

Preliminary Evaluation of Energy Conservation Measures for the Denton Independent School District

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Executive Summary

The Denton Independent School District Board of Trustees requested an analysis of Energy Conservation Measures in the Energy Management Workshop held late last year.

Preliminary evaluations were performed on facilities, systems and applications where the measures would be best applied. Denton Municipal Electric and TXU Energy Services were consulted to ensure validity of potential incentives and buy-back assumptions.

Eight measures were evaluated. Geothermal was excluded in this evaluation as it is currently being implemented by the construction team.

Of the eight measures evaluated, four have attractive simple payback periods of less than six years and should be considered for implementation in existing facilities. They are; Lighting Improvements, HVAC Controls, Intelligent Irrigation Controls and Indoor Water Conservation.

One of the eight measures, Thermal Storage, also has attractive simple payback of 5.2 years, but would only apply to specific new or expanded facilities.

The three remaining measures have payback periods of 13.4 to 34.8 years and are not recommended at this time. They are Solar Heating, Solar Energy and Wind Energy.

Prior to moving forward with any of the measures, a detailed engineering study will be needed to validate this preliminary analysis and recommendations.

Preliminary Evaluation and Recommendation for Energy Conservation Measures
 Denton Independent School District

Energy Conservation Measure	Capital Investment	Utility Incentives & Grants	Net Investment	Annual Utility Savings	Annual Utility Repurchase	Annual Maintenance Savings	Total Savings	Simple Payback Years
HVAC Controls	\$ 95,000	\$ 2,500	\$ 92,500	\$ 13,500	n/a	\$ 3,150	\$ 16,650	5.6
Intelligent Irrigation Controls	\$ 145,000	n/a	\$ 145,000	\$ 25,900	n/a	n/a	\$ 25,900	5.6
Indoor Water Conservation	\$ 175,000	n/a	\$ 175,000	\$ 22,000	n/a	n/a	\$ 22,000	8.0
Lighting Upgrades	\$ 372,000	\$ 5,200	\$ 366,800	\$ 81,564	n/a	n/a	\$ 81,564	4.5
Solar Water Heating	\$ 310,000	\$ 110,000	\$ 200,000	\$ 14,875	n/a	n/a	\$ 14,875	13.4
Solar Energy	\$ 100,000	\$ 2,000	\$ 98,000	\$ 5,011	\$ 499	n/a	\$ 5,510	17.8
Thermal Storage	\$ 84,000	\$ 7,000	\$ 77,000	\$ 8,820	n/a	\$ 6,000	\$ 14,820	5.2
Wind Energy	\$ 540,000	\$ 10,000	\$ 530,000	\$ 31,200	\$ 5,034	\$ (21,000)	\$ 15,234	34.8

HVAC Controls

1. Several campuses in the district still utilize outdated control technologies with pneumatically driven valves, dampers, and actuators. This energy conservation measure focuses on upgrading the systems to direct driven control technology and eliminating the air compressors. This would reduce operations and maintenance costs on existing equipment and reduce energy consumption in those facilities.

The following facilities have been identified and used in this evaluation and recommendation:

Evers Elementary – Pneumatic air is not being used, but system has not been removed.

Hodge Elementary – Pneumatic air is being used for dampers and valve actuators for all AHU's.

McNair Elementary – Pneumatic air is being used for dampers and valve actuators for all AHU's.

Denton Municipal Electric will provide an incentive payment as removing the air compressors and dryers will reduce their load during peak periods.

Cost Estimate \$60,000

Utility Incentive Payment \$2,500

Annual Energy Savings \$7,000

Annual Maintenance Savings \$1,895

2. The evaporative cooling tower fans at Guyer High School should be retrofitted with Variable Speed Drives. This will save energy and reduce wear and tear on the fan drives, thus reducing operation and maintenance costs.

Cost Estimate \$35,000

Annual Energy Savings \$6,500

Annual Maintenance Savings \$1,255

Intelligent Irrigation Controls

The District currently uses electronic time based controllers to control the watering times for over a two thousand zones of outdoor irrigation. These controllers are located and programmed at each campus. Three years ago a method to provide centralized manual override was installed to disable watering during rainy days, however no automatic adjustments are made to watering times.

Intelligent Irrigation Controllers would automatically reduce watering times based on solar levels, outdoor air temperature (less evaporation) and internet based weather data. Programming and monitoring would be accomplished through the districts IT network by only authorized personnel. Local panels would be monitored, providing alerts for un-authorized or extended overrides. Underground irrigation lines would also be monitored for flow to detect leaks and other abnormalities.

The eight campuses not served by Denton Municipal Utilities were included in the preliminary evaluation and recommendation.

Cost Estimate \$145,000

Annual Utility Savings \$25,900

Indoor Water Conservation

This energy conservation measure is designed to reduce water consumption and wastewater production through the installation of low flow toilets, flush valves, faucets, faucet aerators, and manual control valves. The Energy Act of 1992 mandates the use of toilets which limit water use to 1.6 gallons per flush (gpf), showerheads that consume no more than 2.5 gallons per minute (gpm), and faucets that deliver less than or equal to 2.0 gallons per minute (gpm).

Existing high volume fixtures and faucets would be replaced with efficient commercial grade toilets and low flow flush valves, and the existing faucets would be retrofitted with low flow aerators. Foot-operated pedal valves would be installed in the kitchen areas to reduce water consumption and energy cost while providing improved sanitary conditions.

The following campuses were surveyed to provide this evaluation and recommendation: Calhoun Middle School, Denton High School and Ryan High School

Opportunities for water conservation were found at all three campuses, with the greatest opportunity being presented at Ryan High School. Portions of Denton High School and Calhoun Middle School have already been retrofitted with low flow devices through construction projects.

Cost Estimate \$175,000

Annual Utility Savings \$22,000

Lighting Upgrades

The district experienced a successful lighting retrofit project during the summer of 2008 at Denton High School, Ryan High School and several of the Elementary School Gymnasiums. Many other facilities still utilize older, inefficient lamps and ballasts.

This recommendation would consist of upgrading the old lamps and ballasts with new, high efficiency lamps and ballasts. This retrofit alone will save energy, but also reduce the demand on the HVAC system since less heat load will be distributed by the lighting system.

The electric utility provider will typically provide an incentive for implementing this measure as it reduces their load during peak periods.

The following facilities have been identified and used in this evaluation and recommendation:

Ann Windle, Calhoun MS, EP Rayzor ES, McMath MS, Pecan Creek ES, Rivera ES, Wilson ES & WS Ryan ES.

Cost Estimate \$372,000

Utility Incentive Payment \$5,200

Annual Energy Savings \$81,564

Solar Water Heating

This energy conservation measure is designed to reduce the cost of heating domestic hot water by using solar heat to supplement the gas water heaters. Solar heat collectors would be located on the roof of the building and a heat exchanger would be installed in the mechanical room to heat the water.

The financial estimate includes a Department of Energy Grant to supplement the capital cost of the equipment.

Guyer High School was considered for this analysis, however the application would be viable at any of your secondary schools, providing there was an acceptable location for the solar collectors.

Cost Estimate \$310,000
Grant \$110,000
Annual Energy Savings \$14,875

Solar Energy

This energy conservation measure generates electricity by using the sun. Photovoltaic solar cells would be located on the roof of a campus to capture the energy from the sun and supplement the electrical power to run the building.

At times when excess power was being generated, such as on weekends, DME would purchase the excess power generated at the same ECA rate as it charges Denton ISD, in other-words, zero-net metering. DME would also provide an incentive payment for this measure as it would reduce their load during peak periods.

Cost Estimate \$100,000
Utility Incentive Payment \$2,000
Annual Energy Savings \$5,011
Annual Energy Sales \$499

Thermal Storage

This application would utilize excess chiller plant capacity to generate low temperature ice during nights and weekends which would then be used (melted) to supplement cooling for the schools during occupied hours, rather than running additional chillers during peak electrical load conditions. This is a very standard application that has been prevalent in the marketplace for over twenty years.

The cost and savings analysis is based on purchasing only ice storage tanks instead of chiller capacity, a decision that would be incorporated with a building expansion at a campus which uses chilled water for cooling. Note, it is not a good stand-alone retrofit measure, rather would be applied to offset the high cost of owning and operating new chiller capacity.

The electric utility provider will share in the cost of this energy conservation measure as it reduces their load during their peak load periods.

Cost Estimate \$84,000
Utility Incentive Payment \$7,000
Annual Energy Savings \$8,820
Annual Maintenance Savings \$6,000

Wind Energy

Wind Power is the fastest growing source of electricity generation in the United States. With the continued development of the wind industry, federal and state incentives and rebates, and continued rise in fuel costs, small scale wind farms seem destined to become an even more viable option for an alternative energy source.

There are several factors to consider when evaluating the feasibility of a wind turbine as a renewable energy source. A few of the major items to consider include:

- Site specific wind conditions
- State and local zoning ordinances and issues
- Local interconnections and availability of power purchase agreements

Site Specific Wind Conditions - For the purposes of this report, the Advanced Technology Center was deemed to be the most appropriate site for the installation of a wind turbine and renewable energy option. From a preliminary perspective, its location, size of property, and facility use lead it to be one of the better alternatives. The wind resource is typically categorized in seven wind zones. Generally speaking, Denton is located in a Class 2 wind zone. No known published public data was available for the site specific location at the time of this report. The State Energy Conservation Office (SECO) states that Class 4 and above wind sites are considered good resources.

State and Local Zoning Ordinances and Issues - Many zoning ordinances in North Texas have eliminated the possibility of utilizing wind as a renewable energy source due to the danger of blade failure during operation. Environmental concerns such as the aesthetics, noise of the blades, and birds colliding with the rotors must also be considered through an environmental study during the development phase of the project.

The Advanced Technology Center is served by Denton Municipal Electric. DME has a favorable interconnection policy and would purchase the excess power generated by such a wind turbine at the same ECA rate as it charges Denton ISD, in other-words, zero-net metering. DME would also provide an incentive payment for this measure as it would reduce their load during peak periods. Regardless of the favorable posture of DME, the lack of wind quickly erodes the payback opportunity for this application.

Cost Estimate \$540,000
Utility Incentive Payment \$10,000
Annual Energy Savings \$31,200
Annual Energy Sales \$5,034
Annual Maintenance Cost \$21,000