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Texas Comptroller of Public Accounts

Facility Preliminary Energy Assessments and Recommendations

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Dayton Independent School District

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SECO State Energy Conservation Office

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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**.

State Energy Conservation Office

Program Administrator:	Stephen Ross
Phone:	512-463-1770
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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 February 2011, **SECO** received a request for technical assistance from Doug Coleman, Assistant Superintendent of Administrative Services for **Dayton 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 **Dayton ISD,** (hereafter known as DISD) 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 Doug Coleman, Steve Bell, and Oran Hamilton, future Energy Manager, 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 **$292,653** may be saved annually if all recommended projects are implemented. The estimated installed cost of these projects should total approximately **$884,634**, yielding an average simple payback of **3** years.

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

SUMMARY:	IMPLEMENTATION COST	ESTIMATED SAVINGS	SIMPLE PAYBACK
HVAC ECRM #1	$14,000	$3,127	4-1/2 Years
HVAC ECRM #2	$500	$500	1 Year
Lighting ECRM #1	$39,700	$6,700	6 Years
Lighting ECRM #2	$7,900	$5,300	1-1/2 Years
Lighting ECRM #3	$600	$435	1-1/2 Years
Lighting ECRM #4	$53,500	$6,700	8 Years
Lighting ECRM #5	$9,934	$1,516	6-1/4 Years
Controls ECRM #1	$750,000	$100,000	7-1/2 Years
Controls ECRM #2	$3,000	$150,000	0 Years
Controls ECRM #3	$3,000	$98,373	0 Years
Electric ECRM #1	$1,000	$5,000	6 Months
Envelope ECRM #1	$1,500	$375	4 Years
TOTAL PROJECTS	**$ 884,634**	**$292,653**	**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 DISD. 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.

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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 DISD, ESA returned to the facilities to perform the following tasks:

1. Design and monitor 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. Develop and draft 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 DISD 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
Administration	80,528	24%	$1.83	41%
Nottingham ES	84,830	31%	$1.70	31%
Dayton HS	86,745	34%	$1.57	21%
Brown ES	73,475	13%	$1.46	12%
Wilson MS	56,382	-13%	$1.03	-21%
Colbert ES	47,001	-27%	$0.97	-25%
SFA ES	46,788	-28%	$0.96	-26%
Richter ES	42,839	-34%	$0.89	-32%
Average Value:	64,824		$1.30	

Dayton ISD purchases electricity from Entergy Texas, Inc. 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

OWNER: Dayton ISD **BUILDING:** Administration

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	19,760		0	0	1,241	0	17
FEBRUARY	2010	15,360		0	0	1,100	0	17
MARCH	2010	17,120		0	0	1,699	0	21
APRIL	2010	18,560		0	0	1,374	1	23
MAY	2010	23,040		0	0	1,719	0	17
JUNE	2010	21,920		0	0	1,729	0	17
JULY	2010	22,960		0	0	1,831	0	17
AUGUST	2010	24,720		0	0	1,729	1	22
SEPTEMBER	2010	18,560		0	0	1,321	0	17
OCTOBER	2010	16,000		0	0	1,169	0	17
NOVEMBER	2010	17,440		0	0	1,625	0	17
DECEMBER	2010	19,600		0	0	1,509	1	17
TOTAL		**235,040**	**0**	**0**	**0**	**$18,046**	**3**	**$219**

			Energy Use Index:		
Annual Total Energy Cost =	$18,265	Per Year	Total Site BTU's/yr / Total Area (sq.ft.)	80,528	BTU/s.f.yr
Total KWH x 0.003413 =	802.19	x 106			
Total MCF x 1.03 =	3.09	x 106	**Energy Cost Index:**		
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$1.83	$/s.f. yr
Total Site BTU's/yr	805.28	x 106			
Floor area:	10,000	s.f.			

OWNER: Dayton ISD **BUILDING:** Nottingham 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	91,500		0	0	5,612	431	3,864
FEBRUARY	2010	95,500		0	0	6,829	348	4,025
MARCH	2010	136,500		0	0	12,996	74	868
APRIL	2010	135,000		0	0	10,049	38	460
MAY	2010	139,000		0	0	10,243	24	294
JUNE	2010	142,000		0	0	10,404	20	250
JULY	2010	201,500		0	0	15,048	20	198
AUGUST	2010	187,500		0	0	13,842	24	240
SEPTEMBER	2010	156,000		0	0	11,787	21	214
OCTOBER	2010	106,500		0	0	8,647	74	702
NOVEMBER	2010	136,000		0	0	12,140	132	1,198
DECEMBER	2010	102,500		0	0	8,476	175	1,584
TOTAL		**1,629,500**	**0**	**0**	**0**	**$126,073**	**1,381**	**$13,897**

			Energy Use Index:		
Annual Total Energy Cost =	$139,970	Per Year	Total Site BTU's/yr / Total Area (sq.ft.)	84,830	BTU/s.f.yr
Total KWH x 0.003413 =	5,561.48	x 106			
Total MCF x 1.03 =	1,422.43	x 106	**Energy Cost Index:**		
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$1.70	$/s.f. yr
Total Site BTU's/yr	6,983.91	x 106			
Floor area:	82,328	s.f.			

OWNER: Dayton ISD **BUILDING:** Dayton HS

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
MONTH	YEAR	CONSUMPTION KWH	METERED KW/KVA	CHARGED KW/KVA	COST OF DEMAND	TOTAL ALL ELECTRICAL COSTS $	CONSUMPTION MCF	COSTS $
JANUARY	2010	319,200		0	0	19,649	1,214	10,043
FEBRUARY	2010	279,200		0	0	19,757	1,013	10,886
MARCH	2010	363,400		0	0	35,049	570	6,142
APRIL	2010	434,200		0	0	31,085	408	4,406
MAY	2010	439,200		0	0	33,102	295	3,195
JUNE	2010	384,000		0	0	28,944	217	2,360
JULY	2010	446,400		0	0	33,851	305	2,644
AUGUST	2010	468,800		0	0	32,075	23	232
SEPTEMBER	2010	380,400		0	0	26,868	285	2,473
OCTOBER	2010	360,000		0	0	26,008	501	4,843
NOVEMBER	2010	329,800		0	0	30,625	768	6,367
DECEMBER	2010	293,000		0	0	22,624	958	7,933
TOTAL		**4,497,600**	**0**	**0**	**0**	**$339,637**	**6,557**	**$61,524**

Annual Total Energy Cost = $401,161 Per Year

Total KWH x 0.003413 = 15,350.31 x 106
Total MCF x 1.03 = 6,753.71 x 106
Total Other x ____ x 106
Total Site BTU's/yr 22,104.02 x 106

Floor area: 254,816 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 86,745 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $1.57 $/s.f. yr

OWNER: Dayton ISD **BUILDING:** Brown ES

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
MONTH	YEAR	CONSUMPTION KWH	METERED KW/KVA	CHARGED KW/KVA	COST OF DEMAND	TOTAL ALL ELECTRICAL COSTS $	CONSUMPTION MCF	COSTS $
JANUARY	2010	119,040		0	0	7,189	318	2,738
FEBRUARY	2010	123,840		0	0	8,523	203	2,260
MARCH	2010	151,680		0	0	14,620	122	1,370
APRIL	2010	165,120		0	0	12,220	92	1,028
MAY	2010	200,640		0	0	15,017	61	691
JUNE	2010	184,320		0	0	14,364	46	523
JULY	2010	175,680		0	0	14,037	40	375
AUGUST	2010	210,240		0	0	14,542	44	410
SEPTEMBER	2010	176,640		0	0	12,475	73	666
OCTOBER	2010	154,560		0	0	11,293	100	900
NOVEMBER	2010	129,600		0	0	12,363	297	2,564
DECEMBER	2010	132,480		0	0	9,858	76	669
TOTAL		**1,923,840**	**0**	**0**	**0**	**$146,501**	**1,472**	**$14,194**

Annual Total Energy Cost = $160,695 Per Year

Total KWH x 0.003413 = 6,566.07 x 106
Total MCF x 1.03 = 1,516.16 x 106
Total Other x ____ x 106
Total Site BTU's/yr 8,082.23 x 106

Floor area: 110,000 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 73,475 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $1.46 $/s.f. yr

OWNER: Dayton ISD **BUILDING:** Wilson JH

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
MONTH	YEAR	CONSUMPTION KWH	METERED KW/KVA	CHARGED KW/KVA	COST OF DEMAND	TOTAL ALL ELECTRICAL COSTS $	CONSUMPTION MCF	COSTS $
JANUARY	2010	146,000		0	0	8,685	605	5,425
FEBRUARY	2010	140,000		0	0	9,464	451	5,215
MARCH	2010	149,000		0	0	14,060	155	1,803
APRIL	2010	133,000		0	0	9,596	53	627
MAY	2010	142,000		0	0	10,690	30	359
JUNE	2010	161,000		0	0	12,113	22	273
JULY	2010	158,000		0	0	11,765	166	1,556
AUGUST	2010	170,000		0	0	11,954	32	(898)
SEPTEMBER	2010	189,000		0	0	12,936	39	(524)
OCTOBER	2010	141,000		0	0	10,237	63	77
NOVEMBER	2010	164,000		0	0	14,589	235	2,117
DECEMBER	2010	172,000		0	0	12,489	359	3,221
TOTAL		**1,865,000**	**0**	**0**	**0**	**$138,578**	**2,210**	**$19,251**

Annual Total Energy Cost = $157,829 Per Year

Total KWH x 0.003413 = 6,365.25 x 106
Total MCF x 1.03 = 2,276.30 x 106
Total Other x ____ x 106
Total Site BTU's/yr 8,641.55 x 106

Floor area: 153,267 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 56,382 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $1.03 $/s.f. yr

OWNER: Dayton ISD **BUILDING:** Colbert ES

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
MONTH	YEAR	CONSUMPTION KWH	METERED KW/KVA	CHARGED KW/KVA	COST OF DEMAND	TOTAL ALL ELECTRICAL COSTS $	CONSUMPTION MCF	COSTS $
JANUARY	2010	37,189		0	0	2,391	169	1,528
FEBRUARY	2010	28,773		0	0	2,235	26	313
MARCH	2010	23,235		0	0	2,434	6	91
APRIL	2010	29,390		0	0	2,314	5	69
MAY	2010	42,748		0	0	3,297	119	0
JUNE	2010	39,494		0	0	3,140	1	1,418
JULY	2010	42,683		0	0	3,423	2	32
AUGUST	2010	47,042		0	0	3,391	2	35
SEPTEMBER	2010	37,422		0	0	2,796	2	38
OCTOBER	2010	27,317		0	0	2,189	3	43
NOVEMBER	2010	25,607		0	0	2,570	8	85
DECEMBER	2010	27,618		0	0	2,412	28	264
TOTAL		**408,518**	**0**	**0**	**0**	**$32,592**	**371**	**$3,916**

Annual Total Energy Cost = $36,508 Per Year

Total KWH x 0.003413 = 1,394.27 x 106
Total MCF x 1.03 = 382.13 x 106
Total Other x ____ x 106
Total Site BTU's/yr 1,776.40 x 106

Floor area: 37,795 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 47,001 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $0.97 $/s.f. yr

OWNER: Dayton ISD **BUILDING:** SF Austin ES

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
MONTH	YEAR	CONSUMPTION KWH	METERED KW/KVA	CHARGED KW/KVA	COST OF DEMAND	TOTAL ALL ELECTRICAL COSTS $	CONSUMPTION MCF	COSTS $
JANUARY	2010	63,748		0	0	4,208	225	2,028
FEBRUARY	2010	54,993		0	0	4,131	206	2,395
MARCH	2010	75,121		0	0	7,417	39	464
APRIL	2010	90,092		0	0	6,691	20	248
MAY	2010	96,051		0	0	7,421	16	199
JUNE	2010	66,664		0	0	5,397	5	78
JULY	2010	87,334		0	0	7,105	7	84
AUGUST	2010	107,233		0	0	7,643	13	135
SEPTEMBER	2010	86,062		0	0	6,234	15	158
OCTOBER	2010	73,940		0	0	5,090	19	192
NOVEMBER	2010	63,181		0	0	5,878	75	685
DECEMBER	2010	57,504		0	0	4,764	76	699
TOTAL		**921,923**	**0**	**0**	**0**	**$71,979**	**716**	**$7,365**

Annual Total Energy Cost =	$79,344	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	46,788 BTU/s.f.yr
Total KWH x 0.003413 =	3,146.52	x 106		
Total MCF x 1.03 =	737.48	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$0.96 $/s.f. yr
Total Other x ____		x 106		
Total Site BTU's/yr	3,884.00	x 106		
Floor area:	83,013	s.f.		

OWNER: Dayton ISD **BUILDING:** Richter ES

MONTH / YEAR		ELECTRIC					NAT'L GAS / FUEL	
			DEMAND					
MONTH	YEAR	CONSUMPTION KWH	METERED KW/KVA	CHARGED KW/KVA	COST OF DEMAND	TOTAL ALL ELECTRICAL COSTS $	CONSUMPTION MCF	COSTS $
JANUARY	2010	57,200		0	0	3,822	248	2,230
FEBRUARY	2010	52,900		0	0	3,981	131	1,532
MARCH	2010	71,100		0	0	7,105	33	403
APRIL	2010	86,000		0	0	6,462	0	17
MAY	2010	83,500		0	0	6,596	0	17
JUNE	2010	73,400		0	0	5,812	0	17
JULY	2010	79,800		0	0	6,262	0	17
AUGUST	2010	105,900		0	0	7,520	0	17
SEPTEMBER	2010	92,000		0	0	6,698	0	17
OCTOBER	2010	71,400		0	0	5,549	18	182
NOVEMBER	2010	65,800		0	0	6,296	71	653
DECEMBER	2010	54,500		0	0	4,553	120	1,093
TOTAL		**893,500**	**0**	**0**	**0**	**$70,656**	**621**	**$6,195**

Annual Total Energy Cost =	$76,851	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	42,839 BTU/s.f.yr
Total KWH x 0.003413 =	3,049.52	x 106		
Total MCF x 1.03 =	639.63	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$0.89 $/s.f. yr
Total Other x ____		x 106		
Total Site BTU's/yr	3,689.15	x 106		
Floor area:	86,117	s.f.		

4.0 RATE SCHEDULE ANALYSIS:

ELECTRICITY PROVIDER:

RETAIL ELECTRIC PROVIDER: None Contract price: $0.08824 per kWh

TRANSMISSION AND DISTRIBUTION UTILITY: Entergy Texas, Inc.

Electric Rate: Secondary Service > 10 kVA

I. TRANSMISSION AND DISTRIBUTION CHARGES:

Customer Charge	=	$425.05 per month
Billing Load Charge	=	$8.56 per kW
Energy Charge	=	$0.00854 per kWh

Average Savings for consumption = $0.000657/kWh + $-0.002207/kWh + $0.08824/kWh
=$0.08669/kWh

Average Savings for demand = $1.1026898 + $3.11813449 + $0.636156 +$1.113893 + $0.455734 + $0.153885 + $0.008909 + $0.499202 + $-0.056777 = $ 7.03182629/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: $126,561

Total quantity purchased during the analyzed billing cycle: 13,331 MCF

Average cost per MCF = Cost of natural gas / quantity purchased = $126,561 / 13,331 MCF

Average cost per MCF = $9.49

5.0 CAMPUS DESCRIPTIONS:

Note: CVAHU = Constant Volume Air Handling Unit; MZAHU = Multi-Zone Air Handling Unit,

FCU = Fan coil Unit, VAVAHU = variable air volume 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.

Facility	Year originally Constructed	Approximate Square Footage	Basic HVAC Cool/Heat	Basic HVAC Air Distribution	Basic Lighting System Description	Basic Control System Description
Dayton HS	1999	254,816	Water Cooled Chiller/ HW Boiler	CVAHU with hot water reheat	90% T12 10% T8 10% MH(gym)	DDC Automated Logic
Nottingham ES	1999	82,328	Air cooled chillers / natural gas boilers	FCUs hot water reheat	T8 T12 Cafeteria MH Gym	Thermostat
Wilson JHS	1975	153,267	Air cooled chillers / natural gas boilers	(2)MZAHU, (10) FCU, and VAVAHUs with hot water reheat	T12 with T8 when lamp goes out (5%)	Pneumatics

6.0 ENERGY RECOMMENDATIONS:

HVAC ECRM 1 CONVERT 3-WAY VALVES TO 2-WAY; INSTALL/REPLACE VFDs

Variable Volume water distribution systems utilize differential pressure sensors to evaluate the load requirements of a chilled or hot water heating system. The pressure in the supply side piping and return side piping is compared to determine how much water is required by the spaces to maintain comfort. All systems require a three-way valve at the end of the loop to meet the minimum flow for the chillers. The rest can be removed, and the required flow of water will decrease. Adding a VFD to the pumps will decrease the flow to the units and in doing so, save pump energy. Currently the pumps are running at a constant speed and have balancing valves shut to limit the flow.

Dayton High School has one 50 horsepower pump and one 30 horsepower pump. Each choked down 60%. Assumptions for the following payback analysis include: (1) they run every hour of the school year, (2) the pump motor is 80% efficient, and (3) the pump is 85% efficient.

Estimated Cost: $8,000 *Estimated Savings: $1,787* *Estimated Payback: 4-1/2 Years*

Woodrow Wilson Junior High School has three 20 horsepower primary pumps; one dedicated to each chiller. There is not a dedicated secondary building loop pump. Each chiller pump is choked down 60% by the manual control valve (see picture to the right). Assumptions for the following payback analysis include: (1) they run every hour of the school year, (2) the pump motor is 80% efficient, and (3) the pump is 85% efficient.

Estimated Cost: $6,000 *Estimated Savings: $1,340* *Estimated Payback: 4-1/2 Years*

District total
Estimated Cost: $14,000 *Estimated Savings: $3,127* *Estimated Payback: 4-1/2 Years*

HVAC ECRM 2: TIMERS FOR DOMESTIC WATER HEATERS

Some of the water heaters around the district were noted to be electric. 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 Dayton High School, Nottingham Elementary and Woodrow Wilson Junior High. Pricing is per unit and should be multiplied throughout the district. Connecting these to the existing BAS, where available, is an arguably better solution since power outages could potentially erase programming sequences for electronic timers.

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

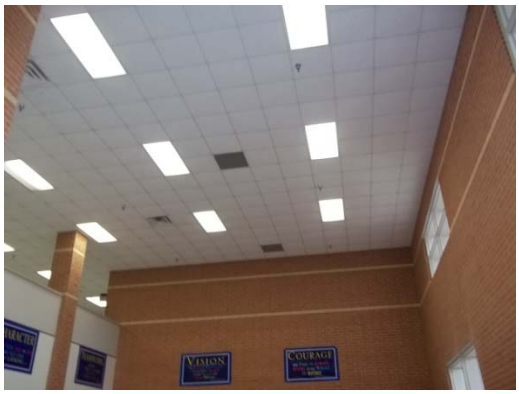
Lighting ECRM 1: RETROFIT OF T12 LIGHTING TO T8:

Parts of Dayton High School, Wilson Junior High School, and Nottingham Elementary School, were noted to utilize T12 components in their linear fluorescent lighting fixtures. T12 components produce approximately 18% less light and consume about 20% more energy than the T8 lamps and electronic ballasts that may be retrofit into the existing linear fluorescent fixtures. Senate Bill 300 requires Texas school districts to install the most efficient lamps and ballasts possible in their existing fixtures. *Therefore we recommend the district retrofit the fixtures at these facilities with T8 lamps and electronic ballasts.*

Estimated Cost: $39,700 Estimated Savings: $6,700 Estimated Payback: 6 years

Lighting ECRM 2: DAYLIGHTING/DE-LAMPING OPPORTUNITIES:

Daylighting is the practice of incorporating natural daylight into spaces to reduce the reliance on artificial light fixtures. These same areas require artificial light fixtures at night when the natural light contribution has ceased. Unfortunately, many times the artificial fixtures in these areas are switched on throughout the day because of poor staff training or because the lighting design did not incorporate appropriate lighting controls to promote the operation of the daylighting strategies. As a result, there are often energy saving opportunities available to school districts with only minor lighting control modifications or staff training. One of the schools demonstrating this type of opportunity is Dayton High School. The lobby has approximately 30' ceilings and the walls are filled with transom windows. There are twenty fluorescent fixtures in the lobby area that are switched on during the day, when the natural daylight contribution is all that is required for proper illumination. We recommend training staff not to turn these fixtures on during the day, or if necessary, make proper switching scheme modifications to allow the fixtures to be left off during the day.



In other situations, such as the cafeteria at Nottingham, the 2-lamp F96T12 inch fixtures are left operating throughout the school day, even during unoccupied periods. *We recommend these fixtures should be retrofit with T8 lamps and electronic ballasts and placed under the control of occupancy sensors in the space.* This room also has windows on two sides of the space. Although at times, unoccupied periods can still have student traffic in the space as students move from one area of the building to another, these safety light levels can be easily matched without the lights operating.

In other facilities lacking windows, w*e recommend the district just operate 2-lamps (half the light) in each of the cafeteria fixtures during unoccupied periods.*

The corridors at Dayton High School utilize 3-lamp fixtures at 6 feet centerline to centerline spacing and have windows down one side. Typical school corridors are illuminated with 2-lamp T8 fixtures at 10' centerline to centerline spacing. Light levels in the corridors were measured to be 30-47 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 foot-candles. We recommend the district consider removing the center lamp in each fixture in the corridors at Dayton High School. Light levels will fall to 20-30 footcandles, which still exceeds IESNA recommendations, yet creates energy savings.

The corridors at Nottingham ES have 3-lamp fixtures to light the corridor providing 23-30 footcandles. As per the recommendation for Dayton High 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: $7,900 Estimated Savings: $5,300 Estimated Payback: 1-1/2 Years

Lighting ECRM 3: OCCUPANCY SENSOR INSTALLATION

There were several areas of the facilities that were noted to have light fixtures operating during unoccupied periods. The first line of defense for the district to eliminate unnecessary fixture operation is to conduct staff training to turn lights off as the last occupant leaves the room. Studies have shown that linear fluorescent fixtures, the type of fixture most often found in classrooms, offers energy savings 23 seconds after they have been turned off when considering the startup current required to turn the fixtures back on when the occupants return. If the training is unsuccessful in changing the behavior of the occupants, then automatic means of turning off the lights, most commonly occupancy sensors, can be employed to perform the task. One such location where this strategy is advisable is the administration area at Dayton High School. There are numerous rooms with 3-lamp T8 fluorescent light fixtures that were noted to be on during unoccupied periods; we recommend installing occupancy sensors to ensure the lights are off when nobody is in the space.

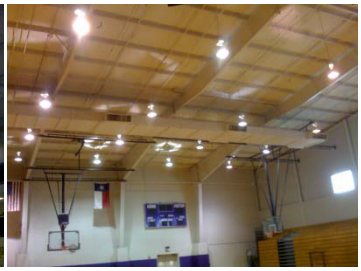
Estimated Cost: $600 Estimated Savings: $435 Estimated Payback: 17 months

Lighting ECRM 4: METAL HALIDE FIXTURE RETROFIT TO T5 LINEAR FLUORESCENT

The Wilson JHS cafeteria/ front lobby has (16) 1000-watt metal halide fixtures that were producing 9 footcandles on the tabletops at the time of the survey. IESNA recommendations for school cafeterias are 30-35 footcandles. 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 8-lamp 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.* Similarly, the gymnasium utilizes (24) 400-watt metal halides and (48)2 lamp T-12 fluorescent fixtures. *We recommend replacing these fixtures with T5 high bay fluorescent fixtures.*

Estimated Cost: $22,000 Estimated Savings: $2,750 Estimated Payback: 8 Years

Dayton High School Cafeteria has fifteen 400w Metal Halide fixtures. The Competition Gym has thirty-six 400w Metal Halide fixtures and the Women's Gym has fifteen 400w Metal Halide fixtures



Estimated Cost: $23,100 Estimated Savings: $2,900 Estimated Payback: 8 Years

Nottingham Elementary has twenty four 400W Metal Halide fixtures in the Gym.

Estimated Cost: $8,400 Estimated Savings: $1,050 Estimated Payback: 8 Years

District total

Estimated Cost: $53,500 Estimated Savings: $6,700 Estimated Payback: 8 Years

Lighting ECRM 5: REPLACE INCANDESCENT EXIT FIXTURES WITH LED FIXTURES

Dayton High School and Nottingham Elementary School were noted to have numerous incandescent exit fixtures in the buildings. Most incandescent exit fixtures have two each 15-watt lamps and consume 30 watts per fixture, 8,760 hours per year. Therefore, each fixture consumes 263 kWh per year. LED exit fixtures consume less than 5 watts per fixture and reduce electrical consumption to 44 kWh per year.

Estimated Cost: $9,934 Estimated Savings: $1,516 Estimated Payback: 6-1/4 Years

Controls ECRM 1: REPLACE PNEUMATIC CONTROLS WITH DDC EMS

Wilson JHS was noted to operate with a combination of electronic energy management systems and pneumatic thermostats and controls. This also occurs at other campuses within the district that were not visited during this survey. *We recommend retrofitting the existing energy management systems to full DDC (Direct Digital Control) systems.* To achieve the full benefit of these new DDC systems, we recommend the district pursue two steps:

Controls ECRM 1a: Replace pneumatic controls with DDC systems

Pneumatic controls require operation of an air compressor and are inherently cost intensive systems to maintain. Some of the pneumatic controllers were noted to be disabled and may or may not have been appropriately capped off when they were disabled. Converting the systems to DDC will allow the air compressor to be abandoned and, if appropriately commissioned, will result in significant energy savings for the district.

Controls ECRM 1b: Install damper controllers on Outside Air dampers

The largest reason the units are currently programmed to startup at 5:00am, is the observation that the systems take an extended period of time to reach setpoint in time for the first occupant to arrive at the building. A significant cause for this slow startup is the lack of controls on the outside air dampers; they remain open during startup and operation during unoccupied periods. This allows larger than necessary latent and sensible cooling loads on the system during these times. Keeping the dampers closed during startup and after-hours operation will result in more efficient and less energy intensive system operation that will reach setpoint more rapidly. Cost summary information incorporates both phases for Controls ECRM 1.

Estimated Cost: $750,000 Estimated Savings: $83,000 Estimated Payback: 9 Years

Controls ECRM 2: MINIMIZE SYSTEM RUN TIMES

Currently, the district is programmed to allow HVAC systems to operate from 4:30am through 9:00pm, 16.5 hours per day for Dayton High School and Wilson Junior High. Most others start before 6 am and run till 7or 8 pm. However, many of the facilities are only occupied from 7:30am to 3:45pm. There is significant energy savings available by limiting the HVAC system operation to times coinciding with occupancy schedules. For Elementary and Middle Schools, we recommend limiting operation of the systems to 7:30am to 4:00pm; for High Schools, we recommend limiting operation to 7:30am to 6:00pm. There are custodial and extracurricular activities that occur outside these hours, but in most cases, the residual heating or cooling should be adequate to provide at least minimal comfort for these occupants during these extended hours.

Estimated Cost: $3,000 Estimated Savings: $150,000 Estimated Payback: Instantaneous

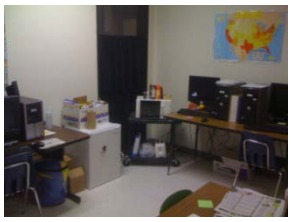
Controls ECRM 3: RESCHEDULE WEEKEND DEHUMIDIFICATION OPERATION

The district is currently running each facility for four or more hours on Saturday and Sunday to combat the development of mold in the buildings. This is often occurring until 1 pm or even later at Stephen F Austin. This is not only affecting the consumption of electricity but is also affecting the demand charges paid though the entire year. *We recommend changing the run time to early in the morning to minimize the impact on demand charges.*

Estimated Cost: $3,000 Estimated Savings: $30,000 Estimated Payback: 1 Month

Electrical ECRM 1: REMOVE PLUG LOAD FROM CLASSROOMS.

Nearly all classrooms had plug loads that were for personal use. These items included microwaves, mini-fridges, space heaters, plug in candles, coffee machines and lamps. These items were found in every campus visited and were left running without regard. Many of the personal refrigerators had nothing in them, candles and lamps were left on when no one was in the room. Teachers should consolidate food storage to dedicated refrigerators in the teacher's lounge. Conditioning setpoint temperatures should be identified in a district-wide energy policy with the anticipation that staff uncomfortable with the setpoints make adjustments in their daily attire to allow them to be comfortable with the stated setpoints.



Estimated Cost: $1,000 Estimated Savings: $5,000 Estimated Payback: 6 Months

Envelope ECRM 1: REPLACE WINDOW IN WOODROW WILSON JHS CAFETERIA

In the Cafeteria, it was noted that there was a large crack in one of the windows located high on the south wall. The staff had performed a good job of preventing mold and mildew from becoming established on the walls, but the maintenance expense and the risk for an indoor air quality issue to develop warrants the replacement of the window.

Estimated Cost: $1500 Estimated Savings: $375 Estimated Payback: 4 Years

7.0 MAINTENANCE AND OPERATION RECOMMENDATIONS

HVAC

- Increase frequency of filter replacement
- Fix chiller on Dayton High School
- Replace flow meter controlling bypass valve on Dayton High School
- Stop controlling Nottingham auditorium chiller with the Disconnect switch.
- Fix Outside Air unit for Wilson JHS gym
- Clean the condenser coils of the chillers at Wilson
- Keep electric boiler off during peak electrical load conditions

Lighting

- Turn off all light fixtures not required during daytime
- Fix all exterior lighting control
- Turn off lights in unoccupied spaces
- Do not turn on Football Stadium field lights until cooling is turned off at Nottingham

Controls

- Relocate EMS sensors to improve temperature sampling at Dayton High School
- Fix leaks in pnematics at Wilson JHS.

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

It was noted during the survey that most of the HVAC filters have not been changed with regularity. We recommend the district replace each HVAC filter with a new pleated filter or rolled filter media every 60-90 days. This condition was noted at multiple campuses.

The Dayton High School chiller was inoperable at the time of visit. This adds extra wear to the other three chillers. Also, the building may not be able to adequately cool itself as the temperatures begin to rise, creating a possible loss of humidity control. This should be fixed.

Also at Dayton High School, the flow meter that controls the bypass valve is broken. This makes the pumps work harder by sending the water around the entire loop instead of returning to the chillers. This also makes the chillers work more than necessary.

The Nottingham Auditorium chiller is being turned on and off by the teachers using the electrical disconnect. Not only is this dangerous for the teacher but it is also hazardous to the equipment. Sudden shutdowns should be avoided on this type of equipment.

The outside air unit serving the gym at Wilson Junior High School is in need of repair. It is unknown what is wrong with it, but it is causing more work to be done by other parts of the air conditioning system.

At Wilson Junior High, the condenser fins are dirty and bent. They should be cleaned and straightened [combs available for less than $10]. The installation of coil guards prevents future fin combing, which ultimately results in a combination of deferred labor savings, eliminating the need for maintenance personnel to perform the task and energy savings resulting from the units maintaining optimum operating efficiency. We recommend installing hail guards on the units to prevent future coil fin damage.

Lighting M&O

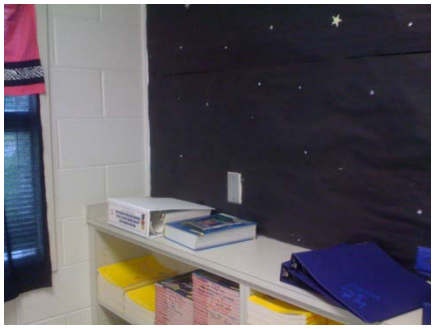
Some areas of the buildings noted in Section 6.0 of the report had light fixtures that were not required to be operating during the day or fixtures left operating in unoccupied spaces. The least expensive remedy to these issues is to train staff to not turn on fixtures not needed during daytime hours 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.

Many campuses had exterior night lighting operating during the daytime.

The High School football stadium lights are hooked up to the electrical service at Nottingham Elementary. Every effort to keep from turning on the lights at the stadium until Nottingham Elementary is shut down should be taken. The added electrical demand of running the lights at the stadium and the lights and air conditioning at Nottingham will be extremely high. It is not known at this time if this is occurring but should be added to this report.

Controls M&O

There were sensors noted in many locations that were not conducive to appropriate temperature sampling. Many sensors at Dayton High School are right next to the windows and pick up heat from them. Another sensor 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.



The pneumatic control system at Wilson ran continuously during our inspection. It is believed that it might turn off for 2 minutes out of every hour. The continual operation of the compressor is an indication that there are numerous leaks throughout the system. While it is impossible to find them all, an effort should be made to reduce the losses.

Many doors to the exterior of the building were left open through the day. The controls and HVAC will not work properly with this occurring. This is often a sign of a much bigger problem of the system not properly controlling the environment and should be investigated further.

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	($884,634)		0	($884,634)
Year 1		$ 292,653.00	0	$292,653
Year 2		$ 292,653.00	0	$292,653
Year 3		$ 292,653.00	0	$292,653
Year 4		$ 292,653.00	0	$292,653
Year 5		$ 292,653.00	0	$292,653
Year 6		$ 278,020.35	($5,000)	$273,020
Year 7		$ 263,387.70	($5,000)	$258,388
Year 8		$ 248,755.05	($5,000)	$243,755
Year 9		$ 234,122.40	($5,000)	$229,122
Year 10		$ 219,489.75	($5,000)	$214,490
Year 11		$ 204,857.10	($10,000)	$194,857
Year 12		$ 190,224.45	($10,000)	$180,224
Year 13		$ 175,591.80	($10,000)	$165,592
Year 14		$ 160,959.15	($10,000)	$150,959
Year 15		$ 146,326.50	($10,000)	$136,327
			Internal Rate of Return	**30.93%**

More information regarding financial programs available to Dayton ISD 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

ENTERGY TEXAS, INC. Electric Service SCHEDULE LGS	Sheet No.: 16 Effective Date: 5-2-11 Revision: 12 Supersedes: LGS Effective 8-15-10 Schedule Consists of: Two Sheets

LARGE GENERAL SERVICE

I. APPLICABILITY

This Schedule is applicable under the regular terms and conditions of the Company to Customers who contract for not less than 300 kW or not more than 2,500 kW of electric service at Company's available line voltage.

II. NET MONTHLY BILL

Billing Item	Per Month
A. Customer Charge:	$425.05
B. Billing Load Charge:	
All kW	$ 8.56 per kW
C. Energy Charge: (1)	
All kWh	$ 0.00854 per kWh

(1) Plus the Fixed Fuel Factor per Schedule FF and all applicable riders.

D. Delivery Voltage Adjustment

The Delivery Voltage below represents the voltage of the line from which service is delivered or, if applicable, the voltage used in determining the facilities charge under Schedule AFC. When service is metered at a voltage other than the Delivery Voltage, metered quantities will be adjusted by 1.5% for each transformation step to the Delivery Voltage.

Delivery Voltage	Adjustment
Secondary	No adjustment
Primary (2.4KV-34.5KV)	($0.58) per kW of Billing Load
69KV/138KV	($1.15) per kW of Billing Load

E. Minimum Charge

The monthly minimum charge will be the sum of the Customer Charge, the Billing Load Charge, and the Delivery Voltage Adjustment. Where the installation of excessive new facilities is required or where there are special conditions affecting the service, Company may require, in the Contract, a higher minimum charge and/or Facilities Agreement pursuant to Schedule AFC, to compensate for the additional costs.

III. METERING, PHASE AND VOLTAGE OF SERVICE

Service under this rate schedule will be rendered at the Company's standard phase and voltage available at the point of service.

(Continued on reverse side)

Where the Customer elects to take service at the available line voltage (greater than Secondary), metering will be installed at that voltage and Customer will receive the applicable Voltage Adjustment per § II (D) above. In such cases, Customer may elect to have Company install the necessary transformation facilities to provide service at a lower voltage. Customer will then pay facilities charges pursuant to Schedule AFC or at the Company's option, provide such facilities at Customer's own expense. At Company's option, metering may then be at Secondary and Customer's metered quantities will be adjusted pursuant to § II (D) above.

Where service is taken at multiple voltage levels and Customer requests totalizing arrangements for billing purposes, the Delivery Voltage Adjustment will be computed based upon demand, but weighted by kWh consumption at each voltage level.

Where service is of extremely fluctuating or intermittent type, Company may specify shorter intervals of load measurement than 30-minute intervals.

IV. POWER FACTOR ADJUSTMENT

Where Customer's power factor of total service supplied by Company is such that 85% of measured monthly maximum kVA used during any 30-minute interval exceeds the corresponding measured kW, Company will use 85% of such measured maximum kVA as the number of kW for all purposes that measured maximum kW load is specified herein. However, where Customer's power factor is regularly 85% or higher, Company may at its option omit kVA metering equipment or remove same if previously installed.

V. DETERMINATION OF BILLING LOAD

The kW of Billing Load will be the greatest of the following:

(A) The Customer's maximum measured 30-minute demand during any 30-minute interval of the current billing month, subject to §§ III, and IV above; or

(B) 50% of the first 500 kW of Contract Power plus 75% of all additional kW of Contract Power as defined in § VI; or

(C) (1) For existing accounts with contracts for service for loads existing prior to August 15, 2010 - 60% of the Highest Contract Power established prior to August 15, 2010 as defined in § VI,
(2) For new accounts with contracts for service for loads not existing prior to August 15, 2010 – Does not apply; or

(D) 300 kW.

VI. DETERMINATION OF CONTRACT POWER

Unless Company gives Customer written notice to the contrary, Highest Contract Power and Contract Power will be as defined below:

Highest Contract Power - the greater of (i) the highest Billing Load established during the billing months of June through September since service to Customer began under the currently effective contract or (ii) the contracted kW specified in the currently effective contract.

 (Continued on next page)

ENTERGY TEXAS, INC.
Electric Service

SCHEDULE LGS (Cont.)

Sheet No.: 17
Effective Date: 5-2-11
Revision: 12
Supersedes: LGS Effective 8-15-10
Schedule Consists of: Two Sheets

LARGE GENERAL SERVICE

Contract Power – the highest load established under § V (A) above during the billing months of June - September during the 12 months ending with the current month. For the initial 12 months of Customer's service, the Contract Power shall be estimated in advance from best data available and subject to adjustment for difference in actual and estimated.

VII. **USE OF SERVICE**

Electric service furnished under this rate shall not be used by Customer as an auxiliary or supplementary service to engines or other prime movers, or to any other source of power except in conjunction with rider for Standby and Maintenance Service. Customer shall not sub-meter and resell any energy purchased under this rate, except as may be specifically authorized by the appropriate regulatory authority.

VIII. **AMOUNT DUE AND PAYMENT**

The past due amount for service furnished for which payment is not made within sixteen (16) days of the billing date shall be the monthly bill, including all adjustments under the rate schedule and applicable riders, plus 5%. The 5% penalty on delinquent bills shall not be applied to any balance to which the penalty has already been applied. If the amount due when rendered is paid prior to such date, the monthly bill, including all adjustments under the rate schedule and applicable riders, shall apply. If providing service to the State of Texas or to municipalities or other political subdivisions of this state, Company shall not assess a fee, penalty, interest or other charge to these entities for delinquent payment of a bill.

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 Dayton ISD, 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: M. S. Kuhrt
Date: 3/8/11
Name (Mr./Ms./Dr.) Michael S. Kuhrt
Title: Superintendent
Organization: Dayton ISD
Phone: 936-258-2667
Street Address: 100 Cherry Creek Rd.
Fax: 936-258-5616
Mailing Address: P.O. Box 248
E-Mail: mike.kuhrt@daytonisd.net
Dayton, Tx. 77535
County: Liberty

Contact Information:

Name (Mr./Ms./Dr.): Doug Coleman
Title: Asst. Supt.
Phone: 936-258-2667
Fax:
E-Mail: doug.coleman@daytonisd.net
County:

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.

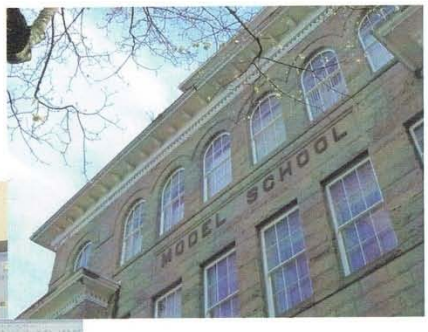
APPENDIX V - TEXAS ENERGY MANAGERS ASSOCIATION (TEMA)

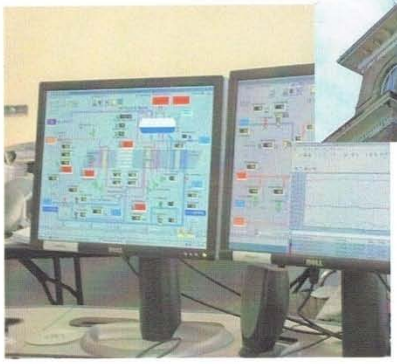
ANNOUNCING!

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