PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

Investigation Report for Riverland Community College – Austin Campus

Minnesota
STATE COLLEGES
& UNIVERSITIES

Riverland
COMMUNITY COLLEGE
A Technical & Community College

3/15/2012

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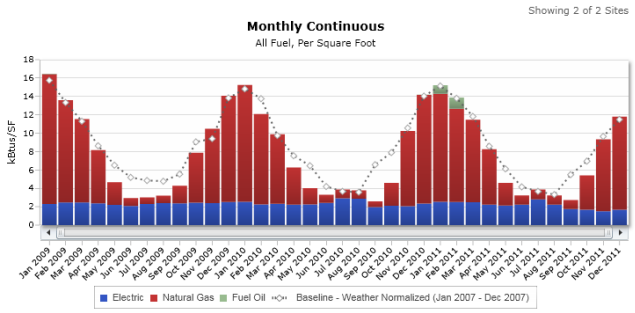
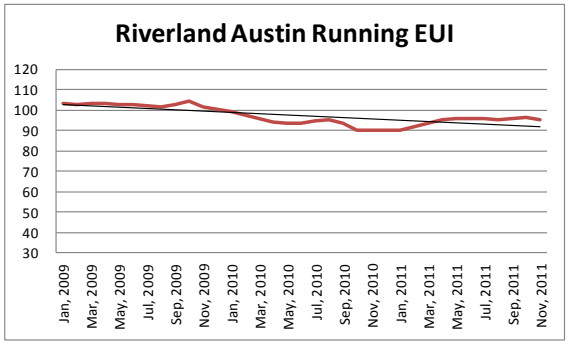
Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of Riverland Community College was performed by Hallberg Engineering, Inc. This report is the result of that information.

Payback Information and Energy Savings				
Total Project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$75,243		Total Project Cost	$173,666
Future costs including Implementation , Measurement & Verification	$98,423		Study and Administrative Cost Paid with ARRA Funds	($81,243)
Total Project Cost	$173,666		Austin Utilities Rebates	($)
			Total costs after co-funding	$92,423
Estimated Annual Total Savings ($)	$27,929		Estimated Annual Total Savings ($)	$27,929
Total Project Payback	6.2		Total Project Payback with co-funding	3.3
Electric Energy Savings	**15.8%**	**and**	**Gas Energy Savings**	**0.1%**





Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	361,379	36,229,328	39,109,437	-2,880,109	-7%	$523,467.48	$0.01
2010	365	361,379	32,540,864	37,176,972	-4,636,108	-12%	$506,003.08	$0.02
2011	365	361,379	33,608,276	36,223,046	-2,614,770	-7%	$470,297.90	$0.01

Riverland Community College Consumption Report

The energy use at Riverland Community College dropped approximately 9% over the period of the investigation.

Summary Tables

Facility Name	Riverland Community College
Location	1900 8th Avenue NW, Austin, MN 55912
Facility Manager	Judy Enright
Number of Buildings Investigated	19
Interior Square Footage Investigated	361,379
PBEEEP Provider	Hallberg Engineering
Study Period	Fall 2010 through Spring 2011
Annual Energy Cost	$470,298 (2011)
Utility Company	Austin Utilities (Electric and Natural Gas), Unknown Utility (Fuel Oil)
Site Energy Use Index (EUI)	Site EUI: 90 kBtu/ft^2 (2011) East Campus EUI: 76 kBtu/ft^2 West Campus EUI: 103 kBtu/ft^2
Benchmark EUI (from B3)	Site Benchmark: 122 kBtu/ft^2 East Campus Benchmark: 115 kBtu/ft^2 West Campus Benchmark: 139 kBtu/ft^2

Buildings Investigated:

The sixteen buildings listed below totaling 356,095 interior square feet at Riverland Community College Austin were investigated.

Building Name	State ID's Included	Area (Square Feet)	Year Built
Administration	E26139C0566	East	15,329
Classroom	E26139C0166	East	46,763
College Center	E26139C0366	East	9,562
Fine Arts	E26139C0466	East	22,850
Gym	E26139C0266	East	29,743
Heating Plant	E26139C0666	East	3,484
Library	E26139C0893	East	31,698
Nursing	E26139C0766	East	8,709
A Building	E26273T0171	West	54,572
B Building	E26273T0271	West	22,307
B Building- Addition #1	E26273T0684	West	7,830
B Building- Addition #2	E26273T0888	West	8,700
B Building- Addition #3	E26273T1191	West	2,700
C Building	E26273T0371	West	31,409
D Building	E26273T0471	West	37,278
E Building	E26273T0571	West	23,161

Mechanical Equipment Included in Investigation: Summary Table			
Total	**East Campus**	**West Campus**	**Equipment Description**
1	1	1	Andover Invensys Building Automation System
16	8	8	Buildings
356,095	168,138	187,957	Interior Square Feet
40	27	13	Air Handlers
168	54	114	VAV Boxes
3	0	3	Rooftop Units
1	0	1	Exhaust Fan
2	0	2	Make-up Air Units
3	1	2	Chillers
1	1	0	Cooling Towers
3	0	3	Steam Boilers (dual fuel- natural gas or fuel oil)
7	4	3	Hot Water Boilers (natural gas)
47	39	8	Pumps (HW, CHW, or CDW)
3	0	3	Heat Exchangers (Steam to HW)
475			Points for trending

Implementation Information			
Estimated Annual Total Savings ($)	4.5% Savings		$27,929
Total Estimated Implementation Cost ($)			$92,423
GHG Avoided in U.S Tons (CO2e)			378
Electric Energy Savings (kWh) (2011 Usage 2,772,680 kWh)	15.8% Savings		439,452
Gas Energy Savings (Therms) (2011 Usage was 235,790 Therms)	0.1 % Savings		277
Statistics			
Number of Measures identified			5
Number of Measures with payback < 3 years			1
Screening Start Date	06/8/2010	Screening End Date	09/24/2010
Investigation Start Date	12/16/2010	Investigation End Date	2/24/2102
Final Report	3/15/2012		

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Riverland Community College Austin Cost Information			
Phase		**To date**	**Estimated Future Cost**
Screening		$5,804	
Investigation [Provider]*		$60,000	
Investigation [CEE]*		$9,439	$1,000
Implementation			$92,423
Implementation [CEE]			$2,500
Measurement & Verification			$2,500
Total		$75,243	$98,423

Co-funding Summary	
Study and Administrative Cost	$81,243
Utility Co-Funding - Estimated Total ($)	$0
Total Co-funding ($)	$81,243

*Some project costs have been prorated between Austin and Owatonna based on square footage.

Riverland Community College Overview

The energy investigation identified 4.5% of total energy savings at Riverland Community College with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at Riverland Community College include adjusting building controls, adding occupancy sensors to many light fixtures and optimizing the run times of the hot water pump on the East Campus and of the air handlers on the west campus. The total cost of implementing all the measures is $92,423.

Implementing all these measures can save the facility approximately $27,929 a year. In addition to the 4.5% savings that these measures will lead to, we note that during the period of the PBEEEP investigation energy use at Riverland Community College decreased approximately 9% compared to the year prior to the study. It is now 26% below the benchmark value according to the Minnesota Benchmarking and Beyond database (B3).

The site is made up of two campuses, West Campus and East Campus, each of which contains a number of buildings. The East campus has eight attached buildings totaling 168,138 square feet and one 2,400 square foot detached building. The West campus has eight attached buildings totaling 187,957 square feet and two small detached buildings. There is a map of both campuses showing the location of each building within the site at the end of the Screening Report.

The East campus has a central hot water boiler plant with two larger boilers that operate during the winter and two smaller condensing boilers that operate during the spring, summer, and fall. Hot water from the boiler plant is sent to the air handlers and baseboard radiation throughout the buildings. The East campus also has a central chilled water plant with one chiller and one cooling tower. The entire East campus is cooled with the chilled water except for the gymnasium, which is not cooled.

The West campus has a central steam boiler plant with three fire-tube boilers that serve the entire campus and operate during the winter. The steam is sent to the air handlers. There are also three smaller condensing hot water boilers (two in Building A, one in Building B) that operate during the spring, summer, and fall to provide reheat. During the winter, heat exchangers transfer heat from steam to hot water that is used in the reheats of Buildings A and B. The West campus has two air-cooled chillers, one that serves Building A and one that serves Building B. The rest of the West campus is not cooled except for portions of Building C, where the rooftops that serve that area have DX cooling.

The East campus has one natural gas meter, one electrical meter, and one fuel oil meter that are currently active. The West campus has two natural gas meters, one electrical meter, and one fuel oil meter that are currently active. There is also one electrical meter for the billboard.

Findings Summary

Site: Riverland CC Austin

Eco #	Building	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
5	WEST CAMPUS (B Bldg)	Duct static pressure is not being reset. AHU 1- 2 Bldg A.	$2,190	$1,125	1.95	$0	1.95	15
11	WEST CAMPUS (B Bldg)	Existing light fixtures are not controlled via occupancy sensors.	$47,260	$15,134	3.12	$0	3.12	206
4	EAST CAMPUS (A Bldg)	AHU hot water circulation pump run time	$3,545	$993	3.57	$0	3.57	14
17	EAST CAMPUS (A Bldg)	Existing light fixtures are not controlled via occupancy sensors.	$37,360	$10,200	3.66	$0	3.66	139
1	WEST CAMPUS (B Bldg)	AHU run time.	$2,068	$478	4.33	$0	4.33	5
		Total for Findings with Payback 3 years or less:	**$2,190**	**$1,125**	**1.95**	**$0**	**1.95**	**15**
		Total for all Findings:	**$92,423**	**$27,929**	**3.31**	**$0**	**3.31**	**378**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Riverland Austin

Type	Finding Type	Findings	Location	for no
a.1 (1)	Time of Day enabling is excessive	2		
a.2 (2)	Equipment is enabled regardless of need, or	2		
a.3 (3)	Lighting is on more hours than necessary.	1	1	
a.4 (4)	OTHER_Equipment Scheduling/Enabling	1	1	
b.1 (5)	Economizer Operation – Inadequate Free		1	
b.2 (6)	Over-Ventilation – Outside air damper failed in	2		
b.3 (7)	OTHER_Economizer/OA Loads	2		
c.1 (8)	Simultaneous Heating and Cooling is present	2		
c.2 (9)	Sensor/Thermostat needs calibration,		2	
c.3 (10)	Controls "hunt" and/or need Loop Tuning or		2	
c.4 (11)	OTHER_Controls	2		
d.1 (12)	Daylighting controls or occupancy sensors		2	
d.2 (13)	Zone setpoint setup/setback are not		2	
d.3 (14)	Fan Speed Doesn't Vary Sufficiently		2	
d.4 (15)	Pump Speed Doesn't Vary Sufficiently		2	
d.5 (16)	VAV Box Minimum Flow Setpoint is higher than		2	
d.6 (17)	Other_Controls (Setpoint Changes)	1	1	
e.1 (18)	HW Supply Temperature Reset is not	1	1	
e.2 (19)	CHW Supply Temperature Reset is not	1	1	
e.3 (20)	Supply Air Temperature Reset is not		2	
e.4 ( )	Supply Duct Static Pressure Reset is not		2	
e.5 (21)	Condenser Water Temperature Reset is not		2	
e.6 (22)	Other_Controls (Reset Schedules)		2	
f.1 (23)	Daylighting Control needs		2	
f.2 (24)	Pump Discharge Throttled		2	
f.3 (25)	Over-Pumping	1	1	
f.4 (26)	Equipment is oversized for load.		2	
f.5 (27)	OTHER_Equipment Efficiency/Load Reduction		2	
g.1 (28)	VFD Retrofit - Fans		2	
g.2 (29)	VFD Retrofit - Pumps		2	
g.3 (30)	VFD Retrofit - Motors (process)		2	
g.4 (31)	OTHER_VFD		2	

h.1 (32)	Retrofit - Motors		2	
h.2 (33)	Retrofit - Chillers		2	
h.3 (34)	Retrofit - Air Conditioners (Air Handling Units,		2	
h.4 (35)	Retrofit - Boilers		2	
h.5 (36)	Retrofit - Packaged Gas fired heating		2	
h.6 (37)	Retrofit - Heat Pumps		2	
h.7 (38)	Retrofit - Equipment (custom)		2	
h.8 (39)	Retrofit - Pumping distribution method		2	
h.9 (40)	Retrofit - Energy/Heat Recovery		2	
h.10 (41)	Retrofit - System (custom)		2	
h.11 (42)	Retrofit - Efficient Lighting		2	
h.12 (43)	Retrofit - Building Envelope		2	
h.13 (44)	Retrofit - Alternative Energy		2	
h.14 (45)	OTHER_Retrofit		2	
i.1 (46)	Differed Maintenance from		2	
i.2 (47)	Impurity/Contamination		2	
i.3 ( )	Leaky/Stuck Damper		2	
i.4 ( )	Leaky/Stuck Valve		2	
i.5 (48)	OTHER_Maintenance		2	
j.1 (49)	OTHER		2	

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**
	• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**
	• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**
	• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**
	• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**
	• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**
	• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**
	• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**
	• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**
	• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**
	• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**
	• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**
	• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**
	• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**
	• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**
	• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**
	• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**
	• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**
	• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**
	• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**
	• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**
	• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**
	• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**
	• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**
	• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**
	• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**
	• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**
	• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**
	• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**
	• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**
	• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**
	• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**
	• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**
	• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**
	• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**
	• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**
	• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**
	• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**
	• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**
	• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**
	• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**
	• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**
	• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**
	• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**
	• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**
	• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**
	• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**
	• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**
	• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**
	• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**
	• Please contact PBEEEP Project Engineer for approval

Findings Summary

Building: EAST CAMPUS (A Bldg)

Site: Riverland CC Austin

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
10	One return fan serves two AHU supply fan	$135	$97	1.39	$0	1.39	1
4	AHU hot water circulation pump run time	$3,545	$993	3.57	$0	3.57	14
17	Existing light fixtures are not controlled via occupancy sensors.	$37,360	$10,200	3.66	$0	3.66	139
1	Hot water system - Control problem - The flow measuring station is not reading accuraterly.	$0	$0	0.00	$0	0.00	0
2	Hot water system - Over pumping	$0	$0	0.00	$0	0.00	0
3	Hot water system - constant flow in a variable volume system.	$0	$0	0.00	$0	0.00	0
5	AHU run time	$0	$0	0.00	$0	0.00	0
6	Optimal start not being utilized.	$0	$0	0.00	$0	0.00	0
7	Inadequate minimum outdoor air ventilation	$0	$0	0.00	$0	0.00	0
8	Set of fixed dampers in outdoor air duct	$0	$0	0.00	$0	0.00	0
9	Return air CO2 reads the same value	$0	$0	0.00	$0	0.00	0
11	Chilled water valve opens during heating mode	$0	$0	0.00	$0	0.00	0
12	Outdoor air damper does not modulate open when the CO2 level is above setpoint	$0	$0	0.00	$0	0.00	0
13	Space pressure does not change or reads a negative number.	$0	$0	0.00	$0	0.00	0
14	The reheat valve modulates even though the DAT is above DAT setpoint	$0	$0	0.00	$0	0.00	0
15	Chilled water supply temperature remains a constant temperature. Does not reset.	$0	$0	0.00	$0	0.00	0
16	Simultaneous cooling and heating.	$0	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$135**	**$97**	**1.39**	**$0**	**1.39**	**1**
	Total for all Findings:	**$41,040**	**$11,290**	**3.64**	**$0**	**3.64**	**154**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: EAST CAMPUS (A Bldg)

FWB Number:	12701	Eco Number:	4
Site:	Riverland CC Austin	Date/Time Created:	3/14/2012

Investigation Finding:	AHU hot water circulation pump run time	Date Identified:	1/19/2011
Description of Finding:	AHU hot water circulation pumps run regardless of call for heat during occupied and/or during unoccupied schedule. AHU's D6A, D6B, B1A, B1B, B2A, B2B, B3A, B3B, E12A, E13, A10, A11, A14, A15, A16, A17, A18, A21, A22		
Equipment or System(s):	Pump, HW distribution	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Equipment is enabled regardless of need, or such enabling is excessive		

Implementer:	Controls Contractor or In-house staff	Benefits:	Energy will be saved by not running the circulating pump during unoccupied times.
Baseline Documentation Method:	By reviewing the pump operation while on site, screen captures, and discussions with building operations staff.		
Measure:	Disable HW circ pump during unoccupied times		
Recommendation for Implementation:	Recommend programming the circulating pumps to shut off when the hot water valve is closed.		
Evidence of Implementation Method:	Trend pump status and hot water valve position of each of the affected AHUs at 15 minute intervals for 2 weeks during each of the heating/swing/cooling seasons.		

Annual Electric Savings (kWh):	15,765	Contractor Cost ($):	$2,565
Estimated Annual kWh Savings ($):	$993	PBEEEP Provider Cost for Implementation Assistance ($):	$980
		Total Estimated Implementation Cost ($):	$3,545

Estimated Annual Total Savings ($):	$993	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.57	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.57	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	14	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	3.5%	Percent of Implementation Costs:	3.8%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: EAST CAMPUS (A Bldg)

FWB Number:	12701	Eco Number:	10
Site:	Riverland CC Austin	Date/Time Created:	3/14/2012

Investigation Finding:	One return fan serves two AHU supply fan	Date Identified:	1/19/2011
Description of Finding:	The return fan serves the supply fans and if only one AHU starts the RA fan should run to a reduced CFM to prevent negative pressure in the space. AHU's B1A, B1B		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Deleted
Finding Type:	Finding Deleted by Provider		

Implementer:	Controls Contractor or In-house staff	Benefits:	Energy will be saved by having the return fan run at a reduced CFM.
Baseline Documentation Method:	By reviewing trend data and the BAS screen.		
Measure:	Verify RA fan/SA fan control		
Recommendation for Implementation:	Recommend reducing speed of the return fan when only one AHU is running.		
Evidence of Implementation Method:	Trend the return fan vsd speed, AHU-B1B supply fan vsd speed and fan status, and the AHU-B1A vsd speed and fan status for two weeks.		

Annual Electric Savings (kWh):	1,544	Contractor Cost ($):	$135
Estimated Annual kWh Savings ($):	$97	PBEEEP Provider Cost for Implementation Assistance ($):	$0
		Total Estimated Implementation Cost ($):	$135

Estimated Annual Total Savings ($):	$97	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.39	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.39	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	1	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.3%	Percent of Implementation Costs:	0.1%

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Findings Details

Building: EAST CAMPUS (A Bldg)

FWB Number:	12701	Eco Number:	17
Site:	Riverland CC Austin	Date/Time Created:	3/14/2012

Investigation Finding:	Existing light fixtures are not controlled via occupancy sensors.	Date Identified:	8/16/2011
Description of Finding:	There are many rooms identified during site investigations that have the potiential to reduce lighting run time with the assitance of occupancy sensors.		
Equipment or System(s):	Interior Lighting	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Lighting is on more hours than necessary		

Implementer:	Controls Contractor or In-house staff	Benefits:	Energy will be saved by reducing the run time hours of light fixtures.
Baseline Documentation Method:	Refer to ECO calculations for field counts of lighting fixture quantities.		
Measure:	Retrofit existing light fixtures with occupancy sensors.		
Recommendation for Implementation:	Recommend retrofitting existing light fixtures identified with occupancy sensors to monitor motion in the space and shut off lighting when the space is not occupied.		
Evidence of Implementation Method:	Test each knew occupancy sensor to ensure that the sensor shuts off lighting when the room is not occupied. Shut off delays will need to be coordinated with facility staff.		

Annual Electric Savings (kWh):	161,897	Contractor Cost ($):	$35,400
Estimated Annual kWh Savings ($):	$10,200	PBEEEP Provider Cost for Implementation Assistance ($):	$1,960
		Total Estimated Implementation Cost ($):	$37,360

Estimated Annual Total Savings ($):	$10,200	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.66	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.66	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	139	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	36.4%	Percent of Implementation Costs:	40.4%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

12701 - Austin East

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	X	AHU's		This was originaly identified as an ECO but later determined to not have energy savings potiential.
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	X	AHU's		See ECO#1
	a.3 (3)	Lighting is on more hours than necessary.	X	Classroom		See ECO#2
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Investigation looked for, but did not find this issue.	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
	b.3 (7)	OTHER_Economizer/OA Loads	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Investigation looked for, but did not find this issue.	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.			Investigation looked for, but did not find this issue.	
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	
	d.6 (17)	Other_Controls (Setpoint Changes)	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.6 (22)	Other_Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping	X	Pumps	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	

PBEEEP State Government

Rev. 2.0 (12/16/2010)

12701 - Austin East

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	
	g.3 (30)	VFD Retrofit - Motors (process)			Investigation looked for, but did not find this issue.	
	g.4 (31)	OTHER_VFD			Investigation looked for, but did not find this issue.	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Investigation looked for, but did not find this issue.	
	h.4 (35)	Retrofit - Boilers			Investigation looked for, but did not find this issue.	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Investigation looked for, but did not find this issue.	
	h.6 (37)	Retrofit - Heat Pumps			Investigation looked for, but did not find this issue.	
	h.7 (38)	Retrofit - Equipment (custom)			Investigation looked for, but did not find this issue.	
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Investigation looked for, but did not find this issue.	
	h.10 (41)	Retrofit - System (custom)			Investigation looked for, but did not find this issue.	
	h.11 (42)	Retrofit - Efficient Lighting			Investigation looked for, but did not find this issue.	
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	
	h.13 (44)	Retrofit - Alternative Energy			Investigation looked for, but did not find this issue.	
	h.14 (45)	OTHER_Retrofit			Investigation looked for, but did not find this issue.	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER			Investigation looked for, but did not find this issue.	

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MAINTENANCE ITEMS

Riverland Community College
AUSTIN EAST CAMPUS
PBEEEP - Findings

Item Number	Location	Description of Item	Recommendations
1	Boiler Plant	Heating Water System - The flow measuring station that allows minimum flow through the bypass valve is not reading accurately.	
2	D6A & D6B Mechanical Room	The hot water supply and return loops serving the Nursing area AHU and radiation loop hot water, the valves are not modulating.	
3	D6A & D6B Mechanical Room	AHU D6B - In the outdoor air duct, there is a set of fixed dampers that are not completely open. The dampers can cause a pressure drop during economizer mode.	Consider removing the set of fixed dampers.
4	D6A, D6B & E12A Mechanical Room	AHU D6A, D6B and E12A - The return air CO2 sensor is reading the same value all of the time. Sensor may be out of calibration or need to be replace	Sensor may be out of calibration or need to be replaced.
5	B1A & B1B Mechanical Room	AHU B1A and B1B - One return fan serves the supply fan for AHU B1A and B1B.	When only one unit is running consider reducing fan speed to prevent a negative pressure in the space.
6	B2A and A21 Mechancial Room	AHU B2A and A21 - The cooling coil valve was 100% open during the heating mode even though chilled water is not available. The cooling valve is a normally closed valve and is energized to open. Consider making a change in the program to keep valve closed when no chilled water is available.	Consider making a change in the program to keep valve closed when no chilled water is available.
7	B2B Mechanical Room	AHU B2B - When the return air CO2 is above setpoint, the outdoor air dampers do not modulate open beyond minimum OA MA setpoint. The program should be reviewed.	The program should be reviewed.

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MAINTENANCE ITEMS

Riverland Community College
AUSTIN EAST CAMPUS
PBEEEP - Findings

Item Number	Location	Description of Item	Recommendations
8	All AHU's	The space static pressure ranges from a negative number to zero or not reading and pressure.	Re-calibrate space pressure sensors.
9	SAU B7 & B8 Mechanical Room	SAU B7 and B8 - The pre-cooling coil valve modulates, the cooling valve is 100% open and the heating coil valve modulates all at the same time to maintain supply air temperature setpoint.	The program should be reviewed to prevent simultaneous cooling and heating.
10	Chiller	Chiller graphic - The chilled water supply temperture is linked to the chilled water return temperature and the chilled water return temperature is linked to the chilled water supply temperature.	Verify and re-link through the BAS.
11	AHU B3B, E12B and SAU B7 Mechanical Room	AHU B3B, E12B and SAU B7 - The reheat valve is modulating even though the discharge air temperature is below setpoint.	The program should be reviewed to see why the reheat valve is modulating.

Findings Summary

Building: WEST CAMPUS (B Bldg)

Site: Riverland CC Austin

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
5	Duct static pressure is not being reset. AHU 1- 2 Bldg A.	$2,190	$1,125	1.95	$0	1.95	15
11	Existing light fixtures are not controlled via occupancy sensors.	$47,260	$15,134	3.12	$0	3.12	206
1	AHU run time.	$2,068	$478	4.33	$0	4.33	5
2	During unoccupied heating mode the steam valve modulates to far open and the discharge air temperat	$0	$0	0.00	$0	0.00	0
3	Humidity setpoint is 30% but the supply air humidity was 12.83%.	$0	$0	0.00	$0	0.00	0
4	Overheating during uoccupied heating mode.	$0	$0	0.00	$0	0.00	0
6	Simultaneous heating and cooling. AHU 1 Bldg B	$0	$0	0.00	$0	0.00	0
7	Duct static pressure setpoint is not being maintained. AHU 1 Bldg B	$0	$0	0.00	$0	0.00	0
8	Duct static pressure setpoint is not being reset. RTU 1 Bldg B.	$0	$0	0.00	$0	0.00	0
9	Cooling valve is open even though it is not enabled. AHU 1 Bldg B.	$0	$0	0.00	$0	0.00	0
10	Supply air temperature below setpoint	$0	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$2,190**	**$1,125**	**1.95**	**$0**	**1.95**	**15**
	Total for all Findings:	**$51,518**	**$16,737**	**3.08**	**$0**	**3.08**	**226**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: WEST CAMPUS (B Bldg)

FWB Number:	12702	Eco Number:	1
Site:	Riverland CC Austin	Date/Time Created:	3/14/2012

Investigation Finding:	AHU run time.	Date Identified:	3/15/2011
Description of Finding:	Air handling unit (Area A, AHU-2) occupied schedules significantly differ from class schedules/observed usage for the campus.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	Controls contractor - The Riverland controls contractor who works on this campus estimated the cost for implementation.	Benefits:	Reducing the occupied schedule/run time of the equipment will save fan and heating/cooling energy.
Baseline Documentation Method:	By reviewing the AHU programmed occupied schedule, trend data and comparing it with the posted class schedules it was determined that the AHU starts earlier than the class schedule. Based on discussions with building operations staff there are potiential opportunities to reduce the run time of the air handling equipment.		
Measure:	Modify the occupied schedules in the BAS. An Optimal Start sequence should be implemented to maintain building comfort for design heating days.		
Recommendation for Implementation:	Occupied modes for the following AHU's are currently set to: AHU-2 5:45AM-9:00PM (Mon.-Thu.) 5:45AM-6:00PM(Fri.) 6:45AM-2:30PM(Sat.). Proposed occupied modes for the following AHU's: AHU-2 7:00AM-9:00PM (Mon.-Thu.) 7:00AM-6:00PM(Fri.) 7:00AM-2:30PM(Sat.). Recommend adjusting the occupied schedules in the BAS and implementing an Optimum Start sequence for the air handling unit. The prime purpose of the optimum start sequence would be to maintain buliding comfort at low temperatures. The optimum start sequence should use an algorithm for morning start-up. This algorithm shall minimize the unoccupied warm-up period while still achieving comfort conditions by the start of scheduled occupied period.		
Evidence of Implementation Method:	The supply fan status, MAT, RAT, DAT, OAT, VFD speed, heating valve and cooling valve will be trended for 15 minute intervals for one week during the summer and winter to verify it is following the schedule specified in the Recommendation for Implementation section of the Findings Workbook. All space temperatures will be trended for one week as well during peak heating season and peak cooling season to assure spaces are warming up or cooling down to the desired setpoints before occupancy of the building.		

Annual Electric Savings (kWh):	3,714	Annual Natural Gas Savings (therms):	277
Estimated Annual kWh Savings ($):	$234	Estimated Annual Natural Gas Savings ($):	$244
Contractor Cost ($):	$108		
PBEEEP Provider Cost for Implementation Assistance ($):	$1,960		
Total Estimated Implementation Cost ($):	$2,068		

Estimated Annual Total Savings ($):	$478	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	4.33	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	4.33	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	5	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	1.7%	Percent of Implementation Costs:	2.2%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: WEST CAMPUS (B Bldg)

FWB Number:	12702	Eco Number:	5
Site:	Riverland CC Austin	Date/Time Created:	3/14/2012

Investigation Finding:	Duct static pressure is not being reset. AHU 1- 2 Bldg A.	Date Identified:	3/29/2011
Description of Finding:	The supply fan modulates to maintain duct static pressure setpoint. Fan trend data and BAS screens indicate that the supply fan is setup to maintain the constant duct static pressure setpoint.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Reset Schedules)
Finding Type:	Supply Duct Static Pressure Reset is not implemented or is sub-optimal		

Implementer:	Controls contractor - The Riverland controls contractor who works on this campus estimated the cost for implementation.	Benefits:	Energy savings by allowing the supply fan to modulate for desired airflow.
Baseline Documentation Method:	By reviewing the BAS setpoints and duct static pressure trend data.		
Measure:	Make program changes to reset the duct static pressure based on the airflow needs of the VAV boxes.		
Recommendation for Implementation:	Currently the BAS is programmed to maintain a constant static pressure in the duct of 1". Recommend programming the BAS to implement a static pressure reset based on polling VAV box damper positions. The static pressure reset sequence should use a PID loop to poll VAV damper position. When more than (3, adj.) boxes are at their minimum damper position the duct static pressure shall be reset to a point where the supply fan can maintain air flow requried at the minimum VAV boxes.		
Evidence of Implementation Method:	The supply fan speed, supply fan status, all VAV box damper positions, and duct static pressure shall be trended for 15 minute intervals for one week in the heating and cooling seasons to verify the sequence is operating as intended.		

Annual Electric Savings (kWh):	17,862	Contractor Cost ($):	$1,230
Estimated Annual kWh Savings ($):	$1,125	PBEEEP Provider Cost for Implementation Assistance ($):	$960
		Total Estimated Implementation Cost ($):	$2,190

Estimated Annual Total Savings ($):	$1,125	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.95	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.95	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	15	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	4.0%	Percent of Implementation Costs:	2.4%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: WEST CAMPUS (B Bldg)

FWB Number:	12702	Eco Number:	11
Site:	Riverland CC Austin	Date/Time Created:	3/14/2012

Investigation Finding:	Existing light fixtures are not controlled via occupancy sensors.	Date Identified:	3/30/2011
Description of Finding:	There are many rooms identified during site investigations that have the potiential to reduce lighting run time with the assitance of occupancy sensors.		
Equipment or System(s):	Interior Lighting	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Lighting is on more hours than necessary		

Implementer:	Controls Contractor or In-house staff, price estiamtes come from 2008 RS MEANS ELECTRICAL. Additional factors were added to the RS MEANS price to represent a more conservative payback.	Benefits:	Energy will be saved by reducing the run time hours of light fixtures.
Baseline Documentation Method:	Refer to document "RCC-AWC ECO#3 Occupancy Sensors" for field counts of lighting fixture quantities.		
Measure:	Retrofit existing light fixtures with occupancy sensors.		
Recommendation for Implementation:	Recommend retrofitting existing light fixtures identified with occupancy sensors to monitor motion in the space and shut off lighting when the space is not occupied.		
Evidence of Implementation Method:	Test each knew occupancy sensor to ensure that the sensor shuts off lighting when the room is not occupied. Shut off delays will need to be coordinated with facility staff.		

Annual Electric Savings (kWh):	240,214	Contractor Cost ($):	$45,300
Estimated Annual kWh Savings ($):	$15,134	PBEEEP Provider Cost for Implementation Assistance ($):	$1,960
		Total Estimated Implementation Cost ($):	$47,260

Estimated Annual Total Savings ($):	$15,134	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	3.12	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	3.12	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	206	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	54.0%	Percent of Implementation Costs:	51.1%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

12702 - Austin West Campus

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	X	AHU's		See ECO #1
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	X	AHU's		See ECO #1
	a.3 (3)	Lighting is on more hours than necessary.				See ECO #3
	a.4 (4)	OTHER_Equipment Scheduling/Enabling	X	AHU's		See ECO #1
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Investigation looked for, but did not find this issue.	
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
	b.3 (7)	OTHER_Economizer/OA Loads	X	RTU	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints	X	AHU's	Investigation looked for, but did not find this issue.	Investigated but determined there were no energy savings.
	c.4 (11)	OTHER_Controls	X	AHU's	Investigation looked for, but did not find this issue.	This was originaly identified as an ECO but later determined to not have energy savings potiential.
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Investigation looked for, but did not find this issue.	
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.			Investigation looked for, but did not find this issue.	
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	X	AHU's		See ECO #2
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Investigation looked for, but did not find this issue.	
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	
	d.6 (17)	Other_Controls (Setpoint Changes)			Investigation looked for, but did not find this issue.	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal	X	AHU's	Investigation looked for, but did not find this issue.	Investigated but determined there were no energy savings.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	
	e.6 (22)	Other_Controls (Reset Schedules)			Investigation looked for, but did not find this issue.	
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Investigation looked for, but did not find this issue.	
	f.2 (24)	Pump Discharge Throttled			Investigation looked for, but did not find this issue.	
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	
	f.4 (26)	Equipment is oversized for load.			Investigation looked for, but did not find this issue.	
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Investigation looked for, but did not find this issue.	
	g.1 (28)	VFD Retrofit - Fans			Investigation looked for, but did not find this issue.	

PBEEEP State Government

Rev. 2.0 (12/16/2010)

12702 - Austin West Campus

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
g. Variable Frequency Drives (VFD):	g.2 (29)	VFD Retrofit - Pumps			Investigation looked for, but did not find this issue.	
	g.3 (30)	VFD Retrofit - Motors (process)			Investigation looked for, but did not find this issue.	
	g.4 (31)	OTHER_VFD			Investigation looked for, but did not find this issue.	
h. Retrofits:	h.1 (32)	Retrofit - Motors			Investigation looked for, but did not find this issue.	
	h.2 (33)	Retrofit - Chillers			Investigation looked for, but did not find this issue.	
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Investigation looked for, but did not find this issue.	
	h.4 (35)	Retrofit - Boilers			Investigation looked for, but did not find this issue.	
	h.5 (36)	Retrofit - Packaged Gas fired heating			Investigation looked for, but did not find this issue.	
	h.6 (37)	Retrofit - Heat Pumps			Investigation looked for, but did not find this issue.	
	h.7 (38)	Retrofit - Equipment (custom)			Investigation looked for, but did not find this issue.	
	h.8 (39)	Retrofit - Pumping distribution method			Investigation looked for, but did not find this issue.	
	h.9 (40)	Retrofit - Energy/Heat Recovery			Investigation looked for, but did not find this issue.	
	h.10 (41)	Retrofit - System (custom)			Investigation looked for, but did not find this issue.	
	h.11 (42)	Retrofit - Efficient Lighting			Investigation looked for, but did not find this issue.	
	h.12 (43)	Retrofit - Building Envelope			Investigation looked for, but did not find this issue.	
	h.13 (44)	Retrofit - Alternative Energy			Investigation looked for, but did not find this issue.	
	h.14 (45)	OTHER_Retrofit			Investigation looked for, but did not find this issue.	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Investigation looked for, but did not find this issue.	
	i.2 (47)	Impurity/Contamination			Investigation looked for, but did not find this issue.	
	i.3 ( )	Leaky/Stuck Damper			Investigation looked for, but did not find this issue.	
	i.4 ( )	Leaky/Stuck Valve			Investigation looked for, but did not find this issue.	
	i.5 (48)	OTHER_Maintenance			Investigation looked for, but did not find this issue.	
j. OTHER	j.1 (49)	OTHER			Investigation looked for, but did not find this issue.	

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Kelly Delaney,CxA

MAINTENANCE ITEMS

Riverland Community College
AUSTIN WEST CAMPUS
PBEEEP - Findings - Maintenance Items

Item Number	Location	Description of Item	Recommendations
1	AHU 1, 3 and 4 Bldg A	During unoccupied mode the steam valve modulates to maintain a mixed air temperature setpoint and overshoots the mixed air temperture setpoint.	The PID loop in the program should be adjusted to prevent overshooting the setpoint.
2	AHU 1, 2 and 3 Bldg A	On the graphic page the humidifier was enabled and at 100% but when physically checked it was in standby mode.	Verify communication from the humidifer to the BAS.
3	AHU 1, Bldg B	The outdoor air damper was modulating to maintain mixed air temperature setpoint at the same time the heating valve was modulating to maintain discharge air temperture setpoint.	Consider maintaining discharge air temperature setpoint and add a mixed air low limit to the program.
4	RTU 1, Bldg B	RTU 1 - The duct static pressure is not being reset. The VFD modultes to maintain duct static setpoint.	Make program changes to reset the duct static pressure based on the airflow needs of the VAV boxes.
5	AHU 1, Bldg B	The cooling valve is open in manual operator even though it is not enabled.	Remove point from manual operator.
6	AHU 2, Bldg A	During mechanical cooling the discharge air tempeature was 5 degrees below the discharge air temperature setpoint and the cooling valve was modulating.	The PID loop in the program should be adjusted to prevent overshooting the setpoint.
7	Summer Boiler Bldg B	When the boiler fires, the hot water supply temperature rises 11 degrees over active hot water setpoint.	Review parameters in the boiler controller.

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MAINTENANCE ITEMS

Riverland Community College
AUSTIN WEST CAMPUS
PBEEEP - Findings - Maintenance Items

Item Number	Location	Description of Item	Recommendations
8	VAV Box 002, Bldg A	On the graphics the room temperature read 32 degrees.	Check thermostat.
9	RTU 1, Bldg B	During mechanical cooling the discharge air tempeature was 10 degrees below discharge air temperature setpoint and DX cooling was still at 25%.	Review parameters in the RTU controller for mechanical cooling.

PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

SCREENING RESULTS FOR RIVERLAND COMMUNITY COLLEGE-AUSTIN CAMPUS

September 24, 2010

Minnesota
STATE COLLEGES
& UNIVERSITIES

Riverland
COMMUNITY COLLEGE
A Technical & Community College

Campus Overview

Riverland Community College- Austin Campus	
Location	1900 8th Avenue NW, Austin, MN 55912
Facility Manager	Judy Enright
Number of Buildings	19
Interior Square Footage	361,379
PBEEEP Provider	CEE (Angela Vreeland)
Date Visited	August 5, 2010
Annual Energy Cost	$505,866 (2009)
Utility Company	Austin Utilities (Electric and Natural Gas), Unknown Utility (Fuel Oil)
Site Energy Use Index (EUI)	Site EUI: 104 kBtu/ft^2 (2009) East Campus EUI: 83 kBtu/ft^2 West Campus EUI: 124 kBtu/ft^2
Benchmark EUI (from B3)	Site Benchmark: 122 kBtu/ft^2 East Campus Benchmark: 107 kBtu/ft^2 West Campus Benchmark: 135 kBtu/ft^2

Riverland Community College in Austin, MN is comprised of nineteen buildings ranging in size from 384 to 54,572 interior square feet. The total area of the buildings on the campus is 361,379 square feet. The college has two campuses (East and West) each of which are comprised of a group of attached buildings and a few smaller detached buildings. The East campus has eight attached buildings totaling 168,138 square feet and one 2,400 square foot detached building. The West campus has eight attached buildings totaling 187,957 square feet and two small detached buildings. There is a map of both campuses showing the location of each building within the site at the end of this report.

Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of Riverland Community College in Austin was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on August 5, 2010 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

A detailed investigation of the energy usage and energy savings opportunities of the sixteen buildings listed below totaling 356,095 interior square feet at the Austin Campus of Riverland Community College (CC) is recommended at this time.

Buildings Recommended for Investigation:

Building Name	State ID	Campus	Square Footage	Year Built
Administration	E26139C0566	East	15,329	1966
Classroom	E26139C0166	East	46,763	1966
College Center	E26139C0366	East	9,562	1966
Fine Arts	E26139C0466	East	22,850	1966
Gym	E26139C0266	East	29,743	1966
Heating Plant	E26139C0666	East	3,484	1966
Library	E26139C0893	East	31,698	1993
Nursing	E26139C0766	East	8,709	1966
A Building	E26273T0171	West	54,572	1971
B Building	E26273T0271	West	22,307	1971
B Building- Addition #1	E26273T0684	West	7,830	1984
B Building- Addition #2	E26273T0888	West	8,700	1988
B Building- Addition #3	E26273T1191	West	2,700	1991
C Building	E26273T0371	West	31,409	1971
D Building	E26273T0471	West	37,278	1971
E Building	E26273T0571	West	23,161	1971

Investigation of the three buildings listed below totaling 5,284 square feet is not recommended.

Buildings Not Recommended for Investigation:

Building Name	State ID	Campus	Square Footage	Year Built
Maintenance Shed	E26139C0980	East	2,400	1980
Garage	E26273T0990	West	2,500	1990
Hazardous Waste Building	E26273T1090	West	384	1990

Details obtained through the screening process regarding the buildings recommended for investigation are included in the following:

Energy Use Index B3 Benchmark

The site Energy Use Index (EUI) for both campuses combined is 104 kBtu/sqft, which is 14% lower than the B3 Benchmark of 122 kBtu/sqft. The EUI for the East campus is 83 kBtu/sqft, which is 23% lower than the B3 Benchmark of 107 kBtu/sqft. The EUI for the West campus is 124 kBtu/sqft, which is 8% lower than the B3 Benchmark of 135 kBtu/sqft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks.

Currently, the East and West campus buildings are grouped together in the on-line B3 Benchmarking tool, making it difficult to determine the energy performance of each campus. The EUIs above were calculated by CEE, which has begun the process of dividing the buildings by campus so that the building staff can track the energy use of each campus separately.

Metering

The East campus has one natural gas meter, one electrical meter, and one fuel oil meter that are currently active. The West campus has two natural gas meters, one electrical meter, and one fuel oil meter that are currently active. There is also one electrical meter for the billboard.

Documentation

There is a significant amount of mechanical documentation, including equipment schedules, mechanical plans, balance reports, and control sequences for the East campus and Buildings A and B of the West campus. The mechanical documentation is limited for Buildings C, D, and E of the West campus.

An HVAC Upgrade and Modification Study was done for the West campus in December 2008 by an engineering and architecture firm. The study focused on retrofit measures, including replacing boilers and air handlers. The study provides information about the current operation and sizing of equipment at the West campus.

Mechanical Equipment

The East campus has a central hot water boiler plant with two larger boilers that operate during the winter and two smaller condensing boilers that operate during the spring, summer, and fall. Hot water from the boiler plant is sent to the air handlers and baseboard radiation throughout the buildings. The East campus

also has a central chilled water plant with one chiller and one cooling tower. The entire East campus is cooled with the chilled water except for the gymnasium, which is not cooled.

The West campus has a central steam boiler plant with three fire-tube boilers that serve the entire campus and operate during the winter. The steam is sent to the air handlers. There are also three smaller condensing hot water boilers (two in Building A, one in Building B) that operate during the spring, summer, and fall to provide reheat. During the winter, heat exchangers transfer heat from steam to hot water that is used in the reheats of Buildings A and B. The West campus has two air-cooled chillers, one that serves Building A and one that serves Building B. The rest of the West campus is not cooled except for portions of Building C, where the rooftops that serve that area have DX cooling.

The following table lists the key mechanical equipment in the buildings of both campuses that are recommended for investigation.

Mechanical Equipment Summary Table			
Total	**East Campus**	**West Campus**	**Equipment Description**
1	1	1	Andover Invensys Building Automation System
16	8	8	Buildings
356,095	168,138	187,957	Interior Square Feet
40	27	13	Air Handlers
3	0	3	Rooftop Units
168	54	114	VAV Boxes
1	0	1	Exhaust Fan
2	0	2	Make-up Air Units
3	1	2	Chillers
1	1	0	Cooling Towers
3	0	3	Steam Boilers (dual fuel- natural gas or fuel oil)
7	4	3	Hot Water Boilers (natural gas)
47	39	8	Pumps (HW, CHW, or CDW)
3	0	3	Heat Exchangers (Steam to HW)

Controls and Trending

The East campus is completely controlled by the Andover Building Automation System (BAS). All pneumatic actuators within the East campus were replaced with digital actuators except for the air handlers in the gymnasium and boiler plant, which still have pneumatic actuation. Buildings A and B in the West campus have full DDC actuation and are controlled by the Andover BAS. The remainder of the West campus (Buildings C, D, and E) has pneumatic actuation and controls.

The Andover BAS can be accessed remotely for trend set up and data downloading. Although trending is not currently done, the automation system is capable of trending and the trend data can be exported from the system in csv or Excel format. The points on the automation system for each building are listed in the building summary tables starting on page 7 of this report.

Lighting

A lighting retrofit was conducted in 2004 throughout the East and West campuses, so the majority of indoor lighting is T8 32 watt lamps. The emergency lighting is T8 25 watt lamps. Approximately 5% of the indoor lighting is controlled by occupancy sensors and 95% is controlled by manual switches. The outdoor lighting is controlled by photocells.

Reasons for Recommendation

From a campus-wide standpoint, the main reason for recommending that Riverland Community College in Austin move forward with the investigation is that the annual energy cost is over half a million dollars; it averages $1.40 per square foot; a reduction in this cost should support the cost of the energy investigation and more importantly produce savings that can be used by the College for other purposes.

At Riverland Community College in Austin the buildings exist in two groups of attached buildings (East and West campuses). Since the buildings are attached, investigating only some buildings in each campus is impractical and would neglect interactions between the attached buildings. Therefore, the campuses will each be treated as a building and the three small detached buildings will not be included. Both campuses are recommended to move forward; the following characteristics were important in the decision process:

- Square footage
- Level of control by the building automation system
- Trending capability and remote access to the automation system
- Equipment size and quantity
- Support from the staff and management to include building in an investigation

Building Summary Tables

The following tables are based on information gathered from interviews with facility staff, building walk-throughs, automation system screen-captures, and equipment documentation. The purpose of these tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge.

East Campus*					
Area (sqft)	168,138	Year Built	1966-1993	Occupancy (hrs/yr)	3,484
HVAC Equipment					

Air Handlers (27 total)

Description	Type	Size	Notes
A10	Variable Volume with VFDs on SF and RF	7,800 cfm, 5 HP SF, 2 HP RF	CHW and HW with HW reheat, serves 19 VAV boxes
A11	Variable Volume Multizone System with VFDs on SF and RF	7,400 cfm, 7.5 HP SF, 2 HP RF	Hot and Cold deck with HW reheat in each zone
A14	Variable Volume with VFDs on SF and RF	3,600 cfm, 3 HP SF, 1 HP RF	CHW and HW with HW reheat
A15	Variable Volume with VFDs on SF and RF	2,000 cfm, 2 HP SF, 0.75 HP RF	CHW and HW with HW reheat, serves 2 VAV boxes
A16	Variable Volume with VFDs on SF and RF	3,800 cfm, 5 HP SF, 2 HP RF	CHW and HW, serves 4 VAV boxes
A17	Variable Volume with VFDs on SF and RF	5,600 cfm, 5 HP SF, 2 HP RF	CHW and HW with HW reheat, serves 2 VAV boxes
A18	Variable Volume with VFDs on SF and RF	4,500 cfm, 5 HP SF, 2 HP RF	CHW and HW with HW reheat, serves 15 VAV boxes
A21	Variable Volume with VFDs on SF and RF	7,000 cfm, 7.5 HP SF, 3 HP RF	CHW and HW with HW reheat, serves 3 VAV boxes
A22	Variable Volume with VFDs on SF and RF	10,600 cfm, 7.5 HP SF, 3 HP RF	CHW and HW with HW reheat
B1A	Variable Volume with VFDs on SF and RF	4,300 cfm, 5 HP SF, 5 HP RF	CHW and HW with HW reheat, RF shared with B1B

*NOTE: The East Campus is comprised of Administration, Classroom, College Center, Fine Arts, Gymnasium, Heating Plant, Library, and Nursing.

HVAC Equipment- East Campus, Continued

Air Handlers (Continued)

Description	Type	Size	Notes
B1B	Variable Volume with VFDs on SF	3,300 cfm, 5 HP SF	CHW and HW with HW reheat
B2A	Variable Volume with VFDs on SF and RF	5,800 cfm, 5 HP SF, 7.5 HP RF	CHW and HW with HW reheat, RF shared with B2B
B2B	Variable Volume with VFDs on SF	6,600 cfm, 5 HP SF	CHW and HW with HW reheat
B3A	Variable Volume with VFDs on SF and RF	2,700 cfm, 2 HP SF, 5 HP RF	CHW and HW with HW reheat, RF shared with B3B
B3B	Variable Volume with VFDs on SF	5,800 cfm, 5 HP SF, 5 HP RF	CHW and HW with HW reheat
B4	Variable Volume with VFD on SF	3,000 cfm, 2 HP SF	CHW and HW with HW reheat
B5	Variable Volume with VFD on SF	3,000 cfm, 2 HP SF	CHW and HW with HW reheat
D6A	Variable Volume Multizone System with VFDs on SF and RF	4,200 cfm, 5 HP SF, 5 HP RF	Hot and Cold deck, RF shared with D6B, serves 5 VAV boxes
D6B	Variable Volume Multizone System with VFDs on SF and RF	4,700 cfm, 5 HP SF	Hot and Cold deck, serves 4 VAV boxes
B7	Constant Volume with SF and RF	5,900 cfm, 5 HP SF, 2 HP RF	CHW and HW with CHW precool and HW preheat
B8	Constant Volume with SF and RF	5,900 cfm, 5 HP SF, 2 HP RF	CHW and HW with CHW precool and HW preheat
E12A	Variable Volume with VFDs on SF and RF	6,800 cfm, 5 HP SF, 2 HP RF	CHW and HW with HW reheat
E12B	Constant Volume with SF and RF	4,800 cfm, 5 HP SF, 2 HP RF	CHW and HW with CHW precool and HW preheat
E13	Variable Volume with VFDs on SF and RF	13,000 cfm, 10 HP SF, 5 HP RF	CHW and HW with HW reheat
Gym Unit 7C	Constant Volume with SF	12,000 cfm, 5 HP SF	HW only
Gym Unit 8C	Constant Volume with SF	12,000 cfm, 5 HP SF	HW only
Gym Unit 9C	Constant Volume with SF	4,700 cfm, 2 HP SF	HW only

PBEEEP State Government

HVAC Equipment- East Campus, Continued

VAV boxes

Description	Type	Size	Notes
54 VAV boxes			

Chilled Water System

Description	Type	Size	Notes
C 1	Water-Cooled York Centrifugal Chiller	450 Tons	Enabled when OAT>65F, 44F CHWST setpoint
CT 1	Cooling Tower	450 Tons, 30 HP	2-speed fan, 70F CDWST setpoint
CHP 1	Constant Volume CHWP	900 gpm, 10 HP	Circulates CHW through chiller
CHP 2	Constant Volume CHWP	900 gpm, 20 HP	Circulates CHW to buildings
CHP 7E	Constant Volume CHWP	214 gpm, 5 HP	Secondary CHW pump serves AHU E13A
10 CHWPs	Constant Volume CHWPs	All 1.5 HP or less	Secondary CHW pumps
CSP 1	Constant Volume CDWP	1,350 gpm, 20 HP	Circulates CDW through cooling tower

Hot Water System

Description	Type	Size	Notes
B 1, B 2	HW Water Tube Boilers	8,880 kBtu/hr each	Dual fuel- natural gas or fuel oil, used during winter
B3, B4	HW Condensing Boilers	1,400 kBtu/hr each	Operate during spring, summer, and fall
B3 and B4 HW Pumps	Constant Volume	120 gpm, 1.5 HP each	
HWP 33F, HWP 34F	Variable Volume Secondary Pumps	655 gpm, 40 HP each	
30 HWPs	Constant Volume HWPs	All 1 HP or less	Secondary HW pumps

Points on BAS- East Campus

Air Handlers

Description	Points
A16	RAT, RARH, RA CO2, RF VFD speed, Economizer damper position, OA CO2, MAT, HW valve, CHW valve, SF VFD speed, DAT, DA static pressure, HWST, CHWST, Space temp, Space pressure, Setback setpoint, Set up setpoint, RA reset setpoint, Economizer enable setpoint, Minimum outside air setpoint, CO2 setpoint, Dehumidify setpoint, Duct static setpoint, Space pressure setpoint, Max VFD limit setpoint, Cooling DA setpoint, Heating DA setpoint, Min OA MA setpoint
A10, A14, A15, A17, A18, A21, A22, B1A, B2A, B3A, E12A, E13	Same as A16 (above), but also includes HW reheat valve and Reheat setpoint.
A11	Same as A16 (above), but also includes HW reheat valve, Zone damper, Warm up setpoint, and Reheat setpoint,
B1B, B2B, B3B, B4, B5	Same as A16 (above), but also includes HW reheat valve and Reheat setpoint and DOES NOT include RF VFD speed.
B7, B8, E12B	Same as A16 (above), but also includes Pre-HW valve and Pre-CHW valve and DOES NOT include RF VFD speed and SF VFD speed.
D6A, D6B	Same as A16 (above), but also includes Zone damper and Warm up setpoint.

VAV Boxes

Description	Points
Each unit	DAT from AHU, Percent cooling, HW valve position (not all units), Box flow, Max flow, Min flow, Reheat flow, Room temp, Unoccupied heating setpoint, CFM setpoint, Cooling setpoint, Heating setpoint, HW baseboard radiation valve (not all units)

Chilled Water System

Description	Points
System	Chiller status, CHWST, CHWRT, CDWST, CDRT, Cooling tower valve, Fan speed (high or low), OAT enable setpoint, CDWT setpoint

Hot Water System

Description	Points
System	HWST, HWRT, B1/B2 flow, B1/B2 isolation valve, B1/B2 bypass valve, HW pump speed, B1/B2 OA reset setpoint, B1/B2 OA enable setpoint, B1/B2 flow setpoint, B3/B4 OA reset setpoint, B3/B4 OA enable setpoint, HW loop DP setpoint, B1/B2 night setback setpoint, B3/B4 night setback setpoint, B1/B2 lead, B3/B4 lead, B1/B2 enable, B3/B4 enable

Additional Comments- East Campus

- This building is comprised of offices, classrooms, a gymnasium, an auditorium, a library, a computing center, and laboratories.
- All windows in the building, except the North wing, were replaced recently with double-pane windows.

West Campus*					
Area (sqft)	187,957	Year Built	1971-1991	Occupancy (hrs/yr)	3,796
HVAC Equipment					

Air Handlers

Description	Type	Size	Notes
AHU 1 (Bldg A)	Variable Volume with VFDs on SF and RF	20,000 cfm, 25 HP SF, 10 HP RF	CHW and steam, serves VAV boxes in Building A
AHU 2 (Bldg A)	Variable Volume with VFDs on SF and RF	19,000 cfm, 25 HP SF, 10 HP RF	CHW and steam, serves VAV boxes in Building A
AHU 3 (Bldg A)	Variable Volume with VFD on SF	3,800 cfm, 7.5 HP SF	CHW and steam, serves VAV boxes in Building A
AHU 4 (Bldg A)	Variable Volume with VFD on SF	4,600 cfm, 7.5 HP SF	CHW and steam, serves VAV boxes in Building A
AHU 1 (Bldg B)	Variable Volume with VFDs on SF and RF	16,250 cfm, 25 HP SF, 10 HP RF	CHW and steam, serves VAV boxes in Building B, has PRVs (PV-1 and PV-2) for intake and exhaust
AHU C1/C2	Constant Volume with SF (C1) and RF (C2)	22,800 cfm, 15 HP SF	Steam, serves Building C
AHU C3	Constant Volume with SF	19,525 cfm, 15 HP SF	Steam, serves Building C
AHU D1, AHU D2	Constant Volume with SF	14,500 cfm, 10 HP SF each	Steam, serves Building D
AHU D3, AHU D4	Constant Volume with SF	15,000 cfm, 10 HP SF each	Steam, serves Building D
AHU E3	Constant Volume with SF	9,075 cfm, 5 HP SF	Steam, serves Art Room in Building E
AHU E4	Constant Volume with SF	18,300 cfm, 15 HP SF	Steam, serves Carpentry in Building E

VAV boxes

Description	Type	Size	Notes
78 VAVs (Bldg A)		122-2,130 cfm each	HW reheat coil in all boxes, serve Building A
20 VAVs (Bldg B)		100-4,500 cfm each	14 VAVs have HW reheat coil, served by AHU 1in Building B, the units without heating coils are exhaust units
16 VAVs (Bldg B)		250-2,700 cfm each	HW reheat coil in all boxes, served by RTU 1, serve Building B

*NOTE: The West Campus is comprised of A Building, B Building, B Building- Addition #1, B Building- Addition #2, B Building- Addition #3, C Building, D Building, and E Building.

HVAC Equipment- West Campus, Continued

Rooftop Units

Description	Type	Size	Notes
RTU 1	Variable Volume with VFDs on SF and EF	15,700 cfm, 15 HP SF, 5 HP EF	DX cooling and steam, serves 16 VAV boxes in Building B
RTU C1, RTU C2	Constant Volume with SF and RF	15,000 cfm, 10 HP SF each	DX cooling and steam, serve Building C

Make-up Air Units

Description	Type	Size	Notes
Paint Booth MAU	Constant Volume	7.5 HP SF	Steam, no cooling. Serves paint booth in Building D
Boiler Room MAU	Constant Volume	7.5 HP SF	Steam, no cooling. Serves Boiler Room in Building E

Exhaust Fans

Description	Type	Size	Notes
EF 1	Variable Volume with VFD	10,000 cfm, 15 HP	Exhausts air from fume hoods in Building B

Chilled Water System

Description	Type	Size	Notes
CH 1	Air-cooled Reciprocating Chiller	180 Tons	Enabled when OAT>65F, 44F CHWST setpoint, serves Building A
P 1, P 2	Constant Volume CHWP	360 gpm, 10 HP each	Circulate CHW to Building A
Chiller	Air-cooled Rotary Liquid Chiller	80 Tons	Enabled when OAT>65F, serves Building B
CHWP 1, CHWP 2	Variable Volume CHWPs with VFDs	182 gpm, 5 HP each	Circulate CHW to Building B

Hot Water System

Description	Type	Size	Notes
Boiler 1, Boiler 2	HW Condensing Boilers	223 kBtu/hr output	Used during the summer only for VAV box reheats in Building A
P 3, P 4	Variable Volume HW Pumps with VFDs	120 gpm, 5 HP each	Circulate HW to Building A
HX 1, HX 2	Steam to HW Heat Exchangers	1,220 lbs steam/hr each	Convert steam to HW for Building A
Boiler 1	Condensing HW boiler	300 kBtu/hr input	Used during summer only for VAV box reheats in Building B
HWP 1, HWP 2	Constant Volume HW Pumps	21 gpm, 0.5 HP each	Located in return HW line for Building B
HEX 1	Steam to HW Heat Exchanger	330 lbs steam/hr	Converts steam to HW for Building B
B-1, B-2, B-3	Steam Fire-tube Boilers	5,540 kBtu/hr, 160 BHP each	Provide 8 psi steam to entire West Building, located in Building E, dual fuel (natural gas or fuel oil)

Points on BAS- West Campus

Air Handlers

Description	Points
AHU 1 (Bldg A), AHU 2 (Bldg A)	RAT, RARH, RF speed, Econ damper position, OAT, MAT, Steam valve, CHW valve, SF speed, Humidifier %, DAT, DARH, DSP, DAT setpoint, DSP setpoint, Econ enable setpoint, Morning warm-up setpoint, Min OA setpoint, Humidity setpoint, Night setback setpoint
AHU 3 (Bldg A), AHU 4 (Bldg A)	RAT, RARH, Econ damper position, OAT, MAT, Steam valve, CHW valve, SF speed, Humidifier %, DAT, DARH, DSP, DAT setpoint, DSP setpoint, Econ enable setpoint, Morning warm-up setpoint, Min OA setpoint, Humidity setpoint, Night setback setpoint
AHU 1 (Bldg B)	Building pressure, RA CO2, RARH, RAT, RF speed, RF status, Econ damper position, OA cfm, MAT, 1/3 Steam valve, 2/3 Steam valve, CHW valve, SF speed, SF status, Humidifier %, DAT, DSP, DAT setpoint, DSP setpoint, Building pressure setpoint, RARH setpoint, Min cfm setpoint, Steam valve lockout setpoint, Cooling valve lockout setpoint, Humidifier lockout setpoint, CO2 limit, MAT low limit
AHU C1/C2, AHU C3, AHU D1, AHU D2, AHU D4, AHU E3, AHU E4	*NOTE: There are no points for these units because they are not controlled by the BAS.*

VAV Boxes

Description	Points
Units in Building A	Space temp, Current airflow, Airflow setpoint, Max flow, Min flow, Occupied/unoccupied, Space temp setpoint, Unoccupied heating setpoint, Unoccupied cooling setpoint, Reheat flow
Units in Building B	Space temp, Current airflow, Airflow setpoint, Max flow, Min flow, Occupied/unoccupied, Night heating mode, Night cooling mode, Damper position, HW valve position, Space temp setpoint, Unoccupied heating setpoint, Unoccupied cooling setpoint

Rooftop Units

Description	Points
RTU 1	Building pressure, Average space temp, EF status, EF speed, OAT, OA cfm, Econ damper position, MAT, DX cooling, SF status, SF speed, 1/3 Steam valve, 2/3 Steam valve, DAT, DSP, DAT setpoint, Unoccupied MAT setpoint, DSP setpoint, Building pressure setpoint, Min OA cfm setpoint, Steam valve lockout setpoint, Econ enable setpoint, Morning warm-up setpoint, Unoccupied heating setpoint, Unoccupied cooling setpoint, MAT low limit setpoint
RTU C1, RTU C2	*NOTE: There are no points for these units because they are not controlled by the BAS.*

Points on BAS- West Campus, Continued

Make-up Air Units

Description	Points
MAUs	*NOTE: There are no points for these units because they are not controlled by the BAS.*

Exhaust Fans and Power Roof Ventilators

Description	Points
EF 1	Fan speed, Fan status, Suction pressure
PV 1, PV 2	*NOTE: There are no points for these units*.

Chilled Water System

Description	Points
Building A	OAT, Chiller status, CHWRT, CHWST, P 1 command, P 2 command, Chiller enable setpoint
Building B	OAT, CHWST, CHWRT, CHWP 1 speed, CHWP 2 speed, CHW loop pressure, Chiller lockout setpoint, CHW loop differential pressure setpoint, Lead chiller pump

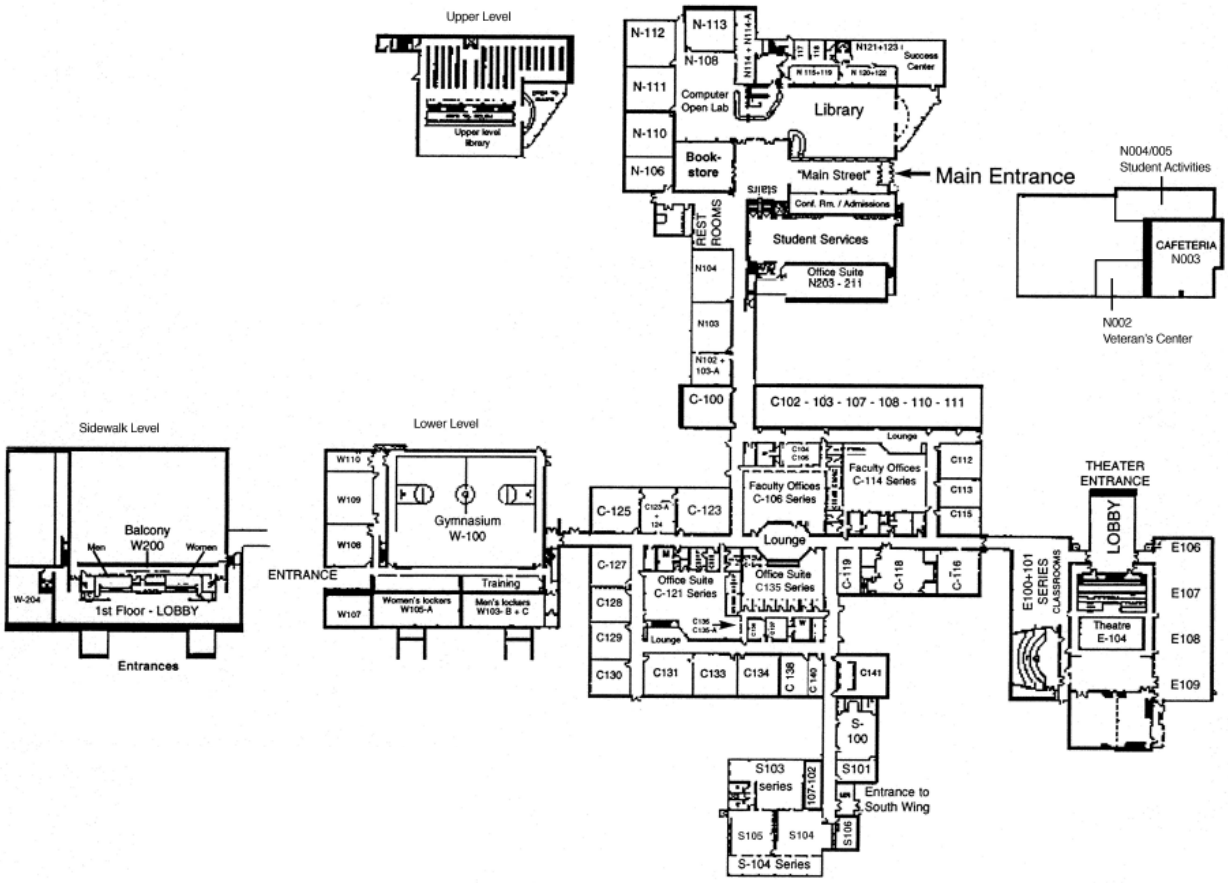
Hot Water System

Description	Points
Building A	Boiler status, Steam system on/off, Differential pressure, HWST, HWRT, P 3 speed, P 4 speed, Changeover valve positions, Valve positions, OAT, Pump enable setpoint, HW reset setpoint, Night setback setpoint, Differential pressure setpoint, HWST setpoint
Building B	Boiler status, HWST, HWRT, HWP 1 status, HWP 2 status, Loop differential pressure, HWST setpoint, HW differential pressure setpoint
B-1, B-2, B-3	*NOTE: There are no points for these units because they are not controlled by the BAS.*

Additional Comments- West Campus

- This building is comprised of offices, classrooms, a computing center, a kitchen/dining area, a maintenance area, warehouse space, and laboratories.

East Campus Map



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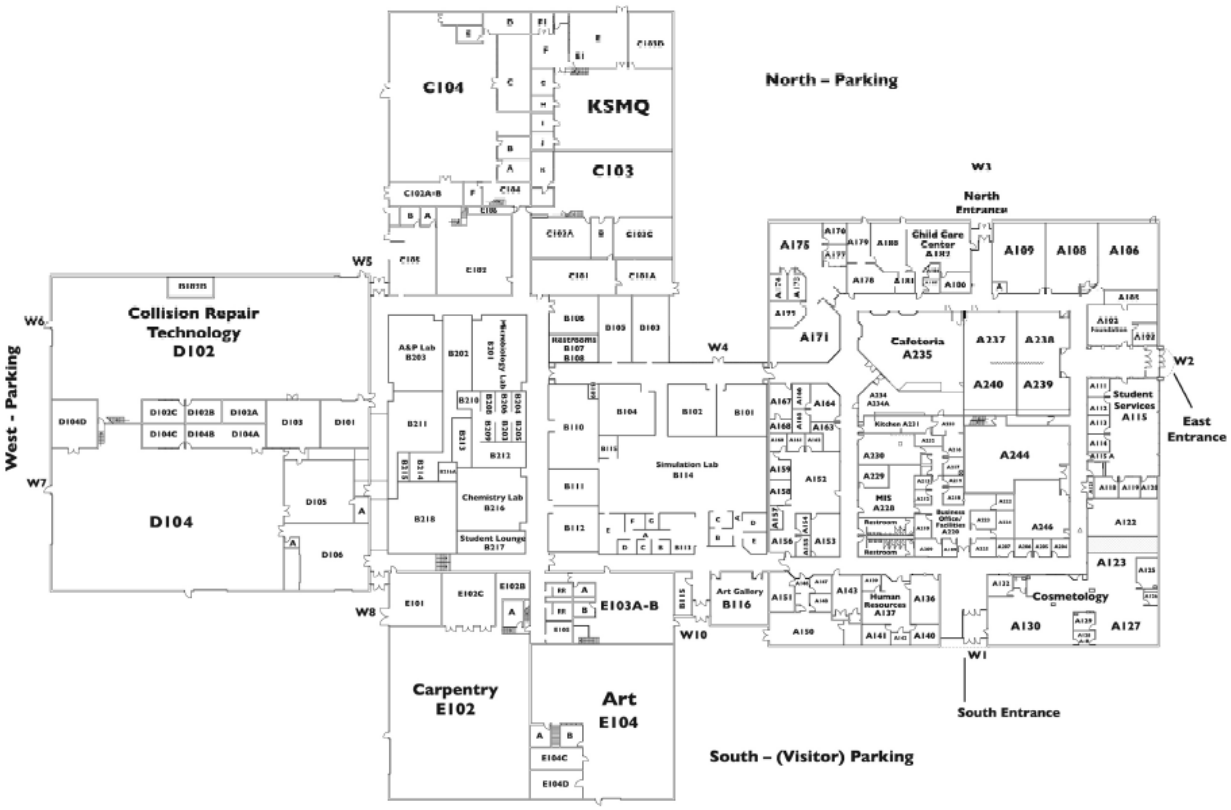
West Campus Map



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PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HP	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
CFM	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH