

## Appendix A2

<b>ECO Energy Summary - Macalester College</b>							
ECO #	Description	Summer Peak Demand Savings (kW)	Annual Energy Savings (kWh)	Annual Heat Energy Savings (MMBTU)	Estimated Other Cost Savings - \$	Total Rebates - \$	Rebate Type: Recommissioning, Custom, or Prescriptive
1	Modify discharge and mixed air reset control on all air-handling units by changing from reset by outside air to reset based on building demand		0	1,152	\$0	\$5,761	Recommissioning
2	Readjust start and end times of air-handler operation to match building occupancy as closely as possible		15,969	-36	\$0	\$552	Recommissioning
3	Provide reset of VAV air-handler discharge static pressure for all AHU's when there is limited cooling demand from the space being served		56,721	0	\$0	\$2,148	Recommissioning
4	Modify control strategy for heating pump operation to allow individual building heating pumps to be energized based on building demand instead of outside air temperature	24.0	14,784	0	\$0	\$1,243	Recommissioning
5	Separate operating schedules of exhaust fans serving rest rooms from air-handlers so that they can be scheduled independently	17.8	-1,076	1,127		\$287	Recommissioning
6	Modify enthalpy/economizer control program to utilize outside vs. return air dry bulb comparison when chilled water for cooling is not available		14,800		\$0	\$676	Recommissioning

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7	Modify control sequence on AHU start-up to keep the OA dampers closed until occupancy, unless the AHU's are in economizer mode and the space is calling for cooling	56.7	7,210		\$0	\$2,807	Recommissioning
8	Modify operation on all air-handler heating valves to allow them to remain under control when the unit is turned off			294		\$1,470	Recommissioning
9	Modify cooling control algorithm to ensure that the outside air dampers on all air-handlers are 90% open before the cooling valve opens		5,038	348	\$0	\$1,538	Recommissioning
10	Connect (14) recirculating domestic hot water pumps to the EMS and program to operate on building occupancy		81,367	336		tbd	Custom
11	Restore night setback/setup control function to all heated/cooled spaces in the academic buildings		-45,754	1,430	\$0	\$3,945	Recommissioning
12	Install occupancy sensors in select areas to control operation of the electronic VAV terminal units and lighting in Campus Center, Kagin and Dayton Halls to allow for reduced operation when the space is vacant	5.4	-4,450	230	\$500	\$3,308	Recommissioning
13	Install occupancy sensors in select areas to control operation of the pneumatic VAV terminal units and lighting in Carnegie, Library, Old Main and 30 Mac to allow for reduced operation when the space is vacant	5.4	-4,450	230	\$500	\$3,308	Recommissioning

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14	Modify chilled water supply software algorithm to allow chilled water pumps in the buildings to energize on building demand rather than when the chiller plant energizes		7,141	0	\$0	\$326	Recommissioning
15	Provide feedback from select academic buildings to allow the chiller plant to be energized based on schedule, demand and outdoor air enthalpy		98,560	0	\$0	\$0	Recommissioning
16	Reset chilled water temperature at the main chiller plant in response to overall campus building space demand	52.5	109,944	0	\$0	\$0	Recommissioning
17	Install a separate DX cooling unit to provide cooling for the laboratory animals and allow the chilled water plant to be energized independently		14,800	0	\$1,000	tbd	Custom
18	Remove inlet vanes and install variable frequency drives (VFD) on supply air-handlers in the Library, Carnegie, & 30 Mac (3 total)	5.5	21,048		\$0	\$2,100	Prescriptive
19	Install variable frequency drives (VFD) and remove inlet vanes on return air fans in Carnegie and Weyerhauser Halls, and Library AHU-3 return fan (5 total)	4.0	15,277		\$0	\$2,350	Prescriptive
20	Install hand-set interval timers for the grill, kitchen and bakery exhaust fans in the Campus Center so that the units operate only as needed	7.4	15,346	1,617	\$0	\$0	Recommissioning

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21	Install a CO <sub>2</sub> sensor in the return air of Campus Center AHU-1 for monitoring and adjusting minimum outside air delivered during occupied periods	3.3	1,891	62	\$0	\$1,200	Recommissioning
22	Install an occupancy sensor in the Game Room of the Campus Center so that the air-handler operates only when the space is occupied		3,708	78	\$0	\$559	Recommissioning
23	Install humidity sensor and controls in the lower level of the Campus Center to allow AHU-1 to cycle on during unoccupied periods only when conditions require humidity control		31,047	503	\$0	\$0	Recommissioning
24	Install variable frequency drives (VFD) on air-handlers serving the Campus Center dining room to operate at reduced speed when the space is marginally occupied	8.9	52,912	461	\$0	\$2,467	Recommissioning
25	Reduce heat loads in the Campus Center Bookstore through lighting improvements and add additional cooling capacity to the Bookstore and Print Shop to allow the discharge air temperature of AHU-2 to be raised from a continuous discharge of 59°		0	185	\$0	\$923	Recommissioning
26	Install controls and a damper in the outdoor air intake of Campus Center make-up air unit MUA-2 to allow use of penthouse relief air for make-up prior to using untempered outside air		-9	635	\$0	\$3,173	Recommissioning

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27	Install a unit heater in Kagin Hall Room 203 to allow air-handler AT-2 to cycle on unoccupied temperature in the main space rather than the small storage room		23,710	366	\$0	\$995	Recommissioning
28	Modify controls to Chapel air-handler S-1 to allow unit to operate only when the space is occupied or on a call for heating/cooling		31,987	323	\$0	\$0	Recommissioning
29	Provide a hot water reset control for the 77 Mac building		0	14	\$0	\$72	Recommissioning
30	Install variable frequency drives (VFD) on exhaust fans serving rest rooms and other spaces in the residence halls to operate at reduced airflow during periods of limited occupancy		18,626			\$850	Recommissioning
31	Reset heating water temperature for the residence halls by using feedback from the occupied spaces			781	\$0	\$3,903	Recommissioning
32	Restore night setback control function to residence halls by applying heating water temperature depression during late night to early morning hours			281	\$0	\$1,404	Recommissioning
33	Provide separate schedules for each of the exhaust/make-up fans in Doty, Dupre and Bigelow Halls so that they can be scheduled independently	7.9	21,962	1,087	\$0	\$5,836	Recommissioning
34	Modify controls to allow cycling of AHU-1 serving Dayton Hall VAV's during periods of low activity or marginal occupancy		6,479	21	\$0	\$403	Recommissioning

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35	Replace existing (32 or 28) watt fluorescent lamps with 25 watt lamps	0.5	1,924	0	\$0	\$100	Prescriptive
36	Install occupancy sensors in the hallways of residence halls that currently operate continuously		6,950	0	\$0	\$500	Prescriptive
37	Provide daylighting sensors to reduce lighting levels in south and west-facing rooms in the Library and Campus Center		7,280		\$0	\$50	Prescriptive
38	Install occupancy sensors to control lighting in rest rooms of Carnegie, Old Main, 77 Mac, Weyerhauser and Doty Halls		5,200	0	\$0	\$500	Prescriptive
39	Install photocells in the Chapel ambulatory area to turn off lights when the ambient level exceeds a certain level		1,310		\$0	\$25	Prescriptive
40	Convert 3-way heating water valves on AHU's to 2-way, install VFD on heating pumps, and provide for pressure control (5 VFD's, 6 controls total)	17.4	90,850		\$0	\$6,960	Recommissioning
41	Insulate remaining bare sections of steam/condensate piping in the attic of Bigelow Hall			178	\$0	tbd	Custom
42	Insulate exterior walls of boilers 1 & 2 in the heating plant, and various steam accessories including valve bonnets			1,688	\$0	tbd	Custom
	Totals	216.71	728,100	13,390	\$2,000	\$61,736	