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# School Energy Management Policy/Guidelines and Education Plan

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## EXECUTIVE SUMMARY

The Middleton-Cross Plains Area School District (MCPASD) and its ten schools are working to be leaders in Wisconsin and beyond in environmental awareness and sustainable practices. The District is committed to implementing more environmentally friendly practices and reducing our collective carbon footprint at all levels. The School Energy Management Policy/ Guidelines and Education Plan developed by MCPASD provides a framework to help fulfill our commitment to the efficient use of energy resources, to operate our facilities, to reduce the District's reliance on non-renewable energy sources and to engage our students, staff, parents and community in facilitating a cultural change related to energy use.

### Goals

- 1) To continue our District's efficient and effective use of energy.
- 2) To increase student and staff awareness/knowledge regarding energy usage in our schools.
- 3) To integrate energy management with energy education.
- 4) To apply knowledge gained from classroom experience to the day-to-day operation of District facilities.
- 5) To extend to citizens of the community applicable practices that are developed and maintained within the District.

### Objectives

- 1) Student and teachers will use our schools as "learning laboratories" regarding energy use.
- 2) School building occupants will be able to identify, develop, analyze and use concepts or strategies that reduce energy use.
- 3) School building occupants will know how to access relevant energy information.

## **Rationale**

Understanding the principals of energy use and conservation are key components of sustainability. Knowledge is critical in fostering systematic change or facilitating the "re-culturing" of an organization. Learning the concepts or skills outlined in our District's School Energy Management Policy/ Guidelines and Education Plan provides our students and staff with the knowledge base and background to help lead the changes needed to reduce our reliance on non-renewable energy starting in our schools, our homes and our community.

### **Why is energy management important?**

- Energy and resource conservation
- Financial savings/cost avoidance - redirecting scarce resources to student learning
- Reduced pollution, waste, and CO<sub>2</sub> emissions/carbon neutrality
- Create an improved, less wasteful learning environment for our students
- Encourage staff and student learning about conservation
- Provide leadership through practicing/modeling conservation
- Improve and upgrade our facilities - better learning/work environments.

## **Plan Development Process**

The creation of the School Energy Management Policy/ Guidelines and Education Plan is a collaborative effort involving a cross section of District staff members who are interested in the process of integrating energy conservation into the educational and operational streams within the District. From the outset, teachers, administrators, custodians, facilities maintenance personnel, energy consultants and the Energy Manager became willing participants in the uncharted startup process aimed at challenging all energy users to become educated on the need to conserve energy at all levels.

Many challenges were encountered as the process evolved: namely, the difficulties involved in selecting, delegating and scheduling members during the initial planning stages. In addition, the selection of appropriate subject paths for sub-groups to follow became a bit problematic. Fortunately, expert guidance was provided by our KEEP representative Melissa Rickert, whose concise direction enabled our group to take the first steps in the beginning phase of this important work. As an added bonus, our group enlisted the expertise and experience of Rapid Improvement Consultant Kevin Little, who added his time-tested insight and perspective to the process. The KEEP program supplied the necessary support and funding for this effort.

# ENERGY MANAGEMENT POLICY/GUIDELINES

## Background

Prior to 2004 most energy-related modifications and improvements produced at the Middleton-Cross Plains Area School District were of a more technical variety. At the start of first semester, 2004, MCPASD contracted with Energy Education, Inc., a consulting firm specializing in energy conservation, to integrate a people-based approach into its program. By devoting resources to the hiring of a District Energy Manager, MCPASD was able to consolidate the efforts of all staff into a more coordinated energy management plan. Because of these changes, MCPASD is now in a position to increase involvement of teachers, students and support staff to expand the educational component its energy management program.

## Purpose

The number of energy applications that exist within a school district is virtually unlimited. Opportunities for identifying and managing resources assigned to these applications are daunting and incalculable. It is the responsibility of the District's Energy Manager, supported by Administration and District's Sustainability Committee, to unearth and identify as many of these opportunities as possible. The ultimate goal of such efforts is to motivate all energy users to share in the challenge of reducing consumption and costs while pursuing educational excellence and achievement.

The ability of the District to successfully reach its goals associated with energy usage and conservation is based on the ability of all parties to participate in the day-to-day program outlined in the Energy Management Policies/Guidelines. The Energy Management Policy/Guidelines must be as comprehensive and uncomplicated as possible in order to foster acceptance and compliance among all staff members.

With the Energy Management Policy/Guidelines as a reference guide, every staff member (and student) has the proper direction and tools for the challenge of containing energy consumption and costs. The natural course of action should result in the continual increase in cost avoidance.

The Energy Management Policies/Guidelines document accepted practices and procedures. The policies/guidelines embody the values that the Middleton-Cross Plains Area School District has accepted over time and serves as a model for all to follow. Existing values may be reviewed and deleted if necessary and new entries added to improve and update the information included therein. Energy management is the primary reason for its existence, but an expansion of scope may be required as newer concepts such as "sustainability" and "renewable energy" take root.

### **Responsibilities**

- All staff and students are expected to be "energy savers" as well as "energy consumers".
- All District staff are responsible for implementation of the guidelines.
- Custodians are responsible for control and operation of mechanical, electrical and related systems at each site.
- Since the night custodian is typically the last person to leave a building in the evening, he/she is responsible for verification of the nighttime shutdown.
- The Principal is responsible to oversee and enforce the total energy effort at his/her building.
- The Energy Manager performs routine audits of all facilities and communicates the results to the appropriate personnel.
- The Energy Manager tracks energy consumption and provides regular reports to Principals and Head Custodians indicating performance with regard to energy savings.
- All non-school calendar dates are to be regarded by staff as unoccupied energy shutdown opportunities and treated accordingly.

## Building Improvements

1. Repair all areas of water intrusions and eliminate any areas of standing water.
2. All doors and windows should be closed during periods of humid weather.
3. Maintain positive building pressure.
4. A moisture extraction plan should be implemented when cleaning carpets.
5. All air leaks in a building's "envelope" are to be closed using added insulation and/or caulk.

## Cooling/Air Conditioning

1. Occupied temperature settings shall **NOT** be set below 75° F.
2. During unoccupied times, the air conditioning equipment shall be **off**.
3. Air conditioning start times may be adjusted (depending on weather) to ensure classroom comfort when school begins.
4. Close outside air dampers during unoccupied times.
5. Ceiling fans should be operated per guidelines in all areas that have them.
6. Relative humidity levels should not exceed 60% at any time.
7. Equipment appropriate filtration shall be utilized and filtration shall be changed or replaced in accordance with an established schedule.
8. Establish a district maintenance program to ensure clean coils and drain pans.
9. Air conditioning should not be utilized in classrooms during the summer months unless the classrooms are being used for summer school or year-round school. Relative humidity levels should be monitored to verify level remains below 60%. Air conditioning may be used by exception only or in those schools that are involved in a team-cleaning concept.
10. In all areas which have evaporative coolers such as shops, kitchens and gymnasiums, the doors leading to halls which have air conditioned classrooms or dining areas should be kept closed as much as possible.
11. Classroom doors should remain **closed** when HVAC is operating. Ensure that doors separating conditioned and unconditioned space remain closed at all times (e.g., between hallways and gym/pool areas).
12. Utilize data loggers to document building humidity, temperature, and light levels to ensure compliance with district guidelines.
13. All exhaust fans should be turned **off** every day and during unoccupied hours.

## Heating (Equipment)

1. The standard occupied temperature setting (set point) shall be 68 ° F during heating season. The set point may be increased only if circumstances require or justify an adjustment. Occupied temperature setting shall **NOT** exceed 72° F.
2. The unoccupied temperature setting (set point) shall be 55° F unless circumstances require or justify an adjustment.
3. During the spring and fall when there is no threat of freezing, all steam and forced air heating systems should be switched off during unoccupied times. Hot water heating systems should be switched off using the appropriate loop pumps.
4. Ensure that domestic hot water systems are set no higher than 120° F (180° F in food service kitchens) and hot water heaters and pumps turned off during unoccupied periods whenever possible.
5. Classroom doors should remain **closed** when HVAC is operating. Ensure that doors between conditioned and unconditioned space remain closed at all times (e.g., between hallways and gym/pool areas).
6. Utilize data loggers to document building humidity, temperature, and light levels to ensure compliance with district guidelines.
7. All exhaust fans should be turned **off** every day and during unoccupied hours.
8. Personal space heaters are NOT allowed under any circumstances.

## Lighting

1. All unnecessary lighting in unoccupied areas will be turned **off**. Teachers should make certain that lights are turned off when leaving the classroom. Utilize natural lighting where appropriate.
2. All outside lighting shall be **off** during daylight hours.
3. Lights in gyms should not be left on unless activities are taking place. In multi-station gym facilities, lights should be left off in stations when the space is not being utilized.
4. All lights will be turned off when students and teachers leave school. Custodians will turn on lights only in the areas in which they are working.
5. Refrain from turning lights on unless definitely needed. Remember that lights not only consume electricity, but also give off heat that places an additional load on the air conditioning equipment and thereby increases the use of electricity necessary to cool the room.

## Food Service

1. Equipment should be started as late as possible and run a minimum of time.
2. Exhaust fans will run only as necessary.
3. Energy-saving equipment will be utilized whenever possible.

## Computers and Office Equipment/Machines

1. All office and classroom equipment/machines ("smart boards", copy machines, laminating equipment, etc.) shall be switched **off** each night and during unoccupied times. Fax machines should remain on.
2. All computers should be completely turned **off** each night. This includes the monitor, local printer and speakers. Network equipment is excluded.
3. All capable computers should be programmed for the "energy saver" mode using *the power management* feature. If network constraints restrict this for the PC, ensure the monitor "sleeps" after 10-minutes of inactivity.
4. All new computers, computer peripherals, and office equipment that are purchased by the District should be "ENERGY STAR®" rated (unless "ENERGY STAR" rated equipment is not available or if there are extenuating circumstances).

## Other

1. The domestic hot water temperature set point will be no higher than 115 degrees. Food service operations requiring higher temperature levels by code shall use booster units or dedicated water heaters when possible.
2. Requests for exemption and questions regarding set point temperatures that are considered to be too hot or too cold must be addressed in writing to the Facilities Systems Manager at which time he/she will investigate the complaint or request for exemption. If the issue cannot be resolved while adhering to the energy policy, the District's Facilities Services Manager shall make the determination as to what action, if any, will be taken. The appeal process will follow the normal chain of command.
3. The Facilities Services Department may adjust set points to provide the best overall performance of the HVAC system.
4. Vending machines, when their use is permitted by the District, shall be the most energy efficient as possible. The District will require ENERGY STAR rated vending machines whenever possible.

## **Education/Professional Development**

1. Maintenance and custodial personnel should attend relevant training opportunities when they are offered. Instructional and other support staff members should be afforded training whenever applicable.
2. All staff should receive training on energy conservation.
3. Curricular material and presentation should contain relevant and practical information and instruction relating to energy conservation.

## **Summer School & Other Programs during Unoccupied Times**

1. To the greatest extent possible, scheduled classes/non-school programs will be located in an area that affords participants the most comfort for the least amount of energy and cost.
2. The date for the restart of A/C during the summer recess will be preset and announced by Administration prior to the close of the school year.
3. Unless required by special circumstances, the use of A/C is not supplied during the summer.

## **Personal (non-district owned) Appliances**

1. Bringing personal appliances (such as such as electric coffee makers, microwaves, refrigerators, toaster ovens, pizza makers, and/or other cooking or refrigeration appliances) to school is strongly discouraged. If a staff member needs to bring a personal appliance to school, he/she is required to receive approval from their principal or supervisor. The request for use of a personal appliance shall include rationale as to why the personal appliance is needed. Approval granted by the staff member's principal or supervisor will NOT extend beyond the current school year.
2. Approved appliances must be UL-listed, energy efficient and, whenever possible, ENERGY STAR rated (affixed with the ENERGY STAR label).
3. Appliances with a heating element MUST feature an auto shut-off or timer that will automatically shut the unit off when not being used.
4. Appliances are required to be shut off and unplugged during all extended break periods during the school year. All personal appliances shall be taken home following conclusion of each school year.
5. The use of small fans, radios and desk lamps (only with fluorescent or LED lamps) are allowed, but must be turned off when not in use. Incandescent or quartz lamp fixture/bulbs are NOT allowed.
6. Personal space heaters are NOT allowed under any circumstances.

## **District Appliances**

1. District-owned appliances such as refrigerators, stoves, microwaves, and commercial coffee-makers are allowed in designated spaces/rooms including staff breakrooms, family & consumer education classrooms, health offices, public meeting spaces and other spaces where the appliance's function is an integral part of the educational or administrative process.
2. Whenever feasible, the District's appliances are to be ENERGY STAR rated for efficiency and cost effectiveness.
3. When replacing an aging or malfunctioning appliance, the District should consider several key factors, i.e., energy efficiency, cost, size, location and number of potential users.

**Disclaimer: These guidelines are not intended to be all-inclusive. They may be modified for local conditions. These guidelines supersede all previous instructions related to building management or energy usage guidelines. It is essential that these energy guidelines be observed and implemented as outlined.**

# ENERGY EDUCATION PLAN

## Philosophy Statement

We want our school community to understand the use of energy, how to conserve energy and why this is important for our future and the future of the planet.

We want continuity across grades and subjects with respect to energy education.

We want our school buildings to be a laboratory and place for learning about energy use and have our buildings demonstrate proper conservation.

## Goals

### **Phase 1 (2010-11 School Year):**

Establish/create school-based sustainability or energy action teams in at least 50% of our schools

Promote conscientious use of energy in our schools by making all staff aware of the implications of the following sustainable/conservation measures: turning off lights and closing doors/windows (where applicable based on the mechanical/HVAC system in the school).

Staff and students, with the assistance of the District Energy Manager, will establish a baseline of energy conservation practices in their school, and document a 10% increase in practices by the end of the 2010-11 school year.

Establish a process to review and implement energy conservation suggestions from school-based teams (student and staff, including the head custodians).

**Phase 2 (2011-12 School Year):**

Establish/create school-based sustainability or energy action teams in 100% of our schools

10% of teaching staff will implement at least one activity from the energy curriculum.

MCPASD Sustainability committee will annually document collaborations with community (public library, families, non-profits, municipalities) involving energy education.

Encourage, promote and support energy education opportunities for collaboration among schools/departments.

## Curricular Framework

### Kindergarten

All of these activities correlate with K-5 Science ELO's under the concept of Scientific Reasoning.

KEEP Theme(s)	Key Concepts	Activities- Classroom Connections	Site Connections/ Use of building	Alignment with State Standards & District ELO's	Type of Assessment	Resources
T 1	We need energy Define energy	Evidence of Energy	Classroom gym	Environ. Ed. B.4.2 Phy Ed. D.4.4 Science A.4.2, D. 4.4, F. 4.4	<b>Formative:</b> When students define energy, do they relate to movement, sound, heat, and light to evidence that energy is being used? <b>Summative:</b> Have students create symbols to represent things that indicate energy is being used.	Blue Keep p. 42 Phy. Ed. teachers
T 3 T 4	Quality of life Quality of environment Management of energy resource use	Pulling the Plug on Phantom Load	Classroom	English f.4.1 FCS C.3 Science A.4.1, D. 4.8	<b>Formative:</b> Did students correctly list electrical items that begin with the same letter? <b>Summative:</b> What electrical appliances at home could be plugged into a power strip and turned off more often to save energy?	Learning buddies Red Keep book p. 52
T 1	.Definition of energy Energy flow in living systems	Energy From Food	School kitchen Classroom gym	Environ. Ed. B.4.2 Phy. Ed. D.4.4 Science F.4.4	<b>Formative:</b> Review questions asked during the activity to see if students understand how they get their energy from food <b>Summative:</b> Challenge class to organize their drawings into 3 groups. Rank these activities according to the amount of energy used.	Blue Keep p. 40 District food service person Phy. Ed. teacher

## First Grade

All of these activities correlate with K-5 Science ELO's under the concept of Scientific Reasoning.

KEEP Theme(s)	Key Concepts	Activities-Classroom Connections	Site Connections/ Use of building	Alignment with State Standards & District ELO's	Type of Assessment	Resources
T 2 T 3	Development of energy resources Consumption of resources Quality of the environment	Digging for Coal	Classroom	Science B.4.10, B.4.8, E.4.7 Soc. St. H.4.2 Environ. Ed. A.4.3, A.4.4	<b>Formative</b> : Can students explain how coal is made and where it comes from ? How well did students perform the cookie mining exercise? <b>Summative</b> : Have students mention 3 positive and negative aspects of mining and using coal.	Blue Keep p. 108
T 1	Definition of energy Natural laws that govern energy Energy flow in nonliving systems	Exploring Heat	Home Classroom Kitchen	Science: E.4.7 Soc. St. H.4.2	<b>Formative</b> : How carefully did students observe or conduct the investigations? Can students provide a definition for thermal energy, convection, and conduction?	Blue Keep p. 44

## Second Grade

All of these activities correlate with K-5 Science ELO's under the concept of Scientific Reasoning.

KEEP Theme(s)	Key Concepts	Activities - Classroom Connections	Site Connections/ Use of building	Alignment with State Standards & District ELO's	Type of Assessment	Resources
T 1	Natural laws that govern energy flow in nonliving systems	Taking Temperatures	Outside Classroom	Science: D.4.4, A.4.3	<p><b>Formative:</b> Can students read a thermometer properly? Are they able to describe how heat energy affects the movement of molecules?</p> <p><b>Summative:</b> conduct an ice cube melting contest. Have groups identify where they think an ice cube will melt fastest.</p>	Blue Keep p. 50
T 2	Energy flow in ecosystems	Food Chain Game	Classroom Gym Outside	living: B.4.4 Science: F.4.4	<p><b>Formative:</b> Did students follow the game directions? Could they explain why all the energy and nutrients from one organism in a food chain are not transferred to the next?</p> <p><b>Summative:</b> Have students create a simple food chain or web showing how energy flows through the system and nutrients are cycled.</p>	Blue Keep p. 57 Science Resource teacher
T 1 T 3 T 4	Quality of life Management of energy resource use	Cost of Computers	Computer lab Classroom	English: E.8.1, E.8.2, F.8.1 EE: A.8.1, A.8.4, A.8.5 Math: D.8.4 Science: D.8.7, D.8.8, D.8.9	<p><b>Formative:</b> How well did students complete the Calculating Computer Costs Activity Sheet?</p> <p>Were students able to provide ways to lower the electricity costs of the classroom computers?</p> <p><b>Summative:</b> Have students calculate the cost savings if they were to operate the classroom computers more efficiently.</p>	Keep Red bk. P. 61 Use Watt-meter

### Third Grade

All of these activities correlate with K-5 Science ELO's under the concept of Scientific Reasoning.

KEEP Theme(s)	Key Concepts	Activities-Classroom Connections	Site Connections/ Use of building	Alignment with State Standards & District ELO's	Type of Assessment	Resources
T 1	Definition of energy Natural laws that govern energy	Potentially Kinetic	Classroom	Science: D. 4.4	<b>Formative:</b> Are students able to define kinetic and potential energy? Can they give examples of each? <b>Summative:</b> The Tic Tac Toe game should provide insight in students' understanding of different forms of energy?	Blue Keep p. 62
T 1	Energy flow in systems Energy flow in nonliving systems	Sun, Wind, Water	Art room Classroom	Science: A.4.3, E.4.7, F.4.4 Soc. St. A.4.6	<b>Formative :</b> Can students define evaporation and condensation and explain the role of energy in each ? Are students able to identify the presence of sun, wind, and water in the water cycle? <b>Summative:</b> Check students' stories about the water cycle to make sure they included all parts of water cycle.	Blue Keep p. 47
T 1 T 2	Energy flows in ecosystems including human societies	Classroom Energy Flow	classroom	Science : A.4.3	<b>Formative :</b> Were students able to identify appliances and equipment that use energy ? <b>Summative:</b> Use the Energy Flow Arrows to quiz students on how items in the room transfer energy by having them fill in the blank arrows.	Blue Keep p. 38

KEEP Theme(s)	Key Concepts	Activities-Classroom Connections	Site Connections/ Use of building	Alignment with State Standards & District ELO's	Type of Assessment	Resources
T1-4	Quality of life Quality of the environment Management of energy resource use	Design a Cool School	Art room Classroom	Art: C.8.1, D.8.3, L.8.3 English: F.8.1 Health: A.8.2 Science: C.8.1, C.8.4, C.8.10 SS: A.8.10, D.8.11, E.8.4 Tech Ed. B.8.4, B.8.6, C.8.3, D.8.2	<b>Formative:</b> How well did students integrate knowledge learned to design a high performance school building? <b>Summative:</b> Are there other buildings in your community that have high performance building design elements?	Red Keep p. 77 Tech Ed. Teachers Art teachers

## Fifth Grade

All of these activities correlate with K-5 Science ELO's under the concept of Scientific Reasoning.

KEEP Theme(s)	Key Concepts	Activities-Classroom Connections	Site Connections/ Use of building	Alignment with State Standards & District ELO's	Type of Assessment	Resources
T-1, T-3, T-4	-quality of life -management of energy resource use	Cost of Computers	Use of building computers	English: E.8.1, E.8.2, F.8.1 EE: A.8.1, A.8.4, A.8.5 Math: D.8.4 Science: D8.7, D8.8, D.8.9 ELO: identify a variable within a controlled experiment	<b>Formative:</b> How well did students complete the Calculating Computer Costs Activity Sheet? -Were students able to provide ways to lower the electricity costs of their classroom computer(s) or their home computer? -Were the students able to identify ways to educate other students & staff about the cost of computers? <b>Summative:</b> Have students calculate the cost savings if they were to operate the classroom computer(s) more efficiently.	Red KEEP book, p. 61 Using Watt-Meters (from the District or Public Library)

KEEP Theme(s)	Key Concepts	Activities-Classroom Connections	Site Connections/ Use of building	Alignment with State Standards & District ELO's	Type of Assessment	Resources
T-1, T-2, T-3, T-4	<ul style="list-style-type: none"> <li>-quality of life</li> <li>-quality of environment</li> <li>-management of energy resource use</li> </ul>	Design a Cool School	<p>Use of computer lab &amp; technology teacher</p> <p>Could be done in conjunction with art teacher</p>	<p>Art: C.8.1, D.8.3, L.8.3</p> <p>English: F.8.1</p> <p>EE: A.8.1, D.8.1</p> <p>Health: A.8.2</p> <p>Science: C.8.1, C.8.4, C.8.10</p> <p>SS: A.8.10, D.8.11, E.8.4</p> <p>Tech. Ed: B.8.4, B.8.6, C.8.3, D.8.2</p>	<p>-Can students summarize how each economic sector in their community uses energy?  <b>Summative:</b> Have students create a profile of energy use in their community based on their survey findings. Encourage a variety of reporting out devices.</p> <p>Formative: How well did students integrate knowledge learned to design a high performance school building?  -Can students accurately name several high performance building design elements?  -Did students present their designs to the class clearly explaining the high performance attributes needed?  <b>Summative:</b> Are there other buildings in your community that have high performance design attributes? (where are they located &amp; which design elements do they possess?)</p>	Red KEEP book, p. 77

## Science

Energy Concepts	Suggested Class Connection	KEEP Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
<p>Energy can be measured and quantified (working with units, including conversions)</p> <p>Power is the rate at which energy is used.</p>	Physics	Energy and Your School p.72 Light and Your Load		students calculate the cost of lighting their classroom with a more or less efficient lighting option. What are the savings/costs associated with the new lighting option?	Science: A.12.5, B.12.4, C.12.3, G.12.3	
<p>Power is the rate at which energy is used.</p>	Physics	Energy and Your School p.72 Light and Your Load		students calculate the cost of lighting their classroom with a more or less efficient lighting option. What are the savings/costs associated with the new lighting option?	Science: A.12.5, B.12.4, C.12.3, G.12.3	
<p>With each energy conversion from one form to another some of the energy becomes unavailable for further use. (2nd Law of Thermodynamics). The measure of dispersal of energy is called entropy.</p>	Chemistry Physics Environment	Energy and Your School p.72 Light and Your Load		students calculate the cost of lighting their classroom with a more or less efficient lighting option. What are the savings/costs associated with the new lighting option?	Science: A.12.5, B.12.4, C.12.3, G.12.3	

Energy Concepts	Suggested Class Connection	KEEP Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
Some of the energy converted by systems flows through them. The rest is stored within them for seconds of many years.	Physics Chemistry Physical Science	KEEP Activity Guide p.158 The Miracle of Solar Cells	Solar cell demonstration (small solar cells, wires, motor or lightbulb)	Describe how a solar cell works. Describe the electrical characteristics of a solar cell.	Science(Phys Sci, Life and Env Sci Personal&social perspectives) Env Ed(knowledge)	Solar Cells on Roof of School
Ecosystems use energy to maintain biogeochemical cycles--such as the sedimentary, gaseous, and hydrologic cycles--between living and nonliving systems.	Biology Environment	KEEP Activity Guide p.93 Puzzling Wisconsin's Biological Communities Energy and Your School p. 29 Seeking Inhabitable Schools		Create vegetation/land use cover maps for Wisconsin.	Env Ed(questioning, knowledge, issue investigation) Science(Sci connections.Nature of Sci, Earth&Space Sci, Life & Env)	
Ecosystems are characterized by (a) types and quantities of available energy sources (b) types and characteristics of energy flows (c) energy budgets, which are the amount of energy available with respect to the amount of energy used by an ecosystem. The total energy budget of an ecosystem determines its carrying capacity.	Biology Environment	KEEP Activity Guide p.93 Puzzling Wisconsin's Biological Communities Energy and Your School p. 29 Seeking Inhabitable Schools		Create vegetation/land use cover maps for Wisconsin.	Env Ed(questioning, knowledge, issue investigation) Science(Sci connections.Nature of Sci, Earth&Space Sci, Life & Env)	

Energy Concepts	Suggested Class Connection	KEEP Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
Some energy sources are concentrated, such as the nuclear energy stored in enriched uranium used in a nuclear power plant, and others are diffuse, such as thermal energy stored in the oceans.	Physical Science ChemCom	KEEP Activity Guide p.161 Energy Debate		Provide facts about how each resource is developed and summarize advantages and disadvantages (bullet board, ppt etc)	Science(Nature of Sci, Sci Inquiry, Pers & soc perspectives) Env Ed(Questioning&Analysis, knowledge, issue investigation)	Energy Stewards Website
Each renewable energy resource has inherent qualities that make it more suitable for some applications than others.	Physical Science Environment	KEEP Activity Guide p.158 The Miracle of Solar Cells Physics: Double Renewables p.73 Double Renewables p.119	Solar cell demonstration (small solar cells, wires, motor or lightbulb)	Describe how a solar cell works. Describe the electrical characteristics of a solar cell. Suggest a location for a solar panel on school grounds and explain why.	Science(Phys Sci, Life and Env Sci Personal&social perspectives) Env Ed(knowledge)	Solar Cells on Roof of School
The efficiency of converting renewable energy sources to useable energy varies according to the source and/or technology used.	Physical Science Environment Chem Com	KEEP Activity Guide p.158 The Miracle of Solar Cells Double Renewables p.110 Double Renewables p.119	Solar cell demonstration (small solar cells, wires, motor or lightbulb)	Describe how a solar cell works. Describe the electrical characteristics of a solar cell. Suggest a location for a solar panel on school grounds and explain why.	Science(Phys Sci, Life and Env Sci Personal&social perspectives, applications) Env Ed(knowledge)	Solar Cells on Roof of School

Energy Concepts	Suggested Class Connection	KEEP Connections and Activities	Other Resources	Assessment	Wisconsin Academic Standards	Site Use
Renewable energy systems can be centralized or decentralized.	Physical Science Environment	KEEP Activity Guide p.161 Energy Debate KEEP Activity Guide p.158 The Miracle of Solar Cells Doble Renewables p.73	Solar cell demonstration (small solar cells, wires, motor or lightbulb)	Provide facts about how each resource is developed and summarize advantages and disadvantages (bullet board, ppt etc)  Describe how a solar cell works. Describe the electrical characteristics of a solar cell. Suggest a location for a solar panel on school grounds and explain why.	Science(Nature of Sci, Sci Inquiry, Pers & soc perspectives) Env Ed(Questioning&Analysis, knowledge, issue investigation)  Science(Phys Sci, Life and Env Sci Personal&social perspectives) Env Ed(knowledge)	Energy Stewards Website  Solar Cells on Roof of School

## Social Studies

Energy Education Standards	Subject Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
Energy sources are considered to be energy resources by individuals and society when they serve societal needs and wants.	KEEP Activity Guide p.161 Energy Debate		Provide facts about how each resource is developed and summarize advantages and disadvantages(bulletten board, ppt etc)	(Hist, Geography),	
Geographically, Earth's energy resources are unevenly distributed.	KEEP Activity Guide p.161 Energy Debate		Provide facts about how each resource is developed and summarize advantages and disadvantages(bulletten board, ppt etc)	(Hist, Geography),	Energy Stewards Website
Supply and demand influence energy resource discovery, development and use. The supply and demand for an energy resource is determined by resource availability, level of technological development, and societal factors such as lifestyle, health and safety, economics, politics, and culture.	KEEP Activity Guide p.210 Energy Prices and the Laws of Supply and Demand		Apply supply and demand curves to price and quantity of other energy resources(elect, nat gas, propane, coal, etc)	Hist, Poli Sci, Econ, Behav Sci	

Energy Education Standards	Subject Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
A driving factor in the development of energy-related technology has been people's desire for comfort, convenience and entertainment.	KEEP Activity Guide p.227 KEEP Activity Guide p. 206 Driving Reasons Energy and Your School p.133 Energy Investigations for School Buildings Doable Renewables p.114		Investigation Report, Calculate mpg and identify vehicle maintenance, write a paragraph detailing choices in design essential to developing a green home	Poli Sci, Beh Sci, Econ	Energy Stewards Website
Individuals and businesses can create their own renewable energy from decentralized systems such as a wind system. Using renewable energy from a decentralized system may require lifestyle modifications ...	KEEP Activity Guide p.227 Doable Renewables p.114		report on energy and society/environment write a paragraph detailing choices in design essential to developing a green home	Poli Sci, Beh Sci	Energy Stewards Website
The market price of energy includes the cost of energy resource exploration, recovery, refining, pollution control, distribution, and transportation, as well as taxes and other fees.	KEEP Activity Guide p.210 Energy Prices and the Laws of Supply and Demand		Apply supply and demand curves to price and quantity of other energy resources(elect, nat gas, propane, coal, etc)	Hist, Poli Sci, Econ, Behav Sci	
Other costs that are not part of the market price of energy (called externality costs) are due to factors such as environmental damage, property damage, civil unrest, war, and health care.	KEEP Activity Guide p.206 Driving Reasons		Calculate mpg and identify vehicle maintenance,	Econ, Beh Sci	

Energy Education Standards	Subject Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
<p>The rate of energy consumption is influenced by energy prices and externality costs. When comparing the cost of renewable energy to non-renewable energy, externality costs associated with non-renewable energy should be considered.</p>	<p>KEEP Activity Guide p.206 Driving Reasons Energy and Your School p.91 Demanding School Electric Bills</p>		<p>Calculate mpg and identify vehicle maintenance,</p>	<p>Econ, Beh Sci</p>	<p>Energy Stewards Website</p>
<p>When consumers consider purchasing renewable energy systems, they are often concerned about payback. With the current prices of energy, some decentralized renewable energy systems will accomplish a full payback within their lifespan. Factors that influence payback are given and prospects for increased likelihood of payback are discussed.</p>	<p>Energy and Your School p.91 Demanding School Electric Bills</p>		<p>Students can analyze school electric bills and usage.</p>	<p>Science: A.12.5, C.12.2</p>	<p>Energy Stewards Website</p>

Energy Education Standards	Subject Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
<p>Most renewable energy sources are free. Therefore, development and production investments go toward materials and labor rather than purchasing fuel. This money is often spent within the U.S. and is frequently spent within the same state or town where the resource is located.</p>	<p>Economics, Business            Doable Renewables p.114            Doable Renewables p.119</p>		<p>Write a paragraph detailing choices in developing a green home.            Choose a nearby subdivision and write an analysis of the sustainability of it</p>	<p>Economics</p>	
<p>Sociopolitical processes result in laws and regulations that govern energy development, availability, and use. Sociopolitical processes have usually governed centralized energy systems such as public utilities.</p>	<p>Research national regulations governing energy development, and identify parties who supported or opposed the regulations. (eg. recent moratorium on deepwater drilling)</p>		<p>presentations</p>	<p>Hist, Poli Sci, Beh Sci, Econ</p>	
<p>The positive and negative effects of energy resource development and use are not shared equally among states, regions, nations, and individuals, although sociopolitical processes have made some effort to address this.</p>	<p>KEEP Activity Guide p.220 Viewpoints</p>		<p>Presentations</p>	<p>Hist, Poli Sci, Beh Sci</p>	<p>Energy Stewards Website, Computer Lab</p>

Energy Education Standards	Subject Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
Wisconsin's sociopolitical processes result in laws and regulations that govern energy development, availability and use.	Research WI regulations governing renewables, and identify parties who supported or opposed the legislation. (eg. wind turbine development)		presentations	Hist, Poli Sci, Beh Sci, Econ	
Support for renewable energy development is influenced by society and politics. In the United States, renewable energy resource development has been governed by the energy policies of political administrations.	KEEP Activity Guide p.220 Viewpoints		presentations	Hist, Poli Sci, Beh Sci	Energy Stewards Website, Computer Lab
Sociopolitical processes result in laws and regulations that govern renewable energy development, availability, and use. Access and zoning laws have been developed to guide renewable energy system placement and installation.	Doable Renewables p.114 Doable Renewables p.119		Write a paragraph detailing choices in developing a green home. Choose a nearby subdivision and write an analysis of the sustainability of it	Economics, Beh Sci	
The availability of energy resources has shaped cultures, and each culture has value systems that influence how energy resources are used.	Investigate energy usage in different countries based on availability of energy. Identify cultural practices that reflect availability.		presentations	Geography,, Beh Sci	

Energy Education Standards	Subject Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
Using renewable energy can help mitigate the effects of extracting fossil fuels. Extracting fossil fuels affects the cultures, environments, and health of individuals.	KEEP Activity Guide p.220 Viewpoints		presentations	Hist, Poli Sci, Beh Sci	Energy Stewards Website, Computer Lab
It takes less energy and less money to preserve the environment than it does to restore the environment after it has been altered.	KEEP Activity Guide p.220 Viewpoints		presentations	Hist, Poli Sci, Beh Sci	Energy Stewards Website, Computer Lab
There are environmental costs and benefits involved in the development, manufacture, distribution, and installation of renewable energy technologies. Each renewable energy technology and its application (e.g. centralized or decentralized) has unique environmental costs and benefits.	Double Renewables p.110		Summarize knowledge of ethanol and attitude toward ethanol use.	Geography	

Energy Education Standards	Subject Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
<p>A citizen, acting individually or as part of a group or organization, may make decisions (such as deciding to ride a bicycle instead of driving a car) and take actions (riding the bicycle) that determine how the energy they use will be managed. Citizens may also affect the actions of other individuals, groups, or organizations to determine how the energy they use will be managed. This can be accomplished by ecomanagement (physical action), education, persuasion, consumer action, political action, or legal action.</p>	<p>KEEP Activity Guide p.257 Energy and Your School p.35 Is Your Classroom Energy Efficient</p>		<p>Action plan</p>	<p>Poli Sci, Beh Sci</p>	<p>Energy Stewards Website</p>
<p>The decisions and actions taken by societies and their citizens depend on the barriers and incentives associated with energy management choices. Examples of barriers include high energy costs, lack of access to new technologies, and laws that discourage the development or use of certain energy resources. Examples of incentives include rebates, building codes that promote energy conservation, and appliance efficiency standards.</p>	<p>KEEP Activity Guide p.257 Energy and Your School p.35 Is Your Classroom Energy Efficient</p>		<p>Action plan</p>	<p>Hist, Poli Sci, Beh Sci</p>	<p>Energy Stewards Website</p>

Energy Education Standards	Subject Connections and Activities	Other Resources	Assessment	Wisconsin Model Academic Standards	Site Use
<p>The use of decentralized renewable energy systems is usually a personal choice rather than a government mandate, although there are government programs that provide incentives for using renewable energy.</p>	<p>KEEP Activity Guide p.257</p>		<p>Action plan</p>	<p>Hist, Poli Sci, Beh Sci</p>	
<p>New types of societies—such as a sustainable society or a postindustrial society whose economy is based on information and service—may emerge as energy resource development and use changes.</p>	<p>KEEP Activity Guide p.253</p>		<p>Futures wheel</p>	<p>Hist, Poli Sci, Beh Sci</p>	

## **Staff Development Plan**

Staff/professional development is a key component of the District's overall energy management program. Staff/professional development opportunities will be made available for faculty members and for employees with operational responsibilities (i.e. custodial/maintenance staff).

Potential staff/professional development opportunities for faculty (and other interested staff that help support the program) include:

- Courses, workshops, seminars offered by KEEP
- Courses, workshops, seminars offered by Wisconsin Focus on Energy
- Selected conferences

In addition, the District's website will be utilized to increase student, staff and community awareness of energy conservation/sustainability and provide helpful energy-related information/resources.

Sustain Dane has expressed an interest in working with interested Dane County school districts to collaborate on sustainable initiatives including sharing of ideas and best practices, developing programs, seeking funding to develop/support sustainability, and staff/professional development related

## **Involving Building Occupants**

- Teachers incorporating energy into lessons
- Involve custodians in energy tours of their schools and, where applicable, use of renewable energy technologies (i.e. solar hot water at MHS)
- Incorporate school nurse and office personnel
- Students will be more energy aware and ask teachers to turn down lighting, etc. i.e. act as energy police
- Involve school nutrition service personnel in use of energy in the preparation of food discussion
- Involve facilities service personnel in presentation about different lighting options in school
- Involve coaches, club advisors and other non-staff user of District facilities in reducing energy use
- Custodians inform users of recycling rules
- Administrators are supportive of energy conservation initiatives

## MONITORING AND REPORTING

### Energy Management

For a school district, the process of gathering, sorting, evaluating and disseminating energy information is a critically important aspect of building management - one that routinely requires diligence at every turn. In the Middleton-Cross Plains Area School District (MCPASD), these responsibilities fall mainly to the District Energy Manager and Facilities Services Supervisor. There exist numerous database functions that require close attention on a daily and monthly basis. The Energy CAP software program is managed by the Energy Manager in concert with Energy Education, Inc., one of several energy consulting firms that support the District's energy initiative. This program utilizes the utility information supplied to the Energy Manager, who compiles and processes such data to generate reports that demonstrate performance increases or decreases, as well as problems and opportunities.

The District established a baseline for utility/energy usage back in 2004. This baseline has been updated/revised (and will continue to be updated/revised) as various more energy efficient equipment or systems have been implemented, facilities have increased in size, significant changes in energy-consuming equipment have occurred, and/or the use of facilities has substantially changed.

With regard to monitoring, the Energy Manager and Facilities Services Manager use available utility-supplied data to screen out usage spikes, drops and other aberrations that may indicate changing patterns of operation. Spikes in cost and usage can indicate problems and/or unexpected or unexplained program use increases. Drops in both costs and usage may substantiate improved operational methods or techniques. The ability to "drill down" into the available data and obtain information that validates such changes is an important tool for those involved in the screening process. Likewise, our consultant (Rapid Improvement, LLC) is able to perform similar functions to identify useful performance trends.

Data-based utility information is compared against baseline figures every month and pertinent reports are subsequently distributed amongst a host of users. Percentage increases and/or decreases are given to school principals, head custodians and maintenance personnel for the purpose of keeping these groups up-to-date on the progress being made at their individual sites.

In addition, data on meters and trending patterns serve as appropriate indicators of possible problems, allowing for scheduling changes or repairs to

mission-critical HVAC and lighting systems. Also, reports are filed with the senior administrators and the Board of Education for their review and analysis. Inevitably, this function should be extended to the educational sector for use by teachers and students in the classroom setting.

Data is transferred to user groups in various ways. General staff meetings and e-mails currently are currently the preferred methods used to inform staff of both performance and operational directives. In the future, the District's website will be a more active vehicle for the delivery and availability of information relating to the District's mission with regard to energy conservation and such concepts as sustainability and renewable energy. The Energy Manager's role in monitoring, reporting and coordinating this effort is central to the overall success of the District's energy program. The advent of the KEEP program and its connection to this mission could bring many more stakeholders closer to this ongoing project and increase involvement in all areas.

### **Energy Education Initiatives**

The Assistant Superintendent of Educational Services will have the responsibility of overseeing the District's energy education initiatives with assistance from the Sustainability Committee. Principals will be responsible for supporting and monitoring energy education initiatives at the school level.

### **Energy Education Initiatives/Plan**

The Assistant Superintendent of Educational Services will have the responsibility of overseeing the District's energy education initiatives with assistance from the Sustainability Committee and coordinate the energy education initiatives/plan with the appropriate curriculum committees. Principals will be responsible for supporting, monitoring and reporting on energy education initiatives at the school level. Each school is strongly encouraged to have a representative on the District's Sustainability Committee.

The Energy Stewards webportal will be the designated tool for each school to report and provide updates regarding their energy education initiatives, actions and efforts. Each school will determine who will update their school's Energy Stewards website. The Assistant Superintendent of Educational Services, Energy Manager and Sustainability Committee will monitor the Energy Stewards webportal to review each school's progress.

#### 2010-11 School Year:

- Track each school's efforts on building awareness with school staff and students regarding the following initiatives: turning off lights when not needed, closing doors & windows appropriately for conditioned spaces (school dependent) and reducing the number/use of personal appliances
- Track which schools have completed a energy use behavior study (to be piloted at one school first to gain confidence in survey method and communications)
- Report on faculty/staff who have attended or participated in professional development related to energy education/management/conservation
- Develop a Sustainability link on the District's website for staff, students and community to access information/resources on energy use/conservation and provide progress reporting on our District's efforts

#### 2011-12 School Year:

- Track the number of teachers who have used KEEP activities with their students during the school year and how many activities were used

## SUSTAINING ENERGY INITIATIVES

The Middleton-Cross Plains Area School District has a long-standing commitment to energy conservation. This commitment includes the allocation of appropriate resources needed to support the District's energy initiatives. One of the most important investments made by MCPASD to coordinate its energy initiatives is the position of Energy Manager. The District's Energy Manager will be responsible, with support and guidance from the District's Sustainability Committee and consultants/partners (i.e. Energy Education, Inc. and Rapid Improvement Associates, LLC), for facilitating the implementation of the School Energy Policy and Education Plan.

Additional funding, derived from a portion of the energy savings resulting from implementation of the School Energy Policy and Education Plan, will be allocated to provide on-going support for and to sustain energy initiatives. The Energy Manager and Assistant Superintendent of Business Services will develop, with input from the Sustainability Committee, a budget to support energy and other sustainability initiatives. The budget should include funding to support:

- Periodic meetings of the Sustainability Committee
- Professional Development
- Curriculum Development
- Grants for pilot energy projects or initiatives (student-focused)
- Start-up costs (i.e. supplies, equipment) for implementation of curriculum resulting from the energy education plan

Development and implementation of a formal communication plan is a key component in creating awareness and building momentum for the initiatives included in the School Energy Policy and Education Plan. The communication plan will consist of the following elements:

- Key Audiences
- Key Messages
- Initial Message(s)
- Communication Vehicles

Community engagement and involvement is an important factor in increasing the impact of the energy initiatives and promoting energy conservation outside of the schools. The MCPASD Energy Manager serves as the school district liaison to the City of Middleton Sustainability Committee and the City of Middleton has appointed a liaison to District's Sustainability Committee.

**Detailed Energy Audit  
for the  
Middleton-Cross Plains Area School District**



**Conducted by Johnson Controls**



**2400 Kilgust Road  
Madison, WI**

**August 24, 2009**

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## I. Executive Summary

On behalf of Johnson Controls, we would like to express our sincere appreciation and thanks to the people of the Middleton-Cross Plains Area School District (MCPASD) for their time, energy and effort in assisting us with the development of this detailed energy audit report and recommendations for facility improvement measures. We are confident that the implementation of these improvements will result in reduced energy consumption, increased utility savings and reduced carbon emissions – without compromising the safe, comfortable and sustainable learning environment to which your teachers, students and parents are accustomed.

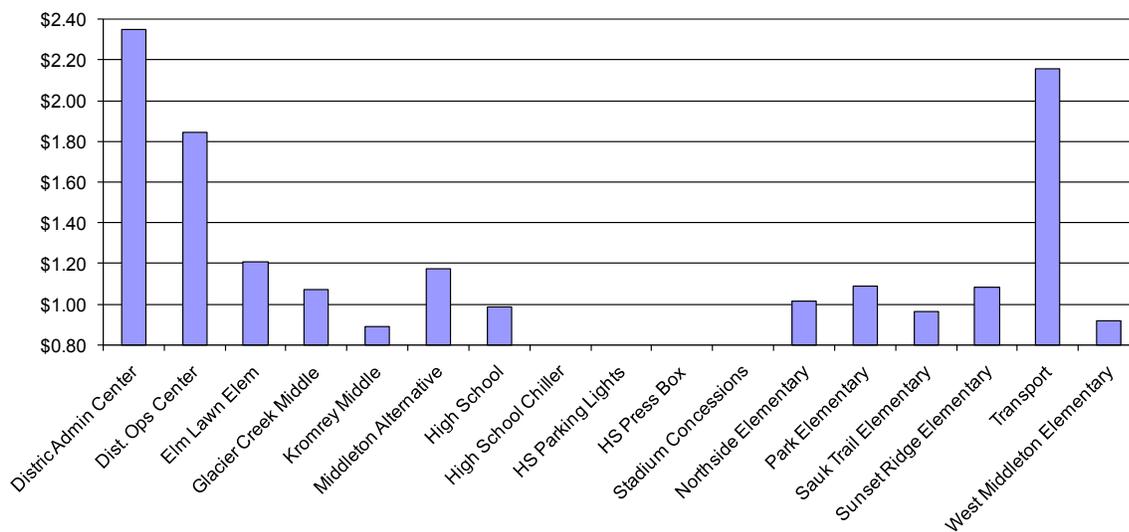
The high quality of your schools is a significant reason why Middleton ranks as one of the nation's best places to live. MCPASD is committed to providing a safe, secure and healthy learning environment in which productivity of students and staff is optimized. Another reason is your community's strong commitment to sustainability, as exemplified by 25% of the land within city limits being "green space" with parks, ponds and conservancy areas.

Likewise, Johnson Controls is committed to helping your schools achieve optimal building efficiency while also implementing renewable energy as a means to contribute to a sustainable environment. It is in this context that we assessed your facilities, analyzed your utility spending, and proposed a number of facility improvements that provide a practical solution to the problem of rising energy consumption and expense. Jointly, we have identified the following project goals:

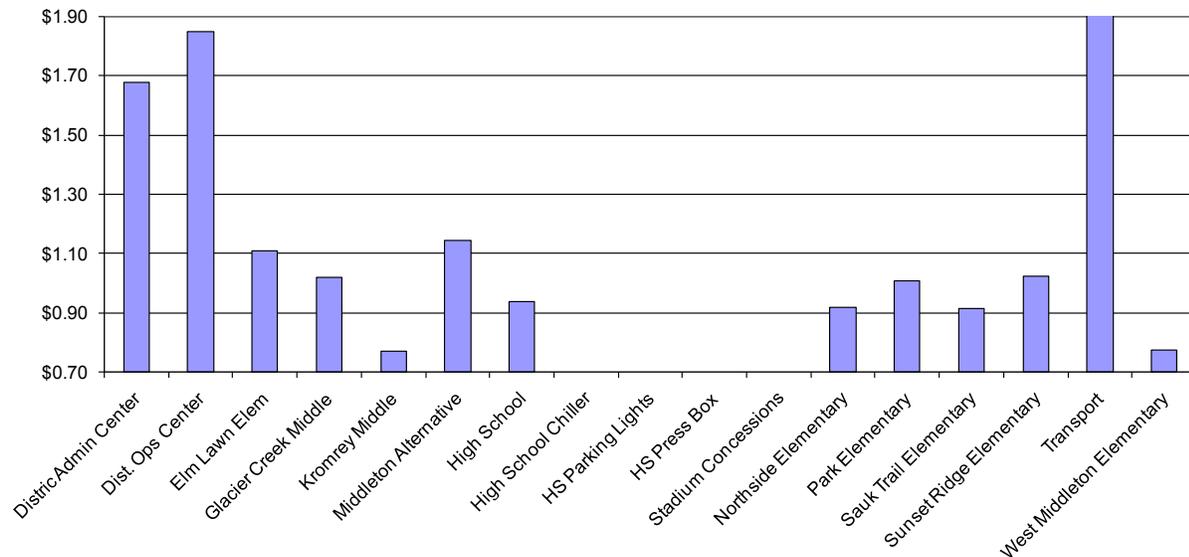
- Identify improvements that enhance the learning environment,
- Reduce energy and operating costs,
- Optimize reliability of existing systems,
- Extend the useful life of existing systems and minimize unplanned capital spending,
- Increase safety, satisfaction and comfort for students and staff.

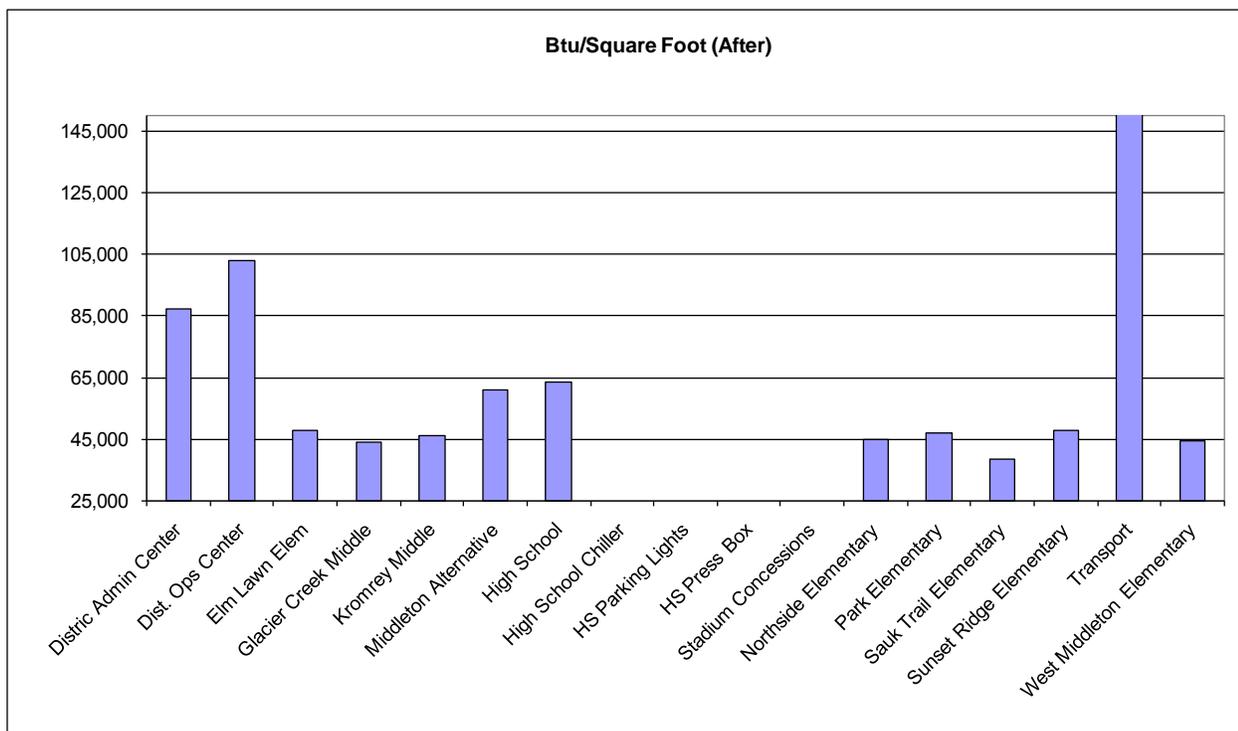
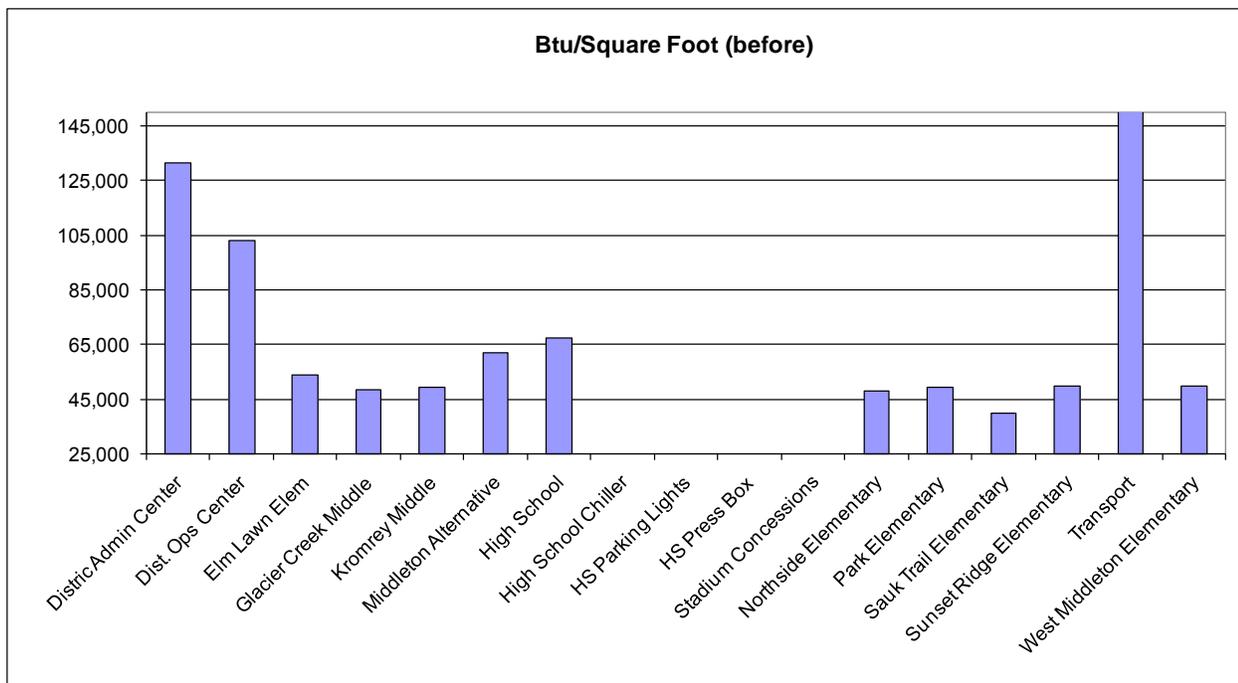
The initial task reviews the district's utility costs to establish a benchmark and determine the potential range of savings. As shown in the charts below, the district has a very low utility cost at most of the buildings, which is also reflected in their Energy Star rating. There are several buildings which can be improved by installing facility improvement measures. This can realistically result in a projected 9% energy reduction.

**Cost per Square Foot (Before)**



**Cost per Square Foot (After)**





It was apparent during our preliminary survey of the district that the staff is doing excellent work in the area of building maintenance and energy conservation. During our detailed assessment, our service department conducted a comprehensive review of mechanical equipment and all service repair costs. This further confirmed that the district staff is effectively managing their buildings. Despite the quality of maintenance, several opportunities to improve energy efficiency and reduce operating costs were identified. Additionally, some equipment had exceeded its estimated service life and was due for replacement. This report addresses retro-commissioning, lighting, building automation and controls, HVAC efficiency upgrades and the introduction of solar lighting and solar thermal for domestic and pool water heating.

Consequently, we propose a guaranteed energy savings performance contract that would install energy efficient equipment and pay for these upgrades through the resulting savings in energy and operations. This will be a turnkey program with Johnson Controls serving as the single-point of responsibility. MCPASD will benefit from our local service organization which will provide superior support, and minimize project risk. Our corporate offices in Milwaukee will ensure the highest level of technical oversight of new technologies such as Solar PV. We will also maximize Wisconsin Focus on Energy grants as part of this project. The energy savings are guaranteed to ensure that MCPASD realizes the many benefits of this project. With 123 years in business and \$38 billion in FY08 revenue, Johnson Controls has the financial strength and stability to fulfill our commitment to your school district.

Both Johnson Controls and MCPASD worked closely with Focus on Energy to apply for grants and rebates that would minimize the required investment. Focus also provided third party independent review of the proposed energy efficiency measures to assure the district that the projected savings were accurate. We are currently estimating \$176,686 in Focus grants in the base case of facility improvement measures detailed below. Focus has indicated that this project may qualify for a new program where MCPASD can “bid” on energy savings and possibly receive a higher grant. Johnson Controls would like to recognize Charlie Schneider and Jennifer Everhart for their assistance in developing this proposal.

The investment grade audit was reviewed by district staff and each FIM was prioritized to develop a mix of projects that met the district’s financial and operations criteria. A base project scope was agreed upon and several options were provided that the district presented to the Board on August 10, 2009:

- **Base Case.** The base case consists of lighting, HVAC, controls, and water conservation upgrades in nearly all school buildings. The base case includes a solar pool heating system for the High School. The base case also includes an efficient heat pump system to replace the antiquated heating and cooling system in the District Administrative Center. This base case has a guaranteed maximum price of \$2,312,554 and qualifies for Focus on Energy grants of \$176,686. It will generate \$110,652 in energy and water savings annually. There are also operating savings estimated at \$51,927 annually. The payback is under 14 years. (See Table 1, Base Case and FIM Data Worksheet in Appendix for additional detail.)
- **Option A.** The proposed DAC heat pump system is an air-cooled system (rejecting heat to the air while in the air conditioning mode). It can be integrated with a ground source water loop. The loop will improve the performance of the heat pump in cooling and can provide

supplemental heating. The incremental cost to install the ground source water is \$125,000 and will save a negligible amount of energy. (See Table 1, Option A and FIM Data Worksheet in Appendix for additional detail.). The ground source heat pump system will be quiet, more reliable, and less subject to weather extremes. More importantly, the ground source heat pump should be integrated into the district's renewable energy curriculum and be shown to help achieve your sustainability goals.

- Option B and C.** The district staff wanted to include renewable energy technologies in every building to maximize student interaction and involvement. Wind turbines, solar photovoltaic panels, and solar hot water panels were evaluated. Current utility programs are structured for private businesses and home owners, taking advantage of tax credits and accelerated depreciation. The economics of wind and solar generation are not yet attractive for schools and other public organizations. Solar hot water, however, is attractive, especially in swimming pool applications, and to a lesser extent in domestic hot water heating. The cost to install solar hot water systems at the middle schools is \$72, 063 and would save \$1,165 annually. The cost to install solar hot water systems at four elementary would be \$62,250 and would save \$1,062 annually. (The solar system at Kromrey would be installed on the building structure that is planned to be retained.) (See Table 1, Options B and C and FIM Data Worksheet in Appendix for additional detail.) Option D is the Base Case and Options A, B & C combined.

Table 1, Performance Contract Project Summary

Middleton-Cross Plains Area School District									
PERFORMANCE CONTRACT PROJECT SUMMARY									
	Cost	Grant	Net Cost	Inc. Cost	Energy Savings	Payback	Operating Savings	Payback	CO2 (LB-15 yr)
PHASE I									
Base Case	\$ 2,312,554	\$ 176,686	\$ 2,135,868	\$ -	\$ 110,652	19.3	\$ 51,927	13.1	20,942,046
Option A--Ground Source Loop	\$ 2,437,554	\$ 176,686	\$ 2,260,868	\$ 125,000	\$ 110,652	20.4	\$ 51,927	13.9	20,942,046
Option B--Solar HW MS	\$ 2,395,867	\$ 187,936	\$ 2,207,931	\$ 72,063	\$ 111,817	19.7	\$ 51,927	13.5	21,134,176
Option C--Solar HW Elem	\$ 2,385,024	\$ 186,906	\$ 2,198,118	\$ 62,250	\$ 111,714	19.7	\$ 51,927	13.4	21,118,101
Option D--All GREEN!	\$ 2,593,337	\$ 198,156	\$ 2,395,181	\$ 259,313	\$ 112,879	21.2	\$ 51,927	14.5	21,311,231
PHASE II									
Sunset Ridge & Glacier Creek	\$ 1,009,379	\$ -	\$ 1,009,379		\$ 450	2,243.1	\$ 10,650	90.9	
Other	TBD								

The performance contract project will impact nearly every school building in the district. A matrix of facility improvements is shown in Table 1A. The solar hot water and ground source heat pump systems are shown as “options”.

Table 1A, FIM Matrix by Building

Building	Controls	HVAC	Lighting	Renewable	Water	RetroCx
<b>District Wide</b>	Yes					
<b>DAC</b>	Yes	Yes	Yes	Option A		
<b>DOC</b>	Yes				Yes	
<b>Elm</b>	Yes	Yes	Yes	Option C	Yes	
<b>Glacier</b>		Phase 2	Yes	Option B	Yes	Yes
<b>Kromrey</b>	Yes		Yes	OptionB		Yes
<b>MASH</b>						
<b>MHS</b>	Yes		Yes	Yes	Yes	Yes
<b>Northside</b>	Yes		Yes	Option C	Yes	
<b>Park</b>	Yes		Yes	PV,Option C	Yes	
<b>Sauk Trail</b>	Yes		Yes			
<b>Sunset</b>	Yes	Phase 2	Yes			
<b>West M.</b>	Yes		Yes		Yes	

Following the School Board meeting on August 10, we incorporated a few changes to these project options based upon MCPASD feedback: (1) Addition of Retro-Commissioning budget of \$45,000 for High School, Kromrey and Glacier Creek as required by Focus on Energy; (2) a change from solar hot water at three (3) of the Elementary Schools to the implementation of Solar PV at all six Elementary Schools for a net increased cost of \$45,914 ( in addition, we included (6) computerized weather stations for curriculum enhancement); and, (3) the addition of annual capital cost avoidance of \$59,800 to reflect needed replacement of aging equipment. These changes are incorporated into a revised Project Summary (Table 2). On August 24, 2009, these modified options were presented to the Board. Option D was selected and subsequently approved.

Table 2, Revised Performance Contract Project Summary

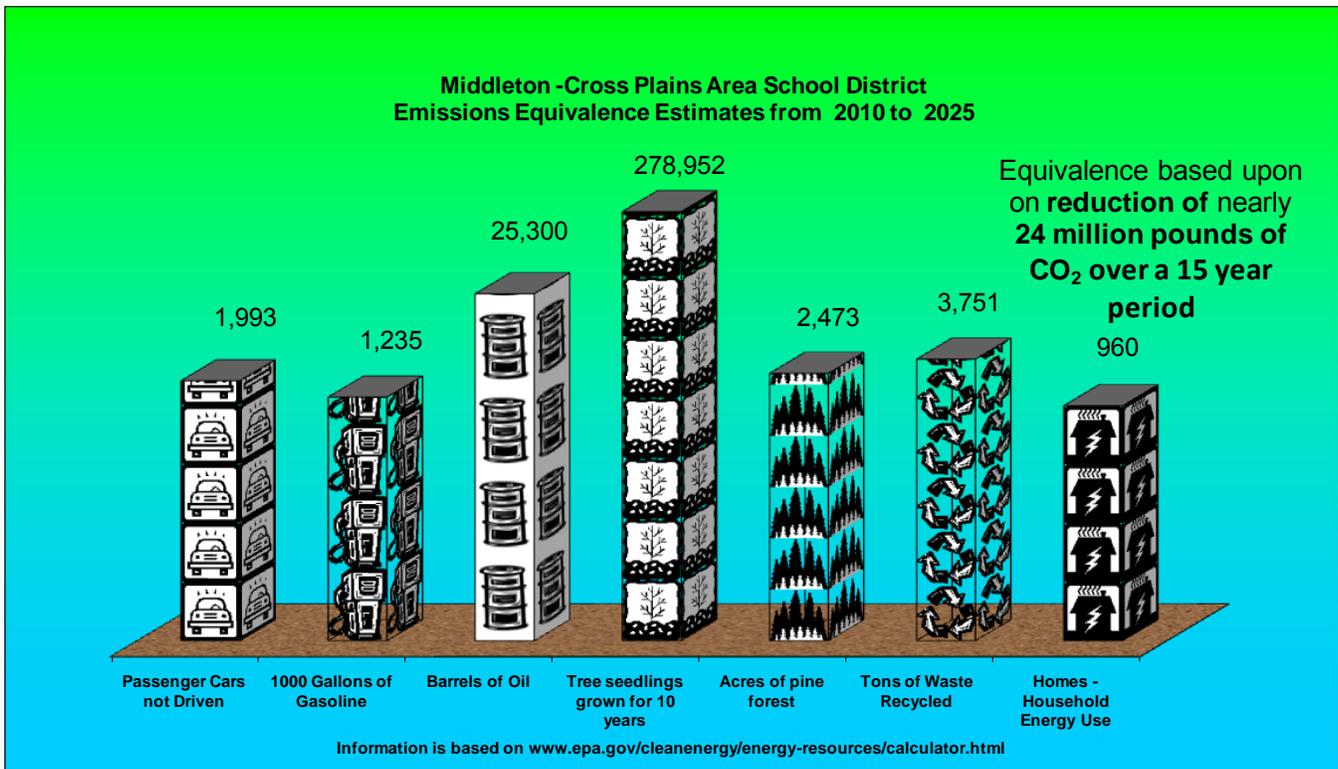
Middleton-Cross Plains Area School District									
PERFORMANCE CONTRACT PROJECT SUMMARY									
	Cost	Grant	Net Cost	Inc. Cost	Energy Savings	Payback 1	Payback 2	Payback 3	LBS CO2
PHASE I									
Base Case	\$ 2,358,304	\$ 176,686	\$ 2,181,618	\$ -	\$ 125,952	17.3	12.3	9.2	23,984,305
Option A--Ground Source Loop	\$ 2,483,304	\$ 176,686	\$ 2,306,618	\$ 125,000	\$ 125,952	18.3	12.9	9.7	23,984,305
Option B--Solar HW MS	\$ 2,441,617	\$ 187,936	\$ 2,253,681	\$ 72,063	\$ 127,117	17.7	12.6	9.4	24,267,456
Option C--Solar PV Elem	\$ 2,483,248	\$ 188,686	\$ 2,294,562	\$ 112,944	\$ 128,016	17.9	12.8	9.6	24,116,456
Option D--All GREEN!	\$ 2,691,561	\$ 199,936	\$ 2,491,625	\$ 310,007	\$ 129,181	19.3	13.8	10.3	24,636,619
Note:									
Payback 2 includes Operating Savings of \$51,927 for each option.									
Payback 3 includes Avoided Cost Savings of \$59,800 for each option.									

The audit identified numerous improvements at Sunset Ridge Elementary and Glacier Creek Middle School. The preliminary evaluation suggested that the water loop heat pump systems in both schools could be converted to a ground source heat pump system. Unfortunately, the water loops within the buildings were uninsulated and the cold water from the ground loop would probably cause condensation that could lead to mold issues. Also, the buildings are not occupied in the summer months and the heating and cooling loads would not be balanced, which is critical for the ground loop. The heat pumps throughout the buildings are nearing the end of their service life. These units will need to be replaced. More efficient units are available, but energy savings will be limited. Upgrading the HVAC systems was considered beyond the scope of the proposed performance contract at this time. The district is exploring the option of including these improvements in a Phase II project, hopefully utilizing Qualified School Construction Bonds that are allocated for 2010.

Johnson Controls worked closely with MCPASD to submit an application to the Wisconsin Department of Public Instruction for Qualified School Construction Bonds (QSCB). These American Recovery and Reinvestment Act (ARRA) funds have 0% interest rate. MCPASD was notified on August 5, 2009 of a \$500,000 allocation specifically for this project. The QSCB bond will permit the district to avoid approximately \$220,000 in interest costs over this 14 year project. MCPASD is evaluating other low cost financing options to fund the balance of the project. Due to the ARRA requirement for transparency and accountability, our performance contract will provide for complete measurement and verification. Additionally, MCPASD will work diligently to address other potential requirements such as "Buy American" and "Prevailing Wage".

In terms of implementing our proposed facility improvement measures, we can start immediately and capture significant savings during this heating season without jeopardizing building operations with techniques we have successfully applied on many similar projects throughout Wisconsin. We are confident that we can complete the installation and commissioning of all systems by September 1, 2010. Maintenance personnel will have received training on all new equipment prior to the start of the 2010 school year.

The proposed Performance Contract has significant savings in energy that translate to reduced carbon emissions. Johnson Controls, which has been a leader in developing sustainability markets, has a greenhouse gas calculator. Over a 15 year period, the approximate life of the project, we can reduce over 20 million pounds of carbon dioxide which translates to the *energy consumed by 960 households*:



MCPASD leadership and Johnson Controls both view this project as an opportunity to engage the students, teachers, parents and the community in energy awareness, behavioral modification, the application of life-long learning skills and community involvement. The district has already involved the City of Middleton, encouraging the Mayor and the City Administrator to apply for ARRA grants and to pursue a performance contract. The district and Johnson Controls are now working to integrate this project into the curriculum utilizing a web-based monitoring system, inter-school competition and student team projects. The district has already piloted a renewable energy program at the Alternative High School using lessons plans and classroom experiments provided by the Johnson Controls' Academy. The energy savings from this project are significant, but the real value will be realized when the students influence their parents and they jointly embrace sustainability.

Recognizing the current economic conditions and the challenges of obtaining taxpayer support for school facilities, Johnson Controls will help communicate the success of Middleton-Cross Plains Area School District's energy conservation and environmental leadership program. Our local resources will work with your staff to provide and implement a solid public relations plan to share the program's achievements with the local community that could positively influence future referendum support.

We enjoy working with your team and look forward to building on our collaborative relationship to take Middleton-Cross Plains to the next level of energy efficiency leadership.