Susan Combs
Texas Comptroller of Public Accounts

Facility Preliminary Energy Assessments and Recommendations

Prepared by:

ESA ENERGY SYSTEMS ASSOCIATES, Inc

A TERRACON COMPANY

100 East Main Street

Round Rock, Texas 78664

(512) 258-0547

Galveston Independent School District

July 7, 2011

ESA
Energy Systems Associates, Inc.
A Terracon COMPANY

SECO
State Energy Conservation Office

Table of Contents

1.0 EXECUTIVE SUMMARY: 3
Table 1: Summary of Recommended Energy Cost Reduction Measures (ECRMs) 4
2.0 ENERGY ASSESSMENT PROCEDURE: 5
3.0 ENERGY PERFORMANCE INDICATORS: 6
4.0 RATE SCHEDULE ANALYSIS: 12
ELECTRICITY PROVIDER: 12
NATURAL GAS PROVIDER: 14
5.0 CAMPUS DESCRIPTIONS: 15
Table 2: School Facilities Analyzed For This Report 15
6.0 ENERGY RECOMMENDATIONS: 16
HVAC ECRM 1: COMBINE CHILLER PLANTS AT BALL HIGH SCHOOL 16
HVAC ECRM 2: OPEN CHOKED WATER VALVES AND BALANCE PUMPS WITH VFDS 16
HVAC ECRM 3: ADD VFD ON COOLING TOWER OF WEIS MIDDLE SCHOOL 17
HVAC ECRM 4: REPLACE ELECTRIC BOILERS AT CRENSHAW WITH PROPANE BOILERS 18
Lighting ECRM 1: RETROFIT OF METAL HALIDE LIGHTING TO T8: 18
Lighting ECRM 2: DE-LAMPING OPPORTUNITIES: 20
CONTROLS ECRM 1: TIMERS FOR DOMESTIC WATER HEATER CIRCULAITNG PUMPS 21
Envelope ECRM 1: REPLACE ROOF AT WEIS MIDDLE SCHOOL 21
Envelope ECRM 2: REPLACE WINDOWS WITH INSULATED ENCLOSURES 21
7.0 MAINTENANCE AND OPERATION RECOMMENDATIONS 22
8.0 FINANCIAL EVALUATION 24
9.0 GENERAL COMMENTS 25
APPENDICES 26
APPENDIX I - SUMMARY OF FUNDING AND PROCUREMENT OPTIONS FOR CAPITAL EXPENDITURE PROJECTS 27
APPENDIX II - ELECTRIC UTILITY RATE SCHEDULE 34
APPENDIX IV - PRELIMINARY ENERGY ASSESSMENT SERVICE AGREEMENT 39
APPENDIX V - TEXAS ENERGY MANAGERS ASSOCIATION (TEMA) 41
APPENDIX VI - UTILITY CHARTS ON CD 43

1.0 EXECUTIVE SUMMARY:

This **Energy Efficient Partnership Service** is provided to public school districts and hospitals as a portion of the state's ***Schools/ Local Government Energy Management Program***; a program sponsored by the **State Energy Conservation Office (SECO)**, a division of the **State of Texas Comptroller of Public Accounts**.

Program Administrator:	Stephen Ross
Phone:	512-463-1770
Address:	State Energy Conservation Office LBJ State Office Building 111 E. 17th Street Austin. Texas 78774

The service assists these public, non-profit institutions to take basic steps towards energy efficient facility operation. Active involvement in the partnership from the entire administration and staff within the agencies and institutions is critical in developing a customized blueprint for energy efficiency for their facilities.

In April, 2011, **SECO** received a request for technical assistance from Paul Byers, Energy Manager for **Galveston I.S.D.** **SECO** responded by sending ESA **Energy Systems Associates, Inc.**, a registered professional engineering firm, to prepare this preliminary report for the school district. This report is intended to provide support for the district as it determines the most appropriate path for facility renovation, especially as it pertains to the energy consuming systems around the facility. It is our opinion that significant decreases in annual energy costs, as well as major maintenance cost reductions, can be achieved through the efficiency recommendations provided herein.

This study has focused on energy efficiency and systems operations. To that end, an analysis of the utility usage and costs for **Galveston ISD,** (hereafter known as GISD) was completed by ESA **Energy Systems Associates, Inc**., (hereafter known as *Engineer*) to determine the annual energy cost index (ECI) and energy use index (EUI) for each campus or facility. A complete listing of the Base Year Utility Costs and Consumption is provided in Section 3.0 of this report.

Following the utility analysis and a preliminary consultation with *Paul Byers*, a walk-through energy analysis was conducted throughout the campus. Specific findings of this survey and the resulting recommendations for both operation and maintenance procedures and cost-effective energy retrofit installations are identified in Section 7.0 of this report.

We estimate that as much as **$159,565** may be saved annually if all recommended projects are implemented. The estimated installed cost of these projects should total approximately **$687,000**, yielding an average simple payback of **4-1/3** years.

Table 1: Summary of Recommended Energy Cost Reduction Measures (ECRMs)

SUMMARY:	IMPLEMENTATION COST	ESTIMATED SAVINGS	SIMPLE PAYBACK
HVAC ECRM #1	$60,000	$15,500	3-4/5 Years
HVAC ECRM #2	$24,000	$7,350	3-1/4 Years
HVAC ECRM #3	$6,000	$715	8-1/4 Years
HVAC ECRM #4	$100,000	$29,250	3-2/5 Year
Lighting ECRM #1	$142,500	$23,750	6 Years
Lighting ECRM #2	$4,000	$2,000	2 Years
Controls ECRM #1	$500	$500	1 Years
Envelope ECRM #1	$50,000	$5,500	9 Years
Envelope ECRM #2	$300,000	$75,000	4 Years
TOTAL PROJECTS	**$ 687,000**	**$159,565**	**4-1/3 Years**

Although additional savings from reduced maintenance expenses are anticipated, these savings projections are not included in the estimates provided above. As a result, the actual Internal Rate of Return (IRR), for this retrofit program has been calculated and shown in Section 8.0 of this report.

Our final "summary" comment is that **SECO** views the completion and presentation of this report as a beginning, rather than an end, of our relationship with GISD. We hope to be ongoing partners in assisting you to implement the recommendations listed in this report. Please call us if you have further questions or comments regarding your Energy Management Issues.

*ESA Energy Systems Associates, Inc., James W. Brown (512) 258-0547
A Terracon Company

2.0 ENERGY ASSESSMENT PROCEDURE:

Involvement in this on-site analysis program was initiated through completion of a Preliminary Energy Assessment Service Agreement. This PEASA serves as the agreement to form a "partnership" between the client and the State Energy Conservation Office (SECO) for the purposes of energy costs and consumption reduction within owned and operated facilities. After receipt of the PEASA, an initial visit was conducted by the professional engineering firm contracted by SECO to provide service within that area of the state to review the program elements that SECO provides to school districts and determine which elements could best benefit the district. A summary of the *Partner's* most recent twelve months of utility bills was provided to the engineer for the preliminary assessment of the Energy Performance Indicators. After reviewing the utility bill data analysis and consultation with SECO to determine the program elements to be provided to GISD, ESA returned to the facilities to perform the following tasks:

1. Designing and monitoring customized procedures to control the run times of energy consuming systems.
2. Analyze systems for code and standard compliance in areas such as cooling system refrigerants used, outside air quantity, and lighting illumination levels.
3. Develop an accurate definition of system and equipment replacement projects along with installation cost estimates, estimated energy and cost savings and analyses for each recommended project.
4. Develop a prioritized schedule for replacement projects.
5. Developing and drafting an overall Energy Management Policy.
6. Assist in the development of guidelines for efficiency levels of future equipment purchases.

3.0 ENERGY PERFORMANCE INDICATORS:

In order to easily assess the *Partner's* energy utilization and current level of efficiency, there are two key "Energy Performance Indicators" calculated within this report.

1. Energy Utilization Index

The Energy Utilization Index (EUI) depicts the total annual energy consumption per square foot of building space, and is expressed in "British Thermal Units" (BTUs).

To calculate the EUI, the consumption of electricity and gas are first converted to equivalent BTU consumption via the following formulas:

ELECTRICITY Usage

[Total KWH /yr] x [3413 BTUs/KWH] = _____ BTUs / yr

NATURAL GAS Usage

[Total MCF/yr] x [1,030,000 BTUs/MCF] = _____ BTUs / yr

After adding the BTU consumption of each fuel, the total BTUs are then divided

by the building area.

EUI = [Electricity BTUs + Gas BTUs] divided by [Total square feet]

2. Energy Cost Index

The Energy Cost Index (ECI) depicts the total annual energy cost per square foot of building space.

To calculate the ECI, the annual costs of electricity and gas are totaled and divided by the total square footage of the facility:

ECI = [Electricity Cost + Gas Cost] divided by [Total square feet]

These indicators may be used to compare the facility's current cost and usage to past years, or to other similar facilities in the area. Although the comparisons will not provide specific reasons for unusual operation, they serve as indicators that problems may exist within the energy consuming systems.

THE CURRENT GISD ENERGY PERFORMANCE INDICATORS:

CAMPUS	ENERGY UTILIZATION INDEX (EUI) BTUs/sf-year	COMPARISON TO DISTRICT AVERAGE	ENERGY COST INDEX (ECI) $/sf-year	COMPARISON TO DISTRICT AVERAGE
Crenshaw MS/ES	121,172	75%	$2.46	44%
Ball HS	71,530	3%	$1.78	4%
Weis ES	61,607	-11%	$1.78	4%
Rosenberg ES	67,291	-3%	$1.68	-2%
Central MS	59,180	-15%	$1.63	-5%
Parker ES	62,368	-10%	$1.61	-6%
Austin MS	41,521	-40%	$1.05	-39%
Average Value:	69,238		$1.71	

Galveston ISD purchases electricity from GDF Suez. The transmission and distribution utility is Centerpoint Energy. The energy history spreadsheets are shown on the next few pages.

The rate schedule analysis for the district is shown in Section 4.0.

A copy of the rate schedule is included in Appendix I.

It was noted during the utility bill analysis that the consumption histories for Austin and Central Middle Schools do not indicate the typical reduction in consumption during the summer months that is typically seen in Texas school facilities. This indicates a possibility that the schedules in the energy management systems are not being updated for changes in occupancy during non-occupied months.

Additionally, the gas consumption history for Central Middle School indicates zero use throughout the year but the facility still incurred $226 in customer charges. *We recommend the district close this meter if it is indeed not being used.*

OWNER: Galveston ISD **BUILDING:** Austin MS

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
		CONSUMPTION	METERED	CHARGED	COST OF	TOTAL ALL ELECTRICAL	CONSUMPTION	COSTS
MONTH	YEAR	KWH	KW/KVA	KW/KVA	DEMAND	COSTS $	MCF	$
JANUARY	2010	98,532		0	0	9,279	122	1,214
FEBRUARY	2010	98,567		0	0	9,260	90	994
MARCH	2010	112,240		0	0	10,410	55	504
APRIL	2010	124,660		0	0	11,455	30	281
MAY	2010	124,327		0	0	11,597	18	190
JUNE	2010	119,168		0	0	10,947	11	127
JULY	2010	118,283		0	0	10,875	11	134
AUGUST	2010	93,432		0	0	8,934	10	134
SEPTEMBER	2009	120,591		0	0	10,984	29	226
OCTOBER	2009	112,446		0	0	10,332	21	181
NOVEMBER	2009	97,974		0	0	9,087	47	429
DECEMBER	2009	100,596		0	0	9,331	71	629
TOTAL		**1,320,816**	**0**	**0**	**0**	**$122,491**	**515**	**$5,043**

Annual Total Energy Cost =	$127,534	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	41,521	BTU/s.f.yr
Total KWH x 0.003413 =	4,507.95	x 106			
Total MCF x 1.03 =	530.45	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$1.05	$/s.f. yr
Total Other x ____		x 106			
Total Site BTU's/yr	5,038.40	x 106			
Floor area:	121,345	s.f.			

Electric Utility	Account #	Meter#	Gas Utility	Meter #
GDF Suez	1501161003	0	Texas Gas Service	0

OWNER: Galveston ISD **BUILDING:** Ball HS

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
		CONSUMPTION	METERED	CHARGED	COST OF	TOTAL ALL ELECTRICAL	CONSUMPTION	COSTS
MONTH	YEAR	KWH	KW/KVA	KW/KVA	DEMAND	COSTS $	MCF	$
JANUARY	2010	435,987		0	0	45,508	1,357	13,143
FEBRUARY	2010	432,798		0	0	45,059	1,275	13,006
MARCH	2010	497,419		0	0	49,871	1,046	8,306
APRIL	2010	497,272		0	0	49,918	544	4,109
MAY	2010	599,546		0	0	59,235	195	1,640
JUNE	2010	516,632		0	0	51,835	111	921
JULY	2010	482,205		0	0	49,535	59	568
AUGUST	2010	641,860		0	0	63,278	44	418
SEPTEMBER	2009	582,900		0	0	57,831	29	209
OCTOBER	2009	567,996		0	0	54,106	78	606
NOVEMBER	2009	446,519		0	0	46,333	356	2,890
DECEMBER	2009	537,929		0	0	52,219	622	5,216
TOTAL		**6,239,063**	**0**	**0**	**0**	**$624,728**	**5,716**	**$51,032**

Annual Total Energy Cost =	$675,760	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	71,530	BTU/s.f.yr
Total KWH x 0.003413 =	21,293.92	x 106			
Total MCF x 1.03 =	5,887.48	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$1.78	$/s.f. yr
Total Other x ____		x 106			
Total Site BTU's/yr	27,181.40	x 106			
Floor area:	380,000	s.f.			

Electric Utility	Account #	Meter#	Gas Utility	Meter #
GDF Suez	2046170005	0	Texas Gas Service	0

OWNER: Galveston ISD **BUILDING:** Central MS

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
		CONSUMPTION	METERED	CHARGED	COST OF	TOTAL ALL ELECTRICAL	CONSUMPTION	COSTS
MONTH	YEAR	KWH	KW/KVA	KW/KVA	DEMAND	COSTS $	MCF	$
JANUARY	2010	166,239		0	0	16,559	0	15
FEBRUARY	2010	155,340		0	0	15,733	0	15
MARCH	2010	224,921		0	0	21,197	0	15
APRIL	2010	216,439		0	0	20,547	0	15
MAY	2010	325,968		0	0	29,606	0	15
JUNE	2010	328,173		0	0	29,367	0	16
JULY	2010	347,165		0	0	30,806	0	15
AUGUST	2010	340,577		0	0	30,846	0	15
SEPTEMBER	2009	245,378		0	0	23,846	0	15
OCTOBER	2009	226,365		0	0	21,955	0	30
NOVEMBER	2009	225,903		0	0	21,635	0	15
DECEMBER	2009	214,126		0	0	20,700	0	45
TOTAL		**3,016,594**	**0**	**0**	**0**	**$282,797**	**0**	**$226**

Annual Total Energy Cost =	$283,023	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	59,180 BTU/s.f.yr
Total KWH x 0.003413 =	10,295.64	x 106		
Total MCF x 1.03 =	0.00	x 106	**Energy Cost Index:**	
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$1.63 $/s.f. yr
Total Site BTU's/yr	10,295.64	x 106		
Floor area:	173,972	s.f.		

Electric Utility	Account #	Meter#	Gas Utility	Meter #
GDF Suez	4926680000	0	Texas Gas Service	0

OWNER: Galveston ISD **BUILDING:** Crenshaw MS/ES

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
		CONSUMPTION	METERED	CHARGED	COST OF	TOTAL ALL ELECTRICAL	CONSUMPTION	COSTS
MONTH	YEAR	KWH	KW/KVA	KW/KVA	DEMAND	COSTS $	MCF	$
JANUARY	2010	256,500		0	0	15,494	0	0
FEBRUARY	2010	265,000		0	0	16,258	0	0
MARCH	2010	230,500		0	0	14,443	0	0
APRIL	2010	174,500		0	0	15,007	0	0
MAY	2010	128,000		0	0	8,479	0	0
JUNE	2010	133,000		0	0	8,934	0	0
JULY	2010	120,500		0	0	8,663	0	0
AUGUST	2010	139,500		0	0	9,916	0	0
SEPTEMBER	2009	119,000		0	0	5,647	0	0
OCTOBER	2009	98,500		0	0	6,546	0	0
NOVEMBER	2009	154,000		0	0	14,085	0	0
DECEMBER	2009	229,500		0	0	18,562	0	0
TOTAL		**2,048,500**	**0**	**0**	**0**	**$142,034**	**0**	**$0**

Annual Total Energy Cost =	$142,034	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	121,172 BTU/s.f.yr
Total KWH x 0.003413 =	6,991.53	x 106		
Total MCF x 1.03 =	0.00	x 106	**Energy Cost Index:**	
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$2.46 $/s.f. yr
Total Site BTU's/yr	6,991.53	x 106		
Floor area:	57,699	s.f.		

Electric Utility	Account #	Meter#	Gas Utility	Meter #
GDF Suez	0	0	Texas Gas Service	0

OWNER: Galveston ISD **BUILDING:** Parker ES

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
		CONSUMPTION	METERED	CHARGED	COST OF	TOTAL ALL ELECTRICAL	CONSUMPTION	COSTS
MONTH	YEAR	KWH	KW/KVA	KW/KVA	DEMAND	COSTS $	MCF	$
JANUARY	2010	87,454		0	0	8,916	154	1,366
FEBRUARY	2010	93,257		0	0	9,438	246	2,471
MARCH	2010	95,914		0	0	9,621	208	1,939
APRIL	2010	104,510		0	0	10,308	114	977
MAY	2010	117,331		0	0	11,567	56	467
JUNE	2010	107,343		0	0	10,939	28	254
JULY	2010	97,060		0	0	10,130	18	180
AUGUST	2010	115,450		0	0	11,561	10	119
SEPTEMBER	2009	118,142		0	0	11,606	0	30
OCTOBER	2009	104,219		0	0	10,494	4	57
NOVEMBER	2009	88,026		0	0	8,988	5	71
DECEMBER	2009	88,587		0	0	9,071	73	653
TOTAL		**1,217,293**	**0**	**0**	**0**	**$122,639**	**916**	**$8,584**

Annual Total Energy Cost =	$131,223	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	62,368	BTU/s.f.yr
Total KWH x 0.003413 =	4,154.62	x 106			
Total MCF x 1.03 =	943.48	x 106	**Energy Cost Index:**		
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$1.61	$/s.f. yr
Total Site BTU's/yr	5,098.10	x 106			
Floor area:	81,742	s.f.			

Electric Utility	Account #	Meter#	Gas Utility	Meter #
GDF Suez	6415603008	0	Texas Gas Service	0

OWNER: Galveston ISD **BUILDING:** Rosenberg ES

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
		CONSUMPTION	METERED	CHARGED	COST OF	TOTAL ALL ELECTRICAL	CONSUMPTION	COSTS
MONTH	YEAR	KWH	KW/KVA	KW/KVA	DEMAND	COSTS $	MCF	$
JANUARY	2010	71,588		0	0	7,201	210	2,006
FEBRUARY	2010	69,016		0	0	6,997	153	1,516
MARCH	2010	76,470		0	0	7,585	114	938
APRIL	2010	86,556		0	0	8,381	61	482
MAY	2010	95,159		0	0	9,186	13	122
JUNE	2010	84,166		0	0	8,204	6	65
JULY	2010	83,095		0	0	8,104	22	249
AUGUST	2010	105,538		0	0	10,260	15	130
SEPTEMBER	2009	98,622		0	0	9,555	7	60
OCTOBER	2009	91,445		0	0	8,868	7	68
NOVEMBER	2009	75,289		0	0	7,478	37	328
DECEMBER	2009	72,151		0	0	7,216	130	1,100
TOTAL		**1,009,095**	**0**	**0**	**0**	**$99,035**	**775**	**$7,064**

Annual Total Energy Cost =	$106,099	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	67,291	BTU/s.f.yr
Total KWH x 0.003413 =	3,444.04	x 106			
Total MCF x 1.03 =	798.25	x 106	**Energy Cost Index:**		
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$1.68	$/s.f. yr
Total Site BTU's/yr	4,242.29	x 106			
Floor area:	63,044	s.f.			

Electric Utility	Account #	Meter#	Gas Utility	Meter #
GDF Suez	8741671007	0	Texas Gas Service	0

OWNER: Galveston ISD **BUILDING:** Weis MS

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
		CONSUMPTION	METERED	CHARGED	COST OF	TOTAL ALL ELECTRICAL	CONSUMPTION	COSTS
MONTH	YEAR	KWH	KW/KVA	KW/KVA	DEMAND	COSTS $	MCF	$
JANUARY	2010	131,620		0	0	13,417	23	262
FEBRUARY	2010	129,654		0	0	13,226	2	36
MARCH	2010	140,495		0	0	14,107	0	15
APRIL	2010	159,278		0	0	15,718	0	15
MAY	2010	183,061		0	0	17,695	0	15
JUNE	2010	145,366		0	0	14,538	0	15
JULY	2010	135,343		0	0	13,785	0	15
AUGUST	2010	179,376		0	0	17,606	0	15
SEPTEMBER	2009	177,988		0	0	17,471	15	202
OCTOBER	2009	164,523		0	0	16,205	4	67
NOVEMBER	2009	140,486		0	0	14,220	29	268
DECEMBER	2009	134,606		0	0	13,537	23	217
TOTAL		**1,821,796**	**0**	**0**	**0**	**$181,525**	**96**	**$1,142**

Annual Total Energy Cost =	$182,667	Per Year
Total KWH x 0.003413 =	6,217.79	x 106
Total MCF x 1.03 =	98.88	x 106
Total Other x ____		x 106
Total Site BTU's/yr	6,316.67	x 106
Floor area:	102,532	s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 61,607 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $1.78 $/s.f. yr

Electric Utility	Account #	Meter#	Gas Utility	Meter #
GDF Suez	4139168008	0	Texas Gas Service	0

4.0 RATE SCHEDULE ANALYSIS:

ELECTRICITY PROVIDER:

RETAIL ELECTRIC PROVIDER: GDF Suez Contract price: $0.07264 per kWh

TRANSMISSION AND DISTRIBUTION UTILITY: Centerpoint Energy

Electric Rate: Secondary Service > 10 kVA

I.	TRANSMISSION AND DISTRIBUTION CHARGES:		
	Customer Charge	=	$5.27 per meter
	Metering Charge	=	$116.89 per Month
	Transmission System Charge	=	$1.4709 per 4CP kVA
	Distribution System Charge	=	$3.118137 per Billing kVA
II.	SYSTEM BENEFIT FUND	=	$0.000657 per kWh
III.	TRANSITION CHARGES		
	Transition Charge 1	=	$0.636156/kVA
	Transition Charge 2	=	$1.113893/kVA
	Transition Charge 3	=	$0.455734/kVA
IV.	NUCLEAR DECOMMISSIONING CHARGE	=	$0.008909 per kVA
V.	TRANSMISSION COST RECOVERY FACTOR	=	$0.618334/kVA
VI.	COMPETITIVE METERING CREDIT	=	$15.69 per Customer
VII.	OTHER CHARGES		
	a. Municipal Account Franchise Credit	=	$-0.002207 per kWh
	b. Rate Case Expenses Surcharge	=	$15.69 per Customer
	c. Rider UCOS Retail Credit	=	$-0.016314 per kVA
	d. Advanced Metering System Surcharge	=	$3.16 per Non-IDR Meter
	e. Energy Efficiency Cost Recovery Factor	=	$3.30/Customer per Month
	f. ADFIT Credit	=	$-0.056777 per kVA
VIII.	SYSTEM RESTORATION CHARGE	=	$0.153885 per kVA
IX.	TAXES		
	Reimbursement of Misc. Gross Receipts Tax/Fee	=	1.997%
	Reimbursement of UDC PUC Gross Receipts	=	0.167%
X.	UTILITY SERVICE DISCRE-UCS CREDIT	=	$-0.01227765
XI.	GROSS RECEIPTS TAX	=	.1997% Of All T&D Charges

Average Savings for consumption = $0.07264/kWh + $0.000657/kWh + $-0.00207/kWh = $0.071227/kWh

Average Savings for demand = $1.4709 + $3.118137 + $0.636156 + $1.113893 + $0.455734 + $0.008909 + $0.618334 + $-0.016314 + $-0.056777 + $0.153885 = $ 7.502857/kVA**

** This number is a generalization of average cost per kW because the rate schedule from Centerpoint utilizes three (3) different types of demand for the calculation of the utility bill:

1. NCP kVA: Peak demand during 15 minute interval of current billing cycle
2. 4CP kVA: Average demands of June, July, August and September of previous calendar year; usually only applied to IDR metered accounts
3. Billing kVA: Ratchet demand representing higher of two calculations: 80% of peak demand in last 11 months or current NCP kVA

NATURAL GAS PROVIDER:

The rate schedule for Natural gas is unavailable, but we have calculated the average cost per MCF of purchased natural gas in the district by analyzing the utility histories for the schools surveyed in this report.

Total cost for natural gas at the eight facilities in the analyzed billing cycle: $73,091

Total quantity purchased during the analyzed billing cycle: 8,018 MCF

Average cost per MCF = Cost of natural gas / quantity purchased = $73,091 / 8,018 MCF

Average cost per MCF = $9.12

5.0 CAMPUS DESCRIPTIONS:

Galveston ISD consists of 13 educational campuses (1 High Schools, 3 Middle Schools and 3 Elementary Schools, and 6 other learning facilities) which are located in Galveston County; in and throughout the cities of Galveston and Bolivar Peninsula. The energy survey focused on seven of the educational campuses:

Table 2: School Facilities Analyzed For This Report

Facility	Year originally Constructed	Approximate Square Footage	Basic HVAC Cool/Heat	Basic HVAC Air Distribution	Basic Lighting System Description	Basic Control System Description
Weis MS	1976	102,532	Water Cooled Chiller/ HW Boiler	VAVAHU with hot water reheat	100% T8 MH in Gym	DDC TAC
Ball HS	1954	380,000	Water Cooled Chiller/ HW Boiler	VAVAHU with hot water reheat	100% T8 MH in Gym	DDC Automated Logic
Morgan El	1978	154,000	Water Cooled Chiller/ HW Boiler	MZAHU with hot water reheat	100% T8 MH in Gym	DDC Automated Logic
Central MS	1954	173,972	Water Cooled Chiller/ HW Boiler	VAVAHU with hot water reheat	100% T8 MH in Gym	DDC Automated Logic
San Jacinto	1965	50,000	Water Cooled Chiller/ HW Boiler	MZAHU with hot water reheat	100% T8 MH in Gym	DDC TAC
Austin MS	1939	121,345	Water Cooled Chiller/ HW Boiler	VAVAHU with electric reheat	100% T8 MH in Gym	DDC Automated Logic
Crenshaw ES & MS	2005	57,699	Water Cooled Chiller/ HW Boiler	VAVAHU with hot water reheat	100% T8 MH in Gym	DDC TAC

Note: VAVAHU = Variable Air Volume Air Handling Unit; MZAHU = Multi-Zone Air Handling Unit

The selection of campuses represented a mix of older and newer campuses which allows for comparison of energy strategies between older and newer designs as well as the ability to extrapolate recommendations for these facilities to other facilities in the district.

6.0 ENERGY RECOMMENDATIONS:

HVAC ECRM 1: COMBINE CHILLER PLANTS AT BALL HIGH SCHOOL

It was noted during the survey that Ball High School has two chiller plants. One was built in 1995 and the other in 2005.

The chiller plant built in 1995 (chiller plant 1) has two constant volume condenser pumps, two constant volume secondary pumps and two constant volume primary pumps. The chillers are from 1995 and not as efficient as the units installed in 2005. Chiller plant 1 has a hard time keeping up with loads, often running both chillers to maximum capacity. There also appears to be a problem with the staging in the control system for the two chillers. The second chiller will come on when the first is managing the load adequately.

The chiller plant built in 2005 (chiller plant 2) has variable frequency drives on the cooling towers and two secondary pumps, as well as more efficient chillers. It rarely operates more than one chiller at a time.

The two plants are located across an access drive from each other. *We recommend connecting the two plants so that the more efficient plant can do most of the work for the entire building.* By adding piping between the two plants, plant 2 can be more loaded than plant 1. Plant 2 conditions and distributes the water much more efficiently than the older plant.

A secondary benefit of this project would be operational redundancy for maintenance and future purchases. envelope

Estimated Cost: $60,000 *Estimated Savings: $15,500* *Estimated Payback: 3.8 Years*

HVAC ECRM 2: OPEN CHOKED WATER VALVES AND BALANCE PUMPS WITH VFDS

It was noted during the survey that numerous facilities had water pipes with valves choked down to balance the water flow. This creates unneeded resistance in the system that must be overcome continuously by the pump. It can be found on the condenser water piping, chilled water piping, and hot water piping.

Image 1. Crenshaw Condenser balancing valves.

<u>Crenshaw Elementary and Middle School</u>

The two 25hp secondary pumps are choked 50% and operate with a VFD. One pump is dedicated to one chiller. *We recommend the district open the valves and allow the VFD to adjust the flow to the loading required at the time.*

The two 15hp condenser pumps are choked 50%. *We recommend the district open the valves and re-balance the system with a new VFD on each pump to allow them to maintain minimum flow through the chiller at a reduced power requirement from the current loading.*

Estimated Cost: $6,000 *Estimated Savings: $1,850* *Estimated Payback: 3.2 Years*

Weis Middle School

The 20hp secondary pumps are choked 25% and operate with a VFD. *We recommend the district open the valves and limit the VFD on each pump to the max flow required*

The two primary pumps are choked 70%. They are powered by two 5 horsepower pumps, each dedicated to a chiller. *We recommend the district open the valves and rebalance the system with a new VFD on each pump and run them at a reduced constant speed.*

Estimated Cost: $3,000 *Estimated Savings: $900* *Estimated Payback: 3.3 Years*

Ball High School

The two 20hp primary pumps are choked 40% at the pump and 60% at the chiller. *We recommend the district open the valves and rebalance the system with a new VFD on each pump and run them at a reduced constant speed.*

The two 25hp condenser pumps are choked 60% at the pump, 60% the chiller and 20% on the return. *We recommend the district open the valves and rebalance the system with a new VFD on each pump and run them at a reduced constant speed.*

Image 2. Ball HS primary balancing valves.

Estimated Cost: $15,000 *Estimated Savings: $4,600* *Estimated Payback: 4.25 Years*

District wide savings:

Estimated Cost: $24,000 *Estimated Savings: $7,350* *Estimated Payback: 3-1/4 Years*

HVAC ECRM 3: ADD VFD ON COOLING TOWER OF WEIS MIDDLE SCHOOL

Currently Weis Middle School has (2) 15 hp two-speed motors on the cooling tower. According to maintenance personnel, it runs 95% of the time on the high speed, regardless of outside temperature. Savings can be achieved by installing a VFD on the motor and letting it back off when it does not need to operate at full speed.

Estimated Cost: $6,000 *Estimated Savings: $715* *Estimated Payback: 8-1/4 Year*

HVAC ECRM 4: REPLACE ELECTRIC BOILERS AT CRENSHAW WITH PROPANE BOILERS

Currently Crenshaw has two boilers that make up 1800 Amps (each 900 Amp service) of the 2700 Amps feeding the building. Looking at the electric utility data shows that when these boilers turn on the build uses massive amount of electricity.

Natural gas costs one third the amount of electricity per BTU of heat. Since there is no natural gas service to the Bolivar Peninsula, propane is the next best option. *We recommend installing a propane-fired boiler in lieu of the electric unit.*

This measure will reduce consumption and demand charges on GISD's electric bill.

Estimated Cost: $100,000 Estimated Savings: $29,250 Estimated Payback: 3.4 Year

Lighting ECRM 1: RETROFIT OF METAL HALIDE LIGHTING TO T8:

All seven schools surveyed were noted to utilize metal halide fixtures. One characteristic of metal halide fixtures is their inherently long re-strike. This means that if the fixtures are ever turned off, it can take up to 15 minutes for them to come back on. This long re-strike encourages staff to leave the lights on throughout the day, even if the space is not occupied. *We recommend replacing the metal halides with T5 high-bay fixtures to improve overall light levels in the space and to allow the fixtures to be turned off during unoccupied periods of the day.*

<u>Ball High School</u>

Image 3. Ball HS Cafeteria lights.

The Cafeteria has twenty- 250W Metal Halides with skylights. The existing fixtures should be replaced with T-8 2X4 fixtures.

The Competition Gym has thirty 400W metal halide fixtures; the practice gymnasium utilizes twenty-eight 400-watt metal halide fixtures. We recommend replacing these fixtures with 6-lamp T5 high-bay fixtures.

The Band Hall has twenty 400W Metal Halides. The existing fixtures should be replaced with T5 fluorescent fixtures.

Estimated Cost: $49,000 Estimated Savings: $8,200 Estimated Payback: 6 years

Crenshaw Elementary and Middle School

The Competition Gym has twenty 400W metal halide. We recommend replacing these with T8 high bay fixtures.

Estimated Cost: $10,000 Estimated Savings: $1,675 Estimated Payback: 6 years

Weis Middle School

Image 4. Weis MS Gym lights.

The Competition Gym has thirty-two 250W metal halide. We recommend replacing these with T8 high bay fixtures.

Estimated Cost: $16,000 Estimated Savings: $2,675 Estimated Payback: 6 years

Morgan Elementary School

The Gym has fifteen 400W metal halide. We recommend replacing these with T8 high bay fixtures.

Estimated Cost: $7,500 Estimated Savings: $1,250 Estimated Payback: 6 years

Central Middle School

The Competition Gym has thirty 400W metal halide. We recommend replacing these with T5 high-bay fixtures.

Estimated Cost: $15,000 Estimated Savings: $2,500 Estimated Payback: 6 years

Image 5. Central MS competition gym lighting.

San Jacinto Middle School

The Competition Gym has twenty-four 400W metal halide. We recommend replacing these with T5 high-bay fixtures.

Estimated Cost: $12,000 *Estimated Savings: $2,000* *Estimated Payback: 6 years*

Austin Middle School

Image 5. Austin MS library lighting.

The Library has fifteen 1000W metal halide. We recommend replacing these with two T8 high bay fixtures. Similarly, the practice gymnasium utilizes thirty-six 400-watt metal halides. We recommend replacing these fixtures with T5 high-bay fluorescent fixtures.

Estimated Cost: $33,000 *Estimated Savings: $5,500* *Estimated Payback: 6 years*

District Wide
Estimated Cost: $142,500 *Estimated Savings: $23,750* *Estimated Payback: 6 years*

Lighting ECRM 2: DE-LAMPING OPPORTUNITIES:

The corridors at Weis Elementary utilize two 3-lamp fixtures at 10 feet spacing. Light levels in the corridors were measured to be 60-72 footcandles. The Illumination Engineering Society of North America (IESNA) develops recommendations for appropriate light levels in various spaces in school buildings. Their recommendation for school corridors is 5-10 footcandles. We recommend the district consider removing the inboard lamp in the corridor fixtures at Weis Elementary. Light levels will fall to 40-45 footcandles, which still exceeds IESNA recommendations.

Image 7. Weis MS hallway lighting.

The corridors and classrooms at San Jacinto have 3-lamp fixtures to light the corridor. As per the recommendation for Weis Middle School, these fixtures can be de-lamped to 2-lamp fixtures by removing the center lamp and still provide adequate light levels in the corridors.

Estimated Cost: $4,000 Estimated Savings: $2,000 Estimated Payback: 2 Years

CONTROLS ECRM 1: TIMERS FOR DOMESTIC WATER HEATER CIRCULAITNG PUMPS

All of the water heaters around the district were noted have electric circulating pumps running continuously. Programmable timers can be installed with these units that will limit the operation of the water heater to scheduled occupancy hours and eliminate operation during holidays and on weekends. This condition was noted at all schools walked. Pricing is reflective of Weis Middle school only.

Image 8. Weis MS circ. pump.

Estimated Cost: $500 Estimated Savings: $500 Estimated Payback: 1 Year

Envelope ECRM 1: REPLACE ROOF AT WEIS MIDDLE SCHOOL

At Weis Middle School there is a 50 ft by 30 ft section of roofing that is past its expected life. That area of the build experiences most of the hot and cold calls. The integretaty of the insulation and roofing materials has been compromised. *We recommend replacing the roofing in this area and make it equal to the rest of the building.*

Estimated Cost: $50,000 Estimated Savings: $5,500 Estimated Payback: 9 Years

Envelope ECRM 2: REPLACE WINDOWS WITH INSULATED ENCLOSURES

Ball High School and Central Middle School were built before air conditioning was used throughout the entire building. Instead the buildings where built with operable single pane glass windows that could be opened to let in fresh outside air. Over the years, air conditioning was added to the building, but the single pane windows remained. *We recommend removing the operable single pane windows in Ball High School Gym and in Central Middle School gym and replace them with insulated weatherproof enclosures. Also Central Middle School Library windows should be replace with double pane energy efficient windows since the air conditioning serving that room cannot keep up with the load.*

Image 10. Ball HS gym with original windows.

Estimated Cost: $300,000 Estimated Savings: $75,000 Estimated Payback: 4 Years

7.0 MAINTENANCE AND OPERATION RECOMMENDATIONS

HVAC

- Fix temp sensor at Weis Chiller
- Fix LWT sensor at Central Chiller
- Cap OA openings at Ball HS
- Keep electric boiler off during peak electrical load conditions
- Verify elec heat stages at low load conditions
- Increase frequency of filter replacement

Lighting

- Turn off all light fixtures not required during daytime
- Turn off lights in unoccupied spaces

Controls

- Relocate EMS sensors to improve temperature sampling

Maintenance and Operation procedures are strategies that can offer significant energy savings potential, yet require little or no capital investment by the district to implement. Exact paybacks are at times difficult to calculate, but are typically always less than one year. The difficulties with payback calculation are often related to the fact that the investigation required to make the payback calculation, for example measuring the air gap between exterior doors and missing or damaged weatherstripping so that exact air losses may be determined, is time and cost prohibitive when the benefits of renovating door and weather weatherstripping are well documented and universally accepted.

HVAC M&O#1 & 2

At GISD, the HVAC M&O opportunities include replacing broken sensors at Weis Middle school and Central Middle school. Without accurate temperature readings, the system cannot control itself properly.

Image 11. Ball HS outside air louver into room.

HVAC M&O #3

There are original outside air louvers that transfer ventilation air into the mechanical rooms at Ball High School. Since the redesigned air handling system has a duct feeding the unit, these openings are of no use, and add unneeded load to the system. We recommend you cap them off so that the hot outside air does not get into the building untreated.

HVAC M&O #4

Crenshaw ES &MS has two large electric boilers. Natural gas is not available at the facility, but the EMS can be programmed to limit the impact of the boiler on the demand-side of the utility bill by eliminating boiler operation during peak demand times of the day. At these times, the rooms should be close to setpoint so eliminating the boiler operation during peak times should not result in uncomfortable conditions in the spaces.

HVAC M&O #5

It was also noted during the survey, that some of the HVAC filters have not been changed with regularity. We recommend the district replace each HVAC filter with a pleated filter every 60-90 days.

Lighting M&O #1 & 2

Some areas of the buildings noted in Section 6.0 of the report had light fixtures that were not required to be operating during the day or were fixtures left operating in unoccupied spaces. The least expensive remedy to these issues is to train staff to not turn on fixtures not needed during daytime hours and to turn off fixtures in unoccupied spaces. Failure of the behavioral modification training will require the district to invest capital into automatic controls for the fixtures.

Controls M&O

There were sensors noted in many locations that were not conducive to appropriate temperature sampling. One such sensor is was noted to be installed immediately over a computer (subject to heat from the computer). We recommend the district relocate these sensors to improve the accuracy of the temperature sampling in the space.

8.0 FINANCIAL EVALUATION

Financing of these projects may be provided using a variety of methods such as Bond Programs, municipal leases, or state financing programs like the SECO LoanSTAR Program.

If the project was financed with in-house funds, the internal rate of return for the investment would be as follows:

Proposal:	Perform recommended ECRMs			
Assumptions:				
1. Equipment will last at least 15 years prior to next renovation				
2. No maintenance expenses for first five years (warranty period)				
3. $5,000 maintenance expense next 5 years				
4. $10,000 maintenance expense next 5 years				
5. Savings decreases 5% per year after year 5				
Cash Flow	**Project Cost**	**Project Savings**	**Maintenance Expense**	**Net Cash Flow**
Time 0	($687,000)		0	($687,000)
Year 1		$ 159,565.00	0	$159,565
Year 2		$ 159,565.00	0	$159,565
Year 3		$ 159,565.00	0	$159,565
Year 4		$ 159,565.00	0	$159,565
Year 5		$ 159,565.00	0	$159,565
Year 6		$ 151,586.75	($5,000)	$146,587
Year 7		$ 143,608.50	($5,000)	$138,609
Year 8		$ 135,630.25	($5,000)	$130,630
Year 9		$ 127,652.00	($5,000)	$122,652
Year 10		$ 119,673.75	($5,000)	$114,674
Year 11		$ 111,695.50	($10,000)	$101,696
Year 12		$ 103,717.25	($10,000)	$93,717
Year 13		$ 95,739.00	($10,000)	$85,739
Year 14		$ 87,760.75	($10,000)	$77,761
Year 15		$ 79,782.50	($10,000)	$69,783
			Internal Rate of Return	**19.74%**

More information regarding financial programs available to GISD can be found in:

APPENDIX I: SUMMARY OF FUNDING AND PROCUREMENT OPTIONS

9.0 GENERAL COMMENTS

This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted engineering practices. All estimations provided in this report were based upon information provided to ESA by the District and their respective utility providers. While cost saving estimates have been provided, they are not intended to be considered a guarantee of cost savings. No guarantees or warranties, expressed or implied, are intended or made. Changes in energy usage or utility pricing from those provided will impact the overall calculations of estimated savings and could result in different or longer payback periods.

APPENDICES

APPENDIX I - SUMMARY OF FUNDING AND PROCUREMENT OPTIONS FOR CAPITAL EXPENDITURE PROJECTS

SUMMARY OF FUNDING OPTIONS FOR CAPITAL EXPENDITURE PROJECTS

Several options are available for funding retrofit measures which require capital expenditures.

LoanSTAR Program:

The Texas LoanSTAR program is administered by the State Energy Conservation Office (SECO). It is a revolving loan program available to all public school districts in the state as well as other institutional facilities. SECO loans money at 3% interest for the implementation of energy conservation measures which have a combined payback of eight years or less. The amount of money available varies, depending upon repayment schedules of other facilities with outstanding loans, and legislative actions. Check with Eddy Trevino of SECO (512-463-1876) for an up-to-date evaluation of prospects for obtaining a loan in the amounts desired.

TASB (Texas Association of School Boards) Capital Acquisition Program:

TASB makes loans to school districts for acquiring personal property for "maintenance purposes". Energy conservation measures are eligible for these loans. The smallest loan TASB will make is $100,000. Financing is at 4.4% to 5.3%, depending upon length of the loan and the school district's bond rating. Loans are made over a three year, four year, seven year, or ten year period. The application process involves filling out a one page application form, and submitting the school district's most recent budget and audit. Contact Cheryl Kepp at TASB (512-467-0222) for further information.

Loans on Commercial Market:

Local lending institutions are another source for the funding of desired energy conservation measures. Interest rates obtainable may not be as attractive as that offered by the LoanSTAR or TASB programs, but advantages include "unlimited" funds available for loan, and local administration of the loan.

Leasing Corporations:

Leasing corporations have become increasingly interested in the energy efficiency market. The financing vehicle frequently used is the municipal lease. Structured like a simple loan, a municipal leasing agreement is usually a lease-purchase agreement. Ownership of the financed equipment passes to the district at the beginning of the lease, and the lessor retains a security interest in the purchase until the loan is paid off. A typical lease covers the total cost of the equipment and may include installation costs. At the end of the contract period a nominal amount, usually a dollar, is paid by the lessee for title to the equipment.

Bond Issue:

The Board may choose to have a bond election to provide funds for capital improvements. Because of its political nature, this funding method is entirely dependent upon the mood of the voters, and may require more time and effort to acquire the funds than the other alternatives.

SUMMARY OF PROCUREMENT OPTIONS FOR CAPITAL EXPENDITURE PROJECTS

State Purchasing:

The General Services Commission has competitively bid contracts for numerous items which are available for direct purchase by school districts. Contracts for this GSC service may be obtained from Sue Jager at (512) 475-2351.

Design/Bid/Build (Competitive Bidding):

Plans and specifications are prepared for specific projects and competitive bids are received from installation contractors. This traditional approach provides the district with more control over each aspect of the project, and task items required by the contractors are presented in detail.

Design/Build:

These contracts are usually structured with the engineer and contractor combined under the same contract to the owner. This type team approach was developed for fast-track projects, and to allow the contractor a position in the decision making process. The disadvantage to the district is that the engineer is not totally independent and cannot be completely focused upon the interest of the district. The district has less control over selection of equipment and quality control.

Purchasing Standardization Method:

This method will result in significant dollar savings if integrated into planned facility improvements. For larger purchases which extend over a period of time, standardized purchasing can produce lower cost per item expense, and can reduce immediate up-front expenditures. This approach includes traditional competitive bidding with pricing structured for present and future phased purchases.

Performance Contracting:

Through this arrangement, an energy service company (ESCO) using in-house or third party financing to implement comprehensive packages of energy saving retrofit projects. Usually a turnkey service, this method includes an initial assessment of energy savings potential, design of the identified projects, purchase and installation of the equipment, and overall project management. The ESCO guarantees that the cost savings generated will, at a minimum, cover the annual payment due over the term of the contract. The laws governing Performance Contracting for school districts are detailed in the Texas Education Code, Subchapter Z, Section 44.901. Senate Bill SB 3035, passed by the seventy-fifth Texas Legislature, amends some of these conditions. Performance Contracting is a highly competitive field, and interested districts may wish to contact Eddy Trevino of State Energy Conservation Office, (SECO), at 512-463-1896 for assistance in preparing requests for proposals or requests for qualifications.

Solution Center

How to Finance Your Energy Program

Cost and financing issues are pivotal factors in determining which energy-efficiency measures will be included in your final energy management plan. Before examining financing options, you need to have a reasonably good idea of the measures that may be implemented. For this purpose, you will want to perform cost/benefit analyses on each candidate measure to identify those with the best investment potential. This document presents a brief introduction to cost/benefit methods and then suggests a variety of options for financing your program.

Selecting a Cost/Benefit Analysis Method

Cost/benefit analysis can determine if and when an improvement will pay for itself through energy savings and to help you set priorities among alternative improvement projects. Cost/benefit analysis may be either a simple payback analysis or the more sophisticated life cycle cost analysis. Since most electric utility rate schedules are based on both consumption and peak demand, your analyst should be skilled at assessing the effects of changes in both electricity use and demand on total cost savings, regardless of which type of analysis is used. Before beginning any cost/benefit analyses, you must first determine acceptable design alternatives that meet the heating, cooling, lighting, and control requirements of the building being evaluated. The criteria for determining whether a design alternative is "acceptable" includes reliability, safety, conformance with building codes, occupant comfort, noise levels, and space limitations. Since there will usually be a number of acceptable alternatives for any project, cost/benefit analysis allows you to select those that have the best savings potential.

Simple Payback Analysis

A highly simplified form of cost/benefit analysis is called simple payback. In this method, the total first cost of the improvement is divided by the first-year energy cost savings produced by the improvement. This method yields the number of years required for the improvement to pay for itself.

This kind of analysis assumes that the service life of the energy-efficiency measure will equal or exceed the simple payback time. Simple payback analysis provides a relatively easy way to examine the overall costs and savings potentials for a variety of project alternatives. However, it does not consider a number of factors that are difficult to predict, yet can have a significant impact on cost savings. These factors may be considered by performing a life-cycle cost (LCC) analysis.

Simple Payback

As an example of simple payback, consider the lighting retrofit of a 10,000-square-foot commercial office building. Relamping with T-8 lamps and electronic, high-efficiency ballasts may cost around $13,300 ($50 each for 266 fixtures) and produce annual savings of around $4,800 per year (80,000 kWh at $0.06/kWh). This simple payback for this improvement would be

$$\frac{\$13{,}300}{\$4{,}800/\text{year}} = 2.8 \text{ years}$$

That is, the improvement would pay for itself in 2.8 years, a 36% simple return on the investment (1/2.8 = 0.36).

Life-Cycle Cost Analysis

Life-cycle cost analysis (LCC) considers the total cost of a system, device, building, or other capital equipment or facility over its anticipated useful life. LCC analysis allows a comprehensive assessment of all anticipated costs associated with a design alternative. Factors commonly considered in LCC analyses include initial capital cost, operating costs, maintenance costs, financing costs, the expected useful life of equipment, and its future salvage values. The result of the LCC analysis is generally expressed as the value of initial and future costs in today's dollars, as reflected by an appropriate discount rate.

The first step in this type of analysis is to establish the general study parameters for the

continued

Financing Mechanisms

Capital for energy-efficiency improvements is available from a variety of public and private sources, and can be accessed through a wide and flexible range of financing instruments. While variations may occur, there are five general financing mechanisms available today for investing in energy-efficiency:

- **Internal Funds.** Energy-efficiency improvements are financed by direct allocations from an organization's own internal capital or operating budget.
- **Debt Financing.** Energy-efficiency improvements are financed with capital borrowed directly by an organization from private lenders.
- **Lease or Lease-Purchase Agreements.** Energy-efficient equipment is acquired through an operating or financing lease with no up-front costs, and payments are made over five to ten years.
- **Energy Performance Contracts.** Energy-efficiency measures are financed, installed, and maintained by a third party, which guarantees savings and payments based on those savings.
- **Utility Incentives.** Rebates, grants, or other financial assistance are offered by an energy utility for the design and purchase of certain energy-efficient systems and equipment.

These financing mechanisms are not mutually exclusive (i.e., an organization may use several of them in various combinations). The most appropriate set of options will depend on the size and complexity of a project, internal capital constraints, in-house expertise, and other factors. Each of these mechanisms is discussed briefly below, followed by some additional funding sources and considerations.

Internal Funds

The most direct way for the owner of a building or facility to pay for energy-efficiency improvements is to allocate funds from the internal capital or operating budget. Financing internally has two clear advantages over the other options discussed below – it retains internally all savings from increased energy-efficiency, and it is usually the simplest option administratively. The resulting savings may be used to decrease overall operating expenses in future years or retained within a revolving fund used to support additional efficiency investments. Many public and private organizations regularly finance some or all of their energy-efficiency improvements from internal funds.

In some instances, competition from alternative capital investment projects and the requirement for relatively high rates of return may limit the use of internal funds for major, standalone investments in energy-efficiency. In most organizations, for example, the highest priorities for internal funds are business or service expansion, critical health and safety needs, or productivity enhancements. In both the public and private sectors, capital that remains available after these priorities have been met will usually be invested in those areas that offer the highest rates of return. The criteria for such investments commonly include an annual return of 20 percent to 30 percent or a simple payback of three years or less.

Since comprehensive energy-efficiency improvements commonly have simple paybacks of five to six years, or about a 12 percent annual rate of return, internal funds often cannot serve as the sole source of financing for such improvements. Alternatively, however, internal funding can be used well and profitably to achieve more competitive rates of return when combined with one or more of the other options discussed below.

Debt Financing

Direct borrowing of capital from private lenders can be an attractive alternative to using internal funds for energy-efficiency investments. Financing costs can be repaid by the savings that accrue from increased energy-efficiency. Additionally, municipal governments can often issue bonds or other long-term debt instruments at substantially lower interest rates than can private corporate entities. As in the case of internal funding, all savings from efficiency improvements (less only the cost of financing) are retained internally.

Debt financing is administratively more complex than internal funding, and financing costs will vary according to the credit rating of the borrower. This approach may also be restricted by formal debt ceilings imposed by municipal

policy, accounting standards, and/or Federal or state legislation.

In general, debt financing should be considered for larger retrofit projects that involve multiple buildings or facilities. When considering debt financing, organizations should weigh the cost and complexity of this type of financing against the size and risk of the proposed projects.

Lease and Lease-Purchase Agreements

Leasing and lease-purchase agreements provide a means to reduce or avoid the high, up-front capital costs of new, energy-efficient equipment. These agreements may be offered by commercial leasing corporations, management and financing companies, banks, investment brokers, or equipment manufacturers. As with direct borrowing, the lease should be designed so that the energy savings are sufficient to pay for the financing charges. While the time period of a lease can vary significantly, leases in which the lessee assumes ownership of the equipment generally range from five to ten years. There are several different types of leasing agreements, as shown in the sidebar. Specific lease agreements will vary according to lessor policies, the complexity of the project, whether or not engineering and design services are included, and other factors.

Energy Performance Contracts

Energy performance contracts are generally financing or operating leases provided by an Energy Service Company (ESCo) or equipment manufacturer. The distinguishing features of these contracts are that they provide a guarantee on energy savings from the installed retrofit measures, and they provide payments to the ESCo from the savings, freeing the customer from any need of up-front payments to the ESCo. The contract period can range from five to 15 years, and the customer is required to have a certain minimum level of capital investment (generally $200,000 or more) before a contract will be considered.

Under an energy performance contract, the ESCo provides a service package that typically includes the design and engineering, financing, installation, and maintenance of retrofit measures to improve energy-efficiency. The scope of these improvements can range from measures that affect a single part of a building's energy-using

Types of Leasing Agreements

Operating Leases are usually for a short term, occasionally for periods of less than one year. At the end of the lease period, the lessee may either renegotiate the lease, buy the equipment for its fair market value, or acquire other equipment. The lessor is considered the owner of the leased equipment and can claim tax benefits for its depreciation.

Financing Leases are agreements in which the lessee essentially pays for the equipment in monthly installments. Although payments are generally higher than for an operating lease, the lessee may purchase the equipment at the end of the lease for a nominal amount (commonly $1). The lessee is considered the owner of the equipment and may claim certain tax benefits for its depreciation.

Municipal Leases are available only to tax-exempt entities such as school districts or municipalities. Under this type of lease, the lessor does not have to pay taxes on the interest portion of the lessee's payments, and can therefore offer an interest rate that is lower than the rate for usual financing leases. Because of restrictions against multi-year liabilities, the municipality specifies in the contract that the lease will be renewed year by year. This places a higher risk on the lessor, who must be prepared for the possibility that funding for the lease may not be appropriated. The lessor may therefore charge an interest rate that is as much as 2 percent above the tax-exempt bond rate, but still lower than rates for regular financing leases. Municipal leases nonetheless are generally faster and more flexible financing tools than tax-exempt bonds.

Guaranteed Savings Leases are the same as financing or operating leases but with the addition of a guaranteed savings clause. Under this type of lease, the lessee is guaranteed that the annual payments for leasing the energy-efficiency improvements will not exceed the energy savings generated by them. The owner pays the contractor a fixed payment per month. If actual energy savings are less than the fixed payment, however, the owner pays only the small amount saved and receives a credit for the difference.

How to Finance Your Energy Program *continued*

Bulk Purchasing. Large organizations generally have purchasing or materials procurement departments that often buy standard materials in bulk or receive purchasing discounts because of the volume of their purchases. Such organizations can help reduce the costs of energy-efficiency renovations if their bulk purchasing capabilities can be used to obtain discounts on the price of materials (e.g., lamps and ballasts). While some locales may have restrictions that limit the use of this option, some type of bulk purchasing can usually be negotiated to satisfy all parties involved.

Project Transaction Costs. Certain fixed costs are associated with analyzing and installing energy measures in each building included in a retrofit program. Each additional building, for example, could represent additional negotiations and transactions with building owners, building analysts, energy auditors, equipment installers, commissioning agents, and other contractors. Similarly, each additional building will add to the effort involved in initial data analysis as well as in tracking energy performance after the retrofit. For these reasons, it is often possible to achieve target energy savings at lower cost by focusing only on those buildings that are the largest energy users. One disadvantage with larger buildings is that the energy systems in the building can be more difficult to understand, but overall, focusing on the largest energy users is often the most efficient use of your financial resources.

Direct Value-Added Benefits. The primary value of retrofits to buildings and facilities lies in the reduction of operating costs through improved energy-efficiency and maintenance savings. Nevertheless, the retrofit may also directly help address a variety of related concerns, and these benefits (and avoided costs) should be considered in assessing the true value of an investment. A few examples of these benefits include the improvement of indoor air quality in office buildings and schools; easier disposal of toxic or hazardous materials found in energy-using equipment; and assistance in meeting increasingly stringent state or Federal mandates for water conservation. Effective energy management controls for buildings can also provide a strong electronic infrastructure for improving security systems and telecommunications.

Economic Development Benefits. In addition to direct savings on operating costs and the added-value benefits mentioned above, investments in energy-efficiency can also support a community's economic development and employment opportunities. Labor will typically constitute about 60 percent of a total energy investment, and about 50 percent of equipment can be expected to be purchased from local equipment suppliers; as a result, about 85 percent of the investment is retained within the local economy. Additionally, funds retained in urban areas will generally be re-spent in the local economy. The Department of Commerce estimates that each dollar retained in an urban area will be re-spent three times. This multiplier effect results in a three-fold increase in the economic benefits of funds invested in energy-efficiency, without even considering the savings from lower overall fuel costs.

For more information contact the Rebuild America Clearinghouse at 252-459-4664 or visit www.rebuild.gov

Rebuild America
U.S. Dept. of Energy

APPENDIX II - ELECTRIC UTILITY RATE SCHEDULE

CenterPoint Energy Houston Electric, LLC
Applicable: Entire Service Area

CNP 8017

6.1.1.1.3 SECONDARY SERVICE GREATER THAN 10 KVA

AVAILABILITY
This schedule is applicable to Delivery Service for non-residential purposes at secondary voltage with demand greater than 10 kVA when such Delivery Service is to one Point of Delivery and measured through one Meter.

TYPE OF SERVICE
Delivery Service will be single or three-phase, 60 hertz, at a standard secondary voltage. Delivery Service will be metered using Company's standard Meter provided for this type of Delivery Service. Any Meter other than the standard Meter will be provided at an additional charge and/or will be provided by a Meter Owner other than the Company pursuant to Applicable Legal Authorities. Where Delivery Service of the type desired is not available at the Point of Delivery, additional charges and special contract arrangements may be required prior to Delivery Service being furnished, pursuant to Section 6.1.2.2, Construction Services, in this Tariff.

MONTHLY RATE

I. Transmission and Distribution Charges:

	Standard Class	Subclass Exception	
Customer Charge	$5.27	$0.00	per Retail Customer per Month
Metering Charge			
Non-IDR Metered	$31.86	$17.07	per Retail Customer per Month
IDR Metered	$116.89	$116.89	per Retail Customer per Month
Transmission System Charge			
Non-IDR Metered	$1.1027	$1.1027	per NCP kVA
IDR Metered	$1.4709	$1.4709	per 4CP kVA
Distribution System Charge	$3.118137	$3.118137	per Billing kVA

The following charges are applicable to both the Standard Class and the Subclass Exception

II.	**System Benefit Fund:**	See Rider SBF
III.	**Transition Charge:**	See Schedules TC, TC2, TC3 and SRC
IV.	**Nuclear Decommissioning Charge:**	See Rider NDC
V.	**Transmission Cost Recovery Factor:**	See Rider TCRF

VI.	**Excess Mitigation Credit:**		Not Applicable
VII.	**State Colleges and Universities Discount:**		See Rider SCUD
VIII.	**Competition Transition Charge:**		See Rider CTC
IX.	**Competitive Metering Credit:**		See Rider CMC
X.	**Other Charges or Credits:**		
	A. Municipal Account Franchise Credit (see application and explanation below)	$(.002207)	per kWh
	B. Rate Case Expenses Surcharge		See Rider RCE
	C. Rider UCOS Retail Credit		See Rider RURC
	D. Advanced Metering System Surcharge		See Rider AMS
	E. Energy Efficiency Cost Recovery Factor		See Rider EECRF
	F. Accumulated Deferred Federal Income Tax Credit		See Rider ADFITC

COMPANY SPECIFIC APPLICATIONS

DETERMINATION OF BILLING DEMAND FOR TRANSMISSION SYSTEM CHARGES

Determination of NCP kVA The NCP kVA applicable under the Monthly Rate section shall be the kVA supplied during the 15 minute period of maximum use during the billing month.

Determination of 4 CP kVA The 4 CP kVA applicable under the Monthly Rate section shall be the average of the Retail Customer's integrated 15 minute demands at the time of the monthly ERCOT system 15 minute peak demand for the months of June, July, August and September of the previous

calendar year. The Retail Customer's average 4CP demand will be updated effective on January 1 of each calendar year and remain fixed throughout the calendar year. Retail Customers without previous history on which to determine their 4 CP kVA will be billed at the applicable NCP rate under the "Transmission System Charge" using the Retail Customer's NCP kVA.

DETERMINATION OF BILLING DEMAND FOR DISTRIBUTION SYSTEM CHARGES

Determination of Billing kVA The Billing kVA applicable to the Distribution System Charge shall be the higher of the NCP kVA for the current billing month or 80% of the highest monthly NCP kVA established in the 11 months preceding the current billing month (80% ratchet). The 80% ratchet shall not apply to seasonal agricultural Retail Customers.

OTHER PROVISIONS

Secondary Service Greater Than 10 kVA. This Rate Schedule is applicable only to Retail Customers whose peak demand for the current month is greater than 10 kVA, as measured in the fifteen minute period of highest demand, or whose peak demand exceeded 10 kVA in any of the previous eleven months, and that otherwise qualify under this Rate. This Rate Schedule is applicable to Delivery Service provided for Electric Power and Energy supplied by Retail Customer's REP for Temporary service subject to provisions of Section 6.1.2.2, Construction Services. The Electric Power and Energy delivered may not be re-metered or sub-metered by the Retail Customer for resale except pursuant to lawful sub-metering regulations of Applicable Legal Authorities. Retail Customer's previous metered usage under this or any other Rate Schedule will be used, as needed, in determining the billing determinants under the Monthly Rate section.

Subclass Exception. The Subclass Exception is applicable only to Retail Customers who otherwise qualify for the Secondary Service Greater Than 10 kVA rate schedule and either: (1) whose highest NCP kVa for the most recent 12 months is equal to or less than 50 kVA; or (2) whose highest NCP kVa for the most recent 12 months is greater than 50 kVA but less than or equal to 400 kVA and whose load factor was less than or equal to 10% for each of the most recent 12 months. The most recent 12 months ends with and includes the current month. The monthly load factor is determined as follows:

load factor = billing kWh for the month/ (NCP kVA X number of days in billing period X 24)

Service Voltages. Company's standard service voltages are described in 6.2.2, Standard Voltages and in the Company's Service Standards.

Municipal Account Franchise Credit. A credit equal to the amount of franchise fees included in the Transmission and Distribution Charges will be applied to municipal accounts receiving service within the incorporated limits of such municipality which imposes a municipal franchise fee upon the

Company based on the kWh delivered within that municipality and who have signed an appropriate Franchise Agreement.

Adjustment To The Charges Applied To Retail Customer's Demand Measurement If data to determine the Retail Customer's *Demand Measurement* becomes no longer available, the Company will determine a *Conversion Factor* which will be used as an adjustment to all per unit charges that will then be applied to the *New Demand Measurement*. *Demand Measurement* shall include the Billing kVA, the 4 CP kVA, NCP kVA or any other demand measurement required for billing under this Rate Schedule or any applicable rider(s) or any other applicable schedule(s). *New Demand Measurement* shall be the billing determinants which replace the *Demand Measurement*. The *Conversion Factor* will apply to unit prices per kVA such that when applied to the *New Demand Measurement*, the revenue derived by the Company under demand based charges shall be unaffected by such lack of data.

This adjustment may become necessary because of changes in metering capabilities, such as, Meters that record and /or measure kW with no ability to determine kVA or Meters which meter data in intervals other than 15 minutes. This adjustment also may become necessary due to changes in rules, laws, procedures or other directives which might dictate or recommend that Electric Power and Energy, electric power related transactions, wire charges, nonbypassable charges and/or other transactions measure demand in a way that is inconsistent with the definitions and procedures stated in the Company's Tariff. This adjustment is applicable not only in the instances enumerated above but also for any and all other changes in *Demand Measurement* which would prevent the Company from obtaining the necessary data to determine the kVA quantities defined in this Rate Schedule, applicable Riders and other applicable schedules.

The Conversion Factor shall render the Company revenue neutral to any change in *Demand Measurement* as described above.

NOTICE
This Rate Schedule is subject to the Company's Tariff and Applicable Legal Authorities.

APPENDIX IV - PRELIMINARY ENERGY ASSESSMENT SERVICE AGREEMENT

OFFICE OF THE COMPTROLLER TEXAS

SECO State Energy Conservation Office

Public Schools, Colleges and Non-Profit Hospitals

Preliminary Energy Assessment Service Agreement

Investing in our public schools, colleges and non-profit hospitals 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 GISD, 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: 4/20/11

Name (Mr./Ms./Dr.) David D. Dworsky Title: CFO

Organization: Galveston ISD Phone: 409-766-5100

Street Address: 3904 Avet Galveston 77551 Fax: 409-765-6384

Mailing Address: PO Box 1000 E-Mail: david_dworsky@gisd.org

Galveston TX 77553 County: Galveston

Contact Information:

Name (Mr./Ms./Dr.): Paul Byers Title: MEP Coordinator / Energy Manager

Phone: 409-692-3940 Fax: 409-765-6248

E-Mail: paul_byers@gisd.org County: Galveston

Please sign and mail or fax to: Stephen Ross, Schools and Education Program Administrator, State Energy Conservation Office, 111 E. 17th Street, Austin, Texas 78774. Phone: 512-463-1770. **Fax 512-475-2569.**

AND fax to the SECO Contractor for this service, **Colby May**, ESA Energy Systems Associates, Inc. Phone: 512-258-0547, x124. **Fax: 512-388-3312.**

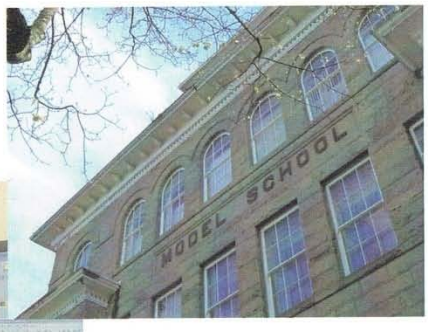
APPENDIX V - TEXAS ENERGY MANAGERS ASSOCIATION (TEMA)

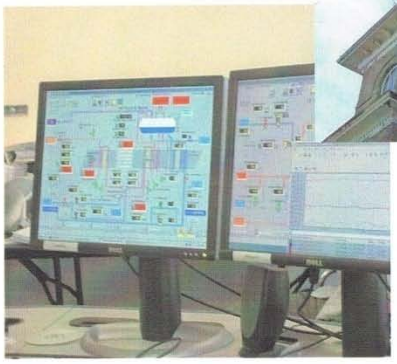
ANNOUNCING!

TEMA

TEXAS ENERGY MANAGERS ASSOCIATION

A PROFESSIONAL ASSOCIATION FOR THOSE RESPONSIBLE FOR ENERGY MANAGEMENT IN TEXAS PUBLIC FACILITIES





- Networking
- Sharing Knowledge and Resources
- Training Workshops
- Regional Meetings
- Annual Conference
- Certification
- Legislative Updates
- Money-Saving Opportunities

WWW.TEXASEMA.ORG

Check the website for Membership and Association information.

SECO
State Energy Conservation Office

APPENDIX VI - UTILITY CHARTS ON CD