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Texas Comptroller of Public Accounts

# Facility Preliminary Energy Assessments and Recommendations


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## Killeen Independent School District

December 23, 2010

ESA-Energy Systems Associates, Inc.
F-4882

SECO
State Energy Conservation Office

# Table of Contents


1.0 EXECUTIVE SUMMARY: ..... 3

Table 1: Summary of Recommended Energy Cost Reduction Measures (ECRMs) ..... 4

2.0 ENERGY ASSESSMENT PROCEDURE: ..... 5

3.0 ENERGY PERFORMANCE INDICATORS: ..... 6

4.0 RATE SCHEDULE ANALYSIS: ..... 13

ELECTRICITY PROVIDER: ..... 13

NATURAL GAS PROVIDER: ..... 14

5.0 CAMPUS DESCRIPTIONS: ..... 15

Table 2: School Facilities Analyzed For This Report ..... 15

6.0 ENERGY RECOMMENDATIONS: ..... 16

COMMENDATION ..... 16

HVAC ECRM 1: RENOVATION OF AGED HVAC EQUIPMENT ..... 16

CONTROLS ECRM 1: ASSIMILATE REMAINDER OF KLSS HVAC UNITS INTO ALERTON EMS ..... 17

CONTROLS ECRM 2: INSTALL VENDING MACHINE CONTROLS ..... 17

LIGHTING ECRM 1: OCCUPANCY SENSOR INSTALLATION ..... 18

SUMMARY: ALL ECRMs ..... 18

7.0 MAINTENANCE AND OPERATION RECOMMENDATIONS ..... 19

8.0 FINANCIAL EVALUATION ..... 22

9.0 GENERAL COMMENTS ..... 23

APPENDICES ..... 24

APPENDIX I - SUMMARY OF FUNDING AND PROCUREMENT OPTIONS FOR CAPITAL EXPENDITURE PROJECTS ..... 25

SUMMARY OF FUNDING OPTIONS FOR CAPITAL EXPENDITURE PROJECTS ..... 26

SUMMARY OF PROCUREMENT OPTIONS FOR CAPITAL EXPENDITURE PROJECTS ..... 27

APPENDIX II - ELECTRIC UTILITY RATE SCHEDULE ..... 32

APPENDIX IV - PRELIMINARY ENERGY ASSESSMENT SERVICE AGREEMENT ..... 35

APPENDIX V - TEXAS ENERGY MANAGERS ASSOCIATION (TEMA) ..... 37

APPENDIX VI - UTILITY CHARTS ON CD ..... 39

APPENDIX VII – RECOMMENDED PREVENTIVE MAINTENANCE PRACTICES ..... 40

## 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**.

SECO
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 Darren Cole, Energy Management Specialist for **Killeen 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 **Killeen ISD,** (hereafter known as KISD ) 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. Cole*, 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 **$3,300** may be saved annually if all recommended projects are implemented. The estimated installed cost of these projects should total approximately **$9,380**, yielding an average simple payback of **3** years.

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

| SUMMARY: | IMPLEMENTATION COST | ESTIMATED SAVINGS | SIMPLE PAYBACK |
|---|---|---|---|
| Controls ECRM #1 | $7,200 | $1,000 | 7-1/4 Years |
| Controls ECRM #2 | $180 | $140 | 1-1/4 Years |
| Lighting ECRM #1 | $2,000 | $2,160 | 1 Year |
| **TOTAL PROJECTS** | **$ 9,380** | **$3,300** | **3 Years** |

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

Our final "summary" comment is that **SECO** views the completion and presentation of this report as a beginning, rather than an end, of our relationship with KISD. 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 KISD, 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 KISD 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 |
|---|---|---|---|---|
| Audie MS | 44,846 | -5% | $1.34 | 12% |
| Harker Hts HS | 53,351 | 13% | $1.31 | 10% |
| Patterson MS | 75,147 | 60% | $1.26 | 6% |
| Eastern MS | 44,651 | -5% | $1.23 | 3% |
| Skipcha ES | 35,719 | -24% | $1.18 | -1% |
| Saegert ES | 34,840 | -26% | $1.17 | -2% |
| Killeen HS | 52,455 | 11% | $1.15 | -4% |
| Ellison HS | 38,851 | -17% | $1.05 | -12% |
| Shoemaker HS | 43,878 | -7% | $1.05 | -12% |
| Average Value: | 47,082 | | $1.19 | |
| KLSS | 133,511 | 184% | $4.31 | 261% |

Note: The KLSS building, also known as the district data center, operates much differently than the school facilities and the subsequent energy indices reflect the differences in operation and control. Therefore, these indices have been omitted from the average of the surveyed schools to avoid skewing the school data results.

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Killeen ISD purchases electricity from Reliant through the Energy for Schools Program. The Transmission and Distribution utility is Oncor. The energy history spreadsheets are shown on the next few pages.

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

A copy of the rate schedule is included in Appendix I

**OWNER:** KISD **BUILDING:** Audie 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 | 107,156 | | | | 12,239 | 199 | $1,619 |
| FEBRUARY | 2010 | 98,271 | | | | 11,206 | 39 | $317 |
| MARCH | 2010 | 93,227 | | | | 10,696 | 39 | $316 |
| APRIL | 2010 | 102,741 | | | | 11,961 | 39 | $316 |
| MAY | 2010 | 127,406 | | | | 14,691 | 40 | $331 |
| JUNE | 2010 | 135,313 | | | | 15,563 | (15) | ($1,230) |
| JULY | 2010 | 111,288 | | | | 12,849 | 4 | $34 |
| AUGUST | 2010 | 130,804 | | | | 14,630 | 12 | $83 |
| SEPTEMBER | 2009 | 137,092 | | | | 15,491 | 12 | $83 |
| OCTOBER | 2009 | 120,836 | | | | 13,752 | 48 | $336 |
| NOVEMBER | 2009 | 105,716 | | | | 11,864 | 72 | $509 |
| DECEMBER | 2009 | 98,219 | | | | 11,270 | 190 | $1,541 |
| **TOTAL** | | **1,368,069** | **0** | **0** | **0** | **$156,212** | **679** | **$4,255** |

| | | | | | |
|---|---|---|---|---|---|
| Annual Total Energy Cost = | $160,467 | Per Year | **Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.) | 44,846 | BTU/s.f.yr |
| Total KWH x 0.003413 = | 4,669.22 | x 106 | | | |
| Total MCF x 1.03 = | 699.37 | x 106 | **Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.) | $1.34 | $/s.f. yr |
| Total Other x ____ | | x 106 | | | |
| Total Site BTU's/yr | 5,368.59 | x 106 | | | |
| Floor area: | 119,712 | s.f. | | | |

**OWNER:** KISD **BUILDING:** Harker Heights 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 | 226,994 | | | | 25,592 | 1,158 | $7,811 |
| FEBRUARY | 2010 | 222,288 | | | | 25,055 | 552 | $3,428 |
| MARCH | 2010 | 203,056 | | | | 23,371 | 598 | $3,677 |
| APRIL | 2010 | 257,693 | | | | 29,374 | 69 | $442 |
| MAY | 2010 | 347,302 | | | | 39,055 | 38 | $254 |
| JUNE | 2010 | 308,990 | | | | 35,133 | 28 | $243 |
| JULY | 2010 | 329,173 | | | | 37,408 | 24 | $222 |
| AUGUST | 2010 | 401,422 | | | | 44,256 | 48 | $381 |
| SEPTEMBER | 2009 | 302,363 | | | | 33,643 | 74 | $566 |
| OCTOBER | 2009 | 241,517 | | | | 27,077 | 109 | $944 |
| NOVEMBER | 2009 | 238,122 | | | | 26,381 | 883 | $6,502 |
| DECEMBER | 2009 | 236,736 | | | | 26,637 | 1,592 | $11,263 |
| **TOTAL** | | **3,315,656** | **0** | **0** | **0** | **$372,982** | **5,173** | **$35,733** |

| | | | | | |
|---|---|---|---|---|---|
| Annual Total Energy Cost = | $408,715 | Per Year | **Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.) | 53,351 | BTU/s.f.yr |
| Total KWH x 0.003413 = | 11,316.33 | x 106 | | | |
| Total MCF x 1.03 = | 5,328.19 | x 106 | **Energy Cost Index:** Total Energy Cost/yr / Total Area (sq.ft.) | $1.31 | $/s.f. yr |
| Total Other x ____ | | x 106 | | | |
| Total Site BTU's/yr | 16,644.52 | x 106 | | | |
| Floor area: | 311,983 | s.f. | | | |

**OWNER:** KISD **BUILDING:** Patterson MS

| MONTH / YEAR | | ELECTRIC | | | | | NAT'L GAS / FUEL | |
|---|---|---|---|---|---|---|---|---|
| | | | DEMAND | | | | | |
| | | CONSUMPTION | METERED | CHARGED | COST OF | TOTAL ALL ELECTRICAL | CONSUMPTION | COSTS |
| MONTH | YEAR | KWH | KW/KVA | KW/KVA | DEMAND | COSTS $ | MCF | $ |
| JANUARY | 2010 | 98,800 | | | | 1,129 | 476 | $3,446 |
| FEBRUARY | 2010 | 872,000 | | | | 10,067 | 304 | $2,058 |
| MARCH | 2010 | 89,200 | | | | 10,268 | 0 | $0 |
| APRIL | 2010 | 109,600 | | | | 12,596 | 70 | $494 |
| MAY | 2010 | 134,000 | | | | 15,245 | 47 | $322 |
| JUNE | 2010 | 118,000 | | | | 13,540 | 78 | $518 |
| JULY | 2010 | 98,400 | | | | 11,436 | 45 | $343 |
| AUGUST | 2010 | 142,419 | | | | 15,529 | 1 | $22 |
| SEPTEMBER | 2009 | 128,800 | | | | 15,595 | 55 | $446 |
| OCTOBER | 2009 | 113,600 | | | | 12,708 | 97 | $901 |
| NOVEMBER | 2009 | 108,000 | | | | 12,045 | 477 | $3,832 |
| DECEMBER | 2009 | 94,000 | | | | 10,735 | 411 | $3,229 |
| **TOTAL** | | **2,106,819** | **0** | **0** | **0** | **$140,893** | **2,061** | **$15,611** |

| | | | | | |
|---|---|---|---|---|---|
| | | | **Energy Use Index:** | | |
| Annual Total Energy Cost = | $156,504 | Per Year | Total Site BTU's/yr / Total Area (sq.ft.) | 75,147 | BTU/s.f.yr |
| Total KWH x 0.003413 = | 7,190.57 | x 106 | | | |
| Total MCF x 1.03 = | 2,122.83 | x 106 | **Energy Cost Index:** | | |
| Total Other x ____ | | x 106 | Total Energy Cost/yr / Total Area (sq.ft.) | $1.26 | $/s.f. yr |
| Total Site BTU's/yr | 9,313.40 | x 106 | | | |
| Floor area: | 123,936 | s.f. | | | |

**OWNER:** KISD **BUILDING:** Eastern Hills 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 | 87,776 | | | | 9,925 | 242 | $1,639 |
| FEBRUARY | 2010 | 83,983 | | | | 9,632 | 174 | $1,084 |
| MARCH | 2010 | 88,731 | | | | 10,128 | 72 | $456 |
| APRIL | 2010 | 109,485 | | | | 12,428 | 27 | $176 |
| MAY | 2010 | 132,556 | | | | 14,913 | 15 | $104 |
| JUNE | 2010 | 92,529 | | | | 10,731 | 5 | $53 |
| JULY | 2010 | 116,424 | | | | 13,286 | 4 | $50 |
| AUGUST | 2010 | 148,491 | | | | 16,394 | 16 | $131 |
| SEPTEMBER | 2009 | 117,903 | | | | 13,119 | 21 | $169 |
| OCTOBER | 2009 | 98,663 | | | | 11,049 | 34 | $305 |
| NOVEMBER | 2009 | 92,358 | | | | 10,327 | 187 | $1,387 |
| DECEMBER | 2009 | 81,448 | | | | 9,187 | 318 | $2,267 |
| **TOTAL** | | **1,250,347** | **0** | **0** | **0** | **$141,119** | **1,115** | **$7,821** |

| | | | | | |
|---|---|---|---|---|---|
| | | | **Energy Use Index:** | | |
| Annual Total Energy Cost = | $148,940 | Per Year | Total Site BTU's/yr / Total Area (sq.ft.) | 44,651 | BTU/s.f.yr |
| Total KWH x 0.003413 = | 4,267.43 | x 106 | | | |
| Total MCF x 1.03 = | 1,148.45 | x 106 | **Energy Cost Index:** | | |
| Total Other x ____ | | x 106 | Total Energy Cost/yr / Total Area (sq.ft.) | $1.23 | $/s.f. yr |
| Total Site BTU's/yr | 5,415.88 | x 106 | | | |
| Floor area: | 121,295 | s.f. | | | |

**OWNER:** KISD **BUILDING:** Skipcha 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 | 127,095 | | | | 13,939 | 0 | $0 |
| FEBRUARY | 2010 | 103,358 | | | | 11,337 | 0 | $0 |
| MARCH | 2010 | 95,499 | | | | 10,476 | 0 | $0 |
| APRIL | 2010 | 99,954 | | | | 11,189 | 0 | $0 |
| MAY | 2010 | 106,485 | | | | 12,150 | 0 | $0 |
| JUNE | 2010 | 107,094 | | | | 12,868 | 0 | $0 |
| JULY | 2010 | 96,947 | | | | 11,752 | 0 | $0 |
| AUGUST | 2010 | 121,554 | | | | 13,467 | 0 | $0 |
| SEPTEMBER | 2009 | 92,643 | | | | 10,430 | 0 | $0 |
| OCTOBER | 2009 | 79,218 | | | | 8,943 | 0 | $0 |
| NOVEMBER | 2009 | 108,134 | | | | 11,824 | 0 | $0 |
| DECEMBER | 2009 | 132,707 | | | | 14,554 | 0 | $0 |
| **TOTAL** | | **1,270,688** | **0** | **0** | **0** | **$142,929** | **0** | **$0** |

| | | | | | |
|---|---|---|---|---|---|
| | | | **Energy Use Index:** | | |
| Annual Total Energy Cost = | $142,929 | Per Year | Total Site BTU's/yr / Total Area (sq.ft.) | 35,719 | BTU/s.f.yr |
| Total KWH x 0.003413 = | 4,336.86 | x 106 | | | |
| Total MCF x 1.03 = | 0.00 | x 106 | **Energy Cost Index:** | | |
| Total Other x ____ | | x 106 | Total Energy Cost/yr / Total Area (sq.ft.) | $1.18 | $/s.f. yr |
| Total Site BTU's/yr | 4,336.86 | x 106 | | | |
| Floor area: | 121,416 | s.f. | | | |

**OWNER:** KISD **BUILDING:** Saegert 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 | 112,804 | | | | 12,950 | 0 | $0 |
| FEBRUARY | 2010 | 111,086 | | | | 12,744 | 0 | $0 |
| MARCH | 2010 | 93,389 | | | | 10,780 | 0 | $0 |
| APRIL | 2010 | 99,135 | | | | 11,447 | 0 | $0 |
| MAY | 2010 | 112,842 | | | | 12,856 | 0 | $0 |
| JUNE | 2010 | 89,839 | | | | 10,821 | 0 | $0 |
| JULY | 2010 | 95,135 | | | | 11,215 | 0 | $0 |
| AUGUST | 2010 | 115,677 | | | | 12,988 | 0 | $0 |
| SEPTEMBER | 2009 | 102,238 | | | | 11,566 | 0 | $0 |
| OCTOBER | 2009 | 88,851 | | | | 10,078 | 0 | $0 |
| NOVEMBER | 2009 | 92,993 | | | | 10,437 | 0 | $0 |
| DECEMBER | 2009 | 125,415 | | | | 14,394 | 0 | $0 |
| **TOTAL** | | **1,239,404** | **0** | **0** | **0** | **$142,276** | **0** | **$0** |

| | | | | | |
|---|---|---|---|---|---|
| | | | **Energy Use Index:** | | |
| Annual Total Energy Cost = | $142,276 | Per Year | Total Site BTU's/yr / Total Area (sq.ft.) | 34,840 | BTU/s.f.yr |
| Total KWH x 0.003413 = | 4,230.09 | x 106 | | | |
| Total MCF x 1.03 = | 0.00 | x 106 | **Energy Cost Index:** | | |
| Total Other x ____ | | x 106 | Total Energy Cost/yr / Total Area (sq.ft.) | $1.17 | $/s.f. yr |
| Total Site BTU's/yr | 4,230.09 | x 106 | | | |
| Floor area: | 121,416 | s.f. | | | |

**OWNER:** KISD **BUILDING:** Killeen 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 | 181,386 | | | | 20,759 | 1,605 | $11,583 |
| FEBRUARY | 2010 | 175,411 | | | | 20,090 | 1,383 | $9,255 |
| MARCH | 2010 | 159,687 | | | | 18,688 | 833 | $5,203 |
| APRIL | 2010 | 189,454 | | | | 21,870 | 166 | $1,093 |
| MAY | 2010 | 291,626 | | | | 32,969 | 92 | $619 |
| JUNE | 2010 | 278,740 | | | | 31,547 | 59 | $393 |
| JULY | 2010 | 313,540 | | | | 35,408 | 52 | $451 |
| AUGUST | 2010 | 327,822 | | | | 36,336 | 86 | $682 |
| SEPTEMBER | 2009 | 259,681 | | | | 29,019 | 915 | $885 |
| OCTOBER | 2009 | 192,469 | | | | 21,672 | 222 | $1,916 |
| NOVEMBER | 2009 | 178,996 | | | | 20,184 | 0 | $0 |
| DECEMBER | 2009 | 183,835 | | | | 20,963 | 1,044 | $7,785 |
| TOTAL | | 2,732,647 | 0 | 0 | 0 | $309,505 | 6,457 | $39,865 |

| | | | | |
|---|---|---|---|---|
| Annual Total Energy Cost = | $349,370 | Per Year | **Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.) | 52,455 BTU/s.f.yr |
| Total KWH x 0.003413 = | 9,326.52 | x 106 | | |
| Total MCF x 1.03 = | 6,650.71 | x 106 | **Energy Cost Index:** | |
| Total Other x ____ | | x 106 | Total Energy Cost/yr / Total Area (sq.ft.) | $1.15 $/s.f. yr |
| Total Site BTU's/yr | 15,977.23 | x 106 | | |
| Floor area: | 304,592 | s.f. | | |

**OWNER:** KISD **BUILDING:** Ellison 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 | 232,859 | | | | 26,267 | 747 | $5,007 |
| FEBRUARY | 2010 | 218,848 | | | | 24,935 | 470 | $2,936 |
| MARCH | 2010 | 204,401 | | | | 23,467 | 109 | $695 |
| APRIL | 2010 | 242,149 | | | | 27,504 | 35 | $227 |
| MAY | 2010 | 319,330 | | | | 35,791 | 17 | $114 |
| JUNE | 2010 | 276,875 | | | | 31,336 | 17 | $146 |
| JULY | 2010 | 269,510 | | | | 30,441 | 14 | $127 |
| AUGUST | 2010 | 366,597 | | | | 40,266 | 28 | $224 |
| SEPTEMBER | 2009 | 273,650 | | | | 30,328 | 44 | $337 |
| OCTOBER | 2009 | 229,695 | | | | 25,510 | 80 | $685 |
| NOVEMBER | 2009 | 220,849 | | | | 24,445 | 533 | $3,954 |
| DECEMBER | 2009 | 232,582 | | | | 26,136 | 889 | $6,399 |
| TOTAL | | 3,087,345 | 0 | 0 | 0 | $346,426 | 2,983 | $20,851 |

| | | | | |
|---|---|---|---|---|
| Annual Total Energy Cost = | $367,277 | Per Year | **Energy Use Index:** Total Site BTU's/yr / Total Area (sq.ft.) | 38,851 BTU/s.f.yr |
| Total KWH x 0.003413 = | 10,537.11 | x 106 | | |
| Total MCF x 1.03 = | 3,072.49 | x 106 | **Energy Cost Index:** | |
| Total Other x ____ | | x 106 | Total Energy Cost/yr / Total Area (sq.ft.) | $1.05 $/s.f. yr |
| Total Site BTU's/yr | 13,609.60 | x 106 | | |
| Floor area: | 350,306 | s.f. | | |

**OWNER:** KISD **BUILDING:** Shoemaker 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 | 217,783 | | | | 24,568 | 1,122 | $7,577 |
| FEBRUARY | 2010 | 185,249 | | | | 21,078 | 689 | $4,328 |
| MARCH | 2010 | 190,302 | | | | 21,890 | 306 | $1,926 |
| APRIL | 2010 | 248,284 | | | | 28,414 | 81 | $520 |
| MAY | 2010 | 287,981 | | | | 32,536 | 48 | $318 |
| JUNE | 2010 | 34,260 | | | | 3,859 | 29 | $259 |
| JULY | 2010 | 264,129 | | | | 30,299 | 28 | $259 |
| AUGUST | 2010 | 361,602 | | | | 40,074 | 65 | $515 |
| SEPTEMBER | 2009 | 264,034 | | | | 29,372 | 89 | $680 |
| OCTOBER | 2009 | 210,067 | | | | 23,459 | 132 | $1,139 |
| NOVEMBER | 2009 | 209,409 | | | | 23,082 | 814 | $5,050 |
| DECEMBER | 2009 | 208,393 | | | | 23,525 | 1,304 | $9,365 |
| **TOTAL** | | **2,681,493** | **0** | **0** | **0** | **$302,156** | **4,707** | **$31,936** |

| | | |
|---|---|---|
| Annual Total Energy Cost = | $334,092 | Per Year |
| Total KWH x 0.003413 = | 9,151.94 | x 106 |
| Total MCF x 1.03 = | 4,848.21 | x 106 |
| Total Other x ____ | | x 106 |
| Total Site BTU's/yr | 14,000.15 | x 106 |
| Floor area: | 319,068 | s.f. |

**Energy Use Index:**

Total Site BTU's/yr / Total Area (sq.ft.) = 43,878 BTU/s.f.yr

**Energy Cost Index:**

Total Energy Cost/yr / Total Area (sq.ft.) = $1.05 $/s.f. yr

## 4.0 RATE SCHEDULE ANALYSIS:

### ELECTRICITY PROVIDER:

**RETAIL ELECTRIC PROVIDER (REP): Reliant Energy for Schools [** $0.11 per kWh **]**

**TRANSMISSION AND DISTRIBUTION (T&D): Oncor**

**Electric Rate: Secondary Service > 10 kW**

| | | | |
|---|---|---|---|
| I. | TRANSMISSION AND DISTRIBUTION CHARGES: | | |
| | Customer Charge | = | $3.50 per meter |
| | Metering Charge | = | $18.41 per meter |
| | Transmission System Charge (Non-IDR Meter) | = | $1.99 per NCP kW |
| | Distribution System Charge | = | $3.97 per DS Billing kW |
| II. | SYSTEM BENEFIT FUND | = | $0.000655 per kWh |
| III. | TRANSITION CHARGES | | |
| | Transition Charge 1 | = | $0.188/kW |
| | Transition Charge 2 | = | $0.248/kW |
| IV. | NUCLEAR DECOMMISSIONING CHARGE | = | $0.044 per DS Billing kW |
| V. | TRANSMISSION COST RECOVERY FACTOR | = | $0.233457/NCP kW |
| VI. | ENERGY EFFICIENCY COST RECOVERY | = | $9.66/billing period |
| VII. | COMPETITIVE METERING CREDIT | = | $5.47 per month |
| VIII. | RATE CASE SURCHARGE | = | $0.007944/kW |
| IX. | ADVANCED METERING COST RECOVERY FACTOR | = | $3.98 per month |

Average Savings for consumption = $0.11/kWh + $0.000655/kWh = $0.110655/kWh

Average Savings for demand = $1.99 + $3.97 + $0.188 + $0.248 + $0.044 + $0.233457 + $0.007944

= $6.68/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. DS (Distribution System) Billing kW: Ratchet demand representing higher of two calculations: 80% of peak demand in last 11 months or current NCP kW

## 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: $156,072

Total quantity purchased during the analyzed billing cycle: 23,175 MCF

Average cost per MCF = Cost of natural gas / quantity purchased = $156,072 / 23,175 MCF

**Average cost per MCF = $6.73**

## 5.0 CAMPUS DESCRIPTIONS:

**Killeen ISD** consists of 48 educational campuses (4 High Schools, 12 Middle Schools and 32 Elementary Schools) which are located in the cities of Killeen, Nolanville, Harker Heights, as well as students within Fort Hood Army Base, in Bell and Coryell Counties. The energy survey focused on nine of the educational campuses and the district data center (KLSS):

### Table 2: School Facilities Analyzed For This Report

| Facility | Year originally Constructed | Approximate Square Footage | Basic HVAC Cool/Heat | Basic Lighting System Description | Basic Control System Description |
|---|---|---|---|---|---|
| Audie MS | 2004 | 119,712 | Packaged RTUs | T8 | DDC - ALERTON |
| Harker Heights HS | 1995 | 311,983 | Packaged RTUs | T8 | DDC - ALERTON |
| Patterson MS | 2009 | 123,936 | Packaged RTUs | T8 | DDC - ALERTON |
| Eastern Hills MS | 1987 | 121,295 | Packaged RTUs | T8 | DDC - ALERTON |
| Skipcha ES | 2006 | 121,416 | Packaged RTUs | T8 | DDC - ALERTON |
| Saegert ES | 2006 | 121,416 | Packaged RTUs | T8 | DDC - ALERTON |
| Killeen HS | 1964 | 304,592 | Packaged RTUs | T8 | DDC - ALERTON |
| Ellison HS | 1978 | 350,306 | Water-cooled chillers / natural gas boiler // Packaged RTUs | T8 | DDC - ALERTON |
| Shoemaker HS | 1996 | 310,620 | Packaged RTUs | T8 | DDC - ALERTON |
| KLSS (Data Center) | 1943 | 46,196 | RTUs / Liebert Underfloor | T8 | DDC - ALERTON |

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:

### COMMENDATION

Killeen ISD has done an exceptional job maintaining their equipment and managing their energy consumption. We estimate the performance of the school district in terms of facility maintenance and energy management to be within the top 1% of Texas school districts. We acknowledge the technical expertise and diligent effort of KISD in these areas.

Examples of the practices in place at KISD:

1. HVAC and ventilation systems at all district Kitchens are limited to operate between 0530 and 1430 hours.
2. Operation of all HVAC and ventilation systems at all campuses (excluding Kitchens) is limited to one hour before occupancy and 1 hour after last bell.
3. District has demand ventilation control of all RTU outside air dampers to limit incorporation of outside air to required times.
4. Domestic and space heat boilers are controlled with timeclocks.
5. Exterior lighting is controlled by timeclock and photocell.

### HVAC ECRM 1: RENOVATION OF AGED HVAC EQUIPMENT

Ellison High School has the only central system in the district. It was renovated in 2009 and serves approximately one-third of the campus. The remainder of Ellison and the other campuses are conditioned with rooftop units. None of the units are older than 15 years, but many of the school's units are 12-15 years old. The normal useful life expectancy of a rooftop unit is 15-20 years. Maintenance of the units appears to have been significantly above average and therefore we would expect the district to get 20 years of life from most of the units. The challenging element to having so many units about the same age is that they will need to be scheduled for replacement at about the same time. The current replacement cost for RTUs is approximately $2,050 per nominal ton of cooling capacity. By utilizing a replacement procedure called planned obsolescence, in which the district budgets to replace as many of the oldest and most intensive maintenance units each year as possible, the district can avoid the potential to have several units be replaced on an emergency basis as they are allowed to fail on their own, as well as avoid the larger expense of replacing 2-3 schools worth RTUs five to eight years in the future.

As an example, the following is the equipment inventory for Shoemaker High School:

| *Make / Size* | *Approximate Age (Years)* | *Quantity* | *Make / Size* | *Approximate Age (Years)* | *Quantity* |
|---|---|---|---|---|---|
| York 2-ton | 15 | 5 | Lennox 15T | 12 | 3 |
| York 3-ton | 15 | 2 | Lennox 4-ton | 12 | 50 |
| York 4-ton | 15 | 48 | Lennox 10 T | 12 | 3 |
| York 7-1/2 T | 15 | 11 | Lennox 5-ton | 11 | 20 |
| York 10-ton | 15 | 2 | Trane 50-ton | 11 | 1 |
| York 8-1/2 T | 15 | 6 | Lennox 2-ton | 11 | 4 |
| York 12.5 T | 15 | 1 | Lennox 7.5T | 12 | 2 |
| York 15-ton | 15 | 3 | Lennox 8.5T | 12 | 2 |
| Lennox 8.5T | 12 | 2 | Carrier S/S | unknown | 1 |

This inventory represents 419 nominal cooling tons of 15 year old RTUs and 465 nominal cooling tons of 11-12 year old units. If replaced in one project, this would represent approximately $1,812,200 in renovation HVAC units.

### CONTROLS ECRM 1: ASSIMILATE REMAINDER OF KLSS HVAC UNITS INTO ALERTON EMS

It was noted during the survey, that three of the portable buildings at the KLSS complex are not under Energy Management System (EMS) control. We recommend all HVAC units at the facilities have the ability to be monitored and controlled through the Alerton EMS, assuming that the portable buildings will remain in operation at KLSS and their functionalities are not being relocated to the new data center building just purchased.

*Estimated Cost: $7,200 Estimated Savings: $1,000 Estimated Payback: 7-1/4 Years*

### CONTROLS ECRM 2: INSTALL VENDING MACHINE CONTROLS

It was noted during the survey that the district has vending machines without energy controls installed. Vending machine controls include occupancy sensors that turn off the advertisement lighting and cycle the compressor off when no occupancy is detected in the immediate area. The peak temperature that the contents of the machine is allowed to reach is programmable and the compressor will cycle as needed to maintain the programmed temperature, but will not run continuously as is the current case. Pricing is supplied per single vending machine.

Estimated Cost: $180 Estimated Savings: $140 Estimated Payback: 1-1/4 Years

## LIGHTING ECRM 1: 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. One such location that this strategy is available is Harker Heights HS. There are 157 two-lamp T8 fluorescent light fixtures in the cafeteria and 92 six-lamp T8 fixtures in the gymnasium that were noted to be on during unoccupied periods; we recommend installing occupancy sensors to ensure the lights are off when nobody is in the space. The cost savings are based upon the expectations that the existing fixtures described above would conservatively be turned off an additional 3 hours per day (with the assumption that these fixtures are used each weekday of the year) and does not include demand savings:

*Cafeteria*
157 fixtures * [2 lamps * .032 watts/lamp * 0.9 ballast factor] = 9.0432 kW/month saved
9.0432kW * 3 hours/day * 261 days = 7,081 kWh saved per year

Annual savings = 7,081 kWh * $0.110655/kWh = $784 saved annually

*Gymnasium*
92 fixtures * [6 lamps * .032 watts/lamp * 0.9 ballast factor] = 15.89 kW cafeteria fixtures
15.89 kW * 3 hours/day * 261 days = 12,442 kWh saved per year

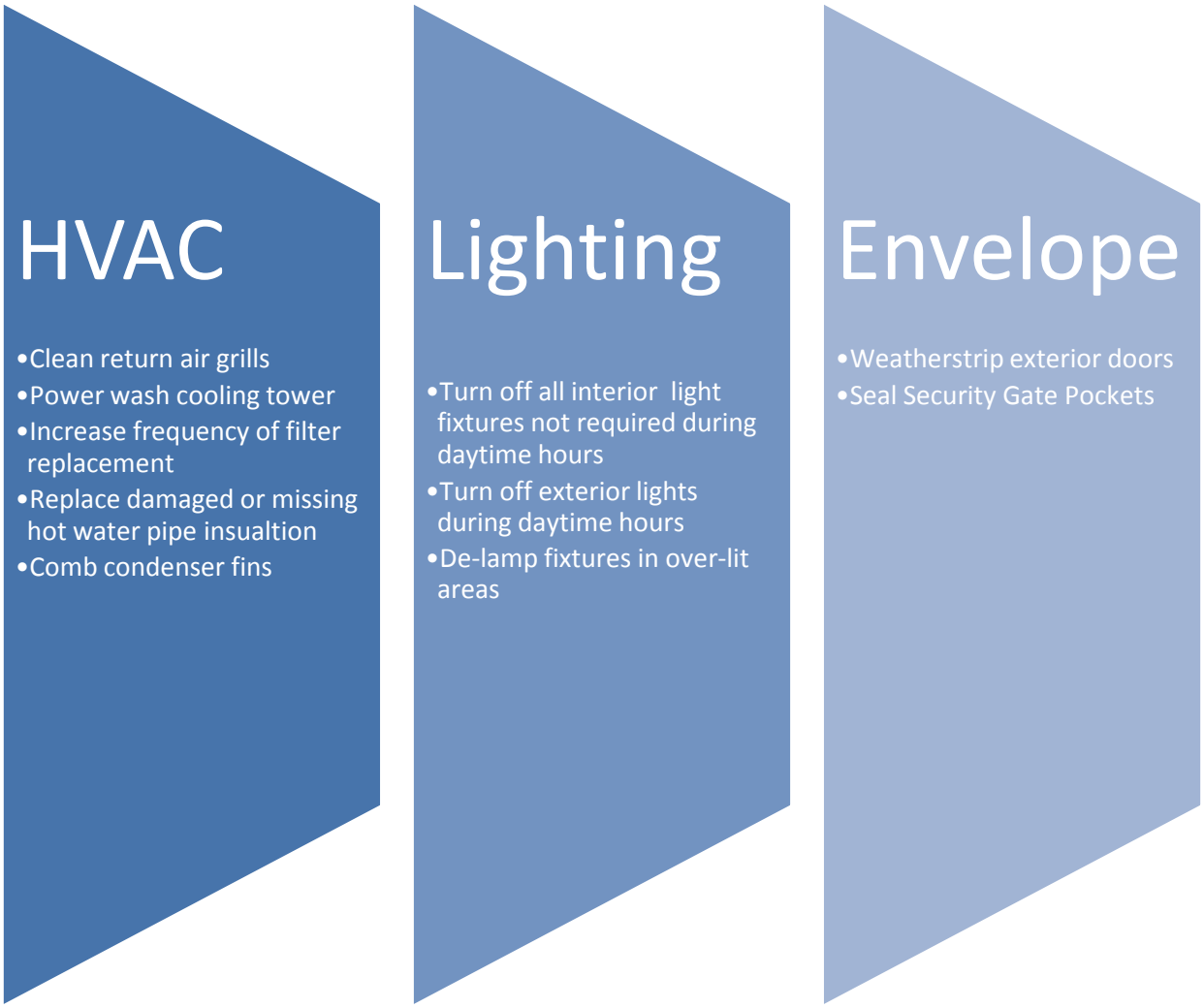
Annual savings = 12,442 kWh * $0.110655/kWh = $1,377 saved

*Total Project*
Estimated Cost: $2,000 Estimated Savings: $2,160 Estimated Payback: 1 Year

## SUMMARY: ALL ECRMs

Estimated Cost: $9,380 Estimated Savings: $3,300 Estimated Payback: 3 Years

## 7.0 MAINTENANCE AND OPERATION RECOMMENDATIONS




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

*HVAC M&O 1*

During the survey, there were several return air grills noted to be dirty. This condition can minimize the air allowed to return to the HVAC unit and lead to a number of maintenance and indoor air quality issues.

*HVAC M&O2*

There were several air filters noted during the survey that were dirty. We recommend the district increase the frequency of filter replacements for units that operate in areas more prone to dirt and debris to preserve the cleanliness of the HVAC units and promote good indoor air quality.

*HVAC M&O 3*

The cooling tower at Ellison HS was noted to be leaking at the basin and had a build-up of scale on the fill media. We recommend the leak be repaired to preserve water treatment and conserve water. We recommend the tower be power washed to ensure efficient operation.

*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.

*Lighting M&O 2*

During the survey, it was noted that light fixtures were operating in areas that receive natural daylight through windows, lightwells or skylights. We recommend turning off light fixtures in areas where natural daylight supplied the required illumination levels to conduct the tasks assigned to that area. The following chart documents some of these areas for opportunity:

| Facility | Quantity and Type of Fixture | Location |
|---|---|---|
| Harker Heights HS | 7 each 2-lamp fixtures | Cafeteria corridor |
| Harker Heights HS | 2 each can lights, 2 each strips | Stairwells |
| Harker Heights HS | 76 each 2-lamp can fixtures | Auditorium lobby |
| Eastern Middle School | 7 each 4-lamp fixtures | Cafeteria |
| Eastern Middle School | 3 each 6-lamp and 3 each 2-lamp fixtures | Cafeteria stage |
| Skipcha Elementary | 20 each can lights | Cafeteria |
| Skipcha Elementary | 8 each 4-lamp fixtures | Cafeteria |
| Killeen HS | 16 each 2-lamp fixtures | Cafeteria and Eatery |

*Lighting M&O 3*

There were areas noted during the survey where light fixtures were providing higher illumination levels than those required by the Illumination Engineering Society of North America (IESNA). This organization determines the optimum light levels required to perform assigned tasks in specific areas of buildings. For example, IESNA recommends that school corridors have between 10-15 footcandles of illumination for safe school activities. One of the corridors at Patterson Middle School has 4-lamp fixtures and delivers 114 footcandles in the corridor space. We recommend these fixtures be de-lamped to just 2-lamps per fixture. Similarly, the offices at Patterson have 105 footcandles at the desktop level with 3-lamp fixtures. IESNA recommends office areas have 50 footcandles and therefore we recommend the office areas be de-lamped to just 2 lamps per fixture as well.

Similar to Patterson's corridors, Eastern Middle School has a hallway with 21 each 3-lamp fixtures and 60 footcandles; Skipcha Elementary has 4-lamp fixtures in the lobby that could be de-lamped to just 2 lamps per fixture.

Fixtures with electronic ballasts can be de-lamped without significant effects for the electronic ballast or fixture itself.

*Envelope M&O 1*

There were several exterior doors noted during the survey that had damaged or missing weatherstripping (see picture to the right). This condition allows conditioned air to escape and contaminants and insects to enter the building. We recommend the district replace damaged or missing weatherstripping.

*Envelope M&O 2*

Two facilities, Audie and Patterson Middle Schools, have large interior security gates that recess into "pockets" above the first floor ceiling. These pockets, 6" wide by the 10' width of the corridor, are not sealed to the plenum or exterior of the building as cold air was noted to fall from the pocket onto the corridor floor below. The staff reports that this falling air is hot during the cooling season. This air must be conditioned by the HVAC system and causes areas of discomfort in the corridor. We recommend the district seal the source of the plenum or exterior air from the security gate pocket.

## 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. $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 | ($9,380) | | 0 | ($9,380) |
| Year 1 | | $ 3,300.00 | 0 | $3,300 |
| Year 2 | | $ 3,300.00 | 0 | $3,300 |
| Year 3 | | $ 3,300.00 | 0 | $3,300 |
| Year 4 | | $ 3,300.00 | 0 | $3,300 |
| Year 5 | | $ 3,300.00 | 0 | $3,300 |
| Year 6 | | $ 3,234.00 | ($500) | $2,734 |
| Year 7 | | $ 3,168.00 | ($500) | $2,668 |
| Year 8 | | $ 3,102.00 | ($500) | $2,602 |
| Year 9 | | $ 3,036.00 | ($500) | $2,536 |
| Year 10 | | $ 2,970.00 | ($500) | $2,470 |
| Year 11 | | $ 2,904.00 | ($1,000) | $1,904 |
| Year 12 | | $ 2,838.00 | ($1,000) | $1,838 |
| Year 13 | | $ 2,772.00 | ($1,000) | $1,772 |
| Year 14 | | $ 2,706.00 | ($1,000) | $1,706 |
| Year 15 | | $ 2,640.00 | ($1,000) | $1,640 |
| | | | | |
| | | | **Internal Rate of Return** | **32.66%** |

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

APPENDIX I: SUMMARY OF FUNDING AND PROCUREMENT OPTIONS

## 9.0 GENERAL COMMENTS

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

# APPENDICES

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

## SUMMARY OF FUNDING OPTIONS FOR CAPITAL EXPENDITURE PROJECTS

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

**LoanSTAR Program:**

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

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

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

**Loans on Commercial Market:**

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

**Leasing Corporations:**

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

**Bond Issue:**

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

## SUMMARY OF PROCUREMENT OPTIONS FOR CAPITAL EXPENDITURE PROJECTS

**State Purchasing:**

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

**Design/Bid/Build (Competitive Bidding):**

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

**Design/Build:**

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

**Purchasing Standardization Method:**

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

**Performance Contracting:**

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

Solution Center

# How to Finance Your Energy Program

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

## Selecting a Cost/Benefit Analysis Method

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

## Simple Payback Analysis

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

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

### Simple Payback

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

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

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

## Life-Cycle Cost Analysis

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

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

continued

## Financing Mechanisms

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

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

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

## Internal Funds

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

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

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

## Debt Financing

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

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

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

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

### Lease and Lease-Purchase Agreements

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

### Energy Performance Contracts

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

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

### Types of Leasing Agreements

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

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

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

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

## How to Finance Your Energy Program *continued*

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

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

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

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

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

Rebuild America
U.S. Dept. of Energy

# APPENDIX II - ELECTRIC UTILITY RATE SCHEDULE

# 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:** Aug 2010 → $0.188/kW TC2 → May 2010 → $0.248/kW | 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 | Sept 2010 - IDR - $0.233457 /kW |
| **VI. Energy Efficiency Cost Recovery Factor:** | See Rider EECRF | Dec 2009 → $9.66 /month |
| **VII. Competitive Meter Credit:** | See Rider CMC | $ 5.47/month |
| **VIII. Advanced Metering Cost Recovery Factor:** | See Rider AMCRF | $ 3.98/month |

**Other Charges or Credits**

| | | |
|---|---|---|
| **IX. Rate Case Expense Surcharge:** | See Rider RCE | per Distribution System billing kW $0.007944/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.

no previous PSA

Signature: [signature] Date: 11/3/10

Name (Mr./Ms./Dr.) Darron Cole Title: Energy Mgmt Spec.

Organization: Killeen ISD Phone: 254-336-0052

Street Address: 110 N. U.S. Young Drive Fax: 254-336-0102

Mailing Address: 110 North U.S. Young Drive E-Mail: Darron.Cole@killeenisd.org

Killeen, Tx 76543 County: Bell - ESA

**Contact Information:**

Name (Mr./Ms./Dr.): Darron Cole Title: Energy Mgmt Spec

Phone: 254-336-0052 Fax: 254-336-0102

E-Mail: Darron.Cole@killeenisd.org County: Bell

Please sign and mail or fax to: Juline Ferris, **Schools and Education** Program Specialist, State Energy Conservation Office, 111 E. 17th Street, Austin, Texas 78774. Phone: 512-936-9283. Fax 512-475-2569.

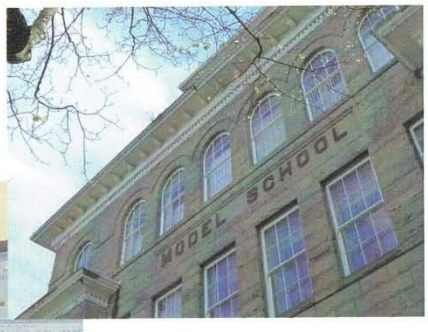
# APPENDIX V - TEXAS ENERGY MANAGERS ASSOCIATION (TEMA)

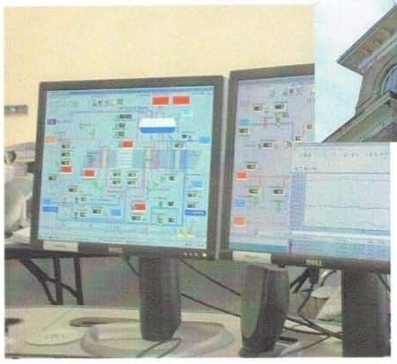
ANNOUNCING!

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

# APPENDIX VII – RECOMMENDED PREVENTIVE MAINTENANCE PRACTICES

## FROM

## 2010 RS MEANS

## FACILITIES MAINTENANCE AND REPAIR COST DATA

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D3035 130 1950** | | | | | | |
| **Chiller, reciprocating, air cooled, up to 25 tons** | | | | | | |
| 1 Check unit for proper operation, excessive noise or vibration. | .033 | | ✓ | ✓ | ✓ | ✓ |
| 2 Run system diagnostics test. | .325 | | ✓ | ✓ | ✓ | ✓ |
| 3 Check oil level in sight glass of lead compressor only, add oil as necessary. | .042 | | ✓ | ✓ | ✓ | ✓ |
| 4 Check superheat and subcooling temperatures. | .325 | | | | | ✓ |
| 5 Check liquid line sight glass, oil and refrigerant pressures. | .036 | | ✓ | ✓ | ✓ | ✓ |
| 6 Check contactors, sensors and mechanical safety limits. | .094 | | | | | ✓ |
| 7 Check electrical wiring and connections; tighten loose connections. | .120 | | | | | ✓ |
| 8 Clean intake side of condenser coils, fans and intake screens. | 1.282 | | | | | ✓ |
| 9 Inspect fan(s) or blower(s) for bent blades of imbalance. | .086 | | | | | ✓ |
| 10 Lubricate shaft bearings and motor bearings as required. | .281 | | | | | ✓ |
| 11 Inspect plumbing and valves for leaks, adjust as necessary. | .077 | | ✓ | ✓ | ✓ | ✓ |
| 12 Check evaporator and condenser for corrosion. | .026 | | ✓ | ✓ | ✓ | ✓ |
| 13 Clean chiller and surrounding area. | .066 | | ✓ | ✓ | ✓ | ✓ |
| 14 Fill out maintenance checklist and report deficiencies. | .022 | | ✓ | ✓ | ✓ | ✓ |
| **Total labor-hours/period** | | | .627 | .627 | .627 | 2.815 |
| **Total labor-hours/year** | | | 5.016 | 1.254 | .627 | 2.815 |

| | Description | Labor-hrs. | Cost Each: 2010 Bare Costs Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 1900 | Chiller, recip., air cooled, up to 25 tons, annually | 2.815 | 47.50 | 146 | | 193.50 | 234 | 285 |
| 1950 | Annualized | 9.712 | 47.50 | 505 | | 552.50 | 680 | 840 |

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D3035 130 2950** | | | | | | |
| **Chiller, reciprocating, air cooled, over 25 tons** | | | | | | |
| 1 Check unit for proper operation, excessive noise or vibration. | .033 | | ✓ | ✓ | ✓ | ✓ |
| 2 Run system diagnostics test. | .455 | | ✓ | ✓ | ✓ | ✓ |
| 3 Check oil level in sight glass of lead compressor only, add oil as necessary. | .042 | | ✓ | ✓ | ✓ | ✓ |
| 4 Check superheat and subcooling temperatures. | .325 | | | | | ✓ |
| 5 Check liquid line sight glass, oil and refrigerant pressures. | .036 | | ✓ | ✓ | ✓ | ✓ |
| 6 Check contactors, sensors and mechanical safety limits. | .094 | | | | | ✓ |
| 7 Check electrical wiring and connections; tighten loose connections. | .120 | | | | | ✓ |
| 8 Clean intake side of condenser coils, fans and intake screens. | 1.282 | | | | | ✓ |
| 9 Inspect fan(s) or blower(s) for bent blades of imbalance. | .237 | | | | | ✓ |
| 10 Lubricate shaft bearings and motor bearings as required. | .341 | | | | | ✓ |
| 11 Inspect plumbing and valves for leaks, adjust as necessary. | .117 | | ✓ | ✓ | ✓ | ✓ |
| 12 Check evaporator and condenser for corrosion. | .052 | | ✓ | ✓ | ✓ | ✓ |
| 13 Clean chiller and surrounding area. | .117 | | ✓ | ✓ | ✓ | ✓ |
| 14 Fill out maintenance checklist and report deficiencies. | .022 | | ✓ | ✓ | ✓ | ✓ |
| **Total labor-hours/period** | | | .874 | .874 | .874 | 3.273 |
| **Total labor-hours/year** | | | 6.992 | 1.748 | .874 | 3.273 |

| | Description | Labor-hrs. | Cost Each: 2010 Bare Costs Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 2900 | Chiller, recip., air cooled, over 25 tons, annually | 3.273 | 68 | 170 | | 238 | 285 | 350 |
| 2950 | Annualized | 12.887 | 68 | 670 | | 738 | 905 | 1,100 |

## D30 HVAC — D3045 110 Air Handling Unit

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D3045 110 1950** | | | | | | |
| **Air handling unit, 3 tons through 24 tons** | | | | | | |
| 1 Check with operating or area personnel for deficiencies. | .035 | | | ✓ | ✓ | ✓ |
| 2 Check controls and unit for proper operation. | .033 | | | ✓ | ✓ | ✓ |
| 3 Check for unusual noise or vibration. | .033 | | | ✓ | ✓ | ✓ |
| 4 Check tension, condition and alignment of belts, adjust as necessary. | .029 | | | ✓ | ✓ | ✓ |
| 5 Clean coils, evaporator drain pan, blower, motor and drain piping, as required. | .380 | | | | | ✓ |
| 6 Lubricate shaft and motor bearings. | .047 | | | ✓ | ✓ | ✓ |
| 7 Replace air filters. | .078 | | | ✓ | ✓ | ✓ |
| 8 Inspect exterior piping and valves for leaks; tighten connections as required. | .077 | | | ✓ | ✓ | ✓ |
| 9 Clean area around equipment. | .066 | | | ✓ | ✓ | ✓ |
| 10 Fill out maintenance checklist and report deficiencies. | .022 | | | ✓ | ✓ | ✓ |
| **Total labor-hours/period** | | | | .420 | .420 | .800 |
| **Total labor-hours/year** | | | | .840 | .420 | .800 |

| | Description | Labor-hrs. | Cost Each: 2010 Bare Costs Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 1900 | Air handling unit, 3 thru 24 tons, annually | .800 | 42 | 41.50 | | 83.50 | 97.50 | 117 |
| 1950 | Annualized | 2.060 | 90.50 | 107 | | 197.50 | 232 | 279 |

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D3045 110 2950** | | | | | | |
| **Air handling unit, 25 tons through 50 tons** | | | | | | |
| 1 Check with operating or area personnel for deficiencies. | .035 | | | ✓ | ✓ | ✓ |
| 2 Check controls and unit for proper operation. | .033 | | | ✓ | ✓ | ✓ |
| 3 Check for unusual noise or vibration. | .033 | | | ✓ | ✓ | ✓ |
| 4 Clean coils, evaporator drain pan, blower, motor and condensate drain piping, as required. | .380 | | | | | ✓ |
| 5 Lubricate shaft and motor bearings. | .047 | | | ✓ | ✓ | ✓ |
| 6 Check belts for wear, proper tension, and alignment; adjust as necessary. | .029 | | | ✓ | ✓ | ✓ |
| 7 Inspect exterior piping and valves for leaks; tighten connections as required. | .077 | | | ✓ | ✓ | ✓ |
| 8 Check operation and clean dampers, louvers and shutters; lubricate all pivot points and linkages. | .078 | | | | | ✓ |
| 9 Replace air filters. | .078 | | | ✓ | ✓ | ✓ |
| 10 Clean area around equipment. | .066 | | | ✓ | ✓ | ✓ |
| 11 Fill out maintenance checklist and report deficiencies. | .022 | | | ✓ | ✓ | ✓ |
| **Total labor-hours/period** | | | | .420 | .420 | .878 |
| **Total labor-hours/year** | | | | .840 | .420 | .878 |

| | Description | Labor-hrs. | Cost Each: 2010 Bare Costs Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 2900 | Air handling unit, 25 thru 50 tons, annually | .878 | 131 | 45.50 | | 176.50 | 201 | 234 |
| 2950 | Annualized | 2.138 | 355 | 111 | | 466 | 530 | 615 |

## D30 HVAC | D3025 130 | Boiler, Hot Water, Oil/Gas/Comb.

| | PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|---|
| | **PM System D3025 130 4950** | | | | | | |
| | **Boiler, hot water; oil, gas or combination fired, over 1000 MBH** | | | | | | |
| 1 | Check combustion chamber for air or gas leaks. | .117 | | | | | ✓ |
| 2 | Inspect and clean oil burner gun and ignition assembly where applicable. | .987 | | | | | ✓ |
| 3 | Inspect fuel system for leaks and change fuel filter element, where applicable. | .147 | | | | | ✓ |
| 4 | Check fuel lines and connections for damage. | .035 | | ✓ | ✓ | ✓ | ✓ |
| 5 | Check for proper operational response of burner to thermostat controls. | .199 | | | ✓ | ✓ | ✓ |
| 6 | Check and lubricate burner and blower motors. | .120 | | | ✓ | ✓ | ✓ |
| 7 | Check main flame failure protection and main flame detection scanner on boiler equipped with spark ignition (oil burner). | .186 | | ✓ | ✓ | ✓ | ✓ |
| 8 | Check electrical wiring to burner controls and blower. | .120 | | | | | ✓ |
| 9 | Clean firebox (sweep and vacuum). | .819 | | | | | ✓ |
| 10 | Check operation of mercury control switches (i.e., steam pressure, hot water temperature limit, atomizing or combustion air proving, etc.). | .215 | | ✓ | ✓ | ✓ | ✓ |
| 11 | Check operation and condition of safety pressure relief valve. | .046 | | ✓ | ✓ | ✓ | ✓ |
| 12 | Check operation of boiler low water cut off devices. | .085 | | ✓ | ✓ | ✓ | ✓ |
| 13 | Check hot water pressure gauges. | .109 | | ✓ | ✓ | ✓ | ✓ |
| 14 | Inspect and clean water column sight glass (or replace). | .191 | | ✓ | ✓ | ✓ | ✓ |
| 15 | Clean fire side of water jacket | .433 | | | | | ✓ |
| 16 | Check condition of flue pipe, damper and exhaust stack. | .221 | | | ✓ | ✓ | ✓ |
| 17 | Check boiler operation through complete cycle, up to 30 minutes. | .887 | | | | | ✓ |
| 18 | Check fuel level with gauge pole, add as required. | .098 | | ✓ | ✓ | ✓ | ✓ |
| 19 | Clean area around boiler. | .182 | | ✓ | ✓ | ✓ | ✓ |
| 20 | Fill out maintenance checklist and report deficiencies. | .022 | | ✓ | ✓ | ✓ | ✓ |
| | **Total labor-hours/period** | | | 1.169 | 1.709 | 1.709 | 5.219 |
| | **Total labor-hours/year** | | | 9.352 | 3.418 | 1.709 | 5.219 |

| | Description | Labor-hrs. | Cost Each: 2010 Bare Costs Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 4900 | Boiler, hot water, O/G/C, over 1000 MBH, annually | 5.219 | 107 | 271 | | 378 | 455 | 555 |
| 4950 | Annualized | 19.698 | 112 | 1,025 | | 1,137 | 1,400 | 1,725 |

## D30 HVAC | D3045 410 | Pump, Centrifugal

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D3045 410 1950** | | | | | | |
| **Centrifugal pump over 1 H.P.** | | | | | | |
| 1 Check for proper operation of pump. | .022 | | | | ✓ | ✓ |
| 2 Check for leaks on suction and discharge piping, seals, packing glands, etc.; make minor adjustments as required. | .077 | | | | ✓ | ✓ |
| 3 Check pump and motor operation for excessive vibration, noise and overheating. | .022 | | | | ✓ | ✓ |
| 4 Check alignment of pump and motor; adjust as necessary. | .260 | | | | ✓ | ✓ |
| 5 Lubricate pump and motor. | .099 | | | | ✓ | ✓ |
| 6 Clean exterior of pump, motor and surrounding area. | .096 | | | | ✓ | ✓ |
| 7 Fill out maintenance checklist and report deficiencies. | .022 | | | | ✓ | ✓ |
| **Total labor-hours/period** | | | | | .598 | .598 |
| **Total labor-hours/year** | | | | | .598 | .598 |

| | Description | Labor-hrs. | Cost Each: 2010 Bare Costs: Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 1900 | Centrifugal pump, over 1 H.P., annually | .598 | 7.10 | 31 | | 38.10 | 46.50 | 57 |
| 1950 | Annualized | 1.196 | 14.15 | 62.50 | | 76.65 | 92.50 | 114 |

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D3045 410 2950** | | | | | | |
| **Centrifugal pump w/reduction gear, over 1 H.P.** | | | | | | |
| 1 Check with operating or area personnel for deficiencies. | .035 | | | | ✓ | ✓ |
| 2 Clean pump exterior and check for corrosion on pump exterior and base plate. | .030 | | | | ✓ | ✓ |
| 3 Check for leaks on suction and discharge piping, seals, packing glands, etc. | .077 | | | | ✓ | ✓ |
| 4 Check pump, gear and motor operation for vibration, noise, overheating, etc. | .022 | | | | ✓ | ✓ |
| 5 Check alignment and clearances of shaft reduction gear and coupler. | .260 | | | | ✓ | ✓ |
| 6 Tighten or replace loose, missing, or damaged nuts, bolts and screws. | .005 | | | | ✓ | ✓ |
| 7 Lubricate pump and motor as required. | .099 | | | | ✓ | ✓ |
| 8 When available, check suction or discharge, pressure gauge readings and flow rate. | .022 | | | | ✓ | ✓ |
| 9 Clean area around pump. | .066 | | | | ✓ | ✓ |
| 10 Fill out maintenance checklist and report deficiencies. | .022 | | | | ✓ | ✓ |
| **Total labor-hours/period** | | | | | .638 | .638 |
| **Total labor-hours/year** | | | | | .638 | .638 |

| | Description | Labor-hrs. | Cost Each: 2010 Bare Costs: Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 2900 | Centrifugal pump, w/ red. gear, over 1H.P., annually | .638 | 7.10 | 33 | | 40.10 | 49 | 60.50 |
| 2950 | Annualized | 1.276 | 14.15 | 66.50 | | 80.65 | 98 | 121 |

## D20 PLUMBING — D2025 260 — Water Heater, Gas/Oil/Steam

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D2025 260 3950** | | | | | | |
| **Water heater, steam coil, to 2500 gallon** | | | | | | |
| 1 Check with operating or area personnel for deficiencies. | .035 | | | | ✓ | ✓ |
| 2 Check for water leaks to tank and piping; check steam lines for leaks. | .077 | | | | ✓ | ✓ |
| 3 Check operation and condition of pressure relief valve. | .010 | | | | ✓ | ✓ |
| 4 Check steam modulating valve and steam condensate trap for proper operation. | .068 | | | | ✓ | ✓ |
| 5 Check electrical wiring connections on controls and switches. | .094 | | | | ✓ | ✓ |
| 6 Check for proper water temperature setting; adjust as required. | .029 | | | | ✓ | ✓ |
| 7 Clean, test and inspect sight gauges, valves and drains. | .040 | | | | ✓ | ✓ |
| 8 Check automatic controls for proper operation including temperature regulators and thermostatic devices. | .094 | | | | ✓ | ✓ |
| 9 Check insulation on heater; repair as necessary. | .077 | | | | ✓ | ✓ |
| 10 Drain sediment from tank. | .325 | | | | | ✓ |
| 11 Clean up area around unit. | .066 | | | | ✓ | ✓ |
| 12 Fill out maintenance checklist and report deficiencies. | .022 | | | | ✓ | ✓ |
| **Total labor-hours/period** | | | | | .612 | .937 |
| **Total labor-hours/year** | | | | | .612 | .937 |

| | Description | Labor-hrs. | Cost Each: 2010 Bare Costs: Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 3900 | Water heater, steam coil, to 2500 gal., annually | .937 | 28.50 | 48.50 | | 77 | 91.50 | 111 |
| 3950 | Annualized | 1.549 | 28.50 | 80.50 | | 109 | 131 | 161 |

374

## D30 HVAC | D3055 210 | Package Unit, Air Cooled

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D3055 210 1950** | | | | | | |
| **Package unit, air cooled, 3 tons through 24 tons** | | | | | | |
| 1 Check with operating or area personnel for deficiencies. | .035 | | | ✓ | ✓ | ✓ |
| 2 Check tension, condition, and alignment of belts; adjust as necessary. | .029 | | | ✓ | ✓ | ✓ |
| 3 Lubricate shaft and motor bearings. | .047 | | | ✓ | ✓ | ✓ |
| 4 Replace air filters. | .055 | | | ✓ | ✓ | ✓ |
| 5 Clean electrical wiring and connections; tighten loose connections. | .120 | | | | | ✓ |
| 6 Clean coils, evaporator drain pan, blowers, fans, motors and drain piping as required. | .385 | | | | | ✓ |
| 7 Perform operational check of unit; make adjustments on controls and other components as required. | .077 | | | ✓ | ✓ | ✓ |
| 8 During operation of unit, check refrigerant pressure; add refrigerant as necessary. | .135 | | | ✓ | ✓ | ✓ |
| 9 Check compressor oil level; add oil as required. | .033 | | | | | ✓ |
| 10 Clean area around unit. | .066 | | | ✓ | ✓ | ✓ |
| 11 Fill out maintenance checklist and report deficiencies. | .022 | | | ✓ | ✓ | ✓ |
| **Total labor-hours/period** | | | | .466 | .466 | 1.004 |
| **Total labor-hours/year** | | | | .932 | .466 | 1.004 |

| | Description | Labor-hrs. | Cost Each 2010 Bare Costs Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 1900 | Package unit, air cooled, 3 thru 24 ton, annually | 1.004 | 42.50 | 52 | | 94.50 | 112 | 134 |
| 1950 | Annualized | 2.402 | 68 | 125 | | 193 | 229 | 278 |

| PM Components | Labor-hrs. | W | M | Q | S | A |
|---|---|---|---|---|---|---|
| **PM System D3055 210 2950** | | | | | | |
| **Package unit, air cooled, 25 tons through 50 tons** | | | | | | |
| 1 Check with operating or area personnel for deficiencies. | .035 | | | ✓ | ✓ | ✓ |
| 2 Check tension, condition, and alignment of belts; adjust as necessary. | .029 | | | ✓ | ✓ | ✓ |
| 3 Lubricate shaft and motor bearings. | .047 | | | ✓ | ✓ | ✓ |
| 4 Replace air filters. | .078 | | | ✓ | ✓ | ✓ |
| 5 Clean electrical wiring and connections; tighten loose connections. | .120 | | | | | ✓ |
| 6 Clean coils, evaporator drain pan, blowers, fans, motors and drain piping as required. | .385 | | | | | ✓ |
| 7 Perform operational check of unit; make adjustments on controls and other components as required. | .130 | | | ✓ | ✓ | ✓ |
| 8 During operation of unit, check refrigerant pressure; add refrigerant as necessary. | .272 | | | ✓ | ✓ | ✓ |
| 9 Check compressor oil level; add oil as required. | .033 | | | | | ✓ |
| 10 Clean area around unit. | .066 | | | ✓ | ✓ | ✓ |
| 11 Fill out maintenance checklist and report deficiencies. | .022 | | | ✓ | ✓ | ✓ |
| **Total labor-hours/period** | | | | .679 | .679 | 1.217 |
| **Total labor-hours/year** | | | | 1.358 | .679 | 1.217 |

| | Description | Labor-hrs. | Cost Each 2010 Bare Costs Material | Labor | Equip. | Total | Total In-House | Total w/O&P |
|---|---|---|---|---|---|---|---|---|
| 2900 | Package unit, air cooled, 25 thru 50 ton, annually | 1.217 | 59.50 | 63 | | 122.50 | 144 | 172 |
| 2950 | Annualized | 3.254 | 95.50 | 169 | | 264.50 | 315 | 380 |