Final Report

Energy Efficiency Feasibility Study
and
Resulting Plan for the Bay Mills Indian Community

U.S. Department of Energy Tribal Energy Program
Award # DE-EE0005173

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March 2014

Executive Summary

In 2011 the Inter-Tribal Council of Michigan, Inc. was awarded an Energy Efficiency Development and Deployment in Indian Country grant from the U.S. Department of Energy's Tribal Energy Program. This grant aimed to study select Bay Mills Indian Community community/government buildings to determine what is required to reduce each building's energy consumption by 30%. The Bay Mills Indian Community (BMIC) buildings with the largest expected energy use were selected for this study and included the Bay Mills Ellen Marshall Health Center building, Bay Mills Indian Community Administration Building, Bay Mills Community College main campus, Bay Mills Charter School and the Waishkey Community Center buildings. These five sites are the largest energy consuming Community buildings and comprised the study area of this project titled "Energy Efficiency Feasibility Study and Resulting Plan for the Bay Mills Indian Community".

The end objective of this study, plan and the Tribe is to reduce the energy consumption at the Community's most energy intensive buildings that will, in turn, reduce emissions at the source of energy production, reduce energy expenditures, create long lasting energy conscious practices and positively affect the quality of the natural environment.

This project's feasibility study and resulting plan is intended to act as a guide to the Community's first step towards planned energy management within its buildings/facilities. It aims to reduce energy consumption by 30% or greater within the subject facilities with an emphasis on energy conservation and efficiency. The primary goals of the project are to foster a culture of energy conservation and maximize long-term savings. In order to meet these goals, this project provided both specific strategies and efficiency items for reducing energy usage. The completed document contained a five year implementation and reinvestment plan to largely cover efficiency improvement costs. No cost conservation measures constituted the short-term actions. The mid-term and long-term actions are planned to be funded by contributing 50% of the cost savings to an energy savings account. The information and strategies in this project were intended to be a resource for an ongoing process of planning, implementation and evaluation of energy efficiency and conservation.

The energy audits and related power consumption analyses conducted for this study revealed numerous significant energy conservation and efficiency opportunities for all of the subject sites/buildings. In addition, many of the energy conservation measures require no cost and serve to help balance other measures requiring capital investment. Reoccurring deficiencies relating to heating, cooling, thermostat setting inefficiencies, powering computers, lighting, items linked to weatherization and numerous other items were encountered that can be mitigated with the energy conservation measures developed and specified during the course of this project.

Project Overview

The Bay Mills Indian Community Energy Reduction Feasibility Study was accomplished by collecting historical energy consumption data, analyses of historical energy use data, detailed energy audits including occupant and building manager interviews, thermography evaluation, itemized energy consumption calculations, energy conservation and energy efficiency alternatives research, energy conservation measure choice, energy conservation measure savings and cost calculations, reinvestment and sequence strategies to meet objectives and community

awareness throughout the project. These efforts were utilized with the objective of reducing each building's energy consumption by 30% or greater.

Project Objectives

The completed Bay Mills Indian Community Energy Reduction and Feasibility Study and Resulting Plan project's objectives were centered on conducting a feasibility study and developing a plan to reduce energy consumption at Bay Mills Indian Community's most energy use intensive buildings by 30%. Within these two main objectives were many underlying objectives that were the framework of the project and include:

- Emphasis on education relating to conservation, new technologies, high efficiency hardware and building practices, renewable energy, environmental impacts of existing energy sources and potential for reinvestment into Community owned systems versus paying others
- Supply the recipe to BMIC that can be used to reduce energy consumption 30%.
- Provide BMIC with the information to reduce energy bill expenditures.
- Provide BMIC with the information to effectively reduce their share of emissions at coal fired electricity plants.
- Provide BMIC with the information to reduce dependency on nonrenewable energy.
- Help provide BMIC with the basis to begin incorporating renewable energy and hardware within the Community.
- Help enable another avenue for BMIC to connect with their cultural value of respect for the earth and living inhabitants.
- Help provide construction related employees with skills relating to new energy efficiency practices that can be marketable.

Description of Activities Performed

Community awareness was a fundamental activity that took place throughout this project. Presentations, pamphlets, interviews, staff involvement and cooperative energy efficiency strategy development were instrumental in creating community awareness.

Activities performed in this project began by looking at each building's current energy use in the form of electricity and natural gas utility bills. Two years of previous utility bills were collected, analyzed and formed the numbers representing existing energy use. These past numbers served as the baseline for comparison to energy conservation measures. In addition to yearly energy use, plotting historical monthly use was analyzed to determine increases associated with seasonal loads tied to heating and cooling.

Following the collection and analyses of historical energy consumption, detailed energy audits were conducted at each building. Room by room energy audit inspections were conducted with the knowledge and assistance of Hugh Clark, an HVAC specialist within the Bay Mills Indian Community Maintenance Department. Energy consuming devices, thermostats, occupant behaviors and building envelop conditions were documented and entered into a building energy use calculation spreadsheet. Within the spreadsheet, each column contained an energy consuming item within the building and calculations for daily and yearly kilowatt hours/ccf and costs. In addition, energy conservation measure costs, savings, payback and overall percentage

of energy reduction were also calculated. This calculation spreadsheet allowed an item by item, room by room or total building quantitative view of energy use for each building.

Thermography was utilized to evaluate each building's envelope for deficiencies tied to insulation and air sealing. Extensive thermal imaging was conducted at near 0F and after dark to reveal heat loss from insufficient insulation and/or air sealing from attics, foundations, walls, windows, doors and numerous other building penetrations. Any deficiencies would be reversed during summer/cooling months with increased energy use to cool buildings. All thermal images were analyzed and those that revealed deficiencies were included with individual building information.

Following extensive calculations to quantify all aspects of building energy use, conservation and efficiency alternatives were researched and evaluated to cut energy consumption with the most reliable and cost effective alternative. Tribal decision makers were presented with preliminary findings to discuss alternatives and steer plan energy reduction measures. As with many aging buildings, the period of time some of these buildings will continue to be utilized is uncertain. Future building lifespan uncertainty reinforced the focus on maximizing conservation measures when available. Conservation measures reduced or eliminated capital expenditures that could possibly be wasted with a newly constructed building.

Following the selection of energy conservation measures, a reinvestment strategy was developed to help pay or offset capital expenditures associated with energy efficiency measures. Reinvestment was illustrated within the Plan (also shown below) in a matrix that shows individual measures, their implementation sequence, savings, capital expenditure and contribution to energy savings account. Reinvestment is a critical sustainability element of this energy efficiency reduction project's plan.

Finally, a comprehensive Bay Mills Indian Community Energy Reduction Feasibility Study and Resulting Plan document was completed that provided a step-by-step guide to realizing energy reductions of 30% or greater in the subject facilities.

Conclusions and Recommendations

It is the conclusion of this project that energy savings of 30% or greater is feasible and sustainable within the subject facilities and can be similarly expected in numerous other buildings and homes. Key elements that were repeatedly discovered in this project that revealed deficiencies/opportunities are thermostat optimization, computer power management (hibernation), lighting systems and the benefit of reinvestment of energy savings into other energy conservation measures. In addition, many of the deficiencies require no capital expenditure or relatively short payback periods. These "low hanging fruit" constituted energy conservation measures that were prioritized in this project's goal of reducing energy and maximizing long-term savings.

The findings of this project prompt the following recommendations:

- Advocate energy audits as a means of energy use reduction/utility bill savings
- Create community awareness of potential savings and methods
- Develop energy use baseline

- Determine, prioritize and exhaust no-cost energy conservation measures
- Develop reinvestment strategy and energy savings account
- Implement following reinvestment strategy and sequence
- Evaluate energy reduction savings after implementation to validate success
- Continue to stay abreast of energy efficiency technology

Specific Findings, Conclusions and Recommendations

The following reinvestment/sequence matrix and individual facility energy conservation measures illustrate the findings and recommendations that were determined through this energy reduction and feasibility study and resulting plan for the Bay Mills Indian Community.

Energy Savings Reinvestment Matrix

Year Executed	Description of Measure	Facility Impacted	Initial Cost	Estimated Annual Savings	Energy Savings Account Balance	Contribution to Energy Savings Account (50% of Savings)						Total 5 Year Savings
						2014	2015	2016	2017	2018	Total	
2014	Computer Hibernation	BMIC Admin, Health Center, Waishkey Center, Charter School	$0	$11,326	$0	$5,663	$5,663	$5,663	$5,663	$5,663	**$28,315**	**$56,630**
2014	College Computer Hibernation	Admin, Library, Learning Center	$0	$2,799	$0	$1,400	$1,400	$1,400	$1,400	$1,400	**$6,998**	**$13,995**
2014	Thermostat Optimization	BMIC Admin, Health Center, Charter School	$0	$12,777	$0	$6,389	$6,389	$6,389	$6,389	$6,389	**$31,943**	**$63,885**
2014	College Thermostat Optimization	Admin, Mikanuk, Library, Learning Center	$0	$6,912	$0	$3,456	$3,456	$3,456	$3,456	$3,456	**$17,280**	**$34,560**
2014	Elimination of Redundant Items	BMIC Admin, Health Center, Waishkey Center, Charter School	$0	$2,174	$0	$1,087	$1,087	$1,087	$1,087	$1,087	**$5,435**	**$10,870**
2014	College Elimination of Redundant Items	Admin, Mikanuk, Library, Learning Center	$0	$905	$0	$453	$453	$453	$453	$453	**$2,263**	**$4,525**
2014	Turn Off Entry Electric Heat at Night	Health Center	$0	$594	$0	$297	$297	$297	$297	$297	**$1,485**	**$2,970**
2014	Unplug Unused Summer Items	Charter School	$0	$598	$0	$299	$299	$299	$299	$299	**$1,495**	**$2,990**
2014	Replace Incandesent Bulbs w/CFLs	BMIC Admin, Health Center, Waishkey Center, Charter School	$48	$862	$0	$431	$431	$431	$431	$431	**$2,155**	**$4,310**
2014	College Replace Incandescent Bulbs w/CFLs	BMCC Admin, Mikanuk, Library, Learning Center	$88	$1,517	$0	$759	$759	$759	$759	$759	**$3,793**	**$7,585**
2014	Insulation & Air Sealing	BMIC Admin	$10,000	$687	$0	$344	$344	$344	$344	$344	**$1,718**	**$3,435**
2014	Air Sealing Exteior Doors	Waishkey, Charter School	$5,200	$906	$0	$453	$453	$453	$453	$453	**$2,265**	**$4,530**
2014	College Air Sealing Exterior Door	Mikanuk	$200	$12	$0	$6	$6	$6	$6	$6	**$30**	**$60**
2014	College Insulation	BMCC Learning Center	$1,953	$122	$0	$61	$61	$61	$61	$61	**$305**	**$610**
2014	Retrocommission HVAC System	Mikanuk	$5,778	$5,778	$0	$2,889	$2,889	$2,889	$2,889	$2,889	**$14,445**	**$28,890**
2014 Year End Totals			**$23,267**	**$47,969**	**$23,985**	**$23,985**						
2015	Improved Foundation Insulation & Air Sealing	BMIC Library	$1,104	$255	$22,881		$128	$128	$128	$128	**$510**	**$1,020**
2015	Improved Attic Insulation	BMIC Learing Center	$1,953	$122	$20,928		$61	$61	$61	$61	**$244**	**$488**
2015	Interior Lighting	BMIC Admin, Health Center, Charter School	$15,719	$4,170	$5,209		$2,085	$2,085	$2,085	$2,085	**$8,340**	**$16,680**
2015	College Interior Lighting	Mikanuk, Library, Learning Center	$2,635	$1,191	$2,574		$596	$596	$596	$596	**$2,382**	**$4,764**
2015	Pop & Vending Machine	Health Center	$238	$269	$2,336		$135	$135	$135	$135	**$538**	**$1,076**
2015	College Pop & Vending Machines	BMCC Admin,Mikanuk, Library	$854	$965	$1,482		$483	$483	$483	$483	**$1,930**	**$3,860**
2015	Coffe Makers w/Insulated Carafe	Admin, Health Center, Waishkey	$780	$783	$702		$392	$392	$392	$392	**$1,566**	**$3,132**
2015	College Coffe Makers w/Insulated Carafe	BMCC Admin,Mikanuk, Learning Center	$650	$480	$52		$240	$240	$240	$240	**$960**	**$1,920**
2015 Year End Totals			**$23,933**	**$8,235**	**$28,154**		**$28,102**					
2016	Exterior Lighting	Health Center, Waishkey Center, Charter School	$11,077	$3,085	$17,077			$1,543	$1,543	$1,543	**$4,628**	**$9,255**
2016	College Exterior Lighting	BMCC Campus, Library	$5,305	$1,427	$11,772			$714	$714	$714	**$2,141**	**$4,281**
2016	Water Heating	BMIC Admin, Charter School	$3,447	$998	$8,325			$499	$499	$499	**$1,497**	**$2,994**
2016	Water Heating	BMCC Admin	$2,798	$665	$5,527			$333	$333	$333	**$998**	**$1,995**
2016	Timed Power Supplies	BMIC Admin, Health Center, Waishkey Center, Charter School	$3,194	$1,923	$2,333			$962	$962	$962	**$2,885**	**$5,769**
2016	College Time Power Supplies	BMCC Admin, Mikanuk, Library, Learning Center	$2,390	$1,101	-$58			$551	$551	$551	**$1,652**	**$3,303**
2016 Year End Totals			**$28,211**	**$25,669**	**$32,644**			**$32,702**				
2017	Refrigeration	BMIC Admin, Health Center, Waishkey Center	$10,395	$1,816	$22,249				$908	$908	**$1,816**	**$3,632**
2017	College Refrigeration	BMCC Admin	$1,890	$296	$20,359				$148	$148	**$296**	**$592**
2017	Gymnasium Lighting	Waishkey	$2,585	$508	$17,774				$254	$254	**$508**	**$1,016**
2017	Water Coolers	BMIC Admin, Waishkey	$573	$119	$17,201				$60	$60	**$119**	**$238**
2017	College Water Coolers	BMCC Admin	$191	$40	$17,010				$20	$20	**$40**	**$80**
2017	Water Heating	Waishkey Center	$2,300	$647	$14,710				$324	$324	**$647**	**$1,294**
2017	Interior Lighting	Waishkey Center	$4,395	$1,291	$10,315				$646	$646	**$1,291**	**$2,582**
2017 Year End Totals			**$22,329**	**$4,717**	**$45,375**				**$35,060**			
2018	Interior Lighting	BMCC Admin	$15,563	$1,767	$29,812					$884	**$884**	**$1,767**
2108	HVAC Upgrade	Waishkey	$175,000	$8,111	-$145,188					$4,056	**$4,056**	**$8,111**
2018 Year End Totals			**$190,563**	**$9,878**	**-$145,188**					**$39,999**		
Cumulative Totals			**$288,303**	**$96,468**	**-$145,188**	**$23,985**	**$28,102**	**$32,702**	**$35,060**	**$39,999**	**$159,847**	**$319,694**

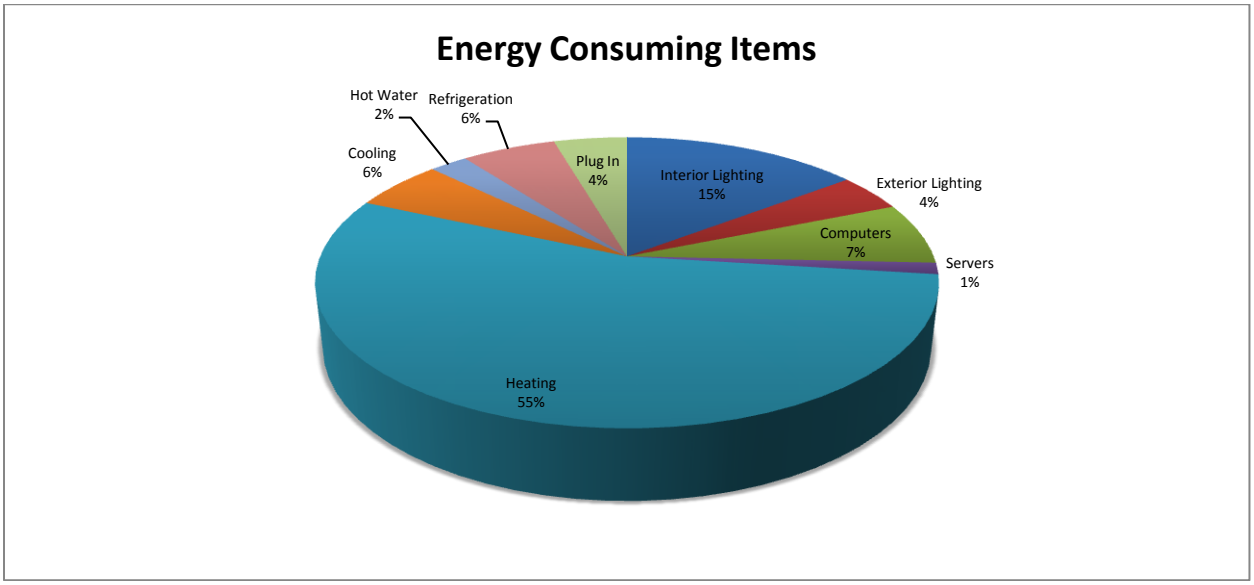
Bay Mills Indian Community Charter School (ECMs Totaling 42% Energy Reduction)

The Bay Mills Indian Community Charter School is a single story 17,000ft^2 K-6 elementary school owned by the Tribe. The school was opened in 2003 in its current building, a new modular structure that was intended to be used for approximately five years during the interim of when a permanent structure would be built. Ten years later and the structure continues to be used with no concrete plans to replace the school building. The school has 96 students and has 180 days of classroom instruction per year.

The school utilizes grid electricity and natural gas as sources of energy. Electricity is used for all items requiring energy except for building heating where natural gas is used. Each room has its own wall mounted combination heat and air conditioning unit with programmable thermostat.

The school building features wood frame construction, wood siding, vinyl sliding windows, three sets of double metal utility exterior doors, one single metal entry door, flat roof and elevated off the ground with skirting along perimeter.

Analyses of the school's energy consumption history and energy audit information revealed that heating is the largest energy consuming item followed by interior lighting, refrigeration, computers, cooling and other items shown in the following chart.



To improve building energy performance, the following Energy Conservation Measures (ECMs) were developed in response to energy audit and analyses findings. Each ECM is further described below.

ECM	Description of ECM	% Energy Use Savings	Total Cost Savings ($/year)	Estimated Capital Cost ($)	Simple Payback (years)
1	Thermostat optimization (6pm-6am 10 degree setback/step-up; thermostat heat setting @ 69 degrees; 78 degrees AC)	41%/23.3%	$5,619	$0	0
2	Hibernate computers during non-work hours	62%/3.9%	$1066	$0	0
3	Interior Lighting (Occupancy sensors)	40.0%/5.4%	$1,297	$2,156	1.66
4	Exterior Lighting (LED retrofits and reduce on time)	94.4%/3.7%	$897	$5,127	5.71
5	Energy Efficient Water Heaters	62%/1.4%	$333	$1,149	3.46
6	Unplug Appliances During Summer (Kitchen freezer, fridge, icemaker, drinking fountain)	37%/2.5%	$598	$0	$0
7	Replace Incandescent Bulbs with CFLs	78.3%/0.3%	$67	$4	0.06
8	Timed Power Supplies (Copiers, Printers, Postage)	49%/0.7%	$163	$233	1.5
9	Eliminate Redundant Items (½ fridge)	100%/0.3%	$76	$0	0
10	Exterior Door Air Sealing	0.4%/0.23%	$55	$200	3.6
	Total	**42%**	**$10,171**	**$8,869**	**0.9**

ECM 1: Thermostat Optimization

Existing Conditions

Currently, the building's heating and cooling operates in a steady-state/occupied scenario 24 hours a day and 365 days a year. During energy audit visits, the average thermostat heat setting was 74 degrees and thermostat air conditioning settings at 72 degrees. The building is already equipped with programmable thermostats for nearly every room. Significant energy is wasted for excessive heating and cooling temperatures and heating and cooling of building during unoccupied times.

Energy Conservation Measure
Optimize thermostat heating and cooling thermostat programming in the each classroom, office and the cafeteria to the EPA recommended temperature during school hours. In addition, program setbacks and step ups outside of occupied times. See Appendix – Thermostat Optimization for breakdown of savings/wasted energy.

Thermostat Setting	Existing Condition	New Condition
Heat	Avg. 74°F 24hrs/auto	Weekdays 6am-6pm: 69°F Weekdays 6pm-6am & Weekends 59° Classrooms & Cafeteria: Heat Off During Summer
Cooling	Avg. 72°F 24hrs/auto	Classrooms & Cafeteria: AC Off During Summer Office Weekdays 7am-5pm: 78°F Office Weekdays 5pm-7am & Weekends 78°F

Savings
Building heating energy reduction: 38%
Building cooling energy reduction: 41%
Overall building energy reduction: 23.3%
Annual savings: $5,619
Capital investment: $0
Payback: 0 years

ECM 2: Computer Power Management

Existing Conditions
The energy audit of the Charter school determined that work station computer systems largely remain powered on 24 hours per day and teachers' laptops are powered during school hours as they are often taken home for work. Computers that remain on after work cause unnecessary power consumption and can be mitigated by hibernating computers after/before school hours.

Energy Conservation Measure
Hibernating is a power management setting that every computer operating system has for reducing energy consumption. Utilizing this feature to power down computers outside of class/work hours will reduce the current wasted energy associated with keeping computers powered on when the building is unoccupied. Enabling the Hibernate feature to the specifications below will cause each computer to consume near zero energy outside of class/work hours (approximately 14 hours/day).

Computer Type	Existing Condition	New Condition
Workstation	Powered on 24/7	Enable Hibernate feature in each computer's Power Management settings after 90 minutes of inactivity.
Laptop	On average, removed after hours	Enable Hibernate feature in each computer's Power Management settings after 90 minutes of

		inactivity.

Savings
Computer energy reduction: 62%
Overall building energy reduction: 3.9%
Annual savings: $957
Capital investment: $0
Payback: 0 years

Savings are calculated using the following: four computers operating 261 week days calculated with 10 work hours and 14 efficiency mode hours, 72 weekend days calculated with 100% hibernation/efficiency mode; 33 computers operating 180 week days calculated with 10 work hours and 14 efficiency mode hours, 72 weekend days calculated with 100% hibernation/efficiency mode.

ECM 3: Interior Lighting

Existing Conditions
The school's interior is equipped with energy efficient T8 fluorescent bulbs and fixtures on manual light switches. While these lights are efficient, additional electricity can be conserved by utilizing occupancy sensors to automatically turn a room's lights off when unoccupied. U.S. EPA estimates 40-47% savings when occupancy sensors are used in school settings.

Energy Conservation Measure
Purchase and install occupancy sensors in 27 rooms that will result in lights automatically turning off when room is unoccupied. Multi-technology sensors would be used and prevent lights from unintentionally being turned off (see Appendix – Lighting for recommended Leviton occupancy sensor unit).

Lighting Item	Existing Condition	New Condition
Interior Lighting	High efficiency interior lighting controlled manually by on/off switches.	Purchase and install 27 occupancy sensors that will automatically detect if the room is occupied/unoccupied and control lights by turning on when occupied and turning off when unoccupied.

Savings
Interior lighting reduction: 40%
Overall building energy reduction: 5.4%
Annual savings: $1,297
Capital investment: $2,156
Payback: 1.66 years

Calculations for energy savings are based on a 40% reduction of current electricity associated with interior lighting.

ECM 4: Exterior Lighting

Existing Conditions

The parking lot and building exterior is currently lighted by twelve 450 watt high pressure sodium lights on a timer that has the lights remaining on ten hours per night. Both the bulbs' high wattage and timer on throughout the night cause energy consumption that can be significantly reduced.

Energy Conservation Measure

Replace existing 450 watt high pressure sodium bulbs with 56 watt LED retrofit bulbs and optimize timer for 2 hours on before the start of school and 2 hours after school. Significant energy will be saved through conservation (reduced on time) and high efficiency bulb replacement. LED lights also provide advantages from long operational life.

Exterior Light	Existing Condition	New Condition
High Pressure Sodium Lights	Twelve 450 watt exterior lights remaining on 10 hours per night.	Replace 450 watts HPS bulbs with 56 watt LED retrofit bulbs. Reset timer to 2 hours on in morning and 2 hours on in the afternoon/evening weekdays only.

Savings

Exterior lighting reduction: 94.4%
Overall building energy reduction: 3.7%
Annual savings: $897
Capital investment: $5,127
Payback: 5.71 years

ECM 5: High Efficiency Water Heater

Existing Conditions

The school currently uses a 40 gallon electric water heater to meet its need for hot water. Of the various types of common ways to heat water, electric water heaters are amongst the most expensive and double that of natural gas or hybrid/heat pumps. Hot water demand is for kitchen needs and the two restrooms.

Energy Conservation Measure

Replace the existing electric water heater with a power vented natural gas or hybrid/heat pump water heater. Both alternatives would result in cutting energy used for hot water in half while remaining safe and reliable.

Appliance	Existing Condition	New Condition
Water Heater	One 40 gallon standard electric water heater.	Replace existing water heater with power vented natural gas or hybrid-electric water heater.

Savings
Hot water energy reduction: 62%
Overall building energy reduction: 1.4%
Annual savings: $333
Capital investment: $1,149
Payback: 3.46 years

ECM 6: Unplugging Unutilized Items During Summer Months

Existing Conditions
Energy auditing revealed that several items that are not utilized/necessary during the summer vacation months remained on and consuming energy. Items that remained on included a commercial kitchen freezer, commercial size refrigerator, residential size refrigerator, icemaker and drinking fountain. With the cafeteria unused during the summer months, unplugging these appliances is an excellent means of conserving electricity.

Energy Conservation Measure
Unplug the commercial sized freezer, commercial sized refrigerator, residential sized refrigerator, commercial icemaker and drinking fountain during the summer.

Appliance	Existing Condition	New Condition
Kitchen Commercial Freezer	Powered on all year	Unplug between school dismissal in spring and fall start of school.
Kitchen Commercial Refrigerator	Powered on all year	Unplug between school dismissal in spring and fall start of school.
Kitchen Refrigerator	Powered on all year	Unplug between school dismissal in spring and fall start of school.
Kitchen Icemaker	Powered on all year	Unplug between school dismissal in spring and fall start of school.
Drinking Fountain	Powered on all year	Unplug year round. Drinking water supply originates from deep groundwater and is cold without refrigeration.
Teachers' Lounge Refrigerator	Powered on all year	Remain plugged in all year for office staff working during summer.

Savings
Subject appliance energy reduction: 23%
Overall building energy reduction: 2.9%
Annual savings: $684
Capital investment: $0
Payback: 0 years

ECM 7: Replacing Incandescent Light Bulbs

Existing Conditions

The vast majority of interior lighting at the school is from energy efficient fluorescent lighting but there are remaining incandescent bulbs. Incandescent bulbs use approximately four times the electricity as energy efficient alternative bulbs and can be easily and cheaply replaced.

Energy Conservation Measure

Purchase and replace incandescent bulbs with energy efficient compact fluorescent bulbs. Benefits of CFLs will include significantly less energy consumption for comparable light output and longer bulb life.

Savings

Energy reduction from incandescent bulbs: 78.3%
Overall building energy reduction: 0.3%
Annual savings: $67
Capital investment: $4
Payback: 0.06 years

ECM 8: Timed Power Supplies

Existing Conditions

Various electronic items throughout the building continue to draw "phantom" power as they sit idle after class/work hours. Energy auditing showed that copiers and printers continue to draw electricity even when idle and building is unoccupied.

Energy Conservation Measure

Purchase five APC P11GTV power strips to power down printers with master device/hibernating computer automatically and three APC Day & Time Timer/Surge Protectors to limit power to copiers 10 hours per day.

Plug In Device	Existing Condition	New Condition
Printer	Five printers that are inconsistently powered off	Purchase and utilize APC P11GTV power strips to power down printers when master device/hibernating computer powers down
Copier	Three copy machines that continue to draw power unnecessarily after work hours	Purchase and utilize APC Day & Time Timer/Surge Protector to limit power to copiers 10 hours per day

Savings

Timed electronic energy reduction: 49%
Overall building energy reduction: 0.7%
Annual savings: $163
Capital investment: $233
Payback: 1.5 years

ECM 9: Removing Redundant Energy Consuming Items

Existing Conditions

½ size refrigerator is redundant when other refrigerators are available in building.

Energy Conservation Measure

Eliminate ½ size refrigerator and utilize other existing refrigerators in the building.

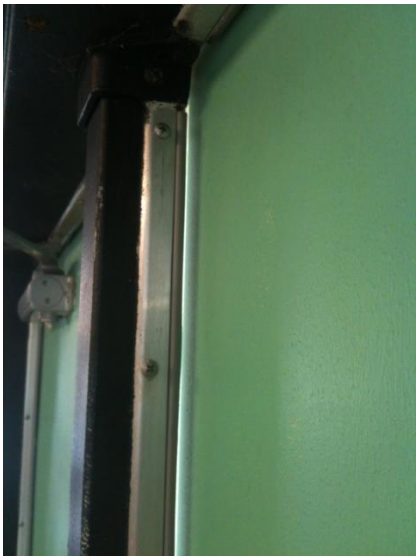
Savings

Energy reduction from eliminating redundant items: 100%
Overall building energy reduction: 0.3%
Annual savings: $76
Capital investment: $0
Payback: 0 years

ECM 10: Exterior Door Air Sealing

Existing Condition

Overall assessment of the building's weatherization is good with the exception of exterior doors that all lack a good seal resulting in air infiltration/heat loss. The



doors are in good condition but lack proper sealing into door frame because of worn weather stripping and/or improper fit.

Energy Conservation Measure

Purchase durable door seals/weather strip kits to effectively seal door into frame and thereby reduce air infiltration/heat loss from leaky closed doors. In addition, adjust strike plates to ensure that door closes snugly against door seal.

Savings

Heating & cooling energy reduction: 0.4%
Overall building energy reduction: 0.23%
Annual savings: $55
Capital investment: $200
Payback: 3.6 years

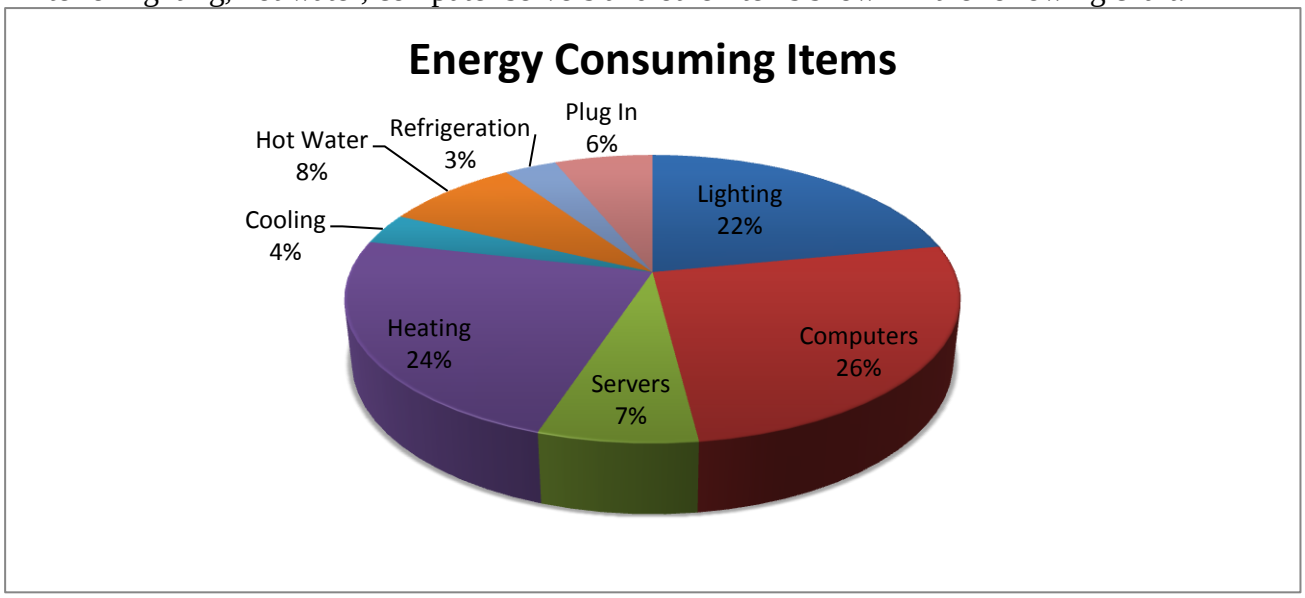
Bay Mills Indian Community Administration Building (ECMs Totaling 50% Energy Reduction)

The Bay Mills Indian Community Administration Building is an 11,400ft^2 split level office building owned by the Tribe. The Administration Building was constructed in the early 1970s and is situated directly on the south shore of the Saint Marys River/Lake Superior. The Administration Building is connected via a hallway to the Kings Club Casino. The administration and casino portions of the building share an electric meter but separate gas meters. The shared electricity meter posed some challenge in differentiating electricity for just the administration activities portion but was successfully determined from the completed energy auditing performed in the project. Like many older buildings, the Administration Building has had additions and building alterations performed. The building serves approximately 25 staff and is utilized year round.

The Administration Building utilizes grid electricity and natural gas as sources of energy. Electricity is used for all items requiring energy and natural gas is the primary heating fuel source and is supplemented by electric baseboard heating in some parts of the building. Heating is controlled by two programmable thermostats, each tied to a natural gas forced air furnace and six upstairs offices with individual manual thermostats controlling electric baseboard heating. The six upstairs offices and the Tribal court offices have individual wall AC units.

The Administration Building features wood frame construction, fiberglass insulation, vinyl siding, a combination of wood framed and vinyl sliding windows, one glass/aluminum framed double exterior door, one single metal entry door, one sliding glass door, pitched roof and half of the building with a blocked basement and the other half on a slab foundation.

Analyses of the Administration Building's energy consumption history and energy audit information revealed that computers are the largest energy consuming item followed by heating, interior lighting, hot water, computer servers and other items shown in the following chart.



To improve building energy performance, the following Energy Conservation Measures (ECMs) were developed in response to energy audit and analyses findings. Each ECM is further described below.

ECM	Description of ECM	% Energy Use Savings	Total Cost Savings ($/year)	Estimated Capital Cost ($)	Simple Payback (years)
1	Hibernate computers during non-work hours	67.4%/13.8%	$1,753	$0	0
2	Interior Lighting (T8 Fixtures, bulbs and occupancy sensors)	49.4%/9.5%	$1,208	$8,372	6.93
3	Energy Efficient Water Heaters (2)	62%/5.2%	$665	$2,298	3.46
4	Thermostat optimization (6pm-6am 10 degree setback/step-up; thermostat heat setting @ 70 degrees; 76 degrees AC) & Turning Off Electric Baseboard and Wall AC Units at Close of Work Day	29%/7.7%	$968	$0	0
5	Energy Efficient Refrigerators (Replace 2 w/ 1 Efficient fridge)	89.4%/2.6%	$336	$945	2.81
6	Replace Incandescent Bulbs with CFLs	78.3%/2.0%	$256	$14	0.06
7	Timed Power Supplies (Copiers, Printers, Postage)	53.4%/1.6%	$200	$323	1.61
8	Coffee Makers w/lnsulated Carafe	92%/1.0%	$132	$130	0.98
9	Eliminate Redundant Items (Space heaters, ½ fridge)	100%/0.7%	$88	$0	0
10	Energy Star Water Cooler	45.2%/0.3%	$40	$191	4.81
11	Insulation & Air Sealing (Air seal attic deck and wall AC; Insulate attic and foundation)	20%/5.4%	$687	$10,000	14.5

	Total	**49.8%**	**$6,333**	**$22,273**	**3.51**

ECM 1: Computer Power Management

Existing Conditions

The energy audit of the Administration Building determined that work station computer systems largely remain powered on 24 hours per day. Computers that remain on after work cause unnecessary power consumption and can be mitigated by hibernating computers after/before work hours.

Energy Conservation Measure

Hibernating is a power management setting that every computer operating system has for reducing energy consumption. Utilizing this feature to power down computers outside of work hours will reduce the current wasted energy associated with keeping computers powered on when the building is unoccupied. Enabling the Hibernate feature to the specifications below will cause each computer to consume near zero energy outside of work hours (approximately 14 hours/day) and thereby result in a significant reduction in energy.

Computer Type	Existing Condition	New Condition
Workstation	Powered on 24/7	Enable Hibernate feature in each computer's Power Management settings after 90 minutes of inactivity.

Savings

Computer energy reduction: 67.4%
Overall building energy reduction: 13.8%
Annual savings: $1,753
Capital investment: $0
Payback: 0 years

Savings are calculated using the following: twenty-seven computers operating 261 week days calculated with 10 work hours and 14 efficiency mode hours, 72 weekend days calculated with 100% hibernation/efficiency mode.

ECM 2: Interior Lighting

Existing Conditions

The Administration Building's interior is equipped with T12 fluorescent bulbs and fixtures on manual light switches. While these lights are more efficient than incandescent bulbs, newer and more efficient T8 bulbs and occupancy sensors would result in greater energy savings.

Energy Conservation Measure

Purchase and install T8 fixtures, bulbs and occupancy sensors for 24 rooms/offices that will consume less energy from higher efficiency lights and electricity conservation by automatically turning off lights when room is unoccupied. Multi-

technology sensors would be used and prevent lights from unintentionally being turned off (see Appendix – Lighting for recommended Leviton occupancy sensor unit). U.S. EPA estimates 25% savings when occupancy sensors are used in office settings.

Lighting Item	Existing Condition	New Condition
Interior Lighting	Ceiling T8 fixtures and bulbs with manual on/off switches	Purchase and install 70 X 2 T8 lamp fixtures (Grainger item #2PFV4 @ $71.35 each); 10 X 4 T8 lamp fixtures (Grainger item # 3XY83 @ $146.05); 24 Leviton Multi-Technology Occupancy Sensor Units @ $79.86).

Savings
Interior lighting reduction: 49%
Overall building energy reduction: 9.5%
Annual savings: $1,208
Capital investment: $8,372
Payback: 6.93 years

Calculations for energy savings are based on increased efficiency of T8 fixtures over T12 and a 25% reduction relating to the use of occupancy sensors.

ECM 3: High Efficiency Water Heaters

Existing Conditions
The Administration Building currently uses two 40 gallon electric water heaters to meet its need for hot water. Of the various types of common ways to heat water, electric water heaters are amongst the most expensive and double that of natural gas or hybrid/heat pumps. Hot water demand is for kitchen needs and two restrooms.

Energy Conservation Measure
Replace the existing electric waters heater with hybrid/heat pump water heaters. This measure would result in cutting energy used for hot water in half while remaining safe and reliable. In heat pump mode, these water heaters will use heat from ambient air and transfer it to the water in the tank. This type of water heater will be especially beneficial in the furnace/server room where excessive heat is generated and can be used for water heating.

Appliance	Existing Condition	New Condition
Water Heater	Two 40 gallon standard electric water heaters.	Replace two existing water heaters with hybrid/heat pump water heaters that would consume approximately ½ of the energy of existing standard electric water heaters.

Savings
Hot water energy reduction: 62%
Overall building energy reduction: 5.2%

Annual savings: $665
Capital investment: $2,298
Payback: 3.46 years

ECM 4: Thermostat Optimization

Existing Conditions

Currently, the building's heating and cooling operates in a steady-state/occupied scenario 24 hours a day and 365 days a year. During energy audit visits, heat thermostat settings averaged 72 degrees on two programmable thermostats and widely varied on manual thermostats controlling electric baseboards. The electric baseboard heat is typically set in the mid 70s with no setback to compensate for cold and drafty north offices. Summer air conditioning thermostat settings average 72 degrees for two central AC units with two programmable thermostats and seven manually operated wall mounted AC units. Significant energy is wasted for excessive heating and cooling temperatures and heating and cooling of building during unoccupied times.

Energy Conservation Measure

Optimize thermostat heating and cooling programming to the EPA recommended temperature during work hours. In addition, program setbacks and step ups outside of occupied times for programmable thermostats and implement procedure to turn electric baseboard heat at the end of each work day. See Appendix – Thermostat Optimization for breakdown of savings/wasted energy.

Thermostat Setting	Existing Condition	New Condition
Heat – Forced Air	Avg. 72°F 24hrs/auto	Weekdays 6am-6pm: 70°F Weekdays 6pm-6am & Weekends 60°
Heat – Electric Baseboard	Avg. 74°F 24hrs/manual	Weekdays office hours: 70°F Weekdays 6pm-6am & Weekends: Electric baseboard heat turned off at the close of each work day.
Cooling – Central AC	Avg. 72°F 24hrs/auto	Weekdays 6am-6pm: 76°F Weekdays 6pm-6am & Weekends: off
Cooling – Wall AC Units	Avg. 72°F 24hrs/manual	Weekdays office hours: 76°F Weekdays 6pm-6am & Weekends: Wall AC units turned off at the close of each work day.

Savings

Building heating & cooling energy reduction: 29%
Overall building energy reduction: 7.7%
Annual savings: $968
Capital investment: $0
Payback: 0 years

ECM 5: High Efficiency Refrigerators

Existing Conditions

The Administration Building currently uses two standard/non-high efficiency refrigerators. These refrigerators are located in the staff kitchen and the Bay Mills News office and consume approximately double the electricity of current high efficiency units. In addition, the number of staff working in the Tribal Administration building could utilize one full size refrigerator instead of two full size units.

Energy Conservation Measure

Replace the two existing refrigerators with one high efficiency refrigerator in the staff kitchen.

Appliance	Existing Condition	New Condition
Refrigerators	Two non-high efficiency refrigerators.	Replace the two existing refrigerators with one high efficiency refrigerator that would consume significantly less electricity.

Savings

Refrigeration energy reduction: 89.4%
Overall building energy reduction: 2.6%
Annual savings: $336
Capital investment: $945
Payback: 2.81 years

ECM 6: Replacing Incandescent Light Bulbs

Existing Conditions

The vast majority of interior lighting at the Administration Building is fluorescent lighting but there are some remaining incandescent bulbs. Incandescent bulbs use approximately four times the electricity as energy efficient alternative bulbs and can be easily and cheaply replaced.

Energy Conservation Measure

Purchase and replace incandescent bulbs with energy efficient compact fluorescent bulbs. Benefits of CFLs will include significantly less energy consumption for comparable light output and longer bulb life.

Savings

Energy reduction from incandescent bulbs: 78.3%
Overall building energy reduction: 2.0%
Annual savings: $256
Capital investment: $14
Payback: 0.06 years

ECM 7: Timed Power Supplies

Existing Conditions

Various electronic items throughout the building continue to draw "phantom" power as they sit idle after work hours. Energy auditing showed that copiers, printers and a postage machine continue to draw electricity even when idle and building is unoccupied.

Energy Conservation Measure

Purchase seven APC P11GTV power strips to power down printers with master device/hibernating computer automatically and three APC Day & Time Timer/Surge Protectors to limit power to copiers 10 hours per day.

Plug In Device	Existing Condition	New Condition
Printer	Seven printers that are inconsistently powered off	Purchase and utilize 7 APC P11GTV power strips to power down printers when master device/hibernating computer powers down
Copier	Three copy machines that continue to draw power unnecessarily after work hours	Purchase and utilize 3 APC Day & Time Timer/Surge Protector to limit power to copiers 10 hours per day
Postage	One postage machine that is powered on 24/7	Purchase and utilize 1 APC Day & Time Timer/Surge Protector to limit power to postage machine to 10 hours per day

Savings

Timed electronic energy reduction: 49%
Overall building energy reduction: 0.7%
Annual savings: $163
Capital investment: $233
Payback: 1.5 years

ECM 8: Replacing Conventional Coffee Pot with Thermal Carafe Unit

Existing Conditions

The staff kitchen has a coffee machine with hot plate that remains on and drawing electricity throughout the work day to heat coffee pot.

Energy Conservation Measure

Purchase and replace conventional coffee machine with unit that heats water/coffee during brew and maintains heat by means of insulated carafe and doesn't require electricity beyond brew time. Benefits of thermal carafe unit will include significantly less energy consumption for coffee.

Appliance	Existing Condition	New Condition
Staff Kitchen Coffee Machine	One coffee machine that draws power throughout the day for heating	Replace with Bunn BT Velocity Brew Drip Coffee Maker with Insulated Carafe

	elements.	

Savings
Energy reduction from thermal carafe style coffee maker: 92.0%
Overall building energy reduction: 1.0%
Annual savings: $132
Capital investment: $130
Payback: 0.98 years

ECM 9: Removing Redundant Energy Consuming Items

Existing Conditions
Space heaters and a ½ size refrigerator are convenient but are redundant when a staff refrigerator is available in the building and central heating combined with improved weatherization would provide necessary heat. In addition, operating space heaters will alter temperature and impact thermostats tied to central heating and cooling and cause excessive central HVAC operation/energy consumption.

Energy Conservation Measure
Eliminate ½ size refrigerator and utilize existing refrigerator in the staff kitchen. Eliminate space heaters and improve building's heat retention with air sealing and improved insulation (see ECM 11: Air Sealing and Insulation).

Savings
Energy reduction from eliminating redundant items: 100%
Overall building energy reduction: 0.7%
Annual savings: $88
Capital investment: $0
Payback: 0 years

ECM 10: Energy Star Water Cooler

Existing Conditions
The existing water cooler located in the BMIC News office is a standard/non-Energy Star water cooler. Higher efficiency units are available that would reduce energy consumption tied to water cooler units.

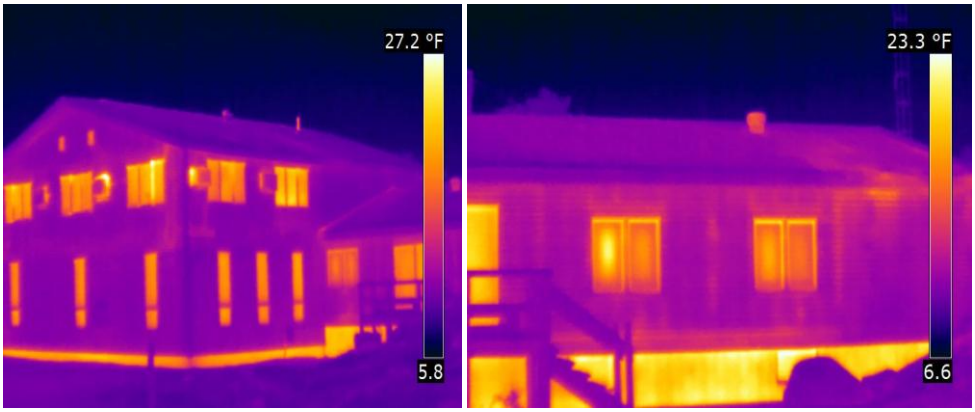
Energy Conservation Measure
Purchase and replace existing water cooler with Energy Star water cooler.

Savings
Energy reduction from Energy Star water cooler: 45.2%
Overall building energy reduction: 0.3%
Annual savings: $40
Capital investment: $191
Payback: 4.81 years

ECM 11: Building Air Sealing & Insulation

Existing Condition

While a blower test was not possible for the Administration Building, energy auditing and building weatherization inspection revealed that there are air sealing and insulation deficiencies. Weatherization deficiencies found include insufficient air sealing and insulation along foundation, insufficient air sealing of attic deck and insufficient attic insulation. These items contribute to building heat loss and consequently increase energy consumption and lower occupant comfort.



Energy Conservation Measure

Improve building's weatherization by preventing air infiltration/exfiltration through air sealing and resistance to heat loss during winter months and heat gain during summer months through improved insulation.

Weatherization Component	Existing Condition	New Condition
Air sealing	Insufficient air sealing in attic deck, perimeter of windows and attic access doors.	Air seal top plates in attic with 1" closed cell spray foam. Caulk perimeter of window trim and attic access doors.
Attic insulation	Variable: No insulation to R24 fiberglass batts	Additional R44 of blown cellulous in attic.
Foundation insulation/air seal	No insulation evident	2" of closed cell spray foam (R21) on foundation walls above grade and into rim joist area (insulates and air seals).

Savings

Heating & cooling energy reduction: 20.0%
Overall building energy reduction: 5.4%
Annual savings: $687
Capital investment: $10,000
Payback: 14.5 years

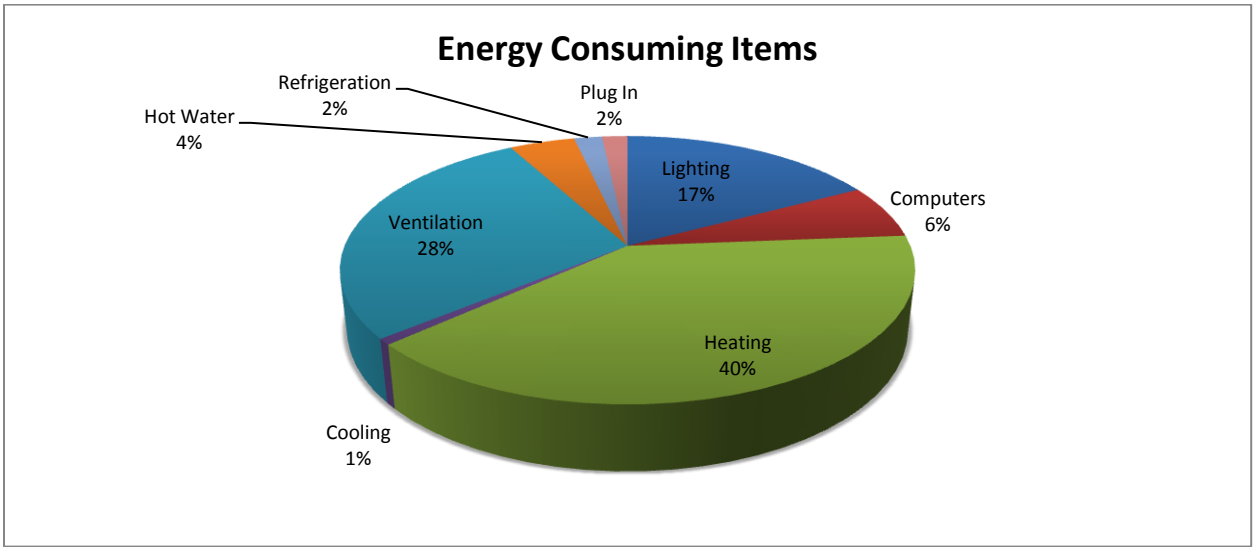
Bay Mills Indian Community Waishkey Center Community Building (ECMs Totaling 35.1% Energy Reduction)

The Bay Mills Indian Community Waishkey Center is largely a single story 29,475ft^2 multi-purpose Community building owned by the Tribe. The Waishkey Center was constructed in the early 1970s and has been utilized for numerous purposes. The Waishkey Center's future is uncertain in terms of how it will be utilized. Currently, the main functions of the building are the gymnasium, home to the Boys and Girls club and the Bay Mills Police Department who will be soon moving to a new construction and permanent building. The most striking characteristic of the building is the uncertain future use causing certain maintenance and needed mechanical system upgrades to remain in question as the building's future purpose is decided.

The Waishkey Center utilizes grid electricity and natural gas as sources of energy. Electricity is used for all items requiring energy except for building heating and hot water where natural gas is used. HVAC controls have largely been gutted leaving the HVAC system operating in an inefficient steady state.

The Waishkey Center building features block construction, brick exterior, aluminum sliding windows, three sets of double metal utility exterior doors, three single metal entry door, flat roof and slab foundation.

Analyses of the Waishkey Center's energy consumption history and energy audit information revealed that heating is the largest energy consuming item followed by ventilation, interior lighting, computers, hot water and other items shown in the following chart.



To improve building energy performance, the following Energy Conservation Measures (ECMs) were developed in response to energy audit and analyses findings. Each ECM is further described below.

ECM	Description of ECM	Energy Use Savings	Total Cost Savings ($/year)	Estimated Capital Cost	Simple Payback
1	Hibernate computers during non-work hours	67.4%/4.3%	$1,818	$0	0
2	HVAC Upgrade – New Rooftop Furnace & AC Units, Direct Digital Controls, Air Handlers, Duct Optimization, Duct Cleaning and Thermostat Optimization	28%/19.2%	$8,111	$175,000	21.6
3	Replace Incandescent Bulbs with CFLs	78.3%/.2%	$94	$5	0.06
4	Energy Efficient Gymnasium Lights (T5 High Bay Fixtures & Bulbs)	29.3%/1.2%	$508	$2,585	5.09
5	Exterior Lights w/ LED Retrofit Bulbs	75%/.8%	$325	$1,677	5.16
6	Interior Lighting (Occupancy sensors and limited T8 Fixtures and bulbs)	26.1%/3.1%	$1,291	$4,395	6.93
7	Coffee Makers w/lnsulated Carafe	84%/0.4%	$169	$130	0.77
8	Timed Power Supplies (Copiers, Printers)	63.5%/0.5%	$213	$180	.85
9	Eliminate Redundant Items (Space heaters, ½ fridge)	100%/0.3%	$112	$0	0
10	Energy Efficient Refrigerators	78.7%/1.4%	$592	$3,780	6.39
11	Energy Star Water Cooler	45.2%/0.2%	$79	$382	4.81
12	Air Sealing Exterior Doors	5%/2.0%	$851	$5,000*	5.9*
13	High Efficiency Water Heater(s) & Thermostat Optimization	35%/1.5%	$647	$2,300	3.55
	Total	**35.1%**	**$14,810**	**$195,434**	**13.2**

ECM 1: Computer Power Management

Existing Conditions

The energy audit of the Waishkey Center determined that work station computer systems largely remain powered on 24 hours per day. Computers that remain on after work cause unnecessary power consumption and can be mitigated by hibernating computers after/before work hours.

Energy Conservation Measure

Hibernating is a power management setting that every computer operating system has for reducing energy consumption. Utilizing this feature to power down computers outside of work hours will reduce the current wasted energy associated with keeping computers powered on when the building is unoccupied. Enabling the Hibernate feature to the specifications below will cause each computer to consume near zero energy outside of work hours (approximately 14 hours/day) and thereby result in a significant reduction in energy.

Computer Type	Existing Condition	New Condition
Workstation	Powered on 24/7	Enable Hibernate feature in each computer's Power Management settings after 90 minutes of inactivity.

Savings

Computer energy reduction: 67.4%
Overall building energy reduction: 4.3%
Annual savings: $1,818
Capital investment: $0
Payback: 0 years

Savings are calculated using the following: eighteen computers operating 261 week days calculated with 10 work hours and 14 efficiency mode hours, 72 weekend days calculated with 100% hibernation/efficiency mode.

ECM 2: HVAC Upgrades

Existing Conditions

Currently, the building's heating and cooling operates in a steady-state/occupied scenario 24 hours a day and 365 days a year as a result of old and compromised HVAC controls and air handlers. The two boilers in the heating system are two years old and reliable but the remaining HVAC system has not had necessary upgrades and, as a result, the control system is gutted and doesn't offer adequate control of heating and ventilation. In addition to running the air handlers continuously, the air handlers are old, inefficient and intended for a building with a different purpose when an indoor swimming pool was housed in the Waishkey Center. The indoor swimming pool has been removed and converted to the Boys and Girls Club activity space and office space. No documented duct cleaning has surely led to restricted airflow and decreased HVAC efficiency.

During energy audit visits, pneumatic controlled heat thermostat settings averaged 72 degrees but actual temperature varied widely throughout the building due to heat supply imbalance and air leakage around exterior doors and gymnasium roof.

Air conditioning is present only in the Police Department portion of the building. Summer air conditioning thermostat was set at 74 degrees for the rooftop AC unit.

As with all other buildings in this project, significant energy is wasted for excessive heating and cooling temperatures and heating and cooling of building during unoccupied times.

Energy Conservation Measure

Replace existing HVAC equipment high efficiency heating, cooling and ventilation system. In addition, take advantage of programmability of new system to optimize thermostat heating and cooling to the EPA recommended temperature during work hours along with setbacks and step ups outside of occupied times. See Appendix – Thermostat Optimization for breakdown of savings/wasted energy & Waishkey Center HVAC Upgrade Cost Quote.

HVAC Component	Existing Condition	New Condition
Engineered Design	NA	Waishkey Center would have design and specifications of high efficiency HVAC created for heating and cooling load of building.
HVAC Controls	Pneumatic temperature controls with very limited functionality	• Direct Digital Controls for zone by zone thermostat programming • Demand Control Ventilation for on demand ventilation • Speed control capability of new rooftop heat & AC units • Sensor controls for exhaust fans
Furnace & Air Conditioning	Two natural gas boilers with an estimated 72% efficiency; One rooftop AC unit for Police Department	Replace existing boilers and AC unit with four natural gas fired rooftop units. Each unit would be 17.5 ton cooling and 300 MBH heating. Heat units would be 81% efficient.
Air handlers	Continuously running and inefficient to available equipment	Air handlers would be incorporated in the rooftop units in the above measure.
Ducts	Ducts are restricted and imbalanced	Clean ducts to improve airflow and reroute to optimize heat and cooling supply and return.
Thermostat - Heating	Avg. 72°F 24hrs	Weekdays 6am-6pm: 70°F Weekdays 6pm-6am & Weekends 60°
Thermostat -	Police Department	Entire Waishkey Center

Cooling	AC Avg. 74°F 24hrs/auto	Weekdays 6am-6pm: 76°F Weekdays 6pm-6am & Weekends: off

Savings
Building heating & cooling energy reduction: 28%
Overall building energy reduction: 19.2%
Annual savings: $8,111
Capital investment: $175,000
Payback: 21.6 years

ECM 3: Replacing Incandescent Light Bulbs

Existing Conditions
The vast majority of interior lighting at the Waishkey Center is fluorescent lighting but there are some remaining incandescent bulbs. Incandescent bulbs use approximately four times the electricity as energy efficient alternative bulbs and can be easily and cheaply replaced.

Energy Conservation Measure
Purchase and replace incandescent bulbs with energy efficient compact fluorescent bulbs. Benefits of CFLs will include significantly less energy consumption for comparable light output and longer bulb life.

Savings
Energy reduction from incandescent bulbs: 78.3%
Overall building energy reduction: 0.2%
Annual savings: $94
Capital investment: $5
Payback: 0.06 years

ECM 4: Gymnasium Interior Lighting

Existing Conditions
The Waishkey Center's gymnasium is equipped with eleven 450 watt metal halide bulbs and fixtures on manual light switches. This arrangement of lights is more energy intensive than fluorescent alternatives.

Energy Conservation Measure
Purchase and replace existing metal halide lighting with eleven T5 high bay fluorescent fixtures and bulbs.

Lighting Item	Existing Condition	New Condition
Interior Lighting	Eleven 450 watt metal halide bulbs and fixtures.	Replace 11 Gymnasium Lights with T5 High Bay Fluorescent Fixtures and Bulbs (VaporTight High Bay 6 Lamp T5 Fixture $194.99; T5HO 54W bulb $39.98/6pack)

Savings
Gymnasium lighting reduction: 29.3%
Overall building energy reduction: 1.2%
Annual savings: $508
Capital investment: $2,585
Payback: 5.09 years

ECM 5: Exterior Lighting

Existing Conditions
The parking lot and building exterior is currently lighted by six 150 watt high pressure sodium lights on a timer that has the lights remaining on twelve hours per night. Both the bulbs' high wattage and timer on throughout the night cause energy consumption that can be mitigated.

Energy Conservation Measure
Replace existing 150 watt high pressure sodium bulbs with 45 watt LED retrofit bulbs and optimize timer for 5 hours on before scheduled building occupancy and 5 after. Significant energy will be saved through conservation (reduced on time) and high efficiency bulb replacement. LED lights also provide advantages from long operational life.

Exterior Light	Existing Condition	New Condition
High Pressure Sodium Lights	Six 150 watt exterior lights remaining on 12 hours per night.	Replace 150 watts HPS bulbs with 45 watt LED retrofit bulbs. Reset timer to 5 hours on in morning and 5 hours on in the afternoon/evening weekdays only.

Savings
Exterior lighting reduction: 75%
Overall building energy reduction: 0.8%
Annual savings: $325
Capital investment: $1,677
Payback: 5.16 years

ECM 6: Interior Lighting

Existing Conditions
The majority of the Waishkey Center's interior is equipped with T8 fluorescent bulbs and fixtures on manual light switches but some less efficient T12 lights remain. While T12 lights are more efficient than incandescent bulbs, newer and more efficient T8 bulbs and occupancy sensors would result in greater energy savings.

Energy Conservation Measure
Purchase and install T8 fixtures and bulbs for the Boys and Girls Club main room and 47 occupancy sensors for remaining room/offices. This alternative will consume less energy from higher efficiency lights and electricity conservation by automatically turning off lights when room is unoccupied. Multi-technology sensors would be used and prevent lights from unintentionally being turned off (see Appendix – Lighting for

recommended Leviton occupancy sensor unit). U.S. EPA estimates 25% savings when occupancy sensors are used in office settings.

Lighting Item	Existing Condition	New Condition
Interior Lighting	Mix of T8 and T12 fixtures and bulbs with manual on/off switches	Purchase and install 9 X 2 T8 lamp fixtures (Grainger item #2PFV4 @ $71.35 each)
Light switches	Manual on/off switches	47 occupancy sensors (Leviton Multi-Technology Occupancy Sensor Units @ $79.86)

Savings
Interior lighting reduction: 26.1%
Overall building energy reduction: 3.1%
Annual savings: $1,291
Capital investment: $4,395
Payback: 6.93 years

Calculations for energy savings are based on increased efficiency of T8 fixtures over T12 and a 25% reduction relating to the use of occupancy sensors.

ECM 7: Replacing Conventional Coffee Pot with Thermal Carafe Unit

Existing Conditions
The staff kitchen has a coffee machine with hot plate that remains on and drawing electricity throughout the work day to heat coffee pot.

Energy Conservation Measure
Purchase and replace conventional coffee machine with unit that heats water/coffee during brew and maintains heat by means of insulated carafe and doesn't require electricity beyond brew time. Benefits of thermal carafe unit will include significantly less energy consumption for coffee.

Appliance	Existing Condition	New Condition
Staff Kitchen Coffee Machine	One coffee machine that draws power throughout the day for heating elements.	Replace with Bunn BT Velocity Brew Drip Coffee Maker with Insulated Carafe

Savings
Energy reduction from thermal carafe style coffee maker: 84.0%
Overall building energy reduction: 0.4%
Annual savings: $169
Capital investment: $130
Payback: 0.77 years

ECM 8: Timed Power Supplies

Existing Conditions

Various electronic items throughout the building continue to draw "phantom" power as they sit idle after class/work hours. Energy auditing showed that copiers and printers continue to draw electricity even when idle and building is unoccupied.

Energy Conservation Measure

Purchase four APC P11GTV power strips to power down printers with master device/hibernating computer automatically and two APC Day & Time Timer/Surge Protectors to limit power to copiers 10 hours per day.

Plug In Device	Existing Condition	New Condition
Printer	Four printers that are inconsistently powered off	Purchase and utilize 4 APC P11GTV power strips to power down printers when master device/hibernating computer powers down
Copier	Two copy machines that continue to draw power unnecessarily after work hours	Purchase and utilize 2 APC Day & Time Timer/Surge Protector to limit power to copiers 10 hours per day

Savings

Timed electronic energy reduction: 63.5%
Overall building energy reduction: 0.5%
Annual savings: $213
Capital investment: $180
Payback: 0.85 years

ECM 9: Removing Redundant Energy Consuming Items

Existing Conditions

Space heaters and a ½ size refrigerator are convenient but are redundant when a staff refrigerator is available in the building and central heating combined with improved HVAC system would provide necessary heat.

Energy Conservation Measure

Eliminate one ½ size refrigerator and utilize existing refrigerator in the staff kitchen. Eliminate three space heaters and improve balance of building's HVAC system (see ECM 2: HVAC Upgrades).

Savings

Energy reduction from eliminating redundant items: 100%
Overall building energy reduction: 0.3%
Annual savings: $112
Capital investment: $0
Payback: 0 years

ECM 10: High Efficiency Refrigerators

Existing Conditions

The Waishkey Center currently uses four standard/non-high efficiency refrigerators. These refrigerators are located in the Police Department staff kitchen, Boys and Girls Club room and two in the Boys and Girls Club classroom and consume approximately double the electricity of current high efficiency units.

Energy Conservation Measure

Replace the four existing refrigerators with high efficiency refrigerators.

Appliance	Existing Condition	New Condition
Refrigerators	Four non-high efficiency refrigerators.	Replace the four existing refrigerators with four high efficiency refrigerators that would consume significantly less electricity.

Savings

Refrigeration energy reduction: 78.7%
Overall building energy reduction: 1.4%
Annual savings: $592
Capital investment: $3,780
Payback: 6.39 years

ECM 11: Energy Star Water Cooler

Existing Conditions

The two existing water coolers located in the Police Department conference room and the Boys and Girls Club teen room are standard/non-Energy Star water coolers. Higher efficiency units are available that would reduce energy consumption tied to water cooler units.

Energy Conservation Measure

Purchase and replace two existing water coolers with Energy Star water coolers.

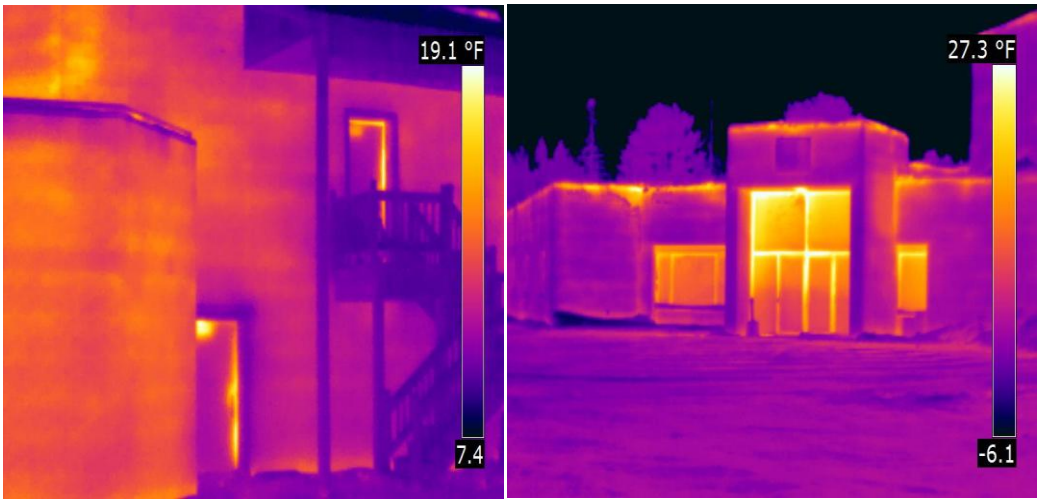
Savings

Energy reduction from Energy Star water cooler: 45.2%
Overall building energy reduction: 0.2%
Annual savings: $79
Capital investment: $382
Payback: 4.81 years

ECM 12: Exterior Door Air Sealing

Existing Condition

Overall assessment of the building's weatherization is fair/poor with one component being exterior doors that lack a good seal resulting in air infiltration/heat loss. The three sets of aluminum framed glass double doors and three single steel doors are in good condition but lack proper sealing into door frame because of worn weather stripping and/or improper fit.



Energy Conservation Measure

Purchase durable door seals/weather strip kits to effectively seal door into frame and thereby reduce air infiltration/heat loss from leaky closed doors. In addition, adjust strike plates to ensure that door closes snugly against door seal.

Savings

Heating & cooling energy reduction: 5.0%
Overall building energy reduction: 2.0%
Annual savings: $851
Capital investment: $5,000
Payback: 5.9 years

ECM 5: High Efficiency Water Heater

Existing Conditions

The Waishkey Center currently has two 100 gallon natural gas atmospheric vented water heaters to meet its low demand for hot water. The two large water heaters were sized for a past period of time when the locker rooms and showers were more utilized. Hot water demand is now much lower. Downsizing to two smaller and more efficient natural gas water heaters would significantly reduce energy associated with heating water.

Energy Conservation Measure

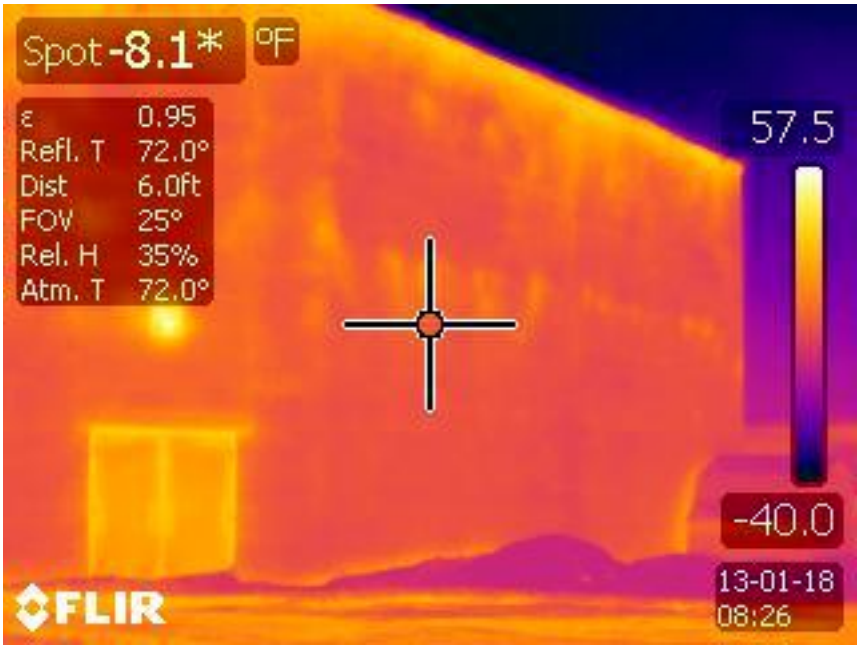
Replace the two existing 100 gallon atmospheric vented 75% AFUE water heaters with two 50 gallon power vented natural gas water heaters and reduce thermostat to 120 degrees.

Appliance	Existing Condition	New Condition
Water Heater	Two 100 gallon natural gas water heaters with temperature setting set near Max.	Replace two existing water heaters with 50 gallon power vented natural gas water heater and set thermostat for 120 degree water.

Savings
Hot water energy reduction: 35%
Overall building energy reduction: 1.5%
Annual savings: $647
Capital investment: $2,300
Payback: 3.55 years

ECM 13: Recommend for Future Upgrade (Considered but not included in this plan - Gymnasium Roof Insulation and Air Sealing

Existing Condition
Overall assessment of the building's weatherization is fair/poor with one component being exterior doors that lack a good seal resulting in air infiltration/heat loss and the other being the gymnasium roof with significant air infiltration and poor insulation at the ceiling/roof level. The roof was recently replaced with a new membrane roof with minimal insulation and no air sealing.



Energy Conservation Measure
Plan for necessary roof/ceiling insulation and air sealing at a point in time when roof is in need of replacement.

Bay Mills Indian Community Ellen Marshall Health Center (ECMs Totaling 34% Energy Reduction)

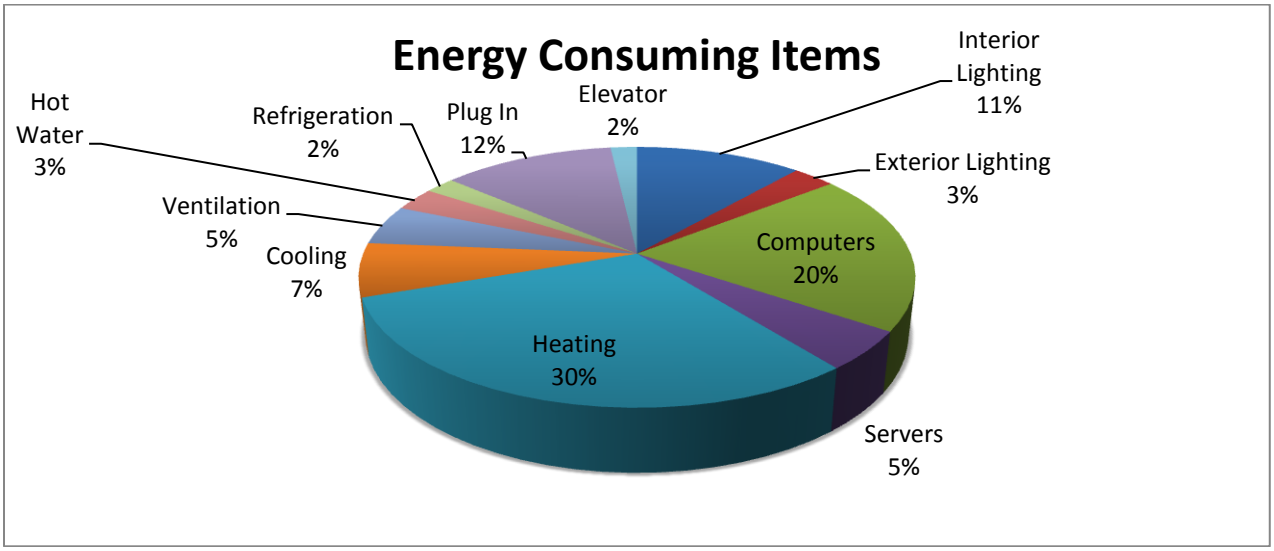
The Bay Mills Indian Community Ellen Marshall Health Center is a 29,980ft^2 three level medical, dental and office building owned by the Tribe. The Health Center was constructed in the early 1990s and is situated directly on the south shore of the Saint Marys River/Lake Superior. The Health Center houses the Tribe's Accounting Department in the basement, medical and dental clinics on the ground floor and community health offices on the second story.

The Health Center is the second newest buildings of those included in this study and plan. The building houses approximately 80 staff and is heavily utilized year round.

The Health Center utilizes grid electricity and natural gas as sources of energy. Electricity is used for all items requiring energy and natural gas is the primary heating fuel source for the boiler heating system. Temperature control (heating and cooling) is controlled by nine programmable thermostats for each of the buildings HVAC zones.

The Health Center building features wood frame construction, fiberglass insulation, vinyl siding, vinyl sliding windows, two glass/aluminum framed double exterior doors, four single metal entry doors, pitched roof and a blocked basement foundation.

Analyses of the Health Center's energy consumption history and energy audit information revealed that heating is the largest energy consuming item followed by computers and related items, plug-in items, interior lighting, cooling, ventilation and other items shown in the following chart.



To improve building energy performance, the following Energy Conservation Measures (ECMs) were developed in response to energy audit and analyses findings. Each ECM is further described below.

ECM	Description of ECM	% Energy Use Savings	Total Cost Savings ($/year)	Estimated Capital Cost ($)	Simple Payback (years)
1	Hibernate computers during non-work hours	67.4%/10.2%	$6,689	$0	0
2	Interior Lighting (Occupancy sensors)	25%/2.5%	$1,665	$7,347	4.41

3	Exterior Lighting (LED retrofit and reduce time on)	96.7%/2.8%	$1,863	$4,273	2.29
4	Thermostat optimization (6pm-6am 10 degree setback/step-up; thermostat heat setting @ 70 degrees; 76 degrees AC)	29%/9.5%	$6,190	$0	0
5	Energy Efficient Refrigerators (Replace 6 Refrigerators)	78.7%/1.4%	$888	$5,670	6.39
6	Replace Incandescent Bulbs with CFLs	78.3%/0.7%	$445	$25	0.06
7	Entry Electric Heat (Procedure to turn off during non-work hours)	50%/0.9%	$594	$0	0
8	Timed Power Supplies (Copiers, Printers, Postage)	62.2%/2.0%	$1,347	$2,458	1.8
9	Coffee Makers w/lnsulated Carafe	84%/0.7%	$482	$520	1.08
10	Eliminate Redundant Items (Space heaters, ½ fridges, refrigerated drinking fountain)	100%/2.8%	$1898	$0	0
11	Pop & Vending Machine (VendingMiser and SnackMiser)	69%/0.4%	$269	$238	0.89
	Total	**34.1%**	**$22,330**	**$20,531**	**0.92**

ECM 1: Computer Power Management

Existing Conditions

The energy audit of the Ellen Marshall Health Center determined that work station computer systems largely remain powered on 24 hours per day. Computers that remain on after work cause unnecessary power consumption and can be mitigated by hibernating computers after/before work hours.

Energy Conservation Measure

Hibernating is a power management setting that every computer operating system has for reducing energy consumption. Utilizing this feature to power down computers outside of work hours will reduce the current wasted energy associated with keeping computers powered on when the building is unoccupied. Enabling the Hibernate feature to the specifications below will cause each computer to consume near zero

energy outside of work hours (approximately 14 hours/day) and thereby result in a significant reduction in energy.

Computer Type	Existing Condition	New Condition
Workstation	103 Computers Powered on 24/7	Enable Hibernate feature in each computer's Power Management settings after 90 minutes of inactivity.

Savings
Computer energy reduction: 67.4%
Overall building energy reduction: 10.2%
Annual savings: $6,689
Capital investment: $0
Payback: 0 years

Savings are calculated using the following: 103 computers operating 261 week days calculated with 10 work hours and 14 efficiency mode hours, 72 weekend days calculated with 100% hibernation/efficiency mode.

ECM 2: Interior Lighting

Existing Conditions
The Health Center's interior is equipped with 800 energy efficient T8 fluorescent bulbs and associated fixtures on manual light switches. While these lights are efficient, additional electricity can be conserved by utilizing occupancy sensors to automatically turn a room's lights off when unoccupied. U.S. EPA estimates 25% savings when occupancy sensors are used in office settings.

Energy Conservation Measure
Purchase and install occupancy sensors in 92 rooms that will result in lights automatically turning off when room is unoccupied. Multi-technology sensors would be used and prevent lights from unintentionally being turned off (see Appendix – Lighting for recommended Leviton occupancy sensor unit).

Lighting Item	Existing Condition	New Condition
Interior Lighting	High efficiency interior lighting controlled manually by on/off switches.	Purchase and install 92 occupancy sensors that will automatically detect if rooms are occupied/unoccupied and control lights by turning on when occupied and turning off when unoccupied.

Savings
Interior lighting reduction: 25%
Overall building energy reduction: 2.5%

Annual savings: $1,665
Capital investment: $7,347
Payback: 4.41 years

Calculations for energy savings are based on a 25% reduction of current electricity associated with interior lighting.

ECM 3: Exterior Lighting

Existing Conditions

The parking lot and building exterior is currently lighted by ten 400 watt high pressure sodium lights on a timer that has the lights remaining on twelve hours per night. Both the bulbs' high wattage and timer on throughout the night cause energy consumption that can be mitigated.

Energy Conservation Measure

Replace existing 400 watt high pressure sodium bulbs with 56 watt LED retrofit bulbs and optimize timer for 2 hours on before office hours and 2 hours after office hours. Significant energy will be saved through conservation (reduced on time) and high efficiency bulb replacement. LED lights also provide advantages from long operational life.

Exterior Light	Existing Condition	New Condition
High Pressure Sodium Lights	Ten 400 watt exterior lights remaining on 12 hours per night.	Replace ten 400 watts HPS bulbs with 56 watt LED retrofit bulbs. Reset timer to 2 hours on in morning and 2 hours on in the afternoon/evening weekdays only.

Savings

Exterior lighting reduction: 96.7%
Overall building energy reduction: 2.8%
Annual savings: $1,863
Capital investment: $4,273
Payback: 2.29 years

ECM 4: Thermostat Optimization

Existing Conditions

Currently, the Health Center's nine zones heating and cooling operates in a steady-state/occupied scenario 24 hours a day and 365 days a year. During energy audit visits, the average thermostat heat setting was 72 degrees and thermostat air conditioning settings at 72 degrees. The building is already equipped with programmable thermostats for every zone. Significant energy is wasted for excessive heating and cooling temperatures and heating and cooling of building during unoccupied times.

Energy Conservation Measure

Optimize thermostat heating and cooling programming for each climate control zone to the EPA recommended temperature during office hours. In addition, program

setbacks and step ups outside of occupied times. See Appendix – Thermostat Optimization for breakdown of savings/wasted energy.

Thermostat Setting	Existing Condition	New Condition
Heat	Avg. 72°F 24hrs/auto	Weekdays 6am-6pm: 70°F Weekdays 6pm-6am & Weekends 60°
Cooling	Avg. 72°F 24hrs/auto	Weekdays 6am-6pm: 76°F Weekdays 6pm-6am & Weekends 86°F

Savings
Building heating energy reduction: 25%
Building cooling energy reduction: 45%
Overall building energy reduction: 9.5%
Annual savings: $6,190
Capital investment: $0
Payback: 0 years

ECM 5: High Efficiency Refrigerators

Existing Conditions
The Health Center currently uses six standard/non-high efficiency refrigerators. These refrigerators are located in the nurses' station, pharmacy, break room, lab, storage room and Human Resources and consume approximately double the electricity of current high efficiency units.

Energy Conservation Measure
Replace the six existing refrigerators with six high efficiency refrigerators.

Appliance	Existing Condition	New Condition
Refrigerators	Six standard efficiency refrigerators.	Replace the six existing refrigerators with six high efficiency refrigerators that would consume significantly less electricity.

Savings
Refrigeration energy reduction: 78.7%
Overall building energy reduction: 1.4%
Annual savings: $888
Capital investment: $5,670
Payback: 6.39 years

ECM 6: Replacing Incandescent Light Bulbs

Existing Conditions
The vast majority of interior lighting at the Health Center is fluorescent lighting but there are 33 remaining incandescent bulbs. Incandescent bulbs use approximately four times the electricity as energy efficient alternative bulbs and can be easily and cheaply replaced.

Energy Conservation Measure

Purchase and replace 33 incandescent bulbs with energy efficient compact fluorescent bulbs. Benefits of CFLs will include significantly less energy consumption for comparable light output and longer bulb life.

Savings
Energy reduction from incandescent bulbs: 78.3%
Overall building energy reduction: 0.7%
Annual savings: $445
Capital investment: $25
Payback: 0.06 years

ECM 7: Entryway & Stairway Electric Heat

Existing Conditions
The Health Center entryways and basement stairways have auxiliary electric heaters that remain constant 24/7 during winter months.

Energy Conservation Measure
Implement procedure to turn off electric heaters at the end of each work day when the building is unoccupied and heating is unnecessary.

Savings
Energy reduction from incandescent bulbs: 50%
Overall building energy reduction: 0.9%
Annual savings: $594
Capital investment: $0
Payback: 0 years

ECM 8: Timed Power Supplies

Existing Conditions
Various electronic items throughout the building continue to draw "phantom" power as they sit idle after class/work hours. Energy auditing showed that copiers and printers continue to draw electricity even when idle and building is unoccupied.

Energy Conservation Measure
Purchase 61 APC P11GTV power strips to power down printers with master device/hibernating computer automatically and 11 APC Day & Time Timer/Surge Protector to limit power to copiers 10 hours per day.

Plug In Device	Existing Condition	New Condition
Printer	61 printers that are inconsistently powered off	Purchase and utilize 61 APC P11GTV power strips to power down printers when master device/hibernating computer powers down
Copier	10 copy machines that continue to draw power unnecessarily after work hours	Purchase and utilize 10 APC Day & Time Timer/Surge Protector to limit power to copiers 10 hours per day

Postage	One postage machine that is powered on 24/7	Purchase and utilize 1 APC Day & Time Timer/Surge Protector to limit power to postage machine to 10 hours per day

Savings
Timed electronic energy reduction: 62.2%
Overall building energy reduction: 2.0%
Annual savings: $1,347
Capital investment: $2,458
Payback: 1.8 years

ECM 9: Replacing Conventional Coffee Pots with Thermal Carafe Units

Existing Conditions
The Health Center's break room, upstairs hall, basement lobby and Human Resources have coffee machines with hot plate that remains on and drawing electricity throughout the work day to heat coffee pots.

Energy Conservation Measure
Purchase and replace conventional coffee machines with units that heat water/coffee during brew and maintain heat by means of insulated carafe and doesn't require electricity beyond brew time. Benefits of thermal carafe units will include significantly less energy consumption for coffee.

Appliance	Existing Condition	New Condition
Conventional Coffee Machine	Four coffee machines that draw power throughout the day for heating elements.	Replace four conventional coffee machines with Bunn BT Velocity Brew Drip Coffee Maker with Insulated Carafe.

Savings
Energy reduction from thermal carafe style coffee maker: 84.0%
Overall building energy reduction: 0.7%
Annual savings: $482
Capital investment: $520
Payback: 1.08 years

ECM 10: Removing Redundant Energy Consuming Items

Existing Conditions
Space heaters, ½ size refrigerator and refrigerated drinking fountains are convenient but are redundant when a staff refrigerator is available in the building. Space heaters are often operated in excess during winter but also in summer when central cooling is operating. Cold groundwater supplies refrigerated drinking fountains and makes refrigeration unnecessary.

Energy Conservation Measure
Eliminate six ½ size refrigerators and utilize full size refrigerators located throughout the Health Center. Eliminate twenty space heaters and increase

summer thermostat AC setting to 76 degrees to better achieve balance of energy savings and comfort. Power down two drinking fountains' refrigeration to eliminate unnecessary cooling of already cold drinking water.

Savings
Energy reduction from eliminating redundant items: 100%
Overall building energy reduction: 2.8%
Annual savings: $1,898
Capital investment: $0
Payback: 0 years

ECM 11: Pop and Vending Machines

Existing Conditions
A pop and vending machine is located in the basement of the Health Center. Each of these two machines operates unmodified and consequently consumes considerably more energy than machines modified with energy efficiency devices.

Energy Conservation Measure
Purchase and install one VendingMiser for the pop machine and one SnackMiser for the vending machine. These units will effectively power down the machines when not in use and automatically power on when needed or contents need to be cooled. These units would offer significant energy consumption savings and maintenance savings. In addition, removing the light bulbs from behind the pop machine's front panel will further reduce energy consumption of unnecessary lighting.

Appliance	Existing Condition	New Condition
Pop Machine	One pop machine that draws power throughout the day for lighting and keeping the machine on 24/7.	Add VendingMiser control unit to power down pop machine when no demand is placed on machine.
Vending Machine	One snack vending machine that draws power throughout the day for lighting and keeping the machine on 24/7.	Add SnackMiser control unit to power down snack vending machine when no demand is placed on machine.

Savings
Energy reduction from VendingMiser and SnackMiser: 69.0%
Overall building energy reduction: 0.4%
Annual savings: $269
Capital investment: $238
Payback: 0.89 years

Bay Mills Community College (ECMs Totaling 38% Energy Reduction)

The Bay Mills Community College "main campus" is comprised of four buildings. The four buildings are the 13,144 ft^2 Administration Building, 6,653 ft^2 Library, 12,000ft^2 Mikanuk Building and the 2,056 ft^2 Learning Center. The Administration Building is a repurposed former fish processing building with building additions that now houses numerous offices, classrooms, computer lab, student lounge area and a credit union. The Library is a purpose built structure with offices in the basement and library material and study areas on the ground floor and loft. The Mikanuk Building is the newest structure mainly occupied by classrooms and several offices. Lastly, the Learning Center is located next to the Administration Building with an open area for student tutoring, assistance and computer workstations. The Bay Mills Community College "main campus" is situated directly on the south shore of the Saint Marys River/Lake Superior.

The Bay Mills Community College utilizes grid electricity and natural gas as sources of energy. Electricity is used for all items requiring energy as well as the main source of heat in some building areas, supplemental heat in other areas along with natural gas as the primary heating fuel source for some building spaces. Temperature control (heating and cooling) is controlled by individual thermostats in portions of the Administration Building with electric baseboard heating and HVAC zoned areas in the remaining buildings.

The Administration Building features wood frame construction, fiberglass insulation, brick, block and wood exteriors, variety of window styles and materials, one glass/aluminum framed double exterior door, four single metal entry doors, low pitched roof and a concrete slab foundation.

The Library Building features wood frame construction, fiberglass insulation, log/wood exterior, vinyl double paned windows, three glass/aluminum framed single exterior doors, metal pitched roof and a basement with block foundation.

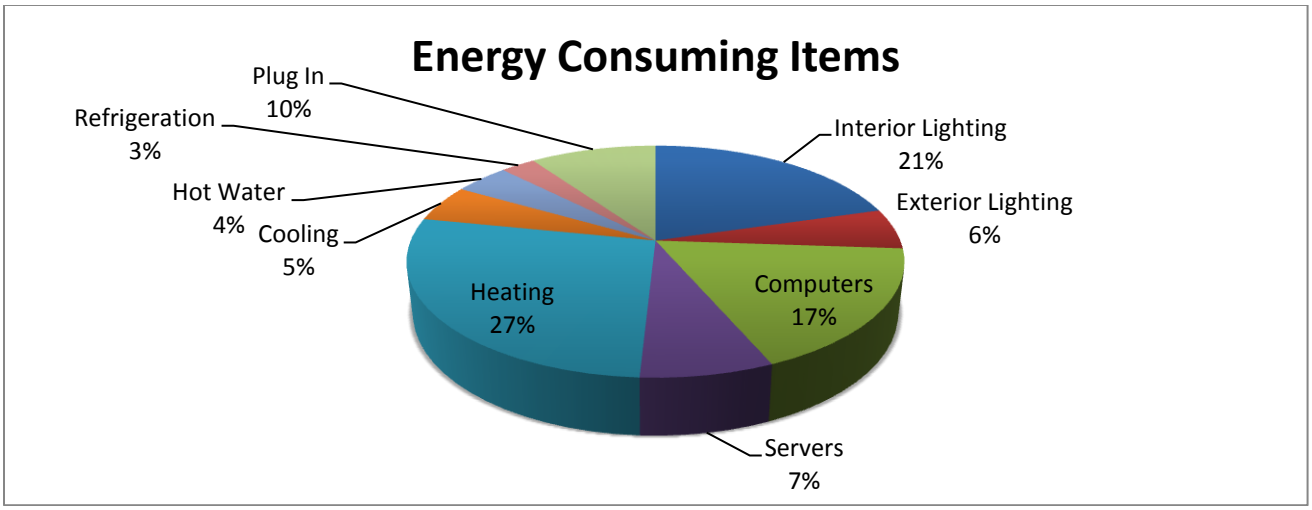
The Mikanuk Building features block construction, vinyl double paned windows, four sets of double glass/aluminum framed exterior doors, metal pitched roof and a basement with block foundation. The Mikanuk Building is the only building with modern direct digital control for the boiler/AC/HVAC system.

The Learning Center building features wood frame construction, fiberglass insulation, wood exterior, aluminum double paned windows, two glass/aluminum framed single exterior doors, flat roof and a block foundation.

Analyses of each building's energy consumption history, energy audit information and Energy Conservation Measures are separated by building below.

Bay Mills Community College Administration Building (ECMs Totaling 44.7% Energy Reduction)

Analyses of the BMCC Administration Building's energy consumption history and energy audit information revealed that heating is the largest energy consuming item followed by interior lighting, computers and related items, plug-in items, servers, cooling, exterior lighting and other items shown in the following chart.



To improve building energy performance, the following Energy Conservation Measures (ECMs) were developed in response to energy audit and analyses findings. Each ECM is further described below.

ECM	Description of ECM	% Energy Use Savings	Total Cost Savings ($/year)	Estimated Capital Cost ($)	Simple Payback (years)
1	Thermostat optimization (6pm-6am 10 degree setback/step-up; thermostat heat setting @ 70 degrees; 76 degrees AC)	30.5%/9.3%	$2,359	$0	0
2	Hibernate computers during non-work hours	54.4%/6.7%	$1,688	$0	0
3	Interior Fluorescent Lighting (T8 Fixtures & Bulbs; Occupancy sensors)	47.3%%/7.0%	$1,767	$15,563	8.8
4	Exterior Lighting (LED retrofits and reduce on time)	93.8%/5.3%	$1,337	$5,074	3.8
5	Energy Efficient Water Heaters	62%/2.6%	$665	$2,798	4.21

6	Energy Efficient Refrigerators	78.7%/1.2%	$296	$1,890	6.39
7	Replace Incandescent Bulbs with CFLs	78.3%/4.2%	$1,069	$74	0.07
8	Timed Power Supplies (Copiers, Printers, Postage)	54.4%/2.7%	$669	$1,627	2.16
9	Eliminate Redundant Items (Space Heaters, ½ fridges, Drinking Fountain Summer Months)	75.4%/2.6%	$625	$0	0
10	Coffee Makers w/lnsulated Carafe	80%/1.2%	$303	$390	1.29
11	Vending Machine Efficiency (VendingMiser, SnackMiser)	70%/1.9%	$482	$427	0.89
12	Energy Efficient Water Cooler	45.2%/0.2%	$40	$191	4.81
	Total	**44.7%**	**$11,300**	**$28,034**	**2.48**

ECM 1: Thermostat Optimization

Existing Conditions

Currently, the BMCC Administration Building's heating and cooling operates in a steady-state/occupied scenario 24 hours a day and 365 days a year. During energy audit visits, the thermostat heat setting varied widely but a conservative average is 72 degrees and thermostat air conditioning settings were also at 72 degrees. The building is a combination of individual office thermostats for each heating and cooling unit and zone programmable thermostats. In both thermostat configurations, significant energy is wasted for excessive heating and cooling temperatures and heating and cooling of building during unoccupied times.

Energy Conservation Measure

Optimize thermostat heating and cooling to EPA recommended temperature during office hours. In addition, program setbacks and step ups outside of occupied times. See Appendix – Thermostat Optimization for breakdown of savings/wasted energy.

Thermostat Setting	Existing Condition	New Condition
Heat	Avg. 72°F 24hrs/auto	Weekdays 6am-6pm: 70°F Weekdays 6pm-6am & Weekends 60°
Cooling	Avg. 72°F 24hrs/auto	Office Weekdays 7am-5pm: 76°F Office Weekdays 5pm-7am & Weekends: OFF

Savings
Building heating energy reduction: 25%
Building cooling energy reduction: 45%
Overall building energy reduction: 9.3%
Annual savings: $2,359
Capital investment: $0
Payback: 0 years

ECM 2: Computer Power Management

Existing Conditions
The energy audit of the BMCC Administration Building determined that work station computer systems largely remain powered on 24 hours per day. Computers that remain on after work cause unnecessary power consumption and can be mitigated by hibernating computers after/before work hours.

Energy Conservation Measure
Hibernating is a power management setting that every computer operating system has for reducing energy consumption. Utilizing this feature to power down computers outside of work hours will reduce the current wasted energy associated with keeping computers powered on when the building is unoccupied. Enabling the Hibernate feature to the specifications below will cause each computer to consume near zero energy outside of work hours (approximately 14 hours/day) and thereby result in a significant reduction in energy.

Computer Type	Existing Condition	New Condition
75 Workstations	Powered on 24/7	Enable Hibernate feature in each computer's Power Management settings after 90 minutes of inactivity.

Savings
Computer energy reduction: 54.4%
Overall building energy reduction: 6.7%
Annual savings: $1,688
Capital investment: $0
Payback: 0 years

Savings are calculated using the following: twenty-seven computers operating 261 week days calculated with 10 work hours and 14 efficiency mode hours, 72 weekend days calculated with 100% hibernation/efficiency mode.

ECM 3: Interior Lighting

Existing Conditions
The majority of the BMCC Administration Building's interior is equipped with T12 fluorescent bulbs and fixtures on manual light switches but some more efficient T8 lights have been added. While T12 lights are more efficient than incandescent bulbs, newer and more efficient T8 bulbs and occupancy sensors would result in greater energy savings.

Energy Conservation Measure

Purchase and install 173 T8 fixtures and bulbs to replace existing T12 fixtures, 37 occupancy sensors for remaining room/offices and 1 hallway occupancy sensor. This alternative will consume less energy from higher efficiency lights and electricity conservation by automatically turning off lights when room is unoccupied. Multi-technology sensors would be used and prevent lights from unintentionally being turned off (see Appendix – Lighting for recommended Leviton occupancy sensor unit). U.S. EPA estimates 25% savings when occupancy sensors are used in office settings.

Lighting Item	Existing Condition	New Condition
Interior Lighting	Mix of T8 (173 fixtures) and T12 (14 fixtures) fixtures and bulbs with manual on/off switches	Purchase and install 173 X 2 T8 lamp fixtures (Grainger item #2PFV4 @ $71.35 each)
Light switches	Manual on/off switches	37 occupancy sensors (Leviton Multi-Technology Occupancy Sensor Units @ $79.86); 1 SensorSwitch HWR-13 for Hallway @ $126

Savings

Interior lighting reduction: 47.3%
Overall building energy reduction: 7.0%
Annual savings: $1,767
Capital investment: $15,563
Payback: 8.8 years

Calculations for energy savings are based on increased efficiency of T8 fixtures over T12 and a 25% reduction relating to the use of occupancy sensors.

ECM 4: Exterior Lighting

Existing Conditions

The parking lot and building exterior is currently lighted by seven 250 watt high and eighteen 100 watt pressure sodium lights on a timer that has the lights remaining on twelve hours per night. Both the bulbs' high wattage and timer on throughout the night cause energy consumption that can be mitigated.

Energy Conservation Measure

Replace existing 250 watt high pressure sodium bulbs with 56 watt LED retrofit bulbs, existing 100 watt bulbs with 21 watt LED retrofit bulbs and optimize timer for 2 hours on before office hours and 2 hours after office hours. Significant energy will be saved through conservation (reduced on time) and high efficiency bulb replacement. LED lights also provide advantages from long operational life.

Exterior Light	Existing Condition	New Condition
High Pressure Sodium Lights	Seven 250 watt and 18 100 watt exterior lights remaining on 10 hours per night.	Replace 250 watts HPS bulbs with 56 watt LED retrofit bulbs and 100 watt HPS bulbs with 21 watt LED retrofit bulbs. Reset timer to 2 hours on in morning and 2 hours on in the afternoon/evening weekdays only.

Savings
Exterior lighting reduction: 93.8%
Overall building energy reduction: 5.3%
Annual savings: $1,337
Capital investment: $5,074
Payback: 3.8 years

ECM 5: High Efficiency Water Heaters

Existing Conditions
The BMCC Administration Building currently uses two 40 gallon electric water heaters to meet its need for hot water. Of the various types of common ways to heat water, electric water heaters are amongst the most expensive and double that of natural gas or hybrid/heat pumps. Hot water demand is for kitchen needs and the restrooms.

Energy Conservation Measure
Replace the existing electric waters heater with hybrid/heat pump water heaters. This measure would result in cutting energy used for hot water in half while remaining safe and reliable. In heat pump mode, these water heaters will use heat from ambient air and transfer it to the water in the tank. This type of water heater will be especially beneficial in a furnace/server room where excessive heat is generated and can be used for water heating.

Appliance	Existing Condition	New Condition
Water Heater	Two 40 gallon standard electric water heaters.	Replace two existing water heaters with hybrid/heat pump water heaters that would consume approximately ½ of the existing energy of the existing standard electric water heaters.

Savings
Hot water energy reduction: 62%
Overall building energy reduction: 2.6%
Annual savings: $665
Capital investment: $2,798
Payback: 4.21 years

ECM 6: High Efficiency Refrigerators

Existing Conditions

The BMCC Administration Building currently has two standard/non-high efficiency refrigerators in use. These refrigerators consume approximately double the electricity of current high efficiency units.

Energy Conservation Measure
Replace the two existing refrigerators with two high efficiency refrigerators.

Appliance	Existing Condition	New Condition
Refrigerators	Two standard efficiency refrigerators.	Replace the two existing refrigerators with two high efficiency refrigerators that would consume significantly less electricity.

Savings
Refrigeration energy reduction: 78.7%
Overall building energy reduction: 1.2%
Annual savings: $296
Capital investment: $1,890
Payback: 6.39 years

ECM 7: Replacing Incandescent Light Bulbs

Existing Conditions
The majority of interior lighting at the BMCC Administration Building is fluorescent lighting but there are 99 remaining incandescent bulbs. Incandescent bulbs use approximately four times the electricity as energy efficient alternative bulbs and can be easily and cheaply replaced.

Energy Conservation Measure
Purchase and replace 99 incandescent bulbs with energy efficient compact fluorescent bulbs. Benefits of CFLs will include significantly less energy consumption for comparable light output and longer bulb life.

Savings
Energy reduction from incandescent bulbs: 78.3%
Overall building energy reduction: 4.2%
Annual savings: $1,069
Capital investment: $74
Payback: 0.07 years

ECM 8: Timed Power Supplies

Existing Conditions
Various electronic items throughout the building continue to draw "phantom" power as they sit idle after class/work hours. Energy auditing showed that copiers, printers and postage machines continue to draw electricity even when idle and building is unoccupied.

Energy Conservation Measure

Purchase 49 APC P11GTV power strips to power down printers with master device/hibernating computer automatically and 11 APC Day & Time Timer/Surge Protector to limit power to copiers and postage machines 10 hours per day.

Plug In Device	Existing Condition	New Condition
Printer	49 printers that are inconsistently powered off	Purchase and utilize 49 APC P11GTV power strips to power down printers when master device/hibernating computer powers down
Copier	9 copy machines that continue to draw power unnecessarily after work hours	Purchase and utilize 9 APC Day & Time Timer/Surge Protector to limit power to copiers 10 hours per day
Postage	2 postage machine that is powered on 24/7	Purchase and utilize 2 APC Day & Time Timer/Surge Protector to limit power to postage machine to 10 hours per day

Savings
Timed electronic energy reduction: 54.4%
Overall building energy reduction: 2.7%
Annual savings: $669
Capital investment: $1,627
Payback: 2.2 years

ECM 9: Replacing Conventional Coffee Pot with Thermal Carafe Units

Existing Conditions
The BMCC Administration Building currently utilizes three coffee machines with hot plates that remain on and drawing electricity throughout the work day to heat coffee pot.

Energy Conservation Measure
Purchase and replace conventional coffee machines with units that heats water/coffee during brew and maintain heat by means of insulated carafe and don't require electricity beyond brew time. Benefits of thermal carafe units will include significantly less energy consumption for coffee.

Appliance	Existing Condition	New Condition
Coffee Machine	Three coffee machines that draws power throughout the day for heating elements.	Replace three convention coffee makers with Bunn BT Velocity Brew Drip Coffee Maker with Insulated Carafe

Savings
Energy reduction from thermal carafe style coffee makers: 80.0%
Overall building energy reduction: 1.2%
Annual savings: $303
Capital investment: $390

Payback: 1.29 years

ECM 10: Pop and Vending Machines

Existing Conditions

A pop and vending machine is located in the BMCC Administration Building. Each of these two machines operates unmodified and consequently consume considerably more energy than machines modified with energy efficiency devices.

Energy Conservation Measure

Purchase and install one VendingMiser for the pop machine and one SnackMiser for the vending machine. These units will effectively power down the machines when not in use and automatically power on when needed or contents need to be cooled. These units would offer significant energy consumption savings and maintenance savings. In addition, removing the light bulbs from behind the pop machine's front panel will further reduce energy consumption of unnecessary lighting.

Appliance	Existing Condition	New Condition
Pop Machine	One pop machine that draws power throughout the day for lighting and keeping the machine on 24/7.	Add VendingMiser control unit to power down pop machine when no demand is placed on machine.
Vending Machine	One snack vending machine that draws power throughout the day for lighting and keeping the machine on 24/7.	Add SnackMiser control unit to power down snack vending machine when no demand is placed on machine.

Savings

Energy reduction from VendingMiser and SnackMiser: 70.0%
Overall building energy reduction: 1.9%
Annual savings: $482
Capital investment: $427
Payback: 0.89 years

ECM 11: Energy Star Water Cooler

Existing Conditions

The one existing water coolers located in the BMCC Administration Building is a standard/non-Energy Star water coolers. Higher efficiency units are available that would reduce energy consumption tied to water cooler units.

Energy Conservation Measure

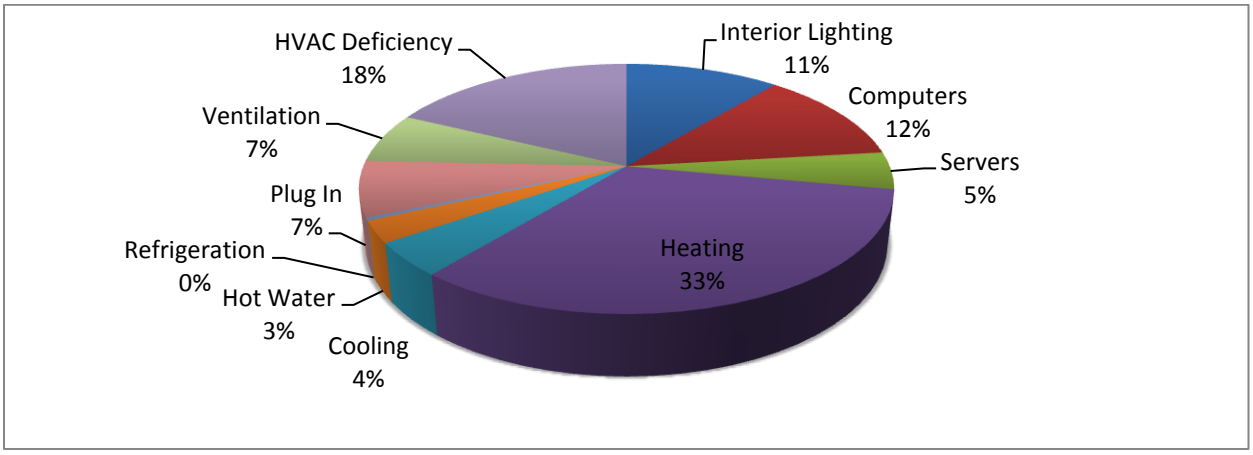
Purchase and replace one existing water cooler with an Energy Star water cooler.

Savings

Energy reduction from Energy Star water cooler: 45.2%
Overall building energy reduction: 0.2%
Annual savings: $40
Capital investment: $191
Payback: 4.81 years

Bay Mills Community College Mikanuk Building (ECMs Totaling 34.9% Energy Reduction)

Analyses of the BMCC Mikanuk building's energy consumption history and energy audit information revealed that heating/HVAC is the largest energy consuming item followed by computers, interior lighting, ventilation, plug-in items, servers, cooling and other items shown in the following chart.



To improve building energy performance, the following Energy Conservation Measures (ECMs) were developed in response to energy audit and analyses findings. Each ECM is further described below.

ECM	Description of ECM	% Energy Use Savings	Total Cost Savings ($/year)	Estimated Capital Cost ($)	Simple Payback (years)
1	Thermostat optimization (6pm-6am 10 degree setback/step-up; thermostat heat setting @ 70 degrees; 76 degrees AC)	24.7%/10.7%	$3,474	$0	0
2	Retrocommission HVAC System	100%/17.8%	$5,778	$0	0
3	Interior Lighting (Occupancy sensors)	25%/2.5%	$814	$1,917	2.36

4	Pop & Vending Machine (VendingMiser and SnackMiser)	69%/0.9%	$269	$238	0.89
5	Coffee Makers w/lnsulated Carafe	84%/0.4%	$121	$130	1.08
6	Replace Incandescent Bulbs with CFLs	84.5%/0.9%	$293	$5	0.02
7	Timed Power Supplies (Copiers, Printers, TVs)	58%/1.2%	$366	$488	1.33
8	Eliminate Redundant Items (Space Heaters)	100%/0.6%	$198	$0	0
9	Exterior Door Air Sealing	Marginal	$12	$200	16.6
	Total	**35%**	**$11,325**	**$2,978**	**0.26**

ECM 1: Thermostat Optimization

Existing Conditions

Because of HVAC direct control software bugs the Mikanuk's heating and cooling operates in a steady-state/occupied scenario 24 hours a day and 365 days a year. During energy audit visits, the thermostat heat setting was 72 degrees and thermostat air conditioning settings were also at 72 degrees. The building is equipped with six zones, programmable thermostats and a central control computer. In the current configuration, significant energy is wasted for excessive heating and cooling temperatures and heating and cooling of building during unoccupied times.

Energy Conservation Measure

Optimize thermostat heating and cooling to EPA recommended temperature during office hours. In addition, program setbacks and step ups outside of occupied times. See Appendix – Thermostat Optimization for breakdown of savings/wasted energy.

Thermostat Setting	Existing Condition	New Condition
Heat	Avg. 72°F 24hrs/auto	Weekdays 6am-6pm: 70°F Weekdays 6pm-6am & Weekends 60°
Cooling	Avg. 72°F 24hrs/auto	Weekdays 7am-5pm: 76°F Weekdays 5pm-7am & Weekends: OFF

Savings

Building heating energy reduction: 25%
Building cooling energy reduction: 45%
Overall building energy reduction: 10.7%
Annual savings: $3,474

Capital investment: $0
Payback: 0 years

ECM 2: Retrocommission HVAC System

Existing Conditions

1. The inability to reduce the temperature for extended periods (i.e. winter breaks). The system also maintained a minimum open setting of the input damper to allow for air exchange. Unfortunately it was common during cold months to enter the building in the morning to find the air temperature above 80F. The system would also show error messages indicating it had reached a "freeze out" condition. Upon further examination, we determined that the minimum input air damper setting allowed extremely cold air to ice up the air conditioner coil in the air handler. A sensor would detect this condition and proceed to run the boiler wide-open in order to melt the ice. Once the sensor was satisfied, the system would restart and allow cold air to enter again. The cycle would repeat itself resulting in very high fuel bills. In order to exit this cycle, the system was set to maintain a constant temperature which stopped the freeze conditions mentioned above. Our fuel bill was drastically reduced by this action but remained higher than optimal because of the inability to step down temperature. The control vendor (ACC) has attempted to change the software.
2. The boilers require repairs every fall and have been unreliable since they were installed. Gas igniters, control valves stuck in the open or closed position, and circulation pumps are common failure points. It is suspected that dust in the combustion chamber is causing igniter failure and improperly aligned connectors are causing the pump failure. The result is over-heated classrooms (thus teachers open windows to compensate) when the zone valves do not close due to failure.
3. The air conditioner requires repairs every spring. There appears to be an electrical problem that has not been solved at this time.

Energy Conservation Measure

If vendor/contractor continues to fail to take responsibility, the calculated annual inefficiency cost of $5,778 could be invested to retrocommission HVAC system and utilize energy savings to repay corrective actions.

Savings

System Error Correction/Reduction: 100%
Overall building energy reduction: 17.8%
Annual savings: $5,778
Capital investment: $0/$5,778
Payback: 0 years

ECM 3: Interior Lighting

Existing Conditions

The BMCC Mikanuk building's interior is equipped with 391 energy efficient T8 fluorescent bulbs and associated fixtures on manual light switches. While these lights are efficient, additional electricity can be conserved by utilizing occupancy sensors to

automatically turn a room's lights off when unoccupied. U.S. EPA estimates 25% savings when occupancy sensors are used in office and classroom settings.

Energy Conservation Measure

Purchase and install occupancy sensors in 24 areas that will result in lights automatically turning off when room is unoccupied. Multi-technology sensors would be used and prevent lights from unintentionally being turned off (see Appendix – Lighting for recommended Leviton occupancy sensor unit).

Lighting Item	Existing Condition	New Condition
Interior Lighting	High efficiency interior lighting controlled manually by on/off switches.	Purchase and install 24 occupancy sensors that will automatically detect if the areas are occupied/unoccupied and control lights by turning on when occupied and turning off when unoccupied.

Savings

Interior lighting reduction: 25%
Overall building energy reduction: 2.5%
Annual savings: $814
Capital investment: $1,917
Payback: 2.36 years

Calculations for energy savings are based on a 25% reduction of current electricity associated with interior lighting.

ECM 4: Pop and Vending Machines

Existing Conditions

A pop and vending machine is located in the BMCC Mikanuk building. Each of these two machines operates unmodified and consequently consumes considerably more energy than machines modified with energy efficiency devices.

Energy Conservation Measure

Purchase and install one VendingMiser for the pop machine and one SnackMiser for the vending machine. These units will effectively power down the machines when not in use and automatically power on when needed or contents need to be cooled. These units would offer significant energy consumption savings and maintenance savings. In addition, removing the light bulbs from behind the pop machine's front panel will further reduce energy consumption of unnecessary lighting.

Appliance	Existing Condition	New Condition
Pop Machine	One pop machine that draws power	Add VendingMiser control unit to power down pop machine when no demand is placed on

	throughout the day for lighting and keeping the machine on 24/7.	machine.
Vending Machine	One snack vending machine that draws power throughout the day for lighting and keeping the machine on 24/7.	Add SnackMiser control unit to power down snack vending machine when no demand is placed on machine.

Savings
Energy reduction from VendingMiser and SnackMiser: 69%
Overall building energy reduction: 0.9%
Annual savings: $269
Capital investment: $238
Payback: 0.89 years

ECM 5: Replacing Conventional Coffee Pot with Thermal Carafe Unit

Existing Conditions
The BMCC Mikanuk building currently utilizes one coffee machine with hot plates that remain on and drawing electricity throughout the work day to heat coffee pot.

Energy Conservation Measure
Purchase and replace conventional coffee machine with a unit that heats water/coffee during brew and maintains heat by means of insulated carafe and doesn't require electricity beyond brew time. Benefits of thermal carafe unit will include significantly less energy consumption for coffee.

Appliance	Existing Condition	New Condition
Coffee Machine	One coffee machine that draws power throughout the day for heating elements.	Replace one conventional coffee maker with Bunn BT Velocity Brew Drip Coffee Maker with Insulated Carafe

Savings
Energy reduction from thermal carafe style coffee makers: 84%
Overall building energy reduction: 0.4%
Annual savings: $121
Capital investment: $130
Payback: 1.08 years

ECM 6: Replacing Incandescent Light Bulbs

Existing Conditions
The vast majority of interior lighting at the BMCC Mikanuk building is fluorescent lighting but there are 6 remaining incandescent bulbs. Incandescent

bulbs use approximately four times the electricity as energy efficient alternative bulbs and can be easily and cheaply replaced.

Energy Conservation Measure
Purchase and replace 6 incandescent bulbs with energy efficient compact fluorescent bulbs. Benefits of CFLs will include significantly less energy consumption for comparable light output and longer bulb life.

Savings
Energy reduction from incandescent bulbs: 84.5%
Overall building energy reduction: 0.9%
Annual savings: $293
Capital investment: $5
Payback: 0.02 years

ECM 7: Timed Power Supplies

Existing Conditions
Various electronic items throughout the building continue to draw "phantom" power as they sit idle after class/work hours. Energy auditing showed that copiers and printers continue to draw electricity even when idle and building is unoccupied.

Energy Conservation Measure
Purchase 11 APC P11GTV power strips to power down printers with master device/hibernating computer automatically and 5 APC Day & Time Timer/Surge Protector to limit power to copiers and TVs 10 hours per day.

Plug In Device	Existing Condition	New Condition
Printer	11 printers that are inconsistently powered off	Purchase and utilize 11 APC P11GTV power strips to power down printers when master device/hibernating computer powers down
Copier	3 copy machines that continue to draw power unnecessarily after work hours	Purchase and utilize 3 APC Day & Time Timer/Surge Protector to limit power to copiers 10 hours per day
TV	Two TVs that are largely powered on 24/7	Purchase and utilize 2 APC Day & Time Timer/Surge Protector to limit power to postage machine to 10 hours per day

Savings
Timed electronic energy reduction: 58%
Overall building energy reduction: 1.2%
Annual savings: $366
Capital investment: $488
Payback: 1.33 years

ECM 8: Removing Redundant Energy Consuming Items

Existing Conditions

Space heaters are convenient but are redundant when central heating and cooling is available. Space heaters are often operated in excess during winter but also in summer when central cooling is operating.

Energy Conservation Measure

Eliminate four space heaters and increase summer thermostat AC setting to 76 degrees to better achieve balance of energy savings and comfort.

Savings

Energy reduction from eliminating redundant items: 100%
Overall building energy reduction: 0.6%
Annual savings: $198
Capital investment: $0
Payback: 0 years

ECM 9: Exterior Door Air Sealing

Existing Condition

Overall assessment of the building's weatherization is good with one component being the exception, exterior doors that lack a good seal resulting in air infiltration/heat loss. The north facing aluminum framed glass double doorway is in good condition but lacks proper sealing into door frame because of worn weather stripping and/or improper fit. Door sealing in this door's location is important as it faces north, Lake Superior and lots of wind.

Energy Conservation Measure

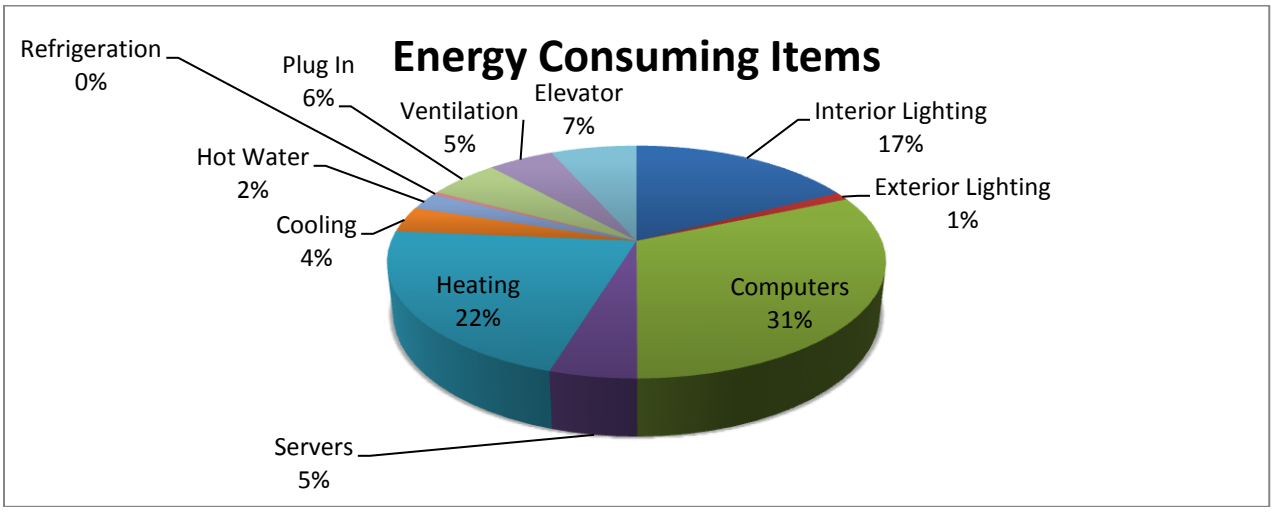
Purchase durable door seals/weather strip kits to effectively seal door into frame and thereby reduce air infiltration/heat loss from leaky closed doors. In addition, adjust strike plates to ensure that door closes snugly against door seal.

Savings

Heating & cooling energy reduction: Marginal
Overall building energy reduction: Marginal
Annual savings: $12
Capital investment: $200
Payback: 16.6 years

Bay Mills Community College Library Building (ECMs Totaling 30.5% Energy Reduction)

Analyses of the Library's energy consumption history and energy audit information revealed that computers and related items are the largest energy consuming item followed by heating, interior lighting, elevator, plug-in items, servers, cooling and other items shown in the following chart.



To improve building energy performance, the following Energy Conservation Measures (ECMs) were developed in response to energy audit and analyses findings. Each ECM is further described below.

ECM	Description of ECM	% Energy Use Savings	Total Cost Savings ($/year)	Estimated Capital Cost ($)	Simple Payback (years)
1	Thermostat optimization (6pm-6am 10 degree setback/step-up; thermostat heat setting @ 70 degrees; 76 degrees AC)	27.9%/8.3%	$720	$0	0

2	Hibernate computers during non-work hours	45.2%/9.5%	$818	$0	0
3	Interior Lighting (Occupancy sensors)	25%/3.3%	$283	$399	1.41
4	Exterior Lighting (LED retrofits and reduce on time)	93.7%/1.1%	$90	$231	2.56
5	Replace Incandescent Bulbs with CFLs	78.3%/1.7%	$148	$8	0.06
6	Timed Power Supplies (Copiers, Printers)	42%/0.7%	$64	$238	3.72
7	Eliminate Redundant Items (Space Heater)	100%/0.3%	$25	$0	0
8	Pop Machine Efficiency	70.9%/2.5%	$214	$189	0.88
9	Improved Foundation Insulation	13.9%/3%	$255	$1,104	4.33
	Total	**30.5%**	**$2,618**	**$2,179**	**0.83**

ECM 1: Thermostat Optimization

Existing Conditions

Currently, the Library's heating and cooling operates in a steady-state/occupied scenario 24 hours a day and 365 days a year. During energy audit visits, the thermostat heat setting was 72 degrees and thermostat air conditioning settings were also at 72 degrees. The building is equipped with two zones and programmable thermostats. In the current configuration, significant energy is wasted for excessive heating and cooling temperatures and heating and cooling of building during unoccupied times.

Energy Conservation Measure

Optimize thermostat heating and cooling to EPA recommended temperature during office hours. In addition, program setbacks and step ups outside of occupied times. See Appendix – Thermostat Optimization for breakdown of savings/wasted energy.

Thermostat Setting	Existing Condition	New Condition
Heat	Avg. 72°F 24hrs/auto	Weekdays & Saturdays 6am-6pm: 70°F Weekdays 6pm-6am & Sundays 60°
Cooling	Avg. 72°F	Weekdays & Saturdays 7am-5pm: 76°F

	24hrs/auto	Weekdays 5pm-7am & Sundays: OFF

Savings
Building heating energy reduction: 25%
Building cooling energy reduction: 45%
Overall building energy reduction: 8.3%
Annual savings: $720
Capital investment: $0
Payback: 0 years

ECM 2: Computer Power Management

Existing Conditions
The energy audit of the BMCC Library building determined that work station computer systems largely remain powered on 24 hours per day. Computers that remain on after work cause unnecessary power consumption and can be mitigated by hibernating computers after/before work hours.

Energy Conservation Measure
Hibernating is a power management setting that every computer operating system has for reducing energy consumption. Utilizing this feature to power down computers outside of work hours will reduce the current wasted energy associated with keeping computers powered on when the building is unoccupied. Enabling the Hibernate feature to the specifications below will cause each computer to consume near zero energy outside of work hours (approximately 14 hours/day) and thereby result in a significant reduction in energy.

Computer Type	Existing Condition	New Condition
35 Workstations	Powered on 24/7	Enable Hibernate feature in each computer's Power Management settings after 90 minutes of inactivity.

Savings
Computer energy reduction: 45.2%
Overall building energy reduction: 9.5%
Annual savings: $818
Capital investment: $0
Payback: 0 years

Savings are calculated using the following: twenty-seven computers operating 261 week days calculated with 10 work hours and 14 efficiency mode hours, 72 weekend days calculated with 100% hibernation/efficiency mode.

ECM 3: Interior Lighting

Existing Conditions
The BMCC Library's interior is equipped with 136 energy efficient T8 fluorescent bulbs and associated fixtures on manual light switches. While these lights are efficient, additional electricity can be conserved by utilizing occupancy sensors to automatically turn a room's lights off when unoccupied. U.S. EPA estimates 25%

savings when occupancy sensors are used in office settings and 30% for library settings.

Energy Conservation Measure

Purchase and install occupancy sensors in 5 areas that will result in lights automatically turning off when room is unoccupied. Multi-technology sensors would be used and prevent lights from unintentionally being turned off (see Appendix – Lighting for recommended Leviton occupancy sensor unit).

Lighting Item	Existing Condition	New Condition
Interior Lighting	High efficiency interior lighting controlled manually by on/off switches.	Purchase and install 5 occupancy sensors that will automatically detect if the areas are occupied/unoccupied and control lights by turning on when occupied and turning off when unoccupied.

Savings

Interior lighting reduction: 25%
Overall building energy reduction: 3.3%
Annual savings: $283
Capital investment: $399
Payback: 1.4 years

Calculations for energy savings are based on a 25% reduction of current electricity associated with interior lighting.

ECM 4: Exterior Lighting

Existing Conditions

The BMCC Library exterior is currently lighted by two 100 watt high pressure sodium lights on a timer that has the lights remaining on approximately twelve hours per night. Both the bulbs' high wattage and timer on throughout the night cause energy consumption that can be mitigated.

Energy Conservation Measure

Replace existing 100 watt bulbs with 21 watt LED retrofit bulbs and optimize timer for 2 hours on before office hours and 2 hours after office hours. Significant energy will be saved through conservation (reduced on time) and high efficiency bulb replacement. LED lights also provide advantages from long operational life.

Exterior Light	Existing Condition	New Condition
High Pressure	Two 100 watt exterior lights	Replace 100 watt HPS bulbs with 21 watt LED retrofit bulbs. Reset timer to 2 hours on in

Sodium Lights	remaining on 12 hours per night.	morning and 2 hours on in the afternoon/evening weekdays only.

Savings
Exterior lighting reduction: 93.7%
Overall building energy reduction: 1.1%
Annual savings: $90
Capital investment: $231
Payback: 2.6 years

ECM 5: Replacing Incandescent Light Bulbs

Existing Conditions
The majority of interior lighting at the BMCC Library building is fluorescent lighting but there are 11 remaining incandescent bulbs. Incandescent bulbs use approximately four times the electricity as energy efficient alternative bulbs and can be easily and cheaply replaced.

Energy Conservation Measure
Purchase and replace 11 incandescent bulbs with energy efficient compact fluorescent bulbs. Benefits of CFLs will include significantly less energy consumption for comparable light output and longer bulb life.

Savings
Energy reduction from incandescent bulbs: 78.3%
Overall building energy reduction: 1.7%
Annual savings: $148
Capital investment: $8
Payback: 0.06 years

ECM 6: Timed Power Supplies

Existing Conditions
Various electronic items throughout the building continue to draw "phantom" power as they sit idle after class/work hours. Energy auditing showed that copiers and printers continue to draw electricity even when idle and building is unoccupied.

Energy Conservation Measure
Purchase 6 APC P11GTV power strips to power down printers with master device/hibernating computer automatically and 1 APC Day & Time Timer/Surge Protector to limit power to copier 0 hours per day.

Plug In Device	Existing Condition	New Condition
Printer	6 printers that are inconsistently powered off	Purchase and utilize 6 APC P11GTV power strips to power down printers when master device/hibernating computer powers down
Copier	1 copy machine that continues to draw	Purchase and utilize 1 APC Day & Time Timer/Surge Protector to limit power to copier 10

	power unnecessarily after work hours	hours per day

Savings
Timed electronic energy reduction: 42%
Overall building energy reduction: 0.7%
Annual savings: $64
Capital investment: $238
Payback: 3.7 years

ECM 7: Removing Redundant Energy Consuming Items

Existing Conditions
Space heaters are convenient but are redundant when central heating and cooling is available. Space heaters are often operated in excess during winter but also in summer when central cooling is operating.

Energy Conservation Measure
Eliminate one space heater and increase summer thermostat AC setting to 76 degrees to better achieve balance of energy savings and comfort.

Savings
Energy reduction from eliminating redundant items: 100%
Overall building energy reduction: 0.3%
Annual savings: $25
Capital investment: $0
Payback: 0 years

ECM 8: Pop Machine

Existing Conditions
A pop machine is located in the basement of the BMCC Library. This machine operates unmodified and consequently consumes considerably more energy than a machine modified with energy efficiency devices.

Energy Conservation Measure
Purchase and install one VendingMiser for the pop machine. This unit will effectively power down the machine when not in use and automatically power on when needed or contents need to be cooled. The VendingMiser units would offer significant energy consumption savings and maintenance savings. In addition, removing the light bulbs from behind the pop machine's front panel will further reduce energy consumption of unnecessary lighting.

Appliance	Existing Condition	New Condition
Pop Machine	One pop machine that draws power throughout the day for lighting and keeping the machine on 24/7.	Add VendingMiser control unit to power down pop machine when no demand is placed on machine.

Savings
Energy reduction from VendingMiser and SnackMiser: 70.9%
Overall building energy reduction: 2.5%
Annual savings: $214
Capital investment: $189
Payback: 0.88 years

ECM 9: Foundation Insulation

Existing Condition
While a blower test was not possible for the BMCC Library, energy auditing and building weatherization inspection revealed that there are deficiencies. Weatherization deficiencies found relate to an uninsulated foundation perimeter. An uninsulated block foundation offers a very very low 1R value that contributes to building heat loss and consequently increases energy consumption and lower occupant comfort.

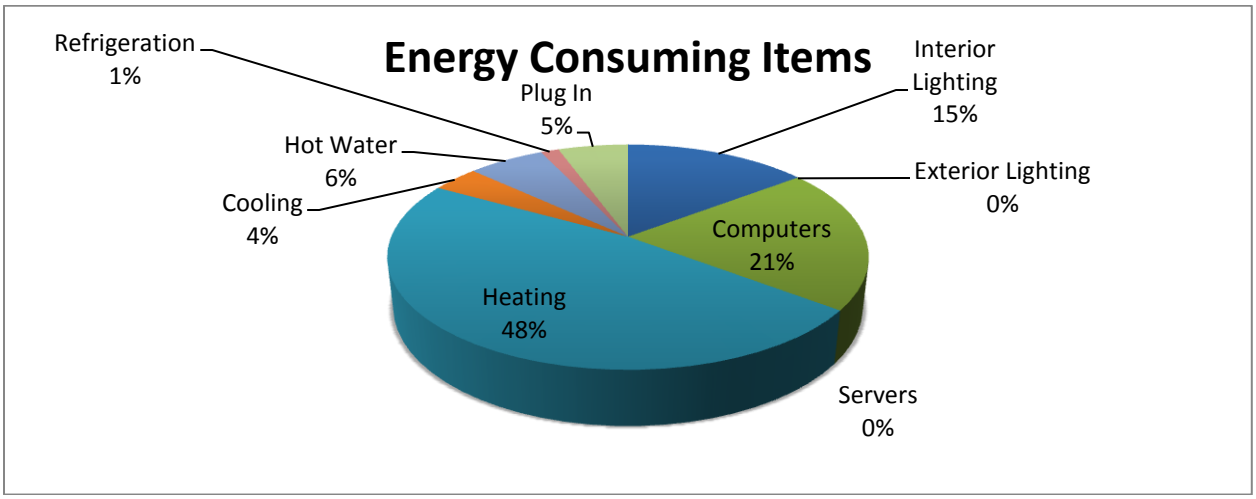
Energy Conservation Measure
Improve building's weatherization by preventing conductive heat loss through the exposed block foundation around the perimeter of the Library and heat gain during summer months through improved insulation.

Weatherization Component	Existing Condition	New Condition
Foundation insulation/air seal	No insulation present	2" of closed cell spray foam (R21) on foundation walls above grade and into rim joist area (insulates and air seals).

Savings
Heating & cooling energy reduction: 13.9%
Overall building energy reduction: 3.0%
Annual savings: $255
Capital investment: $1,104
Payback: 4.3 years

Bay Mills Community College Learning Center Building (ECMs Totaling 37.6% Energy Reduction)

Analyses of the BMCC Learning Center's energy consumption history and energy audit information revealed that heating is the largest energy consuming item followed by computers, interior lighting, hot water, plug-in items, cooling and other items shown in the following chart.



To improve building energy performance, the following Energy Conservation Measures (ECMs) were developed in response to energy audit and analyses findings. Each ECM is further described below.

ECM	Description of ECM	% Energy Use Savings	Total Cost Savings ($/year)	Estimated Capital Cost ($)	Simple Payback (years)
1	Thermostat optimization (6pm-6am 10 degree setback/step-up; thermostat heat setting @ 70 degrees; 76 degrees AC)	26%/13.6%	$359	$0	0
2	Hibernate computers during non-work hours	54.4%/11.1%	$293	$0	0
3	Interior Lighting (Occupancy sensors)	25%/3.6%	$94	$319	3.40
5	Replace Incandescent Bulbs with CFLs	78.3%/0.3%	$7	$1	0.11

6	Timed Power Supplies (Printers)	39.4%/0.1%	$2	$37	18.81
7	Eliminate Redundant Items (Drinking Fountain Refrigeration)	100%/2.2%	$57	$0	0
8	Coffee Makers w/lnsulated Carafe	80%/2.1%	$56	$130	2.3
9	Improved Attic Insulation	8.4%/4.3%	$122	$1,953	17.1
	Total	**37.3%**	**$989**	**$2,440**	**2.47**

ECM 1: Thermostat Optimization

Existing Conditions

Currently, BMCC Learning Center's heating and cooling operates in a steady-state/occupied scenario 24 hours a day and 365 days a year. During energy audit visits, the thermostat heat setting was 72 degrees and thermostat air conditioning settings were also at 72 degrees. The building is equipped with one zone and a programmable thermostat. In the current configuration, significant energy is wasted for excessive heating and cooling temperatures and heating and cooling of building during unoccupied times.

Energy Conservation Measure

Optimize thermostat heating and cooling to EPA recommended temperature during office hours. In addition, program setbacks and step ups outside of occupied times. See Appendix – Thermostat Optimization for breakdown of savings/wasted energy.

Thermostat Setting	Existing Condition	New Condition
Heat	Avg. 72°F 24hrs/auto	Weekdays 6am-6pm: 70°F Weekdays 6pm-6am & Weekends 60°
Cooling	Avg. 72°F 24hrs/auto	Weekdays 7am-5pm: 76°F Weekdays 5pm-7am & Weekends: OFF

Savings

Building heating energy reduction: 25%
Building cooling energy reduction: 45%
Overall building energy reduction: 13.6%
Annual savings: $359
Capital investment: $0
Payback: 0 years

ECM 2: Computer Power Management

Existing Conditions

The energy audit of the BMCC Learning Center building determined that work station computer systems largely remain powered on 24 hours per day. Computers that remain on after work cause unnecessary power consumption and can be mitigated by hibernating computers after/before work hours.

Energy Conservation Measure

Hibernating is a power management setting that every computer operating system has for reducing energy consumption. Utilizing this feature to power down computers outside of work hours will reduce the current wasted energy associated with keeping computers powered on when the building is unoccupied. Enabling the Hibernate feature to the specifications below will cause each computer to consume near zero energy outside of work hours (approximately 14 hours/day) and thereby result in a significant reduction in energy.

Computer Type	Existing Condition	New Condition
13 Workstations	Powered on 24/7	Enable Hibernate feature in each computer's Power Management settings after 90 minutes of inactivity.

Savings

Computer energy reduction: 54.4%
Overall building energy reduction: 11.1%
Annual savings: $293
Capital investment: $0
Payback: 0 years

Savings are calculated using the following: 13 computers operating 261 week days calculated with 10 work hours and 14 efficiency mode hours, 72 weekend days calculated with 100% hibernation/efficiency mode.

ECM 3: Interior Lighting

Existing Conditions

The BMCC Learning Center's interior is equipped with 92 energy efficient T8 fluorescent bulbs and associated fixtures on manual light switches. While these lights are efficient, additional electricity can be conserved by utilizing occupancy sensors to automatically turn a room's lights off when unoccupied. U.S. EPA estimates 25% savings when occupancy sensors are used in office and classroom settings.

Energy Conservation Measure

Purchase and install occupancy sensors in 4 areas that will result in lights automatically turning off when room is unoccupied. Multi-technology sensors would be used and prevent lights from unintentionally being turned off (see Appendix – Lighting for recommended Leviton occupancy sensor unit).

Lighting Item	Existing Condition	New Condition

Interior Lighting	High efficiency interior lighting controlled manually by on/off switches.	Purchase and install 4 occupancy sensors that will automatically detect if the areas are occupied/unoccupied and control lights by turning on when occupied and turning off when unoccupied.

Savings
Interior lighting reduction: 25%
Overall building energy reduction: 3.6%
Annual savings: $94
Capital investment: $319
Payback: 3.14 years

Calculations for energy savings are based on a 25% reduction of current electricity associated with interior lighting.

ECM 4: Replacing Incandescent Light Bulbs

Existing Conditions
The majority of interior lighting at the BMCC Learning Center building is fluorescent lighting but there are 1 remaining incandescent bulbs. Incandescent bulbs use approximately four times the electricity as energy efficient alternative bulbs and can be easily and cheaply replaced.

Energy Conservation Measure
Purchase and replace 1 incandescent bulb with energy efficient compact fluorescent bulbs. Benefits of CFLs will include significantly less energy consumption for comparable light output and longer bulb life.

Savings
Energy reduction from incandescent bulbs: 78.3%
Overall building energy reduction: 0.3%
Annual savings: $7
Capital investment: $1
Payback: 0.11 years

ECM 6: Timed Power Supplies

Existing Conditions
Various electronic items throughout the building continue to draw "phantom" power as they sit idle after class/work hours. Energy auditing showed that printers continue to draw electricity even when idle and building is unoccupied.

Energy Conservation Measure
Purchase 1 APC P11GTV power strip to power down printers with master device/hibernating computer automatically to limit power to printer 10 hours per day.

Plug In Device	Existing Condition	New Condition
Printer	1 printer that is inconsistently powered off	Purchase and utilize 1 APC P11GTV power strip to power down printer when master device/hibernating computer powers down

Savings
Timed electronic energy reduction: 39.4%
Overall building energy reduction: 0.1%
Annual savings: $2
Capital investment: $37
Payback: 18.81 years

ECM 7: Removing Redundant Energy Consuming Items

Existing Conditions
Cold groundwater supplies refrigerated drinking fountains and makes refrigeration unnecessary.

Energy Conservation Measure
Power down one drinking fountain's refrigeration to eliminate unnecessary cooling of already cold drinking water.

Savings
Energy reduction from eliminating redundant items: 100%
Overall building energy reduction: 2.2%
Annual savings: $57
Capital investment: $0
Payback: 0 years

ECM 8: Replacing Conventional Coffee Pot with Thermal Carafe Units

Existing Conditions
The BMCC Learning Center currently utilizes one coffee machine with hot plates that remain on and drawing electricity throughout the work day to heat coffee pot.

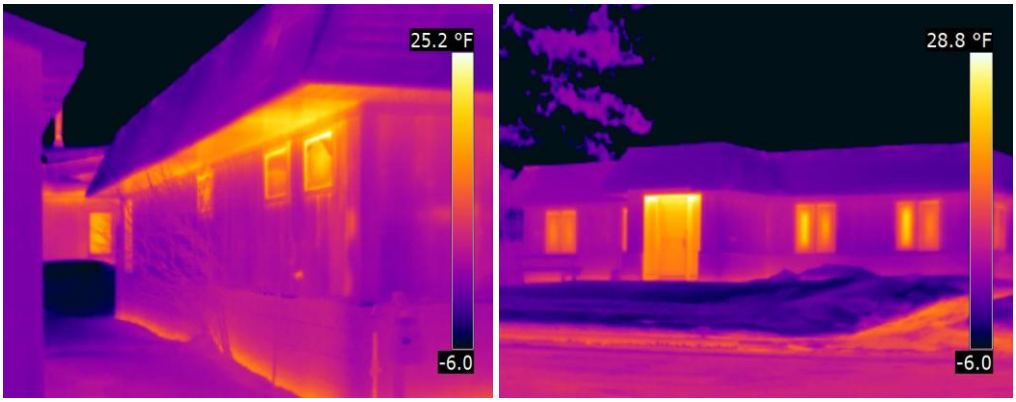
Energy Conservation Measure
Purchase and replace conventional coffee machine with a unit that heats water/coffee during brew and maintains heat by means of insulated carafe and doesn't require electricity beyond brew time. Benefits of thermal carafe unit will include significantly less energy consumption for coffee.

Appliance	Existing Condition	New Condition
Coffee Machine	One coffee machine that draws power throughout the day for heating elements.	Replace one conventional coffee maker with Bunn BT Velocity Brew Drip Coffee Maker with Insulated Carafe

Savings
Energy reduction from thermal carafe style coffee makers: 80%
Overall building energy reduction: 2.1%
Annual savings: $56
Capital investment: $130
Payback: 2.3 years

ECM 9: Attic Insulation

Existing Condition
Thermographic inspection of the Learning Center revealed that there are air sealing and insulation deficiencies. Weatherization deficiencies found include insufficient attic insulation. Insufficient insulation contributes to building heat loss and consequently increase energy consumption and lower occupant comfort.



Energy Conservation Measure
Improve building's weatherization by increasing resistance to heat loss during winter months and heat gain during summer months through improved insulation.

Weatherization Component	Existing Condition	New Condition
Attic insulation	R20 fiberglass batts	Air seal attic deck and meet R60 of blown cellulous in attic.

Savings
Heating & cooling energy reduction: 8.4%
Overall building energy reduction: 4.3%
Annual savings: $122
Capital investment: $1,953
Payback: 17.1 years

Lessons Learned

Lessons learned from this project include the substantial savings that can be gained from no-cost conservation measures, strength of reinvestment of energy savings into energy savings account for sustainability and that newer buildings don't necessarily equate to better performing buildings. It was quickly learned that a large portion of feasible energy reduction can be at low or no-cost using conservation methods. This lesson proved very valuable as the no-cost

conservation measures kick-started a planned energy savings account for continued implementation of energy reduction measures.

Another key lesson learned is the importance of reinvestment to ongoing/sustainable energy reduction and is considered a vital element in lessons learned. The plan in this project calls for 50% of energy savings to be deposited into an energy savings account where it can be drawn from to fund capital expenditures.

Lastly, despite the common notion that newer buildings will out-perform older buildings in terms of energy efficiency, this project provided another example that this isn't always the case. Comparing the newest building in this study, the Mikanuk building on BMCC's campus, to other/older buildings it was learned that this building used substantially more energy per square foot of floor space despite being newer and equipped with energy saving items. Largely due to lack of retrocommissioning, the Mikanuk building's HVAC battles itself and consequently wastes large amounts of energy. The specific problems with this building are described above in the Mikanuk Building Specifics section.