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Texas Comptroller of Public Accounts

Facility Preliminary Energy Assessments and Recommendations

City of Sour Lake Facilities

Prepared by:

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SECO
State Energy Conservation Office

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1. EXECUTIVE SUMMARY

A Preliminary Energy Assessment (PEA) was conducted on November, 22 2011 at the facilities of the City of Sour Lake, Texas. The facilities included the City Hall and Police Station, Community Center, Library and Museum, Domestic Water Plant, and Waste Water Treatment Plant. The present report documents this investigation.

This service was provided by Jacobs at no cost to the City of Sour Lake (the City) by the Texas Comptroller of Public Accounts, State Energy Conservation Office (SECO). This program promotes and encourages an active partnership between SECO and local political subdivisions with the purpose of planning, funding, and implementing cost-effective energy conservation measures. The goal is to reduce energy consumption of existing facilities and ultimately reduce regional emissions and facility energy costs.

The following ECMs were evaluated and recommended for implementation or further detailed analysis:

ECM 1: Replacement of existing T12 fluorescent light fixtures with new T8 fixtures
Facilities: Community Center, Library and Museum

ECM 2: Replacement of existing thermostat with new programmable thermostat
Facility: City Hall

ECM 3: Installation of new window films on building front windows
Facility: Library

ECM 4: Replacement of existing HVAC system with new high efficiency HVAC system
Facility: Museum

It was also recommended to partially modify the operation of the blowers at the aeration basin of the wastewater treatment plant by running one blower at a time instead of three. Before implementing this measure, *the City should verify that the configuration of the aeration system allows this modification.*

A preliminary energy and cost savings evaluation was conducted on each recommended measure listed above. Descriptions of these measures and a summary of each evaluation are presented in the following sections. An overall summary of the results is presented in the ECM Table. Each proposed utility evaluation was based on the prevalent utility costs at the time of the audit.

As seen in the ECM table, the recommended measures provide for a combined estimated annual savings of up to $1,895 with an estimated capital requirement of $12,812 thus yielding a composite simple payback period of 6.76 years.

Descriptions and calculations for the recommended measures can be found within this report. A follow-up visit can be scheduled to address questions regarding the report, project financing options, implementation schedules, or any other aspect of this program or its implementation.

SECO is committed to providing whatever assistance is required in planning, funding, and implementing the recommendations of this report. The City is encouraged to direct any questions or concerns to either of the following:

SECO	Jacobs
Stephen Ross	Scott West
1-800-531-5441, ext 3-1770	817-347-5370

Included in the appendix of this report is also a list of websites that can be utilized in learning more about SECO, Senate Bill 12, various funding solutions, energy saving projects, and various state and federal agency services and programs.

2. FACILITY DESCRIPTION

The preliminary energy audit covered the following buildings:

1. City Hall and Police Station
2. Community Center
3. Library and Museum

The audit also included the following plants:

1. Waste Water Treatment Plant
2. Domestic Water Plant

City Hall and Police Station

The City Hall and Police Station share a single story facility with a construction area of 3,000 square feet. The City Hall occupies approximately 60% of the building space. The Police Station occupies the remaining space. This facility is located at 625 Hwy 105 W, Sour Lake TX 77659.

The facility has a wood cladding exterior and a Dutch gable type roof covered with asphalt shingles.

Both the City Hall and the Police Station use split DX cooling systems composed of a variable speed air handling unit and a high efficiency outdoor condensing unit. For details of these systems, please, refer to Appendix C.

The facility uses non-programmable digital thermostats. The thermostats had a setpoint of 72 degrees F at the City Hall and 73 degrees F at the Police Station at the time of the audit.

The facility uses mainly F32T8 fluorescent lights.

The City Hall operates from Monday through Friday during office hours. The Police Station operates 24 hours the entire year.

Community Center

The Community Center is a hangar-shaped wall and roof metal structure of approximately 6,500 square feet. The facility has a front porch with brick covered walls and columns. This facility is located at 250 S. Ann St, Sour Lake, TX 77659.

The facility uses four old split DX cooling systems. According to Mr. Larry Saurage, the City Manager, the City is in the process of replacing this system with a new energy efficient system.

The facility uses mainly F40T12 lights.

The Community Center operates from Monday through Friday during office hours.

Library and Museum

The Library and the Museum share a single story facility with a construction area of approximately 5,200 square feet. The Library occupies approximately 70% of the building space. The Museum occupies the remaining space. This facility is located at 300 S. Ann St, Sour Lake, TX 77659.

The facility has brick covered walls with windows occupying approximately 40% of the front wall. According to Library Personnel, the amount of heat transferred through the windows creates a noticeable temperature difference inside the Library.

The Library uses a split DX cooling system composed of a high efficiency air handling unit and an outdoor condensing unit. For details of this system, please, refer to Appendix C

The Library uses a digital programmable thermostat. This thermostat had a setpoint of 72 degrees F at the time of the audit.

The Museum uses an old split DX cooling system composed of a fan-coil unit and an outdoor condensing unit. For details of this system, please, refer to Appendix C.

The Museum uses a manual non-programmable thermostat. This thermostat had a setpoint of approximately 72 degrees F at the time of the audit.

The facility uses mainly F40T12 lights.

The Library and Museum operate from Monday through Friday during office hours.

Waste Water Treatment Plant

The waste water treatment plant has an approximate area of 49,000 square feet and includes the sludge storage tanks, a primary clarifier, an aeration section, and a final clarifier. This area also includes a small room with the sewer pits and pumps, and a small portable room used as office space. The plant is located at 728 Sycamore, Sour Lake, TX 77659.

According to the plant operator, the load in the aeration basin of the plant is fairly constant and three blowers usually run at low load (blower inlet vanes restricted) to aerate the entire basin.

Domestic Water Plant

The domestic water plant has an approximate area of 13,600 square feet and includes a water well, a water tank, a mechanical room, and a motor-pump array that supplies water to the city elevated water tanks. The plant is located at 26174 Hwy 105 W., Sour Lake, TX 77659.

3. FACILITY ENERGY PERFORMANCE

Based on the supplied electricity and natural gas billing data, the City's buildings have the following annual consumption, annual cost, Energy Use Index (EUI), and Energy Cost Index (ECI):

Building	Area (sqft)	Electricity			Natural Gas			EUI (KBtu/sqft)	ECI ($/sqft)
		Usage kWh/Yr	Usage Kbtu/Yr	Cost ($)/Yr	Usage ccf/Yr	Usage Kbtu/Yr	Cost ($)/Yr		
City Hall Police Station	3,028	65,209	222,493	6,528	0	0	0	73	2.16
Community Center	6,500	25,707	87,713	3,290	853	98,436	959	29	0.65
Library Museum	5,200	29,468	100,544	3,339	0	0	0	19	0.64

Table 1 – Building Energy Benchmarking

The EUI, an estimate of the energy consumption performance, is measured in thousands of Btus per square foot per year. Likewise, the ECI, an estimate of the energy cost performance, is measured in dollars per square foot per year.

Based on the supplied electricity bill data, the City's domestic water and waste water treatment plants have the following annual consumption and annual cost:

Building	Area (sqft)	Electricity		
		kWh/Yr	Kbtu/Yr	Cost ($)/Yr
Domestic Water Plant	13,600	188,090	641,764	17,829
Waste Water Treatment Plant	44,000	513,338	1,751,510	37,804

Table 2 – Water Plants Energy Benchmarking

4. ENERGY ACCOUNTING

Energy is accounted for through monthly utility bills. Electricity is billed to all the audited facilities. Natural gas is billed to the Community Center.

The following table shows the estimated utility rates:

Utility Provider	Utility	Estimated Rate
Entergy	Electricity	*$0.08 /kWh $4.8/kW
CenterPoint Energy	Natural Gas	**$0.94/ccf

* Includes fuel factor and applicable riders
** Includes base amount and gas cost adjustment

Table 3 – Estimated Utility Rates

5. RECOMMENDATIONS

The following table summarizes the potential opportunities identified during the preliminary energy audit:

ECM	ECM Description	Facility	Estimated Implementation Cost ($)	Estimated Annual Savings (kBtu)	Estimated Annual Savings ($)	Simple Payback (Years)
1	Replacement of T12 lights with T8 lights	Community Center Library Museum	6,350	39,932	1,238	5.13
2	Replacement of T-Stat with Programmable T-Stat	City Hall	162	64,309	179	0.95
3	Installation of Window Films on front wall windows	Library	300	2,205	52	6.00
4	Replacement of HVAC Unit with High Efficiency Unit	Museum	6,000	18,144	426	14.09
			12,812	124,589	1,895	6.76

Table 4 - Energy Conservation Measures

ECM 1 involves replacing the existing T12 fluorescent lights at the Community Center, Library and Museum with new T8 fluorescent lights. This measure includes replacing existing magnetic with high efficiency electronic ballasts. This measure is intended to reduce energy load and consumption of the listed buildings.

ECM 2 involves replacing the existing thermostat at the City Hall with a programmable thermostat. This measure is intended to reduce energy consumption of the listed buildings through an efficient temperature setback schedule.

ECM 3 involves installing window films on the front windows of the Library. This measure is intended to reduce the thermal load in the Library and to increase the comfort level of the occupants.

ECM 4 involves replacing the existing split DX cooling system serving the Museum with a high efficiency system. The existing system has a low energy efficiency ratio and uses an ozone depleting refrigerant.
This measure is intended to reduce energy load and consumption while supporting the phase out of ozone depleting substances.

It is also recommended to partially modify the operation of the blowers at the aeration basin of the wastewater treatment plant by running one blower at a time instead of three. This measure reduces the probability of running the motors at very low load and in consequence at low efficiency, as indicated in the motor data (see appendix D for details).

Before implementing this measure, it must be verified that the configuration of the aeration system allows this modification.

One way to determine if the motors are actually falling in the low efficiency zone is by tracking the motor amperage through the displays available at the aeration basin.

6. EMISSIONS CALCULATIONS

				Equivalent to:		
Electricity Consumption Reduction (kWh/Yr)	Pollution Prevention Factors			Number of cars taken off the road CO_2/10,000	Number of acres of trees planted CO_2/7,300	Number of American homes electricity needs (kWh/Yr)/10,000
	Carbon Dioxide CO_2 (lbs/Yr)	Nitrogen Oxide NOx (grams/Yr)	Sulphur Dioxide SO_2 (grams/Yr)			
17,662	23,391	7,020	25,603	2	3	2

Table 5 - Emission Calculations

With the energy savings shown above, the resulting reduced amount of pollution has been calculated. Performing the proposed measures is equivalent to 2 cars being taken off the road, 3 acres of trees being planted, and 2 American homes being powered with electricity.

APPENDIX A: UTILITY ANALYSIS DATA

Electricity

	City Hall		Community Center		Library		Waste Water Treatment Plant		Domestic Water Plant	
Month	Usage (kWh)	Cost ($)	Usage (kWh)	Cost ($)	Usage (kWh)	Cost ($)	Usage (kWh)	Cost ($)	Usage (kWh)	Cost ($)
Jan-2011	4,194	444	1,229	212	2,004	325	49,520	4,143	19,968	1,667
Feb-2011	4,462	453	1,014	161	2,663	283	48,880	3,312	16,704	1,327
Mar-2011	5,459	472	1,048	147	2,512	272	49,120	3,061	19,104	1,439
Apr-2011	3,542	310	1,209	202	1,516	178	41,680	2,445	13,056	1,033
May-2011	4,634	382	1,365	196	1,906	193	43,360	2,519	13,536	1,346
Jun-2011	4,793	504	2,000	278	2,410	287	44,480	3,573	13,536	1,365
Jul-2011	7,418	784	2,851	316	2,983	314	37,360	3,003	16,992	1,607
Aug-2011	6,587	676	3,586	376	3,294	343	45,520	3,656	14,016	1,585
Sep-2011	7,455	773	2,826	344	3,025	323	40,080	3,247	15,360	1,499
Oct-2011	6,401	664	3,906	461	2,849	310	36,320	2,915	14,496	1,723
Nov-2011	4,830	522	2,531	323	1,850	233	34,240	2,780	15,648	1,753
Dec-2011	5,434	544	2,142	274	2,456	278	42,778	3,150	15,674	1,486
Total	65,209	6,528	25,707	3,290	29,468	3,339	513,338	37,804	188,090	17,829

Natural Gas

	Community Center	
Month	Usage (ccf)	Cost ($)
Jan-2011	192	186
Feb-2011	275	259
Mar-2011	259	245
Apr-2011	54	64
May-2011	18	34
Jun-2011	5	22
Jul-2011	3	19
Aug-2011	0	17
Sep-2011	0	17
Oct-2011	0	17
Nov-2011	7	24
Dec-2011	40	56
Total	853	959

APPENDIX B: ECM INFORMATION

ECM 1: Replacement of existing T12 fluorescent light fixtures with new T8 fixtures
Facilities: Community Center, Library and Museum

QUICKCALC CALCULATION FORM
Interior Fixture Relamping/Replacement
(Electric Cooling and Heating)

Rev. 5/02

Description of ECRM	-
Lighting Retrofit. Replacing T12 fixtures with T8 fixtures	
Facility: Library and Museum	

*assume that fc before/fc after = lumens before/lumens after

Data needed for calculations:

A)	1,170	*hrs/yr*	Summer Operating Hours
B)	1,170	*hrs/yr*	Winter Operating Hours
C)	36	*Lamps*	Total Number of Lamps - Old
D)	36	*Lamps*	Total Number of Lamps - New
E)	190	*Watts/Lamp*	Old Lamp Wattage =___ Watts/Lamp + ___ Ballast Watts
F)	90	*Watts/Lamp*	New Lamp Wattage =___ Watts/Lamp + ___ Ballast Watts
G)	11.31	*Btuh/Watt*	Performance of Cooling System (Table 1)
H) $	0.08	*/kWh*	Electrical Energy Rate - Summer
I) $	0.08	*/kWh*	Electrical Energy Rate - Winter
J) $	4.8	*/kW*	Electrical Demand Rate - Summer
K) $	4.8	*/kW*	Electrical Demand Rate - Winter
L)	100%	*%*	Efficiency of Heating System (Table 3)
M)	0.17		Seasonal Heating Factor (Table 4)
N)	0.66		Seasonal Cooling Factor (Table 4)
O) $	80	*/Lamp*	New Lamp Cost
P) $	47	*/Lamp*	Labor Cost for Lamp Replacement

Calculation:

Q) Lighting Electrical Demand Reduction

$$= \frac{[C(\ )\ x\ E(\ )] - [D(\ )\ x\ F(\ )]}{1{,}000}$$

= 4 kW/ mo

R) Lighting Electrical Energy Savings

$$= Q(\ )\ x\ [A(\ ) + B(\ )]$$

= 8,424 kWh/yr

S) Cooling Electrical Energy Savings

$$= \frac{R(\ )\ x\ 3{,}413\ Btu/kWh\ x\ N(\ )\ x\ 0.80^*}{G(\ )\ x\ 1{,}000}$$

= 1,342 kWh/yr

T) Annual Electrical Energy Savings

$$= R(\ ) + S(\ )$$

= 9,766 kWh/yr

U) Annual Electrical Cost Savings

$$= T(\ )\ x\ [H(\ ) + I(\ )]\ /\ 2 + 12\ x\ Q(\ )\ x\ [J(\ ) + K(\ )]\ /\ 2$$

= $989 /yr

V) Electrical Heating Energy Cost Penalty

$$= 0.80^*\ x\ [R(\ )\ x\ M(\ )\ /\ L(\ )]\ x\ [H(\ ) + I(\ )]\ /\ 2$$

= $92 /yr

*Lighting cooling/heating load factor for 10-hour office use derived from data in Table 17B, pg. 26.23, 1981 *ASHRAE Handbook of Fundamentals*

Annual Cost Savings:

W)	Annual Cost Savings	=	U( ) - V( )	
		=	$897	/yr
X)	Lamp Cost	=	O( ) x D( )	
		=	$2,880	
Y)	Labor Cost	=	P( ) x D( )	
		=	$1,692	
Z)	Implementation Cost	=	X( ) + Y( )	
		=	$4,572	
AA)	Simple Payback	=	Z( ) / W( )	
		=	$5.10	yrs

QUICKCALC CALCULATION FORM

Interior Fixture Relamping/Replacement Rev. 5/02

(Electric Cooling and Heating)

Description of ECRM
Lighting Retrofit. Replacing T12 fixtures with T8 fixtures
Facility: Community Center

*assume that fc before/fc after = lumens before/lumens after

Data needed for calculations:

A)	1,170	*hrs/yr*	Summer Operating Hours
B)	1,170	*hrs/yr*	Winter Operating Hours
C)	14	*Lamps*	Total Number of Lamps - Old
D)	14	*Lamps*	Total Number of Lamps - New
E)	190	*Watts/Lamp*	Old Lamp Wattage =___ Watts/Lamp + ___ Ballast Watts
F)	90	*Watts/Lamp*	New Lamp Wattage =___ Watts/Lamp + ___ Ballast Watts
G)	13.92	*Btuh/Watt*	Performance of Cooling System (Table 1)
H) $	0.08	*/kWh*	Electrical Energy Rate - Summer
I) $	0.08	*/kWh*	Electrical Energy Rate - Winter
J) $	4.8	*/kW*	Electrical Demand Rate - Summer
K) $	4.8	*/kW*	Electrical Demand Rate - Winter
L)	100%	*%*	Efficiency of Heating System (Table 3)
M)	0.17		Seasonal Heating Factor (Table 4)
N)	0.66		Seasonal Cooling Factor (Table 4)
O) $	80	*/Lamp*	New Lamp Cost
P) $	47	*/Lamp*	Labor Cost for Lamp Replacement

Calculation:

Q) Lighting Electrical Demand Reduction

$$= \frac{[C(\ )\ x\ E(\ )]\ -\ [D(\ )\ x\ F(\ )]}{1{,}000}$$

= 1 kW/ mo

R) Lighting Electrical Energy Savings

$$= Q(\ )\ x\ [A(\ )\ +\ B(\ )]$$

= 3,276 kWh/yr

S) Cooling Electrical Energy Savings

$$= \frac{R(\ )\ x\ 3{,}413\ Btu/kWh\ x\ N(\ )\ x\ 0.80^*}{G(\ )\ x\ 1{,}000}$$

= 424 kWh/yr

T) Annual Electrical Energy Savings

$$= R(\ )\ +\ S(\ )$$

= 3,700 kWh/yr

U) Annual Electrical Cost Savings

$$= T(\ )\ x\ [H(\ )\ +\ I(\ )]\ /\ 2\ +\ 12\ x\ Q(\ )\ x\ [J(\ )\ +\ K(\ )]\ /\ 2$$

= $377 /yr

V) Electrical Heating Energy Cost Penalty

$$= 0.80^*\ x\ [R(\ )\ x\ M(\ )\ /\ L(\ )]\ x\ [H(\ )\ +\ I(\ )]\ /\ 2$$

= $36 /yr

*Lighting cooling/heating load factor for 10-hour office use derived from data in Table 17B, pg. 26.23, 1981 *ASHRAE Handbook of Fundamentals*

Annual Cost Savings:

W)	Annual Cost Savings	=	U( ) - V( )
		=	$341 /yr
X)	Lamp Cost	=	O( ) x D( )
		=	$1,120
Y)	Labor Cost	=	P( ) x D( )
		=	$658
Z)	Implementation Cost	=	X( ) + Y( )
		=	$1,778
AA)	Simple Payback	=	Z( ) / W( )
		=	5.21 yrs

ECM 2: Replacement of existing thermostat with new programmable thermostat
Facility: City Hall

QUICKCALC CALCULATION FORM
Programmable Thermostats
(Electric Cooling and Electric or Gas Heating)

Rev. 5/02

Description of ECRM
Replacement of existing thermostats with programmable thermostats
Setting of temperature set back
Facility: City Hall

Data needed for calculations:

A)	0.4	*Btu/hr-ft²-°F*	U-Value of Walls
B)	2090	*ft²*	Wall Area (includes windows and doors)
C)	0.2	*Btu/hr-ft²-°F*	U-Value of Roof
D)	2687	*ft²*	Roof Area
E)	70	*°F*	Heating Season Thermostat Setpoint
F)	60	*°F*	Heating Season Thermostat Setback
G)	2232	*hrs/yr*	Heating Season Setback Hours
H)	78	*°F*	Cooling Season Thermostat Setpoint
I)	88	*°F*	Cooling Season Thermostat Setback
J)	2232	*hrs/yr*	Cooling Season Setback Hours
K)	100%	*%*	Heating Equipment Efficiency (Table 3)
L) $	0.08	*/Mcf (or kWh)*	Natural Gas Rate (or cost per winter kWh for electric heat)
M)	13.92	*Btuh/Watt*	Performance of Cooling System (Table 1)
N) $	0.08	*/kWh*	Electrical Energy Rate - Summer
O) $	0.08	*/kWh*	Electrical Energy Rate - Winter
P) $	162		Installed Cost = 1 Thermostat x $ (115+47)

Calculation:

Q)	Total Envelope UA-Value	=	A( ) x B( ) + C( ) x D( )	
		=	1,373	Btu/hr-°F
R)	Heating Energy Savings	=	Q( ) x [E( ) - F( )] x G( )	
		=	33,654,288	Btu/yr
S)	Heating Cost Reduction*	=	R( ) x L( ) / K( ) x 1,030,000 Btu/Mcf	
		=	$2.38	/yr
T)	Cooling Energy Savings	=	Q( ) x [I( ) - H( )] x J( )	
		=	30,654,288	Btu/yr
U)	Cooling Cost Reduction	=	T( ) x [N( ) + O( )]/2 / 1,000 x M( )	
		=	$176	/yr
V)	Annual Cost Savings	=	S( ) + U( )	
		=	$179	/yr
W)	Simple Payback	=	P( ) / V( )	
		=	0.91	yrs

*For electrically heated buildings:

ECM 3: Installation of Window Films on front wall windows
Facility: Library

QUICKCALC CALCULATION FORM
Window Solar Gain Control for Clear, Unshaded Windows Rev. 5/02
(Electric Cooling and Electric or Gas Heating)

Description of ECRM

Installation of window films on front wall windows

Facility: Library

Data needed for calculations:

A) Glazing Area by Orientation: (N, NE, E, SE, S, SW, W, NW)

Orientation	Area	
E	200	ft^2
Total Area	200	ft^2

B)	0.4		Shading Coefficient of New Shading Device (Table 9)
C)	13	*Btuh/Watt*	Performance of Cooling System (Table 1)
D) $	0.08	*/kWh*	Electrical Energy Rate - Summer
E)	100%	*%*	Efficiency of Heating System (Table 3)
F) $	0.08	*/Mcf (or kWh)*	Natural Gas Rate (or $/kWh - winter if electrically heated)
G) $	1.5	*/ft^2*	Installed Cost of Window Treatment per Square Foot

Table CL - Cooling Load

Cooling Load Table for ____E____ Orientation

Month	(Window Clear Day Heat Gain) per square foot from Table 7 in Appendix	x	(% of Possible Sunshine) from Table 8 in Appendix	x	(days/month)	=	Monthly Solar Gain per square foot
1	634	x	50%	x	0	=	0
2	816	x	50%	x	0	=	0
3	923	x	55%	x	0	=	0
4	989	x	61%	x	10	=	6,033
5	1023	x	69%	x	20	=	14,117
6	1019	x	76%	x	20	=	15,489
7	1006	x	72%	x	20	=	14,486
8	961	x	71%	x	20	=	13,646
9	883	x	70%	x	10	=	6,181
10	788	x	74%	x	0	=	0
11	625	x	62%	x	0	=	0
12	564	x	49%	x	0	=	0
					Annual Total (Btu/ft²)		69,953

69,953 Btu/ft²	x	200 ft²	=	13,990,540 Btu
Annual Total per ft² (from above)		Total Glass Area for this Orientation (enter from Sheet 1)		Total Solar Gain (include in Item K on the calculation form)

Table HL - Heating Load

Heating Load Table for ____E____ Orientation

Month	(Window Clear Day Heat Gain) per square foot from Table 6 in Appendix	x	(% of Possible Sunshine) from Table 7 in Appendix	x	(days/month)	=	Monthly Solar Gain per square foot
1	634	x	50%	x	20	=	6,340
2	816	x	50%	x	20	=	8,160
3	923	x	55%	x	10	=	5,077
4	989	x	61%	x	0	=	0
5	1023	x	69%	x	0	=	0
6	1019	x	76%	x	0	=	0
7	1006	x	72%	x	0	=	0
8	961	x	71%	x	0	=	0
9	883	x	70%	x	0	=	0
10	788	x	74%	x	10	=	5,831
11	625	x	62%	x	20	=	7,750
12	564	x	49%	x	20	=	5,527
						Annual Total (Btu/ft²)	38,685

38,685 Btu/ft²	x	200 ft²	=	7,736,980 Btu
Annual Total per ft² (from above)		Total Glass Area for this Orientation (enter from Sheet 1)		Total Solar Gain (include in Item K on the calculation form)

Calculation:

H)	Sum of Annual Total Cooling Season Solar Gains (Btu) for all Orientations (' of Table CL values)	=	13,990,540	Btu
I)	Annual Reduction in Cooling Solar Gain	=	H( ) x [1 - B( )]	
		=	8,394,324	Btu
J)	Annual Reduction in Cooling kWh	=	[I( ) / C( )] / 1,000	
		=	646	kWh
K)	Sum of Annual Total Heating Season Solar Gains (Btu) for all Orientations (' of Table HL values)	=	38,685	Btu
L)	Annual Reduction in Heating Solar Gain	=	K( ) x [1 - B( )]	
		=	23,211	Btu
M)	Annual Increase in Heating Mcf*	=	L( ) / [E( ) x 1,030,000 Btu/Mcf]	
		=	0	Mcf
N)	Annual Cost Savings	=	J( ) x D( ) - M( ) x F( )	
		=	52	
O)	Implementation Cost	=	G( ) x Total Area from A( )	
		=	300	
P)	Simple Payback	=	O( ) / N( )	
		=	6	yrs
M)	Annual Increase in Heating kWh	=	L( ) / [3,413 Btuh/kW x E( )]	
		=	7	kWh

*For electrically heated buildings:

ECM 4: Replacement of HVAC Unit with High Efficiency Unit
Facility: Museum

QUICKCALC CALCULATION
FORM
Replacement of Low Efficiency HVAC Units

Rev. 5/02

Description of ECRM
Replacement of existing HVAC unit with new high efficiency unit
Location: Museum

Data needed for calculations:

A)	3	*Tons*	Cooling Tonnage to be Replaced
B)	0	*kW*	Resistance Heating to be Replaced
C)	3,854	*hrs/yr*	Cooling Equivalent Full Load Operating Hours (Table 15)
D)	2,901	*hrs/yr*	Heating Equivalent Full Load Operating Hours (Table 16)
E)	5	*mo/yr*	Number of Cooling Months
F)	5	*mo/yr*	Number of Heating Months
G)	1.38	*kW/Ton*	Performance of Existing Cooling Unit (Table 1)
H)	0.92	*kW/Ton*	Performance of New Cooling Unit (Table 1)
I)	100%	*%*	Efficiency of Proposed Heating Unit (Table 3)
J) $	0.08	*/kWh*	Electrical Energy Rate - Summer
K) $	0.08	*/kWh*	Electrical Energy Rate - Winter
L) $	0.094	*/Mcf*	Natural Gas Rate
M) $	0.08	*/kW-mo*	Electrical Demand Rate - Summer
N) $	0.08	*/kW-mo*	Electrical Demand Rate - Winter
O)	0.9		Enter Diversity of Winter Demand
P) $	6,000		Cost of Proposed Unit(s)

Calculation:

Q)	Cooling Demand Reduction	=	A( ) x [G( ) - H( )]	
		=	1.38	kW
R)	Annual Cooling Energy Savings	=	Q( ) x C( )	
		=	5,316	kWh/yr
S)	Cooling Demand Savings	=	Q( ) x E( )	
		=	7	kW-mo/yr
T)	Cooling Cost Savings	=	R( ) x J( ) + S( ) x M( )	
		=	$426	/yr
U)	Original Heating Use	=	B( ) x D( )	
		=	0	kWh/yr
V)	Original Heating Cost	=	U( ) x K( ) + B( ) x F( ) x N( ) x O( )	
		=	$0	/yr
W)	New Heating Use	=	U( ) x 3,413 Btuh/kW / I( ) / 1,030,000 Btu/Mcf	
		=	0	Mcf/yr
X)	New Heating Cost	=	W( ) x L( )	
		=	$0	/yr
Y)	Savings	=	T( ) + V( ) - X( )	
		=	$426	/yr
Z)	Simple Payback	=	P( ) / Y( )	
		=	14.09	yrs

APPENDIX C: FACILITIES HVAC EQUIPMENT

Building	Equipment	Brand	Model	Capacity (ton)	*SEER	Refrigerant
City Hall	Air Handler Unit	Trane	4TEE3F37B1000AA	3	16	R-410A
	Outdoor Condensing Unit	Trane	4TTX6036B1000AA	3	16	R-410A
Police Station	Air Handler Unit	Trane	4TEE3F37B1000AA	3	16	R-410A
	Outdoor Condensing Unit	Trane	4TTX6036B1000AA	3	16	R-410A
Library	Air Handler Unit	Trane	4TEC3F60B1000AA	5	13	R-410A
	Outdoor Condensing Unit	Trane	4A7B4060E1000AB	5	14	R-410A
Museum	Fan Coil Unit	Carrier	FA4ANF036000AFAA	3	10	R-22
	Outdoor Condensing Unit	Bryant	561CJX036000AIAA	3	10	R-22
Community Center	The City is in the process of replacing existing HVAC equipment with new energy efficient equipment					

* Approximate Values

APPENDIX D: AERATION BASIN BLOWER MOTOR PERFORMANCE DATA

REL. S.O.	FRAME	HP	TYPE	PHASE/ HERTZ	RPM	VOLTS
	365T	75	P	3/60	3555	460

AMPS	DUTY	AMB °C/ INSUL.	S.F.	NEMA DESIGN	CODE LETTER	ENCL.
80.7	CONT	40/F	1.15	B	F	FCXE

E/S	ROTOR	TEST S.O.	TEST DATE	STATOR RES.@25 °C OHMS (BETWEEN LINES)
892018	418141005TE	---	---	.0744

PERFORMANCE

LOAD	HP	AMPERES	RPM	% POWER FACTOR	% EFFICIENCY
NO LOAD	0	15.5	3600	7.78	0
1/4	18.8	24.4	3589	77.5	92.8
2/4	37.6	40.7	3579	90.8	95.1
3/4	56.2	59.9	3568	92.1	95.4
4/4	75.0	80.7	3556	91.5	95.0
5/4	93.8	102	3543	90.9	94.4

SPEED TORQUE

	RPM	TORQUE % FULL LOAD	TORQUE LB.-FT.	AMPERES
LOCKED ROTOR	0	218	242	494
PULL UP	1565	190	210	440
BREAKDOWN	3395	228	253	259
FULL LOAD	3556	100	111	80.7

AMPERES SHOWN FOR 460. VOLT CONNECTION. IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE

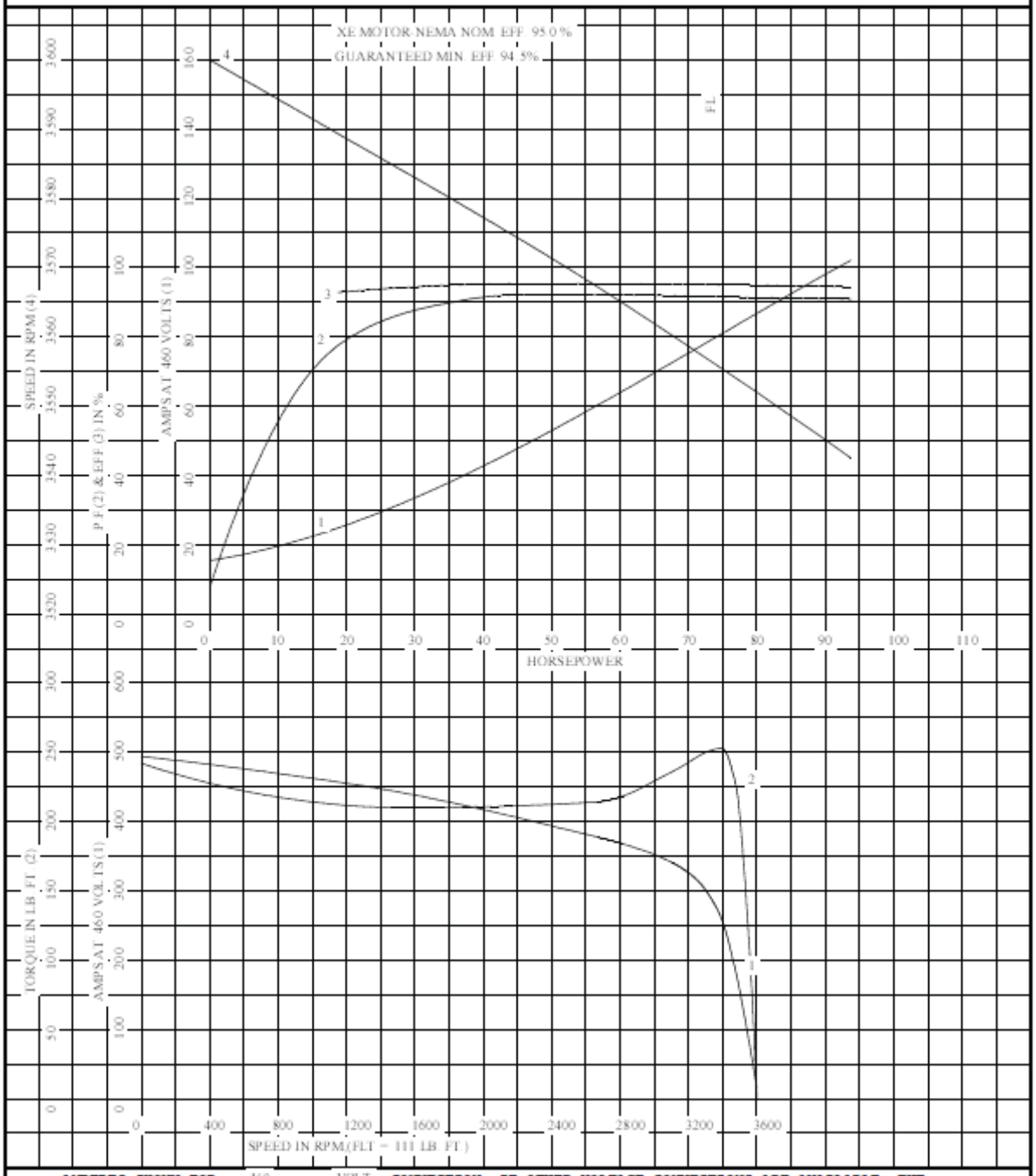
REMARKS: CALCULATED DATA
XE MOTOR-NEMA NOM. EFF. 95.0 %
GUARANTEED MIN. EFF. 94.5%

BALDOR
BALDOR • DODGE • RELIANCE

DR. BY W. L. SMITH
CK. BY G. R. WEBB
APP. BY D. M. BYRD
DATE 03/08/02

A-C MOTOR PERFORMANCE DATA
W01084-A-A001
ISSUE DATE 03/08/02

REL S.O.	RPM 3555	S.F. 1.15	ROTOR 418141005TE
FRAME 365T	VOLTS 460	NEMA DESIGN B	TEST S.O. CALCULATED DATA
HP 75	AMPS 80.7	CODE LETTER F	TEST DATE ---
TYPE P	DUTY CONT	ENCLOSURE FCXE	STATOR RES.@ 25 °C .0744
PHASE/HERTZ 3/60	AMB °C/INSUL 40/F	E/S 892018	OHMS (BETWEEN LINES)



AMPERES SHOWN FOR 460 VOLT CONNECTION, IF OTHER VOLTAGE CONNECTIONS ARE AVAILABLE, THE AMPERES WILL VARY INVERSELY WITH THE RATED VOLTAGE.

BALDOR · DODGE · RELIANCE

DR. BY W.L. SMITH
CK. BY G.R. WEBB
APP. BY D.M. BYRD
DATE 03/08/02

A-C MOTOR PERFORMANCE CURVES

W01084-A-A001

ISSUE DATE 03/08/02

APPENDIX E: ENERGY STAR – PORTFOLIO MANAGER

Energy Star is a joint program between the US Environmental Protection Agency (US EPA) and the Department of Energy (US DOE) that promotes the efficient use of energy in multiple industries. One focus of the Energy Star program is on energy efficiency of existing buildings.

Portfolio Manager was created as an industry tool to aid those that work with existing buildings in benchmarking energy performance. Portfolio Manager benchmarking data is based on the Commercial Buildings Energy Consumption Survey administered by the US DOE Energy Information Administration every four years. The survey includes energy use figures from thousands of buildings throughout the United States for various end uses. For a particular building type (e.g. and office building), the building is compared statistically to similar buildings in the survey and assigned a score of 1-100. A score of 50 indicates an average building in terms of energy performance. A score of 1 means that the building is in the lowest 1% of buildings for energy performance and a score of 100 indicates performance in the top 1%.

	Energy Star - Portfolio Manager		
	Site EUI	Source EUI	Energy Star Rating
Building	Kbtu/sqft	Kbtu/sqft	(1 - 100)
City Hall and Police Station	73.48	245.42	NA
Community Center	28.64	60.93	96
Library and Museum	19.34	64.58	94

Site Energy Use Intensity (EUI) uses figures of metered energy (electrical, kWh and any other fossil fuel types, such as natural gas, ccf) to the building and then converts them to KBtus. This is the same procedure used for EUI earlier in this report. Portfolio Manager also calculates source EUI for easier comparison among fuel types. Source EUI takes into account energy losses from the original fuel source. For electricity, the original fuel consumption occurs at the power plant where electrical conversion efficiencies are often 30-40% for traditional fossil fuel sources. Portfolio Manager uses a source-site factor (or ratio) to convert site energy to source energy and it uses the same figure for all grid-supplied electricity. This ratio is specific to the type of energy used. Grid purchased electricity has a Source-Site Ratio of 3.340; Natural Gas has a ratio of 1.047.

To obtain the Energy Star rating of the City buildings, a one-year baseline was determined using metered utility data during the period January 2011 – November 2011. December 2011 data was estimated based on the data of the previous 11 months. Portfolio Manager did not estimate the Energy Star rating of the City Hall due to the size of the building. To be eligible for rating, the building should have at least 5,000 sq.ft of floor area. The Community Center and Library and Museum perform within the top 10 percentile when compared to typical office buildings. This is partially due to reduced building use compared to typical office space, but is still very good energy performance.

APPENDIX F: FUNDING AND PROCUREMENT

NON-TRADITIONAL FUNDING METHODS

When traditional means of funding projects are not available, non-traditional funding may be desirable in order to implement beneficial projects. Energy and operational cost savings can be used to fund projects such as the ones recommended in this report. A couple of options are available when considering funding projects with cost savings.

The first way would be to secure a low interest loan and fund the projects internally by “fixing” the operational budgets over the term of the loan and use the savings to pay back the loan. Low interest loans are available through the State’s Texas LoanSTAR (Saving Taxes and Resources) Program.

The LoanSTAR Program has served as a national model for state and federal loan programs for energy efficiency retrofits, and is SECO's most highly visible program. Legislatively mandated to be funded at a minimum of $95 million at all times, to date the LoanSTAR Program has saved Texas taxpayers over $250 million through energy efficiency projects, financed for state agencies, institutions of higher education, school districts, and local governments. The program's revolving loan mechanism allows borrowers to repay loans through the stream-of-cost savings generated by the funded projects. The program will fund energy saving projects with a maximum combined simple payback of 10 years.

The interest rate for the LoanSTAR Program is based on several factors which include money market rates and LoanSTAR administrative cost. Rates are evaluated and set every fiscal year, from 9/01 - 8/31.

In order to qualify for funding from the LoanSTAR Program, a detailed energy audit or energy assessment report (EAR) must be completed for the facility/department by a licensed professional engineer in the State of Texas. The purpose of the EAR is to validate the savings estimated in this PEA, through a very detailed approach, as well as confirm the scope of work required for each project.

To assure the borrower that projects are constructed according to the EAR and LoanSTAR technical guidelines, SECO performs design specification review and on-site construction monitoring at 50% and 100% complete.

Another non-traditional solution to funding these projects is to secure the services of a performance contractor. Performance contractors can finance projects in the same manner as the LoanSTAR program by using energy and operational savings as funding for the projects. Performance contractors can package projects with paybacks up to 20 years and pull from a large variety of financial resources for low-interest funding (including the LoanSTAR Program). For more information on this subject feel free to visit the SECO website or call Jacobs at the number shown on the front cover of this PEA.

APPENDIX G: GOVERNMENT LEGISLATION AND STANDARDS

Energy Efficiency Programs in Political Subdivisions

Senate Bill 12

An Act relating to programs for the enhancement of air quality, including energy efficiency standards in state purchasing and energy consumption.

House Bill 3693

An Act relating to energy demand, energy load, energy efficiency initiatives, energy programs, and energy performance measures.

HB 3693 and SB 12 Rules

The State Energy Conservation Office (SECO) has published rules on House Bill (HB) 3693 and Senate Bill (SB) 12 for persons who have an interest in the adoption of energy codes to have an opportunity to comment on newly published editions of the International Energy Conservation Code and the International Residential Code. The code manuals can be purchased at the International Code Council web site.

BACKGROUND

In 2001, the 77th Texas Legislature passed Senate Bill 5 (SB5), also known as the Texas Emissions Reduction Plan, to amend the Texas Health and Safety Code. The legislation required ambitious, fundamental changes in energy use to help the state comply with federal Clean Air Act standards. It applied to all political subdivisions within 38 designated counties, later expanded to 41 counties.

In 2007, the 80th Texas Legislature passed Senate Bill 12 (SB 12) which among other things extended the timeline set in SB 5 for emission reductions. Where SB 5 required political subdivisions to reduce their electrical consumption by five percent (5%) for five years beginning January 1, 2002, the SB 12 legislation requires that such entities establish a goal to make the five percent (5%) reductions each year for six years, effective September 1, 2007.

SB 12 amended the Health and Safety Code Section 388.005, in part, by requiring affected political subdivisions to: implement all cost-effective energy-efficiency measures, establish a goal to reduce electricity consumption by 5 percent each year for 6 years, and report efforts and progress annually to the State Energy Conservation Office (SECO). The report details the efforts being undertaken by SECO to provide assistance and information to affected entities, as well as the progress and efforts made by political subdivisions in meeting the energy efficiency mandates of SB 5/SB 12.

Meeting Your Energy Efficiency Goals

In terms of energy efficiency, the biggest step is requiring new buildings to meet the state's energy performance standards. These standards call for better weather stripping, more efficient air conditioners, stricter insulation guidelines, switches to turn off water heaters, tighter building envelopes and energy-efficient windows for new buildings. Under the new law, municipalities and counties can continue to make local amendments to the state energy codes as long as they are not less stringent than the statewide standard.

Source: http://www.seco.cpa.state.tx.us/sb5compliance.htm

USEFUL WEBSITES:

A. DATABASE OF STATE INCENTIVES FOR RENEWABLE ENERGY

www.dsireusa.org
DSIRE provides information on state, local, utility, and selected federal incentives that promote renewable energy.

B. OFFICE OF ENERGY EFFICIENCY AND RENEWABLE ENERGY

www.eere.energy.gov
EERE is a resource site containing hundreds of web sites and thousands of online documents regarding energy efficiency and renewable energy. Also included are direct links to the Department of Energy offices and programs.

C. PUBLIC UTILITIES COMMISION

www.puc.state.tx.us/electric/projects/25309/25309.cfm
This link provides a source of information for the Energy Efficiency Grant Program. This includes the Program Application and Guidelines as well as a list of eligible counties and utilities.

D. REBUILD AMERICA

www.rebuild.org
Reubild America is a program under the Office of Energy Efficiency and Renewable Energy that focuses on energy efficiency solutions as community solutions. The site provides community partnerships ideas, tools, resources, and energy-smart technologies for help in fulfilling locally designed efficient energy solutions. Categories included are building renovation, new construction, renewable technologies, green building, city lighting, alternatively fueled vehicles, downtown revitalization, and more.

E. STATE ENERGY CONSERVATION OFFICE

http://www.seco.cpa.state.tx.us
The Texas State Energy Conservation Office provides information about various programs that are offered and how they may be implemented. SECO's programs focus on energy cost and consumption at the institutional, industrial, transportation, and residential levels.

F. TEXAS GENERAL LAND OFFICE

www.glo.state.tx.us
The primary mission of the General Land Office (GLO) is the management of state lands and mineral right properties. GLO manages an oil and natural gas program and a state electric power program. These programs provide gas and electricity to state agencies and public school districts at a discounted cost. The proceeds from the programs help to fund the state's Permanent School Fund.

APPENDIX H: SERVICE AGREEMENT

SECO
State Energy Conservation Office

Local Governments and Municipalities

Preliminary Energy Assessment
Service Agreement

Investing in our communities through improved energy efficiency in public buildings is a win-win opportunity for our communities and the state. Energy-efficient buildings reduce energy costs, increase available capital, spur economic growth, and improve working and living environments. The Preliminary Energy Assessment Service provides a viable strategy to achieve these goals.

Description of the Service

The State Energy Conservation Office (SECO) will analyze electric, gas and other utility data and work with Sour Lake, hereinafter referred to as Partner, to identify energy cost-savings potential. To achieve this potential, SECO and Partner have agreed to work together to complete an energy assessment of mutually selected facilities.

SECO agrees to provide this service at no cost to the Partner with the understanding that the Partner is ready and willing to consider implementing the energy savings recommendations.

Principles of the Agreement

Specific responsibilities of the Partner and SECO in this agreement are listed below.

- ✓ Partner will select a contact person to work with SECO and its designated contractor to establish an Energy Policy and set realistic energy efficiency goals.
- ✓ SECO's contractor will go on site to provide walk through assessments of selected facilities. SECO will provide a report which identifies no cost/low cost recommendations, Capital Retrofit Projects, and potential sources of funding. Portions of this report may be posted on the SECO website.
- ✓ Partner will schedule a time for SECO's contractor to make a presentation of the assessment findings key decision makers.

Acceptance of Agreement

This agreement should be signed by your organization's chief executive officer or other upper management staff.

Signature: [signature] Date: 4-1-2011
Name (Mr./Ms./Dr.): LARRY SAURAGE Title: CITY MANAGER
Organization: CITY OF SOUR LAKE Phone: 409 287 2059
Street Address: 625 HWY 105 W Fax: 409 287 2860
Mailing Address: 625 HWY 105 W. E-Mail: lsaurage@cmaccess.com
SOUR LAKE, TEXAS 77659 County: HARDIN

Contact Information:
Name (Mr./Ms./Dr.): LARRY SAURAGE Title: CITY MANAGER
Phone: 409 287 2059 Fax: 409 287 2059
E-Mail: lsaurage@cmaccess.com County: HARDIN

Please sign and mail or fax to: Stephen Ross, Local Governments and Municipalities Program Administrator
State Energy Conservation Office, 111 E. 17th Street, Austin, Texas 78774. Phone: 512-463-1772. Fax 512-475-2569.