Energy Efficiency & Conservation at Sweet Grass County High School:

Past, Present, and Future Energy Savings

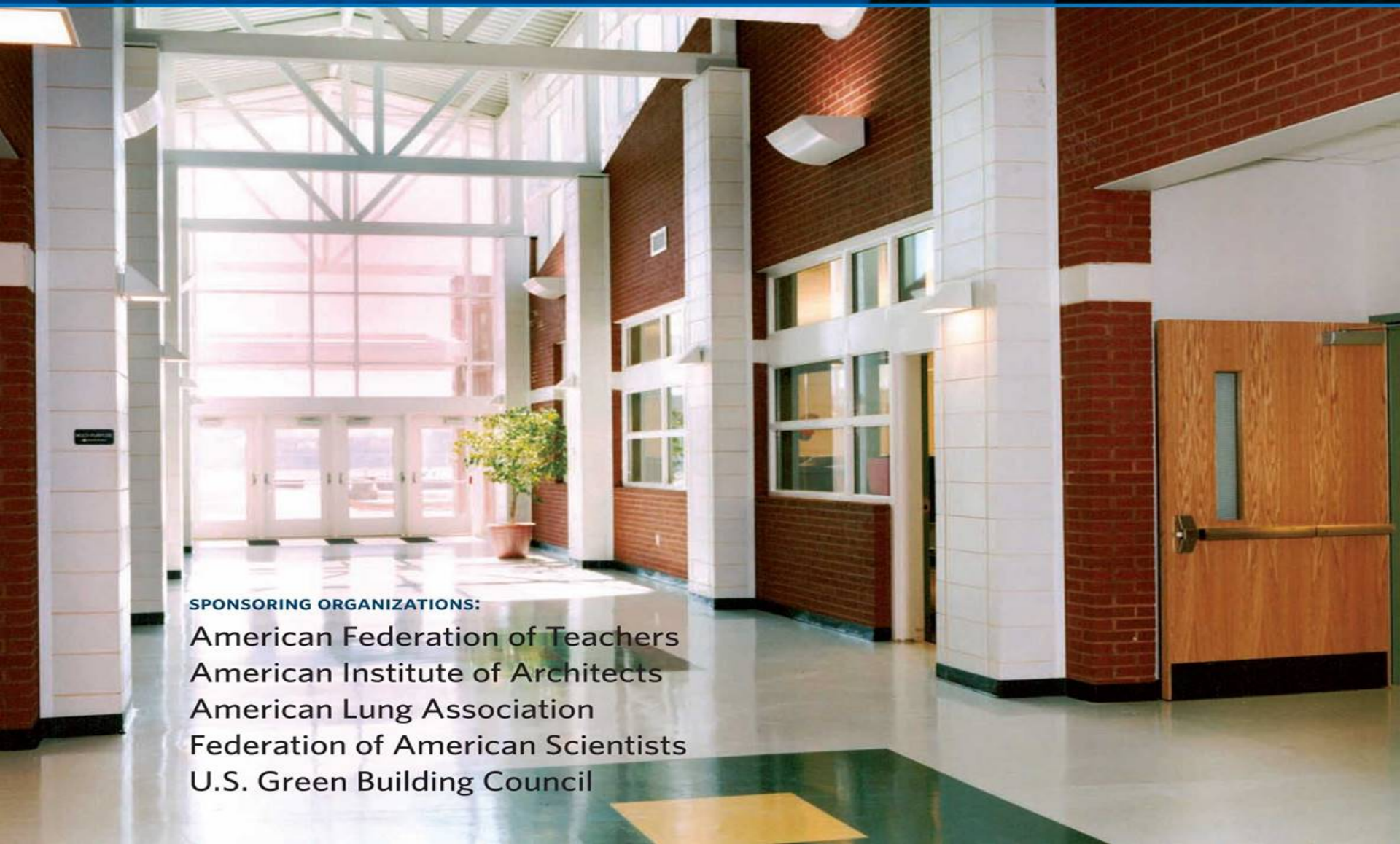
SGHS is proud to be a SMART School by Saving Money And Resources Today!

Energy Savings

- What can you do to save energy in your house?
- What do you think we did to save energy?
- What can we turn off?
- Where can we find wasted energy?

Greening America's Schools
COSTS AND BENEFITS

Gregory Kats



SPONSORING ORGANIZATIONS:

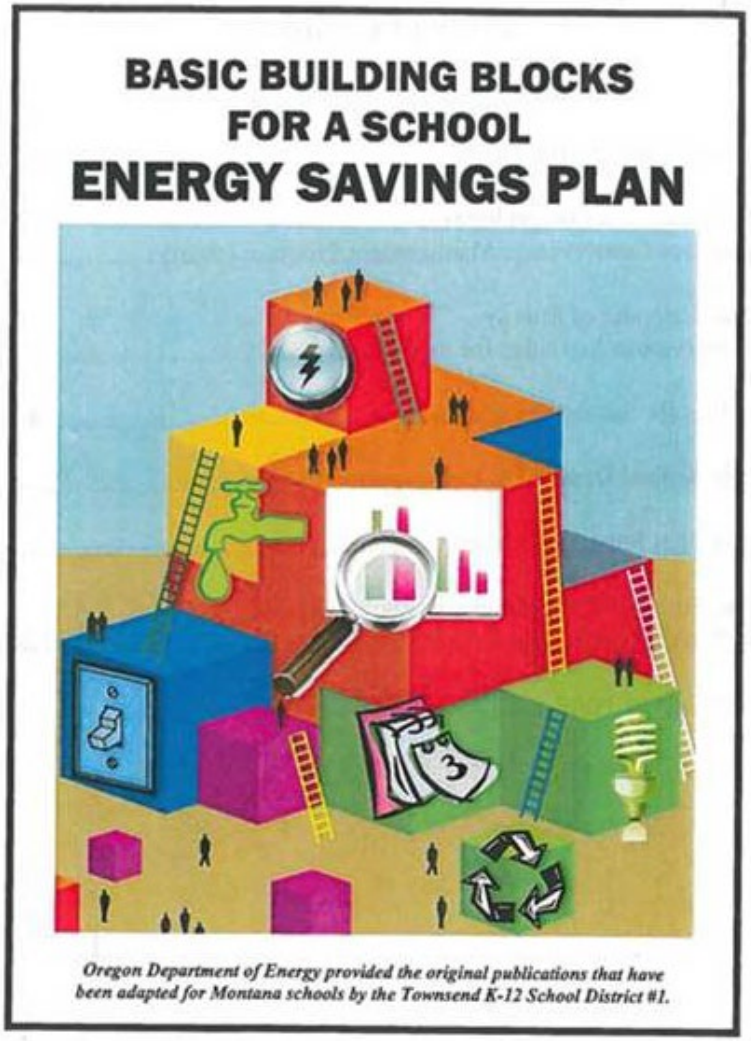
American Federation of Teachers
American Institute of Architects
American Lung Association
Federation of American Scientists
U.S. Green Building Council

Resource: LEED Schools Checklist

Leadership in Energy and Environmental Design

- Sustainable Sites
- Water Efficiency
- Energy and Atmosphere
- Materials and Resources
- Indoor Environmental Quality
- Innovation and Design Process

Adopt Energy Use & Policy Goals



- Resource Conservation Policy
- Components of a Comprehensive Resource Conservation Management Program
- Annual Calendar of Energy Conservation Activities for Schools
- Staff Tips for Saving Energy
- Sample Annual Demand and Consumption Profile
- Factors that Impact Electrical Usage
- Spring, Summer, and Winter Shutdown Activity Checklist
- Facility Survey Form

Energy Savings Myths

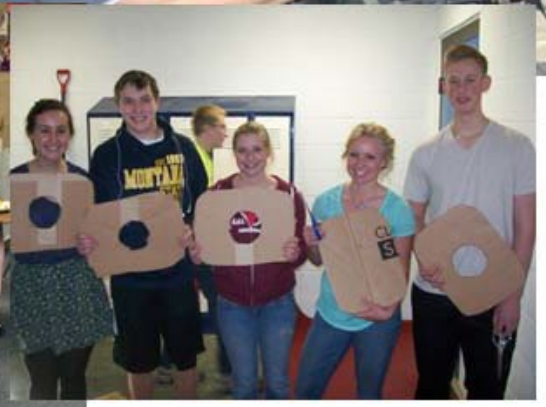
- A great way to save energy is to lower the temperature of the school by lowering the thermostat set points. FALSE!
- The best way to save energy is to eliminate **space heaters** and **coffee pots**. FALSE!
- Energy Savings should be considered exclusively when looking at improvements. FALSE!

Energy Saving Truths

- Occupant health, safety, and productivity are the number one considerations when deciding on school improvements. TRUE!
- Labor costs are $100/square foot as compared to energy being $1/square foot. TRUE!
- Energy Conservation is a side benefit to increasing the performance of your school. TRUE!

How Did SGHS become Energy Efficient?

- Team Effort- Collaboration with Administration, Board, Teachers, Students, Contractors, NorthWestern Energy, and many experts



Do School Facilities Affect Student Learning?

- Teacher satisfaction is reinforced by spaces that support learning.
- In secure, clean and well maintained schools students are more likely to have higher test scores.

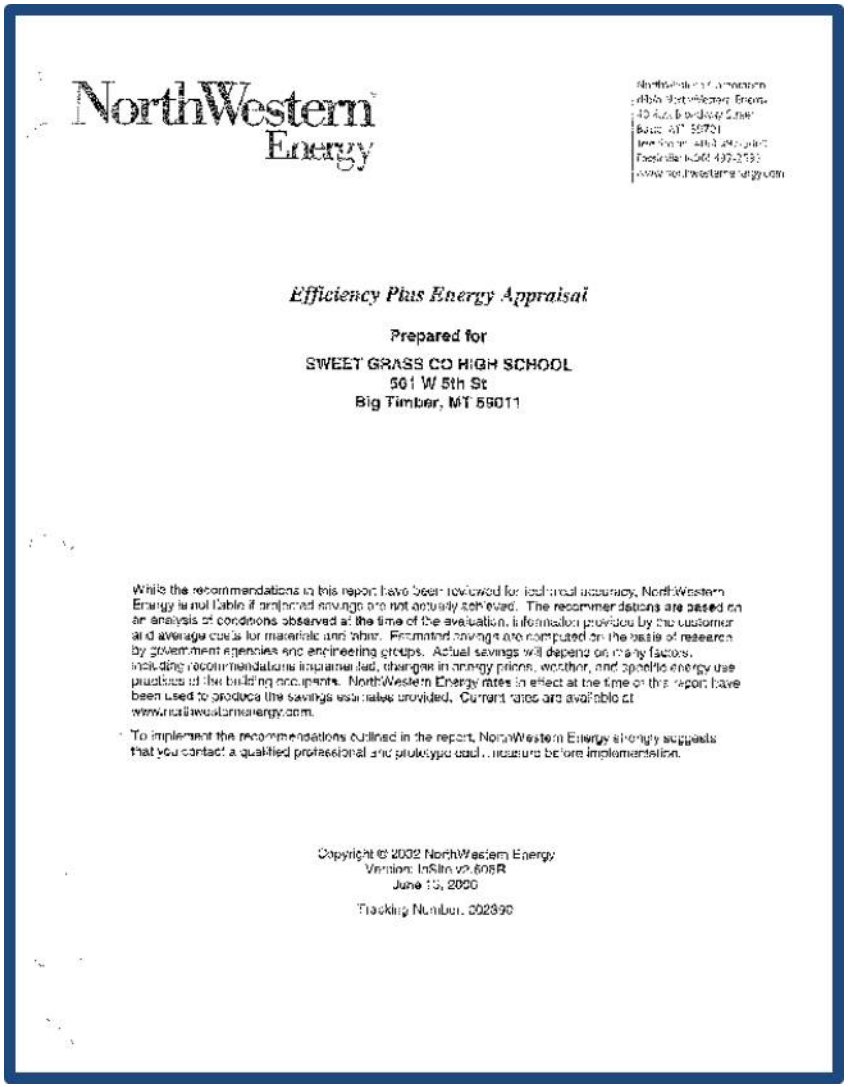
Continuous Quality Improvement

1. **Energy Audit-** In 2006 I invited NorthWestern Energy to come in and do an energy audit of our school.
2. **Decide on Priorities-** From that audit, I received information on high Return on Investment (ROI) projects or “low hanging fruit”.

- **Communicate-** I brought that information to the school board and administration and they decided to invest in projects. Together we prioritized projects and worked collaboratively.
- **Implementation**
- **Feedback success-** From the projects, I then communicated savings from our energy consumption baseline data.
- Then we repeated this process over and over again to complete 28 projects.

Energy Audits Provide crucial decision making information.

- **First Energy Audit-** 2006 Our first audit was free from North Western Energy!
- We focus by prioritizing and completing one project at a time.



NorthWestern Energy

Efficiency Plus Energy Appraisal

Prepared for

SWEET GRASS CO HIGH SCHOOL
501 W 5th St
Big Timber, MT 59011

While the recommendations in this report have been reviewed for technical accuracy, NorthWestern Energy is not liable if projected savings are not actually achieved. The recommendations are based on an analysis of conditions observed at the time of the evaluation, information provided by the customer and average costs for materials and labor. Estimated savings are computed on the basis of research by government agencies and engineering groups. Actual savings will depend on many factors, including recommendations implemented, changes in energy prices, weather, and specific energy use practices of the building occupants. NorthWestern Energy rates in effect at the time of the report have been used to produce the savings estimates provided. Current rates are available at www.northwesternenergy.com.

To implement the recommendations outlined in the report, NorthWestern Energy strongly suggests that you contact a qualified professional and prototype each measure before implementation.

Version: InSite v2.606R
June 15, 2006
Tracking Number: 002396

Some Recommendations from our first Audit

Description	Annual Cost Savings	Cost	Incentives	Simple Payback (years)	Annual Energy Savings	
Lighting						
Install outdoor photocell	$68	$20	$80	0.3	1,290KWh	Outdoor Lighting
Install Metal Halide luminaries	$2,071	$2,984	$256	1.4	13,674 kWh 2.6kW	Retrofit of the Planter area Light fixtures
Install Lighting Controls	$128	$200	$60	1.6	2,444kWh	Controls the Planter Area Lights
Install T-5 high Output Lamps	$1,353	$6,164	$657	4.6	15,359kWh 5.7kW	Gym and Shop Light Retrofits
Install T-8 lamps and electronic ballasts	$53	$262	$60	5.0	737 kWh 0.1kW	
Replace with 4 – 4-4' 54W T5 High Output Lamp	$170	$281	$74	1.7	1,884kWh 0.7kW	
Subtotal Lighting	$3,843	$9,911	$1,187	2.6		
Building Total					35,389kWh 9.1kW	

Energy Experts- Audits

- **Second Audit-** In 2009 MKK Engineering completed an Energy Audit of our School. This audit focused on our HVAC system and our building envelope.
- **Third Audit** – In 2017 we received $20,000 in grant This grant was called a Strategic Energy Management and went further into looking at the functioning of our HVAC system. An expert from Salt Lake City flew in to commission our heating system.

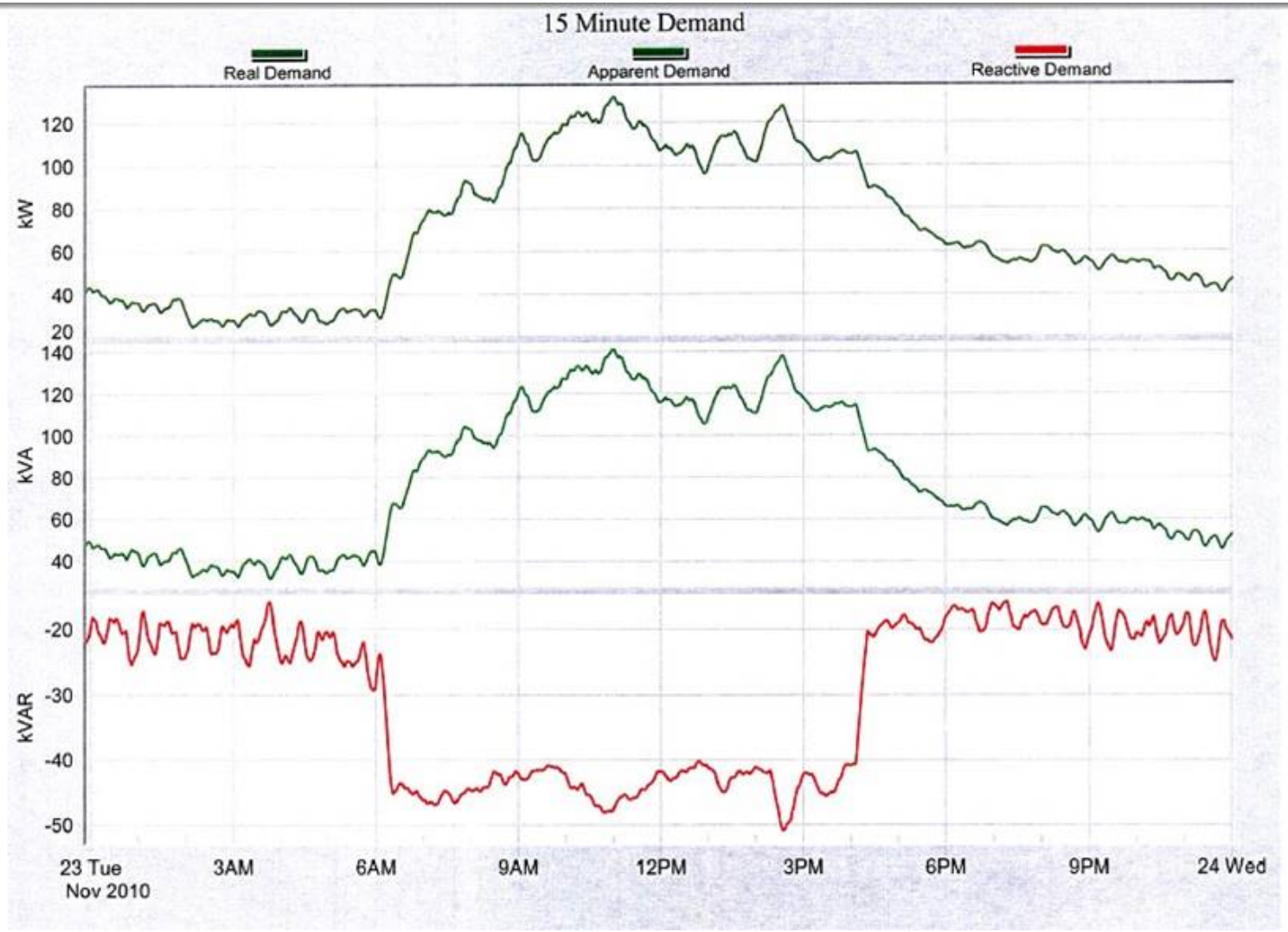
Low Hanging Fruit Example- LED Lights

Cost/Savings Analysis- Project Bulk Re-Lamping 15 Watt LED

Room	Switches	Light Fixtures	Lamps Each	Lamps Total	Ballasts	Ballast Way	Total Ballasts	Watts	Estimated Time On	kWhr	LED KWh	kWh Savings
Total	94	413		1266	90		738	46092		507.828	257.79	250.04
Itemized Costs												
Wiring Harness Cost				$ 2,712.00								
Labor Hours Cost				$ 2,065.00								
15 Watt LED Lamps (Direct Wire)				$ 7,596.00								
Rebate @ $5/lamp				$ (6,330.00)								
Cost of 15 Watt LED Lamps Only with Rebate				$ 1,266.00								
Total Project Cost												
Total Project Cost With Rebate and Re-wiring				$ 3,978.00								
Savings												
								$0.089/250 days		$0.2/250 days		
Annual Cost Electric Use for Florescent Lights								$11,299.17		$25,391.40		
Annual Cost Electric Use for LED Lights								$ 5,735.83		$12,889.50		
Total Annual savings by bulk relamping with 15 Watt Lamps								$ 5,563.35		$12,501.90		
Payback Time with rewiring								0.72		0.32		

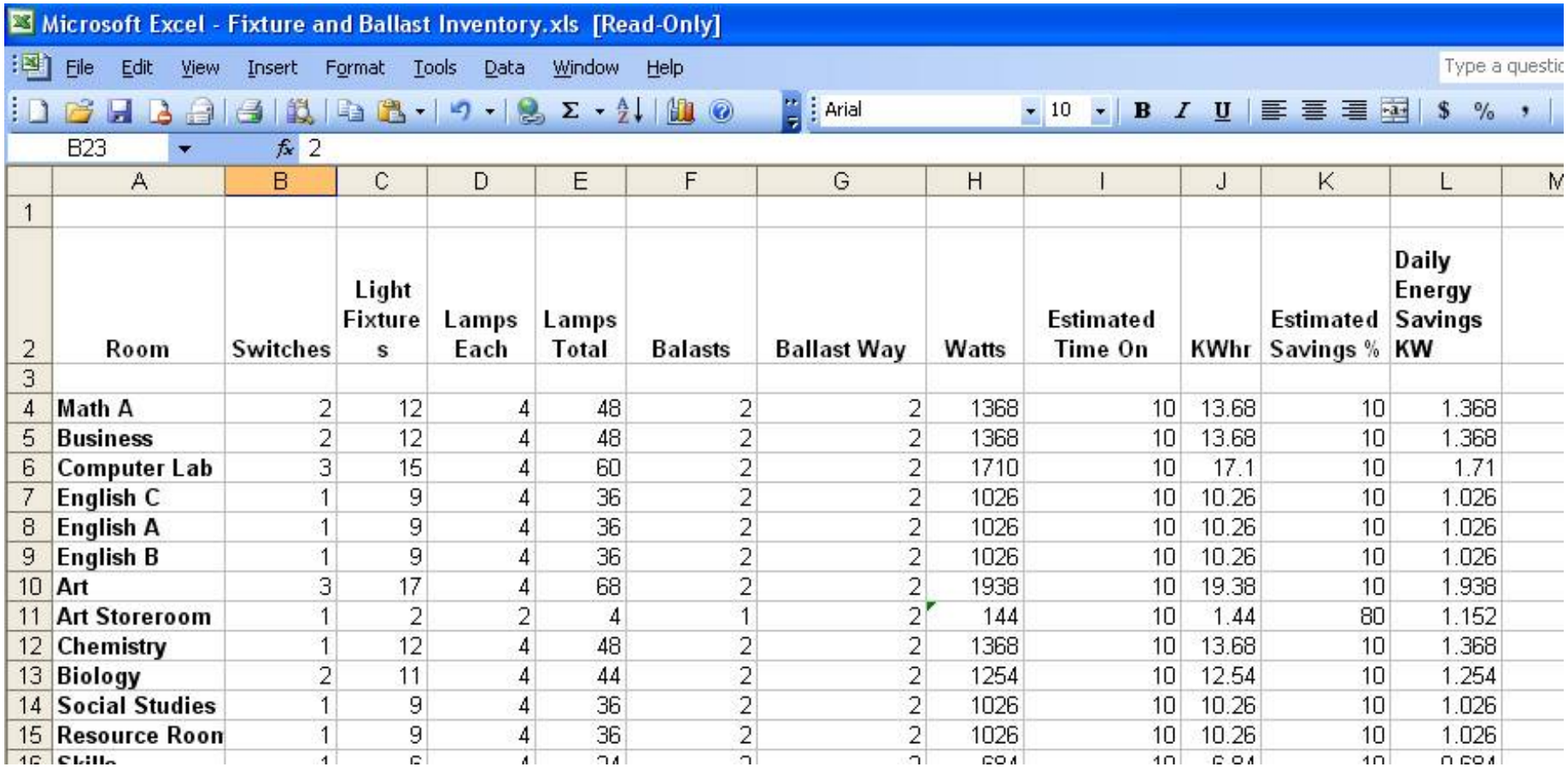
- Average payback of converting from t-8 florescent lamps to LED is 1.5 years.
- It is important to communicate predicted savings.

NorthWestern Energy
Free Data Logging



Logging Building Electrical Use Data

Lighting Inventory

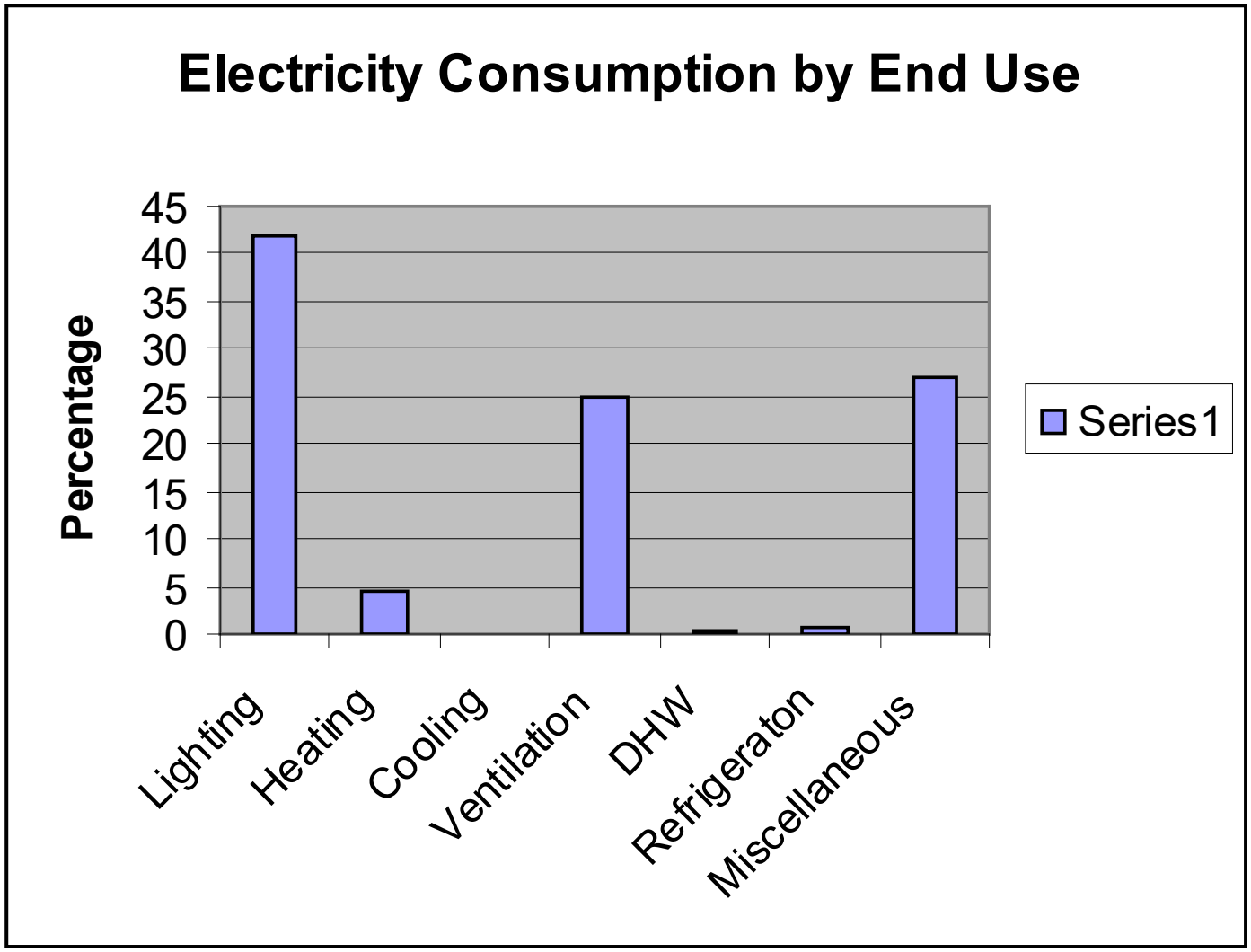

Microsoft Excel - Fixture and Ballast Inventory.xls [Read-Only]

File Edit View Insert Format Tools Data Window Help

Arial 10

B23 2

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2	Room	Switches	Light Fixtures	Lamps Each	Lamps Total	Balasts	Ballast Way	Watts	Estimated Time On	KWhr	Estimated Savings %	Daily Energy Savings KW
3												
4	Math A	2	12	4	48	2	2	1368	10	13.68	10	1.368
5	Business	2	12	4	48	2	2	1368	10	13.68	10	1.368
6	Computer Lab	3	15	4	60	2	2	1710	10	17.1	10	1.71
7	English C	1	9	4	36	2	2	1026	10	10.26	10	1.026
8	English A	1	9	4	36	2	2	1026	10	10.26	10	1.026
9	English B	1	9	4	36	2	2	1026	10	10.26	10	1.026
10	Art	3	17	4	68	2	2	1938	10	19.38	10	1.938
11	Art Storeroom	1	2	2	4	1	2	144	10	1.44	80	1.152
12	Chemistry	1	12	4	48	2	2	1368	10	13.68	10	1.368
13	Biology	2	11	4	44	2	2	1254	10	12.54	10	1.254
14	Social Studies	1	9	4	36	2	2	1026	10	10.26	10	1.026
15	Resource Roon	1	9	4	36	2	2	1026	10	10.26	10	1.026


Electricity Consumption by End Use
Percentage
45
40
35
30
25
20
15
10
5
0
Lighting
Heating
Cooling
Ventilation
DHW
Refrigeraton
Miscellaneous
Series1

Staff Survey

7 of the top 41 building improvements related to the building concerned thermal comfort!

2009-10 Building Items Staff Survey Sorted

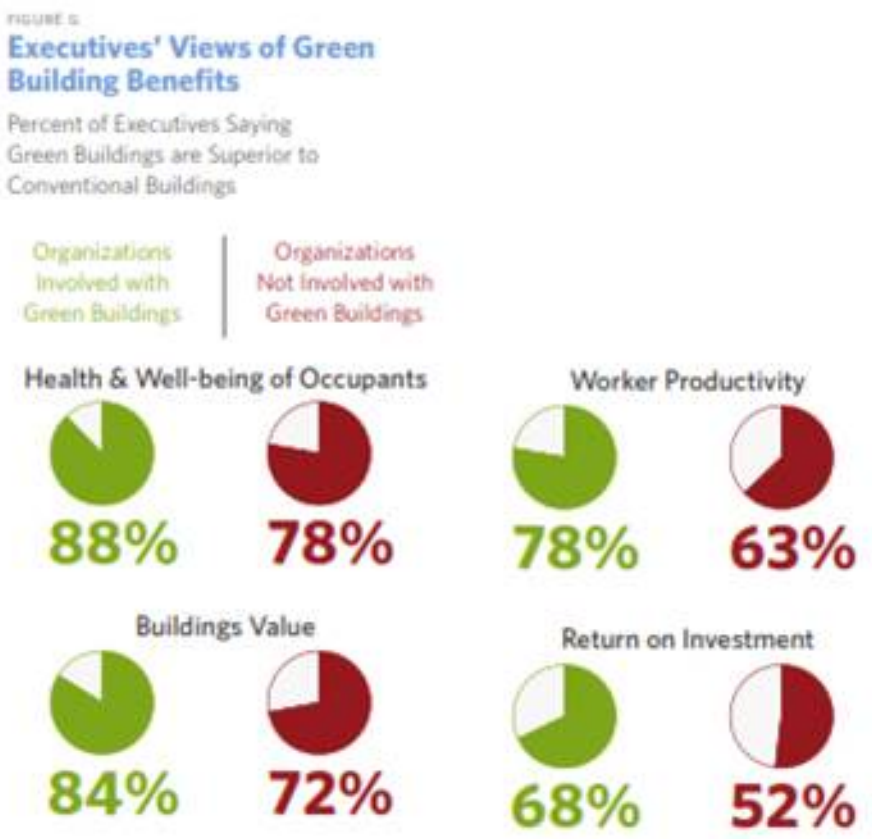
Sorted by Average of Rating and Response

Rating Sort	Average Rating	Responses Sort	Average Response /Rating Sort	Responses	Number of (Responses)	Building Item
1	1	1	1	1,1,1,1,1,1,1	7	AC in the Server Room
2	1.166667	6	4	1,1,2,1,1,1	6	Isolate HV (Heat and Ventilation) controls for the (
4	1.333333	4	4	3,2,1,1,1	6	Install ADA Accessibility Door Hardware
5	1.333333	5	5	1,1,3,1,1,1	6	HV-Heat and Ventilation Controls
7	1.5	7	7	1,1,2,2,2,1	6	Ventilation in the Art Room
11	1.666667	8	9.5	1,2,1,1,2,3	6	Insulate exterior walls
12	1.666667	9	10.5	1,1,2,3,2,1	6	Heat in the Kitchen Storage/Hall/Entry
19	1.857143	2	10.5	2,2,3,1,2,2,1	7	Parking Lot Gravel/Maintenance
6	1.4	16	11	2,1,1,2,1	5	Insulate Roof
9	1.6	17	13	1,1,2,2,2	5	Retrofit/fix heat in locker and shower rooms
10	1.6	18	14	1,1,1,2,3	5	Block sealant on west wall of addition
20	2	10	15	2,2,2,3,1,2	6	Fix Exterior Walls Masonry Mortar
3	1.25	29	16	2,1,1,1	4	Make ADA Accessibility-Restrooms
21	2	11	16	2,2,3,3,2	6	Concrete Restoration Walls/Sidewalks
15	1.8	19	17	1,1,3,3,1	5	Improve Ventilation in Locker Rooms
16	1.8	20	18	1,2,2,1,3	5	Replace Boiler
25	2.166667	12	18.5	1,2,2,3,3,2	6	Painting the Gym rounded covering- flashing
8	1.5	30	19	1,1,2,2	4	Plumbing- Replace Bathroom Cutoff valves, Kitch
17	1.8	21	19	1,2,2,3,1	5	Carpet in Classrooms
36	2.428571	3	19.5	3,2,2,3,3,1,3	7	New Concession Stand
18	1.8	22	20	1,3,1,1,3	5	Landscape the South Berm for Temp Control
31	2.333333	13	22	2,2,3,3,3,1	6	Ceilings- Replace Ceiling Tiles in Gym
14	1.75	31	22.5	1,1,2,3	4	Fix Gutters

Executive Views of Green Schools

Recognition… Dollar Savings

- Our own Superintendent, Mr. Alvin Buerkle, saved us $2,400 on our utility bills by noticing that we were being charged $400/month for supply charges at the football field during the winter when it was not in use.



Mr. Buerkle has showed his concern for the health, productivity, and financial welfare for our building. He has helped implement the building improvements by supporting projects!

- We are creating a culture of conservation, saving money, and making our school healthier and more competitive.

Funding for Projects

- SGHS has funded most all of the lower cost high Return on Investment projects in house.

We completely funded the LED Lights with Building Reserve and SMART Schools Winning Money

- We retrofitted our existing 400 light fixtures- three phases
- $Total Cost $18,986 minus $8,825 in rebates= $10,161

SMART Schools money $3,000 towards the project

Total Cost to the school: $7,161

This year the LED lights no longer are eligible for a NorthWestern Energy rebate.

We managed and completed all upgrades both in house and with local contractors, thus we reap the financial rewards both locally and for the

- We did look at a Performance Based Contractor (McKinistry) to fund and oversee the work, yet we would not see the financial rewards. We passed on this funding option.

28 Energy Savings Projects at SGCHS over the past 18 years…

- Energy Audits
- Lighting Retrofits
- Lighting Controls
- Exhaust Controls
- HVAC Controls
- Air Handler Maintenance
- HVAC Optimization
- Variable Frequency Drives on motors
- Motor replacement with high efficiency motors
- Domestic Hot water timer control
- Domestic Hot water Boiler replacement
- Boiler Tune ups
- Reset Schedule
- Elimination of Balancing Valve
- Building Envelope Study
- Reduction of Compressed Air Leaks
- Gym air handler scheduling
- Summer shutdown of equipment
- Concession stand shut down
- Monitoring Energy Bills and Consumption
- Reduction of chilled food and beverage dispenser machines
- Staggered starts of HVAC equipment
- Weather-stripping and Insulation, window insulating blinds
- Implement best building practices
- Behavioral Change with students and Staff through the SMART School Challenge
- Eliminating electric deep fat fryer in the kitchen
- LED Lamp Project
- Air Infiltration prevention project

Big Wins

- **Gym Air Handler Scheduling-** We don't need two air handlers on all the time- only needed for maximum occupancy.
- **Individual Exhaust Control-** We gave Ms. McCullough individual control of her lab exhaust with a simple wind up timer. The result is 90% savings, 1800 CFM went from all occupied times on (12 hours a day) to a on demand wind up timer switch. This fan was exhausting about $300 of heat energy monthly.
- **High Efficiency Domestic Hot Water Boiler Replacement-** Two DHW boilers means less down time for the kitchen
- **High Performance Lighting-** Example Planter Light fixtures went from 250 Watt to 27 Watts, also instant on and off lights in the gym with lighting controls.
- **Automated Controls-** HVAC- Digital Controls, Occupancy Sensors, Timer Switches. Example is a programmable timer switch for the outside lights. Less time manually monitoring equipment manually.
- **High Efficiency Motors with Variable Frequency Drives**

Implementing Improvements

Lighting Controls

55 Occupancy Sensors Installed		
		Lighting Controls (Occupancy Sensors)
Materials and Labor		$3,650 Labor completed in house!
Anticipated Rebate		$1,632
Net Cost		$2,018
Annual Electricity Savings		$2136
Simple Payback (Years)		0.92245

Added benefit- security and safety

Expensive Project Funding

- We looked for outside funding for more costly projects that were a priority. The primary need was controls for our heating.
- Mr. Buerkle told me of the Quality Schools Grant fund ($10 million dollars) earmarked for energy efficiency projects and school improvement. I wrote the grant in 2009.
- Of all the schools that applied and received funding, we came in second out of 50 schools and received $207,500 to convert our pneumatic controls to digital.

From the Quality Schools Grant- $207,500. Digital Controls retrofit came under budget and we spent the leftover $50,000 on two new high efficiency redundant Domestic Hot Water Heater boilers.

While completing projects I tracked our energy consumption.

- Each month Al, Kim, and I get copies of our utility bills.
- I enter data monthly in an Excel Spreadsheet.
- From this raw data I then convert that information into graphs.
- From the energy consumption graphs we can evaluate building performance and communicate savings.

Raw Consumption Baseline Data in Kilowatt Hours and Dekatherms

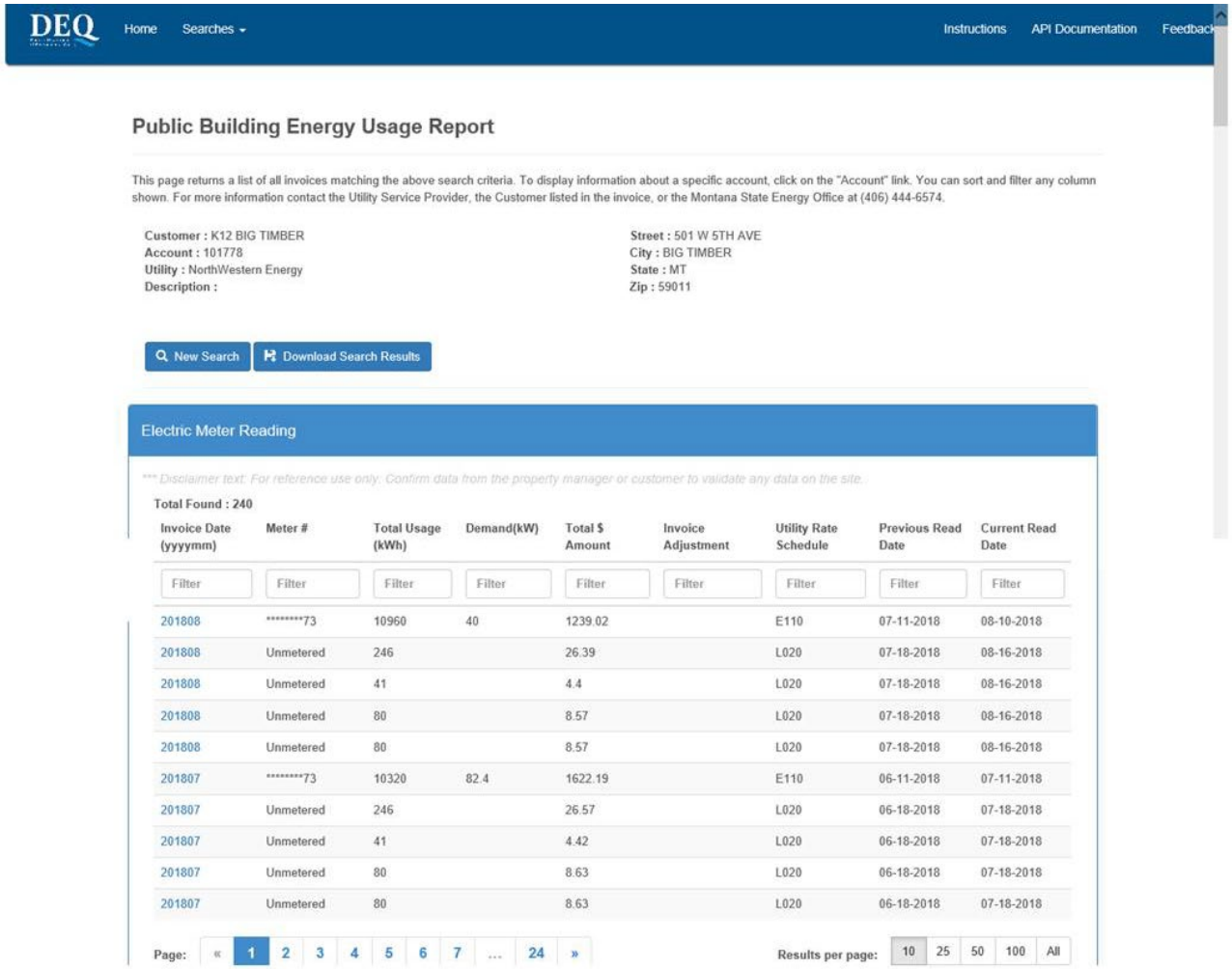
Natural Gas Use Baseline Data

Year	2001-2	2002-3	2003-4	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
December	439.7	373.2	475.8	426.8	404.2	430.6	420.4	373.3	610	448.2	423.3	303.6	450.7	411	385.8	378.6	321.2	
November	367.4	365.5	324.1	303.9	183.7	243.4	211	235.7	297.6	217.2	232.9	236.7	208.4	195.2	214.3	158.7	408.2	281.6
October	218.6	141.6	155.8	152.3	95	105.7	116.7	97.6	159.8	33.9		57.4	108	99.3	43.9	75.5	69.9	123.6
September	24.6	20.6	21.1	24.7	24	21.2	17.7	24.6	21.5	23.1	21.4	16.4	8.6	52.4	14.6	13	11.4	11.5
August	9.3	15.3	0.6	11.9	8.7	10.2	9.8	7.2	6.0	1.7	2.6	2.6	0.9	5.1	5.2	6.1	2.6	2.6
July	11	13	12.8	14	8.5	11	11.4	31.9	9.4	1.7	23.9	6	4.3	6.8	4.3	6.1	1.7	1.8
June	89.2	74.1	118.5	48.4	41.6	56.9	58.8	32.0	23.4	69.2	23.9	31.4	33.3	54.2	68.2	49.4	47.6	
May	270.8	241.1	197.8	254.4	197	162.8	265.5	228.6	213.6	202	139.7	178.9	199.3	143.2	140.6	155.8	243.7	
April	320.6	274.6	233.1	278.5	338.5	265.8	359.4	299.8	314.6	266.6	162.5	242.2	313.7	199.8	266.3	196	224.6	
Feb-00	536.3	488	338.1	303.3	459.4	356.4	374.8	400.4	379	426.2	335.4	312.3	386.3	346	272.5	329.2	562.3	
February	389.2	419	512	382.9	372.1	463.8	475.9	438.4	478.1	410.8	416.3	339.2	458.8	300.6	350	474.1	397.7	
January	548.4	474.6	510.2	636.1	442	588.5	478.4	556.3	534.2	480.7	388.7	568	438.9	507.3	503.2	601	532.4	
Total	3225.1	2900.6	2899.9	2837.2	2574.7	2716.3	2799.8	2725.8	3047.2	2581.3	2170.6	2294.7	2611.2	2320.9	2268.9	2443.5	2823.3	
Mean																		

Electric Use Baseline Data

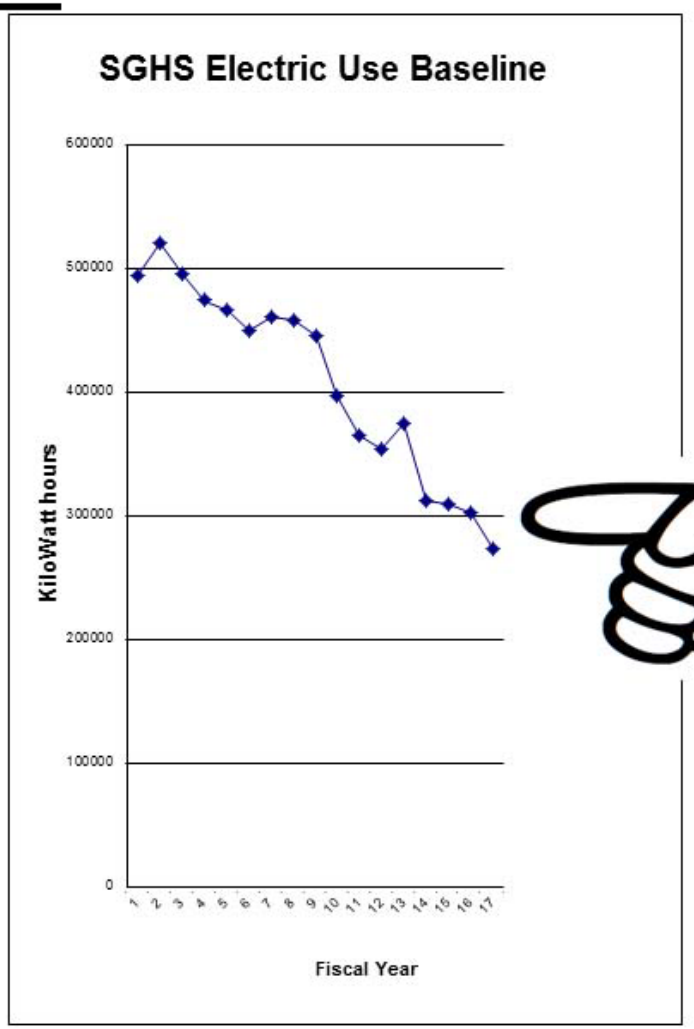
	2001-2	2002-3	2003-4	2004-5	2005-6	2006-7	2007-8	2008-9	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
December	49760	54240	54400	47280	48320	50000	50000	45840	56480	44640	40480	38000	36160	34240	33600	34240	28400	
November	48400	44400	46160	39920	35760	41200	41200	43920	41360	38560	33280	33840	31120	28400	26800	26640	24560	27040
October	45120	44480	42480	42800	46160	39200	39200	39120	39760	33760	33520	31840	30240	27280	25760	25280	23200	23440
September	34400	39440	40560	34800	30800	30080	30080	34880	27440	28320	31760	24560	32640	25760	25120	22960	20480	21280
August	23840	26560	20800	13920	21760	17200	17200	17600	11920	14800	12000	14240	17280	13600	12480	11600	12160	10960
July	21200	20160	16960	14240	18160	15200	15200	25200	12000	14480	13280	14240	19200	15040	12720	11040	10400	10320
June	35600	40880	34480	34720	35760	28720	29120	24000	28880	23040	20480	20960	20640	19600	21920	17680	16800	
May	46720	47920	45280	48800	42160	42320	49360	40160	40240	32320	33200	30800	29520	27280	26800	24480	24800	
April	43200	45520	44400	46560	49040	39440	49600	42160	42000	37360	31600	32880	36720	25360	29120	25600	25120	
March	53360	55200	48800	48800	47280	45760	46960	47840	45920	46640	37520	33440	40800	31680	32960	30320	32960	
February	42320	50720	52160	48640	43760	48240	44880	51280	48880	43040	38240	37520	42320	31600	31840	36560	30400	
January	50720	51440	49280	54000	48080	52640	48000	45920	51200	39920	39840	42000	38400	32880	30800	37120	30160	
	494640	520960	495760	474480	467040	450000	460800	457920	446080	396880	365200	354320	375040	312720	309920	303520	279440	23286.7

Track Your Energy Use!
DEQ Public Building Energy Use Report- DEQDataSearch.mt.gov



Last Years Energy Project #28

- Retrofitting our light fixtures with LED lamps.
- Projected additional electrical savings by 48445 KWh.
- Actual savings 29816 KWh or 10%.



Direct Relationship of Projects to Savings

Electricity Consumption Since 2001 Down 47%

Summer Shutdown

Exit and Emergency Light to LED

Shop Lights 500W Incandescent to 75W CFL

Eliminate Pop Machines

Occupancy Sensors and controls for Lights

Gym Light Retrofit

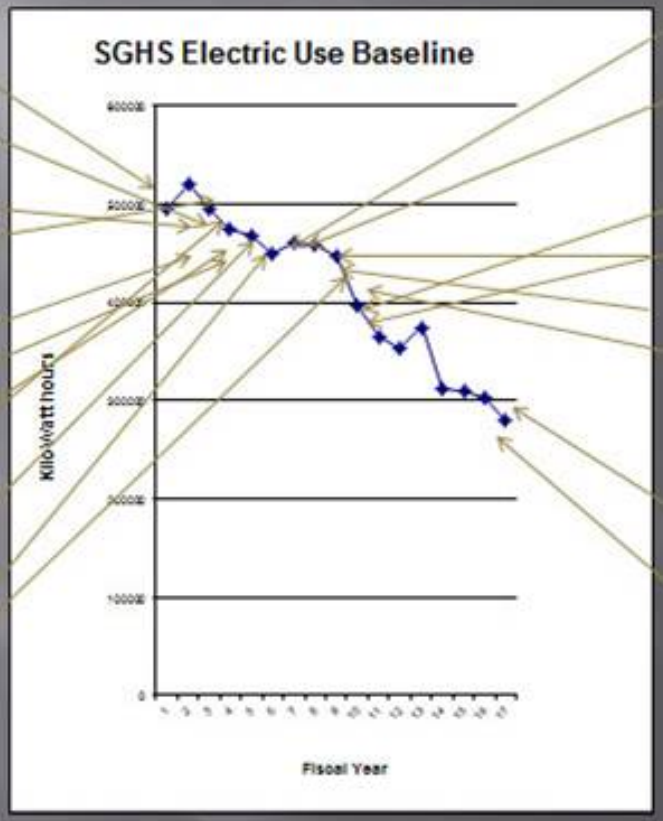
Planter Area Light Retrofit

Outside Light Retrofit

Weatherstripping

Concession Stand Shutdown

Boiler Motor Replacement with NEMA Premium



Building Addition of 2 Classrooms- Skills and Resource

HRV Unit

Exhaust Controls

Insulated Window Blinds

DDC Controls for HVAC

VFD on Motors

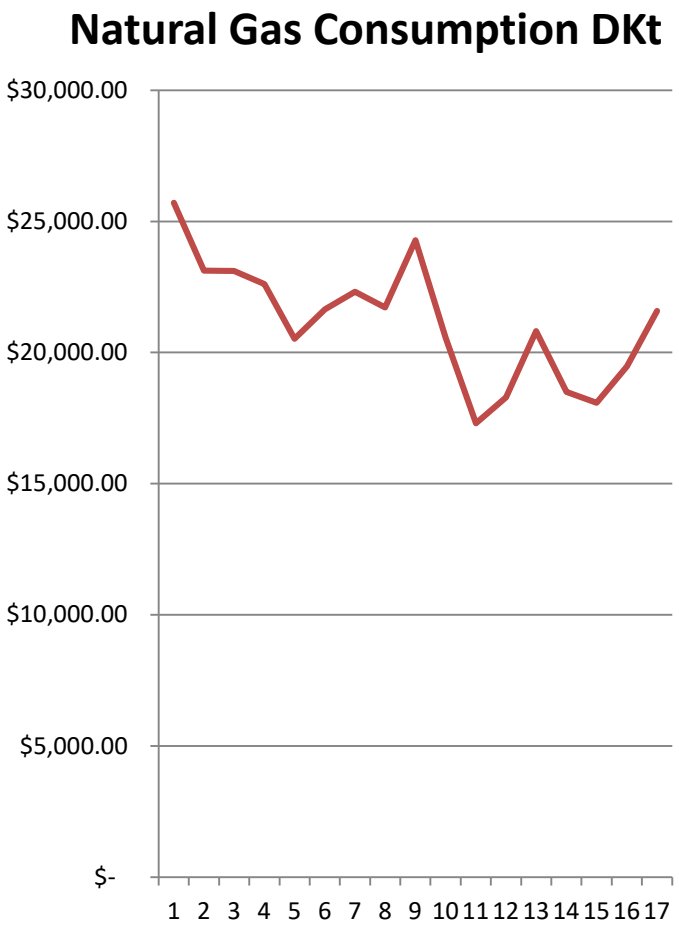
New Domestic Hot Water Heater

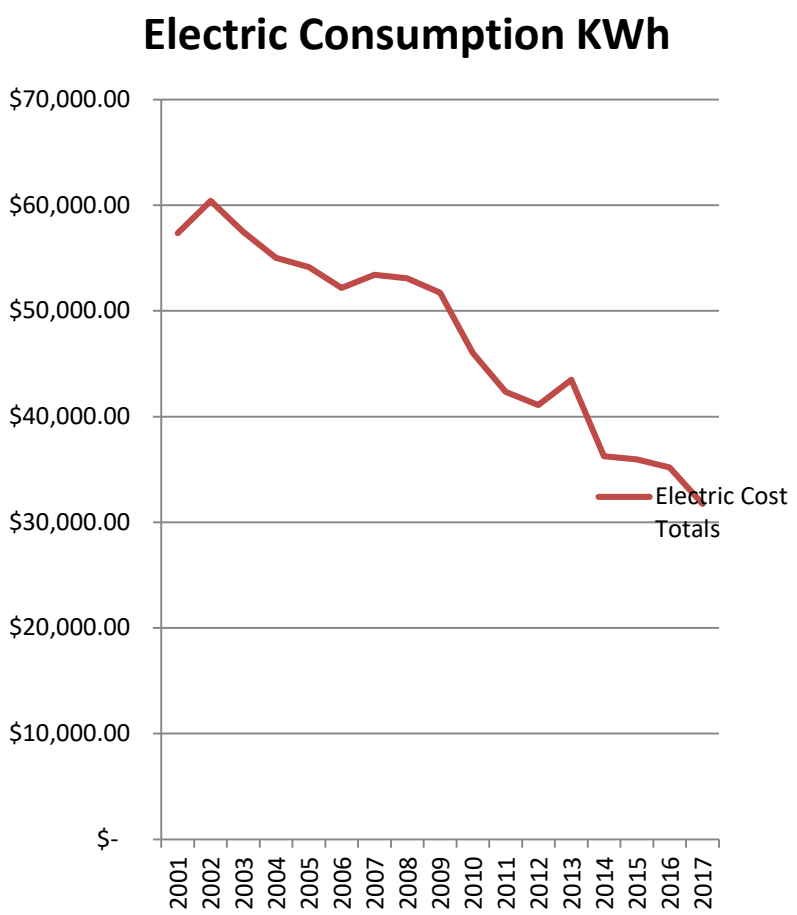
Reduction of Hot Water Heater Circulation Motor

Schoolwide LED Lamp ReplacementMotor

SMART Schools Club

Consumption Graphs- 18 Years



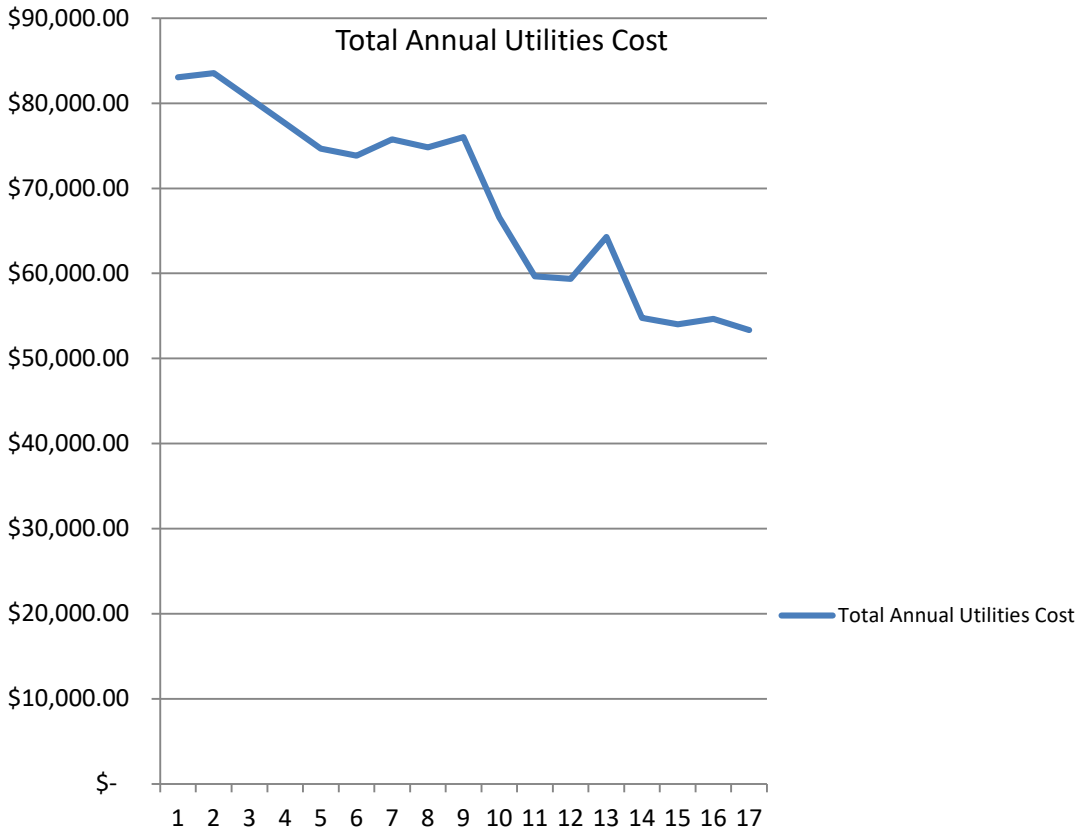


Annual Cost Spreadsheet

	Natural Gas Consumption	Electric Consumption	Natural Gas Cost DekaTherm	Electric Cost KWh	Total Cost	
2001	3225.1	494640	$ 25,704.05	$57,355.98	$83,060.03	$ (0.03)
2002	2900.6	520960	$ 23,117.78	$60,407.92	$83,525.70	$ (465.70)
2003	2899.2	495760	$ 23,106.62	$57,485.85	$80,592.47	$ 2,467.53
2004	2837.2	474480	$ 22,612.48	$55,018.33	$77,630.81	$ 5,429.19
2005	2574.70	467040	$ 20,520.36	$54,155.62	$74,675.98	$ 8,384.02
2006	2716.30	450000	$ 21,648.91	$52,179.75	$73,828.66	$ 9,231.34
2007	2799.8	460800	$ 22,314.41	$53,432.06	$75,746.47	$ 7,313.53
2008	2725.8	457920	$ 21,724.63	$53,098.11	$74,822.74	$ 8,237.26
2009	3047.2	446080	$ 24,286.18	$51,725.21	$76,011.39	$ 7,048.61
2010	2581.3	396880	$ 20,572.96	$46,020.22	$66,593.18	$ 16,466.82
2011	2170.6	365200	$ 17,299.68	$42,346.77	$59,646.45	$ 23,413.55
2012	2294.7	354320	$ 18,288.76	$41,085.18	$59,373.93	$ 23,686.07
2013	2611.2	375040	$ 20,811.26	$43,487.76	$64,299.03	$ 18,760.97
2014	2320.9	312720	$ 18,497.57	$36,261.45	$54,759.02	$ 28,300.98
2015	2268.9	309920	$ 18,083.13	$35,936.77	$54,019.91	$ 29,040.09
2016	2443.5	303520	$ 19,474.70	$35,194.66	$54,669.36	$ 28,390.64
2017	2708.6	273704	$ 21,587.54	$31,737.35	$53,324.89	$ 29,735.11
						$ 245,439.98

A Total of $245,439.98 Savings over 18 years!

Last year we again saved $30,000 compared to our peak energy use



Projected Savings

- Utility Savings of over $300,000 over the next 10 years *if we do nothing more*.
- All money we save can be re-invested into educating our students.
- With our declining enrollment, this money is crucial to keeping our quality teachers.

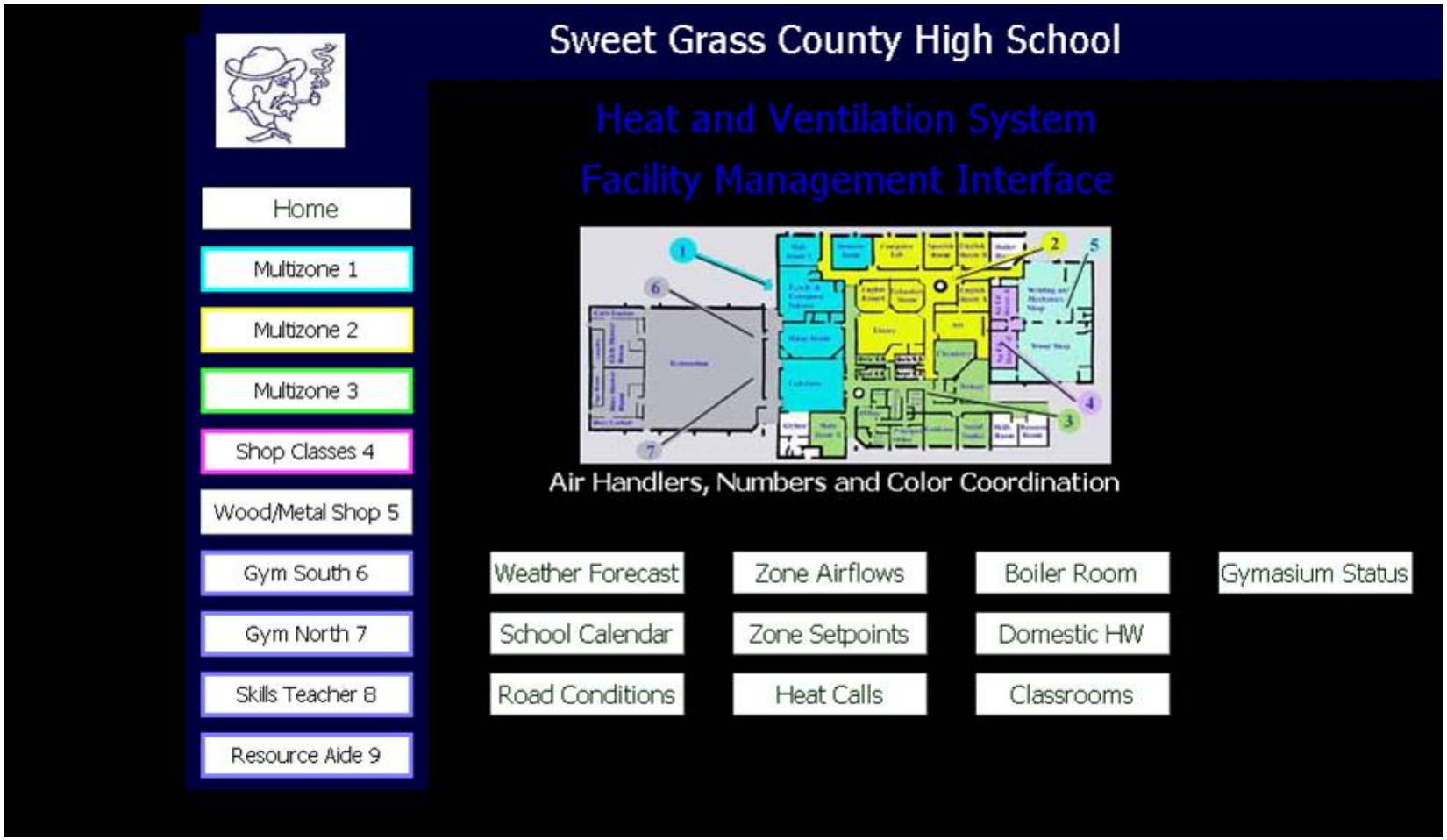
- Energy Use Index- used to compare building based on cost per square foot.
- The nationwide average school energy use index costs are $1.15/ square foot
- In 2001 we were at $1.37/square foot.
- Today SGHS spends $0.81/square foot.
- SGHS now beats the national average by 30%!

Old Heating System Controls

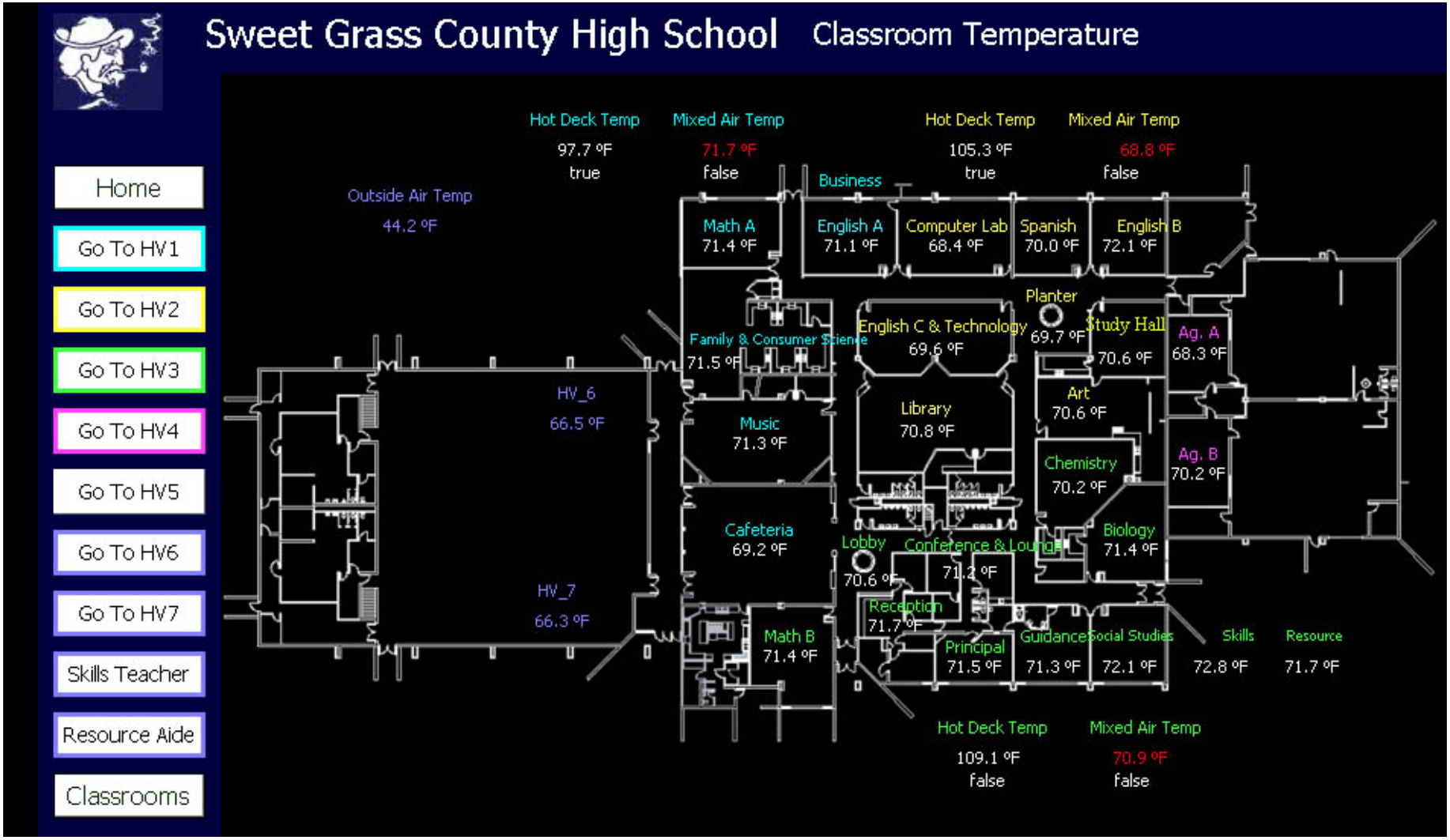
Old Pneumatic Tube Control System. It used air in tubes to control actuators instead of using electricity.

Digital Control System allows for on site troubleshooting by me. Before we had a spaghetti mess of pneumatic controls and actuators which were not addressable. It was an extremely difficult network of tubes and finding problems was like looking for a needle in a haystack. In order to find a leak, we had to use a squeeze bulb!

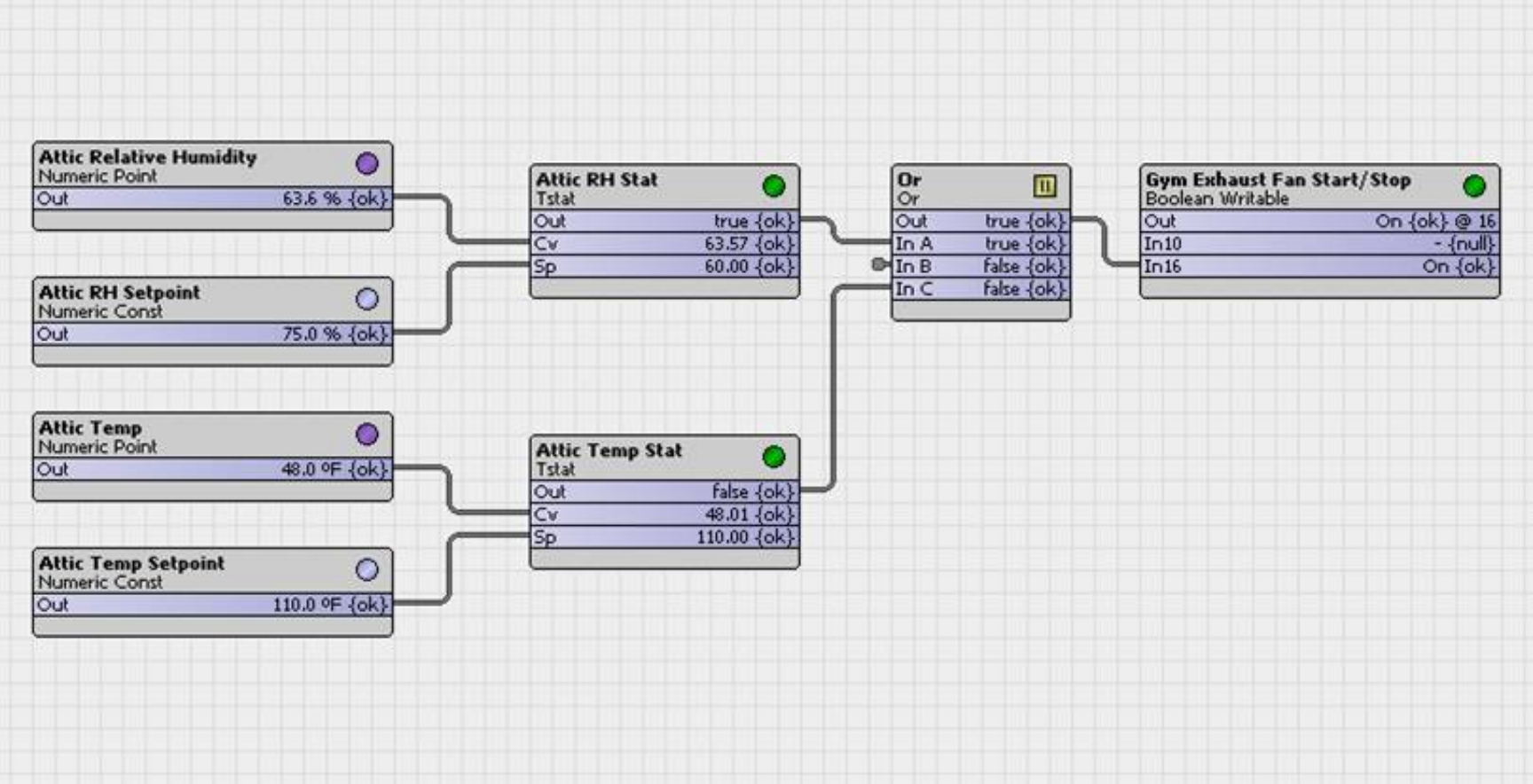
Digital Controls of the Heating System- Improved Troubleshooting



Increased Thermal Comfort

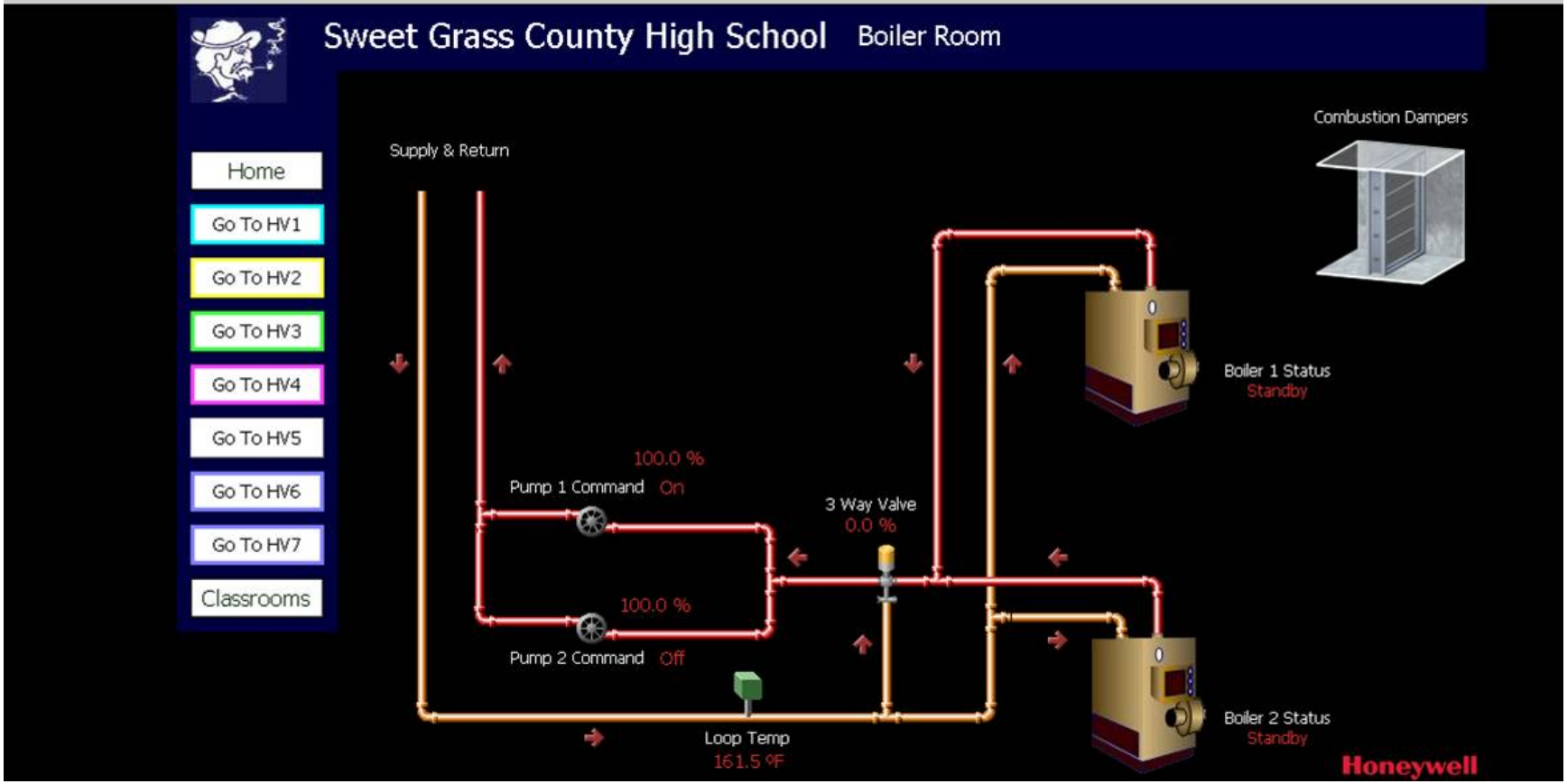


Improved Control Programming- Real time programming can be done from anywhere. Virtual wiring.



Last week we upgraded the gym exhaust programming to include dew point calculations to prevent condensation in the gym.

Improved Monitoring of Building and Systems



Lower Operation & Maintenance Cost

LOWER OPERATIONS AND MAINTENANCE (O&M) COSTS

A major recent study of costs and benefits of green buildings for 40 state agencies found that the operations and maintenance (O&M) benefits of greening California public buildings provide savings worth $\$8/ft^2$ over a 20 year period.[73] Green schools, like other green buildings, incorporate design elements such as commissioning and more durable materials that reduce O&M costs. For example, the Canby School in Oregon, designed by Boora Architects, *(see Table B)* at a level equivalent to LEED Gold, features exterior surfaces of brick and metal with a baked finish that require virtually no maintenance/ painting, as well as a linoleum floor with lower maintenance than conventional flooring.[74] Estimating O&M benefits from green schools is beyond the scope of this study but the benefits are probably significant.

If SGHS is saving $8/square foot over a 20 year period as the study suggests, then the added benefit in dollars to our high school is a total of

$512,000 (64,000 square feet times 8)

Energy Reliability

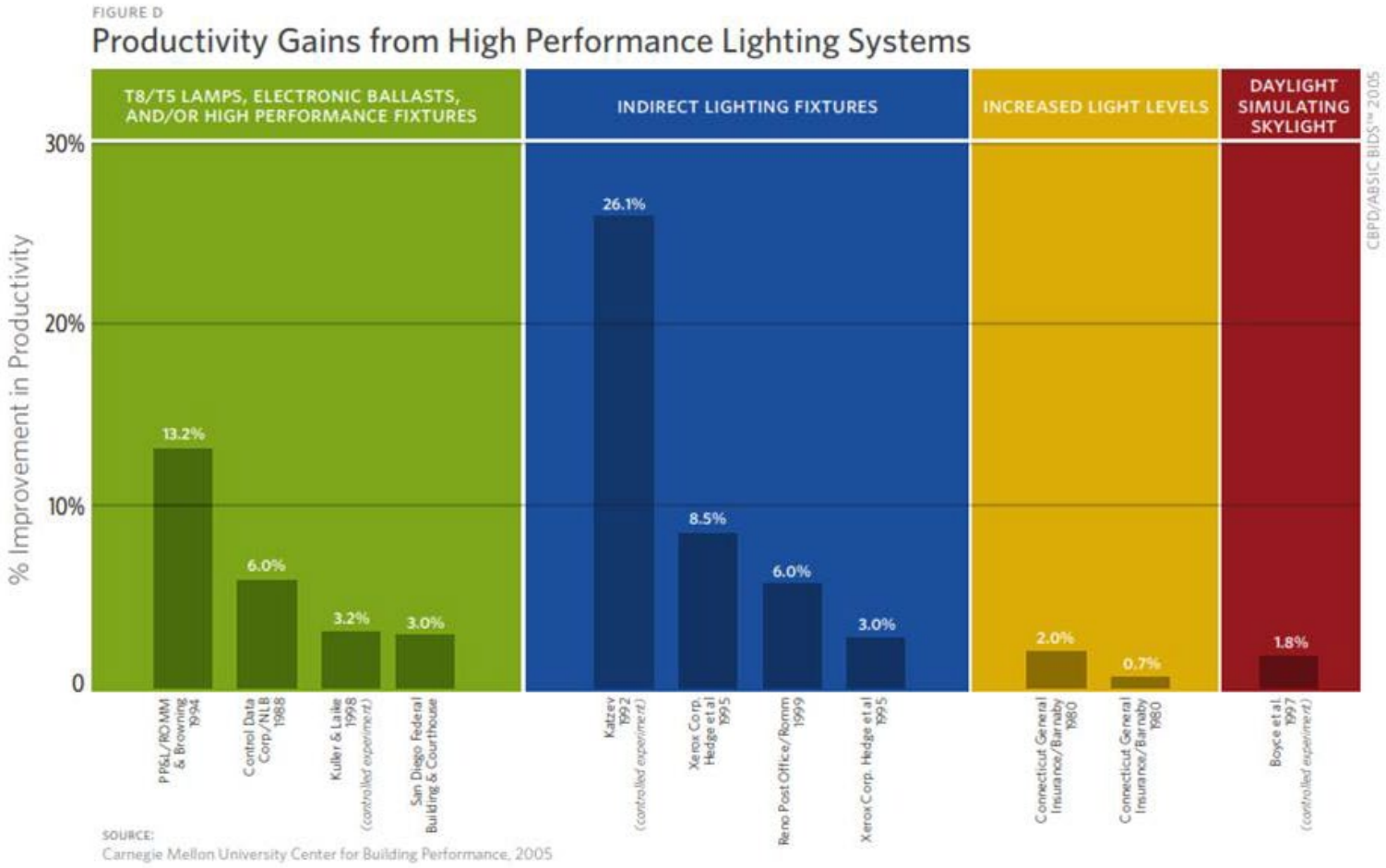
By reducing demand, the energy efficiency programs contribute to system reliability in terms of supply adequacy within a particular area or region... all energy efficiency measures... help maintain adequate margins of generation supply, and can help deter brownouts and blackouts....By reducing load and demand on the power distribution network, the [efficiency] programs decrease the costly likelihood of failures.[76]

This report does not quantify the power quality and reliability economic benefits of greening the nation's schools, but they appear substantial.

By our school eliminating ballasts for florescent lights the benefits are: our energy power factor is better, there is no flickering, the light quality is improved to full spectrum, maintenance costs are significantly lowered, *and* we are saving money!

High Performance Lighting increases Student Performance

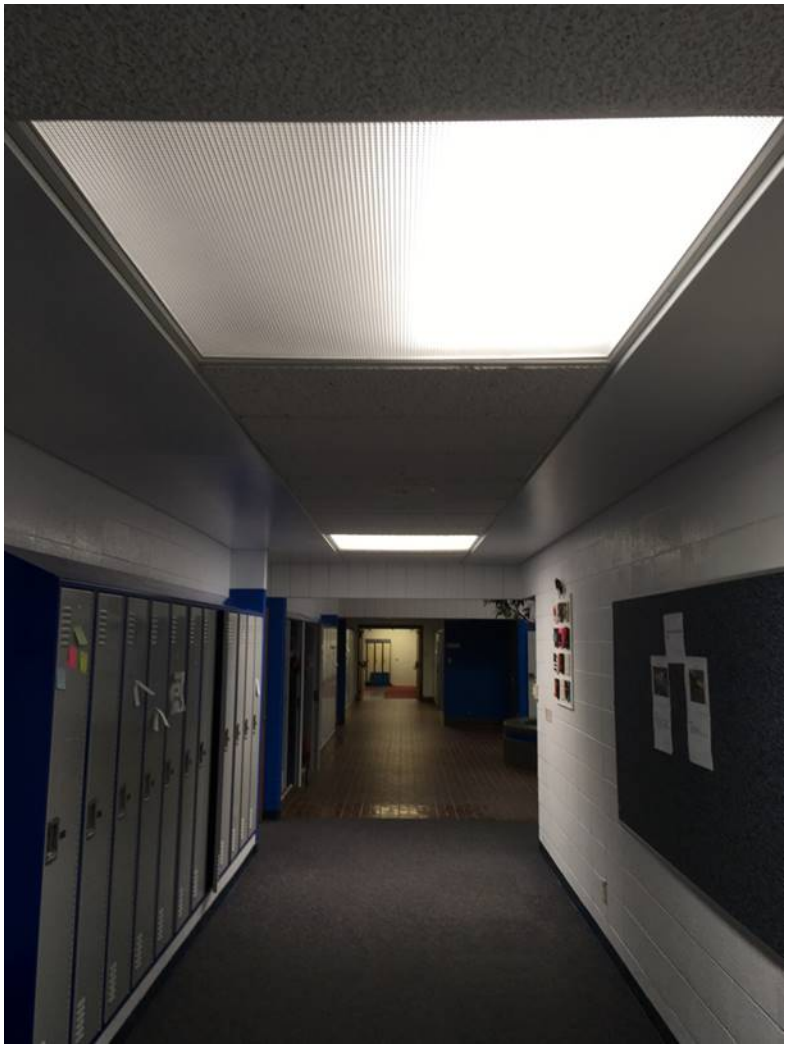
Higher Productivity



Source- Greening of Americas Schools

Lower Maintenance Cost

- Lamps last for 20 years.
- Lamp replacement cost reduced.
- By direct wiring the LED lamps and getting rid of ballasts, I save about 40 hours per year on lighting system maintenance time replacing bad ballasts.
- Ballasts take energy also and create heat, so you maximize your energy savings by removing the ballast when retrofitting to LED lamps.
- By completing a schoolwide LED retrofit, we do not have to worry about mistakenly installing florescent lamps in a LED fixture.
- Eliminating ballasts removes inductive loads– your power quality improves.



SMART Schools have a Better Public Image

Thursday, February 26, 2015

SGHS students get SMART

Recycling, energy savings challenge spurs campus projects

By Sam Spector
Sweet Grass County High School

Lt. Gov. Angela McLean challenged schools across Montana to participate in a contest to save money and resources. SMART refers to a school's ability to "Save Money and Resources Today," and so far more than 50 schools are signed up for this year's contest, now in its second year.

This year, Sweet Grass County High School decided to join the charge, with the approval of the SGHS Board of Trustees and Superintendent Al Buerkle. Head custodian Sam Spector volunteered to be the SMART Schools Coordinator at the start of the year.

Each school has the option of participating in one, two or three different challenges: SMART Energy Challenge, SMART Green Schools Challenge and SMART Recycling Challenge.

SGHS students selected the energy and recycling challenges to compete against other class B schools throughout the state. Schools are assessed based the design and implementation of programs to address each challenge during the 2014-2015 school year. In addition to saving money and promoting health, the top four schools in each category will receive a "SMART Schools" designation, a $1,000 cash prize and statewide recognition from Lt. Gov. McLean.

Spector and Bill Pedersen, a representative of the lieutenant governor's office, spoke to the students Feb. 18 at an all-school assembly about the challenge. Pedersen talked about what this challenge means for both Montana and the world,

Photos courtesy Sam Spector

Sweet Grass County High School students pledged their support for the "Save Money and Resources Today" (SMART) challenge during an assembly Feb. 18. Students and staff implemented several projects as part of the challenge including new plastic bottle recycling bins and paper waste awareness.

Custodians Jeff Harper and ballgame event help John Faw further helped out by recycling what plastic bottles were left in the stand during event cleanup, leading to an approximate 95 percent recycling rate.

Taking plastic out of the equation was crucial to allowing SGHS to drop from an 8-cubic-yard dumpster to a 6-yard dumpster. The city charges the school commercial rates of $13.32/cubic yard whether or not the dumpster is full. This 2-cubic-yard difference saves the school approximately $1,200 per year.

Since 2005 the school reduced waste by 57 percent by going from 14 cubic yards of dumpsters to only one 6-yard dumpster, saving $4,582.08 annually.

SGHS cook Elena Mattheis cleans tin

SGHS- 4 time SMART Schools Energy Champions- Winning $4,000


EXIT
SMART
SCHOOLS
SAVING MONEY AND RESOURCES TODAY
S·M·A·R·T
SCHOOLS
SAVING MONEY AND RESOURCES TODAY

National Recognition

- This year we had the Department of Environmental Quality invited a representative from the Department of Energy to come and showcase our school.
- Russel Lamp from the Department of Energy came and toured our school thus giving Sweet Grass County High School National Recognition.

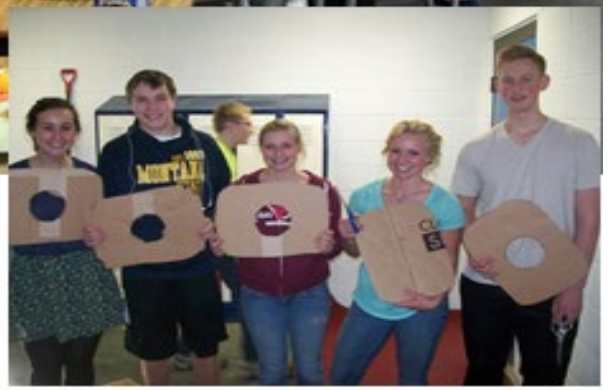
Student Learning

- "I learned that focusing on the little things alone can make a huge difference in the amount of resources used and hence the money saved for the school. The project can be improved next year by just brainstorming more small ways to save resources! Because they will add up!"

  . Sam Curry SMART Club member

Student Involvement… S.M.A.R.T. Club

- One person can make a big difference, but together we make a HUGE difference!

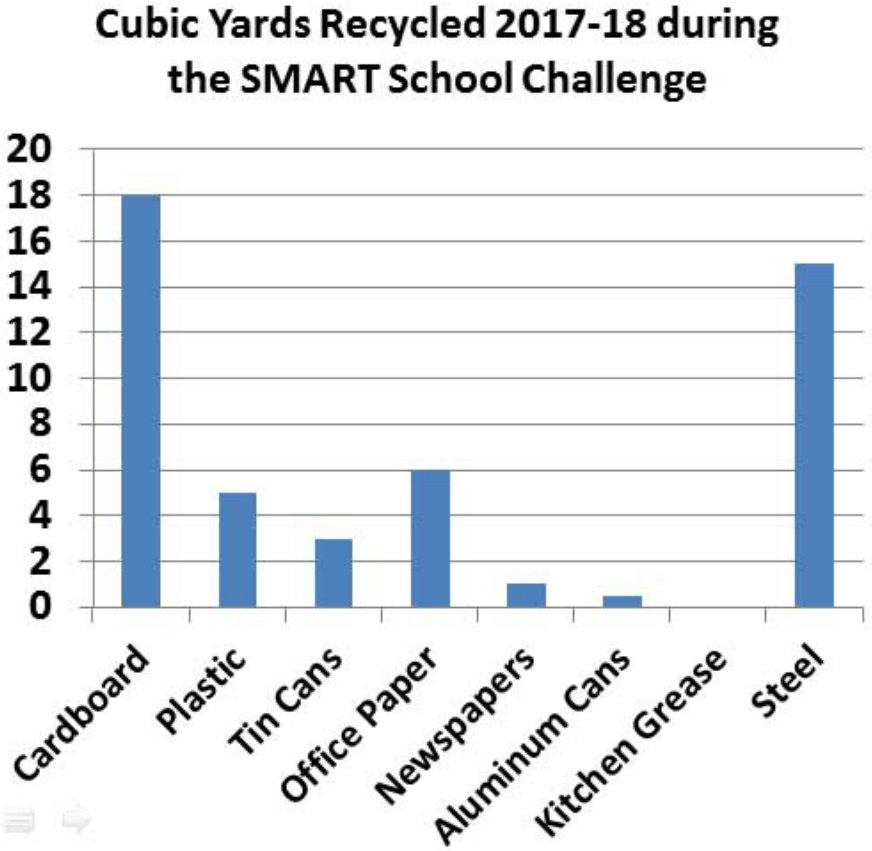


Todays Students are tomorrows Leaders

- "I learned that even just small little tasks can help conserve energy. …….I hope our group can follow through with these ideas, and that we motivate others to want to join the smart group and recycle."

  Holly Emter

Student Participation 2018 SMART Recycling Challenge the SAVY Club and Herders recycled… 18,810 pounds, 48 cubic yards, or 8 dumpsters full!



Recycle Bin Storage Locations

SGHS Recycling

Since 2008, our school has reduced our trash dumpster capacity by:

57%

Annual Savings:

$4,582.08

We pay $13.32/cubic yard commercial rate for trash disposal.

Waste Diversion

Source- Greening of America's Schools- Costs and Benefits

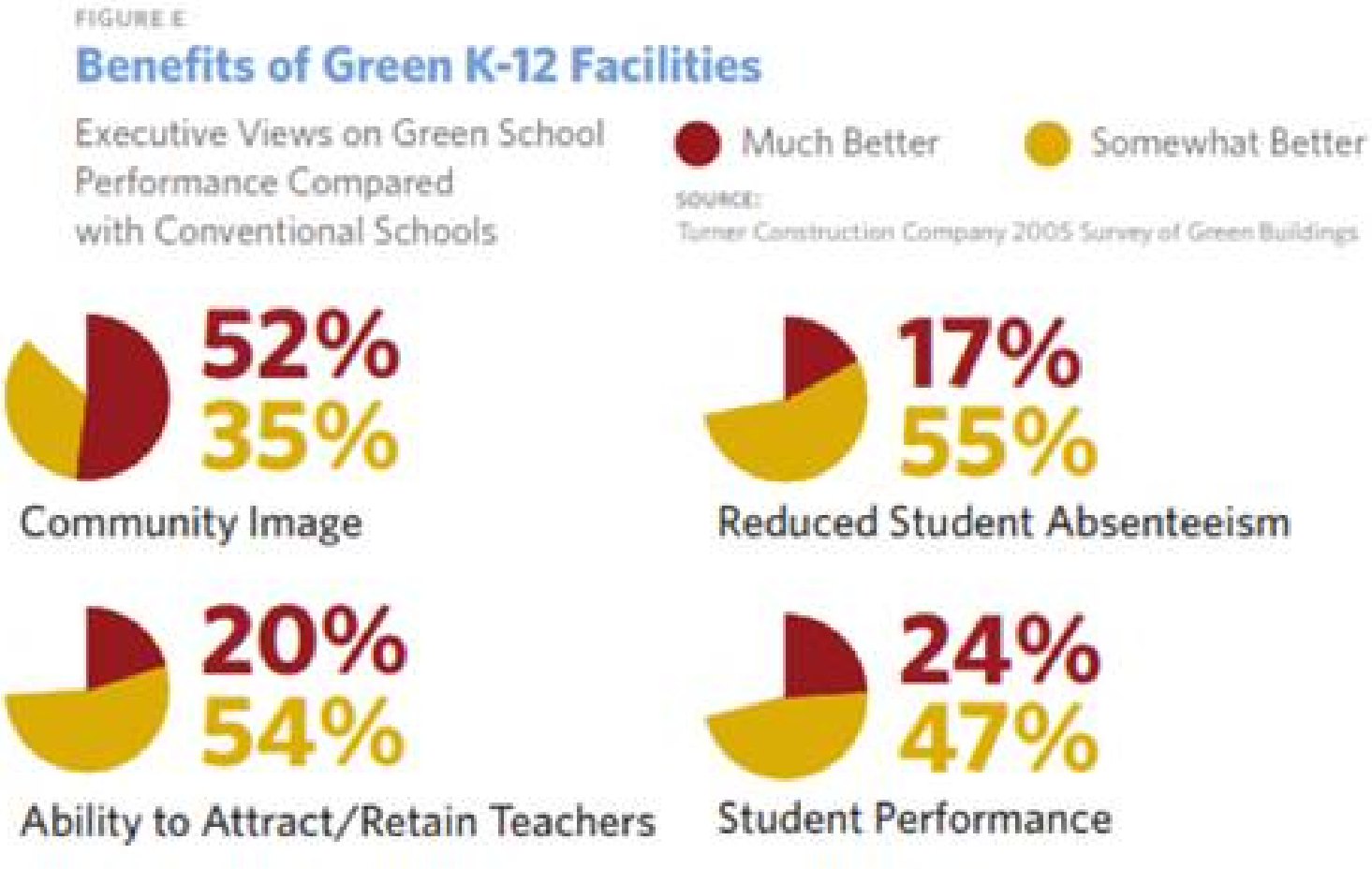
Insurance Costs Lowered

INSURANCE BENEFITS OF GREEN BUILDINGS

- Worker Health & Safety. Various benefits, including lower worker's compensation costs, arise from improved indoor environmental quality, reduced likelihood of moisture damage, and other factors enhancing workplace safety.
- Property Loss Prevention. A range of green building technologies reduce the likelihood of physical damages and losses in facilities.
- Liability Loss Prevention. Business interruption risks can be reduced by facilities that derive their energy from on-site resources and/or have energy-efficiency features. These risks include those resulting from unplanned power outages.
- Natural Disaster Preparedness and Recovery. A subset of energy efficient and renewable energy technologies make facilities less vulnerable to natural disasters, especially heat catastrophes.

Source- Greening of America's Schools- Costs and Benefits

Hidden Benefits of a High Performance School



Source- Greening of America's Schools- Costs and Benefits

What can you do for your school?

- Volunteer to help out with the SMART Schools Program.
- Collaborate with other SMART Schools.
- I plan to launch an internet question and answer platform that school facility managers across Montana can use.

This Years Proposed Projects

- **Solar Energy-** We have applied for funding for a 50Kw solar photovoltaic system.
- **LED Gym Light Retrofit-** We will be retrofitting our 24 gym light fixtures. I have estimated this to save us 7,502 KWh or $1,500 annually. This is an additional savings of 2.8%. The ROI is 1.3 years.

Projected Solar Project- 50KW

- Grant- $67,162
- Cost- $83,953
- Cost after Grant- $16,791
- Benefit- $7,300 Savings per
- Lifetime Benefit Estimate $184,009
- Educational opportunity
- Collaboration with the community members

Proposed 50 KW Solar Array will save

Solar PV System	BOZEMAN GREEN BUILD			John Palm
Return on Investment	PH: 406-580-6068; E-Mail: info@bozemangreenbuild.com			
Sweet Grass High School, 49.91 KW System, (149) Canadian Solar 335 Watt Modules, South Facing Ground-Mount				
System Size:	49.915	(kW)		
System Cost:	83,953.00	$		
Less NorthWestern Energy Grant	-67,162.00			
System Cost After Grant:	16,791.00			
Sweet Grass School District Contribution	16,791.00			
Cost per Watt (after credits):	0.34	$/Watt		
Current Utility Power Cost:	7.40	cents/kWh		
Assumed Annual Utility Cost Increase:	2.5	%		
NREL Est. Production (180 AZ, 10 degree tilt):	1.431	kWh/y/W		
Estimated Annual Production at year 1:	71428	(kWh)		
Estimated Annual Production at year 10:	65847	(kWh)		
Estimated Annual Production at year 25:	57496	(kWh)		
Number of years until payback:	3 years			
Lifetime Monetary Gain:	$184,009.95			
Equivalent APR over system's lifetime:	8.62 %			
Average Electricity Cost Over System Lifetime:	0.9	cents/kWh		

Year	Power Cost	Production (kWh)	Utility Power Savings	Accrued Savings	Return on Investment	Year
1	0.074	71428	$5,286	5,286	31.48%	1
2	0.076	70786	$5,369	$10,655	63.46%	2
3	0.078	70148	$5,454	$16,109	95.94%	3
4	0.080	69517	$5,540	$21,648	128.93%	4
5	0.082	68891	$5,627	$27,276	162.44%	5
6	0.084	68271	$5,716	$32,992	196.48%	6
7	0.086	67657	$5,806	$38,798	231.06%	7
8	0.088	67048	$5,898	$44,695	266.19%	8
9	0.090	66445	$5,991	$50,686	301.87%	9
10	0.092	65847	$6,085	$56,771	338.11%	10
11	0.095	65254	$6,181	$62,953	374.92%	11
12	0.097	64667	$6,279	$69,232	412.31%	12
13	0.100	64085	$6,378	$75,609	450.30%	13
14	0.102	63508	$6,478	$82,088	488.88%	14
15	0.105	62936	$6,581	$88,668	528.07%	15
16	0.107	62370	$6,684	$95,353	567.88%	16
17	0.110	61809	$6,790	$102,143	608.32%	17
18	0.113	61252	$6,897	$109,040	649.39%	18
19	0.115	60701	$7,006	$116,046	691.12%	19
20	0.118	60155	$7,116	$123,162	733.50%	20
21	0.121	59613	$7,229	$130,390	776.55%	21
22	0.124	59077	$7,343	$137,733	820.28%	22
23	0.127	58545	$7,458	$145,191	864.70%	23

Sheet1

Grand Total of Benefits

- **Grant Money-** $207,500 Quality Schools Grant, $20,000 Strategic Energy Management Grant
- **Contest Winnings-** $4,000 SMART Schools Energy Champing Winnings
- **Rebates-** Over $10,000 in rebates.
- **Energy Savings-** Documented $245,439.98 savings over the past 18 years.
- **Operations and Maintenance Cost Savings-** Potential Estimates savings of $512,000 of over the next 20 years. (How much money does it take to take care of a school versus remove an old one?)
- **Future anticipated energy cost savings** between $300,000 and $388,000 over the next ten years.
- **Increased student performance-** priceless
- **Improved Community Relations-** priceless
- **Improved Staff Productivity-** priceless
- **Higher Teacher Retention-** priceless
- **Making my job a bit easier**- priceless
- **Renewable Energy-** Solar $184,009 over the next 25 years
- **Trash Disposal Savings-** Annual savings of $4,582

Thank You

- Community Foundation for the opportunity to share at the Coffee Connection!

Thank You to the SMART Schools Leaders for your commitment to our schools…

- Govenor Steve Bullock and Lt. Governor Mr. Mike Cooney
- Claudia Hewston– 2018 SMART Schools Coordinator
- Robyn Boyle- Energy Resource Specialist Energy Bureau Montana DEQ

Bonnie Rouse

- We would also like to thank Bonnie Rouse for her dedication to the SMART Schools Program.