

August 2010

**SUMMARY
ENERGY EFFICIENT
TECHNICAL ASSISTANCE REPORT
LEE ELEMENTARY SCHOOL
CADDO MILLS ISD
CADDO MILLS, TEXAS**

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TABLE OF CONTENTS

- 1.0 EXECUTIVE SUMMARY**
- 2.0 DISTRICT ENERGY AND COST PERFORMANCE**
- 3.0 ENERGY ACCOUNTING**
- 4.0 SYSTEM AND EQUIPMENT REPLACEMENT PROJECTS**
- 5.0 PRIORITIZED SCHEDULE FOR REPLACEMENT PROJECTES**
- 6.0 GUIDELINES TO ASSIST IN DEVELOPING LONG-RANGE ENERGY PLANS (PER SB300)
FOR PUBLIC ENTITIES**
- 7.0 ENERGY TRACKING AND MONITORING**
- 8.0 FUNDING OPTIONS**

APPENDEICIES

- A. Preliminary Energy Assessment Agreement**
- B. Base Year Consumption History Tables**
- C. Senate Bill 300**
- D. Water Efficiency Guidelines**
- E. Utility Data**

1.0 EXECUTIVE SUMMARY

The Technical Assistance is provided by the State Energy Conservation Office (SECO), a division of the Comptroller of Public Accounts of the State of Texas. This service assists school Districts in taking basic steps toward energy-efficient facility operation. Active involvement by the District in the partnership is critical in developing a customized blueprint for energy efficiency.

One of the first steps toward energy-efficient school operation is identifying the current energy performance of District facilities. An energy performance summary is included in Section 2 and more detailed data by month for each school is in the Appendix of this report.

Successful school energy management programs include the following:

- Identify the Need – District Energy Evaluation
- Appoint an Energy Manager & Provide Training
- Adopt a District Energy Policy
- Write an Energy Management Plan & Present to the School Board
- Implement Energy Accounting System
- Conduct Energy Audits
- Establish Energy Committees
- Adopt Building Operating Procedures & Guidelines
- Involve School Personnel & Students
- Obtain Publicity
- Create Competition & Incentives
- Communicate Success
- Give Personal Contact and Feedback from Energy Accounting
- Energy Procurement

This Technical Assistance Report addresses the following specific requirements:

- System and Equipment Replacement Projects (Section 4): Lee Elementary School
 - HVAC
 - EMCS
 - Gym Lighting
- Prioritized Schedule for Replacement Projects (Section 5)
- Guidelines to Assist in Developing Long-Range Energy Plans (per SB300) for Public Entities (Section 6)
- Energy Tracking and Monitoring (Section 7)
- Funding Options (Section 8)

James D. McClure, P.E. visited the District and met with Mr. Randy P. Ragan, Director of Maintenance. Your personal contact at SECO is Ms. Juline Ferris (Phone: (512) 936-9283); your contact at Estes, McClure & Associates, Inc. is James McClure, P.E., and Gary Bristow, P.E. (Phone: (903) 581-2677). Please call us if you have any questions or comments about this report or other energy management issues.

Caddo Mills ISD covers a 66 square mile area. One thousand four hundred twenty-eight students attend the four campuses. The campuses are located a few miles north of I30 between Greenville and Rockwall.

Review of the Energy Use Index (EUI) for 2009 shown in Section 2 table of this report indicates the District is efficient. In 1978 the EUI or BTU/Ft²-Yr Index for a new efficient school in the area was 36,000 for elementary and 48,000 for secondary schools. This is before the large scale implementation of computers and extended use of facilities by students and community.

The data EMA has for 2008-2009 averages for schools in North and East Texas shows 53,440 for elementary and 60,173 for secondary schools.

Every Caddo Mills ISD campus energy use index is below the North and East Texas average. The lower the EUI index the better the energy performance.

Considering the extended hours of student use, computer and technology load in today's modern schools, and community use **the EUI's for Caddo Mills ISD are reasonable and indicate efficiency.**

Caddo Mills ISD is energy efficient because of the maintenance and operations and their energy efficiency improvement projects.

The following is a brief summary of specific technical assistance for Caddo Mills ISD.

System and Equipment Replacement Projects (Section 4.0) for Lee Elementary School

- Estimated budget is provided for HVAC system equipment replacement. The equipment is 14 years old and has R22 refrigerant that is being passed out of production.
 - HVAC Budget \$ 1,100,000
 - Energy Savings/Yr. \$ \$7503
 - Kw-hrs/Yr. Savings 60,514

- Estimated budget is provided for energy management control system at time of HVAC replacement.
 - EMCS Budget \$ 89,700
 - Energy Savings/Yr. \$ \$6905
 - Kw-hrs/Yr. Savings 55,692

- Estimated budget to replace the two gyms lighting with fluorescent T5 and electronic ballasts.
 - Lighting Budget \$ 8,000
 - Energy Savings/Yr. \$ 1450
 - Kw-hrs/Yr. Savings 11,700

Prioritized Schedule for Replacement Projects (Section 5.0)

All the other campuses/facilities have much newer HVAC than Lee Elementary School. Lee would be a priority for planning and budgeting. The HVAC and EMCS projects above are infrastructure projects.

Guidelines to Assist in Developing Long-Range Energy Plans (Per SB 300) (Section 6)

- The 2009 Texas Legislature passed SB 300 that required a school district to reduce electrical consumption by 5%. Also repealed prior requirements to reduce 5% per year for 6 years. Energy reporting and posting of previous legislation left intact.
- Helpful hints for complying are included in Section 6.
- The district does have a five year energy plan on its website.

Energy Tracking and Monitoring (Section 7.0)

An Energy Tracking and Monitoring system is discussed in Section 7. A spread sheet type system is recommended. This is needed to comply with SB 300. Also it will provide information to identify any billing errors and provide feedback on energy usage.

Appreciation

EMA appreciates the opportunity to provide the information in this report. Our intent is to be helpful and responsive to questions that were asked. SECO is commended for sponsoring and providing this assistance program.

Please call to discuss or ask questions. Thank you.

2.0 DISTRICT ENERGY AND COST PERFORMANCE

The District has a high school, middle school, and two elementary schools. The table below is a summary of one year of energy and cost performance.

The energy use performance or energy use index (EUI) and the energy cost performance or energy cost index (ECI) is provided below. Other detailed data is shown on the Base Year Energy Consumption History table provided in Appendix of this report.

The energy cost index is a valuable tool for comparing the energy cost (\$) of different schools and campuses in a given area. The energy use index allows for comparison of schools on a quantity (BTU) basis. Since the cost of electricity varies by school and natural gas is so much less than the cost of electricity, this index is a true value of the actual energy use on a square foot basis. The lower the EUI value the more energy efficient. The energy cost index (ECI) and the energy use index (EUI) are determined by the following formulas.

$$ECI = \frac{\text{Annual Electrical Cost} + \text{Annual Natural Gas Cost}}{\text{Total Area of School}}$$

$$EUI = \frac{\text{Annual Electrical BTUs} + \text{Annual Natural Gas BTUs}}{\text{Total Area of School}}$$

ENERGY COST & PERFORMANCE

SCHOOL	ECI	EUI	KWH per sq. Ft.	1000 MCF per Sq. Ft.	Total Utility Cost	Area (Sq. Ft.)	ELECT. PROVIDER
High School	\$1.16	41,165	8.7	11.1	\$109,740	94,872	Direct Energy
Middle School	\$0.88	31,990	6.0	11.1	\$62,069	70,430	Direct Energy
Lee Elementary	\$0.75	30,006	5.5	10.9	\$61,686	81,923	Direct Energy
Griffis Elementary	\$0.65	29,129	8.5	0	\$56,634	82,675	FEC*

*Farmers Electric Cooperative

3.0 ENERGY ACCOUNTING

3.1 Monitoring and Tracking

The District does not have an energy monitoring and tracking system. See Section 7 of this report for options and recommendations.

3.2 Utility Providers and Rates

The District retail electric provider is Direct Energy. Farmers Electric Cooperative provides electricity for Griffis Elementary. Atmos provides natural gas for the District.

4.0 SYSTEM AND EQUIPMENT REPLACEMENT PROJECTS

Lee Elementary School is a single story 1996 building and in 1997 two classrooms were added on each end wing. The roof is pitched.

HVAC Replacement

Existing System Type

The existing HVAC system is unitary split-system direct expansion type (50) with natural gas furnaces for space heating. The classroom units are located in closets located inside the occupied rooms and on the exterior walls. The outdoor air-cooled condensing units are located on the ground. Some interior zones have split-system Dx heat pumps (10) and there are 4 cooling only units. Almost all equipment is manufactured by Goodman.

Existing System Age and Life Expectancy

The HVAC system is original to the building except for a few replaced equipment components. The age of the equipment is 14 years old. The supply air duct insulation is coming loose.

The ASHRAE median equipment life estimate for this type of equipment is 15 years. Our observations are that many school districts exceed the ASHRAE median life for unitary DX equipment by several years. To achieve greater than the ASHRAE median service life the equipment must be of good quality manufacturer, suitable application, and maintained per manufacturer's instructions.

As the life expectancy is exceeded, maintenance costs can be expected to increase and down-time increases.

Existing System and Refrigerants Evaluation

The refrigerant in the existing equipment is R22 which has been the standard for many years. When planning for replacement, new equipment is recommended to have R410A refrigerant.

Federal law requires the phase-out of R22 and certain other refrigerant. Several important deadlines have already passed, and others are rapidly approaching. For example, after January 1, 2010 manufacturers cannot produce more equipment with R22. Production of R22 refrigerant by the chemical companies must stop by 2020. By 2015 there will be 90% reduction in R22 refrigerant production.

Prior to the 2010 deadline for ending HVAC equipment production with R22, manufacturers redesigned their products for R410A, a non-ozone depleting refrigerant.

The existing Lee Elementary HVAC equipment is not compatible with R410A or any other new replacement refrigerant. There is not a drop in replacement for R22. Also, since R410A operates at higher pressure than R22, technicians need additional training and new tools (eg. Hoses, gauges, etc.).

Existing System Observations

- All filters observed were clean
- Outside air dampers were open for ventilation
- All thermostat settings at time of visit were good energy efficient settings for the time of day and whether occupied or unoccupied.
- Supply air duct insulation is failing (coming loose)
- All have R22 refrigerant
- Systems and school have appearance of good maintenance

HVAC Recommendations

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- Replace existing HVAC system with high efficiency unitary direct-expansion.
- Recommend R410A refrigerant.
- Recommend complying with increased ASHRAE ventilation standards per code. Use demand control ventilation approach incorporating CO2 sensors.
- Recommend new equipment has energy reclaim using condenser heat and humidity control.
- Replace duct insulation
- Consider/evaluate relocation of some of the air-handlers located in interior zone that results in long refrigerant line lengths.
- HVAC Budget \$ 1,100,000
- Estimated Energy Savings/Yr. \$ 7503
- Estimated Kw-hr/Savings/Yr. 60,514

EMCS

Existing Controls

Lee Elementary has mostly non-programmable standard thermostats. There are a few programmable thermostats.

EMCS Recommendation

- Provide DDC EMCS when new air-conditioning is installed at Lee Elementary.
- Estimated Budget \$ 89,700
- Estimated Energy Savings/Yr. \$ 6905
- Estimated Kw-hr/Saved 55,692

Computer based central DDC type EMCS controls are recommended when new HVAC is installed. This is more suitable for demand control ventilation and humidity control while providing the increased ventilation per ASHRAE Standard/Codes. All will allow central rescheduling.

Lighting Replacement – Lee Elementary Gyms

Existing Gyms

- The original larger gym has 16 metal halide fixtures.
- The 1004 practice gym has 9 metal halide fixtures. There is daylighting provided by two large windows on the east side.

Gym Lighting

Recommendations

- Replace existing metal halide fixtures with energy saving T-5 HO fluorescent light fixtures (4 lamp) with electronic ballasts. In addition to the wattage reduction, the instant on/off T-5 fluorescent fixtures requires no warm-up time and, therefore are more likely to be turned off when not in use. Many school districts use T5 lighting with motion sensors. This is recommended.
- Original Gym
 - Estimated Cost \$ 6400

- Est. Annual/Savings \$ 1159
 - Est. Annual Savings Kw-hrs 9351
- Practice Gym
 - Estimated Cost \$ 1600
 - Est. Annual/Savings \$ 291
 - Est. Annual Savings Kw-hrs 2349

5.0 PRIORITIZED SCHEDULE FOR REPLACEMENT PROJECTS

In general, priority consideration of HVAC replacement or upgrading projects include but are not limited to the following;

- High maintenance costs or issues
- High down time and frequency (reliability)
- Age equipment
- Condition equipment
- Indoor environment and comfort
- Refrigerant type and availability
- Capacity of equipment
- Function or use change
- Increased load from new electronic or other equipment, etc.
- Adequate outside air
- Unavailability of parts
- Maintenance frequency and cost

Priorities for HVAC Replacement

The following are recommended priority for replacement.

All the other campuses/facilities have much newer HVAC than Lee Elementary. Lee is recommended as the priority for planning and budgeting. As the Lee equipment continues to age, energy usage, maintenance costs, and outages should be anticipated.

The District has been successful and has done a good job in keeping up with energy efficient HVAC equipment replacement. The above are just routine normal part of the process.

The priority recommendation is based on equipment age. Other factors as listed above may be considered such as maintenance issues that develop and also extended useful life of equipment.

6.0 GUIDELINES TO ASSIST IN DEVELOPING LONG-RANGE ENERGY PLANS (PER SB 300)

Background

The 2009 Texas Legislature passed SB300 that accomplished the following;

- Requires a school board approved long range plan to reduce annual electric consumption by 5%.
- Repeals requirements to reduce electric consumption by 5% each year for 6 years.
- Left reporting and posting of energy requirements intact (HB 3693 from 2007 session).

SB300 requires five percent annual electric consumption reduction beginning with 2008 state fiscal year and consume electricity in subsequent fiscal years in accordance with the district's energy plan. The act applies beginning with the 2009 – 2010 school year.

The district plan must include strategies for achieving energy efficiency that result in net savings for the district or can be achieved without financial cost to the district. For each strategy in the plan include short term capital cost and lifetime costs and savings that may result from implementation of the strategy. In determining if a strategy may result in financial cost to the district, consider the total net savings that may occur over the seven year period following implementation of the strategy.

Helpful Hints

- Read and understand SB300
- Document 2008 state fiscal year electricity and natural gas consumption
- Determine if district is complying with prior requirement left intact by SB300 (i.e. HB 3693) for reporting and posting energy consumption.
- Establish an energy tracking system and keep updated monthly
- Document maintenance, operations, and custodial strategies to reduce energy usage.
- Document energy efficiency projects already accomplished
- Document energy efficiency projects in progress
- Assign someone for responsibility of energy manager in the district.
- Perform energy audits of existing facilities
- Develop strategies for reducing energy consumption that had no first cost
- Develop list of potential capital projects with costs and benefits
- Prioritize strategies
- Document plan in accordance with SB300

Observations

Based on observations Caddo Mills ISD is energy efficient because of the work of maintenance and operations. An energy tracking systems and documentation for SB 300 are recommended.

7.0 ENERGY TRACKING AND MONITORING

Energy tracking and monitoring is essential to energy management. It's important to know where you are with energy cost, energy performance, and energy consumption. It provides a sound base for comparing a given school from year-to-year as well as with other regional schools. Energy tracking and monitoring is a management tool that is good for feedback of energy usage and cost for campus leaders and school administration.

Another benefit of a tracking and monitoring system is to readily identify trends, problems, and billing errors. Billing errors are most likely to occur when changing retail electric providers, meter changes, or even if the utility company updates or changes their software.

Key Steps in Setting-Up System

- Familiarize with what purchasing and source
- Understand the rates being charged
- Locate all meters (electric, natural gas and water) in District. A good idea is use small floor plan of school to show location and area served.
- For each meter obtain account number and ESID number (electricity) as well as address.
- From district files or by contacting each utility company obtain twelve month history (by month) of consumption and cost.
 - Electric: cost (\$), Kw-hrs, Kw demand actual, Kw demand billed, power factor.
 - Natural gas: cost (\$), mcf
 - Water: consumption (gallons), cost (\$)
- Obtain the area of each facility (sq. ft.)
- Determine type of tracking and monitoring of energy accounting system to use. Note for Caddo Mills ISD size, using Excel spreadsheets should be adequate and less costly than purchasing computer software. Typically this can be accomplished in financial office or by IT department. Another idea is to have a high school science or computer student develop the spread sheets as a project.
- Enter the data from the utility bills into the spread sheets.

Key Factor in Evaluating Results

- Once the utility data is entered for a year (see appendix utility base line charts), then calculate the Energy Use Index (EUI) and the Energy Cost Index (ECI). See Section 2.0. This provides a base for comparison with other schools, districts, and the subject school.
- Compare current month individual campus/facility with the same month in the prior year or a base year. Look for major difference in consumption (eg. Kw-hrs) and determine the reason. There may be a logical reason such as summer school this year or it might indicate an alert to equipment problems or utility provider errors. Question deviations.

Communicate the Results

- The energy tracking and monitoring system is also useful in providing information for letting others in the district and community know about trends and how efficient the district operates.
- The data readily available also helps in evaluating claims of energy saving devices and programs.

Key Terms

- Unit of demand for billing: Kilowatt (KW) = 1,000 watts
- Measure of electrical energy consumption: Kw-hrs
- BTU: Unit of energy
 - 1 Kw-hr = 3413 Btu
 - 1 Mcf of natural gas = 1,030,000 Btu

8.0 FUNDING OPTIONS

School Districts have traditionally tapped bond money, maintenance dollars, or federal grants to fund energy efficient equipment change-outs or additions such as energy efficient lighting systems, high efficiency air conditioning units, and computerized energy management control systems. Today, a broader range of funding options is available. Consult with district financial consultant and attorney. A number of these are listed below.

Texas LoanSTAR Program

The LoanSTAR (Saving Taxes and Resources) Program, which is administered by the State Energy Conservation Office, finances energy-efficient building retrofits. The program's revolving loan mechanism allows borrowers to repay loans through the stream of cost savings realized from the projects. Projects financed by LoanSTAR must have an average simple payback requirements and must be analyzed in an Energy Assessment Report by a Professional Engineer who meets criteria. Upon final loan execution, the District proceeds to implement funded projects through the traditional bid/spec process. For more information contact Juline Ferris at 512/936-9283 for more information.

Capital Acquisition Program or Municipal Financing Program

This program also offers loans to purchase and install energy-saving equipment. The minimal loan amount is \$100,000 and interest rates are competitive. Rates depend on current financial market conditions, the length of the loan, and the District's bond rating. Loan terms are set at three year, four year, seven year, or ten year periods and are not related to project payback. The application procedure is simple: completion of a one-page form and submission of the most recent budget and audit. For more information call 512/467-3695 or contact Texas Association School Boards.

Private Lending Institutions or Leasing Corporations

Banks, leasing corporations, and other private lenders have become increasingly interested in the energy efficiency market. The financing vehicle frequently used by these entities is a municipal lease. Structured like a simple loan, a municipal leasing agreement is usually a lease-purchase arrangement. 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.

Rebates

Many electrical transmission and distribution companies offer rebates for energy projects that reduce the peak electrical demand (kw). Contact the provider in your area for detail. For example Oncor offers energy efficiency rebates for various projects such as upgraded new energy efficient air-conditioning, lighting, and others. The availability of rebates, the amounts, and eligibility requirements vary. Contact the provider before beginning a project as most times they require prior approval and documentation of existing conditions or items to be upgraded.

Grants

There are numerous sources of grants and their requirements, availability, and eligibility vary at times. Examples of some opportunities to monitor included the following:

- State Energy Conservation Office (SECO) monitor SECO's website and the Electronic State Business Daily
- Oncor school matching grant (www.takealoadoftexas.com)

- Oncor Solar PV Program (www.txreincentsives.com/opv/)
- Discretionary and other grants offered by the federal government may be searched at www.grants.gov
- Foundations
- Public Independent School District Energy Efficiency Grants. Monitor SECO (www.seco.cpa.state.tx.us) and the Electronic State Business Daily
- Renewable energy technology grants (SECO).
- Alternative fuel and hybrid vehicle grant program (SECO).

Stimulus

The American Recovery and Reinvestment Act (ARRH), provides stimulus funding in various methods and for different energy projects. The Texas Comptroller of Public Accounts provides convenient Stimulus Tracking Reports (www.tx.comptroller@service.govdelivery.com) For energy project announcements refer to SECO website.

Qualified School Construction Bonds (QSCB's) and Build America Bonds (BAB)

QSCB and BAB bonds are debt financing tools that came out of the federal AARA stimulus. Recent legislation revised the process of QSCB's and BAB. The Hiring Incentives to Restore Employment (HIRE) Act is supposed to simplify the process and result in reduced interest cost to the district. The bonds are taxable to the purchaser and they receive the interest (currently about 5.76 percent).

The federal government pays the district the "lesser of" the taxable issuance rate or the current tax credit rate as of sale date. The district under current conditions pays near zero interest. Depending on use of the QSCB, districts can potentially use with maintenance tax note.

For BAB this is a 30 year taxable bond and the district receives a federal subsidy.

The conditions and suitability of the above bonds are subject to change. Consult with the district's financial consultant with these and all other financial methods, instruments, and options.

Bonds

Traditional school bonds are approved by the voters. These bonds are tax-exempt. Typically these bonds are used for new construction, major renovations, and infrastructure upgrades. Consult district financial planner.

Department of Energy Resource

Refer to DOE's Guide to Financing Energy Smart Schools. See www.eere.energy.gov