Energy Efficiency and Renewable Energy Site Assessment

LCCC
Low Carbon Communities in the Caribbean

Low Carbon Communities in the Caribbean Project

Mega J's Supermarket
St. Lucia

December 10, 2010

Organization of American States

CARILEC
An Association Of Electric Utilities

NREL
NATIONAL RENEWABLE ENERGY LABORATORY

CSEP
Caribbean Sustainable Energy Program

acp-eu energy facility

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EXECUTIVE SUMMARY

The following report summarizes the results from an energy efficiency and renewable energy assessment of a Mega J's supermarket in St. Lucia. A team led by the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL) and comprised of energy assessment workshop trainees conducted the site assessment. During the site visit, the assessment team identified 11 energy conservation measures and one renewable energy measure.

The Mega J super market is a single story warehouse with a gross square footage of 50,000 ft^2 (4,645 m^2). The super market specializes in selling dry goods and currently sells over 5,000 items ranging from refrigerated groceries to household merchandise. In addition to the main super market the facility also has a snack bar, an Island Bakery, a Digital Photo processing office, and a Lens Express.

The super market is open from 9:00 am to 9:00 pm Monday – Saturday and 9:00 am to 6:00 pm on Sundays, and Holidays. The HVAC system provides conditioned air to the facility through a series of eight packaged air conditioning units. The packaged units are located on the south side of the facility and discharge conditioned air through flexible supply ducts located above the warehouse storage racks. The system is currently operated by a series of wall mounted relays. In addition to the packaged AC units, a number of refrigeration units are used to cool the refrigerated display cases.

The overhead lighting consists of 250 Watt metal halide lamps and magnetic ballasts. In addition to the metal halide light fixtures, the facility utilizes a mixture of 40 Watt T-12 and 32 Watt T8 lamps to provide task level illumination for the dry display cases. All of the refrigerated display cases currently utilize 58 Watt eight foot T8 lamps and electronic ballasts.

Electricity is the only utility provided to facility. During the site assessment monthly utility data was provided for the months of January through June. Based on the fact that the utility data had little variance over this six month period, the utility data for the next six months was assumed to be same as the previous six months.

In 2009 the facility consumed 1,196,066 kWh of electricity at a total cost of $390,796. The current overall blended electric rate is $0.327/kWh. This high electric rate puts precedence on reducing electricity use as it will significantly reduce the overall utility bills for the facility.

Table 1 summarizes the energy savings by conservation measure. The table provides an annotated list of measures, estimated economic impact, and implementation cost per energy conservation measure.

Table 1 - Energy Conservation Measures Summary

Energy Conservation Measure	Electricity Savings (kWh)	Total Cost Savings ($/yr)	Implementation Costs ($)	Simple Payback Period (yrs)
Retrofit the T-12 Lighting Systems with T8 Lamps and Electronic Ballasts	8,400	$2,747	$2,663	0.97
Replace the 250 Watt Metal Halide Light Fixtures with High Bay T8 Light Fixtures	89,276	$29,193	$35,739	1.22
Retrofit the T-8 Lighting Systems in the Refrigerated Display Cases with LED Fixtures and Occupancy Sensor Controls	16,570	$5,418	$7,000	1.29
Install a 100 kW Roof Mounted Photovoltaic System	139,640	$45,662	$550,000	12.04
Total Savings	***245,486***	***$80,274***	***$592,739***	***7.38***

The walkthrough assessment focused on lighting opportunities, and if all of the interior lighting opportunities were implemented the site would reduce its overall energy use by 10%. These lighting measures would require an initial investment of $37,359 and reduce the sites electric bills by $45,402 per year.

Additional energy could be saved through the implementation of a roof mounted photovoltaic system and the HVAC measures described in the body of the report.

BACKGROUND

The Low-Carbon Communities in the Caribbean (LCCC) initiative is a collaboration between the US Department of Energy and the Organization of the Americas States under the Energy and Climate Change Partnership of the Americas (ECPA). The ECPA was announced during the 5th Summit of the Americas held in April 2009 in Port-of-Spain, Trinidad and Tobago, where thirty-four heads of state gathered to discuss energy development challenges in the Western Hemisphere.

The objective of the ECPA initiative is to enable participating countries to implement actions and strategies geared towards increasing the sustainability of their energy supplies while reducing carbon emissions from the energy sector through the development and use of renewable energy and energy efficiency systems.

The Organization of American States in partnership with U.S. Department of Energy's National Renewable Energy Laboratory (NREL) and the Caribbean Association of Electric Utilities (CARILEC) conducted a four-day, regional energy-auditing workshop at the Coco-Palm Resort in Rodney Bay St. Lucia from August 24 to 27, 2010. The Energy Auditing workshop co-funded by the OAS's Caribbean Sustainable Energy Program provided fundamental knowledge to strengthen the capacity to carry out energy audits and recommend efficiency measures for public, commercial, and hotel buildings. The workshop explored all major aspects of energy use, energy systems and technologies, energy conservation measures, energy auditing methodology, and hands-on building energy assessments involving on-site data collection and energy modeling tools.

The twenty-nine attendees included government officials, members of CARILEC, as well as representatives of the education, and tourism sectors from Antigua and Barbuda, the Bahamas, Barbados, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia and Saint Vincent and the Grenadines and other Caribbean nations.

CLIMATE DATA

The Mega J super market is located about 10 minutes away from the Rodney Bay Marina in St. Lucia. The single story warehouse has an elevation of 48 ft and a latitude and longitude of 14.02°N, and 60.58°W, respectively. The climate in St. Lucia can be characterized as a tropical climate, similar to all of the surrounding Caribbean islands. The hot and humid conditions are partially tempered by sea breezes and prevailing northeastern trade winds. Since hourly weather data wasn't available for St. Lucia, historic weather data from Harry S Truman airport in the Virgin Islands was analyzed (Table 2). The average temperature and relative humidity remain fairly constant from season to season and the average wind speed is relatively high throughout the year.

Table 2 – Virgin Islands Monthly Weather Summary

Charlotte Amalie Harry S Truman, Virgin Islands												
Elevation: 19 ft				Latitude: 18.35 N				Longitude 64.97 W				
Average Temperature												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
°F	77	78	78	79	81	82	82	85	84	83	80	77
Dew-point Temperature												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
°F	66	69	68	68	72	72	72	73	73	73	75	67
Relative Humidity												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
%	70	75	71	70	75	72	72	67	70	71	85	72
Wind Speed												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
mph	9	11	12	13	10	13	10	11	10	9	9	12
Average Ground Temperature												
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
°F	83	83	82	82	80	79	78	78	78	79	80	81

The hourly weather data was analyzed on a psychometric chart in an attempt to characterize the number of hours the outside air conditions are within the thermal comfort range defined by ASHRAE Standard 55 (the plots were created in the Climate Master tool referenced below).[i] There are only 155 hours (out of 8,760 hours per year) that the outside air conditions are within the acceptable comfort range. Thus, all of the remaining hours of the year, the outside air conditions are above the comfort range and air conditioning is needed to maintain a comfortable interior environment.

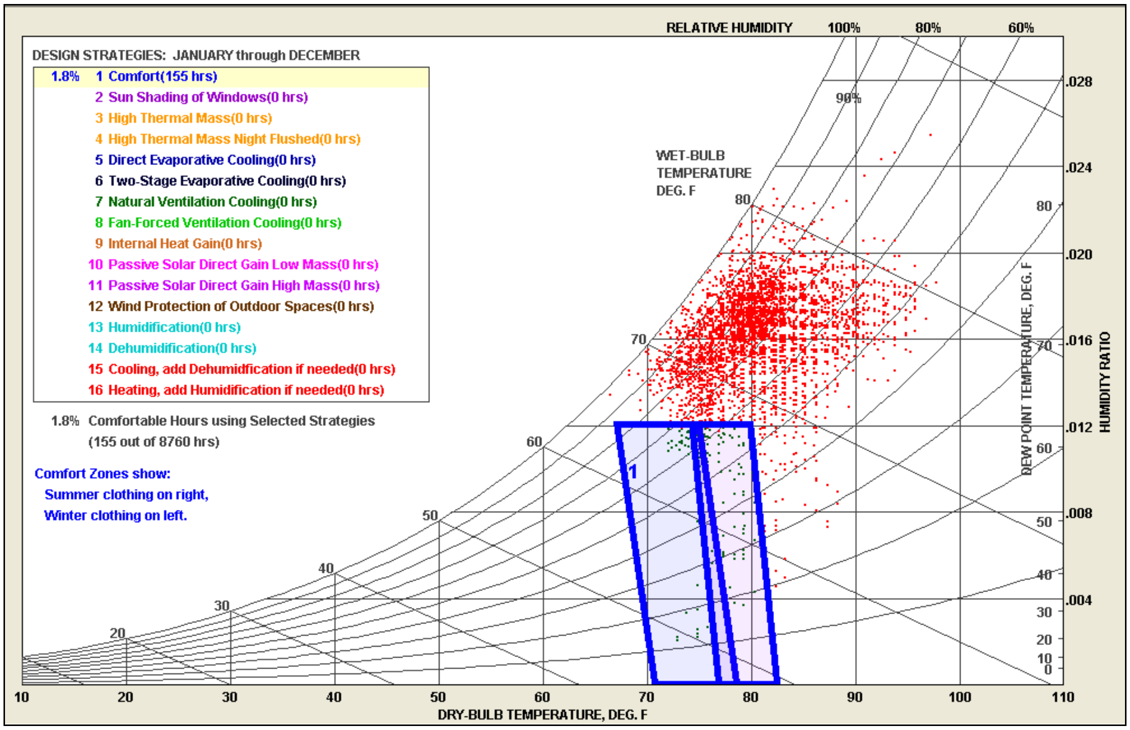

Figure 1 - Virgin Islands Psychometric Chart

The outdoor air temperature ranges from 74 °F to 92.6 °F (about 23 to 33 °C). Thus, the outside air temperature only varies over 18.6 °F temperature difference over the course of the year.

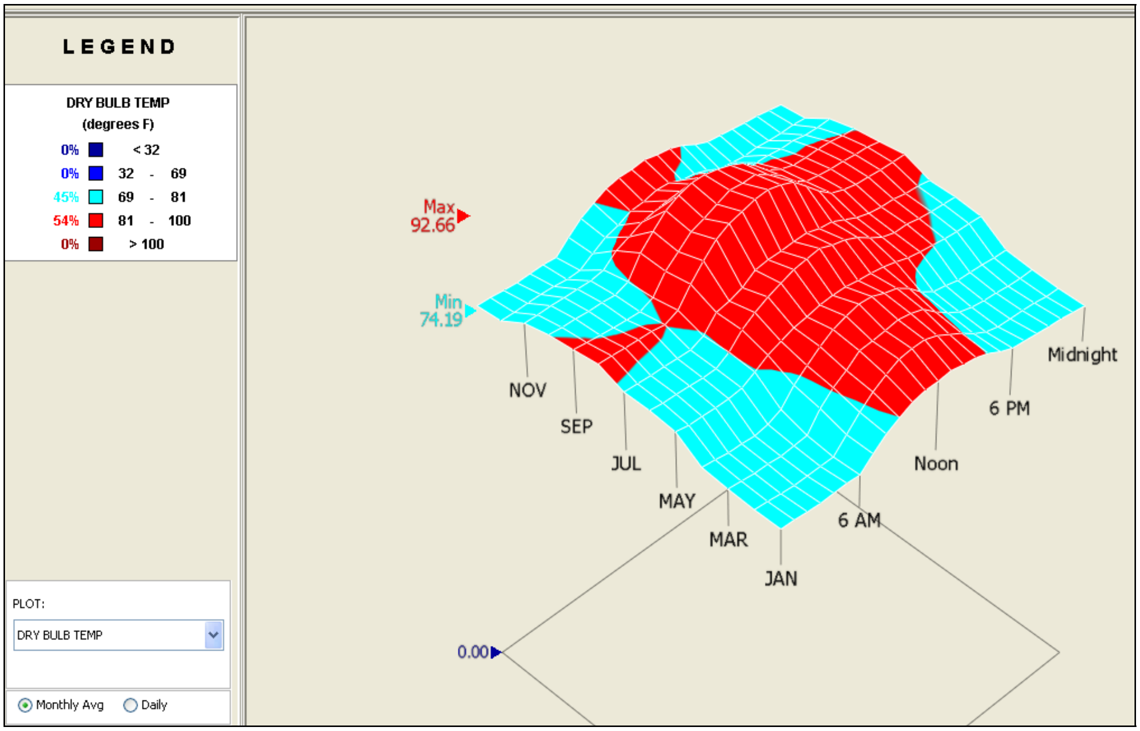

Figure 2 - Virgin Islands Dry bulb Temperature Contour Plot

ENERGY USE AND UTILITY RATE DATA

Electricity is the only utility provided to facility. During the site assessment monthly utility data was provided for the months of January to June. Based on the fact that the utility data had little variance over this six month period, the utility data for the next six months was assumed to be same as the previous six months.

In 2009 the facility consumed 1,196,066 kWh of electricity at a total cost of $390,796. The current overall blended electric rate is $0.327/kWh. This high electric rate puts precedence on reducing electricity use as it will significantly reduce the overall utility bills for the facility. See table 3 for an overview of the monthly electricity usage and costs.

Table 3 - Monthly Electricity Usage and Cost

Units	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Oct	Nov	Dec
kWh	103,514	106,119	112,876	107,981	110,176	114,734	110,176	107,981	112,876	106,119	103,514
$EC	$87,676	$94,128	$97,976	$95,158	$99,158	$102,343	$99,158	$95,158	$97,976	$94,128	$87,676
$US	$32,615	$35,015	$36,447	$35,399	$36,887	$38,071	$36,887	$35,399	$36,447	$35,015	$32,615
$EC/kWh	$0.85	$0.89	$0.87	$0.88	$0.90	$0.89	$0.90	$0.88	$0.87	$0.89	$0.85
$US/kWh	$0.32	$0.33	$0.32	$0.33	$0.33	$0.33	$0.33	$0.33	$0.32	$0.33	$0.32

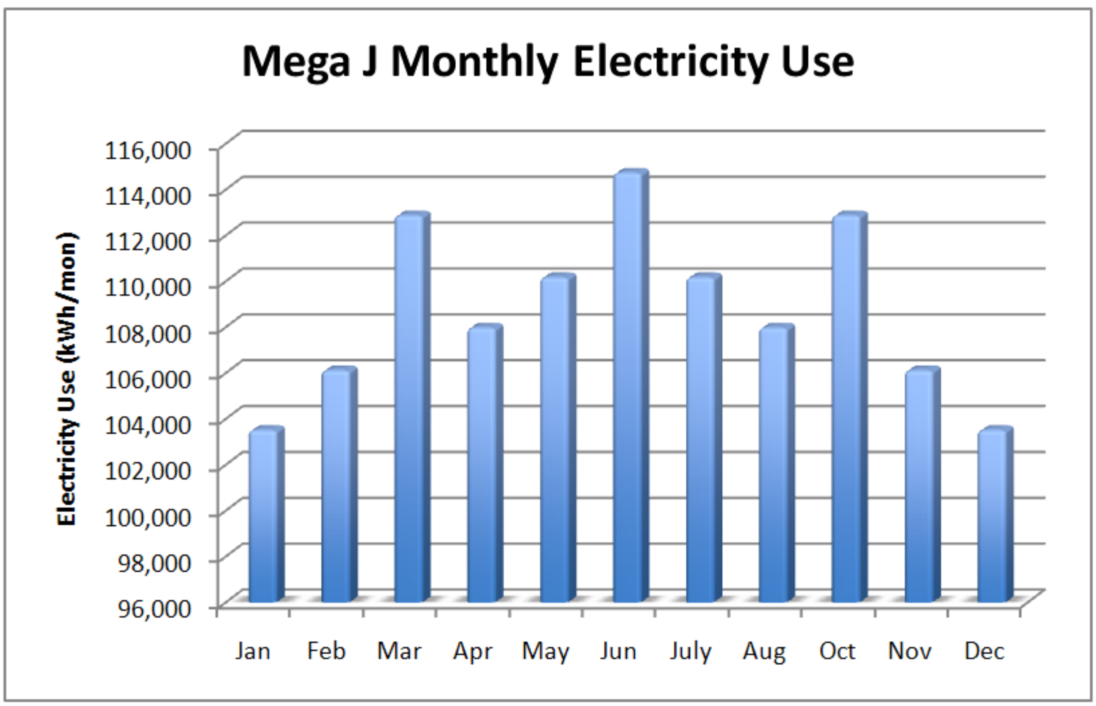

Figure 3 - Monthly Electricity Use

BUILDING OVERVIEW

The Mega J super market is a single story warehouse with a gross square footage of 50,000 ft^2 (4,645 m^2). The super market specializes in selling dry goods and currently sells over 5,000 items ranging from refrigerated groceries to household merchandise. In addition to the main super market the facility also has a snack bar, an Island Bakery, a Digital Photo processing office, and a Lens Express.

Occupancy

The occupancy rate varies throughout the day. The super market is open during the following hours:

Monday – Saturday

- 9:00 am to 9:00 pm

Sunday and Holidays

- 9:00 am to 6:00 pm

Heating, Ventilating, and Air conditioning (HVAC)

The HVAC system consists of eight packaged air conditioning units. The packaged units are located on the south side of the facility and discharge conditioned air through a series of flexible supply air ducts that run above the warehouse storage racks. The system is currently operated by a series of wall mounted relays. The air conditioning system utilizes air cooled direct expansion cooling units and constant volume air handling units.

In addition to the general space air conditioning units the facility also uses a number of refrigeration units to cool the refrigerated display cases.

Lighting

The overhead lighting consists of 250 Watt metal halide lamps and magnetic ballasts. In addition to the metal halide light fixtures, the facility utilizes a mixture of 40 Watt T-12 and 32 Watt T8 lamps to provide task level illumination for the dry display cases. All of the refrigerated display cases currently utilize 58 Watt eight foot T8 lamps and electronic ballasts.

ENERGY CONSERVATION MEASURES

1. Lighting Systems

The primary overhead lighting systems in the Mega J supermarket are 250 Watt high intensity discharge (HID) lamps with magnetic ballasts. The assessment team recorded illuminance levels within the recommended range provided by the Illumination Engineering Society (IES). Table 4 shows the appropriate lighting levels for various activities and the corresponding lighting power density (LPD) requirements of ASHRAE 90.1:[1]

Table 4 - IES Recommended Light Levels

IESNA Recommended Horizontal Illuminances and ASHRAE/IESNA 90.1 LPD Recommendations		
Space Type	**Illuminance (fc)[2]**	**LPD (W/ft²)**
Open Offices	30 to 50 (5 to 10 with task lighting)	1.1
Private Offices	50	1.1
Conference Rooms	30	1.3
Corridors	5	0.5
Restrooms	10	0.9
Lobby	10	1.3
Copy Rooms	10	
Classrooms	30	1.4
Gymnasiums	100	1.1
Dining Areas	10	0.9
Kitchen	50	1.2
Labs	50	1.4
Libraries	30	1.2 (reading area), 1.7 (stacks)
VDT Areas	3	
Museums (display areas)	30	1
General Warehousing/Storage	10	0.8
Inactive Storage	5	0.3
General Manufacturing	30	1.2 (low bay), 1.7 (high bay)
Residences (General)	5	
Parking Areas (uncovered)	0.2	0.15

[1] Light Levels, http://tristate.apogee.net/lite/bblevel.asp

[2] Foot Candles (fc) is a non-SI unit of illuminance or light intensity widely used in photography, film, television, conservation lighting, and the lighting industry. The unit is defined as the amount of illumination the inside surface of a 1-foot radius sphere would be receiving if there were a uniform point source of one candela in the exact center of the sphere (this unit is commonly used in the U.S.).

For more specific information on lighting retrofits and savings, the site should consider purchasing the ISNEA *Advanced Lighting* Guidelines[ii]. For more information on exterior lighting guidelines, refer to the IES *Recommended Lighting Levels for Exterior Lighting*[iii].

1.1. Recommendation: Retrofit the T-12 Lighting Systems with T8 Lamps and Electronic Ballasts

Current Condition: The warehouse currently utilizes linear fluorescent lighting to illuminate the dry display cases. The lamps and ballasts were a mixture of 40 Watt T12 lamps with magnetic ballasts and 32 Watt T8 lamps with electronic ballasts. The magnetic ballasts that drive the 40 Watt T12 lamps have a ballast factor[3] of 1.275 and result in a total wattage per lamp of 51 watts. The fixtures are on from 6:00 am to 10:00 pm Monday – Saturday and 7:00 am to 6:00 pm on Sunday.

Recommended Action: Replace all of the T12 lamps and magnetic ballasts with T8 lamps and electronic ballasts. The site should install 32 Watt T8 lamps and program start ballasts with a ballast factor of 0.80, resulting in a fixture wattage per lamp of 25.6 Watts. Thus, the new lamp/ballast combination will reduce the connected lighting load by 50.2%.

Electricity Savings:	*8,400 kWh/yr*
Cost Savings:	*$2,746.9/yr*
Implementation Costs	*$2,662.5*
Simple Payback	*0.97 years*

Assumptions:

The energy savings were calculated using the total fixture wattages specified above. It was assumed that 30 fixtures with two 40 Watt T12 lamps need to be replaced with two 32 Watt T8 lamps and a single electronic ballast. The total material costs were estimated as $30/ballast and $5/lamp with a total labor cost of 0.75 hrs/fixture x $65/hr. Installed cost data can be taken from RSMeans cost estimation books[4] or equipment costs can be taken from local suppliers or from Grainger[5]. Energy savings were calculated with the Low Bay Lighting Worksheet provided as a part of the training. The cooling energy savings were removed to provide a consistent analysis framework with the high bay lighting measures. See for further details Annex 1.

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[3] The Ballast Factor is defined as the light output (in lumens) with a test ballast, compared to the light output with a laboratory reference ballast that operates the lamp at its specified nominal power rating, see references list for more information.

[4] Source: http://rsmeans.reedconstructiondata.com/

[5] Source: http://www.grainger.com/Grainger/wwg/start.shtml

1.2. Recommendation: Replace the 250 Watt Metal Halide Fixtures with High Bay T8 Fixtures

Current Condition: The open warehouse space is currently illuminated with ninety nine 250 Watt metal halide, high intensity discharge lamps. The total fixture wattage including the ballast factor for the magnetic ballast is 295 Watts and the total connected lighting load for the facility is 29.2 kW. Fifty seven lighting fixtures are on from 6:00 am to 10:00 pm Monday – Saturday and 7:00 am to 6:00 pm on Sunday. Forty two fixtures are on 24 hours a day, seven days a week for security purposes.

Recommended Action: Replace each fixture with a 4 lamp, 32 Watt T8 lamp and high bay lighting fixture. The ballast factor for the new lamp is typically set to 1.15 in an attempt to match the current illuminance levels. The total fixture wattage for the new fixtures is estimated as 147 Watts, representing a 50% reduction in energy use.

Electricity Savings:	*89,276 kWh/yr*
Cost Savings:	*$29,193/yr*
Implementation Costs	*$35,739*
Simple Payback	*1.22 years*

Assumptions:
The energy savings were calculated separately for the fixtures that are on 24 hours a day and the fixtures that are turned on and off based on the occupancy schedule of the facility. The total economics were then calculated by adding the total energy savings, cost savings, and installed costs. The total material costs of each fixture was estimated as $165/fixture plus a total labor cost of 3 hrs/fixture x $65/hr for a total installed cost of $360 per fixture. It was assumed that a four lamp T8 fixture with 32 Watt lamps and a ballast factor of 1.15 were installed. Energy savings were calculated with the High Bay Lighting Worksheet provided as a part of the training. See Annex 2 for more details.

1.3. Recommendation: Retrofit T-8 Lighting In Refrigerated Display Cases with LED Fixtures and Occupancy Sensor Controls

Current Condition: The refrigerated display cases currently utilize 54 Watt 8 ft lamps. The fixtures are on from 6:00 am to 10:00 pm Monday – Saturday and 7:00 am to 6:00 pm on Sunday. The current lighting system uses twice as much energy as the current state of the art LED fixtures. In addition to the increased lighting energy, the current lighting system increases the amount of waste heat that has to be removed from the refrigerated display cases.

Recommended Action: Replace the current T8 lighting fixtures with LED fixtures and occupancy sensor based controls. The new controls will dim the LED fixtures when no occupants are present. A representative retrofit of similar display cases is provided in the following image.[iv]

Figure 4 - Side-by-Side Fluorescent (left) to LED (right) Comparison

Electricity Savings:	*16,570 kWh/yr*
Cost Savings:	*$5,418.4/yr*
Implementation Costs	*$7,000*
Simple Payback	*1.29 years*

Assumptions:
The energy savings were calculated assuming five, five door display cases were retrofit with LED fixtures and occupancy sensor based controls. The energy savings include lighting energy savings and refrigerated display case savings. The total installed costs were estimated as $1,400 per five door display case, based on experience with similar projects.

1.4. Additional Recommendations:

Install Roof Mounted Skylights

- The site should consider installing skylights in conjunction with the T8 lighting retrofit. The skylight to floor area should be set to 5%. This would eliminate the need for electric lighting when the ambient daylight is sufficient. The site would need to consider the building insurance implications associated with implementing this measure.

Install Occupancy Sensors and Re-Zone Interior Lighting Circuits

- Almost ½ of the 250 Watt lighting fixtures are operational 24 hrs a day seven days a week for security purposes. The site should consider re-zoning the interior lighting systems such that additional fixtures can be turned off at night.

In addition, the site should consider installing occupancy sensors on a subset of the security lights so that they will turn off at night.

2. HVAC Systems

Energy savings and economics were not calculated for any of the HVAC measures based on the fact that the assessment team focused on analyzing the lighting systems at this facility and didn't have time to collect the data required to characterize the HVAC system energy use.

2.1. Recommendation: Install Programmable Thermostats to Control the Packaged Air Conditioning Units

Current Condition: The packaged air conditioning units are currently turned on and off through a series of wall mounted relays. The facility manager is responsible for turning the units on before the store opens and off after the store closes each afternoon. If the facility manger forgets to turn the units off they will operate throughout the night.

Recommended Action: Install two wall mounted programmable thermostats. Four packaged units should be tied into a single programmable thermostat in order to prevent the possibility of multiple units being programmed with conflicting schedules and set points. The thermostats shall be commercial units with a minimum of 7 day scheduling capability. The thermostats shall have the ability to turn the units on and off based on time and internal zone temperatures. The thermostats should also have an adjustable dead-band (differential where the thermostat remains neutral – not cooling) and be easy to program.

Calculations: Energy savings can be calculated in eQUEST with the following inputs:

- Cooling system capacity (tons of cooling)
- Cooling system efficiency (EER)
- Packaged unit supply fan horsepower (hp) and efficiency (%)
- Current Operational schedule and set point temperature

The energy savings can then be calculating through a change in the operational schedule and night time set back temperature. The installed costs can be estimated as the cost to install two programmable thermostats and the time it takes to install thermostats.

2.2. Recommendation: Install High Efficiency Packaged Units

Current Condition: The current packaged air conditioning units are standard efficiency units with an estimated EER of 8. The cooling systems operate continuously during occupied hours to cool the facility.

Recommended Action: Investigate the possibility of installing a higher efficiency packaged unit. The unit should have a minimum EER rating of 13, and utilize a variable speed supply fan.

Calculations: Energy savings can be calculated in eQUEST with the following inputs:

- Cooling system capacity (tons of cooling)
- Cooling system efficiency (EER)
- Packaged unit schedule or thermostat schedule
- New cooling system efficiency (EER)
- New cooling system supply fan with variable frequency drive

The energy savings can then be calculating through the savings in cooling system efficiency and supply fan energy savings. If the current system has an EER of 8 and the new system has an EER of 13, the new units will reduce cooling system energy use by 38.5% and significantly reduce the monthly utility bills.

2.3. Recommendation: Retrofit All Refrigerated Display Cases to Enclosed Cases

Current Condition: There are a number of open display cases that discharge conditioned air to the general warehouse space. This type of set up is analogous to leaving the refrigerator door open during store hours and wastes a significant amount of cooling energy.

Recommended Action: Replace the open display cases with enclosed display cases.

Calculations: Energy savings can be calculated in eQUEST with the following inputs:

- Refrigerated Display case capacity (tons of cooling)
- Display case efficiency (EER)
- Open display case capacity (Btu/hr)
- New display case cover R value

The energy savings can then be calculating through the heat loss savings associated with installing a cover over the display cases.

2.4. Recommendation: Install a Heat Recovery System on all of the Refrigerated Display Cases

Current Condition: The current refrigerated display cases utilize an air cooled condenser to discharge waste heat from the display cases.

Recommended Action: Replace the existing refrigeration system with a high efficiency refrigeration system that utilizes a series of heat exchangers to capture waste heat off the condenser to heat the domestic hot water. The new units should have a minimum EER rating of 13, and an appropriately sized heat recovery system.

RENEWABLE ENERGY MEASURES

1.1 Recommendation: Install a Roof Mounted Photovoltaic System

Photovoltaics are semiconductor devices that convert sunlight directly into electricity. They do so without any moving parts and without generating any noise or pollution. They must be mounted in an unshaded location; rooftops, carports and ground-mounted arrays are common mounting locations.

Under full sun, each square meter of PV area produces about 100 Watt of direct current (DC) electricity, though this efficiency depends on the type of collector, the tilt, and azimuth of the collector, the ambient temperature, and the level of sunlight. An inverter is required to convert the DC to alternating current (AC) of the desired voltage compatible with building and utility power systems. The balance of the system consists of conductors/conduit, switches, disconnects, and fuses. Grid-connected PV systems feed power into the facility's electrical system and do not include batteries. Figure 5 shows the major components of a grid-connected PV system and illustrates how these components are interconnected.

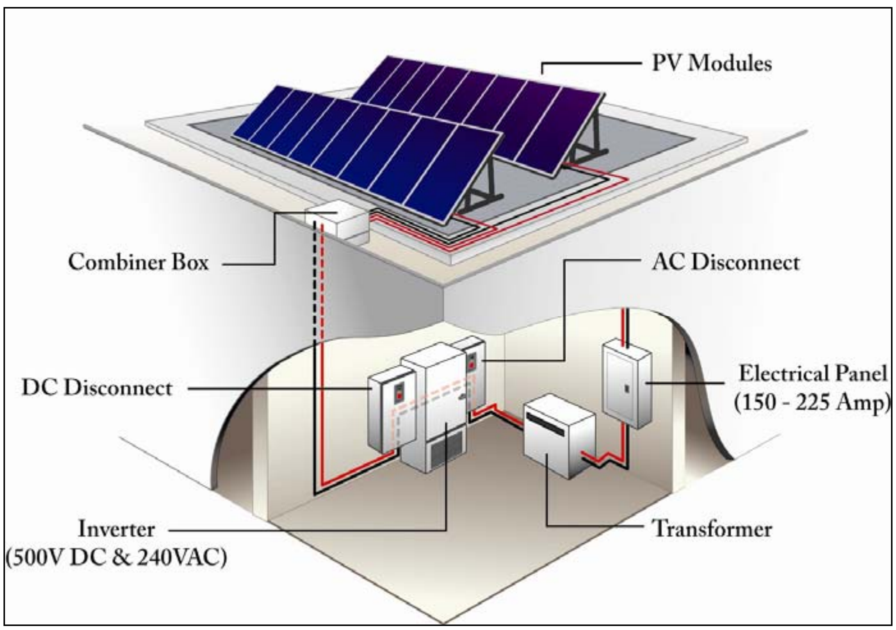

Figure 5 - Depiction of Major Components of Grid Connected Photovoltaic System

Recommended Action: Install a roof-mounted PV system. The roof mounted PV system should be sized based on the available roof area. The area suggested for rooftop PV totals approximately 50,500 ft^2. The rooftop areas designated for PV installations are flat, have excellent solar exposure, and have few existing obstructions. Assuming 75% of the available roof area can be utilized for a rooftop solar PV system and a power density of 8 Watts/ft^2, a 295 kW PV system could be installed (Figure 6). Although the roof could support a 295 kW PV system, a 100 kW

PV system is recommended based on the significant capital costs required to pay for the investment.

Figure 6 - Roof Mounted PV System

The total electricity production, installed costs and simple payback are provided below for a 100 kW PV system:

Electricity Savings:	*139,640 kWh/yr*
Cost Savings:	*$45,662/yr*
Implementation Costs	*$550,000*
Simple Payback	*12 years*

Assumptions:
Energy savings were calculated with using PV watts with the following assumptions (http://rredc.nrel.gov/solar/calculators/PVWATTS/version1/):

- Weather file San Juan Puerto Rico
- System size 100 kW
- DC to AC derate 0.77
- Tilt 15 deg
- Azimuth 165 deg
- Installed Cost $5,500/DC-kW
- Electric Cost $0.327/kWh

REFERENCES

[i] Climate Consultant 5, http://www.energy-design-tools.aud.ucla.edu/

[ii] Illumination Engineering Society, Lighting Handbook https://www.iesna.org/shop/

[iii] http://www.darksky.org/resources/information-sheets/is077.html

[iv] LED Freezer Case Lighting Demonstration, http://www1.eere.energy.gov/buildings/ssl/gatewaydemos_results.html

Annex 1

e-Quest Data Output: Retrofit the T-12 Lighting Systems with T8 Lamps and Electronic Ballasts

		On-Peak	Off-Peak	
Lighting Demand Reduction	kW	0.00	1.52	
Current Lighting Energy Use	kWh/yr	0.00	16,866.72	
Proposed Lighting Energy Use	kWh/yr	0.00	8,466.43	
Total Lighting Energy Savings	kWh/yr	0.00	8,400.29	8,400.29
Cooling Energy Savings	kWh/yr	0.00	3,545.62	2,746.89
Heating Energy Increase	Therms/yr	0.00	0.75	2,662.50
Total Electric Energy Savings	kWh/yr	11,945.91		0.97
Total Electricity Cost Savings	$/yr	3,906.31		
Total Peak Demand Cost Savings	$/yr	0.00		
Total Heating Cost Increase	$/yr	0.00		
Total Cost Savings	$/yr	3,906.31		
Total Implementation Costs	$	2,662.50		
Simple Payback	yrs	0.68		
Discounted Payback	yrs	0.70		
Net Present Value	$	48,286.72		
Savings to Investment Ratio	-	18.14		

Annex 2

e-Quest Data Output: Replace the 250 Watt Metal Halide Fixtures with High Bay T8 Fixtures

		On-Peak	Off-Peak	
Demand Reduction	kW	0.00	8.42	
Current Energy Use	kWh/yr	0.00	69,950.40	
Proposed Energy Use	kWh/yr	0.00	34,904.06	
Total Energy Savings	kWh/yr	0.00	35,046.34	
Total Energy Savings	kWh/yr	35,046.34		89,275.93
Total Electricity Cost Savings	$/yr	11,460.15		29,193.23
Total Peak Demand Cost Savings	$/yr	0.00		35,739.00

Total Cost Savings	$/yr	11,460.15	1.22
Total Implementation Costs	$	20,577.00	
Simple Payback	yrs	1.80	
Discounted Payback	yrs	1.87	
Net Present Value	$	121,084.25	
Savings to Investment Ratio	-	6.88	