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Texas Comptroller of Public Accounts

Facility Preliminary Energy Assessments and Recommendations

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Channelview Independent School District

May 17, 2010

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F-4882

SECO
State Energy Conservation Office

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1.0 EXECUTIVE SUMMARY:

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

State Energy Conservation Office

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

In February 2010, **SECO** received a request for technical assistance from Kris Lynn, Assistant Superintendent for Finance for Channelview 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 **Channelview ISD,** (hereafter known as CISD) 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 *Mr. Lynn*, 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 6.0 of this report.

We estimate that as much as **$35,683** may be saved annually if all recommended projects are implemented. The estimated installed cost of these projects should total approximately **$129,600**, yielding an average simple payback of **4** years.

SUMMARY:	IMPLEMENTATION COST	ESTIMATED SAVINGS	SIMPLE PAYBACK
HVAC ECRM #1	$30,750	$2,560	12 Years
HVAC ECRM #2	$ 5,250	$650	8 Years
Lighting ECRM #1	$ 70,400	$ 11,733	6 Years
Lighting ECRM #2	$ 19,200	$ 3,840	5 Years
Controls ECRM #1	$ 3,000	$ 4,500	9 months
Controls ECRM #2	$ 1,000	$ 12,400	1 month
TOTAL PROJECTS	**$ 129,600**	**$ 35,683**	**4 Years**

Although additional savings from reduced maintenance expenses are anticipated, these savings projections are not included in the estimates provided above. As a result, the actual Internal Rate of Return (IRR), for this retrofit program has been calculated and shown in Section 7.0 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 CISD. We hope to be ongoing partners in assisting you to implement the recommendations listed in this report. Please call us if you have further questions or comments regarding your Energy Management Issues.

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

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 CISD, 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:

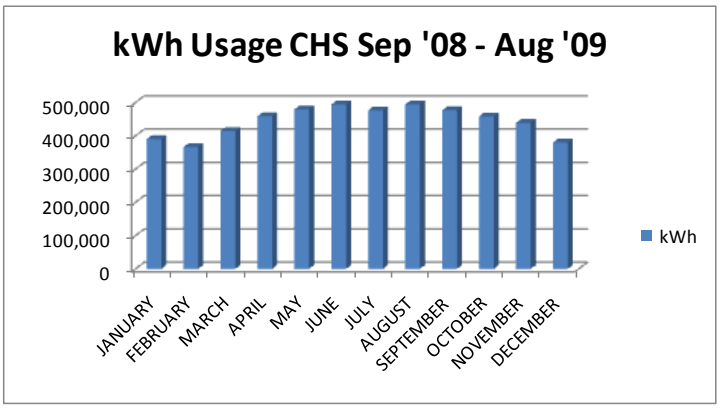
ECI = [Electricity Cost + Gas Cost] divided by [Total square feet]

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 CISD 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
Kolarik	83,480	15%	$2.59	27%
Crenshaw	82,300	14%	$2.07	1%
Channelview HS	76,609	6%	$2.03	-1%
McMullan	66,082	-9%	$1.91	-7%
AJJH	53,290	-26%	$1.63	-20%
Average Value:	72,352		$2.05	

Charting the annual electricity consumption reveals that schools in the district do not experience a significant decrease in consumption for June and July as would be expected for periods of vacationing students (see representative chart for Channelview HS at right). While it is acknowledged that summer months do represent custodial and administrative occupancy periods, and in the Greater Houston area schools must dehumidify the buildings to prevent moisture buildup, the lack of a decrease in consumption for these months may indicate an opportunity for improved coordination of dehumidification processes, as well as improved zoning of June and July Administrative and Custodial activities in order to reduce consumption during these time periods.



Channelview ISD purchases electricity from the General Land Office's Energy for Schools Program. The transmission and distribution utility is Centerpoint Energy. The rate schedule analysis for the district is shown below. A copy of the rate schedule is included in Appendix II.

The EUIs and ECIs noted are notably higher as compared to other school districts in the Greater Houston area. A company that has been hired by Centerpoint Energy to implement the SCORE Program has determined that the average EUI and ECI for Texas school facilities in similar climate regions as Greater Houston is 52,800 BTU/sf-yr and $1.51/sf respectively. Having both consumption and cost indices significantly higher than the regional averages suggests that equipment at Channelview ISD may be running for more hours than equipment at other districts.

OWNER: Channelview ISD **BUILDING:** Channelview 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	389,689	-	-	$ 7,957	$ 42,344	1240	$ 12,612
FEBRUARY	2010	366,070	-	-	$ 7,666	$ 39,968	1004	$ 11,216
MARCH	2010	414,402	-	-	$ 7,784	$ 44,351	781	$ 8,279
APRIL	2009	458,704	-	-	$ 8,075	$ 48,552	545	$ 6,797
MAY	2009	479,595	-	-	$ 9,207	$ 51,526	212	$ 2,863
JUNE	2009	494,151	-	-	$ 8,950	$ 52,554	52	$ 951
JULY	2009	476,186	-	-	$ 9,089	$ 51,109	23	$ 595
AUGUST	2009	494,179	-	-	$ 8,782	$ 52,389	24	$ 564
SEPTEMBER	2009	476,539	-	-	$ 8,966	$ 51,016	52	$ 848
OCTOBER	2009	457,759	-	-	$ 8,520	$ 48,912	111	$ 1,446
NOVEMBER	2009	438,714	-	-	$ 7,974	$ 46,685	239	$ 2,722
DECEMBER	2009	379,447	-	-	$ 7,942	$ 41,425	1282	$ 13,023
TOTAL		**5,325,435**			**$ 100,912**	**$ 570,831**	**5,565**	**$ 61,916**

Annual Total Energy Cost = $632,747 Per Year

Total KWH x 0.003413 = 18,175.71 x 106
Total MCF x 1.03 = 5,731.95 x 106
Total Other x ____ x 106
Total Site BTU's/yr 23,907.66 x 106

Floor area: 312,072 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 76,609 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $2.03 $/s.f. yr

OWNER: Channelview ISD **BUILDING:** Kolarik

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	292,524	-	-	$ 5,694	$ 31,506	26	$ 301
FEBRUARY	2010	294,496	-	-	$ 5,664	$ 31,650	41	$ 501
MARCH	2009	291,773	-	-	$ 5,279	$ 31,025	40	$ 534
APRIL	2009	286,988	-	-	$ 5,475	$ 30,799	46	$ 607
MAY	2009	321,016	-	-	$ 6,263	$ 34,589	40	$ 534
JUNE	2009	269,481	-	-	$ 5,779	$ 29,558	37	$ 493
JULY	2009	258,210	-	-	$ 5,625	$ 28,410	33	$ 653
AUGUST	2009	293,786	-	-	$ 5,926	$ 31,850	24	$ 280
SEPTEMBER	2009	313,293	-	-	$ 6,361	$ 34,006	18	$ 213
OCTOBER	2009	315,163	-	-	$ 6,416	$ 34,226	18	$ 213
NOVEMBER	2009	239,189	-	-	$ 5,166	$ 26,272	58	$ 649
DECEMBER	2009	267,795	-	-	$ 5,292	$ 28,923	41	$ 466
TOTAL		**3,443,714**			**$ 68,940**	**$ 372,814**	**422**	**$ 5,444**

Annual Total Energy Cost = $378,258 Per Year

Total KWH x 0.003413 = 11,753.40 x 106
Total MCF x 1.03 = 434.66 x 106
Total Other x ____ x 106
Total Site BTU's/yr 12,188.06 x 106

Floor area: 146,000 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 83,480 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $2.59 $/s.f. yr

OWNER: Channelview ISD **BUILDING:** AJJH

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	186,390	-	-	$ 5,361	$ 21,809	354	$ 3,554
FEBRUARY	2010	175,897	-	-	$ 5,247	$ 20,768	83	$ 901
MARCH	2010	216,163	-	-	$ 4,964	$ 24,038	133	$ 1,377
APRIL	2009	227,970	-	-	$ 5,428	$ 25,544	147	$ 1,792
MAY	2009	260,976	-	-	$ 5,906	$ 28,935	23	$ 284
JUNE	2009	251,798	-	-	$ 6,239	$ 28,457	23	$ 284
JULY	2009	255,330	-	-	$ 6,317	$ 28,848	24	$ 309
AUGUST	2009	249,351	-	-	$ 5,901	$ 27,904	20	$ 224
SEPTEMBER	2009	237,455	-	-	$ 5,974	$ 26,927	49	$ 518
OCTOBER	2009	236,858	-	-	$ 5,662	$ 26,562	27	$ 289
NOVEMBER	2009	199,403	-	-	$ 5,265	$ 22,860	85	$ 878
DECEMBER	2009	175,084	-	-	$ 5,213	$ 20,662	187	$ 1,908
TOTAL		**2,672,675**			**$ 67,477**	**$ 303,314**	**1,155**	**$ 12,318**

Annual Total Energy Cost = $315,632 Per Year

Total KWH x 0.003413 = 9,121.84 x 106
Total MCF x 1.03 = 1,189.65 x 106
Total Other x ____ x 106
Total Site BTU's/yr 10,311.49 x 106

Floor area: 193,496 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 53,290 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $1.63 $/s.f. yr

OWNER: Channelview ISD **BUILDING:** Crenshaw

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	85,606	-	-	$ 2,716	$ 10,269	558	$ 5,582
FEBRUARY	2010	80,935	-	-	$ 2,633	$ 9,774	474	$ 5,185
MARCH	2010	92,817	-	-	$ 2,387	$ 10,576	474	$ 5,002
APRIL	2009	94,639	-	-	$ 2,381	$ 10,733	446	$ 5,403
MAY	2009	97,966	-	-	$ 2,412	$ 11,057	21	$ 268
JUNE	2009	101,293	-	-	$ 2,443	$ 11,381	15	$ 204
JULY	2009	90,748	-	-	$ 2,620	$ 10,627	9	$ 128
AUGUST	2009	95,244	-	-	$ 2,636	$ 11,040	8	$ 100
SEPTEMBER	2009	120,902	-	-	$ 2,763	$ 13,432	9	$ 107
OCTOBER	2009	102,671	-	-	$ 2,679	$ 11,739	26	$ 287
NOVEMBER	2009	90,880	-	-	$ 2,616	$ 10,635	23	$ 255
DECEMBER	2009	83,962	-	-	$ 2,636	$ 10,045	160	$ 1,642
TOTAL		**1,137,663**			**$ 30,922**	**$ 131,308**	**2,223**	**$ 24,163**

Annual Total Energy Cost = $155,471 Per Year

Total KWH x 0.003413 = 3,882.84 x 106
Total MCF x 1.03 = 2,289.69 x 106
Total Other x ____ x 106
Total Site BTU's/yr 6,172.53 x 106

Floor area: 75,000 s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 82,300 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $2.07 $/s.f. yr

OWNER: **Channelview ISD** **BUILDING:** **McMullan**

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	67,231	-	-	$ 1,706	$ 7,638	157	$ 1,609
FEBRUARY	2010	82,505	-	-	$ 1,767	$ 9,048	121	$ 1,354
MARCH	2010	82,503	-	-	$ 1,567	$ 8,847	142	$ 1,464
APRIL	2009	84,076	-	-	$ 1,942	$ 9,360	29	$ 363
MAY	2009	105,155	-	-	$ 2,131	$ 11,410	6	$ 91
JUNE	2009	110,024	-	-	$ 2,149	$ 11,858	5	$ 75
JULY	2009	84,623	-	-	$ 1,538	$ 9,005	1	$ 34
AUGUST	2009	92,796	-	-	$ 1,588	$ 9,777	2	$ 35
SEPTEMBER	2009	110,358	-	-	$ 1,665	$ 11,402	4	$ 58
OCTOBER	2009	106,485	-	-	$ 2,159	$ 11,555	5	$ 65
NOVEMBER	2009	100,621	-	-	$ 2,127	$ 11,006	8	$ 97
DECEMBER	2009	83,409	-	-	$ 1,846	$ 9,206	77	$ 798
TOTAL		**1,109,786**			**$ 22,185**	**$ 120,112**	**557**	**$ 6,043**

Annual Total Energy Cost =	$126,155	Per Year
Total KWH x 0.003413 =	3,787.70	x 106
Total MCF x 1.03 =	573.71	x 106
Total Other x ____		x 106
Total Site BTU's/yr	4,361.41	x 106
Floor area:	66,000	s.f.

Energy Use Index:
Total Site BTU's/yr / Total Area (sq.ft.) = 66,082 BTU/s.f.yr

Energy Cost Index:
Total Energy Cost/yr / Total Area (sq.ft.) = $1.91 $/s.f. yr

4.0 RATE SCHEDULE ANALYSIS:

ELECTRICITY PROVIDER:

RETAIL ELECTRIC PROVIDER: TXU Energy

Contract price: $0.08824 per kWh

TRANSMISSION AND DISTRIBUTION UTILITY: Centerpoint Energy

Electric Rate: Secondary Service > 10 kVA

I.	TRANSMISSION AND DISTRIBUTION CHARGES:		
	Customer Charge	=	$5.27 per meter
	Metering Charge	=	$116.89 per IDR meter
	Transmission System Charge	=	$1.4709 per 4CP kW
	Distribution System Charge	=	$3.118137 per Billing kVA
II.	SYSTEM BENEFIT FUND	=	$0.000657 per kVA
III.	TRANSITION CHARGES		
	Transition Charge 1	=	$0.621/kW
	Transition Charge 2	=	$1.181063/kW
	Transition Charge 3	=	$0.148887/kW
IV.	NUCLEAR DECOMMISSIONING CHARGE	=	$0.008909 per Billing kVA
V.	TRANSMISSION COST RECOVERY FACTOR	=	$0.420902/NCP kVA
VI.	COMPETITIVE METERING CREDIT	=	- $15.69/month
VII.	RIDER UCOS Retail Credit	=	-$ 0.016314 per 4CP
VIII.	ADVANCED METERING SYSTEM SURCHARGE	=	$ 3.16/month
IX.	Accumulated Deferred Federal Income Tax Credit	=	$ 0.061131 / kVA
X.	GROSS RECEIPTS TAX	=	As per incorporation rules.

Average Savings for consumption = $0.08824/kWh + $0.000657/kWh = **$0.088897/kWh**
Average Savings for demand = $1.4709 + $3.118137 + $0.621 + $1.181063 + $0.148887 + $0.008909 + $0.420902 - $0.016314 + $0.061131 **= $7.01/kVA****

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

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

5.0 CAMPUS DESCRIPTIONS:

Channelview ISD consists of ten educational campuses which are located in and around Channelview, Texas. The energy survey focused on five of the educational campuses:

- Channelview High School
- Kolarik Ninth Grade Center
- Alice Johnson Junior High School
- Crenshaw Elementary School
- McMullan Elementary School

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.

The community recently passed $111 million dollars in bonds for new and renovation construction projects that will ultimately affect every school in the district. The most significant project is a 33 million dollar Junior High School #2 which will relieve pressure on the existing Alice Johnson Junior High.

Channelview High School:

Originally constructed in 1996, this 312,000 square foot campus serves grades 10-12 for Channelview ISD. The building has a brick exterior and predominantly low-sloping metal roof. Much of the building has two stories. There are large areas of fenestration which contribute ambient daylight into the space; much of the lighting, however, is not controlled to account for the natural light during daytime hours.

The building lighting system is a combination of T8 fluorescent, metal halide and compact fluorescent fixtures. Some of the fixtures are currently utilized throughout the day when the ambient light provided through skylights and transom windows is sufficient for the space. This is significantly evident in the main corridor (see Figure 1 to the right) where twenty-four (24) each 175 watt metal halides are used to illuminate the ceiling above the transom, along with 48 transom compact fluorescent can lights at the corridor perimeter. Altogether, these fixtures represent 4.8 kW of light fixtures that are not contributing significantly to the illumination levels in the space during the day. *We recommend that the district train staff to only use these fixtures during nighttime periods when their light contributions do become significant.* Eliminating the operation of the fixtures during the 12 hours that students occupy the building during the day represent approximately $3100 per year in energy savings for these corridor fixtures alone (assuming the

Figure 1: Corridor Daytime Lighting

fixtures do not operate during the day in the summer vacation period; savings will be higher if they operate year around).

Similar lighting savings may be available in other areas of the school. It was noted during the survey that the auditorium lighting was 100% turned on without any occupants. This lighting included all stage and house fixtures. It was reported that the drama department had just completed rehearsal and would return after a break, but the staff and students should be educated as to the impact that leaving all of the fixtures in this type of space on without occupants has on the utility budget for the facility.

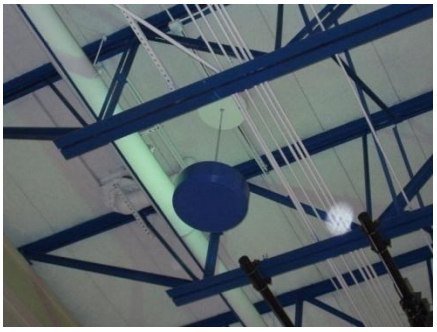


Figure 2: Gym "shielded" bleacher lighting

The competition gymnasium utilizes 28 each 400-watt metal halide fixtures over the court surface and ten (10) additional fixtures over the bleachers which are "shielded" to prevent heat and glare exposure to the spectators (see Figure #2 to the right). 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 coaches and staff to leave the lights on throughout the day, even if the space is not occupied. We recommend that the metal halide fixtures be replaced with new T5 high-bay linear fluorescent fixtures that can be turned off when the space is unoccupied. Additionally, the new fixtures can be designed with multiple ballasts that will allow the fixtures to operate with ½ the number of lamps for general physical education class periods and then fully activated for competitive sports activities.

Similarly, the small gym has an additional 20 each 8-lamp compact fluorescent fixtures. The staff reports that these fixtures have a high maintenance cost and material requirement and *we therefore recommend replacing these fixtures with the new 4-lamp T5 high bay fixtures as well.*

The cafeteria also utilizes metal halide fixtures (175 and 250 watt) in a layin acoustical ceiling. The light levels sampled between 70-75 footcandles, which is significantly higher than required for this type of space by the Illumination Engineering Society of North America (IESNA). Their recommendation for cafeteria spaces is 30-35 footcandles. *We recommend replacing the metal halides with 4-lamp T8 high-bay fixtures. We also recommend installing motion sensors to control one-half of the lamps in the space, as well as a programmable timer for the other lamps in the fixtures.* This will allow the district to maintain a minimum amount of light when students are passing through the space (for safety), and allow the light levels to be fully on during scheduled time periods. Photocell control could also be incorporated into the system to keep unnecessary fixtures by the large windows off during the day.

The HVAC system consists of an 1150 ton capacity central system complete with a 535,000 gallon thermal storage system (TSS). The system has three operating modes:

- Mode 1: 0500 hours to 1200 hours: Normal chiller/cooling tower operation
- Mode 2: 1200 hours to 2200 hours: Chillers off – chilled water from TSS
- Mode 3: 2200 hours to 0500 hours: Chillers make up water to TSS.

This scheduling is designed for the district to eliminate chiller operation during the most expensive demand part of the day for Centerpoint Energy, their Transmission and Distribution provider, and is typical for central system schedules developed for time of use rate schedules which were prevalent before electric deregulation began in 2001.

The district has recently completed inspections of the 1996 Trane Centravac chiller evaporators and condensers including Eddy Current tests and has determined they are in excellent condition. The district has plans to replace the existing boilers. The project will replace two each PVI 3.2 million BTUh input boilers for space heating and one 1,000,000 BTUh input boiler with a 600 gallon storage tank for the domestic hot water.

The HVAC system is under the control of the Johnson Controls energy management system. The staff reports that they are satisfied with the operation of the control system at this time.

Kolarik 9th Grade Center:

Located on the High School campus, this 2006-2007 building serves the ninth grade students only. This has been reportedly one of the highest energy consuming buildings in the district; the data from Section 3.0 supports this assertion as the ECI for this facility is $2.59/sf. The EUI, 83,480 BTUs/sf-yr is also one of the highest in the district. Taken together, high energy consumption and high energy costs for new and efficient equipment suggests that equipment may be operating more hours than average or necessary.

Students occupy the building from 0700 hours to 1415 hours, but the central plant is operated until 2300 hours for Administrative and Custodial staff activities. The Central Office has a redundant DX system which should allow for the central system to be turned off after students have left the building, but this is not currently done.

It was noted during the survey that the outside air fans (OAFs) were operating at minimum flow position (15 Hz on the VFD) at about 3:00 pm, well after students have left the building. It is not necessary for the outside air system to operate when students are not in the building and *we therefore recommend that the district program the outside air system to turn off at 1400 hours.* It was noted during the survey that the outside air dampers do not shut completely or seal well and

Figure 3: Kolarik OA dampers not seal well

we recommend the district make the required adjustments necessary to completely close the outside air dampers so that warm humid afternoon outside air is not brought into the spaces unnecessarily.

The HVAC system itself is a Variable Air Volume (VAV) system equipped with electric duct heaters in single-zone areas and terminal boxes with electric re-heat at multi-zone areas. The staff reports the electric duct heaters are undersized and therefore operate "longer than necessary" when heating is required for the comfort of the spaces. The chillers are three large air-cooled Trane RTAC-1704 chillers.

The gymnasium has 36 of the same 8-lamp compact fluorescent fixtures that the High School gymnasium operates. *We recommend replacing these with high-bay linear fluorescent fixtures recommended for the High School.*

Given the age of the equipment in the building, the high energy costs must be associated with the long scheduling hours controlling the equipment. *We recommend the district begin scheduling the central plant off at 1500 hours*, 45 minutes after the students have left the building, and allow the redundant DX system at the Administration office to maintain comfort in that area until 1630 or 1700 hours as necessary. The custodial staff will have to acclimate to working temperatures in between standard heating and cooling setpoints and to the nighttime setback temperatures which would be preferably 50 to 55°F for heating and 85 to 90°F for cooling.

Alice Johnson Junior High School:

This two-story facility has two "sections" as referred to by the maintenance department. Section I is served by packaged rooftop units; Section II has a combination of package units like Section I and a central system with air cooled chillers for an addition (New Gymnasium, Band Hall, and Music) that was constructed within the last few years. The 15 year old rooftop units in Section I and II were renovated in 2005 with new gas heat exchangers.

The old gymnasium has 64 each 400-watt metal halides. *We recommend replacing these fixtures with 24 each 4-lamp T5 high-bay linear fluorescent fixtures over the court perimeter / bleachers and 30 each 6-lamp T5 high-bay linear fluorescent fixtures over the court area.* The new gymnasium has 16 each 8-lamp compact fluorescent fixtures that we recommend be replaced with 6-lamp T5 HO high-bay fluorescent fixtures.

The Library has already replaced its light fixtures with new T5 fixtures.

Crenshaw Elementary School

Built in 1984, there is an addition scheduled as part of the bond money passed in 2009 for an addition to the facility. The staff states that the new construction will not require an expansion of the existing central plant.

The Office and Cafeteria/Kitchen area has redundant DX systems to allow for after-hour activities without requiring the operation of the central system. Recently, the Cafeteria condensing units (CUs) were vandalized by copper thieves and therefore the 10-ton and 20-ton units have been recently replaced. *The two 7-1/2 ton Carrier CUs at the Office (see Figure 4 to the right) area are older units that we recommend be replaced.* There is significant coil fin damage due to the lack of sufficient coil guards and the refrigerant line insulation is damaged or missing on the piping exterior to the building. Having damage to just 10% of the coil fins can result in a loss of operating efficiency of up to 30% as the unit is no longer able to effectively reject heat to the atmosphere. Missing insulation means that the refrigerant absorbs heat from the exterior ambient air and the capability for the refrigerant to absorb heat from the conditioned space is reduced. These conditions both occurring at these older units denotes units that are not operating with any significant degree of efficiency.

Figure 4: Crenshaw ES Admin Condensing Units

As part of the renovation project, the current unit ventilators will be replaced with new fan coil units and the hot/chilled water piping will be replaced. The existing pneumatic controls will be replaced with new DDC controls.

The existing PVI boiler has a small amount of missing hot water line insulation that should be replaced. The majority of the energy losses in a hot water system are through the hot water piping.

The hot water and chilled water loop pumps do not currently have Variable Frequency Drives (VFDs) limiting flow to match demand requirements in the system. It was unclear if these drives were to be added to the system as part of the bond projects or not. *We recommend the district consider installing these drives for the secondary loop pumps if they have not been considered for the bond.*

The lighting system is a combination of T12 and T8 lighting systems. As a general rule, the older areas of the campus have the T12 lighting and the new addition has the T8 system. The staff

believes that one component of the bond package reserved for Crenshaw ES will address the renovation of the T12 lighting to T8 components.

At the cafeteria, there are six (6) each incandescent can lights in front of the bank of windows that were appropriately off at the time of the survey. These lights should, however, be replaced with new compact fluorescent lamps for the times when they are appropriately used.

The 1984 gymnasium has twelve (12) 400-watt metal halide fixtures and two (2) emergency lighting incandescent fixtures that *we recommend be replaced with new T5 or T8 high-bay linear fluorescent fixtures.*

It was noted during the survey that the exterior canopy metal halide fixtures were operating during daytime hours. The staff reported that they are supposed to be under the control of a photocell. We recommend the district make the necessary repairs to the photocell in order to prevent unnecessary exterior fixture operation during daytime hours.

McMullan ES

Built in 1982, this school had a renovation of its central plant that coincided with improvements at the Junior High School in 2005. The remainder of the mechanical systems remains original to the building construction and the staff reports that this school is the most problematic for Maintenance attempting to maintain occupant comfort. Much of the mechanical system piping and valves are rusty making operation unpredictable. This equipment is under evaluation for replacement in the future bond money mechanical renovation projects.

This campus has Trane Tracer controls in the renovated sections (central plant and some of the terminal boxes); some pneumatic control still exists at the air handlers. Control system modifications have been made to provide air actuated control valves at the air handlers so despite the fact that pneumatic controls are in use, the units can at least be monitored by the control system.

Some of the mechanical rooms are notably dirty. Much of this condition can be attributed to the location of the corridor return air grills (refer to Figure 5 to the right). This particular grill is located immediately above floor level and is within 50' of two exterior doors. The return air intake for the air handler is located adjacent to the return air grill in the wall and therefore takes up all of the dirt not "stopped" at the return air grill. We recommend the district move the return air grill so that the return air is taken from the high levels of the corridor and the low level intake be enclosed and sealed.

Figure 5: McMullan Low Corridor Return Air

It was also noted that the filters at most air handlers were dirty. We recommend the district increase the frequency of filter replacement at the campus. The staff reported that the ductwork was cleaned within the last few years, but the condition of the mechanical rooms and air handler filters suggests that this duct cleaning may be required again soon to preserve good indoor air quality if the frequency of the filter replacement is not increased.

There is a combination of T12 and T8 lighting at this campus and, similar to Crenshaw, it is believed that future bond projects will renovate the T12 systems to T8.

General District Notes:

As noted in Section 3.0, both consumption and cost indices are significantly higher than regional averages for Channelview ISD. There is older and less efficient equipment in use at the district, but the projects contained in the $111 million bond package will replace much of that aged equipment. The control systems are planned to be consolidated into one predominant system which will improve the district's ability to monitor and control the HVAC systems. *We recommend that the district evaluate current operating schedules as the new systems are replaced and evaluate opportunities to limit HVAC system operation to closely match student occupancy schedules.* The district has included redundant DX systems at many campuses to allow spaces used after students have left the building to remain conditioned, but these systems appear to be seldom used because the central systems are operating up to 18 hours per day. By matching operating hours more closely to student occupancy hours, we estimate that the central system at Kolarik, for example, may be able to be scheduled off for an additional 6 hours per day than it is currently operating. Given that the equipment was installed in 2007 and remains in satisfactory and efficient condition, these operating hours must be the primary reason the ECI for this campus is $2.59.

When purchasing new packaged systems and split system condensing units, *we strongly recommend the district emphasize the requirement for quality coil guards in the project specifications.* Almost all of the exposed condensers evaluated in the survey had some damage to the coil fins; many of the existing units demonstrated moderate to heavy coil fin damage due to weather or student vandalism. As mentioned previously, damage to just 10% of the coil fins can lead to a loss of operating efficiency of up to 30%.

6.0 RECOMMENDATIONS

A. MAINTENANCE AND OPERATIONS PROCEDURES

HVAC	•Comb fins on damaged condensing units •Install hail guards to protect fins in future •Inspect and replace damaged or missing refrigerant line insulation
Lighting	•Turn off all light fixtures not required during daytime •Turn off lights in unoccupied spaces
Controls	•Ensure summer vacation schedules changed for control system in summer months

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 CISD, the HVAC M&O opportunities 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.

Lighting M&O

There are numerous light fixtures designed to enhance lighting ambience at night, yet they operate throughout the day as well.

Controls M&O

As evidenced in Section 3.0, many of the district's facilities do not reflect a decrease in consumption during the summer months. Updating the summer vacation hours and limiting central system operation to the minimum number of hours per day required for proper dehumidification and custodial activity should offer significant savings for applicable weeks in June, July and August.

B. CAPITAL EXPENSE PROJECTS

HVAC	•Replace Crenshaw ES Administration 7-1/2 ton S/Ss •Relocate return air grills at McMullan to improve cleanliness of mech room and AHU filters.
Lighting	•Renovate Gym metal halide/CFL fixtures with T5 or T8 high bay linear fluorescent fixtures •Replace CHS Cafeteria metal halides with T8 high bay linear fluorescents
Controls	•Program OA dampers closed for startup and dehumidification processes •Program HVAC system off when students gone

HVAC ECRM

ECRM #1: Replace two (2) 7-1/2 ton split systems at Crenshaw ES Building.

Estimated Installed Cost	=	$30,750
Estimated Energy Cost Savings	=	$ 2,560
Simple Payback Period	=	12 years*

*Extended payback due to reduced usage as redundant system for after hours operation to central system.

ECRM #2: Relocate return air grills at McMullan.

Estimated Installed Cost	=	$ 5,250
Estimated Energy Cost Savings	=	$ 650
Simple Payback Period	=	8 years

LIGHTING ECRMs

ECRM #1: Renovate existing metal halide and compact fluorescent gymnasium lighting with new T5 or T8 high-bay fluorescent fixtures.

At the five schools directly examined with the survey, there are approximately 176 gymnasium fixtures that we recommend be replaced with new T5 or T8 high bay linear fluorescent fixtures. Fixtures should have dual switching capability for adjusting light levels with current activity requirements.

Estimated Installed Cost	=	$ 70,400
Estimated Energy Cost Savings	=	$ 11,733
Simple Payback Period	=	6 years

ECRM #2: Renovate existing metal halide cafeteria lighting with new T5 or T8 high-bay fluorescent fixture at Channelview HS.

Estimated Installed Cost	=	$ 19,200
Estimated Energy Cost Savings	=	$ 3,840
Simple Payback Period	=	5 years

<u>CONTROL ECRMs</u>

ECRM #1: Renovate existing air handlers at Kolarik Elementary so that dehumidification and morning startup can be accomplished with outside air dampers fully close.

Estimated Installed Cost	=	$ 3,000
Estimated Energy Cost Savings	=	$ 4,500
Simple Payback Period	=	9 months

ECRM #2: Re-program control system to limit operation of HVAC system to correlate more closely with student occupancy. Example: Kolarik Ninth Grade Center

Estimated Installed Cost	=	$ 1,000
Estimated Energy Cost Savings	=	$ 12,400
Simple Payback Period	=	1 months

Note, this cost data represents the savings opportunities at Kolarik only; additional facility savings is likely available as operating hours at other facilities are adjusted to more closely match student occupancy hours, in the same manner as described herein for Kolarik.

SUMMARY TABLE:

If all of the recommended projects were completed at one time, the overall project finances would be as follows (excluding HVAC ECRM #1):

Estimated Installed Cost	=	$129,600
Estimated Energy Cost Savings	=	$ 35,683
Simple Payback Period	=	4 years

Should the district desire to implement these projects in stages and not all at once, we recommend the following implementation schedule:

1. Lighting ECRM #1 — Operating light fixtures in unoccupied spaces is one of the largest wastes of energy in a school district. This measure will result in instant energy savings and will reduce the ambient heat produced in the gymnasium space.

2. Controls ECRM #1 — Dehumidification and early morning equipment startup are necessary evils in areas with high humidity. Keeping exhaust fans off overnight and performing startup and dehumidification processes with outside air dampers fully closed will greatly improve the efficiency of the processes.

3. HVAC ECRM #1 — HVAC units that are 20 years old or older do not operate with any degree of efficiency, despite the fact that they may still run. Replacing this unit will greatly improve the efficiency of the unit and occupant comfort in that space.

7.0 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. $500 maintenance expense next 5 years				
4. $1000 maintenance expense next 5 years				
5. Savings decreases 2% per year after year 5				
Cash Flow	**Project Cost**	**Project Savings**	**Maintenance Expense**	**Net Cash Flow**
Time 0	($129,600.00)		0	($129,600)
Year 1		$ 35,683.00	0	$35,683
Year 2		$ 35,683.00	0	$35,683
Year 3		$ 35,683.00	0	$35,683
Year 4		$ 35,683.00	0	$35,683
Year 5		$ 35,683.00	0	$35,683
Year 6		$ 34,969.34	($500)	$34,469
Year 7		$ 34,255.68	($500)	$33,756
Year 8		$ 33,542.02	($500)	$33,042
Year 9		$ 32,828.36	($500)	$32,328
Year 10		$ 32,114.70	($500)	$31,615
Year 11		$ 31,401.04	($1,000)	$30,401
Year 12		$ 30,687.38	($1,000)	$29,687
Year 13		$ 29,973.72	($1,000)	$28,974
Year 14		$ 29,260.06	($1,000)	$28,260
Year 15		$ 28,546.40	($1,000)	$27,546
			Internal Rate of Return	**25.95%**

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

APPENDIX I: SUMMARY OF FUNDING AND PROCUREMENT OPTIONS

APPENDICES

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

SUMMARY OF FUNDING OPTIONS FOR CAPITAL EXPENDITURE PROJECTS

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

LoanSTAR Program:

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

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

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

Loans on Commercial Market:

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

Leasing Corporations:

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

Bond Issue:

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

SUMMARY OF PROCUREMENT OPTIONS FOR CAPITAL EXPENDITURE PROJECTS

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

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

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

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

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

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

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

MONTHLY RATE

I. Transmission and Distribution Charges:

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

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

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

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

COMPANY SPECIFIC APPLICATIONS

DETERMINATION OF BILLING DEMAND FOR TRANSMISSION SYSTEM CHARGES

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

Determination of 4 CP kVA The 4 CP kVA applicable under the Monthly Rate section shall be the average of the Retail Customer's integrated 15 minute demands at the time of the monthly ERCOT system 15 minute peak demand for the months of June, July, August and September of the previous calendar year. The Retail Customer's average 4CP demand will be updated effective on January 1 of each calendar year and remain fixed throughout the calendar year. Retail Customers without previous

history on which to determine their 4 CP kVA will be billed at the applicable NCP rate under the "Transmission System Charge" using the Retail Customer's NCP kVA.

DETERMINATION OF BILLING DEMAND FOR DISTRIBUTION SYSTEM CHARGES

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

OTHER PROVISIONS

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

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

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

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

Municipal Account Franchise Credit. A credit equal to the amount of franchise fees included in the Transmission and Distribution Charges will be applied to municipal accounts receiving service within the incorporated limits of such municipality which imposes a municipal franchise fee upon the Company based on the kWh delivered within that municipality and who have signed an appropriate Franchise Agreement.

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

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

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

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

APPENDIX IV - PRELIMINARY ENERGY ASSESSMENT SERVICE AGREEMENT

SECO
State Energy Conservation Office

Local Governments and Municipalities

Preliminary Energy Assessment Service Agreement

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

Description of the Service

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

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

Principles of the Agreement

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

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

Acceptance of Agreement

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

no PEA on record

Signature: _____ Date: MARCH 8, 2010

Name (Mr./Ms./Dr.) Mr. Greg Ollis Title: Superintendent

Organization: Channelview ISD Phone: 281.452.8008

Street Address: 1403 Sheldon Road Fax: 281.457.9073

Mailing Address: 1403 Sheldon Road E-Mail: greg.ollis@channelview.isd.esc4.net

Channelview, TX 77530 County: Harris / ESA

Contact Information:

Name (Mr./Ms./Dr.): Mr. Kris Lynn Title: Assistant Superintendent of Finance

Phone: 281.452.8014 Fax: 281.452.8070

E-Mail: kris.lynn@channelview.isd.esc4.net County: Harris

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

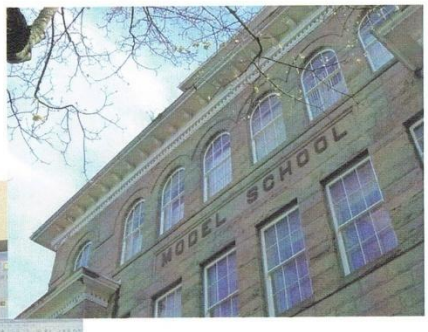
APPENDIX V - TEXAS ENERGY MANAGERS ASSOCIATION (TEMA)

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