EECBG
AUDIT REPORT

Maryland Energy ADMINISTRATION
Powering Maryland's Future

February 7, 2011

Mr. Michael Jackson
1 Municipal Place
Mount Rainier, MD 20712
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Dear Mr. Jackson:

On behalf of the Maryland Energy Administration's (MEA) EmPOWER Energy Efficiency and Conservation Block Grant (EECBG) program, MEA Technical Assistance Team member Khepra Energy Group has performed a desk audit showing preliminary energy savings and financial analysis of energy efficiency improvements for the City of Mount Rainier.

This *Audit Report* presents summary information regarding your proposed EECBG project. Please feel free to use this information in submitting your project for MEA approval.

PROJECT DESCRIPTION & ADDRESS

1. **City Hall**
    a. Recommended Energy Efficiency/Conservation Measures (EECMs) from information supplied by sub-grantee
        i. Compact Fluorescent Lighting Upgrade
            1. Many of the recessed lighting fixtures are using incandescent lighting. Wattages range from 75 to 150W. Installing compact fluorescent (CFL) lighting, while more costly initially, would reduce the fixture wattage by as much as 75% and still provide the same light output. All incandescent lighting should be replaced with CFLs as follows:
                - 79 - 20W CFL replacements
                - 14 - 42W CFL replacement
        ii. Motion Sensors in Private Offices
            1. Current lighting controls consist of a wall switches. Installing motion sensors in the three main private offices (two on the first floor, one on the second floor) would eliminate the possibility that occupants would leave the light on while being away from their office longer than expected. Ceiling mounted sensors would ensure total office coverage to avoid false shutoffs and would reduce energy consumption.
        iii. HVAC Upgrade
            1. One of the outdoor HVAC units was recently replaced due to vandalism and damage. The remaining HVAC unit is nearing the end of its useful life and should also be replaced. The new HVAC unit should have a cooling EER of 10.6 and heating COP of 3.2.
        iv. High Efficiency Domestic Hot Water Heater

1. The current hot water heater is slightly oversized for the usage patterns of the building. The unit is also slightly less than five years past its expected lifetime. The domestic hot water heater should be replaced with a new, more efficient natural gas model. It is suggested that the model have a maximum capacity of 40 gallons and a minimum energy factor compliant with Energy Star requirements.

b. Project Address
Mount Rainier City Hall
1 Municipal Place
Mount Rainier, MD 20712

2. Library

a. Recommended EECMs from information supplied by sub-grantee
i. High Efficiency T8 Lighting Upgrade
1. The current lighting consists of 14 inefficient 8-foot, 4-lamp T12 fixtures. These fixtures should be removed and replaced with (14) 4-lamp T8 fluorescent fixtures with high efficiency, low-power ballasts. The T8 lamps should be Super T8 type, a lamp that while more costly initially provides more lumens per Watt than a traditional T8 lamp and therefore provides a normal light output when paired with a low-power ballast.
ii. 2.5 kW Solar Photovoltaic (PV) Array
1. The Library has a sufficiently large roof area that should be utilized for a small solar PV array. The rear half of the building gives a clear southern exposure free from obstructions such as buildings or tall trees.

b. Project Location
Mount Rainier Library
3409 Rhode Island Avenue
Mount Rainier, MD 20712

3. Terminal Snack Bar

a. Recommended EECMs from information supplied by sub-grantee
i. High Efficiency Heat Pump in Restaurant Area
1. The current heating and cooling system is old and outdated. The dining area is heated using a natural gas unit heater. The unit heater has a stock efficiency and is over 20 years old. It has reached the end of its useful life. The cooling system is a 12 year old, 4-ton, 10 SEER unit. The system should be replaced with an Energy Star or equivalent DOE approved efficiency standard rated unit. This upgrade may allow for the elimination of a unit heater in the dining area and provide significant additional energy savings.
ii. High Efficiency Furnace in Chamber Room
1. The Chamber Room is heated with a 1986 Carrier furnace with a stock efficiency of 77%. The furnace is operating beyond its useful life and should be replaced with a new, high efficiency furnace unit with a DOE/Energy Star compliant efficiency rating.

b. Project Location
Terminal Snack Bar
3405 Rhode Island Avenue
Mount Rainier, MD 20712

4. Police Station

a. Recommended EECMs from information supplied by sub-grantee

i. None
   1. HVAC equipment access was limited at the Police Station. No calculations were performed and no measures recommended due to this lack of information.

b. Project Location
   Mt. Rainier Police Department
   3249 Rhode Island Avenue
   Mount Rainier, MD 20712

BASELINE ANALYSIS

1. Energy Consumption

Electric utility bills were provided for City Hall and the Police Station. The utility bills provided a historical baseline usage of one year of data. Utility bills were not provided for the Terminal Snack Bar or for the Library. Baseline usage was not determined for these buildings. Natural gas bills were not provided for any of the buildings.

Figure 1: Electrical Utility Profile – City Hall

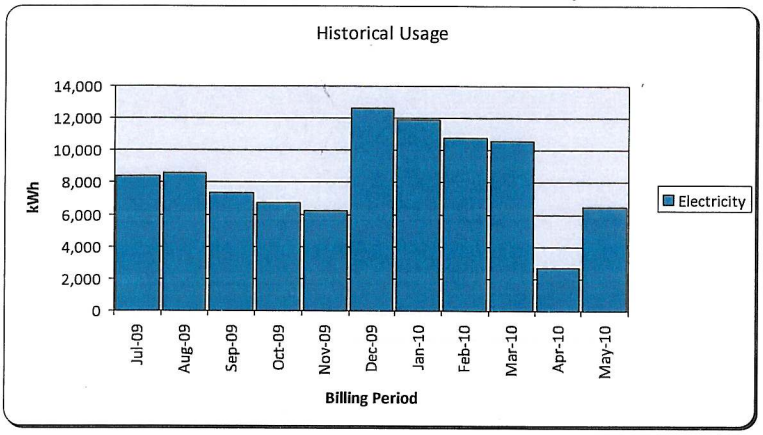
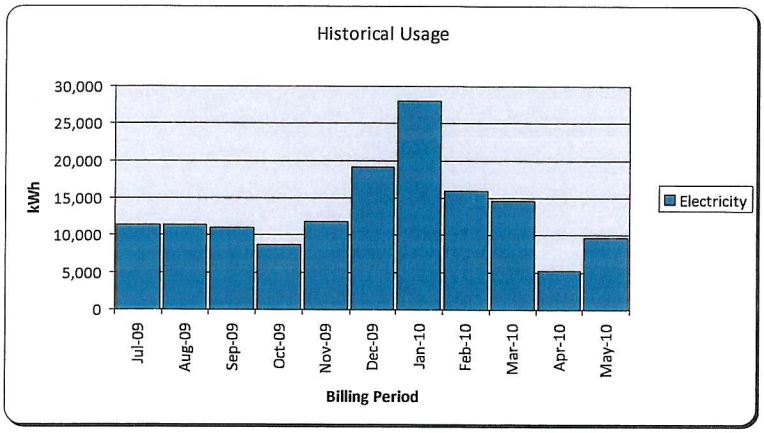


Figure 2: Electrical Utility Profile – Police Station



The following tables summarize the projected savings.

Table 1: Historical Baseline Data and Projected Savings – City Hall Lighting EECM's

Existing Incandescent Lighting	
Schedule 1 - Wattage (W)	75
Schedule 1 - Count	71
Schedule 1 - Annual Usage (hrs)	520
Schedule 1 - Annual Usage (kWh)	2769
Schedule 2 - Wattage (W)	75
Schedule 2 - Count	2
Schedule 2 - Annual Usage (hrs)	2080
Schedule 2 - Annual Usage (kWh)	312
Schedule 3 - Wattage (W)	75
Schedule 3 - Count	3
Schedule 3 - Annual Usage (hrs)	6968
Schedule 3 - Annual Usage (kWh)	1568
Schedule 4 - Wattage (W)	75
Schedule 4 - Count	3
Schedule 4 - Annual Usage (hrs)	8760
Schedule 4 - Annual Usage (kWh)	1971
Schedule 5 - Wattage (W)	150
Schedule 5 - Count	14
Schedule 5 - Annual Usage (hrs)	520
Schedule 5 - Annual Usage (kWh)	1092
Total Annual Usage (kWh)	7712
Energy Rate ($ per kWh)	$0.1155
Total Annual Energy Cost ($)	$890.71

Replacement CFL Lighting	
Schedule 1 - Wattage (W)	20
Schedule 1 - Count	71
Schedule 1 - Annual Usage (hrs)	520
Schedule 1 - Annual Usage (kWh)	738
Schedule 2 - Wattage (W)	20
Schedule 2 - Count	2
Schedule 2 - Annual Usage (hrs)	2080
Schedule 2 - Annual Usage (kWh)	83
Schedule 3 - Wattage (W)	20
Schedule 3 - Count	3
Schedule 3 - Annual Usage (hrs)	6968
Schedule 3 - Annual Usage (kWh)	418
Schedule 4 - Wattage (W)	20
Schedule 4 - Count	3
Schedule 4 - Annual Usage (hrs)	8760
Schedule 4 - Annual Usage (kWh)	526
Schedule 5 - Wattage (W)	42
Schedule 5 - Count	14
Schedule 5 - Annual Usage (hrs)	520
Schedule 5 - Annual Usage (kWh)	306
Total Annual Usage (kWh)	2071

Energy Rate ($ per kWh)	$0.1155
Total Annual Energy Cost ($)	$239.21

Estimated Savings - Replacement Lighting

Energy Consumption Savings (kWh)	5641
Annual Savings ($)	$651.51
System Cost ($)	$930.00
Payback	1.43
Useful Life (years)	5.00

Estimated Savings - Lighting Sensor

Schedule 1 - Annual Usage (kWh)	738
Schedule 2 - Annual Usage (kWh)	83
Schedule 3 - Annual Usage (kWh)	418
Total Unsensored Usage (kWh)	1240
Estimated Sensor Usage Reduction (%)	30.00%
Energy Consumption Savings (kWh)	372
Energy Rate ($ per kWh)	$0.1155
Annual Savings ($)	$42.95
System Cost ($)	$540.00
Payback	12.57
Useful Life (years)	15.00

Table 2: Historical Baseline Data and Projected Savings – City Hall HVAC EECM's

Existing HVAC System

Cooling Capacity - Btu/h	182000
Heating Capacity - Btu/h	137500
Total Annual Usage - Cooling (full load hrs)	1080
Total Annual Usage - Heating (full load hrs)	720
Cooling Energy Usage - Btu	196560000
Heating Energy Usage - Btu	99000000
Cooling Energy Usage - kWh	57608
Heating Energy Usage - kWh	29015
Total Energy Usage - kWh	86624
EER	8.1
COP	2.1

Replacement HVAC System

Cooling Capacity - Btu/h	182000
Heating Capacity - Btu/h	137500
EER	10.9
COP	3.25
Estimated Annual Usage - Cooling Btu	146067523
Estimated Annual Usage - Heating Btu	63969231
Estimated Annual Usage - Cooling kWh	42810
Estimated Annual Usage - Heating kWh	18748
Total Estimated Energy Usage - kWh	61558

Estimated Savings - HVAC System

Energy Consumption Savings (kWh)	25065
Energy Rate ($ per kWh)	$0.1155
Annual Savings ($)	$2,895.06

System Cost	$15,500.00
Payback (years)	5.35
Useful Life (years)	20.00

Existing Water Heater

Annual Usage per System (kWh)	3970
Units	1
Total Annual Usage (kWh)	3970
Energy Rate ($ per kWh)	$0.1200
Annual Energy Cost for Electricity ($)	$476.40

Replacement Water Heater

Annual Usage per System (therms)	191
Units	1
Total Annual Usage (therms)	191
Energy Rate ($ per therm)	$1.16
Annual Energy Cost for Electricity ($)	$221.56

Estimated Savings - Replacement Water Heater

Energy Consumption Savings (kWh)	3970
Energy Consumption Savings (therms)	-191
Annual Savings ($)	$254.84
System Cost ($)	$790.00
Payback	3.10
Useful Life (years)	10+

The estimated cost and benefits for the water heater are based on DOE's water heater calculator available at: http://www1.eere.energy.gov/femp/technologies/eep_waterheaters_calc.html#output and shown in the tables below.

Figure 3: Existing Water Heater

Energy Cost Calculator for Electric and Gas Water Heaters

Vary equipment size, energy cost, hours of operation, and /or efficiency level.

INPUT SECTION

Input the following data (if any parameter is missing, calculator will set to default value).		Defaults
Type of Water Heater	Electric	Electric
Average Daily Usage (gallons per day)*	50 gallons	64*
Energy Factor†	.86	0.92 (electric) 0.61 (gas)
Energy Cost	$ .12 / kWh	$0.06 per kWh $.60 per therm
Quantity of Water Heaters to be Purchased	1 unit(s)	1 unit

* See assumptions for various daily water use totals.
† The comparison assumes a storage tank water heater as the input type. To allow demand water heaters as the comparison type, users can specify an input EF of up to 0.85; however, 0.66 is currently the best available EF for storage water heaters.

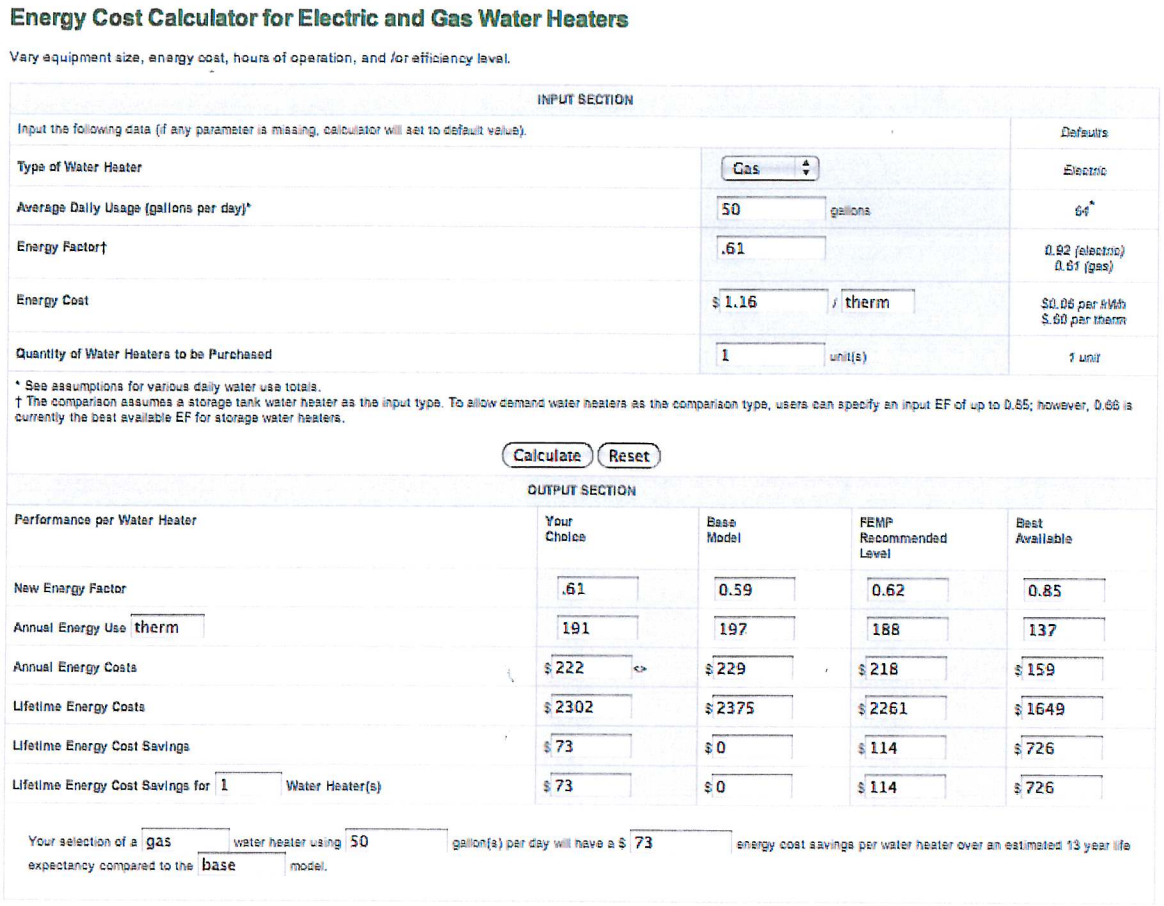
Calculate Reset

OUTPUT SECTION

Performance per Water Heater	Your Choice	Base Model	FEMP Recommended Level	Best Available
New Energy Factor	.86	0.86	0.92	0.95
Annual Energy Use kWh	3970	3970	3711	3594
Annual Energy Costs	$ 476	$ 476	$ 445	$ 431
Lifetime Energy Costs	$ 4622	$ 4622	$ 4321	$ 4185
Lifetime Energy Cost Savings	$ 0	$ 0	$ 301	$ 437
Lifetime Energy Cost Savings for 1 Water Heater(s)	$ 0	$ 0	$ 301	$ 437

Your selection of a electric water heater using 50 gallon(s) per day will have a $ 0 energy cost savings per water heater over an estimated 13 year life expectancy compared to the base model.

Figure 4: Replacement Water Heater



Energy Cost Calculator for Electric and Gas Water Heaters

Vary equipment size, energy cost, hours of operation, and /or efficiency level.

INPUT SECTION

Input the following data (if any parameter is missing, calculator will set to default value).		Defaults
Type of Water Heater	Gas	Electric
Average Daily Usage (gallons per day)*	50 gallons	64*
Energy Factor†	.61	0.92 (electric) 0.61 (gas)
Energy Cost	$ 1.16 / therm	$0.06 per kWh $.60 per therm
Quantity of Water Heaters to be Purchased	1 unit(s)	1 unit

* See assumptions for various daily water use totals.
† The comparison assumes a storage tank water heater as the input type. To allow demand water heaters as the comparison type, users can specify an input EF of up to 0.85; however, 0.66 is currently the best available EF for storage water heaters.

Calculate Reset

OUTPUT SECTION

Performance per Water Heater	Your Choice	Base Model	FEMP Recommended Level	Best Available
New Energy Factor	.61	0.59	0.62	0.85
Annual Energy Use therm	191	197	188	137
Annual Energy Costs	$ 222	$ 229	$ 218	$ 159
Lifetime Energy Costs	$ 2302	$ 2375	$ 2261	$ 1649
Lifetime Energy Cost Savings	$ 73	$ 0	$ 114	$ 726
Lifetime Energy Cost Savings for 1 Water Heater(s)	$ 73	$ 0	$ 114	$ 726

Your selection of a gas water heater using 50 gallon(s) per day will have a $ 73 energy cost savings per water heater over an estimated 13 year life expectancy compared to the base model.

Table 3: Historical Baseline Data and Projected Savings – Library EECM's

<u>Exisiting T12 Lighting</u>	
4-Lamp 60W T12 - Wattage per Fixture (W)	246
4-Lamp 60W T12 - Count	14
4-Lamp 60W T12 - Annual Hrs	3744
4-Lamp 60W T12 - Total Annual Usage (kWh)	12894
Energy Rate ($ per kWh)	$0.1155
Total Annual Energy Cost ($)	$1,489.30
<u>Replacement T8 Lighting</u>	
4-Lamp 28W T12 - Wattage per Fixture (W)	96
4-Lamp 28W T12 - Count	14
4-Lamp 28W T12 - Annual Hrs	3744
4-Lamp 28W T12 - Total Annual Usage (kWh)	5032
Energy Rate ($ per kWh)	$0.1155
Total Annual Energy Cost ($)	$581.19

Estimated Savings - Replacement Lighting	
Energy Consumption Savings (kWh)	9150
Annual Savings ($)	$908.11
System Cost ($)	$3,340.00
Payback	3.68
Useful Life (years)	5.00

Library Photovoltaic EECM

Install a 2.5 kW roof-mounted structure solar photovoltaic (PV) system at the Mt. Rainier Library. The system shall consist of high efficiency solar modules, inverters, mounting hardware with balance of system components and proper ties to grid and the building's electric service. The system will produce approximately 3015kWh per year and will offset the annual electrical consumption at the Mt. Rainer Library. The resulting energy savings from the system at $0.1155 per kWh is $348.23 per year. The system will provide shelter for approximately 250 Sqft of roof area that provides the best southern sun exposure.

The estimated performance of the photovoltaic (PV) system is based on calculations provided by the National Renewable Energy Laboratory (NREL) PVWATTS (version 2) software-based solar calculator, and is summarized in the two following data tables. These performance estimates represent typical PV system performance for the operating environment described but will vary from final installed performance results depending on:

- Design variables such as panel specifications,
- Installed orientation,
- Avoiding site shading conditions;
- Proper installation and commissioning; and
- Proper monitoring and operations/maintenance support.

PVWATTS – Data Table 1

Station Identification	
Cell ID:	0263376
State:	Maryland
Latitude:	38.8 ° N
Longitude:	76.9 ° W
PV System Specifications	
DC Rating:	2.50 kW
DC to AC Derate Factor:	0.770
AC Rating:	1.92 kW
Array Type:	Fixed Tilt
Array Tilt:	38.8 °
Array Azimuth:	180.0 °
Energy Specifications	
Cost of Electricity:	11.6 ¢/kWh

PVWATTS – Data Table 2

Results			
Month	Solar Radiation (kWh/m^2/day)	AC Energy (kWh)	Energy Value ($)
1	3.41	206	23.79
2	3.94	213	24.60
3	5.10	296	34.19
4	5.26	284	32.80
5	5.35	286	33.03
6	5.49	281	32.46
7	5.32	278	32.11
8	5.21	275	31.76
9	5.02	262	30.26
10	4.60	258	29.80
11	3.43	190	21.95
12	3.21	186	21.48
Year	4.61	3015	348.23

The estimated cost of the proposed PV system is summarized in the cost-savings table below. In general, fixed-tilt, roof-mounted PV system costs range from $7 to $9 per watt for a complete, installed, and commissioned system. This audit will assume a mid-price point at $8 per watt or $20,000 for proposed system. Energy produced via renewable systems such as solar PV is eligible for marketable Solar Renewable Energy Credit (SREC) certificates based on actual annual kilowatt-hours of energy generated. SREC's have a current market value typically ranging from $250 to $400 per 1000 kWh (or per 1.0 MWh) of annual production.

The PVWATTS conservatively estimates the PV system will produce approximately 3015kWh annually or approximately 3.015 SREC's per year. The energy production would typically offset the annual utility cost by $750 to $1,200 depending on actual energy production and SREC market values. For the purpose of this audit the assumed per SREC and total annual SREC values for produced electricity are $250 per MWh per year and $754 per year respectively.

Table 4: Projected Savings – Library PV EECM

Photovoltaic (PV) System	
Estimated Size (kW)	2.50
Estimated PV System Cost per kW ($ per W)	$7.25
Estimated Commissioning Cost per kW ($ per W)	$0.75
Total Estimated Cost per kW ($ per W)	$8.00
Total Estimated Installed Cost	$20,000.00
Estimated Annual Electrical Production (kWh)	3015.00
Electrical Utility Rate ($ per kWh)	$0.1155
Annual Value of Electricity Produced ($)	348.23
Annual Number of SREC's (MWh per yr)	3.0150
Value of REC's per MWh ($ per Mwh per yr)	$250.00
Annual Value of REC's ($)	$753.75
Total Annual Economic Benefit ($)	$1,101.98
Payback Period (Yrs)	18.15
Expected Life (Yrs)	25.00

Table 5: Historical Baseline Data and Projected Savings – Terminal Snack Bar HVAC EECM's

Existing HVAC System	
Cooling Capacity (Btu/h)	46000
Heating Capacity (Btu/h)	135000
Total Annual Usage - Cooling (full load hrs)	1080
Total Annual Usage - Heating (full load hrs)	720
Cooling Energy Usage (Btu)	49680000
Heating Energy Usage (Btu)	97200000
Cooling Energy Usage (kWh)	14560
Heating Energy Usage (therms)	972
SEER	10.0
HSPF	6.0
Replacement HVAC System	
Cooling Capacity (Btu/h)	46000
Heating Capacity (Btu/h)	135000
SEER	14.0
HSPF	8.2
Estimated Annual Usage - Cooling Btu	35485714
Estimated Annual Usage - Heating Btu	71121951
Estimated Annual Usage - Cooling kWh	10400
Estimated Annual Usage - Heating therms	711
Estimated Savings - HVAC System	
Energy Consumption Savings (kWh)	4160

Energy Rate ($ per kWh)	$0.1155
Annual Savings Electricity ($)	$480.49
Energy Consumption Savings (therms)	261
Energy Rate ($ per therms)	$1.16
Annual Savings NG ($)	$302.58
Total Annual Savings ($)	$783.07
System Cost	$5,035.00
Payback (years)	6.43
Useful Life (years)	20.00

Existing Furnace

Furnace Efficiency	70.00%
Furnace Capacity (Btu/h)	150000
Annual Usage (Hrs)	720
Annual Usage (Btu)	108000000
Annual Usage (therms)	1080
Units	1
Total Annual Usage (therms)	1080
Energy Rate ($ per therms)	$1.1600
Annual Energy Cost for NG ($)	$1,253.10

Replacement Furnace

Furnace Efficiency	93.00%
Estimated Annual Usage (therms)	813
Units	1
Total Annual Usage (therms)	813
Energy Rate ($ per therms)	$1.16
Annual Energy Cost for NG ($)	$943.19

Estimated Savings - Replacement Furnace

Energy Consumption Savings (therms)	267
Annual Savings ($)	$309.91
System Cost ($)	$1,740.00
Payback	5.61
Useful Life (years)	20+

2. Utility Bill Analysis

Electric bills were provided for City Hall and the Police Station. The electrical utility services are provided from Pepco. Natural gas is provided by an unknown entity. Economic savings calculations are based on $0.1155/kWh taken from the Pepco invoices for City Hall and $1.16/Therm for natural gas, a Maryland state average.

EECBG PROJECT ANALYSIS

The analysis methodology used is consistent with the *International Performance Measurement and Verification Protocol* (www.ipmvp.org) adopted in 2009.

1. **Costs**

The estimated costs of the project are based on values listed in RS Means and typical industry estimates. This audit analyzed the following EECMs for the City Hall, Library, and Terminal Snack Bar for the energy savings that could be realized from their implementation. EECMs for the Police Station were not considered because access to HVAC equipment was not possible the day of the site visit.

Table 5: Estimated Costs within EECBG Award Amount

EECBG award amount	$48,000
City Hall – HVAC Upgrade	$15,500
City Hall – Domestic Hot Water Upgrade	$790
City Hall – CFL Lighting Upgrade	$930
City Hall – Motion Sensors	$540
Library – T8 Lighting Upgrade	$3,340
Library – 2.5 kW Solar PV Array	$20,000
Terminal Snack Bar – Restaurant HVAC	$5,035
Terminal Snack Bar – Furnace	$1,740
Total investment cost	$47,875

2. **Economic, Energy, and Environmental Benefits**

If you use your $48,000 EECBG award to implement the recommended measures, we calculate the below estimated energy, economic and environmental benefits.

Table 6: Estimated Energy, Economic and Environmental Benefits – City Hall

	Energy Benefits	***Lighting***	***Sensor***	***HVAC***	***Water Ht***
a.	Electricity Demand Reduction *(kW)*	NA	NA	NA	NA
b.	Annual Reduction in Electricity Consumption *(kWh) {From estimated cost and savings table}*	5,641.00	372.00	7,207.00	3,970.00
	Annual reduction in Natural Gas Consumption *(Therm)*	0.00	0.00	0.00	-191.00
	Annual reduction in fuel oil consumption *(Gal)*	0.00	0.00	0.00	0.00
	Annual reduction in propane consumption *(Gal)*	0.00	0.00	0.00	0.00
c.	Useful life of energy efficiency measure (years) {EEM useful life * % contributed to annual emissions savings}	5.00	15.00	20.00	10.00
d.	Lifetime energy savings from source *(Million Btu) {(Reduction kWh * 10,000 Btus/kWh + Reduction Therm *99,976 Btu/therm +Reduction Fuel Oil * 140,000 Btus/gal + Reduction propane* 91,330Btus /gal)*c / 1,000,000}*	282.05	55.80	1441.40	206.05
	Economic Benefits				
e.	Installed Cost *($)*	$930.00	$540.00	$15,500.00	$790.00
f.	Annual Cost Savings *($){From estimated cost and savings table}*	$651.51	$42.95	$2,895.06	$254.84

g.	Simple Payback *(years) { e÷f}*	1.43	12.57	5.35	3.10
h.	Lifetime Cost per Million Btu *($){ e÷d}*	$3.30	$9.68	$10.75	$3.83
Environmental Benefits					
i.	Annual carbon dioxide emission reductions *(kg)*	2,910.76	191.95	3,718.81	978.54
j.	Lifetime carbon dioxide emission reductions *(Metric Ton){(i * c)/1000}*	14.55	2.88	74.38	9.79
k.	Lifetime cost per metric ton of carbon reduced *($){ e÷j}*	$63.90	$187.55	$208.40	$80.73

Table 7: Estimated Energy, Economic and Environmental Benefits – Library

Energy Benefits		***Lighting***	***PV***
a.	Electricity Demand Reduction *(kW)*	NA	NA
b.	Annual Reduction in Electricity Consumption *(kWh) {From estimated cost and savings table}*	9,150.00	3,015.00
	Annual reduction in Natural Gas Consumption *(Therm)*	0.00	0.00
	Annual reduction in fuel oil consumption (*Gal*)	0.00	0.00
	Annual reduction in propane consumption (*Gal*)	0.00	0.00
c.	Useful life of energy efficiency measure (years) {EEM useful life * % contributed to annual emissions savings}	5.00	20.00
d.	Lifetime energy savings from source *(Million Btu) {(Reduction kWh * 10,000 Btus/kWh + Reduction Therm *99,976 Btu/therm +Reduction Fuel Oil * 140,000 Btus/gal + Reduction propane* 91,330Btus /gal)*c / 1,000,000}*	457.50	603.00
Economic Benefits			
e.	Installed Cost *($)*	$3,340.00	$20,000.00
f.	Annual Cost Savings *($){From estimated cost and savings table}*	$908.11	$1,101.98
g.	Simple Payback *(years) { e÷f}*	3.68	18.15
h.	Lifetime Cost per Million Btu *($){ e÷d}*	$7.30	$33.17
Environmental Benefits			
i.	Annual carbon dioxide emission reductions *(kg)*	4,721.40	1,555.74
j.	Lifetime carbon dioxide emission reductions *(Metric Ton){(i * c)/1000}*	23.61	31.11
k.	Lifetime cost per metric ton of carbon reduced *($){ e÷j}*	$141.48	$642.78

Table 8: Estimated Energy, Economic and Environmental Benefits – Terminal Snack Bar

Energy Benefits		***HVAC***	***Furnace***
a.	Electricity Demand Reduction *(kW)*	NA	NA
b.	Annual Reduction in Electricity Consumption *(kWh) {From estimated cost and savings table}*	4,160.00	0.00
	Annual reduction in Natural Gas Consumption *(Therm)*	0.00	267.00
	Annual reduction in fuel oil consumption (*Gal*)	0.00	0.00
	Annual reduction in propane consumption (*Gal*)	0.00	0.00
c.	Useful life of energy efficiency measure (years) {EEM useful life * % contributed to annual emissions savings}	20.00	20.00

d.	Lifetime energy savings from source *(Million Btu) {(Reduction kWh * 10,000 Btus/kWh + Reduction Therm *99,976 Btu/therm +Reduction Fuel Oil * 140,000 Btus/gal + Reduction propane* 91,330Btus /gal)*c / 1,000,000}*	832.00	533.87
Economic Benefits			
e.	Installed Cost *($)*	$5,035.00	$1,740.00
f.	Annual Cost Savings *($){From estimated cost and savings table}*	$783.07	$309.91
g.	Simple Payback *(years) { e÷f}*	6.43	5.61
h.	Lifetime Cost per Million Btu *($){ e÷d}*	$6.05	$3.26
Environmental Benefits			
i.	Annual carbon dioxide emission reductions *(kg)*	2,146.56	1,495.73
j.	Lifetime carbon dioxide emission reductions *(Metric Ton){(i * c)/1000}*	42.93	29.91
k.	Lifetime cost per metric ton of carbon reduced *($){ e÷j}*	$117.28	$58.17

3. Additional Benefits

The domestic hot water heater at City Hall is nearing the end of its useful life. Replacing the heater now eliminates the risk of damage as the older tank would begin to leak. Lighting quality should be increased at the Library with the installation of the high efficiency lighting. Operations and maintenance cost reductions should be experienced with the HVAC and lighting EECM's.

RECOMMENDATIONS

Recommended EECMs

After analyzing your potential energy efficiency/conservation measures (EECMs), **we recommend that you implement all listed EECMs with the full amount available under the EECBG award.** They include:

- CFL lighting upgrade at City Hall
- Motion sensors at City Hall
- HVAC upgrade at City Hall
- Domestic hot water upgrade at City Hall
- T8 lighting upgrade at the Library
- 2.5 kW solar PV array at the Library
- Restaurant HVAC installation at the Terminal Snack Bar
- Furnace installation at the Terminal Snack Bar.

We can confirm that the recommended EECMs are eligible to receive EmPOWER EECBG funds, are within your EECBG budget, will reduce energy consumption and/or generate clean energy, and have reasonable payback.

The PV system by itself has a relatively long payback compared to its useful life. Ideally, payback on an EECM should be shorter than the installed equipment's useful life. But, realistically there are some more expensive measures (such as HVAC equipment, LED lighting, or some renewable energy systems) for which nominal paybacks may exceed equipment life based on full installed cost. One consideration is that more than one EECM could be "bundled" to

estimate a lower aggregate payback. Keep in mind EECM costs are estimates and may change after you have actual costs from contractor bids, which in turn may affect estimated payback.

If you have a small amount of EECBG funding available after recommended EECMs are approved and implemented, you may want to contact Account Manager to explore ways to spend down the total award on "loose change" EECMs—such as central or window air conditioners; hot water tanks, tankless water heaters, or solar water heating systems; or ENERGY STAR qualified appliances including refrigerators, dishwashers, computers, and copiers.

If you decide to leverage non-ARRA financial resources to expand your EECBG project beyond the scope estimated to be fundable using your grant, please keep in mind that if you commingle other funds with your EECBG grant for additional measures, you will be required to comply with all ARRA reporting requirements.

Future Projects

Future projects could include:

- HVAC upgrades for the currently unoccupied office building.
- Window replacement in the older buildings along Rhode Island Avenue.

MEA and the EECBG Technical Assistance Team would like to be sure that you are aware of the following additional energy project funding sources that are available in case you wish to consider implementing future energy projects:

- EmPOWER Programs. These Maryland utility rebate programs (e.g., for lighting and HVAC) include:
    - Pepco: http://www.pepco.com/energy/conservation/meiin/
- MEA's Jane E. Lawton Loan Program. This Maryland state program has a limited amount of energy efficiency loan funding available that local governments are eligible for. The minimum loan size is $40,000 so this could be useful for projects that need a substantial amount of additional funding. For more information, browse to http://energy.maryland.gov/incentives/state-local/janeelawton.asp.

Next Steps

On the following page, please find a checklist of items that must be submitted to MEA in order for your project to be approved. Following MEA approval, your Account Manager will work with you on Post-Project Approval steps. Please review Addendum D of your ARRA Addendum to the EECBG Grant Agreement for more information on the procurement requirements.

If you would like to discuss this analysis in greater detail, please contact your account manager.

Sincerely,

Michael Fortin

Michael Fortin
MEA Technical Assistance Team Energy Auditor
Khepra Energy Group
mfortin@khepragroup.com

PROJECT APPROVAL CHECK LIST

As outlined in Attachment E of your EECBG grant agreement, once you have decided on the project that you wish to implement with your EECBG grant funds, MEA must approve your project.

Below is a check list of items that must be submitted to MEA in order for your project to be approved. Your Technical Assistance Team representative will work with you to compile the documentation listed below and to submit the appropriate documentation to MEA.

Check List of Items for Project Approval	
1. Eligible Technology	
☐	a. Ensure that the proposed project is on the list of eligible energy technologies contained in Attachment A of your EECBG grant agreement.
2. Audit Report	
☐	a. Ensure that the project energy savings have been quantified in the *Audit Report* provided by MEA's Technical Assistance Contractor.
3. Historic Preservation	
☐	a. Submit Historical Preservation documentation to MEA. This can consist of either 1) a completed *Maryland Historical Trust (MHT) Project Approval Form* (Attachment C[1] of your grant agreement) signed by MHT *or* 2) documentation from MEA's qualified historian that your project is eligible to be exempted from the MHT review process under the Programmatic Agreement between MEA, MHT, and the U.S. Department of Energy (DOE).
4. Waste Management Plan	
☐	a. Complete and Submit the Maryland *EECBG Waste Management Plan Template, Part 1* (Attachment B in your EECBG grant agreement).

Your completed forms and supporting documentation should be sent to your assigned Technical Assistance Team *Account Manager,* who will make the forms available to MEA for review.

After review by MEA, MEA will send a signed copy of the EECBG *Project Approval Form* (Attachment E of your EECBG grant agreement) to you. Only after you have a signed copy of the *Project Approval Form* can you proceed to procurement and installation for your project—as detailed in the *Post-Project Approval Checklist* available from your *Account Manager*.

[1] All project forms can be found in your grant agreement, and also on MEA's EECBG website: http://www.energy.state.md.us/EECBG.asp

ATTACHMENT E

MARYLAND ENERGY ADMINISTRATION
EMPOWER ENERGY EFFICIENCY AND CONSERVATION BLOCK GRANT CLEAN ENERGY COMMUNITIES PROGRAM

EmPOWER EECBG Project Approval Form

The _____ has been approved to commence with the EmPOWER EECBG Clean Energy Communities project described in the Scope of Work below. The project has been determined to comply with the following requirements of the EmPOWER EECBG Clean Energy Communities program:

- Review by MEA and/or MEA's Technical Assistance Contractor to confirm that the proposed project is eligible to receive EmPOWER EECBG funds.
- Review by MEA and/or MEA's Technical Assistance Contractor to verify that the project will reduce energy consumption and/or generate clean energy.
- Review and determination by the Maryland Historical Trust (Trust) that the proposed project will have "no adverse effect" on any historic property.
- Submission of Part 1 of Attachment B: Maryland EECBG Waste Management Plan to MEA, describing the anticipated waste materials generated through the proposed project.

SCOPE OF WORK

_____

_____

REQUIRED ARRA REPORTING METRICS (as indicated below)

- ☐ Jobs (in FTE)
- ☐ Energy cost savings ($)
- ☐ Renewable Energy Capacity and Generation
- ☐ Energy Savings (by fuel type)
- ☐ Emissions reductions
- ☐ Number of buildings retrofitted
- ☐ Number of streetlights retrofitted
- ☐ Number of traffic lights retrofitted

If upon learning that the Scope of Work targets listed above may not be attainable by the sub-grantee, the sub-grantee shall immediately contact the Maryland Energy Administration Community Program Manager listed below.

Approved by:

_____ Date: _____

Dean Fisher
Community Program Manager
Maryland Energy Administration
Office 410-260-2605
DFisher@energy.state.md.us