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Texas Comptroller of Public Accounts

Facility Preliminary Energy Assessments and Recommendations

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Dallas 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**.

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 March 2011, **SECO** received a request for technical assistance from Michael P. Brown, Executive Director of Facility Services for **Dallas 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 **Dallas 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 *Ms. Robin LaSalle Rose*, 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 **$1,386,775** may be saved annually if all recommended projects are implemented. The estimated installed cost of these projects should total approximately **$6,221,000**, yielding an average simple payback of **4½** years.

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

SUMMARY:	IMPLEMENTATION COST	ESTIMATED SAVINGS	SIMPLE PAYBACK
ECRM #1DW: T12 to T8 Lighting	$495,000	$110,000	4½ Years
ECRM #2DW: Daylight/Delamp	$40,000	$11,500	3½ Years
ECRM #3DW: *Occupancy Sensors	$600 Each	$435 Each	1½ Years
ECRM #4DW: *MH to T5 Lighting	$500 Each	$75 Each	6 2/3 Year
ECRM #5DW: *Exit Light Fixtures	$200 Each	$33 Each	6 Years
ECRM #6DW: Retro-Commissioning	$1,250,000	$350,000	3½ Years
ECRM #7DW: Portable Bldg Control	$1,651,000	$412,775	4 Years
ECRM #8DW: General Controls	No Estimate	----------	----------
ECRM #9DW: Behavioral Modification	$75,000 [Sample of 25 Campuses]	$25,000	3 Years
ECRM #10DW: Energy Master Plan	$1,300,000	$260,000	5 Years
HVAC ECRM #1A: Chillers	$440,000	$31,000	14 Years
HVAC ECRM #1B: Boilers	$80,000	$11,500	7 Years
HVAC ECRM #1C: Variable Drives	$890,000	$175,000	5 Years
TOTAL PROJECTS	**$6,221,000**	**$1,386,775**	**4½ Years**

DW = Districtwide * = Not Included in Table Totals

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. 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 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
Support Center	265,078	163%	$6.15	171%
Nolan Estes	187,984	86%	$4.80	112%
Administrative Building	177,694	76%	$3.85	70%
Haskell Building	75,824	-25%	$2.20	-3%
Adams ES	170,870	69%	$2.19	-3%
Burnet ES	78,882	-22%	$1.76	-22%
Rosemont ES	64,635	-36%	$1.67	-26%
White HS	67,928	-33%	$1.61	-29%
Conrad HS	61,177	-39%	$1.58	-30%
Samuel HS	74,267	-26%	$1.58	-30%
Molina HS	59,248	-41%	$1.50	-34%
Greiner MS	58,755	-42%	$1.49	-34%
Skyline HS	64,252	-36%	$1.47	-35%
Carter HS	74,579	-26%	$1.44	-37%
Cotton Service Center	31,139	-69%	$0.74	-67%
Average Value:	100,821		$2.27	

Dallas ISD purchases electricity from Reliant Energy. The transmission and distribution utility is Oncor 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

Note:
Although we attempted to obtain the monthly Electrical Demand readings and charges for each facility, we were unable to do so. As a result, we cannot address one of the best energy cost reduction strategies available to school districts, i.e., rescheduling non-essential operation of large kW electrical devices to minimize the impact of the monthly Peak Demand.

It is strongly recommended that DISD continue to pursue this data from their utility supplier so that the savings opportunities available through Demand control can be analyzed.

OWNER: Dallas ISD **BUILDING:** Adams 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	49,511		0	0	5,478	1,371	9,522
FEBRUARY	2010	46,206		0	0	5,220	1,500	9,741
MARCH	2010	43,139		0	0	4,913	1,820	10,704
APRIL	2010	44,881		0	0	5,374	510	2,998
MAY	2010	58,595		0	0	6,136	170	976
JUNE	2010	67,346		0	0	6,979	118	671
JULY	2010	52,520		0	0	5,825	0	36
AUGUST	2010	58,517		0	0	6,299	0	34
SEPTEMBER	2010	96,692		0	0	9,177	80	634
OCTOBER	2010	74,943		0	0	7,464	141	1,043
NOVEMBER	2010	61,213		0	0	6,679	236	1,772
DECEMBER	2010	45,687		0	0	5,275	632	4,307
TOTAL		**699,250**	**0**	**0**	**0**	**$74,819**	**6,578**	**$42,438**

Annual Total Energy Cost = $117,257 Per Year

Total KWH x 0.003413 = 2,386.54 x 106
Total MCF x 1.03 = 6,775.34 x 106
Total Other x ____ x 106
Total Site BTU's/yr 9,161.88 x 106

Floor area: 53,619 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 170,870 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $2.19 $/s.f. yr

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** dministrative Buildir

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	465,663		0	0	38,838	941	6,452
FEBRUARY	2010	443,564		0	0	37,221	533	3,348
MARCH	2010	470,619		0	0	39,097	417	2,498
APRIL	2010	480,372		0	0	39,578	276	1,635
MAY	2010	480,482		0	0	39,737	99	581
JUNE	2010	553,250		0	0	45,078	3	50
JULY	2010	526,310		0	0	43,297	3	56
AUGUST	2010	527,439		0	0	43,348	4	67
SEPTEMBER	2010	552,827		0	0	44,898	4	68
OCTOBER	2010	454,467		0	0	37,700	82	614
NOVEMBER	2010	443,637		0	0	37,027	308	2,145
DECEMBER	2010	500,808		0	0	41,007	501	3,187
TOTAL		**5,899,438**	**0**	**0**	**0**	**$486,826**	**3,171**	**$20,701**

Annual Total Energy Cost = $507,527 Per Year

Total KWH x 0.003413 = 20,134.78 x 106
Total MCF x 1.03 = 3,266.13 x 106
Total Other x ____ x 106
Total Site BTU's/yr 23,400.91 x 106

Floor area: 131,692 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 177,694 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $3.85 $/s.f. yr

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Burnet 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	114,986		0	0	12,904	640	4,430
FEBRUARY	2010	125,227		0	0	13,625	702	4,530
MARCH	2010	114,045		0	0	12,525	888	5,231
APRIL	2010	127,020		0	0	13,554	237	1,412
MAY	2010	155,033		0	0	15,795	55	336
JUNE	2010	123,793		0	0	13,071	32	207
JULY	2010	131,157		0	0	13,732	11	113
AUGUST	2010	196,090		0	0	18,986	13	130
SEPTEMBER	2010	170,466		0	0	17,068	22	203
OCTOBER	2010	105,048		0	0	12,273	31	261
NOVEMBER	2010	92,453		0	0	10,892	45	356
DECEMBER	2010	107,674		0	0	12,073	184	1,275
TOTAL		**1,562,992**	**0**	**0**	**0**	**$166,498**	**2,860**	**$18,484**

Annual Total Energy Cost =	$184,982	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	78,882 BTU/s.f.yr
Total KWH x 0.003413 =	5,334.49	x 106		
Total MCF x 1.03 =	2,945.80	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$1.76 $/s.f. yr
Total Other x ____		x 106		
Total Site BTU's/yr	8,280.29	x 106		
Floor area:	104,971	s.f.		

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Carter 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	191,607		0	0	20,625	2,066	14,246
FEBRUARY	2010	188,282		0	0	20,268	1,552	10,070
MARCH	2010	174,158		0	0	19,306	1,873	11,082
APRIL	2010	214,133		0	0	22,364	505	2,994
MAY	2010	249,562		0	0	25,381	183	1,081
JUNE	2010	281,222		0	0	27,452	130	771
JULY	2010	245,948		0	0	24,524	1	73
AUGUST	2010	335,194		0	0	31,414	147	1,176
SEPTEMBER	2010	413,450		0	0	37,661	166	1,316
OCTOBER	2010	258,833		0	0	25,992	174	1,314
NOVEMBER	2010	206,480		0	0	21,844	199	1,477
DECEMBER	2010	172,522		0	0	18,881	750	5,121
TOTAL		**2,931,391**	**0**	**0**	**0**	**$295,712**	**7,746**	**$50,721**

Annual Total Energy Cost =	$346,433	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	74,579 BTU/s.f.yr
Total KWH x 0.003413 =	10,004.84	x 106		
Total MCF x 1.03 =	7,978.38	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$1.44 $/s.f. yr
Total Other x ____		x 106		
Total Site BTU's/yr	17,983.22	x 106		
Floor area:	241,129	s.f.		

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Conrad 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	346,874		0	0	35,427	390	2,863
FEBRUARY	2010	351,054		0	0	35,889	285	1,958
MARCH	2010	311,342		0	0	32,331	178	1,176
APRIL	2010	414,723		0	0	40,644	109	706
MAY	2010	425,057		0	0	41,523	84	536
JUNE	2010	509,734		0	0	47,264	38	276
JULY	2010	534,156		0	0	46,261	35	322
AUGUST	2010	544,102		0	0	50,125	56	492
SEPTEMBER	2010	561,764		0	0	51,597	70	589
OCTOBER	2010	471,558		0	0	44,636	138	1,095
NOVEMBER	2010	396,317		0	0	38,435	265	2,006
DECEMBER	2010	356,548		0	0	35,040	383	2,613
TOTAL		**5,223,229**	**0**	**0**	**0**	**$499,172**	**2,031**	**$14,632**

Annual Total Energy Cost =	$513,804	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	61,177 BTU/s.f.yr
Total KWH x 0.003413 =	17,826.88	x 106		
Total MCF x 1.03 =	2,091.93	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$1.58 $/s.f. yr
Total Other x ____		x 106		
Total Site BTU's/yr	19,918.81	x 106		
Floor area:	325,595	s.f.		

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Cotton Service Cent

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	310,756		0	0	27,177	375	2,668
FEBRUARY	2010	13,260		0	0	1,241	260	1,724
MARCH	2010	484,297		0	0	43,011	321	1,960
APRIL	2010	203,292		0	0	18,812	29	233
MAY	2010	261,004		0	0	22,979	4	87
JUNE	2010	301,530		0	0	26,257	3	80
JULY	2010	285,646		0	0	24,833	2	85
AUGUST	2010	343,723		0	0	29,355	2	85
SEPTEMBER	2010	278,377		0	0	24,589	3	92
OCTOBER	2010	205,665		0	0	19,038	3	96
NOVEMBER	2010	207,075		0	0	19,158	12	160
DECEMBER	2010	12,030		0	0	1,140	161	1,157
TOTAL		**2,906,655**	**0**	**0**	**0**	**$257,590**	**1,175**	**$8,427**

Annual Total Energy Cost =	$266,017	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	31,139 BTU/s.f.yr
Total KWH x 0.003413 =	9,920.41	x 106		
Total MCF x 1.03 =	1,210.25	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$0.74 $/s.f. yr
Total Other x ____		x 106		
Total Site BTU's/yr	11,130.66	x 106		
Floor area:	357,456	s.f.		

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Greiner 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	186,957		0	0	18,880	481	3,430
FEBRUARY	2010	194,744		0	0	19,468	522	3,347
MARCH	2010	142,935		0	0	16,063	197	1,231
APRIL	2010	195,724		0	0	19,737	62	432
MAY	2010	231,419		0	0	22,367	59	391
JUNE	2010	180,437		0	0	18,244	22	186
JULY	2010	192,993		0	0	19,705	16	184
AUGUST	2010	284,543		0	0	26,323	20	219
SEPTEMBER	2010	290,681		0	0	26,945	46	420
OCTOBER	2010	217,958		0	0	21,252	56	477
NOVEMBER	2010	184,565		0	0	19,079	96	750
DECEMBER	2010	182,030		0	0	18,292	100	748
TOTAL		**2,484,986**	**0**	**0**	**0**	**$246,355**	**1,677**	**$11,815**

Annual Total Energy Cost =	$258,170	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	58,755 BTU/s.f.yr
Total KWH x 0.003413 =	8,481.26	x 106		
Total MCF x 1.03 =	1,727.31	x 106	**Energy Cost Index:**	
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$1.49 $/s.f. yr
Total Site BTU's/yr	10,208.57	x 106		
Floor area:	173,748	s.f.		

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Haskell Building

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	56,608		0	0	5,496	Electric Only Facility	
FEBRUARY	2010	63,768		0	0	6,012		
MARCH	2010	39,232		0	0	4,245		
APRIL	2010	34,080		0	0	3,871		
MAY	2010	40,184		0	0	4,310		
JUNE	2010	57,576		0	0	5,537		
JULY	2010	48,848		0	0	4,581		
AUGUST	2010	60,696		0	0	5,462		
SEPTEMBER	2010	48,800		0	0	4,606		
OCTOBER	2010	33,968		0	0	3,534		
NOVEMBER	2010	30,000		0	0	3,246		
DECEMBER	2010	46,088		0	0	4,493		
TOTAL		**559,848**	**0**	**0**	**0**	**$55,393**	**0**	**$0**

Annual Total Energy Cost =	$55,393	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	75,824 BTU/s.f.yr
Total KWH x 0.003413 =	1,910.76	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.)	$2.20 $/s.f. yr
Total Site BTU's/yr	1,910.76	x 106		
Floor area:	25,200	s.f.		

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Molina 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	271,876		0	0	26,404	246	1,682
FEBRUARY	2010	267,719		0	0	26,167	153	986
MARCH	2010	321,467		0	0	31,002	91	570
APRIL	2010	372,395		0	0	33,634	68	423
MAY	2010	455,632		0	0	39,324	55	335
JUNE	2010	395,515		0	0	34,912	21	146
JULY	2010	341,871		0	0	31,090	6	81
AUGUST	2010	455,588		0	0	39,886	37	316
SEPTEMBER	2010	508,129		0	0	43,776	65	509
OCTOBER	2010	405,000		0	0	36,273	71	546
NOVEMBER	2010	373,983		0	0	34,090	79	581
DECEMBER	2010	310,203		0	0	28,923	115	734
TOTAL		**4,479,378**	**0**	**0**	**0**	**$405,481**	**1,007**	**$6,909**

			Energy Use Index:		
Annual Total Energy Cost =	$412,390	Per Year	Total Site BTU's/yr / Total Area (sq.ft.)	59,248	BTU/s.f.yr
Total KWH x 0.003413 =	15,288.12	x 106			
Total MCF x 1.03 =	1,037.21	x 106	**Energy Cost Index:**		
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$1.50	$/s.f. yr
Total Site BTU's/yr	16,325.33	x 106			
Floor area:	275,543	s.f.			

Electric Utility	**Account #**	**Meter#**	**Gas Utility**	**Meter #**
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Nolan Estes

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	465,915		0	0	50,438	1,056	7,441
FEBRUARY	2010	513,348		0	0	53,992	1,351	8,503
MARCH	2010	489,534		0	0	52,318	396	2,387
APRIL	2010	727,818		0	0	71,677	18	137
MAY	2010	1,146,135		0	0	102,245	15	116
JUNE	2010	1,190,079		0	0	105,780	1	39
JULY	2010	1,289,601		0	0	112,796	0	34
AUGUST	2010	1,340,418		0	0	117,452	6	78
SEPTEMBER	2010	1,342,038		0	0	117,603	25	223
OCTOBER	2010	1,059,972		0	0	95,887	26	224
NOVEMBER	2010	687,999		0	0	68,597	45	355
DECEMBER	2010	515,529		0	0	54,421	406	2,765
TOTAL		**10,768,386**	**0**	**0**	**0**	**$1,003,206**	**3,345**	**$22,302**

			Energy Use Index:		
Annual Total Energy Cost =	$1,025,508	Per Year	Total Site BTU's/yr / Total Area (sq.ft.)	187,984	BTU/s.f.yr
Total KWH x 0.003413 =	36,752.50	x 106			
Total MCF x 1.03 =	3,445.35	x 106	**Energy Cost Index:**		
Total Other x ____		x 106	Total Energy Cost/yr / Total Area (sq.ft.)	$4.80	$/s.f. yr
Total Site BTU's/yr	40,197.85	x 106			
Floor area:	213,836	s.f.			

Electric Utility	**Account #**	**Meter#**	**Gas Utility**	**Meter #**
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Rosemont 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	62,357		0	0	6,702	252	1,792
FEBRUARY	2010	58,953		0	0	6,386	258	1,664
MARCH	2010	45,342		0	0	5,326	104	645
APRIL	2010	70,754		0	0	7,769	34	234
MAY	2010	89,033		0	0	8,813	15	113
JUNE	2010	88,198		0	0	8,977	6	65
JULY	2010	91,083		0	0	9,166	1	43
AUGUST	2010	95,264		0	0	9,674	3	58
SEPTEMBER	2010	104,785		0	0	10,840	10	107
OCTOBER	2010	74,812		0	0	7,764	11	118
NOVEMBER	2010	54,490		0	0	6,327	13	129
DECEMBER	2010	55,667		0	0	6,124	68	495
TOTAL		**890,738**	**0**	**0**	**0**	**$93,868**	**775**	**$5,463**

Annual Total Energy Cost =	$99,331	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	64,635	BTU/s.f.yr
Total KWH x 0.003413 =	3,040.09	x 106			
Total MCF x 1.03 =	798.25	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$1.67	$/s.f. yr
Total Other x ____		x 106			
Total Site BTU's/yr	3,838.34	x 106			
Floor area:	59,385	s.f.			

Electric Utility	**Account #**	**Meter#**	**Gas Utility**	**Meter #**
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Samuel 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	222,607		0	0	23,190	1,724	11,858
FEBRUARY	2010	208,942		0	0	22,199	897	5,832
MARCH	2010	179,309		0	0	19,960	1,458	8,592
APRIL	2010	271,330		0	0	26,967	397	2,335
MAY	2010	288,885		0	0	28,444	199	1,137
JUNE	2010	280,016		0	0	27,732	154	868
JULY	2010	211,063		0	0	22,324	2	51
AUGUST	2010	303,164		0	0	33,732	3	53
SEPTEMBER	2010	500,996		0	0	44,252	190	1,457
OCTOBER	2010	383,867		0	0	35,295	180	1,324
NOVEMBER	2010	327,937		0	0	31,326	216	1,554
DECEMBER	2010	226,290		0	0	23,471	569	3,867
TOTAL		**3,404,406**	**0**	**0**	**0**	**$338,892**	**5,989**	**$38,928**

Annual Total Energy Cost =	$377,820	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	74,267	BTU/s.f.yr
Total KWH x 0.003413 =	11,619.24	x 106			
Total MCF x 1.03 =	6,168.67	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$1.58	$/s.f. yr
Total Other x ____		x 106			
Total Site BTU's/yr	17,787.91	x 106			
Floor area:	239,514	s.f.			

Electric Utility	**Account #**	**Meter#**	**Gas Utility**	**Meter #**
Reliant Energy	0	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** ›l Services Support (

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	785,334		0	0	62,593	Electric Only Facility	
FEBRUARY	2010	853,199		0	0	67,507		
MARCH	2010	818,825		0	0	65,089		
APRIL	2010	764,123		0	0	61,081		
MAY	2010	659,963		0	0	52,942		
JUNE	2010	766,996		0	0	60,280		
JULY	2010	725,913		0	0	57,297		
AUGUST	2010	690,252		0	0	54,857		
SEPTEMBER	2010	773,590		0	0	60,628		
OCTOBER	2010	706,403		0	0	55,993		
NOVEMBER	2010	749,882		0	0	59,647		
DECEMBER	2010	922,425		0	0	72,077		
TOTAL		**9,216,905**	**0**	**0**	**0**	**$729,991**	**0**	**$0**

Annual Total Energy Cost =	$729,991	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	265,078	BTU/s.f.yr
Total KWH x 0.003413 =	31,457.30	x 106			
Total MCF x 1.03 =	0.00	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$6.15	$/s.f. yr
Total Other x ____		x 106			
Total Site BTU's/yr	31,457.30	x 106			
Floor area:	118,672	s.f.			

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	1003278943580331	0	Atmos Gas	0

OWNER: Dallas ISD **BUILDING:** Skyline 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	468,351		0	0	48,592	2,074	14,270
FEBRUARY	2010	452,074		0	0	47,357	1,323	8,622
MARCH	2010	36,771		0	0	41,074	1,726	10,195
APRIL	2010	540,769		0	0	53,606	265	1,598
MAY	2010	741,830		0	0	67,942	12	129
JUNE	2010	974,032		0	0	86,143	20	168
JULY	2010	1,089,144		0	0	93,529	14	169
AUGUST	2010	1,113,694		0	0	94,773	17	193
SEPTEMBER	2010	1,248,034		0	0	106,693	22	231
OCTOBER	2010	814,845		0	0	74,641	3,023	21,694
NOVEMBER	2010	667,320		0	0	62,612	102	785
DECEMBER	2010	529,537		0	0	53,517	472	3,263
TOTAL		**8,676,401**	**0**	**0**	**0**	**$830,479**	**9,070**	**$61,317**

Annual Total Energy Cost =	$891,796	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	64,252	BTU/s.f.yr
Total KWH x 0.003413 =	29,612.56	x 106			
Total MCF x 1.03 =	9,342.10	x 106	**Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.)	$1.47	$/s.f. yr
Total Other x ____		x 106			
Total Site BTU's/yr	38,954.66	x 106			
Floor area:	606,278	s.f.			

Electric Utility	Account #	Meter#	Gas Utility	Meter #
Reliant Energy	0	0	Atmos Gas	0

OWNER: **Dallas ISD** **BUILDING:** **White 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	282,580		0	0	29,268	1,004	6,722
FEBRUARY	2010	255,588		0	0	27,360	882	5,331
MARCH	2010	264,152		0	0	27,877	519	3,070
APRIL	2010	319,394		0	0	32,183	141	835
MAY	2010	406,941		0	0	38,362	54	326
JUNE	2010	411,340		0	0	37,865	33	255
JULY	2010	425,646		0	0	38,782	32	275
AUGUST	2010	512,467		0	0	45,978	41	340
SEPTEMBER	2010	432,100		0	0	40,197	76	582
OCTOBER	2010	350,708		0	0	33,832	116	858
NOVEMBER	2010	243,265		0	0	25,804	283	1,958
DECEMBER	2010	232,203		0	0	25,197	536	3,255
TOTAL		**4,136,384**	**0**	**0**	**0**	**$402,705**	**3,717**	**$23,807**

Annual Total Energy Cost =	$426,512	Per Year	**Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.)	67,928	BTU/s.f.yr
Total KWH x 0.003413 =	14,117.48	x 106			
Total MCF x 1.03 =	3,828.51	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	17,945.99	x 106			
Floor area:	264,190	s.f.			

Electric Utility	**Account #**	**Meter#**	**Gas Utility**	**Meter #**
Reliant Energy	0	0	Atmos Gas	0

GENERAL COMMENTS:

While viewing these Base Year tabulations, a few items stood out as being out of the ordinary and we address them at this point for your consideration:

A. **Cotton Service Center**: The normal monthly electrical consumption ranges from 200,000 to 400,000 kWh. However, the data provided for February was 13,260 kWh and for December was 12,030 kWh. It may be that the meters were simply not read on those months and the utility supplier inserted very conservative estimates. However, it is suggested that someone in DISD review the bills each month to see such discrepancies as they arise.
B. **Nolan Estes**: We are uncertain about what this facility is used for, but its energy consumption is far greater than is expected for a 200,000 sf (+/-) school facility.
C. **Summer Consumption**: There is limited, if any, evidence that DISD schools experience reduced occupancy during summer months. In fact, many of the campuses tabulated in this section experienced significantly higher consumption during those months. This observation leads to the *recommendation* that summer operation be reviewed to determine if savings could be obtained via shut down or reduced activity.

4.0 RATE SCHEDULE ANALYSIS:

ELECTRICITY PROVIDER:

RETAIL ELECTRIC PROVIDER: Reliant Energy Contract price: $0.06827 per kWh

TRANSMISSION AND DISTRIBUTION UTILITY: Oncor

Electric Rate: Secondary Service > 10 kVA

I.	TRANSMISSION AND DISTRIBUTION CHARGES:		
	Customer Charge	=	$3.50 per meter
	Metering Charge	=	$18.41 per IDR meter
	Transmission System Charge IDR Metered	=	$1.99 per 4CP kW
	Distribution System Charge	=	$3.97 per Distribution System Billing kW
II.	SYSTEM BENEFIT FUND	=	$0.000655 per kWh see Rider SBF
III.	TRANSITION CHARGES		
	Transition Charge 1	=	$0.188/kW
	Transition Charge 2	=	$0.248/kW
IV.	NUCLEAR DECOMMISSIONING CHARGE	=	$0.044 per Distribution System Billing kW
V.	TRANSMISSION COST RECOVERY FACTOR	=	$0.175714/4CP kW
VI.	ENERGY EFFICIENCY COST RECOVERY FACTOR	=	$9.66/Retail Customer
VII.	COMPETITIVE METER CREDIT	=	$5.47/Month
VIII.	ADVANCED METERING COST RECOVERY FACTOR	=	$3.98/Month
IX.	RATE CASE EXPENSE SURCHARGE	=	$0.007944/kW
X.	TAXES		
	General Local Taxes		

Average Savings for consumption = $0.06827/kWh + $0.000655/kWh = $0.068925/kWh
Average Savings for demand = $1.99 + $3.97 + $0.188 + $0.269 + $0.044 + $0.175714 + $0.007944 = $ 6.644658/kW**

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

1. NCP kW: Peak demand during 15 minute interval of current billing cycle
2. 4CP kW: Average demands of June, July, August and September of previous calendar year; usually only applied to IDR metered accounts
3. Billing kW: 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: $325,944

Total quantity purchased during the analyzed billing cycle: 49,141 MCF

Average cost per MCF = Cost of natural gas / quantity purchased = $325,944 / 49,141 MCF

Average cost per MCF = $6.63

5.0 CAMPUS DESCRIPTIONS:

Dallas ISD consists of 260 educational campuses which are located in Dallas County; in and throughout the city of Dallas. The energy survey focused on seven (7) of the educational campuses:

Table 2: School Facilities Analyzed For This Report

Note: SZAHU = Single-Zone Air Handling Unit; MZAHU = Multi-Zone Air Handling Unit

Facility	Year originally Constructed	Approx. Square Footage	Basic HVAC Cool/Heat	Basic HVAC Air Distribution	Basic Lighting System Description	Basic Control System Description
White HS	Unknown	264,190	Water Cooled & Air Cooled Chillers / natural gas HW Boiler	SZAHU with hot water VAV reheat	75% T12 25% T8	DDC – JCI Metasys
Burnet ES	1955 With 1969 Major Renovation	104,971	Air cooled chillers / natural gas HW boilers	Unit Ventilators with hot & chilled water coils	Combination T12 and T8	DDC - Trane
Administration Building	Unknown	131,692	Water cooled chillers / natural gas HW boilers	MZAHU & SZAHU with hot & chilled water coils	T8	DDC - CSI
Skyline HS	1971	606,278	Water cooled chillers / natural gas HW boiler	MZAHU & SZAHU with hot & chilled water coils	T8	DDC – CSI & JCI
Support Services Building		118,672	Air Cooled Screw Chillers	MZAHU with electric reheat	T12	DDC - JCI
Samuel HS	1955 With 1965 Major Addition	239,514	Water cooled chillers / natural gas HW boilers	SZAHU with HW coils or Fan Powered Box with HW coil	T8 & T12	DDC - CSI
Greiner MS	1990	173,748	Water cooled screw chillers / natural gas HW boiler	SZAHU- all with chilled water and some with hot water coils	T12	DDC - CSI

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:

Districtwide Recommendations:

Although energy cost savings for individual campuses are an important part of these SECO sponsored reports, the *more important goal* is to discover and report on savings opportunities that can be duplicated around the district. In an effort to discover this type of savings opportunities, we emphasize from the outset that the district should select campuses for our survey that are typical of other campuses around the district.

DISD's Energy Department did an excellent job in selecting these prototype campuses for this analysis and the following districtwide recommendations have been generated for the district's consideration:

ECRM #1DW – Districtwide Lighting - T12/T8 Lighting Renovations:

Five (5) of the seven (7) facilities surveyed for this report were noted to utilize T12 components in their linear fluorescent lighting fixtures. In fact, T12 fluorescent lamps and their associated electromagnetic ballasts represent the dominant lighting fixture in White HS, Greiner MS and the Support Services building. Approximately twenty years ago, the old T12 lamps were made obsolete by the introduction of the T8 fluorescent lamp and the electronic ballast that serves the T8 lamps. In short, T12 components produce approximately 18% less light output and consume about 20% more energy than the T8 lamps and electronic ballasts that may be retrofit into the existing linear fluorescent fixtures. Due to the slow process followed by most public entities in replacement of the old T12 lamps, Senate Bill 300 was introduced by the Texas legislature requiring Texas school districts to install the most efficient lamps and ballasts possible within their existing fixtures; in other words, replace T12s with T8s. *Therefore we recommend the district retrofit the fixtures at these facilities with T8 lamps and electronic ballasts. It is also recommended that a lighting analysis be made in each area of the building to determine if fixtures can be rearranged to provide acceptable illumination using fewer fixtures and/or lamps.*

For the five (5) campuses surveyed, this renovation will have the following financial impact:

Estimated Cost: $495,000	Estimated Savings: $110,000	Estimated Payback: 4½ Years

ECRM #2DW: Districtwide Lighting - 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 minor lighting control modifications or staff training. We recommend training staff not to turn on fixtures in areas with large window fenestration areas during the

day. If that approach is unsuccessful, DISD should make proper switching scheme modifications to allow the fixtures to be left off during the day.

The facilities inspected during our site visit had a significant amount of glass fenestration.

- Support Services Building (408 Haskell)
  100% Glass Walls
- Administration Building (3700 Ross)
  15% Glass Walls
- Skyline HS
  60% Glass Walls
- Samuel HS *[photo to left]*
  50% Glass Walls
- Burnet ES
  80% Glass Walls

As a result, there is much lighting energy saving potential around the perimeter of these buildings.

The corridors at most of the visited campuses utilize 2-lamp or 3-lamp fluorescent fixtures at 6 feet on center spacing. Light levels in the corridors were measured to be between 16-57 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 every other fixture in the corridors at all campuses, if at all possible. If 3-lamp fixtures are involved and 1/3 of the illumination level can be eliminated, then we suggest that the center lamp within the fixture be removed and the ballast serving that lamp be disconnected.

For the seven (7) campuses surveyed, this renovation will have the following financial impact:

Estimated Cost: $40,000	Estimated Savings: $11,500	Estimated Payback: 3½ Years

ECRM #3DW: Districtwide Lighting - OCCUPANCY SENSOR INSTALLATION

There were several areas of the facilities that were noted to have artificial 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. The following *cost and savings estimate is for EACH classroom* where this ECRM is implemented

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

ECRM #4DW: Districtwide Lighting - METAL HALIDE FIXTURE RETROFIT TO T5 HIGH BAY

Most DISD cafeterias and gymnasiums have metal halide fixtures that are estimated to be in the 400-watt range. When a 400-watt lamp is operated, the actual energy requirement is around 480-watts due to the energy needs of the ballast that must remain energized throughout lamp operation.

IESNA recommendations for school cafeterias are 30-35 footcandles, and for competition gymnasiums the illumination level is recommended to be around 50 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 400w metal halides with 6-lamp T8 or 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.*

The following *cost and savings estimate is for EACH fixture* where this ECRM is implemented.

Estimated Cost: $500	Estimated Savings: $75/Year	Estimated Payback: 6 2/3 Years

ECRM #5DW: Districtwide Lighting - REPLACE INCANDESCENT EXIT FIXTURES WITH LED

Many DISD campuses 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.

The following *cost and savings estimate is for EACH Exit Fixture* replaced.

Estimated Cost: $200	Estimated Savings: $33/Year	Estimated Payback: 6 Years

ECRM #6DW: Districtwide Controls – Retro-Commissioning

There are four (4) basic automatic control systems serving the HVAC systems throughout the district: TAC's CSI Energy Management Control System (EMCS), Trane Company's EMCS, Johnson Controls' EMCS and Honeywell's EMCS. Although each of these systems is completely capable of operating the HVAC system it serves in an extremely efficient manner, they were found to be delegated primarily to the minimal system output of controlling On/Off times and room set-point temperatures---when they were usable at all.

The simple truth is that these EMCS systems are not communicating with each other very well at this point, and most of the systems we looked at during our visit were, in effect, being operated *manually*. Although DISD has installed Schneider Electric's CSI system as the front-

end communications link between the systems, the LON Works protocol used by JCI, Honeywell and Trane creates a monumental task when attempting to integrate these three systems into a BacNet operation.

Although there are multiple features within these programs and their controllers that could significantly improve energy efficiency and lower energy costs throughout the district if programming for those features was completed, the process is indeed a difficult one.

In addition, we discovered several locations where the connections between the new electronic DDC controls and the old pneumatic controllers were obviously not working (or air was leaking), rendering those controlled points inoperable. There are also installed controllers that seemed to be inoperable during our survey.

One of the most obvious revisions that would produce immediate savings is the manner in which HVAC equipment is operated during night and other unoccupied hours. The current practice of leaving chiller and boiler systems operating when few people are in the building is the result of a prevailing fear of mold and mildew. However, the only equipment that may need to be running during unoccupied hours is the Air Handling Units, and even they need not be on all the time. If the EMCS was reprogrammed to close all outside air dampers and turn off all exhaust fans at night, there would be little humid air entering the building during those hours. As assurance that the infiltration load was not overly high, the AHU's could be allowed to operate under guidance of pressure sensors installed at key locations around the building, or they could simply be turned on for a few minutes each hour to ensure that the building has a slightly positive pressure.

The significant savings opportunity presented by improving/upgrading this existing control system could be obtained through a task called **Retro-Commissioning**. As a result, we strongly *recommend that a full Retro-Commissioning* project be initiated by DISD to ensure that all control components are operating as desired and to install program features not being used at this time and re-programming existing Sequences of Operations (SeqOp) with the goal of improving both comfort and energy efficiency.

As part of this installation, it may be necessary to install mini-split systems in MDF/IDF server rooms, which would allow the central plant to be turned off at night and on holidays. It may also require hiring a Test and Balance firm to help insure that proper flow rates are being attained in both the water and air distribution sides of the HVAC systems.

Our preliminary estimate of the cost to conduct a Retro-Commissioning study for the entire district is:

Estimated Cost: $1,250,000	*Estimated Savings: $350,000*	*Estimated Payback: 3½ Years*

Note: MDF/IDF split system installation and T&B firm fees are not included in this estimate.

ECRM #7DW: Districtwide Controls – Portable Buildings

DISD currently has 1,556 single, 28 double and 93 quad portable buildings that are now providing 1,738 classrooms for students. All of the portable buildings are air conditioned but none are controlled through any means other than the most basic wall or unit mounted thermostat. Some of these thermostats are the programmable type, but due to the limited capability of typical programmable thermostats to adjust for atypical occupancy, most are eventually decommissioned, leaving the heating and cooling systems running around the clock.

Past attempts to gain control of the energy consuming systems within portable buildings have been far less effective than desired. The old wireless devices used were unreliable and were eventually removed from service. However, there are newer, and far more reliable, wireless controllers available today that are reasonably priced and offer substantially more control than the earlier versions.

Due to the significant improvements made in this field, we now recommend installing IP Addressable Programmable Thermostats in portable buildings. These devices will allow the district personnel with appropriate password credentials to monitor and program these units at any district network computer and will limit operation of the HVAC equipment to scheduled occupancy hours.

Estimated Cost for each IP Addressable unit is approximately $600, but when labor and other expenses are added, the units require and installed cost of around $950 each.

Installation of these units within all DISD portable building classrooms will require:

Estimated Cost: $1,651,100	Estimated Savings: $412,775	Estimated Payback: 4 Years

ECRM #8DW: Districtwide Controls – General

Several schools were noted to operate with a combination of electronic energy management systems and pneumatic thermostats and controls. 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 involve three 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: Minimize system run schedules.

Currently, the district's EMCS is typically programmed to allow HVAC systems to operate 10 to 13 hours per day. Many of the facilities are only occupied from 7:30am to 3:45pm. There are 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.

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

The largest reason the units are currently programmed to startup at 6:00-7:00am, 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-hour operation will result in more efficient and less energy intensive system operation that will reach setpoint more rapidly.

Estimated Cost and Annual Savings beyond scope of this report……..

ECRM #9DW: Districtwide Operations – Behavioral Modifications –

Based upon general observations while walking through the DISD facilities, it was generally concluded that there is a need to develop an "energy education" training program for building occupants. Many of the inefficiencies observed were due to simple oversight by teachers and students that could easily be corrected but would pay big dividends within the utility budget.

Some of the common practices observed were:

1. Lights left on in unoccupied rooms.
2. Doors between conditioned and non-conditioned spaces left open
3. Both light switches in dual light level fixtures turned on when only one lamp grouping was needed to meet illumination requirements
4. Room thermostats set far lower than needed for normal comfort

5. Books and storage shelves placed over the supply air registers on floor mounted Unit Ventilators in the classroom *[see photo to left]*
6. Classroom return air grills blocked by filing cabinets
7. Classroom thermostats covered with paper or hidden behind furniture

8. Hot water faucets left running in the kitchen for no obvious reason

9. Domestic hot water temperatures set higher than required by code

10. Windows open while air conditioning system operating *[see photo to the right]*

When issues such as the ones depicted here are discovered, it simply suggests the need to bring energy costs back into the focus of those who control that usage.

As a result, we recommend that DISD consider implementing a Behavioral Modification program to address these occupant controlled inefficiencies. Programs such as Watt Watchers and P.O.W.E.R. (Preserving Our World's Energy Resources) offer an excellent entrance into these behavioral adjustment opportunities. Competition between similar schools offering prizes to the campus that does the most to save energy dollars has also become very popular among energy minded school districts. School assemblies, science fairs focused on energy related issues, all these and more are available to DISD for involvement in the *occupant-side of energy management*.

In the past, behavioral modification programs have been offered to school districts by firms charging a certain portion of the anticipated savings as their fee. However, that method of payment for savings may be very hard to quantify and generally results in a cost far higher than necessary. In fact, programs of this type should be implemented within a selected subset of a school district's campuses by those with experience in the field, but should then be propagated throughout the remainder of the district by a team of district staff members.

The recommendation for a Behavioral Modification Program is therefore made under this concept of an initial subset of campuses. Since DISD has around 260 campuses, <u>we suggest that the first step include 10% or approximately 25 campuses.</u>

Estimated Cost: $75,000	Estimated Savings: $25,000	Estimated Payback: 3 Years

Note: Annual savings are projected at $1,000/campus per year. Actual savings may be significantly higher, depending upon the success of the program.

ECRM #10DW: Districtwide Analysis – Energy System MASTER PLAN –

It is recommended that DISD consider the generation of a 5-year Master Plan that covers all facets of the management of their energy consuming equipment and systems. The purpose of the Energy System Master Plan is to bring together a comprehensive evaluation of facility needs along with the steps that must be taken to meet those needs over time, allowing the school district to move ahead in a businesslike manner, avoiding "surprises" and controlling costs.

The plan should include detailed consideration of all campus and auxiliary facility energy needs and ways in which DISD can increase their energy efficiency and assure energy supply and availability in the years ahead. This will enable the school district to manage their energy costs more effectively in the face of rising prices.

Looking ahead in "phases," the plan provides a way to anticipate needed equipment replacement or changes over time, allowing time to budget in the most cost effective manner

Components of an Energy System Master Plan should include:

- Total analysis of historic utility bills to determine patterns of use, relative over-consumption when compared to other DISD campuses, actual cost per square foot and per occupant, and (possibly) discover billing errors that may result in a refund from utility suppliers
- Analysis of current rate schedules (Tariff) to determine how and when energy *should* be used to maximize productivity while minimizing energy cost.
- Analysis of current Maintenance programs with recommendations for improvements for specific categories of equipment (e.g., air cooled chillers, boilers, etc)
- A complete inventory of items at each campus (if data is available of legible) and a resulting analysis of energy consuming systems to determine equipment condition, age, reliability, maintenance expense, energy expense, life projection, estimated time and cost of replacement, safety and code compliance.
- Financial assessment of future repair/replacement costs with replacement priorities assigned and replacement year estimated for future budgeting purposes.
- Additional tasks as desired by the facility owner

Although intensive and expensive, these Energy System Master Plans can be extremely helpful to Maintenance and Financial Departments in planning for future work and expenses. They are also valuable tools to be distributed to committees assigned to develop future Bond Program expenditures.

We recommend that DISD consider creation of an Energy System Master Plan for the entire district:

Estimated Cost: $1,300,000	Estimated Savings: $260,000	Estimated Payback: 5 Years

Note: Annual savings estimate based upon anticipated energy cost savings only and does not include savings available from reduced maintenance expenses or reduction of emergency repair projects.

INDIVIDUAL CAMPUS RECOMMENDATIONS:

Projects recommended in the seven (7) campuses included within the survey conducted for this SECO sponsored report.

GENERAL COMMENTS REGARDING INDIVIDUAL FACILITIES:

WHITE HS:

- The two existing control systems installed in this facility (Johnson Metasys and Honeywell) do not communicate well and therefore reduce the ability to achieve maximum energy efficiency.
- HVAC systems are turned on at 6AM even though most occupants do not arrive until 8AM or later.
- The boiler serving the Auditorium produces Steam for comfort heating. Due to the inefficiencies within steam generation systems, we recommend that this system be converted to Hot Water whenever significant repairs are needed in this comfort system.

- Lighting:
    - Corridors are generally overlit: Can remove 2 of 4 lamps in fixtures.
    - 30-100watt exterior lamps left on all day: Install timer with photocell.
    - 70-2Lamp 300 watt fixtures in Auditorium turned on at 6AM and off at 8PM: Replace with High Bay Dimmable T5 Fluorescent fixtures
    - 57-400watt Metal Halide lamps in Gyms: Replace with High Bay T5 Fluorescent fixtures

BURNET ES:

- Replace 15-400watt Gym lighting system with High Bay T5 Fluorescent fixtures.

ADMINISTRATION BUILDING:

- Current construction project removing old steam boilers, but replacing with steam units again. DISD should revise policy to eliminate steam boilers as soon as possible.
- CSI control system has been overridden and does not control any equipment at this time. Since everything is running manually, this building costs $3.85/sf to operate which is 70% more than typical DISD facilities. Since construction work is currently going on within this building, it is recommended that problems with this control system be rectified and the system be placed back into service.

SKYLINE HS:

- Building has two control systems installed (Johnson Metasys and CSI). Since these two systems communicate through different protocols, we suggest replacing all JCI

controls with CSI. We also recommend that controls be added to allow for varying of Supply Air Temperature from AHUs.

- This building needs a complete Test and Balance as soon as the current remodeling program is completed.
- Lighting: De-lamp corridor fixtures (approx 50%) and Cafeteria (approx 33%).

SUPPORT SERVICES:

- DDC control systems needs significant repair. Currently the building is being operated manually (in effect.) Chillers are manually turned on at 6AM and off at 10PM; chillers indirectly turn pumps on and off. The Multizone AHUs (MZAHUs) have no control valves in the chilled water lines allowing the water flow to run wild. The constant volume air distribution system requires reheat continuously.
- Lighting: Replace 66 incandescent lamps in Lobby and 8th floor with CFL lamps.
- *This building offers significant savings potential.*

SAMUEL HS:

- Like Skyline HS, this building needs a complete Test and Balance revision.
- Lighting: Replace all corridor T12 lamps in existing 4-lamp fixtures with 2 T8 lamps.

RENOVATION OF HVAC SYSTEMS

It was noted during the survey that several pieces of equipment have reached the end of their useful life expectancy. We recommend this equipment be included in subsequent maintenance budgets to be replaced as planned equipment upgrades in order to avoid the higher cost of emergency replacement when they inevitably fail.

There are also several items of equipment that need to be installed on existing systems to make them operate more efficiently.

HVAC ECRM 1A: CHILLERS

The Carrier 19XL5353 Centrifugal Chiller (approximately 400 tons) serving White High School is in poor operating condition and should be replaced.

Estimated Cost: $440,000	*Estimated Savings: $31,000*	*Estimated Payback: 14 Years*

HVAC ECRM 1B: BOILERS

Three (3) campuses surveyed had boilers that need to be replaced:

- Burnet ES - 2-Pacific Boilers *[Nameplate data illegible]*
- Samuel HS - 1-Pacific Boiler used for Domestic Hot Water
- Greiner MS - 1-Cleaver Brooks Boiler @ 4184 Mbh input

Estimated Cost: $80,000	*Estimated Savings: $11,500*	*Estimated Payback: 7 Years*

HVAC ECRM 1C: VARIABLE FREQUENCY DRIVES

All seven (7) facilities surveyed should be provided Variable Frequency Drives (VFDs) to reduce energy consumption of the water distribution system the air distribution system, or both:

- White HS — Two 40-hp Chilled Water Pumps
- Burnet ES — One 40-hp Chilled Water Pump
One 15-hp Condenser Water Pump
- Admin. Bldg. — Two 20-hp Outside Air Fans
Two 15-hp Chilled Water Pumps
- Skyline HS — Three 100-hp Chilled Water Supply Pumps
Three 25-hp Condenser Water Pumps
Three 30-hp Hot Water Supply Pumps
Three 7½-hp Hot Water Return Pumps
Twenty four 10-hp Singlezone AHUs (SZAHUs)
- Support Services — One 10-hp Outside Air AHU serving all floors
One 7½-hp Exhaust/Relief fan
Two 15-hp Chilled Water Supply Pumps
Two 15-hp Cooling Tower fans
- Samuel HS — One 50-hp Chilled Water Supply Pump
One 15-hp SZAHU serving Cafeteria
Ten 7½ to 10-hp SZAHUs serving above ceiling Fan Powered Boxes
- Greiner MS — Seven 15-hp (estimated, nameplate unreadable) SZAHU

Note:

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 terminal unit on the supply side of the loop so that a satisfied condition in the end of the loop will not

shut water off from the return side of the loop. However, when three-way valves are included at intermediate space units, they serve as a bypass and the pressure reading in the supply piping does not accurately reflect that the spaces may have reached setpoint and are throttling back on load. Therefore the VFD cannot determine the load is satisfied and throttle back for pump and fan energy savings. *We recommend the district replace the three-way valves incorporated in the middle of the supply loops to two-way valves.*

Since determining the quantity of these valves is beyond the scope of this program, the following cost estimate *does not include control valve replacement*.

Estimated Cost: $890,000	*Estimated Savings: $175,000*	*Estimated Payback: 5 Years*

7.0 MAINTENANCE AND OPERATION RECOMMENDATIONS

HVAC

- Comb fins on damaged condensing units
- Install hail guards to protect fins in future
- Keep electric boilers and water heaters off during peak electrical load conditions
- Verify electric heat stages at low load conditions
- Increase frequency of filter replacement
- Add make-up air to all kitchen vent hoods
- Make sure all windows closed when HVAC system is on (eg, White HS Gym)

Lighting

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

Controls

- Eliminate pneumatic controls as soon as possible
- Add occupancy sensors to control of areas with separate systems not a part of the Central Plant (eg, Burnet ES Gym Rooftop Units)
- Add timers to keep Kilns off during peak load hours.

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

At DISD, there are several HVAC M&O opportunities that revolve around combing the condenser fins [combs available for less than $10]. The installation of coil guards prevents future fin combing, which is ultimately a combination of deferred labor savings for 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.

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

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 example is a sensor which has been blocked by a bulletin board posting. 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.

Demand charges can have significant financial penalties for periods much longer than just the month the peak demand is unfortunately high. As can be seen in the Rate Schedule Analysis (Section 4.0), an unfortunate high demand month can trigger a higher ratcheted demand, or if the unfortunate month is June through September, will also affect the 4CP demand calculation. The ratcheted demand can affect the utility bill for up to 11 months; the 4CP will be used as an average of last year's June through September bills for the full subsequent calendar year.

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. $25,000 maintenance expense next 5 years				
4. $50,000 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	($6,221,000)		0	($6,221,000)
Year 1		$ 1,386,775.00	0	$1,386,775
Year 2		$ 1,386,775.00	0	$1,386,775
Year 3		$ 1,386,775.00	0	$1,386,775
Year 4		$ 1,386,775.00	0	$1,386,775
Year 5		$ 1,386,775.00	0	$1,386,775
Year 6		$ 1,317,436.25	($25,000)	$1,292,436
Year 7		$ 1,248,097.50	($25,000)	$1,223,098
Year 8		$ 1,178,758.75	($25,000)	$1,153,759
Year 9		$ 1,109,420.00	($25,000)	$1,084,420
Year 10		$ 1,040,081.25	($25,000)	$1,015,081
Year 11		$ 970,742.50	($50,000)	$920,743
Year 12		$ 901,403.75	($50,000)	$851,404
Year 13		$ 832,065.00	($50,000)	$782,065
Year 14		$ 762,726.25	($50,000)	$712,726
Year 15		$ 693,387.50	($50,000)	$643,388
			Internal Rate of Return	**18.83%**

More information regarding financial programs available to DISD 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 & PROCUREMENT OPTIONS FOR CAPITAL EXPENSE 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

6.1.1.1.3 Secondary Service Greater Than 10 kW

AVAILABILITY

This schedule is applicable to Delivery Service at secondary voltage with demand greater than 10 kW 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, unless Retail Customer is eligible for and chooses a competitive meter provider. Any meter other than the standard meter provided by Company will be provided at an additional charge. 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 of this Tariff.

MONTHLY RATE

I. Transmission and Distribution Charges:

Customer Charge	$3.50	per Retail Customer
Metering Charge	$18.41	per Retail Customer
Transmission System Charge		
Non-IDR Metered	$1.48	per NCP kW
IDR Metered	$1.99	per 4CP kW
Distribution System Charge	$3.97	per Distribution System billing kW

II. System Benefit Fund:	$0.000655	per kWh, See Rider SBF
III. Transition Charge:	See Riders TC1 and TC2	per Distribution System billing kW
IV. Nuclear Decommissioning Charge:	$0.044	per Distribution System billing kW, See Rider NDC
V. Transmission Cost Recovery Factor:	See Rider TCRF	
VI. Energy Efficiency Cost Recovery Factor:	See Rider EECRF	
VII. Competitive Meter Credit:	See Rider CMC	
VIII. Advanced Metering Cost Recovery Factor:	See Rider AMCRF	
Other Charges or Credits		
IX. Rate Case Expense Surcharge:	See Rider RCE	per Distribution System billing kW

COMPANY SPECIFIC APPLICATIONS

At Company's option, locations where the electrical installation has multiple connections to Company's conductors, due to Company facilities limitations or design criteria, may be considered one Point of Delivery for billing purposes.

DETERMINATION OF BILLING DEMAND FOR TRANSMISSION SYSTEM CHARGES

DETERMINATION OF NCP kW

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

DETERMINATION OF 4 CP kW

The 4 CP kW 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 kW will be billed at the applicable NCP rate under the "Transmission System Charge" using the Retail Customer's NCP kW.

DETERMINATION OF BILLING DEMAND FOR DISTRIBUTION SYSTEM CHARGES

DETERMINATION OF BILLING kW

For loads whose maximum NCP kW established in the 11 months preceding the current billing month is less than or equal to 20 kW, the Billing kW applicable to the Distribution System Charge shall be the NCP kW for the current billing month.

For all other loads, the Billing kW applicable to the Distribution System Charge shall be the higher of the NCP kW for the current billing month or 80% of the highest monthly NCP kW established in the 11 months preceding the current billing month (80% ratchet).

The 80% ratchet shall not apply to Retail Seasonal Agricultural Customers.

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 _____, 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: Michael P. Brown
Date: 1. MARCH. 2011
Name (Mr./Ms./Dr.) MR. MICHAEL P. BROWN
Title: EXEC. DIRECTOR OF FACILITY SERVICES
Organization: DALLAS INDEPENDENT SCHOOL DISTRICT
Phone: 972.925.5085
Street Address: 3701 S. Lamar, DALLAS, TX 75215
Fax:
Mailing Address: 3701 S. Lamar, DALLAS, TX 75215
E-Mail: mbrown@dallasisd.org
County: DALLAS

Contact Information:

Name (Mr./Ms./Dr.): Ms. Robin LaSalle Rose
Title: ENERGY MANAGER
Phone: 972. 925. 4524
Fax: 972.925. 003
E-Mail: rlasallerose@dallasisd.org
County: DALLAS

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.**

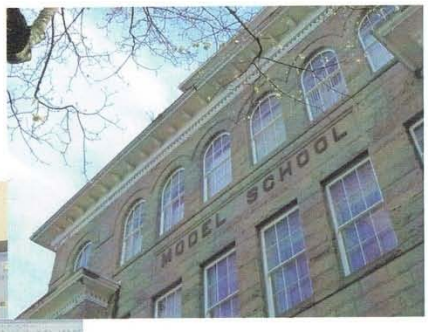
APPENDIX V - TEXAS ENERGY MANAGERS ASSOCIATION (TEMA)

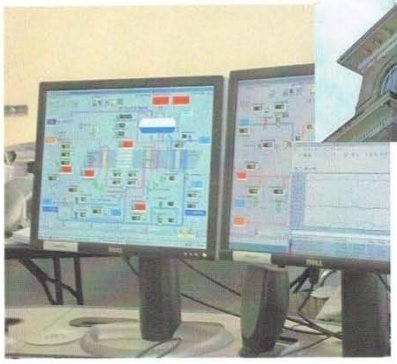
ANNOUNCING!

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