Madeira City Schools
Planning Commission
"Energy Efficiency for Cost Savings" Study
February 12, 2009

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PURPOSE OF STUDY

The "Energy Efficiency for Cost Savings" Committee was formed at the request of the Madeira Schools' Board of Education (BOE) to answer the question: "What are the measures the district could take to further save energy and thus reduce our operational costs?" This is the third study on the topic of energy efficiency completed by the Madeira Schools' Planning Commission. The first study, "Energy Crisis Alternatives" was completed in 1975 (Appendix I) and the second study "Energy Conservation" (Appendix II) was completed in September, 1977. These reports were in response to the 1970's oil crisis.

To answer the BOE's question, the Committee began with assessing the District's performance by gathering data and establishing a baseline. The Committee determined that it would start with the School Year 2006-2007; the same year students, faculty, and staff took occupancy of the newly built Elementary School and Middle School buildings. The established baselines also reflect renovations to the High School that were completed in April 2006.

The Committee then asked the following questions:

1. How can we reduce energy consumption?
2. How can we improve operations and maintenance of the buildings?
3. How can we integrate the importance of energy conservation within the District's culture?

Findings of this Committee are to be presented to the Madeira Schools Planning Commission and the Madeira Schools Board of Education.

BACKGROUND

As school budgets are shrinking, costs for school operations keep growing. Nationally, utility costs rank second, behind salaries, as the biggest budget item confronting schools. Madeira School District is no exception (Attachment I). In 2007-2008, the District's utility costs grew 10.2%. In 2008-2009, utility costs for the District are anticipated to increase 13.3%. (Attachment II).

Market trends suggest that the demand for energy resources will rise dramatically over the next 25 years. Specifically,

- Global demand for all energy sources is forecast to grow by 57% over the next 25 years.
- U.S. demand for all types of energy is expected to increase by 31% within 25 years.
- By 2030, 56% of the world's energy use will be in Asia.
- Electricity demand in the U.S. will grow by at least 40% by 2032.
- New power generation equal to nearly 300 (1,000MW) power plants will be needed to meet electricity demand by 2030.
- Currently, 50% of U.S. electrical generation relies on coal, a fossil fuel; while 85% of U.S. greenhouse gas emissions result from energy-consuming activities supported by fossil fuels.

(DOE/EIA 2007)

Since 2003, price of natural gas has increased by 123%, the price of fuel oil has increased by 107%, and the price of electricity by 32% (NYSERDA 2008). Local energy prices are forecasted to climb approximately two percent of the total bill annually from 2009 thru 2011 (Attachment III). While this is reflective of the current downturn of the economy, long term rates will likely increase substantially reacting to weather, geo-political issues, production disruptions, fear, greed, demand, and supply. A 2006 report "Green America's Schools – Costs and Benefits" projects "average energy prices to slow to 5% per year, or 3% above inflation, over the next 20 years."

With the projection of higher utility costs, without additional funding, this would indicate less and less of the District's budget will be available to allocate towards educational resources.

METHODOLOGY

The committee conducted the following research:

1. Reviewed the history of the district's operating costs and utility usage.
2. Toured and reviewed the district's buildings with District's Director of Facilities & Maintenance.
3. Interviewed the building Principals and Athletic Director on facility usage.
4. Researched national, regional, and local energy efficiency practices.
5. Surveyed teachers and staff on energy practices.
6. Interviewed Industry experts (Larry Feist, Cincinnati State; LEED AP; Kevin Crapsey, Director of National Sales at Prenova; Brad Motz of Motz Engineering; Jeremy Chapman, Melink)
7. Participated in a Energy Management Webcast sponsored by School Dude.
8. Interviewed Steve Waldmann, Manager of School Business Affairs of Kings Local Schools and former Madeira Schools Assistant Superintendant, Paul Imhoff.

DEFINITIONS

For simple descriptions of some of the energy terminology used in this report see Attachment IV.

KEY FINDINGS

The Madeira School District operates three buildings totaling 260,000 square feet (sq. ft.) and serves 1,422 students. In 2004, the residents of the City of Madeira approved a bond to build a new 73,000 sq. ft. elementary school, a new 75,000 sq. ft. middle school, and to renovate the high school which increased the size to 112,000 sq. ft. All construction was completed in 2006 and students took occupancy of the new Madeira Elementary and Middle Schools buildings in the fall of 2006.

Madeira Elementary School (MES) & Madeira Middle School (MMS)

Energy efficiency was a big consideration in the design and construction of both new buildings. The MES and MMS buildings have identical HVAC systems, which are designed to be energy efficient. Other energy efficient systems installed in the buildings include:

- Gas fired boilers (two at each building) with variable speed fans and heat recovery wheels (at the time of construction, the lifetime costs of these systems was less than geothermal)
- Air cooled chiller with variable speed drive for air conditioning
- Insulated duct work
- Fully insulated hot water heater and pipes
- All heating and air conditioning is controlled by a Siemens digital energy management system, which can be adjusted on-site or remotely over the Internet. This system enables the Director of Facilities & Maintenance to control temperature for each room/zone, program temperature based on room/building usage, etc.
- Windows and doors were the most energy efficient available.
- Lighting is efficient T-8 florescent lighting and LED signage
- Maintenance for HVAC system was bid up-front with Dyer providing preventative maintenance
- Turner developed a 50 year plan for the buildings showing lifecycle costs of buildings and how to budget for replacements
- One item considered but not included in new buildings was sensors to turn off lights/control HVAC in each classroom. These units usually have a 5-10 year payback, but would be expensive to install with very small savings. Changing behavior to turn off lights can likely capture most available savings.

Madeira High School (MHS)

Madeira High School was originally constructed in 1958, with a major addition added in 1998 and renovations in 2005-2006. MHS has some areas for potential improvement and cost savings including:

- MHS is heated and cooled by a variety of systems, which are not very efficient compared to the new systems at MMS and MES
- The main boiler used to heat the older part of the building is one potential area for improvement
    - The boiler is not tied to the energy management system, therefore the temperature does not reset at night or vary to adjust when it is not fully utilized
    - The boiler could cycle on/off when needed in the Spring/Fall to improve efficiency
    - The boiler uses a compressor to run pneumatic thermostat / valves
    - The main boiler has capacity, but is not heating the whole building, which is inefficient
- The chiller installed in 1998, which is used to cool the commons building, is not very efficient. This unit is nearing the end its useful life. It could be replaced by a more comprehensive system in conjunction with the rooftop units (see below).
- During the renovation in 2005, 24 gas fired rooftop air conditioning units were installed as a temporary fix vs. to save costs vs. installing a more expensive central unit for the building
    - Each unit cools two rooms and is controlled by the digital energy management system
    - These units are not nearly as efficient as the central system installed at MES and MMS
    - The units have a 10 year life and will likely need replaced in the next 5-7 years
- A geothermal system should be evaluated when the chiller and rooftop units need replaced. New advances in geothermal have reduced the installation costs and payback period for the systems. (See further explanation below).
- New windows were installed in the commons area in 1998. While they are not the most efficient windows, it is not cost effective to replace them to gain energy savings
- Unlike MES and MMS, the ventilation, pipes and hot water tank are not insulated. Insulating the hot water tank is inexpensive and can reduce energy consumption
- While most lighting has been converted to more efficient T-8 tube florescent lighting, the actual wiring design is not conducive to selectively turning on/off lights, which would lead to energy savings.
- The new lights recently installed in the main gym are very efficient and allow for lights to be on 1/3, 2/3 or full lighting. The lights in the auxiliary gym are older Metal Halide High Bay lights and are not very efficient compared to newer alternatives like what was installed in the main gym. High Output Fluorescent High Bay lights can save over $50/year per light fixture over Metal Halide lights.
- Vending machines do not turn off at night or for other periods of low usage. The cost to operate a vending machine is $250 - $350 per year. Vendors can be asked to install timers, (a.k.a. vending misers) which can save 47% of energy costs.
  (Interviews with Jeff Smith (Director of Facilities & Maintenance), Paul Imhoff (former Assistant Superintendent) and Brad Motz (Motz Engineering, Engineer for new buildings, 2008))

Facility Usage

School Year

"Madeira School District operates under a traditional calendar with students utilizing the school buildings 180 days on an average 6.5 hrs/day." School starts around mid-August and ends around Memorial Day. "There is a winter break of two weeks, a week long spring break, and occasional days when the District is closed for a variety of reasons. The summer break is lengthy, typically 75-90 days" (MSPC Report "Balanced School Year" 2007).

Beyond the basic academic day, the school buildings host a variety of activities before/after school and on the weekends. (Attachment V).

The building temperatures and start/stop times are controlled by an operating control system, Siemens Insight v 3.9, with exception in a few areas in the MHS. (The media center, guidance office, board office, commons building, and the gym have individual thermostats located in the areas. Siemens only controls the start/stop function of these thermostats. These controls are not regulated.) Prior to November 2008, the buildings were cooled to an average temperature of 73°F, and heated to an average temperature of

71°F. During unoccupied times, the temperatures are set for 63°F for the MES and MMS, and 60°F for the MHS (both the rooftop units and set thermostats). The Ohio Administrative Code – School Safety provides guidelines for acceptable temperature ranges and relative humidity levels for schools (Attachment VI).

Currently, the buildings/areas are heated during the following times:

School		Programmed Temp.	Heating Hours	Days
MES	All Classrooms	70°F	7:15 a.m.-5:00 p.m.	M-F
	Gym	70°F	6:00 a.m. –8:00 p.m. 6:00 a.m. – 3:30 p.m. 10:00 a.m. – 3:30 p.m.	M-F Sat Sun
MMS	All Classrooms	70°F	6:30 a.m. –4:00 p.m.	M-F
	Gym	70°F	6:40 a.m. –8:30 p.m.	Sun-Sat
MHS	All Classrooms	70°F	4:00 a.m. –3:30 p.m.	M-F
	Gym	70°F	4:00 a.m.–10:00 p.m.	Sun-Sat
	Band	70°F	5:00 a.m. – 5:00 p.m.	M-F
	Cafeteria	70°F	4:30 a.m. – 4:00 p.m.	M-F
	Computer Room	70°F	5:00 a.m. – 9:00 p.m.	Sun - Sat
	Media Center	Varies 76°F	5:00 a.m. – 4:00 p.m.	M-F
	Science	70°F	5:00 a.m.-3:30 p.m.	M-F
	Board Office	70°F	4:00 a.m. 6:00 p.m.	M-F

Programmed versus actual temperatures for the various areas can be reviewed in Appendix III. The appendix provides a snapshot of the buildings/rooms on Thursday, January 22, 2009, at approximately noon. The outside temperature was ~42°F. Classroom temperatures on average were within +/- .5°F with exceptions of the areas at the HS controlled by individual thermostats. All three school gymnasiums averaged a temperature of 71.25°F.

It would appear, after reviewing the building occupancy times and comparing it to the heating hours, there are many opportunities here to reduce energy consumption and reduce the District's gas costs. Gaining an understanding of how long it takes to bring a room up to the desired temperature would assist the Director of Facilities & Maintenance in better scheduling start times. By comparison, the Kings Local School District begins heating 30-45 minutes prior to occupancy (Waldmann 2009). In addition, reviewing weekend start/stop times, consolidating events within a zone or school, and during non-occupied times, restrict pulling in outside air during the warm-up process would assist in reducing gas consumption. Cooling start/stop times should be reviewed with the same diligence to reduce electrical costs.

Currently, the District does not have a formal process to request rooms to be heated/cooled for events scheduled during unoccupied set times. Typically, the Director of Facility & Maintenance receives phone calls, emails, or a copy of the Facility Usage form notifying him of the event from various individuals. Changes can be made from any of the Districts' school buildings or from the Director of Facilities & Maintenance's home via the internet.

Summer Usage

The District hosts a variety of events throughout the summer. The Athletic Director approves the requests. Currently, the District uses all three buildings to host sports camps, band camp, drama camp, open gyms, weight training/conditioning and individual rentals. Camp durations vary between 1-2 weeks. The MES building also hosts a summer program for K-5 from Monday-Friday from 7:30 a.m. -5:30 p.m. Opportunities to coordinate building usage for sports/band camps should be examined to maximize buildings/areas already cooled. The MES should try and minimize electrical consumption thru zoning and minimizing electrical consumption after 11:00 a.m.

In terms of the District's electrical costs, reducing consumption during this timeframe is critical because Duke Energy begins reviewing the District's load management by building which sets each building's peak demand for the next 12 months. This is described in further detail in the section labeled: *Understanding Utility Costs.*

Staff/Teacher Survey

In December 2008, the Energy Efficiency Committee requested teachers and staff to participate in a 10-question Energy Efficiency Survey. One hundred staff and teachers (~50%) completed the survey. This online survey collected information on current energy efficiency actions taken by the staff while in a Madeira City School building. This information combined with the U.S. Department of Energy's assessment of a school district's ability to save 10 – 15% truly points to our need to change behaviors and increase our district's energy awareness. A 10% reduction is equivalent to about $15/student/year. With 1,422 students, the District could potentially save $21,330 (SchoolDude 2008).

Survey results revealed the majority of the staff are currently turning off computers (97%), lights (94.9%), and projectors (58.6%) when they leave for the day; turning off lights (84.5%) and projectors (59.2%) when they leave the room for more than 5 minutes; have the computer in sleep mode after 15 minutes or less (59%); and reducing, reusing and recycling items (85%). See Attachment VII for survey details.

The survey also sought out items or actions that staff would support or be a part of. Staff are supportive of encouraging students to dress according to the weather (84%); getting power strips to plug in various electronic devices to make one switch turn-offs (68%); having a district-wide Earth Day celebration (67%); lowering the thermostats 1-2 degrees if given advance warning (60%); reducing the hot water temperature (58%); and reduce copying by reusing readings or other items students do not need to keep (55%).

Current Energy Curriculum/Student Activities

In addition to the current energy actions highlighted in the staff survey, the committee reviewed the current energy curriculum and student activities within the District. While there are not any energy/environmental clubs for students to participate in, the District supports a student-driven recycling program in all three buildings (computer paper, mixed paper, brown grocery bags, cardboard boxes, envelopes, magazines, newspapers, paperboard, telephone books, and junk mail). Students are responsible for collecting and disposing of the recycled paper in the appropriate dumpsters. Some grades have Earth Day activities and tie in environmental readings. While not a student activity, the Technology Department sends reminders through their newsletter and constantly checks computer efficiency.

Grade levels also teach the following current energy/environment curriculum:

Grade Level	Current Curriculum
All Grades	All grades ask probing questions, challenge scientific observations, and use real world experiences to tie together concepts for best understanding and for students to care about our world
Kindergarten	Respecting the environment
1st Grade	Resources are limited but the supply can be extended through careful use, decreased use, reusing and/or recycling; saving energy
3rd Grade	Non-renewable resources are limited and can be extended through reducing, reusing and recycling
5th Grade	Investigate renewable resources and the positive and negative impacts of human activity and technology on the environment
7th Grade	How overpopulation impacts the environment, depletion and pollution of natural resources, extinction due to habitat change or loss, usage, conservation, and depletion of renewable and non-renewable resources, alternative forms of energy, using technology to help manage resources, human decisions make environmental and economic decisions compete, reduce, reuse, recycle and where does all the waste go
9th Grade	Environmental issues
10th Grade	Acquisition and use of resources, urban growth and waste disposal can accelerate natural change and impact the quality of life, human activity can alter biogeochemical cycles as well as food webs and energy pyramids, human activities can deliberately or inadvertently alter the equilibrium in ecosystems
High School	Looking to offer an Environmental Science college prep class, currently students can take AP Environmental Science as an independent study by special request

District Energy/Utilities Annual Usage

"Kindergarten through high school (K-12) buildings in the U.S. use an average of 10 kWh of electricity and 50 cubic feet of natural gas per square foot (ft^2) annually" (Commercial Energy Advisor 2008). By comparison, the District uses:

Electricity

School	Sq Ft.	U.S. Average kWh Usage	Actual kWh 2006-2007	Actual kWh 2007-2008	Actual *YTD kWh 2008-2009*
Elementary	73,000	730,000	1,020,071	1,020,582	472,623
Middle	75,000	750,000	941,808	932,493	448,298
High	112,000	1,120,000	1,074,892	1,104,568	547,510

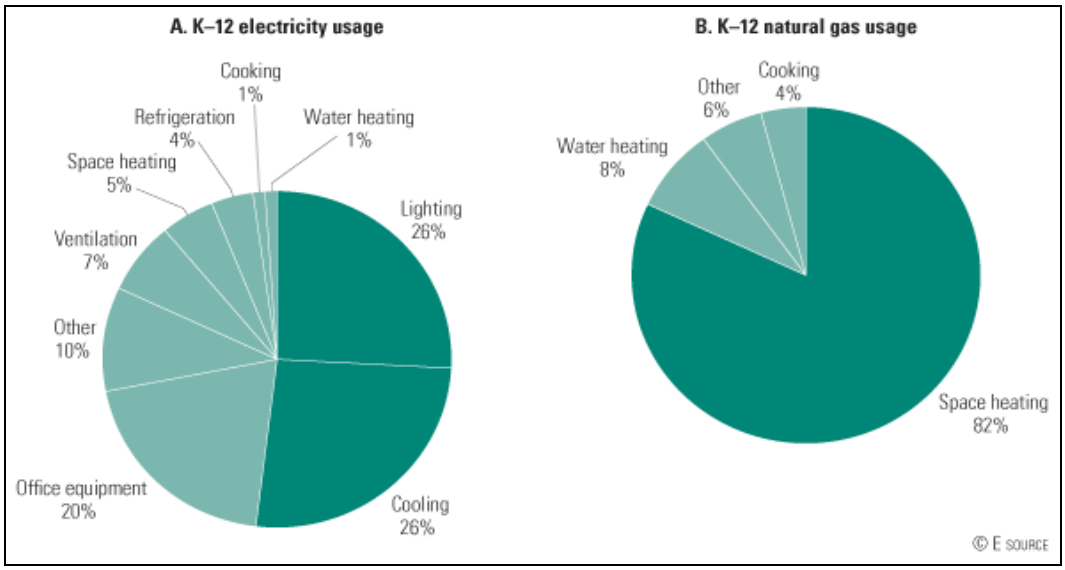
* YTD – June 2008-Dec 2008

Gas

School	Sq Ft.	U.S. Average CCF Usage	Actual CCF 2006-2007	Actual CCF 2007-2008	Actual *YTD CCF 2008-2009*
Elementary	73,000	36,500	43,477	44,825	14,709
Middle	75,000	37,500	35,462	40,155	13,689
High	112,000	56,000	45,369	50,563	15,447

* YTD – June 2008-Dec 2008

"In a typical school building, space heating, cooling, and lighting together account for nearly 70 percent of school energy use (See graphs below). Plug loads, such as computers and copiers, constitute one of the top three electricity end uses, after lighting and cooling" (Commercial Energy Advisor 2008). The District currently does not track individual plug loads, however, devices such as "Kill-A-Watt" electricity usage monitors can be purchased and installed in classrooms to measure consumption by the kilowatt-hour. These devices would not only raise awareness but it can be used as a teaching tool in science, and math.



Data from the U.S. Energy Information Administration show that lighting and cooling account for 52 percent of electricity use and that space heating accounts for 82 percent of natural gas use.

District Energy/Utilities Costs

The Ohio Schools Facility Commission estimates that in 2006, an Ohio school district could expect to pay between $1.50 and $1.75 per square foot in utility costs for a new building that did not use geoexchange systems" (OSFC 2006). By comparison, the District paid:

School	Sq Ft.	Actual 2006-2007	Actual 2007-2008	Appropriated 2008-2009*
Elementary	73,000	$2.01	$2.41	$2.73
Middle	75,000	$2.02	$1.99	$2.25
High	112,000	$1.41	$1.60	$1.81

Note: 2006-2007 figures do NOT include Milford costs.
Note: OSFC does not have more current data available for cost per square foot.

In 2007-2008, the District's energy use is 69% electricity and 31% natural gas. Locally, by comparison, in 2007-2008, Kings Local School District used 67% and 33% respectively (Waldmann 2009). Nationally the average school energy use is 63% and 34% respectively (Kats 2006).

Understanding Utility Costs

Gas

"In order to better manage the District's energy costs, it helps to understand how the District is charged for those costs. Most utilities charge commercial buildings for their natural gas based on the amount of energy delivered." In December 2006, the District joined a consortium of over 90 school districts, and now purchases gas on the open market from EnergyUSA-TCP. This allows the District to purchase gas at competitive prices and below the cost of equivalent volume from the regulated utility company. Two benefits of this agreement: 1) it allows the District to stabilize gas costs over a period of years and 2) the District can make sound financial projections with the budget.

Electricity

Electricity, on the other hand, can be charged based on two measures: consumption and demand. The consumption component of the bill is based on the amount of electricity in kWh that the building consumes during a month. The demand component is the peak demand (in kilowatts) occurring within the month or, for some utilities, during the previous 12 months. For the District, this is calculated by reviewing the May meter read – September meter read. Simply put, whichever month is highest in that timeframe, that determines the maximum actual demand (kW) for the following 12 months (Waldmann 2009). If the District's buildings do not utilize all their "reserved" kW, they will be billed a percentage of that previous maximum actual demand. For example: In October 2008, the following buildings were billed for a different consumption of kW rather than what was the actual usage. The chart below illustrates how the maximum demand determined to be September 2008, will now determine what is billed for the next 12 months.

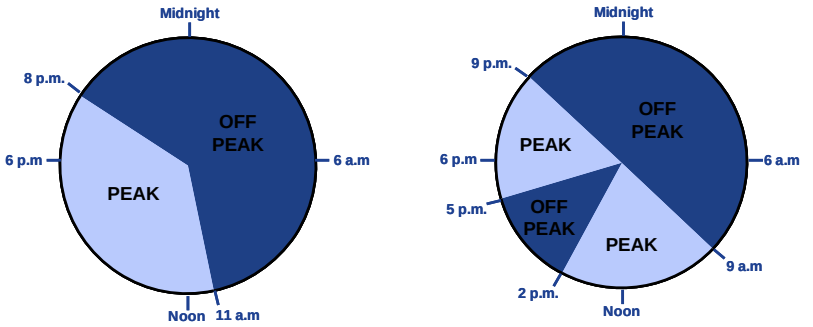
Electricity

School	Maximum kW Actual Demand Billed in Sept 08	Actual kW Sept 16 – Oct 15 2008	Billed kW Sept 16-Oct 15 2008 85% of Previous Maximum Actual Demand	Difference kW for the billing cycle
Elementary	480.70	384.4	408.60	24.20
Middle	441.80	353.1	375.53	22.43
High	433.00	353.8	368.05	14.25

Demand charges can range from a few dollars per kilowatt-month to upwards of $15 per kilowatt-month. Because it can be a considerable percentage of the utility bill, the District should be diligent to reduce peak demand during the four month review process. The chart below shows peak and off-peak periods.

Peak and Off-Peak Periods

Load Management Rider For Customers with Interval Meters
OHIO and KENTUCKY



Summer Season
(May Meter Read – September Meter Read)
Weekday Only

Winter Season
(September Meter Read – May Meter Read)
Weekday Only

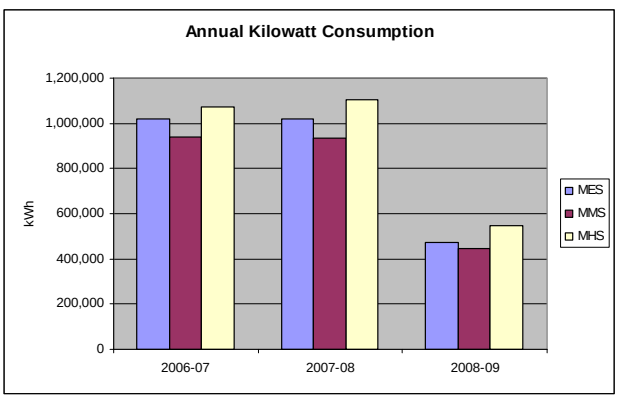
Saturdays, Sundays, and Specified Legal Holidays are Off-Peak Periods

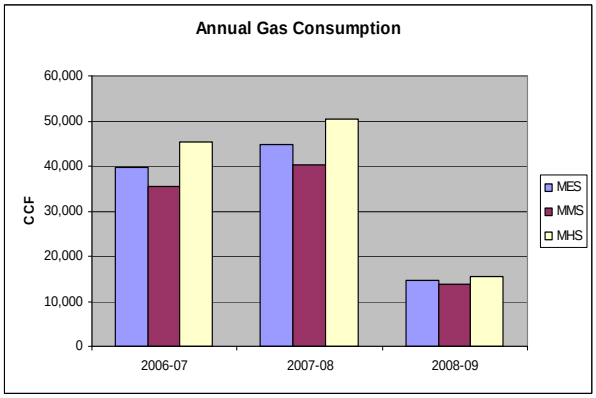
Source: Duke Energy

Currently, the District receives two bills for MHS – one monthly bill from Direct Energy for consumption, and a separate bill from Duke Energy for demand. (Duke also assesses taxes and miscellaneous charges.) MES and MMS only receive one bill from Duke. It is unclear at the time of the report, why the MES and the MMS buildings are not a participant in Direct Energy's program. The original contract indicates that all three buildings should have been set-up as participants in the Direct Energy program. Like with the District's gas provider, Direct Energy also allows the District to purchase electricity at lower rates. However, according to Steve Waldmann, Business Manager of Kings Local School District, this may not always be the case. Kings does not purchase their electricity thru Direct Energy because they found Duke Energy to be less expensive. For more details regarding Duke's billing visit: http://www.duke-energy.com/pdfs/Schedule_G.pdf.

Understanding Consumption

Currently, the District does not track energy usage or gather heating and cooling day's data. However, the committee collected data from July 2006 thru December 2008 from the District's utility bills. (Appendix IV is a copy of the November 2008 bills). From this data, the committee was able to establish an energy baseline for 2006-2007, 2007-2008, and begin collecting the data for 2008-2009 for comparison (Attachments VIII, IX, X). This data will allow the District to begin to compare the energy performance of the District's facilities to each other, and other local schools, and then prioritize which facilities to focus on for improvements. Below is the District's annual kWh and CCF consumption by building. Note: 2008-09 is for the period June 2008-December 2008.





Note: During the 2006-2007 school year versus the 2007-2008 school year we had a 3% decrease in heating degree days (HDD) and a 20% increase in cooling degree days (CDD) (Waldmann 2008). See Attachment XI for history of HDD and CDD for 2006, 2007, and 2008.

Understanding the District's energy consumption in a given month can also help in the effort to control costs. This information combined with tracking heating and cooling days using NOAA's website http://www.weather.gov/climate/xmacis.php?wfo=iln will help put this data into perspective (Attachment XII and XIII for Monthly Electric Consumption and Monthly Gas Consumption by building). Note: 2006-2007 usage numbers for MES and MMS for the months of July, and August do not reflect the District's typical usage. The schools were in the final stages of construction. Also, it should be noted that there was a difference in the school start dates between the years of 2006-2007 and 2007-2008. In 2006, school started after Labor Day, and in 2007, school started mid-August. A difference of 3 weeks.

Consumption vs. Cost Assessment

While the committee has attempted to assess and evaluate the performance of the District, with regards to consumption to cost, the committee recognizes that there is no standard for comparison – the market fluctuates month to month. The only true standard for comparison is consumption. An energy audit could provide the District with an analytical assessment by experts in this field, help answer technical questions, and identify opportunities for enhanced efficiencies. While the price of energy is not something the District can control, it's important to recognize that the District can control their consumption. Professional staff development in energy management should be examined for key individuals.

How can we reduce energy consumption?

"Tight school budgets make low- or no-cost energy expenditure reductions especially important. Many schools can achieve energy savings of up to 25% through behavioral and operational changes" (Commercial Energy Advisor 2008). *This would equate to the District saving up to $142,825.*

No Cost / Low Cost Opportunities

Low-cost and no-cost options were investigated through on-line research and talking with subject experts Larry Feist and Ralf Wells of Cincinnati State. A consolidated list of savings opportunities was created (Attachment XV) and an approximation of how well we are doing on each item was assessed by Jeff Smith and the subcommittee. From this list we selected these top (high return and room for improvement) ideas to recommend for implementation:

1. Turn off lights in unoccupied rooms
2. Add automatic lighting controls
3. Use minimal hallway lighting in off hours
4. Turn off printers and peripherals when not in use
5. Turn off/reduce hot water heating at night/low usage periods
6. Remove space heaters and other heating or refrigeration equipment from classrooms
7. Adjust indoor temperature to 68 in winter and 76 in summer
8. Install energy control "misers" on vending machines (from Vendors)
9. Track energy usage for creating baseline and measuring progress
10. Consolidate after hours activities to one school or one area in the school
11. Send parent letter encouraging students to dress appropriately for the weather
12. Conduct energy audits/energy self checks

How can we improve operations and maintenance of the buildings?

The following are some areas that should be considered in the future when operating systems need replaced or grant money/other funding becomes available to invest in new efficient systems

Example of a
Geothermal well field.

Geothermal

A geothermal system should be considered for the high school when the chiller and/or rooftop units need replaced. Geothermal systems tap into the constant ground temperature of 55°F to draw heat in the winter and cool in the summer. Geothermal systems have many benefits, including:

- Savings of 30% or more in energy consumption than other systems
- Yields the lowest life-cycle cost due to energy consumption and longer life of equipment
- Has a long equipment life - Bore field is 50 years
- Requires less maintenance than other systems and has reduced emissions
- Allows for a smaller mechanical room

Solar

Use of solar power for schools is not as advanced as geothermal. There is not an immediate financial payback for solar in schools due to the high installation cost and amount of electricity a panel array can produce. However, a number of schools, including Indian Hill Primary, have installed solar panels as a teaching tool. Grants and other funding can be found to help pay for the purchase and installation of the solar panels. Additional funding/incentives may be made available through the economic incentive package currently being debated in congress.

- Contact Glen Kizer of the Foundation for Environmental Education at 614-336-0776 for information regarding the process of installing a solar photovoltaic array.

Large Fans

Utilizing fans for air movement can reduce both heating and cooling costs in large, open areas such as the gyms, cafeterias, etc. Kings Local Schools is utilizing such a fan in an auditorium to reduce heating/cooling needs.

- A company in Lexington sells large fans for commercial and industrial space and will provide free estimates of costs and savings (877-BIG-FANS)
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Source: Larry Feist, Cincinnati State, Steve Waldmann, Business Manager of Kings Local Schools, Jeremy Chapman, LEED Consultant with Melink, and research regarding energy efficient schools.

Options for Financing Energy Efficiency Efforts

Choosing a high performance path can open up new financing options that would not be available otherwise, and raise community support. Here is a list of some resources that provide information about alternative financing options for the District

1. "The Guide to Financing EnergySmart Schools" details the process of financing energy efficient school renovations, retrofits or new construction. See http://www1.eere.energy.gov/buildings/energysmartschools/financing_guide.html.
2. "Innovative Financing Solutions: Finding Money for Your Energy Efficiency Projects" covers the topics of understanding performance contracts and tax-exempt lease-purchase agreements. See http://www.energystar.gov/ia/business/COO-CFO_Paper_final.pdf .
3. "Financing Energy Efficiency Projects" is another article that provides information on energy services performance contracts, tax-exempt lease-purchase agreements, and analysis on getting the best deal. See http://www.energystar.gov/ia/business/government/Financial_Energy_Efficiency_Projects.pdf .
4. House Bill 264 – The State of Ohio "The Energy Conservation Program allows school districts to make energy efficiency improvements to their buildings and use the cost savings to pay for those

improvements. This gives districts the ability to borrow funds without having to pass a ballot issue for the authority to borrow. This limited borrowing authority has given districts the ability to save millions in utility bills and operating costs, and all at no additional taxpayer expense. Since the inception of the program, more than 500 Ohio school districts have taken advantage of this opportunity, including Kings Local Schools." See http://www.osfc.state.oh.us/programs/energy.html.

How can we integrate the importance of energy conservation within the District's culture?
The true way to integrate student, staff, and community energy conservation is to improve everyday behaviors, creating an overall culture change. Service learning projects such as celebrating Earth Day and researching and implementing energy conservation measures heightens awareness of the surrounding environment and the energy used every day. Bringing Madeira students and the community into the world-wide campaign to protect our global environment will offer positive behavior changes as well as allowing our students to extend their thinking and actions into the 21st Century. In addition to positive changes, the district will also see financial improvements with less money being used to run facilities allowing more funds to be used towards educational pursuits.

By forming an energy team to create ideas and resources to be implemented through the district, they can encourage and maintain behavior changes towards a more energy efficient culture. Ideally, this team should consist of administrators/teachers from all three buildings, some community members, an administrative overseer, and a consultant from Hamilton County Department of Environmental Services. This sub-committee should focus on:

- Promoting an efficient communication process as to how best to market and follow through with school and community-wide efforts (e.g. newsletter or website)
- Creating a district-wide Earth Day celebration and an Energy Conservation Day to allow students to find ways to reduce energy consumption
- Maintaining and expanding recycling
- Implementing cafeteria waste minimization and composting program
- Researching energy conservation lesson plans to tie into current curriculum
- Recommendations for students, staff, and the community to help change behaviors towards a more energy efficient way
- Creating student energy patrols to help create activities that are kid-appropriate and help share energy efficient ideas
- Researching grants and government funding to further energy efficiency

Attachment XVI provides additional ideas of energy saving activities for schools.

OTHER KEY FINDINGS FOR COST SAVINGS

4-Day School Week
"With strapped state budgets and alluring promises of significant reductions in overhead and transportation costs, the four-day school week has been an increasingly attractive option for schools seeking to cut education costs. According to the National School Boards Association (NSBA), a handful of states, with mostly rural school districts, are experimenting with altering their school calendar. For small, remote school districts, instituting a four-day school week may provide considerable savings by reducing transportation, heating, and other overhead costs." Currently, one out of 7 schools are considering going to a 4-day school week as an option. "Supporters of the shortened week also boast of improved morale and increased attendance (by both students and teachers), open Fridays for sporting events and doctor appointments, and more time to spend with loved ones. Opponents of the four-day school week cite problems with long, exhausting class days and finding day care for children whose parents work outside the home. Additionally, educational experts worry that increased time outside of the classroom could lead to a digression in learned concepts while also making it more difficult to offer elective classes. However, the jury is still out, as there is a lack of comprehensive studies" (NCSL 2009) See http://www.ncsl.org/programs/educ/4DaySchWeek.htm for additional articles on this topic.

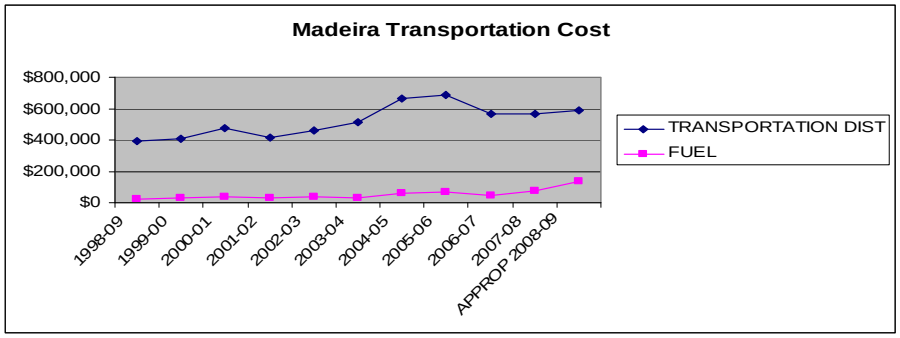
Transportation

Peterman Transportation details that the rider ship rate, 1.05, for the Madeira buses is good and the current bus size is appropriate with the passenger count. Routes are adjusted each year to maximize rider count per bus and reduce route length. Those routes are approved by the School Board. State reimbursement rules are being redrawn. Madeira should be cognizant of these adjustments. Scheduled and mandated maintenance, which leads to fuel efficiency, and safety checks are in compliance with state requirements. Idle times and warm up times are under guidelines as is bus shut down for initial and final loading.

New buses are introduced into the system per contract with the school. National purchasing power for new buses and replacement parts has helped hold down annual operating costs. Propane and natural gas energized busses are not in Peterman's future but they are going to explore hybrids. Madeira should ask to participate in those trials. Current diesel engines are being replaced with a 'greener' design. This, with the new seat belt law requirements, will make new buses approximately $10,000 more each when newly purchased.

Peterman believes there is opportunity for cost and energy savings in the bus and fuel usage for after school activities. These are highest in the fall and spring. Winter rider ship is fairly constant before and after school. They believe a detailed study would be appropriate for consolidating activities which better serves energy consumption and driver cost. Energy and cost reductions could be found by negotiating out the need for transportation of those type four and six riders.

The increase in fuel cost over the last two years has been extremely high. These increases may be recoverable in the pay to participate fees or in a 'surcharged' manner.



Custodial

Scarlet and Grey Custodial Services have been retained by the Madeira Schools for many years. Their service is deemed more than satisfactory. Their use of energy is also un-metered and paid for by the school district. The personnel recognize their responsibility of being energy policemen and that lighting is one of the largest energy costs. Energy saving practices are in place, i.e., working as many hours in daylight without the use of lighting, cold water mopping, and vacuuming rather than dusting. They recommend vigilance on keeping the dirt outside the building with more efficient floor mats at entry areas and clean drop off zones and parking lots. When lighting is necessary, they should explore the use of mobile lighting.

Food Service

The District contracts its lunch sales and preparation to the Milford School Food Services. The energy needed to perform the service is paid for by the District and are un-metered quantities. Best energy efficient practices have been studied and are in place. This, however, may be at the sacrifice of 'green' practices, i.e., throwaway consumables. "Fast foods" and snack items that stay within state guidelines are seldom offered. While these items take less energy to prepare and would increase sales, they are not considered in the best interest of the student's diet. Much of the HS equipment is aged and should be replaced, when necessary, with energy star rated appliances. For this outsourced service to continue to service the District it needs to be profitable for Milford School Food Service. Staff needs to monitor this concern.

Landscape
Brickman Lawn and Landscape's energy usage is strictly fuel needed for operation of its landscaping equipment. The reduction in a meaningful amount of fuel cost is disproportionate with the operational measures that would be dropped to achieve the fuel reduction. The company follows the requirements spelled out in their contract with the schools. Those requirements are appropriate for the desire to keep our new schools looking their visual best. There are opportunities for ground cover and garden areas where annual care costs, and therefore energy costs, would be reduced. Also, there are a limited number of opportunities to place deciduous and evergreen trees to both shade and open up to warmth during specific seasons. Brickman could provide the drawings for placement of the gardens, cover and trees, and the school could find the avenues for funding via memorial gifts or donations. This effort could be made part of an Earth Day or week.

CONCLUSIONS

The U.S. Department of Energy estimates that K-12 schools spend $8.5 billion annually on energy costs. This accounts for more than books and computers combined (School Dude 2008). While there are many misconceptions in regards to energy efficiency (Attachment XVII, Appendix V), implementing energy conservation at Madeira can be inexpensive or free. The key is understanding that energy consumption is a controllable operating expense (Waldmann 2007). Energy costs are one of the few expenses Madeira School District can reduce without affecting its educational mission.

After conducting a general audit of the Madeira School District, the committee has identified several areas for improvement:

A. **Awareness** – Currently, the District does not have an Energy Awareness Campaign or program. Involving and educating stakeholders in reducing energy usage is vital to the Districts success.
B. **Behavioral Changes** – While the Energy Efficiency survey provided details on behaviors that teachers and staff are doing well, there is still room for improvements in many areas including but not limited to: turning off lights, programming computers to go into "sleep mode", unplug chargers to reduce phantom use, and encouraging students/staff to dress appropriately for the weather.
C. **Consumption** – Reducing costs ultimately means reducing consumption. (If prices are stable.) The District has several opportunities to reduce consumption that can be addressed immediately: changing the start warm-up times to 30-45 minutes prior to occupancy, adjusting weekend occupancy start/stop times, lowering gymnasium temperatures, lowering classroom temperatures, and consolidate evening/weekend activities to spaces appropriate to groups size/needs. Additional ideas for reducing consumption involve long-term behavioral changes, and no cost/low costs ideas that are listed in Attachment XVI.

These are the District's ABC's for an energy conservation program; however without "D" – the dedication from the BOE to follow through, very little results can/will be achieved. Research has shown that a successful program must start from the top.

Getting Started
First, the BOE must be dedicated and make a commitment to continuous improvement in energy management. To be successful, the Energy Management Program should be visible to administration, board, and staff; save money, set goals (measurable objectives), be tweaked over time (goals reviewed and updated), use external support (energy consortiums, local municipalities), and provide guidelines for operations and maintenance (School Dude 2008).

The benefits of an Energy Management Program can:

- Control rising costs.
- Provide the District with more dollars that can be used towards education.
- Save the District an estimated 25% of energy costs by energy efficiency.

- Present a positive public image of economy and good stewardship.
- Reduce the District's fossil fuel usage, and lowers emissions.
- Model positive behavior for students.
- Increase community awareness on energy efficiency and conservation.
- Build a systems approach to energy management that can easily be transferred to other sustainability issues facing school districts, such as solid waste, transportation and water usage," (Department of Energy 2008, School Dude 2008, Energy Star 2008, KPPC 2008).

Last but not least, focusing on improving the energy efficiency of the District can serve as a key learning tool for students in terms of science, math, the environment, and social and fiscal responsibility (Energy Star website).

STRATEGIC RECOMMENDATIONS

Rather than re-create the wheel, the committee recommends following the seven-step Energy Star Energy Management Process. Below are suggestions from their website that have been tailored by the committee for the District:

- **Form an Energy Team** –BOE members, Administration, Building Principals, Teachers, Students
- **Establish/Institute an Energy Policy**
  - Establish policy on classroom/gym temperatures for heating/cooling temperatures during occupied hours and non-occupied times. Recommended heating temperature set point: 68°F during occupancy. Recommended cooling temperature set point: 76°F during occupancy. (See Attachment VI for Acceptable Temperatures from the OAC.)
  - Coordinate facility usage for buildings and/or rooms (Ex: Summer, Evening Events)
  - Establish a policy on personal appliances.
  - Limit school purchases to energy efficient equipment for office and school use – look for the Energy Star rating
  - Use the 5-stage approach in EPA's Building Upgrade Manual as building upgrades are needed. This online handbook offers guidance for each stage, from commissioning to plant upgrades. www.energystar.gov/bldgmanual . Specifically:
    - Evaluate cost/benefit of automating the main boiler/pump for improved efficiency (it is not on the energy management system, does not reduce temperature at night, does not cycle on/off in Spring/Fall, etc.)
    - Evaluate HS Food Service Equipment
- **Continue Assessing Performance**
  - Continue Tracking Energy Usage using the spreadsheet started by the Committee
  - Continue Tracking Heating and Cooling Days using NOAA's website
  - Conduct a Facility and Energy Audit
    - Use either an Energy Consultant, or hire a student to co-op from Cincinnati State Renewable Energy Program
  - Begin Assessing Water Usage
  - Begin Tracking Reduction of Carbon Footprint
- **Set Goals**
  - Reduce Consumption by 10% in 2009-2010.
    - Focus on summer season consumption between May 16-September 15
    - Keep Power Factor above 90% (Waldmann 2009)
  - Utilize US EPA Energy Star Portfolio Manager Online tool to track, assess and benchmark energy and water consumption. This free online tool enables the district to enter energy consumption data and to track progress as well and benchmark usage against other like K-12 school buildings. The committee has registered the District on the website and entered in the historical data to begin tracking the District's energy consumption and prioritize investment opportunities (Attachment XVIII).
- **Create Action Plan** - to ensure a systematic process to implement Tactical Recommendations

TACTICAL RECOMMENDATIONS

Below are recommendations that would have a direct impact on reducing consumption within the District

No Cost Recommendations

- Adjust thermostat settings (both temperatures/review timing) using guidelines from District's Energy Policy
- Use 1/2 hallway lighting during non-school hours and during cleaning.
- Turn off lighting and computers when not in rooms
- Remove all unapproved personal appliances from classrooms.
- Get everyone into the act - Implement energy awareness programs to encourage school staff, faculty and students to change their energy behavior and adopt permanent energy-saving habits for school and at home.
- Send parent letter encouraging students to dress appropriately for the weather.
- Review the rates assigned to each meter, to make sure the District is being charged accurately.
- Clarify relationship with Direct Energy for the ES and MS. Should the buildings be included?

Low Cost Recommendation

- Install lighting control motion sensors in break rooms, copy rooms, auditorium, supply rooms
- Install vending misers on vending machines.
- Install thermostat covers with locks in the areas not controlled by the Siemens program.
- Purchase/ Install plug-load control smart power strips for classrooms to minimize phantom usage.
- Evaluate rewiring areas of the MHS lighting to make it more conducive to selectively turning off lights. (Rewiring some of the MES and MMS lighting should also be evaluated to determining if the investment is worth the potential energy savings.)
- Insulate Hot Water Tank off of the main gym at the HS with an insulation blanket
- Install low-e glazing (tinting) on HS Life Skills room's window to control indirect solar heat. Professional installation can cost up to $35/square foot. However, there are do-it-yourself solutions for less than $5/square foot. Total cost would be close to $3,000 for professional installation and $500 for do-it-yourself solutions.
- Purchase kilowatt energy consumption monitors for some classrooms. (Can be shared/rotated thru building.)
- Evaluate installing a timer on the hot water heater in MHS to lower temperature at night then heat it back up in the morning
- Allow opportunities for professional development (w/ regards to energy efficiency) for key individuals – Director of Facility & Maintenance, Energy Team, Assistant Superintendant

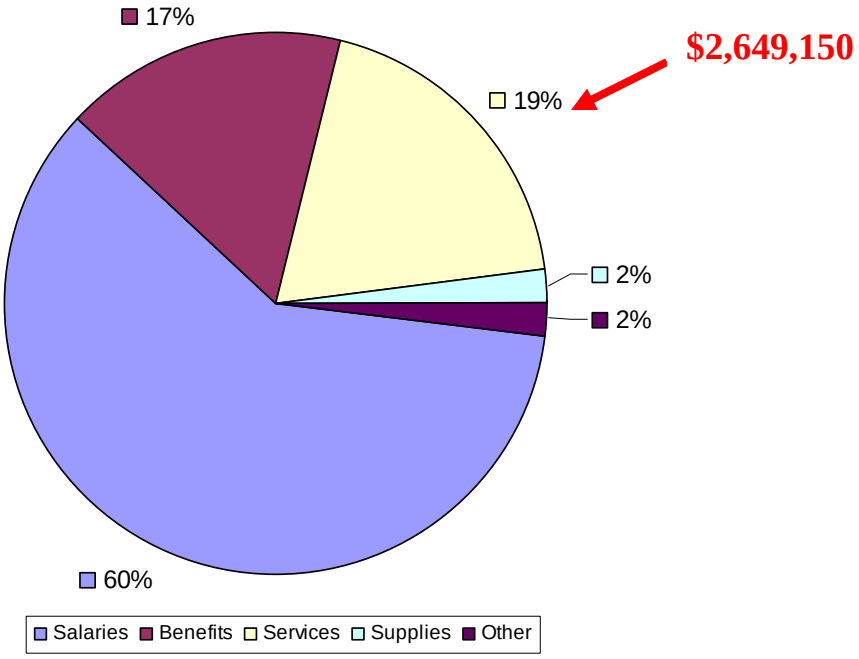
High Cost Recommendation

- Replace existing inefficient lighting in the HS Auxiliary gym with newest and proven efficient lighting technology available (like High Output Fluorescent High Bay lights, which can save over $50/year per light fixture).
- Evaluate cost/benefit of automating the main boiler/pump for improved efficiency.
- Evaluate installation of large fans in open areas (gymnasium, cafeteria, etc.) to reduce heating and cooling costs.
- Evaluate installation of a geothermal system at HS when chiller and rooftop units need replaced, which is likely in the next five to seven years. A geothermal system uses significantly less energy and would qualify for funding under Ohio House Bill 264 because the payback would be less than 15 years. This system could be used to cool the building in the summer and also supplement the heat so the boiler would be used less to heat the building in the winter. The property is well suited for a geothermal well field and advances in technology continue to decrease the cost of installation.

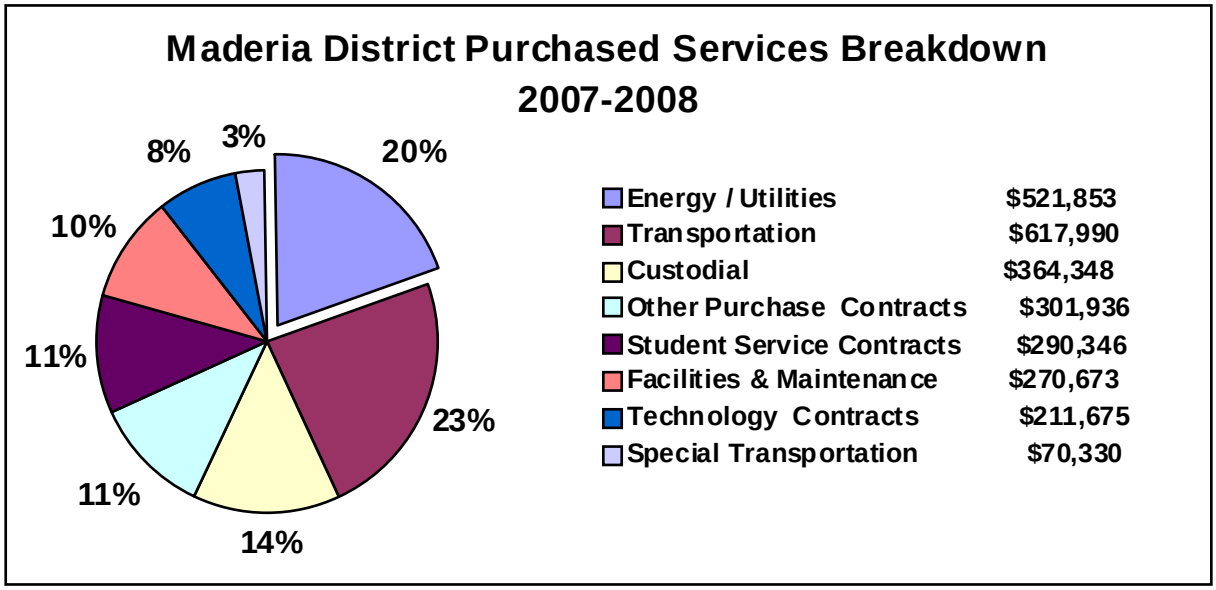
Attachment I
District's 2007-2008 Expenditures

Where does the Money Go

The General Fund expenditures account for the ordinary operations of the district. All tax dollars collected from voter approved operating levies are accounted for in the General Fund. Staff salaries and benefits account for 77% or $11,056,595 of Madeira's expenditures. Of that $11 million 82% is spent on instructional staff and instructional support staff and the remaining 18% is spent on administrative, facility, transportation, and office staff support. The next largest area of expenditures is district services at 19% or $2,649,150. District services include the cost of utilities, building maintenance, school transportation, custodial service, student support service contracts, district insurance, fuel, and other miscellaneous services provided to the district.



Source: Madeira School District Website, Treasurer's page



Attachment II
Districts 10 Year Utility Costs

UTILITIES	CURRENT VENDOR	ACTUAL 2005-06	ACTUAL 2006-07	ACTUAL 2007-08	APPROP 2008-09
HS ELECTRIC	DUKE/STRAT.EN.	90,796.32	107,240.00	119,120.40	131,000.00
*MS ELECTRIC	DUKE/STRAT.EN.	67,901.77	110,070.81	105,919.81	117,000.00
ES ELECTRIC	DUKE/STRAT.EN.	83,383.77	101,945.51	122,976.34	136,000.00
Total Electrical $$		242,081.86	319,256.32	348,016.55	384,000.00
HS WATER	IH WW	11,222.15	14,240.26	9,864.59	10,900.00
*MS WATER	IH WW	4,811.22	8,895.17	2,604.04	2,900.00
ES WATER	IH WW	13,877.75	5,449.84	5,343.42	5,900.00
HS GAS	ENERY USA TPC	68,236.22	51,237.02	59,972.22	72,000.00
*MS GAS	ENERY USA TPC	8,942.60	41,757.67	43,253.88	51,900.00
ES GAS	ENERY USA TPC	7,505.46	45,036.57	52,798.24	63,400.00
Total Gas $$		84,684.28	138,031.26	156,024.34	187,300.00

*MMS was housed in Milford for two year 2004-05 & 2005-06; in 2006-07 Milford billed Madeira $59265 for electric, water, & gas during those two years.

2006-07 was the first year of occupancy for the MMS and MES in the new buildings. There was some inefficiencies that occurred due to adjusting to new systems.

2007-2008 is the 2nd year of occupancy for MMS and MES. This year is considered a closer baseline to forecast future electric, water, gas expenditures.

Electric + Gas		2006-07	2007-08	2008-09
HS Annual Cost	159,032.54	158,477.02	179,092.62	203,000.00
MS Annual Cost	76,844.37	151,828.48	149,173.69	168,900.00
ES Annual Cost	90,889.23	146,982.08	175,774.58	199,400.00
Total Electric + Gas	*326,766.14*	*457,287.58*	*504,040.89*	*571,300.00*

Annual Utility Expense	2006-07	2007-08	2008-09
Total Electric	*319,256.32*	*348,016.55*	*384,000.00*
Total Gas	*138,031.26*	*156,024.34*	*187,300.00*

Cost Per Student			
HS	328.79	373.11	444.20
MS	326.51	320.12	372.03
ES	289.33	336.09	390.22
Cost per Sq Ft.			
HS	1.41	1.60	1.81
MS	2.02	1.99	2.25
ES	2.01	2.41	2.73

Source: Susan Crabill, Treasurer

Attachment III

Duke Energy Ohio Reaches Agreement on Electric Security Plan

Contact: Steve Brash
Phone: 513-419-5966
24-Hour Phone: 704-382-8333

Oct. 27, 2008

CINCINNATI -

Duke Energy Ohio announced today that a settlement agreement has been reached with most intervening parties, the Staff of the Public Utilities Commission of Ohio (PUCO) and the Ohio Consumers' Counsel on its electric security plan under Ohio's new energy law.

The agreement, which establishes generation rates for 2009 through 2011, must be approved by the PUCO.

Under the terms of the settlement, the base cost for generation service will increase by approximately 2 percent of the total bill annually in 2009 and in 2010 for residential customers, and each year from 2009 through 2011 for non-residential customers. The company's original application requested an increase of 6 percent in 2009, 2 percent in 2010 and a decrease of 2 percent in 2011. The bill for generation service will continue to include cost-based trackers for fuel and purchased power, capacity purchases, and environmental compliance expenditures.

"This agreement establishes reasonable prices for dedicated sources of energy supply while providing additional funding to assist low income customers in this challenging economy," said Sandra Meyer, president of Duke Energy Ohio. "It will also provide Duke Energy with the resources to develop energy efficiency programs that will help all customers reduce overall usage and energy bills."

Under the terms of the settlement, the typical monthly cost for a residential customer using 1,000 kilowatt-hours will be $123.40 in January 2009, compared with the current monthly bill of $120.98. This comparison does not include the impact of Duke Energy Ohio's recent delivery rate filing of approximately 5 percent for a typical residential customer that is expected to be effective in second quarter 2009.

Over the three-year term of the agreement Duke Energy will contribute $2.1 million to assist low income customers pay their electricity bills. Area community action agencies will administer the funds for distribution to eligible Duke Energy customers. In addition, low-income weatherization and energy efficiency funding will increase to $1 million per year.

The agreement includes funding for a new infrastructure modernization program that will begin the installation of Smart Grid technology. The new technology is an interactive digital system that can communicate with customers about their energy usage, monitor power quality, identify power outages, turn service on/off remotely, read meters continuously, and support energy efficiency. As a benefit of this program, tighter distribution system reliability targets are established in the settlement.

The agreement also replaces the existing energy efficiency tracker with a new Save-a-Watt model that will compensate Duke Energy based on the success of its energy efficiency programs. The new energy efficiency programs, to include interruptible tariffs for business customers, will help customers lower their overall bills and will help Duke Energy achieve the significant energy efficiency targets established by Ohio's new energy law.

The settlement includes plans to develop an Electronic Bulletin Board that will help consumers compare competitor pricing for electric generation supply. Also, an economic development rate mechanism is established under the settlement to fund any individual arrangements or programs approved by the PUCO. The agreement provides for an economic development grant to the city of Cincinnati. If approved by the PUCO, half of the grant to the city of Cincinnati will be recoverable in rates, while half will be borne by Duke Energy Ohio.

In addition to the PUCO Staff, the other parties signing the settlement agreement are:

- Commercial Group
- Communities United For Action
- Constellation Energy Commodities Group, Inc.
- Constellation NewEnergy, Inc.
- Greater Cincinnati Health Council
- Itegrys Energy Services, Inc.
- Kroger Company
- Natural Resources Defense Council
- Ohio Consumers' Counsel
- Ohio Energy Group
- Ohio Environmental Council
- Ohio Manufacturer's Association
- Ohio Partners for Affordable Energy
- People Working Cooperatively
- Sierra Club of Ohio

Duke Energy's Ohio operations deliver electricity to approximately 690,000 electric customers and natural gas service to approximately 425,000 customers.

Duke Energy, one of the largest electric power companies in the United States, supplies and delivers electricity to approximately 4 million U.S. customers and natural gas service to approximately 520,000 customers in its regulated jurisdictions. The company has approximately 35,000 net megawatts of electric generating capacity in the Midwest and the Carolinas, and natural gas distribution services in Ohio and Kentucky. In addition, Duke Energy has more than 4,000 net megawatts of electric generation in Latin America, and is a joint-venture partner in a U.S. real estate company. Headquartered in Charlotte, N.C., Duke Energy is a Fortune 500 company traded on the New York Stock Exchange under the symbol DUK. More information about the company is available on the Internet at: www.duke-energy.com.

Attachment IV
Energy Definitions

Btu - British thermal unit: a unit of heat equal to the amount of heat required to raise one pound of water one degree Fahrenheit at one atmosphere pressure.

CCF - The unit used to measure the amount of natural gas consumed by a customer. 1 CCF = 100 cubic feet of natural gas.

Demand - The rate at which electric energy or natural gas is delivered to or by a system at a given instant or averaged over a designated period, usually expressed in kilowatts or megawatts (electric).

Demand Charge - The Demand Charge portion of rate design is expected to recover the costs associated with the level of demand for the particular service and will be paid even if no service is taken by the customer; a reservation charge. Included in demand charges are capital-related costs and the cost of operation and maintenance of generation, transmission and distribution.

Energy Conversion Factors: 1 kWh = 3,414.4 BTU
1 CCF = 103,000 BTU = 0.103

kWh - A measure of electricity defined as a unit of work or energy, measured as 1 kilowatt (1,000 watts) of power expended for 1 hour. One kWh is equivalent to 3,414.4 Btu.

Energy Audit - An inspection, survey and analysis of energy flows in a building, process or system with the objective of understanding the energy dynamics of the system under study.

Energy Efficiency - Refers to products or systems using less energy to do the same or better job than conventional products or systems. Energy efficiency saves energy, saves money on utility bills, and helps protect the environment by reducing the demand for electricity.

Heating/Cooling Degree Days – These are measurements of how mild, normal or extreme temperatures are over a period of time. These measurements affect your energy consumption and ultimately, your electric bills. If the outside temperature is 65 degrees or lower, you'll need to use heat to maintain a 70 degree temperature inside. If the outside temperature is 65 degrees or higher, you'll need to use air conditioning to maintain a 70 degree temperature inside. How is this data computed? It is calculated based on an average daily temperature of 65 degrees. If the average temperature is higher than 65 degrees, it is considered a cooling degree day, meaning that you will have to use your air conditioner to maintain a 70 degree temperature inside. If the average temperature is below 65 degrees, it is considered a heating degree day, because you will have to use your heat to maintain a 70 degree temperature inside.

Plug-Loads - Any electrical device that ultimately receives power from an ac wall outlet

Definitions from Duke Energy, and internet sources

Attachment V
Facilities Usage by Building

This list is not all inclusive, but gives an idea how the buildings/spaces are generally used:

School	Activity	Space	Hours	Days
MES	Early Bird	Gym/Cafeteria	7:30 a.m.-9:00a.m.	M-F (all year)
	After School	Gym/Cafeteria	3:30 p.m. -6:00 p.m.	M-F (all year)
	Spanish WKID Culture Club Mad Science Madeira Singers (4th grade) –	4 classrooms 1 classroom/ computer lab 1 classroom 4 classrooms Music Room	8:00 a.m.-8:50 a.m. 8:00 a.m.-8:50 a.m. 3:30 – 4:30 p.m. 3:30 – 4:45 p.m. 3:40 – 4:45 p.m.	M-F 2x/week (all year) 2x/week (all year) 1x/week for 4 weeks 4x/year 2x/week (all year) 1x/week (Sept-April)
	Madeira Rec BB St. Gertrude BB	Gym	4:30 p.m. – 8:45 p.m. 5:45 p.m. – 8:45 p.m. 5:30 p.m. – 8:15 p.m.	M-W (Nov Feb) R (Dec – Feb) F (Dec – Feb)
	Community Courses	Media Center/Computer Lab	Varies, 1-2 hours in p.m.	5-6 x/year
	Scouts -4 troops	1 classroom	3:30 p.m. – 5:00 p.m.	M-F 1x/month (all year)
	Various District Meeting, PTA Events	Media Center, Gym, Cafeteria, Art Room, Music Room	3:45 p.m. – 5:00 p.m. 3:30 – 9:30 p.m.	1x/month F evenings throughout the year
MMS	Student Tutoring No formal after school programs	Classrooms	After school until 4:00 p.m.	M-F
	Volleyball	Gym	3:30 p.m. – 5:30 p.m.	M-F (Aug-Oct)
	BBall, Rec Teams	Gym	3:30 – 9:00 p.m. 8:00 – 6:00 p.m. 12:00 – 6:00 p.m.	M-F (Nov-Mar) Sat Sun
	Community Courses Swing Dance lessons	Media Center/Computer Lab Cafeteria	Varies, 1-2 hours in p.m. Varies, 1.5 hours in p.m.	5-6 x/year 8-10 sessions/year
	Special Events: Band/Choir Concerts		Varies, 1-1.5 hours in p.m.	3x/year
	Parent Activities: Conferences,	Classrooms	3:30 – 9:00 p.m.	
MHS	No details	Classrooms		
	Sports (Games, and Practices), Rec Teams	Gym	3:00 p.m. – 7:00 p.m. 3:00 p.m. – 9:00 p.m. 3:00 p.m. – 6:00 p.m.	M-F (Aug – Oct) M-Sat (Nov – Mar) M-F (Mar – May)
	BOE Mtgs Athletic Boosters, PTA PC, 20/20, After-Prom, Bridge Club, Chess, MSF,	Media Center,	7:00 – 9:00 p.m. 7:00 – 8:30 p.m.	M-F, 1-2x/month
	Music Boosters	Band room	7:00 – 9:00 p.m.	M-F, 1x/month
	Musicals Band/Choir	Auditorium	7:00 p.m. – 9:00 p.m. 6:00 p.m. – 8:00 p.m.	3 performances 2x/year
	Various Activities	Cafeteria	7:00 p.m. – 9:00 p.m.	Varies by Month
	ACT/SAT Conferences	Building	7:30 a.m. – 1:00 p.m. 4:00 p.m. – 8:00 p.m.	Sat, 7x/year 2x/year

Attachment VI
Ohio Administrative Code – School Safety
Acceptable Temperature and Relative Humidity Zone

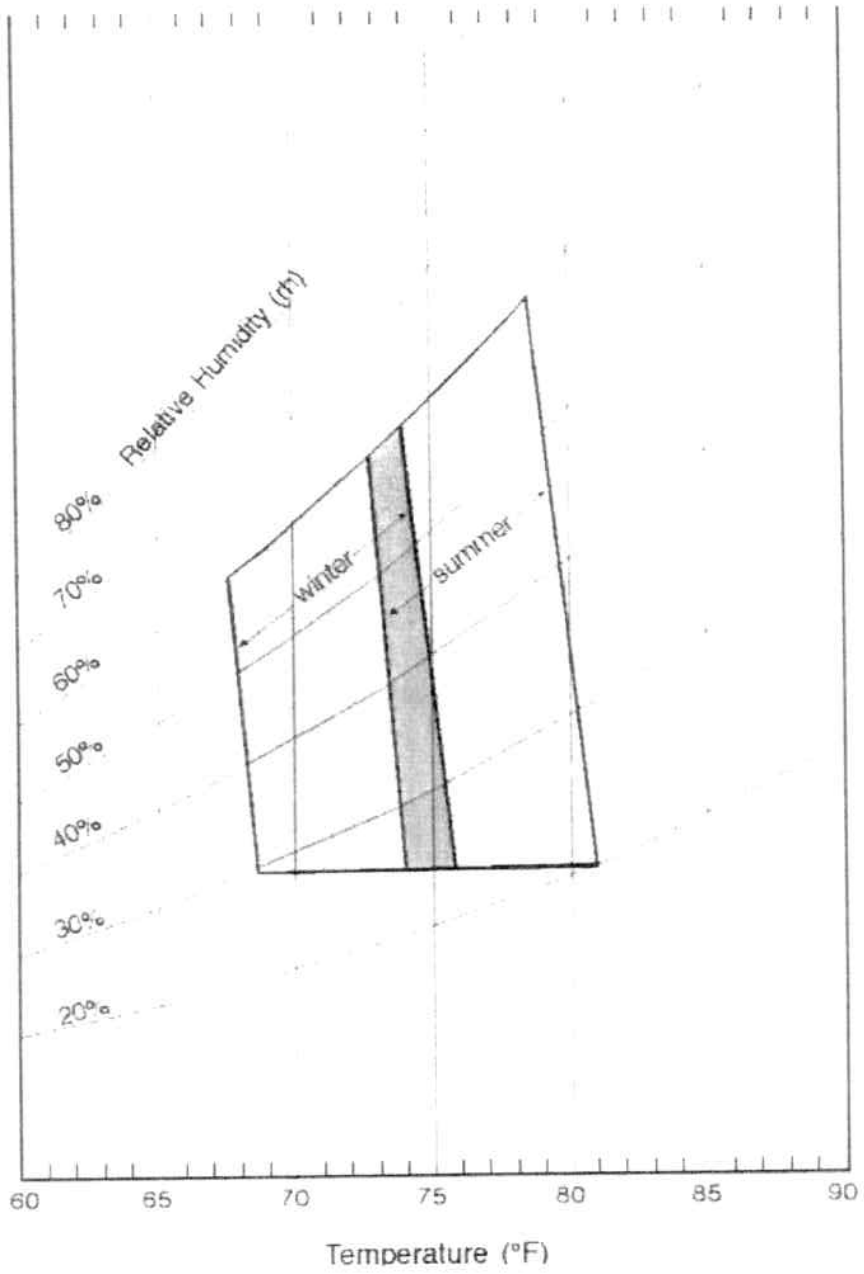


Figure 1. Acceptable ranges of operative temperature and relative humidity for people in typical summer and winter clothing during light, primarily sedentary activity. Ranges based on a 10% dissatisfaction criteria.

Figure 1 based on ASHRAE Standard-55 1992 Thermal Environmental Conditions for Human Occupancy. © American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Contact ASHRAE for the complete updated publication at www.ashrae.org.

Attachment VII
Energy Efficiency Teacher/Staff Survey
Page 1 of 5

1. Please check all items that you turn off when you leave school for the day.

	Response Percent	Response Count
Lights	94.9%	94
Computers	**97.0%**	**96**
Speakers	21.2%	21
Printers	10.1%	10
DVD/VCR	46.5%	46
Projector	58.6%	58
answered question		99
skipped question		1

2. Please check all items that you turn off when you leave your room for more than 5 minutes.

	Response Percent	Response Count
Lights	**84.5%**	**60**
Computers	5.6%	4
Speakers	7.0%	5
Printers	1.4%	1
DVD/VCR	36.6%	26
Projector	59.2%	42
answered question		71
skipped question		29

3. Do you have all computers in sleep mode after 15 minutes or less? (Note: A screen saver doesn't do anything to reduce electricity use)

	Response Percent	Response Count
Always	**38.0%**	**38**
Most of the time	21.0%	21
Half of the time	3.0%	3
Some of the time	8.0%	8
Never	30.0%	30
answered question		**100**
skipped question		**0**

4. Do you unplug chargers when not in use?

	Response Percent	Response Count
Always	24.0%	24
Most of the time	11.0%	11
Half of the time	3.0%	3
Some of the time	25.0%	25
Never	**37.0%**	**37**
answered question		**100**
skipped question		**0**

5. Do you reduce, reuse and recycle items (paper, plastic, glass, etc.) and encourage students to do the same?

	Response Percent	Response Count
Always	**47.0%**	**47**
Most of the time	38.0%	38
Half of the time	5.0%	5
Some of the time	8.0%	8
Never	2.0%	2
answered question		**100**
skipped question		**0**

6. Do you teach curriculum, make literature available, and discuss with students being a greener generation and encouraging environmentally friendly behavior changes?

	Response Percent	Response Count
Always	16.0%	16
Most of the time	15.0%	15
Half of the time	9.0%	9
Some of the time	**36.0%**	**36**
Never	24.0%	24
answered question		100
skipped question		0

7. What other ways do you currently save energy or try to create a more environmentally friendly school?

	Response Count
view	40
answered question	40
skipped question	60

Question 7: What other ways do you currently save energy or try to create a more environmentally friendly school?	
Proactive	3
Reduce garbage	3
Recycle	6
Reuse	13
Use half lights or reduced	4
Don't prop open doors	3
Reduce paper (online quiz/blogs)	1
Encourage to read off computer and not print if necessary	1
Composting	1
Turn off DVD/VCR	2
Told students keep sweatshirt @ school	1
Dress warm to lower temp.	2
Cautious of water usage	2
Turn off lights	4
Print on both sides	3
Double check computers shut down	2
Communicate via email vs. paper	3
Teach about sustainable resources	1

8. Would you support or be a part of the following? Select all that apply.

	Response Percent	Response Count
Start an Energy Patrol where students evaluate and monitor the use of lighting, air conditioning, heating and other energy systems on a daily basis.	31.0%	31
Adding an "energy monitor" to school vending machines.	44.0%	44
Getting a power strip and plug in your chargers, computer, T.V. and DVD player and flip the switch when you're not using it.	68.0%	68
Reduce copying by reusing copied readings, directions or other items each student does not need to keep.	55.0%	55
A District-wide Earth Day celebration or challenge to incorporate knowledge of renewable resources, reducing, reusing, recycling, researching and presenting sustainable energy sources (Solar, Wind, Hydro, Geothermal, etc.) while pulling in community support.	67.0%	67
Lowering Thermostats 1-2 degrees if given advance warning.	60.0%	60
Reducing the hot water temperature in buildings.	58.0%	58
Eliminating Personal Appliances in individual classrooms (consolidate to make appliances available per grade band, per team, per content area).	37.0%	37
Encouraging students to dress appropriately according to the weather (e.g. wearing pants and sweaters in winter).	**84.0%**	**84**
	answered question	**100**
	skipped question	**0**

9. What other ideas do you have for the district to become more environmentally friendly and energy efficient?

	Response Count
view	30
answered question	30
skipped question	70

Question 9: What other ideas do you have for the district to become more environmentally friendly and energy efficient?	
Communication courses on Public School Works	1
Use less styrofoam, reduce waste, compost and recycle in the cafeteria-real trays and silverware	6
Earth Day activities: Display objects created from reused materials	1
Timer or motion sensor on lights, like bathroom	1
Recycle more	3
Advise parents to pack an extra sweatshirt with students to keep warm when we turn down the thermostat	2
Turn ac a few degrees warmer in spring and early fall	1
Solar panels or alternative heating/cooling	3
Have dimmers on lights.	2
Plant more trees around buildings to provide shade	1
Turn off one of the two light switches in rooms	1
Cut hallway light bulbs by half	1
End of year collect materials that can be reused the next year	1
Shorter School day-more early dismissals	1
Regulated constant temp.	4
Have "green" assemblies or speakers	1
Use smaller fonts and print front to back	1

10. Which Madeira school do you work in or spend the majority of your time?

	Response Percent	Response Count
High School	**35.0%**	**35**
Middle School	29.0%	29
Elementary School	30.0%	30
Board Office	6.0%	6
answered question		**100**
skipped question		**0**

Attachment VIII
Energy Consumption - Baseline 2006-2007

2006 -2007 Energy Consumption - Baseline
Madeira School District
Three Buildings 260,000 Square Feet

Total Gas Cost:	$138,031
Total Electric Cos	$319,256
Total:	**$457,288**

Total Gas, CCF	124,308
Total Electric, kWh:	3,057,371
Total Energy BTU's:	**23,242,797,542**

Maderia Elementary	**Madeira Middle School**	**Madeira High School**	**Madeira H.S. Stadium**
Students	Students	Students	
508	**465**	**482**	
Square Feet	Square Feet	Square Feet	
73,000	**75,000**	**112,000**	
Electricity, kWh	Electricity, kWh	Electricity, kWh	Electricity, kWh
1,020,071	**941,808**	**1,074,892**	**20,600**
Gas, CCF	Gas, CCF	Gas, CCF	
43,477	**35,462**	**45,369**	
Energy, BTU	Energy, BTU	Energy, BTU	Energy, BTU
7,961,066,422	**6,868,283,235**	**8,343,111,245**	**70,336,640**
BTU's per Sq. Ft	BTU's per Sq. Ft	BTU's per Sq. Ft	
109,056	**91,577**	**74,492**	
Annual Cost	Annual Cost	Annual Cost	Annual Cost
$146,982	**$151,828**	**$158,477**	**$1,608**
Cost per Sq. Ft	Cost per Sq. Ft	Cost per Sq. Ft	
$2.01	**$2.02**	**$1.41**	
Cost per Student	Cost per Student	Cost per Student	
$289.33	**$326.51**	**$328.79**	

Note: 2006-07 first year in the new MMS and MES buildings. There was some inefficiencies that occurred due to adjusting to new system.
Note: Does not include costs from Milford reflected in 2006-07 expenditures in Treasurer's 2006/07 10 Yr Spreadsheet ($36,3025/electrical, $15,003/gas)

Source: Financial numbers – Susan Crabill, Treasurer
Utility data – Direct Energy, Duke Energy, and Energy USA/TCP utility bills

Attachment IX
Energy Consumption & Cost 2007-2008

2007 -2008 Energy Consumption & Cost
Madeira School District
Three Buildings 260,000 Square Feet

Total Gas Cost:	$156,024	**13.0%**	Total Gas, CCF	135,544	**9.0%**
Total Electric Cos	$348,017	**9.0%**	Total Electric, kWh:	3,078,303	**0.7%**
Total:	**$504,041**	**10.2%**	**Total Energy BTU's:**	**24,471,557,763**	**5.3%**

Maderia Elementary		**Madeira Middle School**		**Madeira High School**		**Madeira H.S. Stadium**	
Students		Students		Students			
523		**466**		**480**			
Square Feet		Square Feet		Square Feet			
73,000		**75,000**		**112,000**			
Electricity, kWh		Electricity, kWh		Electricity, kWh		Electricity, kWh	
1,020,582	**0.1%**	**932,493**	**-1.0%**	**1,104,568**	**2.8%**	**20,660**	**0.3%**
Gas, CCF		Gas, CCF		Gas, CCF			
44,825	**3.1%**	**40,155**	**13.2%**	**50,563**	**11.4%**		
Energy, BTU		Energy, BTU		Energy, BTU		Energy, BTU	
8,101,675,181	**1.8%**	**7,319,904,099**	**6.6%**	**8,979,436,979**	**7.6%**	**70,541,504**	
BTU's per Sq. Ft		BTU's per Sq. Ft		BTU's per Sq. Ft			
110,982		**97,599**		**80,174**			
Annual Cost		Annual Cost		Annual Cost		Annual Cost	
$175,775	**19.6%**	**$149,174**	**-1.7%**	**$179,092**	**13.0%**	**$1,575**	**-2.1%**
Cost per Sq. Ft		Cost per Sq. Ft		Cost per Sq. Ft			
$2.41		**$1.99**		**$1.60**			
Cost per Student		Cost per Student		Cost per Student			
$336.09		**$320.12**		**$373.11**			

Note: During the 06-07 schoolyear vs the 07-08 school year we had a 3% decrease in heating degree days and a 20% increase in cooling degree days.

Source: Financial numbers – Susan Crabill, Treasurer
Utility data – Direct Energy, Duke Energy, and Energy USA/TCP utility bills

Attachment X
Energy Consumption & Cost 2008-2009

Note: Costs are appropriated. Usage is actual – July – December 2008

2008 - 2009 Energy Consumption & Cost
Madeira School District
Three Buildings 260,000 Square Feet

Appropriated Costs for 2008-2009

Total Gas Cost:	$187,300	**20.0%**
Total Electric Cos	$384,000	**10.3%**
Total:	**$571,300**	**13.3%**

Total Gas, CCF	43,845
Total Electric, kWh:	1,485,641
Total Energy BTU's:	**9,588,572,630**

Maderia Elementary	**Madeira Middle School**	**Madeira High School**	**Madeira H.S. Stadium**
Students	Students	Students	
511	**454**	**457**	
Square Feet	Square Feet	Square Feet	
73,000	**75,000**	**112,000**	
Electricity, kWh	Electricity, kWh	Electricity, kWh	Electricity, kWh
472,623	**448,298**	**547,510**	**17,210**
Gas, CCF	Gas, CCF	Gas, CCF	
14,709	**13,689**	**15,447**	
Energy, BTU	Energy, BTU	Energy, BTU	Energy, BTU
3,128,723,971	**2,940,668,691**	**3,460,418,144**	**58,761,824**
BTU's per Sq. Ft	BTU's per Sq. Ft	BTU's per Sq. Ft	
42,859	**39,209**	**30,897**	
Annual Cost	Annual Cost	Annual Cost	Annual Cost
$199,400	**$168,900**	**$203,000**	**$1,357**
Cost per Sq. Ft	Cost per Sq. Ft	Cost per Sq. Ft	
$2.73	**$2.25**	**$1.81**	
Cost per Student	Cost per Student	Cost per Student	
$390.22	**$372.03**	**$444.20**	

Source: Financial numbers – Susan Crabill, Treasurer
Utility data – Direct Energy, Duke Energy, and Energy USA/TCP utility bills

Attachment XI
Heating Degree Days & Cooling Degree Days History
2006-2008

Heating Degree Days

The degree data was obtained from the Cincinnati Greater Airport in Covington, Kentucky.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2006	717	840	691	230	163	9	0	0	75	384	557	734	4161
2007	922	1177	458	395	54	0	0	0	15	188	629	881	4324
2008	1072	942	731	297	162	1	1	0	6	283	673	925	5093
2009													0
AVG	904	986	627	297	126	1	0	0	32	285	620	847	4724

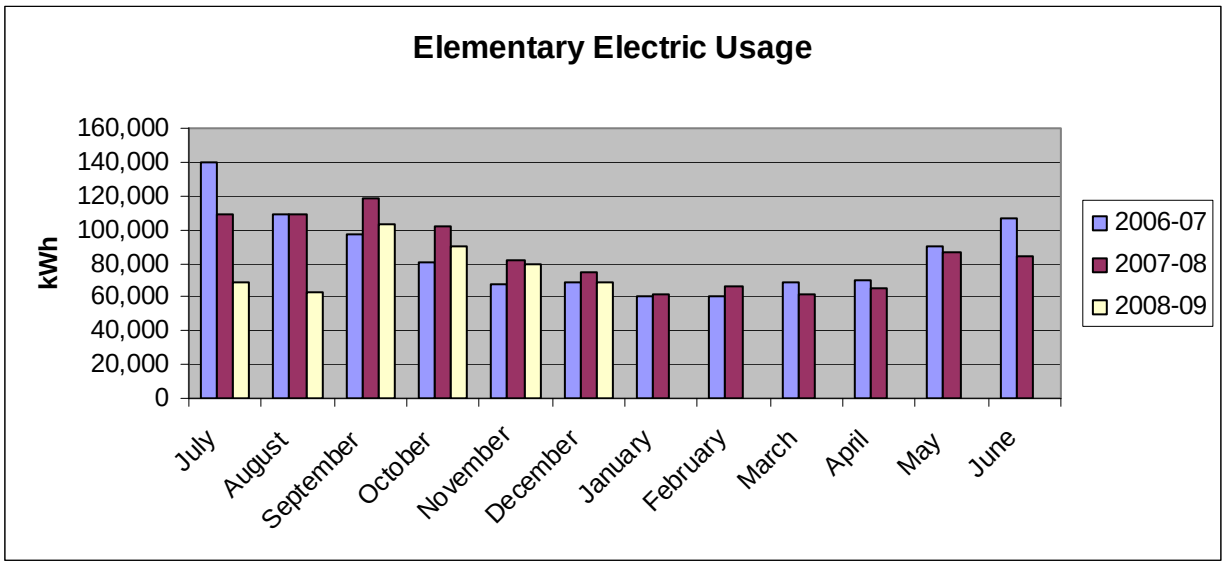
Cooling Degree Days

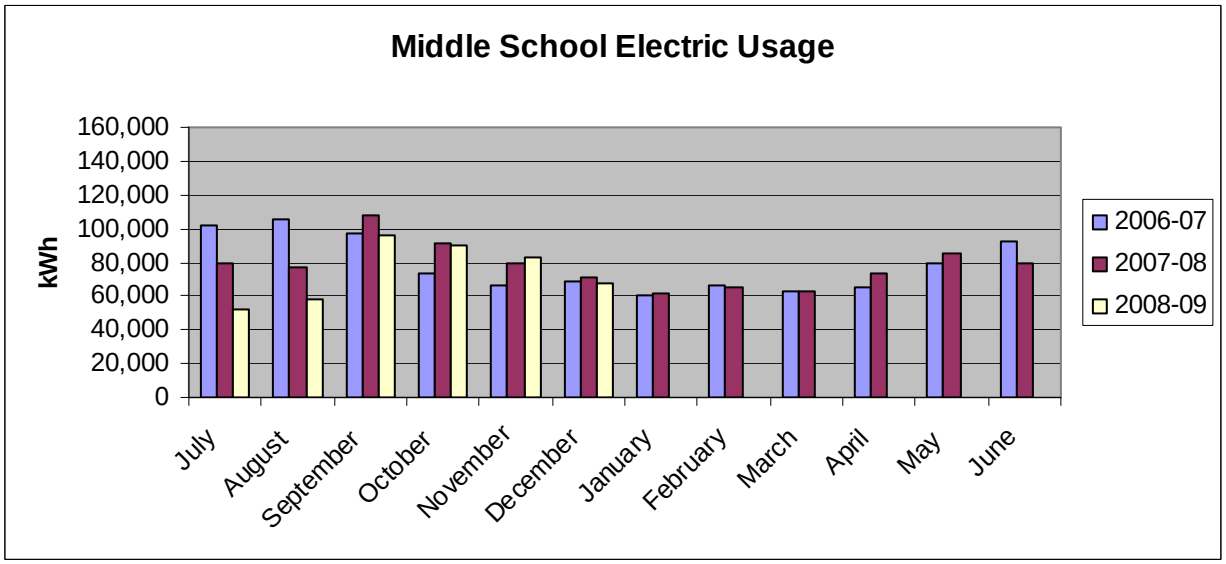
The degree data was obtained from the Cincinnati Greater Airport in Covington, Kentucky.

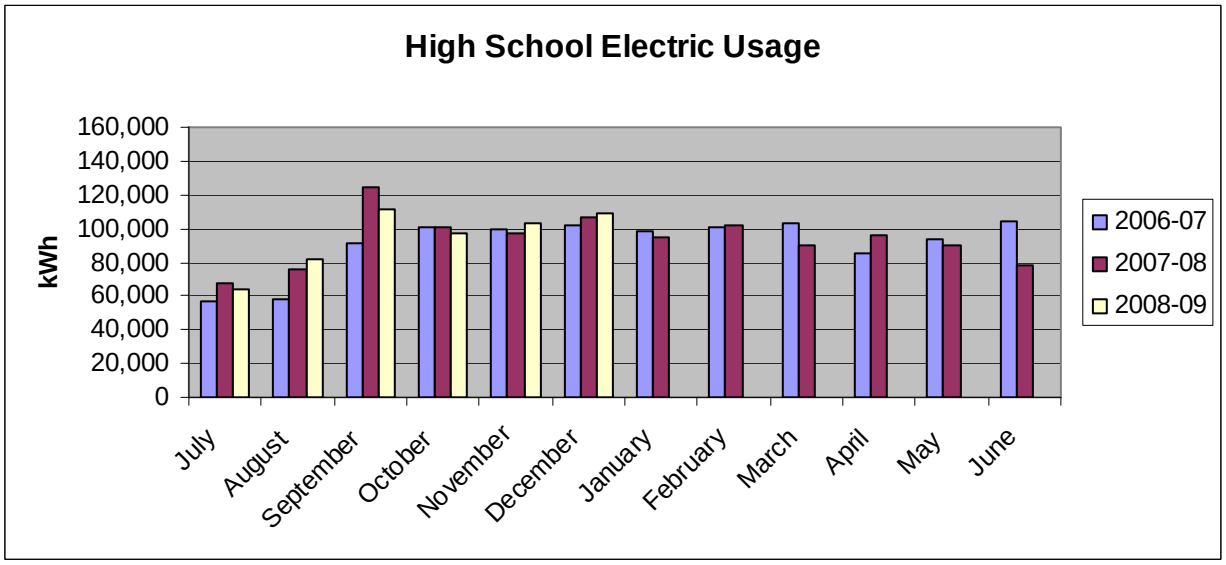
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2006	0	0	0	26	70	167	373	394	56	19	0	0	1105
2007	0	0	24	19	145	286	306	523	259	83	0	0	1256
2008	0	0	0	15	28	242	298	300	196	27	0	0	1036
2009													0
AVG	0	0	12	23	108	232	336	406	170	19	0	0	1304

Source: NOAA's website, Steve Waldmann interview 2009

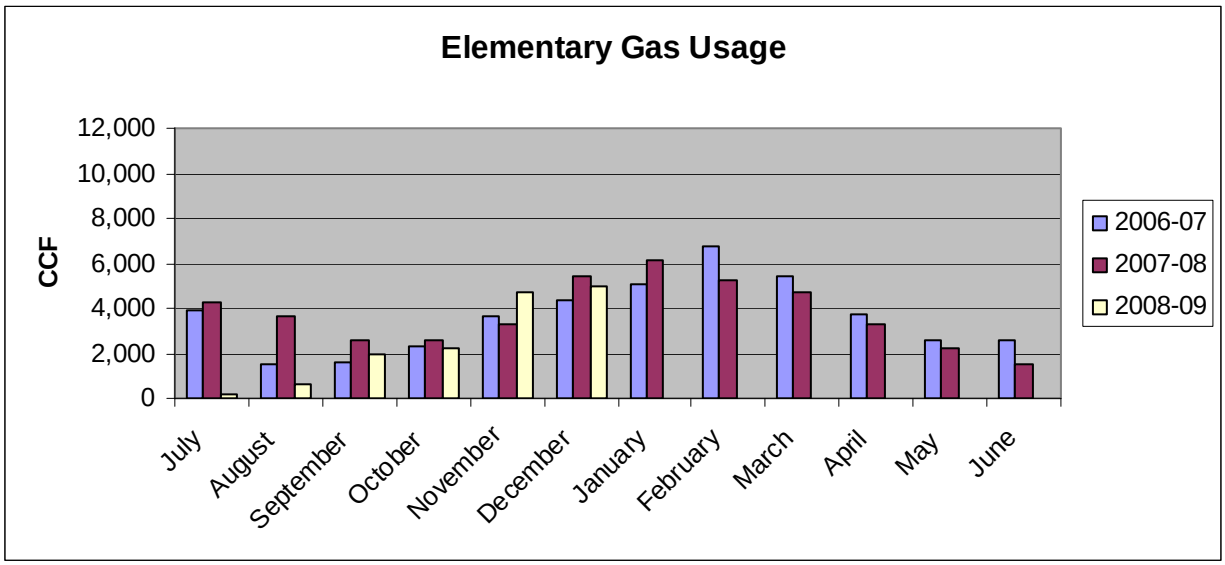
Attachment XII
Consumption by Month by School – Electricity

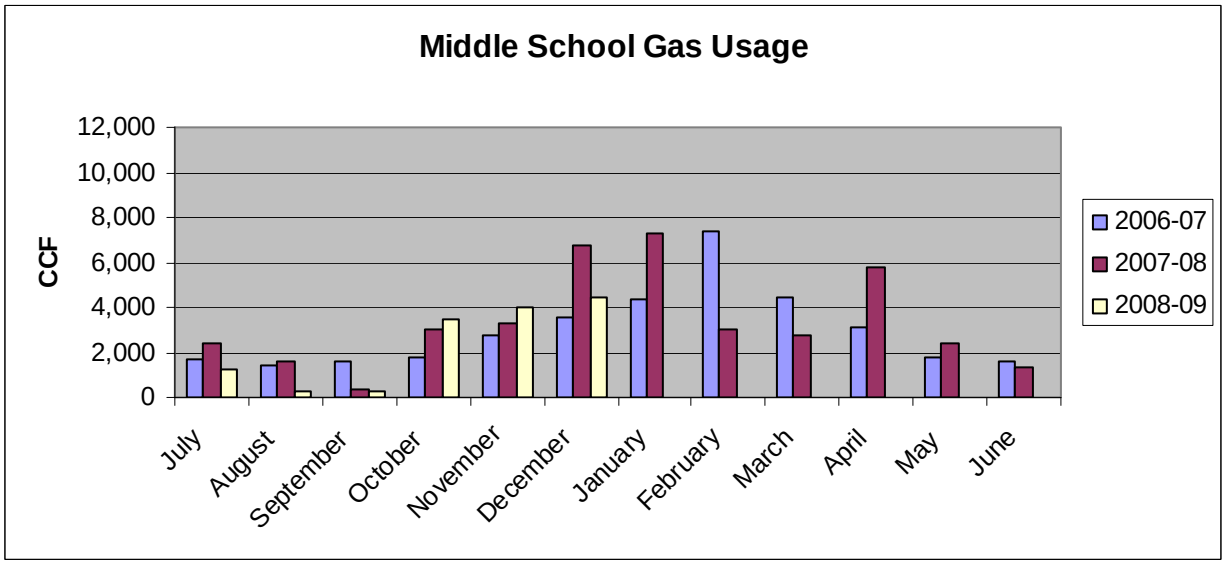


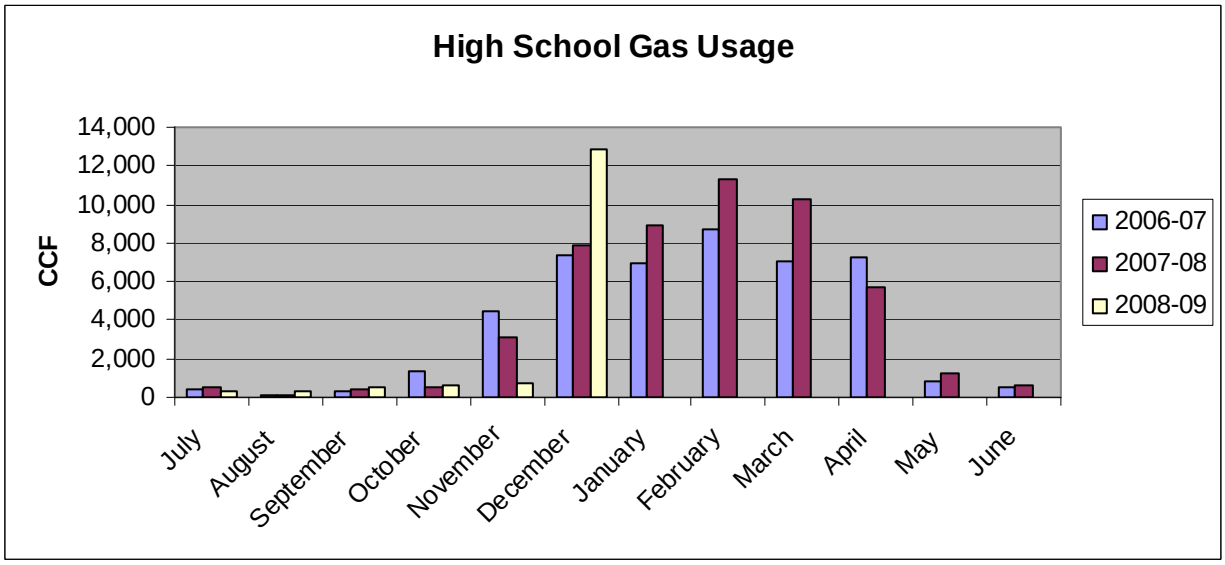




Attachment XIII
Consumption by Month by School – Gas







Attachment XIV
Electric - High School
Page 1 of 7

Energy Data for Madeira School District

Billing Data Collected - kWh

		2006-07	2007-08	2008-09
Direct Energy/Duke Energy				
HS	#11639850			
	July	56,425	67,033	61,778
	August	57,134	74,800	79,152
	September	86,661	118,112	106,021
	October	94,424	95,074	91,223
	November	96,116	93,266	98,936
	December	100,568	105,869	107,166
	January	96,864	93,998	
	February	99,036	101,747	
	March	100,717	89,518	
	April	84,269	94,514	
	May	93,197	88,045	
	June	103,014	76,124	
	Total	1,068,425	1,098,100	544,276

		2006-07	2007-08	2008-09
Direct Energy/Duke Energy				
HS	4-OL			
	July	539	539	539
	August	539	539	539
	September	539	539	539
	October	539	539	539
	November	539	539	539
	December	539	539	539
	January	538	539	
	February	539	539	
	March	539	539	
	April	539	539	
	May	539	539	
	June	539	539	
	Total	6,467	6,468	3,234

		2006-07	2007-08	2008-09
Direct Energy/Duke Energy				
HS	#11550521, #41044210			
Stadium	July	320	310	1,260
	August	380	530	1,640
	September	3,930	5,380	4,460
	October	6,140	5,490	5,020
	November	3,040	3,690	3,850
	December	1,410	710	980
	January	1,460	210	
	February	1,380	200	
	March	1,350	340	
	April	540	1,400	
	May	340	1,120	
	June	310	1,280	
	Total	20,600	20,660	17,210

Source: Direct Energy & Duke Energy bills

Energy Data for Madeira School District

Billing Data Collected-kWh

Duke Energy		2006-07	2007-08	2008-09
MS	#106152443			
	July	102,415	78,829	52,435
	August	104,971	76,606	58,329
	September	96,895	107,294	96,537
	October	74,064	90,788	89,641
	November	66,833	78,815	83,501
	December	69,245	71,060	67,855
	January	60,127	62,197	
	February	66,315	64,755	
	March	63,178	63,372	
	April	65,741	73,555	
	May	79,469	85,854	
	June	92,555	79,368	
	Total	941,808	932,493	448,298

Note: The MS outdoor lights are billed to The City of Madeira. Shared with Sellman Park.

Source: Duke Energy bills

Energy Data for Madeira School District

Billing Data Collected-kWh

Duke Energy		**2006-07**	**2007-08**	**2008-09**
ES	#106165268			
	July	139,570	108,809	67,915
	August	108,009	107,797	61,809
	September	96,324	118,098	102,821
	October	79,425	100,836	89,169
	November	66,800	81,535	79,267
	December	68,127	74,083	67,736
	January	60,084	60,813	
	February	60,161	65,722	
	March	68,511	60,952	
	April	69,584	64,597	
	May	89,693	85,703	
	June	105,970	83,825	
	Total	1,012,258	1,012,770	468,717

Duke Energy		**2006-07**	**2007-08**	**2008-09**
ES	5 OL			
	July	651	651	651
	August	651	651	651
	September	651	651	651
	October	651	651	651
	November	651	651	651
	December	651	651	651
	January	652	651	
	February	651	651	
	March	651	651	
	April	651	651	
	May	651	651	
	June	651	651	
	Total	7,813	7,812	3,906

Source: Duke Energy bills

Energy Data for Madeira School District
Distributor: Energy USA/TCP. Measurements: MMBtu

Gas		2006-07	2007-08	2008-09
HS	**34102055001**			
	July	40	50	37
	August	10	7	32
	September	35	43	57
	October	134	52	60
	November	462	319	80
	December	754	811	1325
	January	718	919	
	February	899	1165	
	March	731	1057	
	April	743	590	
	May	90	130	
	June	57	65	
	Total	**4673**	**5208**	**1591**

Conversion of MMTBtu to CCF (standard measurement of Gas)

Gas		2006-07	2007-08	2008-09
HS	**34102055001**			
	July	388	485	359
	August	97	68	311
	September	340	417	553
	October	1301	505	583
	November	4485	3097	777
	December	7320	7874	12864
	January	6971	8922	0
	February	8728	11311	0
	March	7097	10262	0
	April	7214	5728	0
	May	874	1262	0
	June	553	631	0
	Total	**45369**	**50563**	**15447**

Source: Energy USA/TCP bills

Distributor: Duke Energy July 06-Nov 06; Measurements CCF			
Distributor: Energy USA/TCP Dec. 06-YTD. Measurements: MMBtu			
Gas	**2006-07**	**2007-08**	**2008-09**
MS 2603658001			
July	1703	245	126
August	1437	164	28
September	1594	41	25
October	1769	307	359
November	2755	341	410
December	369	697	462
January	446	755	
February	757	309	
March	457	288	
April	319	599	
May	182	251	
June	169	139	
Total	**11957**	**3891**	**1410**

Conversion of MMTBtu to CCF (standard measurement of Gas)			
Gas	**2006-07**	**2007-08**	**2008-09**
MS 2603658001			
July	1703	2379	1223
August	1437	1592	272
September	1594	398	243
October	1769	2981	3485
November	2755	3311	3981
December	3583	6767	4485
January	4330	7330	0
February	7350	3000	0
March	4437	2796	0
April	3097	5816	0
May	1767	2437	0
June	1641	1350	0
Total	**35462**	**40155**	**13689**

Source: Energy USA/TCP bills

Distributor: Duke Energy July 06 - Dec 06; Measurements CCF			
Distributor: Energy USA/TCP Jan 07-YTD. Measurements: MMBtu			
Gas	**2006-07**	**2007-08**	**2008-09**
ES 61603658001			
July	3873	436	22
August	1491	375	67
September	1594	261	202
October	2353	268	228
November	3655	342	484
December	4346	555	512
January	525	631	
February	693	544	
March	562	482	
April	387	343	
May	265	228	
June	263	152	
Total	**20007**	**4617**	**1515**

Conversion of MMTBtu to CCF (standard measurement of Gas)			
Gas	**2006-07**	**2007-08**	**2008-09**
ES			
July		4233	214
August	1491	3641	650
September	1594	2534	1961
October	2353	2602	2214
November	3655	3320	4699
December	4346	5388	4971
January	5097	6126	0
February	6728	5282	0
March	5456	4680	0
April	3757	3330	0
May	2573	2214	0
June	2553	1476	0
Total	**39604**	**44825**	**14709**

Source: Energy USA/TCP bills

Electricity, kWh - Baseline Info

Total kWh by Building

	2006-07	2007-08	2008-09
MHS	1,074,892	1,104,568	547,510
Stadium	20,600	20,660	17,210
MMS	941,808	932,493	448,298
MES	1,020,071	1,020,582	472,623
District Total	3,057,371	3,078,303	1,485,641

Total Electric, kWh to BTU Conversion, - Baseline Info

Total BTU by Building

1 kWh=3414.4 BTU	**2006-07**	**2007-08**	**2008-09**
MHS	3,670,111,245	3,771,436,979	1,869,418,144
Stadium	70,336,640	70,541,504	58,761,824
MMS	3215709235	3183904099	1530668691
MES	3,482,930,422	3,484,675,181	1,613,723,971
District Total	**10,439,087,542**	**10,510,557,763**	**5,072,572,630**

Total Gas, CCF - Baseline Info

Total CCF by Building

Gas	2006-07	2007-08	2008-09
MHS	45,369	50,563	15,447
MMS	35,462	40,155	13,689
MES	43,477	44,825	14,709
District Total	**124,308**	**135,544**	**43,845**

Total Gas, CCF to BTU Conversion, Baseline Info

Total BTU by Building

1 CCF = 103,000	2006-07	2007-08	2008-09
MHS	4,673,000,000	5,208,000,000	1,591,000,000
MMS	3,652,574,000	4,136,000,000	1,410,000,000
MES	4,478,136,000	4,617,000,000	1,515,000,000
District Total	12,803,710,000	13,961,000,000	4,516,000,000

Total Energy BTU's

Electricity + Gas BTUs	**2006-07**	**2007-08**	**2008-09**
MHS	8,343,111,245	8,979,436,979	3,460,418,144
Stadium	70,336,640	70,541,504	58,761,824
MMS	6,868,283,235	7,319,904,099	2,940,668,691
MES	7,961,066,422	8,101,675,181	3,128,723,971
District Total	23,242,797,542	24,471,557,763	9,588,572,630

BTUs per Sq Ft

By Building	**2006-07**	**2007-08**	**2008-09**
MHS	74,492	80,174	30,897
Stadium	0		
MMS	91,577	97,599	39,209
MES	109,056	110,982	42,859

Source: CCF & kWh Conversion from Duke Energy

Attachment XV

NO and LOW COST ENERGY SAVINGS

Sources:

U.S. Department of Energy Building Technologies Program (www.energysmartschools.gov)
50 Green Strategies that Cost Less, Innovation Design (www.innovativedesign.net)
Toronto District School Board (TDSB) EcoSchools Energy Consumption Guide (ecoschools.tdsb.on.ca)
Myths about Energy in Schools, U.S. Department of Energy Office of Building Technology, State and Community Programs (DOE/GO-102002-1525)
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Larry Feist and Ralf Wells, Cincinnati State
Michael Mauch, LEED Certified Architect

	Potential Savings	How Our Schools Are Doing					
		Excellent	Very Good	Good	Fair	Poor	Not Doing
Lighting	5-15% Energy Savings						
Turn off lights in unoccupied rooms	8-10%			X			
Add automatic lighting controls	TBD			X			
Switch from T-12 to T-8 lighting with electric ballasts	20-30%	X					
Use ENERGY STAR LED signage	24 years longer life	X					
Use as much natural lighting as possible	20-30% increase in grades			X			
Use ganged lighting fixtures in gymnasiums and dim them				X			
Use minimal hallway lighting in off hours					X		
Clean lamps and light fixtures	15% Increase Efficiency			X			
Turn off all outside lights during the day		X					
Minimize outside lighting to critical areas after activities are done			X				
Use portable lighting for night cleaning							X
Turn marquee/outdoor signs off during night (i.e. midnight - dawn).							
Turn school display cases off at night.			X				
Suggest that teachers use only a desk lamp during planning time.							X
Suggest that teachers use only 1/2 of their lights during planning time.							X
Computers, Office Equipment and Plug Load							
Install ENERGY STAR monitor sleep mode software	2-10 Watts						X
Install ENERGY STAR copiers	40% less energy				X		
Turn off printers and peripherals when not in use	$25/year/copier			X			
Install solar power unit for computer lab							X
Replace desktop computers with laptops as they need replacing	Up to 80% less per Computer		X				
Install corner cabinet power strips and switch off when not in use							X
Install energy control "misers" on vending machines (from Vendors)	Up to 47% (of ~$250/yr)						X
Building Envelope							
Close all doors and windows, especially when HVAC is operating			X				
Make sure all doors and windows close tightly			X				
Check caulking and weather stripping, fix leaks				X			
Add low-e glazing to windows							X
Paint roofs and exterior walls a light color to reduce load on AC							X
HVAC, Water and Food Facilities							
Schedule regular maintenance on HVAC units		X					
Perform routine maintenance on hot water heaters	10-20%		X				
Turn off/reduce hot water heating at night/low usage periods						X	
Reduce temperature of heated water (required 85-110 degrees)					X		
Preheat ovens no more than 15 minutes prior to use		X					
Remove space heaters and other heating or refrigeration equipment from classrooms					X		
Keep all vents clear of clutter and obstruction			X				
Keep all faucets in good working order			X				
Adjust indoor temperature to 68 in winter and 76 in summer	3% per degree						
HVAC, Water and Food Facilities (continued)							
Recheck all Energy Management Systems "points" to verify that they are still functioning correctly.			X				
Stagger major equipment (HVAC units, etc.) start times.		X					
Program into the Energy Management System holiday hours and special school events.				X			
Recheck Energy Management Systems start and stop times.				X			
Turn the chiller off in water drinking fountains during certain times of year.						X	
"Lock out" heat after Winter is over to prevent unwanted heating costs during the summer air conditioning season.			X				
Shift usage to off-peak rates - cleaning, cooling.							
Sub-cool buildings during off-peak hours using outside air only. (No A/C).			X				
Turn off exhaust fans in unoccupied spaces.			X				
Calibrate temperature sensors annually.					X		
Start exhaust systems to match opening times.			X				
Landscaping							
Plant more trees and gardens, and use less grass							X
Plant evergreen trees against windward (west) side of schools							X
Plant deciduous trees on north side							X
Use mulch to reduce water quantities.						X	
Mulch existing vegitation and use on gardens							X
Behavioral and Educational							
Recycle					X		
Consolidate after hours activities to one school or one area in the school					X		
Conduct an equipment consolidation program							X
Improve foot and car traffic flow to reduce car cues				X			
Use two sided printing					X		
Reuse readings and other copied materials students do not need to keep					X		
Send parent letter encouraging students to dress appropriately for the weather							X
Post "KEEP DOORS CLOSED" signs in service corridors, gyms, pools, kitchens.							X
Create an energy logo							X
Have energy reduction and recycling competitions with awards for best performance							X
Contact your mechanical, electrical and lighting contractors to solicit energy ideas.			X				
Show the energy system to students and staff to create awareness							X
Feature energy conservation in publications like school newsletters.							X
Track energy usage for creating baseline and measuring progress			X				
Conduct energy audits/energy self checks							X
Involve the local community in energy savings programs (e.g., sharing facilities, parking, libraries…recycling programs…etc)							X
Update management training for efficiency in energy control.							X
Include energy items when setting up employee evaluation forms.							X

Attachment XVI
Energy Saving Activities for Schools

Involve the whole school including services in a year-long program of behavior change initiatives so that everyone helps to save energy. (Services are: food service, main office, nurse, counselors.)
Involve outside organizations (such as colleges, businesses, non-profit organizations) in the school energy efficiency effort. Involvement would be presentations, tours, funding, materials, assistance, promotion, or programs.
Create science fair-type projects (experiments or demonstrations) based on school energy efficiency and enter them in a science fair.
Make presentations on school energy efficiency to the PTA/PTO, the school board and/or the superintendent/school district administration.
Have your students teach other kids what they have learned about energy, environment, and saving energy.
Develop energy information through the arts and present to an audience.
Create an educational display for your school on energy, efficiency, and/or environment**.**
Track monthly energy savings or classroom behavior changes.Post them in a common area at school.
Develop energy saving tips for the school newspaper, weekly bulletin, or PA system.
Correspond with pen pals about energy, environment, and efficiency.You may use email or regular mail.
Write an article for the local paper on your Green Schools project.
Interview local energy professional(s) and publish the interview(s) in a school or local paper.
Create a survey on energy awareness and administer to people in your school.
Design and build a model of an energy-efficient building or a component of an energy-efficient building for public display and/or for public presentations.
Do a "walk-through" energy audit of the school. Make a list of suggestions for saving energy in the building.
Take home information about using energy efficiently.Use the school newsletter, the PTA/PTO or another organization for families.
Organize an energy patrol to encourage people to change energy-using behavior at school and to monitor the school's progress toward behaving in new ways when using energy.
Develop an energy efficiency manual specific to your school or for another building that students have audited.
Research the options for increasing the energy efficiency of school windows, doors, lighting or food service.Define the problem, list the options, and include information about costs.Then note which option(s) the team recommends and why.
Landscape school for energy efficiency.Plant appropriate plants in appropriate sites to increase the building's energy efficiency.
Complete a "walk-through" energy audit of student homes. • Make a list of energy problems in the home and suggest solutions. • Each student talks about it with his or her family and makes a plan to change the family's energy-using behavior.
Give several hours of environmental service or community service related to energy/environment.
Organize and present an energy conference, energy festival or energy workshop for the rest of the school or for the community.
Help to build an energy-efficient building, a greenhouse, or a component of an energy-efficiency system (for example, a daylighting retrofit).
Do a "technical" energy audit of the school (using actual data and calculating losses, savings, etc.).Include a list of suggestions for saving energy in the building.
Create your own Web site. The site should teach about energy efficiency and the environment.
Use the EPA benchmarking tool to rate your school. The ENERGY STAR® Benchmarking Tool is an online tool that evaluates building energy performance on a 0 to 100 scale using detailed data on your building's physical attributes, operating characteristics, and monthly energy consumption. http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager
Establish a Student Advisory Council or environmental club. SACs or clubs should take an active role in the Program and are responsibile for designing and implementing energy–related programs in the school/community.

Attachment XVII
Common Misconceptions Regarding Energy Use

Strategies for Success
School District Energy Management Program

Misconception #1: It costs less to leave fluorescent lights on when leaving the room for a short period of time because it requires more energy to turn it back on. Therefore, leave your lights on to save money on your electric bill.

Reality: When you turn on a fluorescent light bulb (correctly called a "lamp"), there is a very brief jump in current when the ballast charges the cathodes and causes the lamp to start. This inrush of current can be many times greater than the normal operating current of the lamp. However, the spike of current draw normally lasts no longer than 1/10th of a second, and draws the equivalent of about 5 seconds of normal operation. So, if you turn your fluorescent lamp off and on more frequently than every 5 seconds, you will use more power than normal, otherwise you'll being saving energy.

Misconception #2: Turning fluorescent lamps off and on wears them out right away.

Reality: Electric lights have a published rating for expected life. This rating is in the hundreds of hours for many incandescent lights, and in the thousands of hours for most fluorescents. Fluorescent lights have a life rating based on how many hours they are left on every time they are turned on. This is usually referred to as "burn time", and for fluorescent lights the burn time is three hours.

Every time a fluorescent light is turned on, a tiny amount of the coating on the electrodes is burned off. Eventually, enough coating is burned off, and the lamp fails to start. Most full-size fluorescent lamps are rated to last 20,000 hours when left on for 3 hours every time they are turned on. This means that the lamp has roughly 6,667 starts available to use up. (20,000/3 = 6,667)

Misconception #3: Screen savers save energy.

Reality: Screen savers are energy wasters. Most computers use about twice as much energy lighting up the screen as they do for processing. Originally, screen savers were designed to stop screens being burnt by a constant image, but they are not needed for modern screens. Not only can screen savers use as much energy as a full screen of work, but many require considerable processing energy as well. If you want to save energy you can set your saver to 'none' or 'blank screen'. If you want to use your screen saver in conjunction with monitor power management, set the screen saver "wait time" to less than the period of inactivity before the monitor shuts off automatically.

Misconception #4: Turning a computer off each day is bad for the computer system and shortens the life of the equipment.

Reality: Contrary to popular belief, turning on and off the computer doesn't shorten its life. The belief that frequent shutdowns of PCs are harmful persists from the days when hard disks did not automatically park their heads when shut off; frequent on-off cycling could damage such hard disks. Modern hard disks are not significantly affected by frequent shut-downs. Shutting down computers at night and on weekends saves significant energy without affecting the performance. If you are going to be away from the computer for several hours, turn it off.
Leaving a computer on overnight may not use a lot of electricity, especially if your computer and monitor support the "Energy Saver" features that are standard on most new computers. But make no mistake, over the course of months and years, quite a lot of electricity is wasted. It's probably okay to put your PC in a "sleep" mode during the day, but it's best to turn it off during evenings and weekends. This allows the

database to restart during the next turn-on allowing startup to correct any problems that may have occurred during the operating day.

Misconception #5: Turning the heat down (or cooling up) at night does not save energy, since you have to heat the building back up (or cool down) again the next morning.

Reality: Heating and cooling uses more energy and drains more energy dollars than any other system in your school. Typically, over 1/3 of your utility bill goes for heating and cooling. Heating and cooling systems in the United States together emit over a half billion tons of carbon dioxide into the atmosphere each year, adding to global warming. They also generate about 24% of the nation's sulfur dioxide and 12% of the nitrogen oxides, the chief ingredients in acid rain. By turning down the thermostat at night you will generally save 1%-2% of your heating bill for each degree lowered.

Misconception #6: Periodic inspection and tune-up of heating, ventilating and air conditioning systems is a waste of money.

Reality: As they say in medicine, prevention is nine tenths of the cure, and with building maintenance, the same holds true. Preventative maintenance can save you time and money in the long run. The maintenance department is one of the greatest levers of profitability for any capital intensive organization. Maintenance is often an organization's largest single controllable expense. Preventative maintenance is essential to prevent an energy system from using more energy than necessary; keep the system effective in doing its intended job; prevent problems that can lead to reduction in productivity; and help prevent early equipment failure.
Staff training on common maintenance and repair items is also time and money well spent. Preventative maintenance software programs, including PM checklists and work order forms are available to assist in implementing preventative maintenance.

We're here to get you started, and see you through!

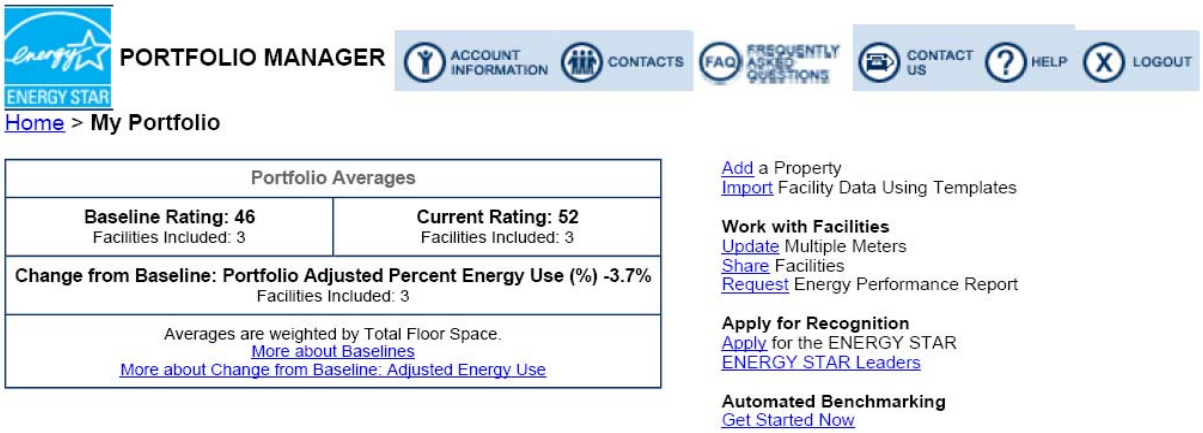
Rebuild Colorado
A Program of the Governor's Office of Energy Management and Conservation
225 East 16th Avenue, Suite 650 Denver, CO 80203
303-866-2264 or 1-800-632-6662
Email: rebuildco@state.co.us
Web: www.colorado.gov/rebuildco

CASDEM
Colorado Association of School District Energy Managers

Attachment XVIII

U.S. EPA Energy Star Portfolio Manager Home Page for Madeira City Schools

- Portfolio Manger is an online tool to track, assess and benchmark energy and water consumption across the district.
- This free online tool enables the district to enter energy consumption data and to track progress as well and benchmark usage against other like K-12 school buildings.
- The Planning Commission team has set up the district on the website and entered in the historical data to enable the district to track their energy consumption and prioritize investment opportunities. The user name and password has been provided to the Administration.



ENERGY STAR PORTFOLIO MANAGER | ACCOUNT INFORMATION | CONTACTS | FREQUENTLY ASKED QUESTIONS | CONTACT US | HELP | LOGOUT

Home > My Portfolio

Portfolio Averages	
Baseline Rating: 46 Facilities Included: 3	**Current Rating: 52** Facilities Included: 3
Change from Baseline: Portfolio Adjusted Percent Energy Use (%) -3.7% Facilities Included: 3	
Averages are weighted by Total Floor Space. More about Baselines More about Change from Baseline: Adjusted Energy Use	

Add a Property
Import Facility Data Using Templates

Work with Facilities
Update Multiple Meters
Share Facilities
Request Energy Performance Report

Apply for Recognition
Apply for the ENERGY STAR
ENERGY STAR Leaders

Automated Benchmarking
Get Started Now

GROUP: All Facilities | Create Group | View All | VIEW: Summary: Facilities | Create View | Edit View | View All

Download in Excel | Search Facility Name: Search

Results **1 - 3** of 3 | **All** # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Facility Name	Current Rating (1-100)	Change from Baseline: Adjusted Energy Use (%)	Total Floor Space (Sq. Ft.)	Energy Use Alerts	Current Energy Period Ending Date	Eligibility for the ENERGY STAR	Last Modified
Madeira Elementary School	44	-11.0	73,000		12/31/2008	Not Eligible: Rating must be 75 or above (ENERGY STAR Eligibility Rules)	02/02/2009
Madeira High School	61	2.7	112,000		12/31/2008	Not Eligible: Rating must be 75 or above (ENERGY STAR Eligibility Rules)	02/02/2009
Madeira Middle School	46	-6.1	75,000		12/31/2008	Not Eligible: Rating must be 75 or above (ENERGY STAR Eligibility Rules)	02/02/2009

Download in Excel | Search Facility Name: Search

Results **1 - 3** of 3 | **All** # A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

The rating is calculated by using the last day of the latest full calendar month where all meters in the facility have meter entries; the Period Ending date reflects that particular date.

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