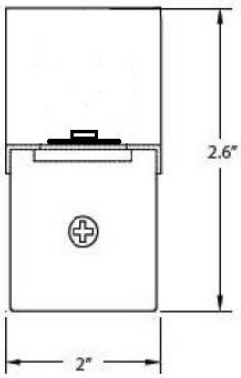
C ETL US LISTED Intertek

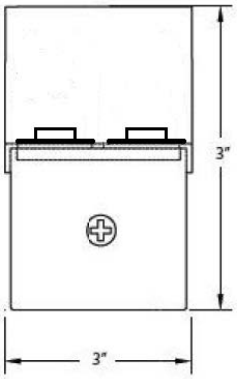
Series SKD

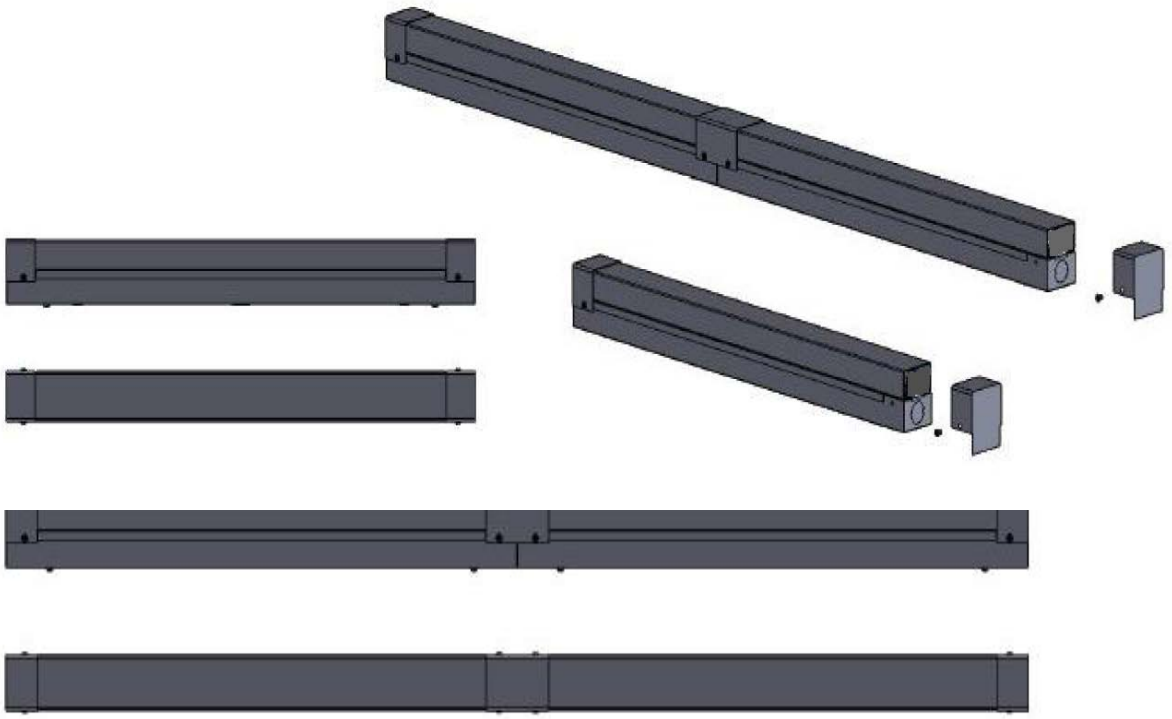
Low Profile LED Surface Mount

DIMENSIONS

All dimensions are inches.
Specifications subject to change without notice.







Intertek

9W LED Lamp Replacement

Model # B7A19A60WUL38 Store SKU #1002861726

Best Seller

EcoSmart >

60-Watt Equivalent A19 Non-Dimmable LED Light Bulb Daylight (8-Pack)

★★★★½ (3029) Write a Review Questions & Answers (22)

- Daylight color temperature provides stimulating, cool light
- Ideal for indoor/covered outdoor use and enclosed fixtures
- $62 estimated lifetime energy savings per bulb

Includes 8 bulbs ($1.35 /bulb)

$10.78

Save up to $100* on your qualifying purchase.
Apply for a Home Depot Consumer Card

Number of Bulbs Included: **8**

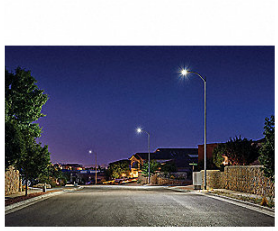
1 PACK | 4 PACK | 8 PACK

Exterior LED Parking and Street Light Fixture

ACUITY AMERICAN ELECTRIC

LED Parking Lot Light Fixture, 4000K Color Temperature, 120 to 277VAC, Arm Mount Type, 6101 lm

Item # **53XH17** Mfr. Model # **ATBS G MVOLT R3** Catalog Page # **455** UNSPSC # **39111605**



Clearance Price

$364.50 / each

~~Web Price $405.00~~

1 Add to Cart

+ Add to List |

Shipping Pickup

Expected to arrive **Mon. Jun 15.**

Ship To 80201 (Change)

Shipping Weight **14.5 lbs.**

Country of Origin **Mexico** | *Country of Origin is subject to change.*

Note: Product availability is real-time updated and adjusted continuously. The product will be reserved for you when you complete your order. More

Technical Specs

Item	Parking Lot Light Fixture	Lumens per Watt	122
Mount Type	Arm	Socket Type	None
Lumens	6101 lm	Standards	CSA
Fixture Wattage	50W	Warranty	5 yr.
Light Distribution Shape	Type III	Fixture Lumens Range	6001 lm and Greater
LED Replacement For	100 to 200W HPS/MH	Wattage Range	41 to 100W
Fixture Sensor Type	Photocell Receptacle	Fixture Rated Life	100,000 hr.
Light Technology	LED	Fixture Height	4-1/2"
Color Temperature	4000K	Fixture Length	23-3/4"
Color Rendering Index	70	Fixture Temp. Range	-40 Degrees to 40 Degrees C
Voltage	120 to 277VAC	Fixture Width	11-1/4"
Fixture Housing Color	Gray	Green Environmental Attribute	Product Contributes To Reducing Energy Consumption
Fixture Housing Material	Die-Cast Aluminum	Green Certification or Other Recognition	DesignLights Consortium (DLC)(R) Listed
Fixture Lens Material	No Lens		

ELEDLIGHTS.COM

LED Flat Corn Lights

Applications

ELEDLIGHTS' Flat Corn Light LED Retrofit Light are an easy and economical way to convert your existing fixtures to energy-saving LED lighting technology. It can easily be installed and is rotatable to get precise angle in shoebox/parking lot lights, wall packs, canopy lights, street lights and more. This flat corn light will immediately reduce power consumption by more than 65% and outperforms other retrofit kits by a wide margin.

Features

- Direct replacement for metal halide
- E39 mogul base
- Easy installation
- Advanced heat dissipation
- Internal driver
- 180° beam angle
- 5000K cold white light
- 50,000-hour operating life
- DLC, UL certified
- 5 year warranty

Specifications

	115W	54W	27W
Light Output	13,500 lumens	6,600 lumens	3,300 lumens
Luminous Efficacy	118 lm/W	122 lm/W	122 lm/W
Power Consumption	115W	54W	27W
Average Lamp Life	50,000 hours	50,000 hours	50,000 hours
Color	Cold White: 5000K	Cold White: 5000K	Cold White: 5000K
Base Type	E39 - Mogul	E39 - Mogul	E26 - Edison
CRI	73	73	73
Reflector Beam Angle	180°	180°	180°
Dimensions	11.7" x 5.4" x 3.4"	11.7" x 5.4" x 3.4"	9.6" x 4.4" x 3.1"
Housing Material	Magnesium Alloy, Aluminum Heat Sink, and PC Cover		
Housing Color	Black and Silver	Black and Silver	Black and Silver
Number of LEDs	196	112	56
Certification	DLC, UL	DLC, UL	DLC, UL
Warranty	5 Years	5 Years	5 Years

7835 Wilkerson Ct, San Diego, CA 92111 • 858.581.0597 • 1610 Republic Road, Huntingdon Valley, PA 19006 • 215.355.7200
Email: lights@eledlights.com • www.eledlights.com

Smart Thermostats

Compare

More Options Available

Best Seller **Google** Nest Learning Thermostat 3rd Gen in Stainless Steel
Model# T3007ES
★★★★★ (10639)
$249.00
Limit 5 per order

Free delivery
31 in stock at Santa Fe
Check nearby stores

Compare

More Options Available

Google Nest Thermostat E
Model# T4000ES
★★★★★ (3490)
BULK PRICE ELIGIBLE $169.00
Buy 2 or more $159.00

Free delivery
8 in stock at Santa Fe
Check nearby stores

Compare

ecobee SmartThermostat with Voice Control
Model# EB-STATE5-01
★★★★★ (470)
$249.00

Free delivery
8 in stock at Santa Fe
Check nearby stores

Compare

ecobee 3 Lite Smart Thermostat
Model# EB-STATE3LT-02
★★★★★ (2009)
$169.00
Get up to $150 in Rebates

Delivery unavailable
2 in stock at Santa Fe
Check nearby stores

Instantaneous DHW Heaters

Model # POU 6T

EcoSmart ›

6.5 kW Point of Use Electric Tankless Water Heater

★★★☆☆ (155) Write a Review Questions & Answers (7)

- Self-modulating technology
- Versatile to mount in different ways
- Intelligently control temperature from 80 to 140-degrees F

($169.00 /unit)

$169.00

Save up to $100[*] on your qualifying purchase.
Apply for a Home Depot Consumer Card

Flow Rate @ 35 F Rise (gallons/min): **1.27 gal (US)/min**

0.68 gal (US)/min | .78 gal (US)/min | 1.07 gal (US)/min | **1.27 gal (US)/min**

Controlled Power Cords and Plug-in Devices

Compare

TP-LINK 6-Outlet Wi-Fi Smart Power Strip

Model# HS300

★★★★★ (11)

$79.99

Compare

Vivitar Smart Home Wi-Fi Power Strip

Model# HA-1007-HD-DRP

★★★☆☆ (2)

$41.19

Compare

Globe Electric Wi-Fi Smart 4 ft. Cord 4-Outlet Surge Protector 2 USB Port Power Strip, No Hub Required and Voice Activated, White

Model# 50077

View the Globe Smart Home Collection

★★★★½ (9)

$37.14

Compare

WireLogic Smart Surge Strip 216,000 Amp and 3240 Joules 10-Outlet - Black

Model# WLPOWER10

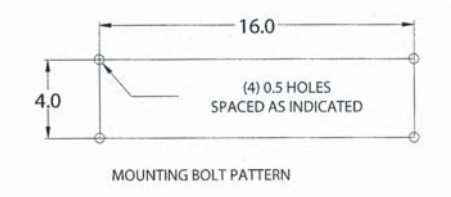
$129.99

Appendix 2:
Landing Lights Specifications

RBMI

Airport Rotating Beacon

MEDIUM INTENSITY



Compliance with Standards

FAA: L-801 AC 150/5345-12 (Current Edition)
ICAO: Annex 14, para. 5.3.3

Uses

L-801 beacons are designed primarily for night operation as identification and location markers for airports.

Features

- Patented belt-drive system eliminates the lubrication required by conventional gear-drive beacons. (U.S. Patent No. 5,339,224)
- Patented liquid-filled lamp connector eliminates the slip rings and brushes found on conventional beacons (U.S. Patent No. 5,816,678)
- Two 13,000 lumen, 150-watt pulse-start metal-halide lamps
- 12,000 hour typical lamp life (3 years)
- One clear lens and one aviation green lens
- No maintenance except lamp replacement
- All moving parts are permanently lubricated
- Impedance-protected motor eliminates burn outs
- 12 rpm rotation, 24 flashes per minute
- Lamps preset at 5° above horizontal, adjustable
- Weatherproof steel cabinet with powder-coated international orange finish
- Optional photocell and/or tell-tale relay
- Mountable on a Hali-Brite Tipdown Pole. See catalog sheet 2035 for photo and details.
- Electrical Power – The beacon operates on 120 VAC, 60 Hz or 220-240 VAC, 50/60 Hz
- Power Consumption–Class I: 395W; Class II: 795W
- Made in the USA and ETL certified by Hali-Brite, Inc., Crosby, MN

Operating Conditions

Temperature:	Class I: -22 °F to +131 °F (-30 °C to +55 °C) Class II: -67 °F to +131 °F (-55 °C to +55 °C)
Wind:	Velocities up to 100 mph (161 kph)

Ordering Code

44A4837- [ ] **1** [ ] **0**

Type
0 = Airport

Style
1 = Standard Base, Belt-Driven

Power
0 = 120 VAC, 60 Hz, without heater, Class I
1 = 220-240 VAC, 50 Hz, without heater, Class I
2 = 120 VAC, 60 Hz, with heater, Class II
3 = 220-240 VAC, 50 Hz, with heater, Class II
4 = 220-240 VAC, 60 Hz, without heater, Class I
5 = 220-240 VAC, 60 Hz, with heater, Class II

Notes
- 220-240 VAC must be single wire with neutral.
- Add tell-tale relay for monitoring (see options below).

Spare Components

Description	Part No.
Ballast Assembly 50 Hz	0200-0024
Ballast Assembly 60 Hz	0200-0023
Belt	0600-0003
Fuse, motor, 0.5 A	2300-0002
Fuse, lamp, 6.25 A	2300-0010
Lamp, 150 W pulse-start metal-halide	3400-0125
Lens, amber	2800-0025
Lens, clear	2800-0006
Lens, green	2800-0043
Lens clip	1500-0011

Optional Accessories

Description	Part No.
Tell-Tale Relay, 120 VAC	L801/802 T/T HBM 120
Tell-Tale Relay, 220/240 VAC	L801/802 T/T HBM 240
Tell-Tale Relay, 220/240 VAC, 50 Hz	L801/802 T/T 240/50
Tower Mounting Kit	4200-0000

Packaging

Cube Shipping Volume:	48 x 25 x 25 in (122 x 63.5 x 63.5 cm)
Weight:	110 lb (49.9 kg) - shipping 75 lb (34 kg) - unpackaged

ADB Airfield Solutions
Leuvensesteenweg 585
B-1930 Zaventem
Belgium

Telephone: +32 (0)2 722.17.11
www.adb-air.com

ADB Airfield Solutions, LLC
977 Gahanna Parkway
Columbus, OH 43230
USA

Telephone: +1 614.861.1304
+1 800.545.4157

Product specifications may be subject to change, and specifications listed here are not binding. Confirm current specifications at time of order.

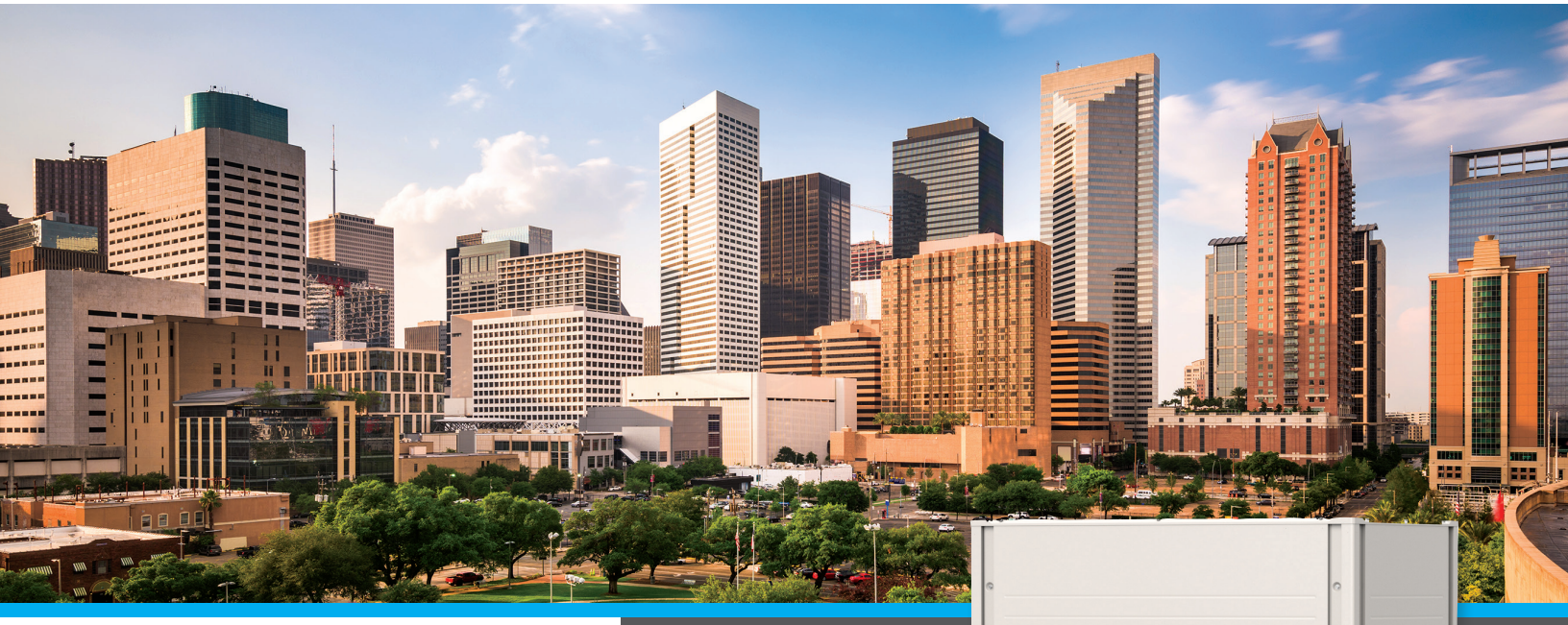
Appendix 3:
HVAC Equipment Specifications

DAIKIN
AIR INTELLIGENCE™

NEW!

VRV IV

Air-Cooled Heat Pump
RXYQ_TATJU / RXYQ_TAYDU



Commercial.
Renovation.
New construction.

Daikin's VRV IV systems integrate advanced technology to provide comfort control with high energy efficiency and reliability. VRV IV provides heating and cooling solutions for multi-family residential to large commercial applications. Daikin VRV IV is the first variable refrigerant flow (VRF) system assembled in North America.

Main features and benefits:

- Total comfort solution for heating, cooling, ventilation and controls.
- Redesigned and optimized for low total Life Cycle Cost (LCC).
- Available in large capacity single modules up to 14 tons and systems up to 34 tons allowing for a more flexible system design.
- Year-round comfort and energy efficiency delivered by combining VRV and VRT technologies.
- High energy efficiency with IEER values up to 27.3.
- Integrated inverter technology delivers high efficiency during part load conditions and provides precise individual zone control.
- Design flexibility with long piping lengths up to 3,280 ft. total, and up to 100 ft. vertical separation between indoor units.
- Corrosion resistant 1000 hr. salt-spray tested Daikin PE blue fin heat exchanger.
- Reduced commissioning time with VRV configuration software and Graphical User Interface (GUI), as compared to VRV III.
- VRV IV takes advantage of Daikin's unique zone and centralized controls that are optimized for the specific needs of North America.
- Outstanding 10-year limited parts warranty* as standard.

Additional information
Before purchasing this appliance, read important information about its estimated annual energy consumption, yearly operating cost, or energy efficiency rating that is available from your retailer.

FIND OUT MORE ABOUT DAIKIN VRV.

*Complete warranty details available from your local distributor, manufacturer's representative, www.daikincomfort.com or www.daikinac.com.

VRV IV Operations

Variable Refrigerant Temperature

Lower capacity is required to cool and heat a building during mid-season.

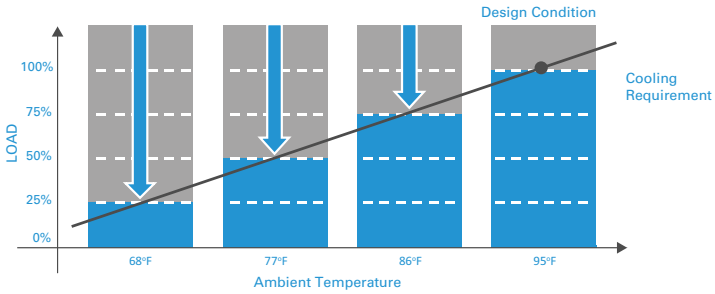
A VRV system adapts to the required changes in capacity by varying the refrigerant volume. This results in an increase in efficiency at part load operation.

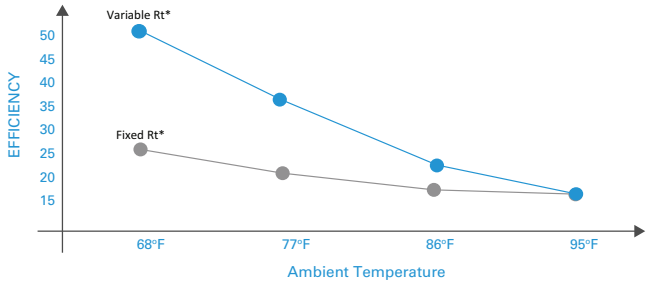
The efficiency of the VRV IV system is further increased by adjusting the refrigerant temperature depending on space load and weather conditions.

Up to 28% Improved Seasonal Cooling Efficiency vs. VRV III

VRV IV VRT Advantages

The graphs below are intended only to depict how new Daikin VRV IV efficiency is increased by using VRT.





*Data based on RXYQ96 outdoor unit only with 100% connection ratio.

Technical Data for VRV IV Heat Pump Outdoor Units

			6 Ton	8 Ton	10 Ton	12 Ton	14 Ton
Model	208-230V/3Ph/60Hz		RXYQ72TATJU	RXYQ96TATJU	RXYQ120TATJU	RXYQ144TATJU	RXYQ168TATJU
	460V/3Ph/60Hz		RXYQ72TAYDU	RXYQ96TAYDU	RXYQ120TAYDU	RXYQ144TAYDU	RXYQ168TAYDU
Performance	Rated Cooling Capacity	Btu/h	69,000	92,000	114,000	138,000	160,000
	Rated Heating Capacity	Btu/h	73,000	103,000	129,000	154,000	176,000
	Operation Range - Cooling	°F DB	10*-122	10*-122	10*-122	10*-122	10*-122
	Operation Range - Heating	°F WB	-4 - 60	-4 - 60	-4 - 60	-4 - 60	-4 - 60
	Sound Pressure	dB(A)	58	61	61	64	65
	IEER (Ducted / Non-Ducted)		20.7 / 25.9	22.5 / 27.3	22 / 25.4	22.6 / 24.8	19.8 / 22.6
	Airflow	cfm	5,544	5,827	6,286	8,228	8,228
Refrigerant Piping	Vertical Pipe Length Above	ft.	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)
	Vertical Pipe Length Below	ft.	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)
	Vertical Pipe Length Between IDU	ft.	100	100	100	100	100
	Actual Pipe Length	ft.	540	540	540	540	540
	Equivalent Pipe Length	ft.	620	620	620	620	620
	Total Pipe Length	ft.	3,280	3,280	3,280	3,280	3,280
Unit	Weight (RXYQ_TAT / RXYQ_TAY)	lbs.	435 / 451	525 / 553	528 / 556	695 / 709	
	Dimensions (H x W x D)	in.	66-11/16 x 36-11/16 x 30-3/16	66-11/16 x 48-7/8 x 30-3/16			

			16 Ton	18 Ton	20 Ton	22 Ton	24 Ton
Model	208-230V/3Ph/60Hz		RXYQ192TATJU	RXYQ216TATJU	RXYQ240TATJU	RXYQ264TATJU	RXYQ288TATJU
	460V/3Ph/60Hz		RXYQ192TAYDU	RXYQ216TAYDU	RXYQ240TAYDU	RXYQ264TAYDU	RXYQ288TAYDU
	Combination		1 x RXYQ120T 1 x RXYQ72T	1 x RXYQ120T 1 x RXYQ96T	2 x RXYQ120T	1 x RXYQ144T 1 x RXYQ120T	2 x RXYQ144T
Performance	Rated Cooling Capacity	Btu/h	184,000	206,000	228,000	250,000	274,000
	Rated Heating Capacity	Btu/h	206,000	230,000	256,000	282,000	308,000
	Operation Range - Cooling	°F DB	23-122	23-122	23-122	23-122	23-122
	Operation Range - Heating	°F WB	-4 - 60	-4 - 60	-4 - 60	-4 - 60	-4 - 60
	Sound Pressure	dB(A)	63	64	64	66	67
	IEER (Ducted/Non-Ducted)		21.2 / 22.2	21.1 / 20.5	20.9 / 20.8	19.6 / 20.3	19.6 / 20.1
	Airflow	cfm	5,544 + 6,286	5,827 + 6,286	6,286 + 6,286	6,286 + 8,228	8,228 + 8,228
Refrigerant Piping	Vertical Pipe Length Above	ft.	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)
	Vertical Pipe Length Below	ft.	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)
	Vertical Pipe Length Between IDU	ft.	100	100	100	100	100
	Actual Pipe Length	ft.	540	540	540	540	540
	Equivalent Pipe Length	ft.	620	620	620	620	620
	Total Pipe Length	ft.	3,280	3,280	3,280	3,280	3,280
Unit	Weight (RXYQ_TAT / RXYQ_TAY)	lbs.	435 + 528 / 451 + 556	525 + 528 / 553 + 556	528 + 528 / 556 + 556	528 + 695 / 556 + 709	695 + 695 / 709 + 709
	Dimensions (H x W x D)	in.	(66-11/16 x 48-7/8 x 30-3/16) + (66-11/16 x 36-11/16 x 30-3/16)	(66-11/16 x 48-7/8 x 30-3/16) x 2			

			26 Ton	28 Ton	30 Ton	32 Ton	34 Ton
Model	208-230V/3Ph/60Hz		RXYQ312TATJU	RXYQ336TATJU	RXYQ360TATJU	RXYQ384TATJU	RXYQ408TATJU
	460V/3Ph/60Hz		RXYQ312TAYDU	RXYQ336TAYDU	RXYQ360TAYDU	RXYQ384TAYDU	RXYQ408TAYDU
	Combination		1 x RXYQ168T 1 x RXYQ144T	2 x RXYQ168T	3 x RXYQ120T	1 x RXYQ168T 1 x RXYQ120T 1 x RXYQ96T	1 x RXYQ168T 1 x RXYQ144T 1 x RXYQ96T
Performance	Rated Cooling Capacity	Btu/h	296,000	312,000	334,000	352,000	372,000
	Rated Heating Capacity	Btu/h	334,000	344,000	372,000	400,000	435,000
	Operation Range - Cooling	°F DB	23-122	23-122	23-122	23-122	23-122
	Operation Range - Heating	°F WB	-4 - 60	-4 - 60	-4 - 60	-4 - 60	-4 - 60
	Sound Pressure	dB(A)	68	68	66	68	68
	IEER (Ducted/Non-Ducted)		18.8 / 19.9	18.5 / 20.6	18.5 / 19.4	18.5 / 21.1	19.0 / 21.1
	Airflow	cfm	8,228 + 8,228	8,228 + 8,228	6,286 + 6,286 + 6,286	5,827 + 6,286 + 8,228	6,286 + 6,286 + 8,228
Refrigerant Piping	Vertical Pipe Length Above	ft.	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)	164 (295 w/outdoor setting)
	Vertical Pipe Length Below	ft.	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295 w/outdoor setting)	130 (295/w/outdoor setting)	130 (295 w/outdoor setting)
	Vertical Pipe Length Between IDU	ft.	100	100	100	100	100
	Actual Pipe Length	ft.	540	540	540	540	540
	Equivalent Pipe Length	ft.	620	620	620	620	620
	Total Pipe Length	ft.	3,280	3,280	3,280	3,280	3,280
Unit	Weight (RXYQ_TAT / RXYQ_TAY)	lbs.	695 + 695 / 709 +709	695 + 695 / 709 +709	528 + 528 + 528 / 525 +528 + 695	525 + 528 + 695 / 553 + 556 + 709	525 + 695 + 695 / 553 + 709 + 709
	Dimensions (H x W x D)	in.	(66-11/16 x 48-7/8 x 30-3/16) x 2		(66-11/16 x 48-7/8 x 30-3/16) x 3		

For all equipment installation and application limitations please refer to the specific Engineering Data Books. * Application rules apply.