Estimated Energy Savings and Cost Savings from a Proposed Automatic Shutdown Cycle for Computers at the New Greenfield High School

By Mr. Bowersox's Sustainable Energy Class

Abstract

Computer power output was monitored for at least 24 hours at 7 locations using a WattsUp!-Pro meter. These locations included two teacher computers, two locations in the Windows based computer lab 2042 (3 computers per meter), two locations in Windows based computer lab 1118 (3 computers per meter), and one location in the Mac lab (2 computers per meter). Our data indicate that the Windows based computers automatically shut down at 9pm and restart at 3:30am. The Mac lab computers do not automatically shut down, but use significantly less power while in idle (sleep) mode, compared to the Windows based computers.

To save energy, limit costs, and reduce greenhouse gas emissions, we propose a change in the shutdown cycle for Windows computers from 9pm—3:30am to 5pm—7:30am. We also propose that the same 5pm—7:30am shutdown cycle be applied to the Mac lab computers, which currently do not shutdown. **This proposal will save the school *at least* 10,943KWH/year, amounting to a cost savings of *at least* $2,626/year.**

These estimates are based on the following conservative assumptions: computers are used only during the 180 day school year (week end and summer use is not factored into our calculations), and that the cost of electricity is $0.24/KWH.

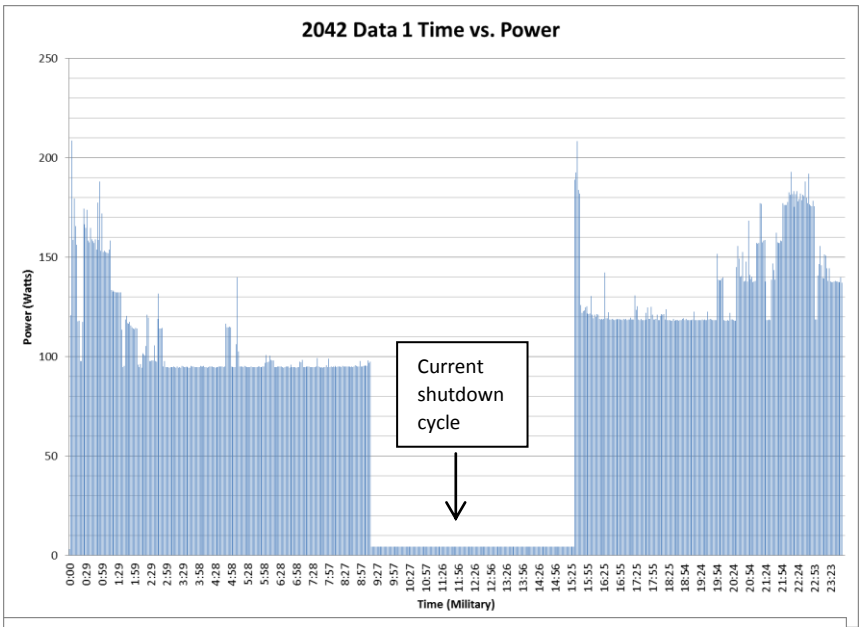
Data and calculations for each of the 7 monitoring locations are presented and summarized in the charts and tables that follow.

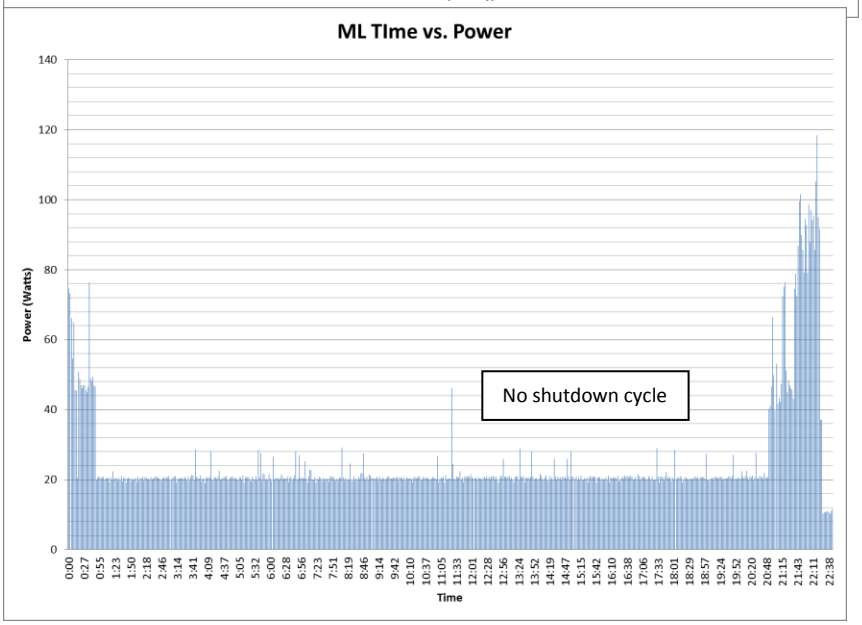
Location	**Total Energy Saved Each Year From a Proposed Shutdown Cycle (KWH)**
Windows Based Computer Labs	5,542 KWH
Mac Computer Lab	639 KWH
Teacher Computers	4762 KWH
Grand Total	10943 KWH

Location	**Total Cost Savings Each Year From a Proposed Shutdown Cycle**
Windows Based Computer Labs	$1330
Mac Lab	$153
Teacher Computers	$1143
Grand Total	$2626

A comparison of energy use and cost between a Windows based computer lab and a Macintosh computer lab

Assumption: Computers are on, in idle mode, for 180 days/year

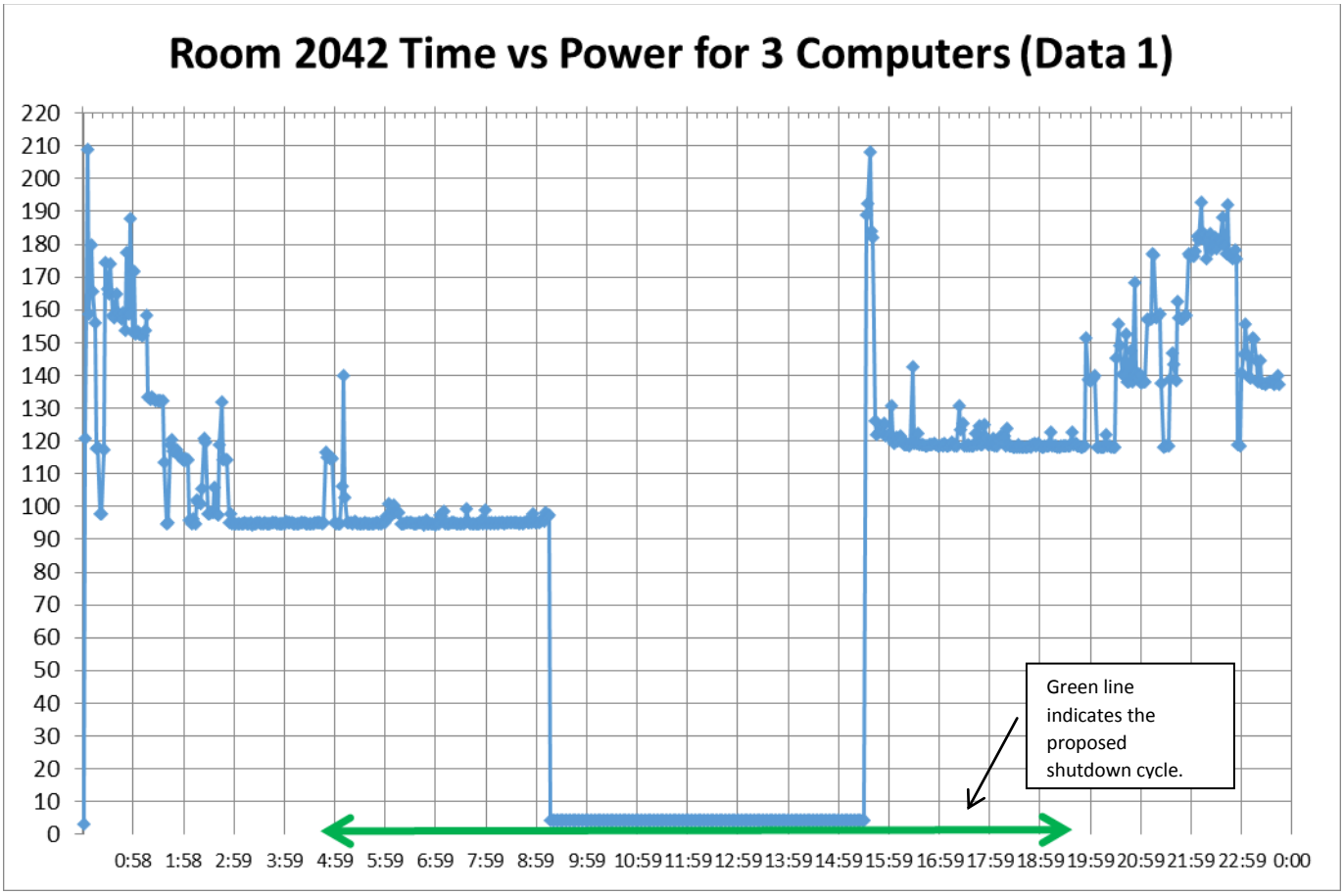




	# of computers	Room 2042 Data 1	# of computers	Mac Lab
Total Energy to run for a day in Watt Hours (3 computers)	3	[(4.4 W)(6 hrs)]+ [(100 W)(18hrs)]= 1,826.4 Whr	2	(20 Watts)(24 Hours)= 480 Whr
Total energy per day in KWH (1 computer)	1	(1826.4Whr)(1KWH/1000 Whr)/3 = 0.61 KWH/ day	1	(480 Whr)(1KWH/ 1000 KWH)/2= 0.24 KWH/day
Total energy per year (1 computer)	**1**	**(0.61 KWH/day)(180 days/ year) = 109.6 KWH/ year**	**1**	**(0.24 KWH/ day)(180 days/year) = 43.2 KWH/ year**
Total energy for the entire lab (27 computers)	27	(109.6)(27 computers) = 2,959 KWH/yr	24	(43.2KWH/yr)(24) = 1037 KWH/yr
Total annual cost for entire Lab	27	(2959KWH/yr)(0.24$/KWH) = $710	24	(1037KWH)($0.24/KWH) = $ 249
Total estimated cost for all labs	108	(4 labs)($710) = $2,840	24	$249

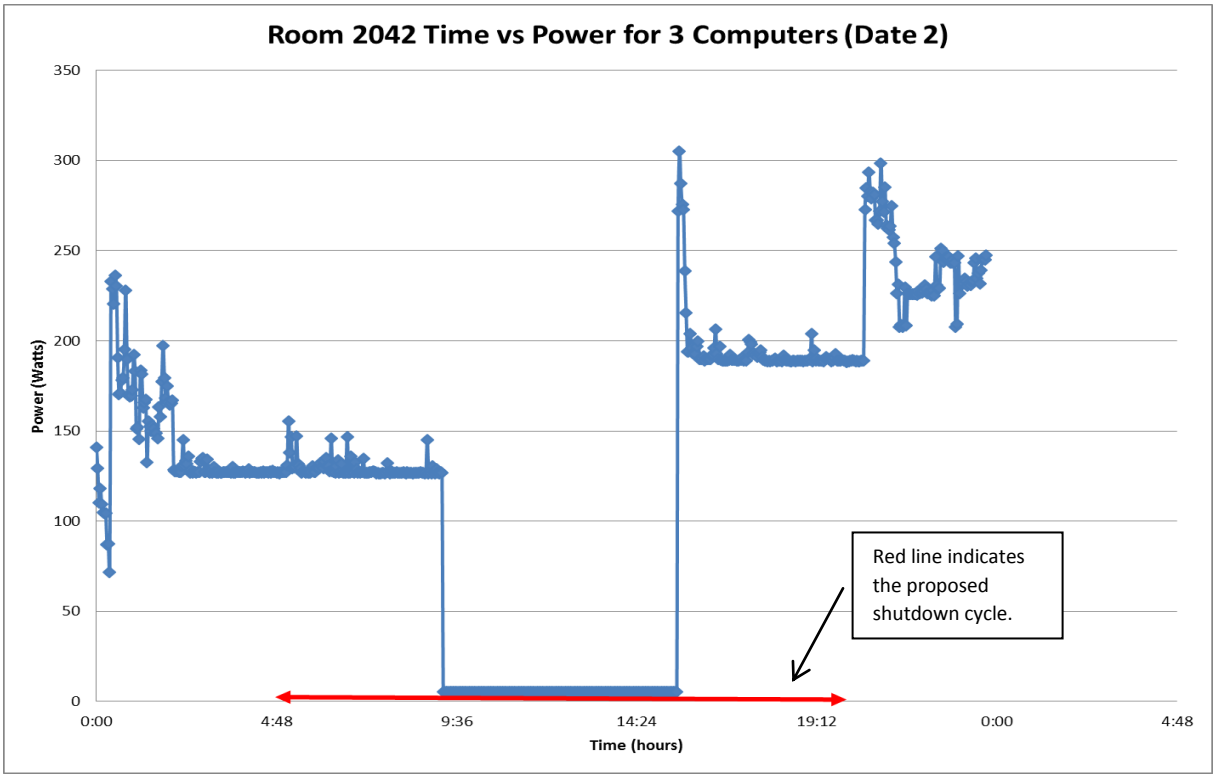
The row highlighted in red shows a direct comparison between a Windows based computer and a Mac computer.

Ben Westerman and Tony Velez

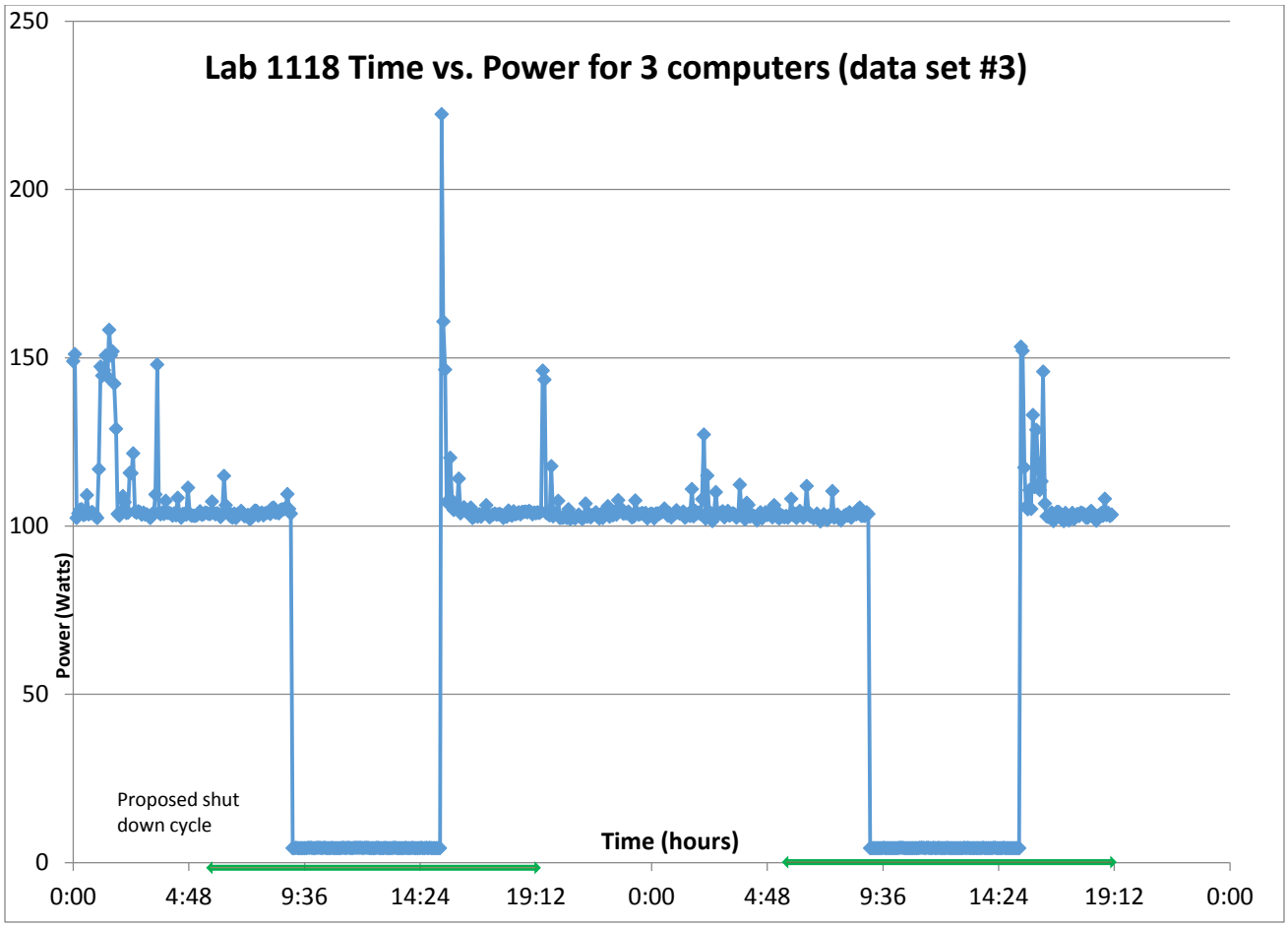


Vampire load under current shutdown cycle (9:16am-3:30am)	(4.4W)(6.24hr) = 27.5 Whr
Vampire load under proposed shutdown cycle (5pm-7:30am)	(4.4w)(14.5hr)=63.8Whr
Total energy use between 5pm and 7:30am under current shutdown cycle	(95w)(4.26hr+4hr)+(4.4w)(6.24hr)= 812.2Wh
Total energy saved each day from proposed shutdown cycle(3 computers)	(812.2Wh-63.8w)= 748.4Wh
Total energy saved each day from proposed shutdown cycle (1 computer)	748.4Whr/3= 249.5Whr
Total energy saved each year from proposed shutdown cycle (1 computer)	(249.5Wh)(180days/yr)=44,910Wh/yr
Computer lab 2042: total energy saved each year from proposed shutdown cycle (27 computers)	(44,910Wh/yr)(27computer/lab)(1KWH/1000wh)= 1212KWH
Annual cost savings from proposed shutdown cycle	1212KWH ($0.24/KWH) = **$291**

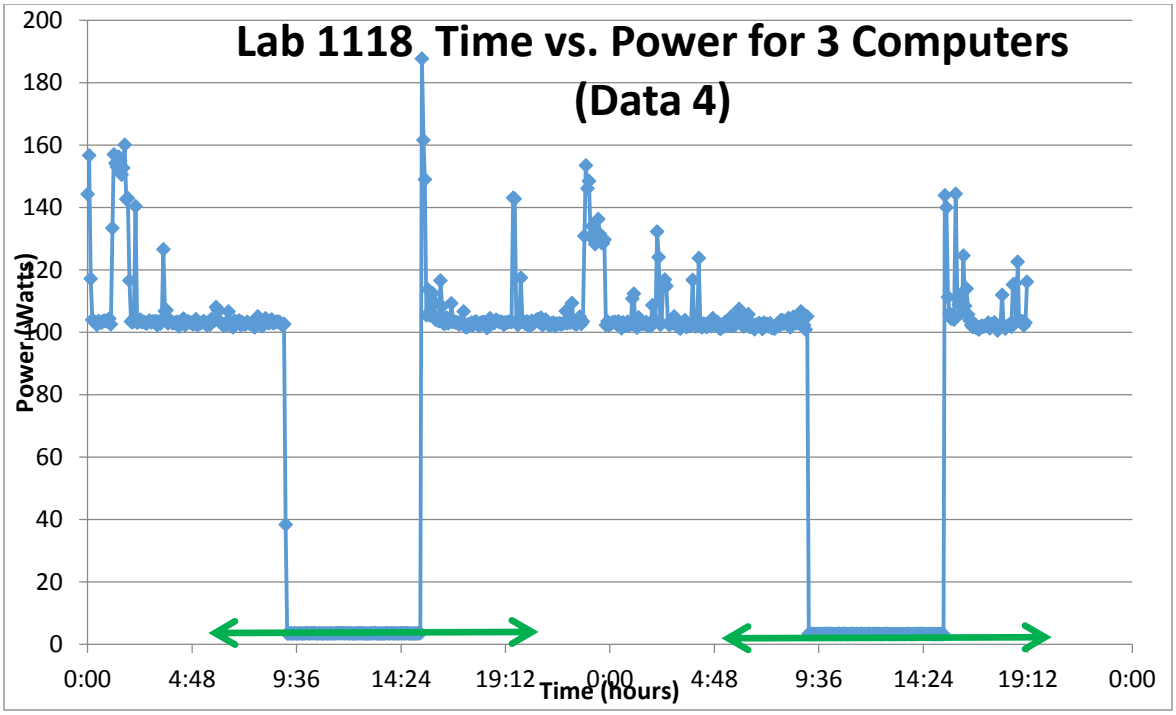
Ethan Joseph, Carlos Gonzalez



Vampire load under current shutdown cycle (9:15pm-3:30am)	(5.27 Watts)(6.25 Hours)=32.9Wh
Vampire load under proposed shutdown cycle (5pm-7:30am)	(5.27 Watts)(14.5 Hours)=76.4Wh
Total Energy use between 5:30pm and 7:30am under current shutdown cycle	((127.4W)(4.25hr+4 hr)+(4.34W)6.25hr)) =1090.25Wh
Total energy saved each day from proposed shut down cycle (3 computers)	(1090Wh – 76.4wh) =1014Wh
Total energy saved each day from proposed shut down cycle (1 computer)	1014Wh/3 = 338Wh
Total energy saved each year from proposed shut down cycle (1 computer)	(338Wh)(180days/year) = 60,831Wh/yr
Computer lab 2042: Total Energy saved each year from proposed shutdown cycle (27 computers**)**	(60831Wh/yr)(27computer/lab)(1KWH/1000Wh) = **1642KWH**
Annual cost savings from proposed shutdown cycle at $0.24/KWH	(1642KWH)($0.24/KWH) = **$394/yr**

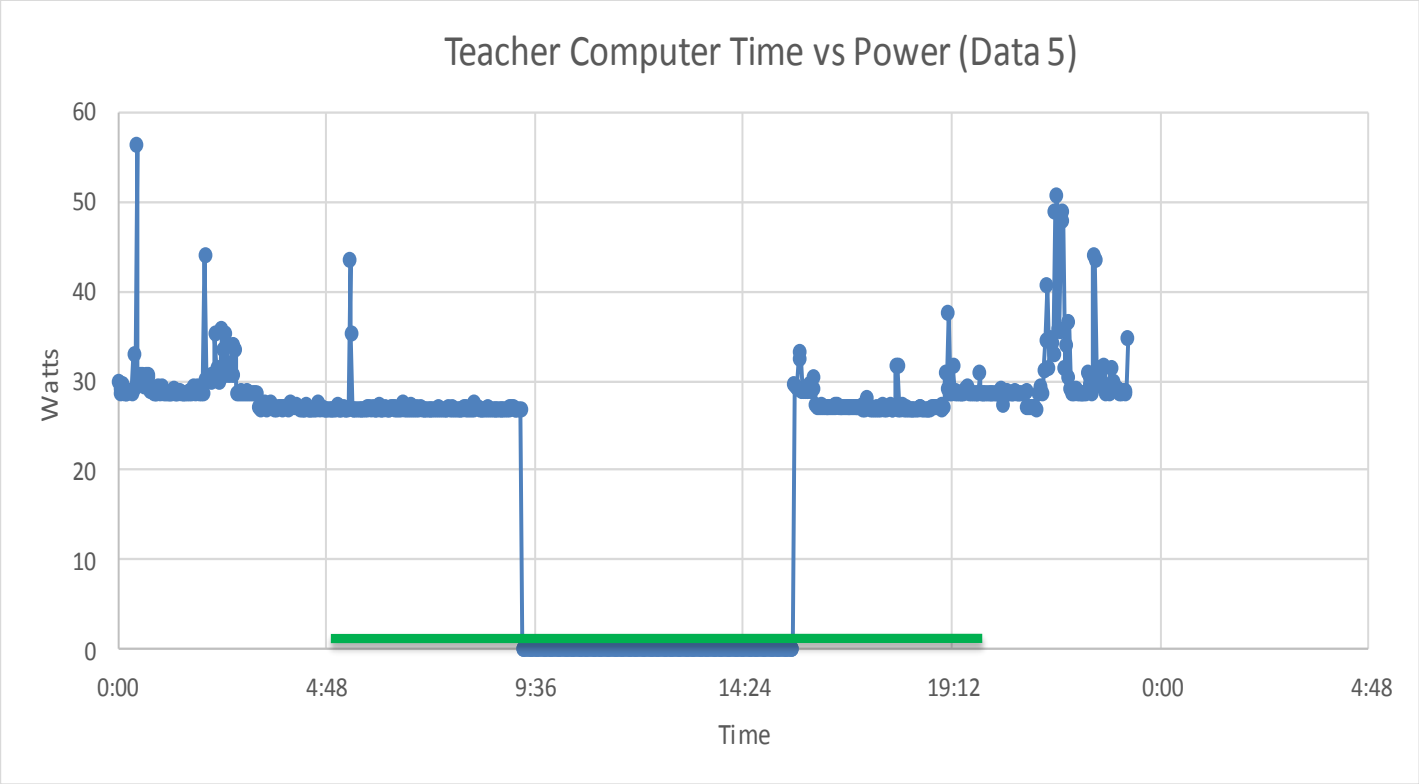


Vampire Load under current shutdown cycle (9pm—3:13am)	(4.34 Watts)(6.22 hours) = 27Wh
Vampire load under proposed shutdown cycle (5pm—7:30am)	(4.34Watts)(14.5 hours) = 63Wh
Total Energy Use between 5pm and 7:30am under current shutdown cycle	((104.8W)(4hr + 4.28hr) + (4.34W)(6.22hr))= 895Wh
Total energy saved each day from proposed shutdown cycle (3 computes)	(895Wh – 63Wh) = 832Wh
Total energy saved each day from proposed shutdown cycle (1 computer)	832Wh/3 = 277Wh
Total energy saved each year from proposed shutdown cycle (1 computer)	(277Wh)(180days/year) = 49,908Wh/yr
Computer lab 1118: Total energy saved each year day from proposed shutdown cycle (27 computers)	(49,908Wh/yr)(27computer/lab)(1KWH/1000Wh) = **1348KWH**
Annual cost savings from proposed shutdown cycle at $0.24/KWH.	(1348KWH)($0.24/KWH) = **$323/yr**



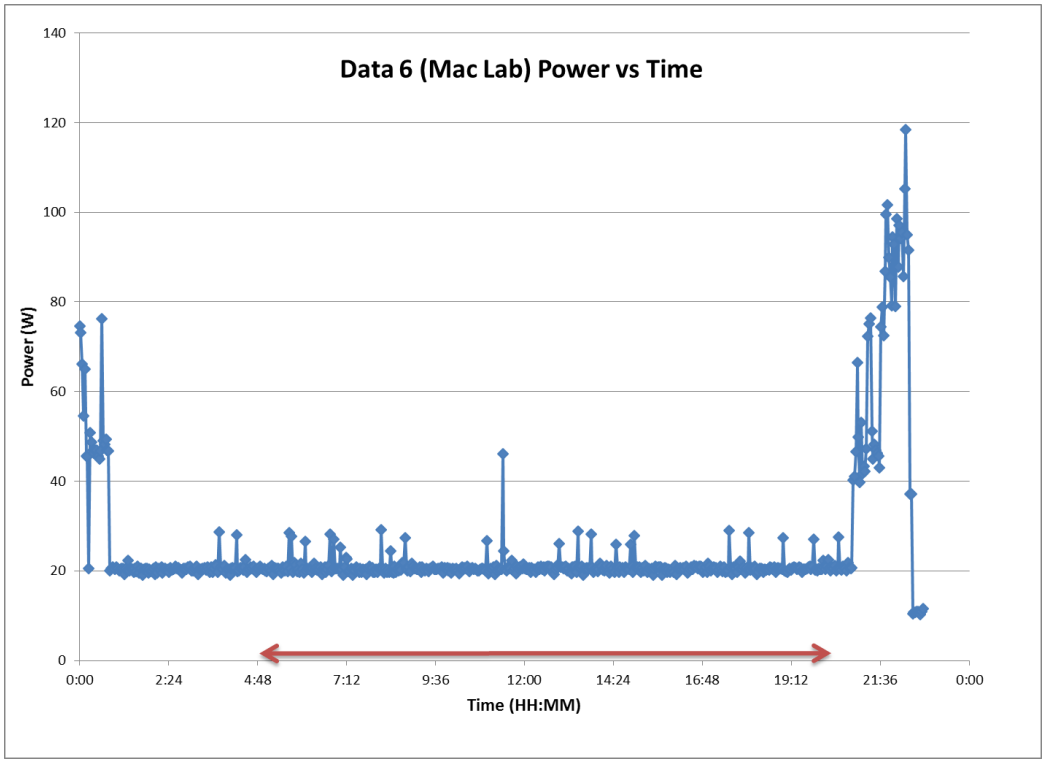
Vampire load current shut down cycle. (9:10pm-3:17am)	(3.5 Watts)(6.11 hours) = 21.39Wh
Vampire load under proposed shutdown cycle (5pm to 7:30am)	(3.5 Watts)(14.5 hours) = 50.75Wh
Total energy use between 5pm and 7:30am under current shutdown cycle.	((103.3W)(4.17hr + 4.22hr) + (3.5W)(6.11hr)) = 877.75Wh
Total energy saved each day from proposed shutdown cycle (3 computers)	(877.75Wh - 50.75Wh) = 827.00Wh
Total energy saved each day from proposed shutdown cycle (1 computer)	827.Wh/3 = 275.67
Total energy saved each year from proposed shutdown cycle (1 computer)	(275.67Wh)(180days/year) = 49,620Wh/yr
Computer lab 1118: total energy saved each year day from proposed shutdown cycle (27 computers)	(49,620Wh/yr)(27 computer/lab)(1KWH/1000Wh) = **1340KWH**
Annual cost savings from proposed shutdown cycle at 40.24/Kwh.	(1340KWH)($0.24/KWH) = **$322/yr**

Caleb Eagles and Zach Pyfrom



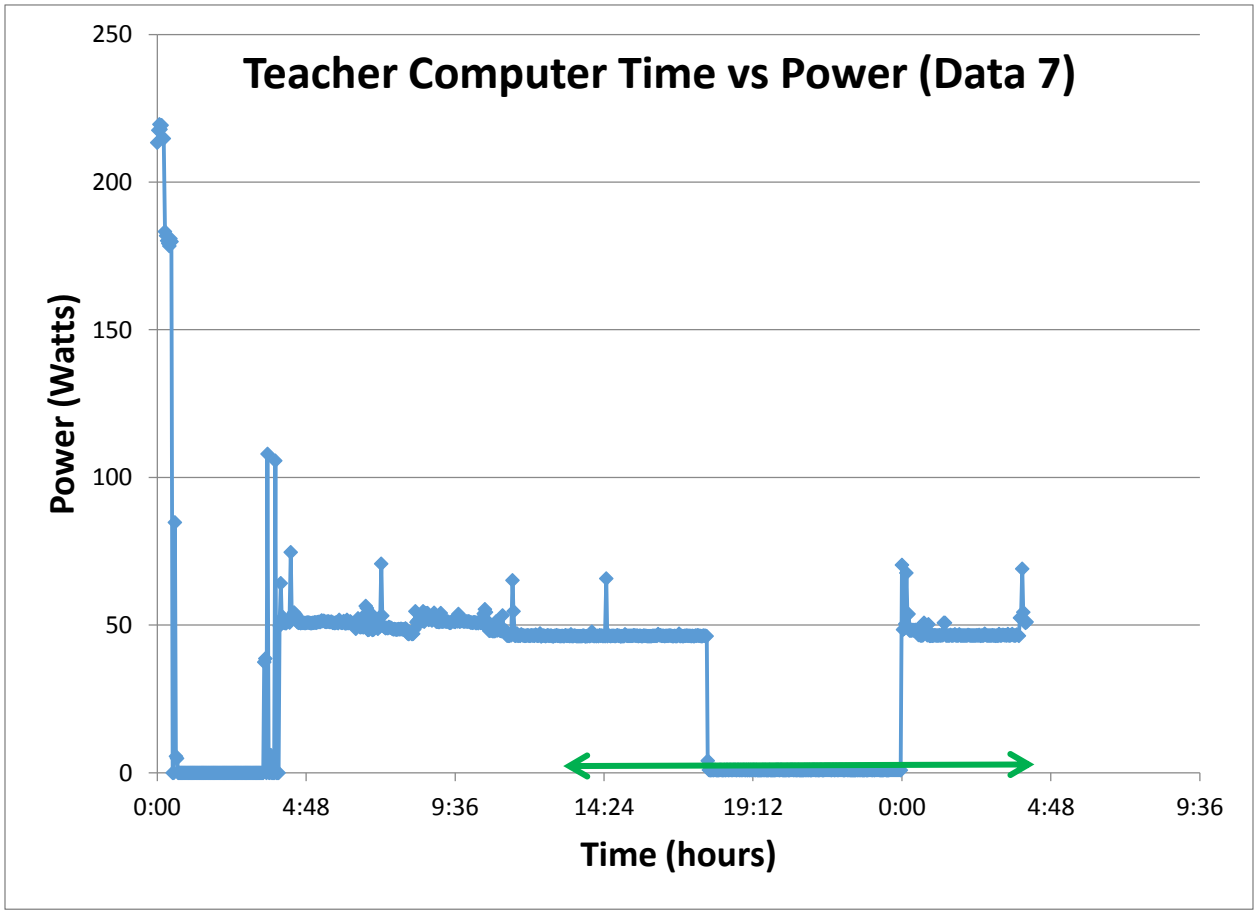
Total energy used between 5pm and 7:30am under current shutdown cycle	45.4 Watts (4.30 hours + 3.97 hours) =375.458 Wh
Total energy saved each day from proposed shutdown cycle	375.458 Wh
Total energy saved each year from proposed shutdown cycle (1 computer)	375.458 Wh (180 days / 1 year) = 67582 Wh/yr
Teacher computers; total energy saved each year from proposed energy shutdown cycle (72 computers)	67582.44 Wh/yr (72 computers)(1KWH/1000WH) = **4866 Wh/yr**
Total annual cost saved from proposed shutdown time	4865935.68 Wh/yr (1 kwh / 1000 Wh) ($0.24 / 1 KWH) **=$1168 per year**

Parker Brown



Vampire Load under current shutdown cycle	N/A (No current shutdown cycle)
Vampire Load under proposed shutdown cycle (5pm-7:30am) per computer	0W
Total Energy Use between 5pm and 7:30am (the proposed shutdown period)	(20W)(14.5hr)=148Wh
Total Energy saved each day from proposed shutdown (1 computer)	**148Wh**
Total Energy saved each year from proposed shutdown cycle (1 computer)	(148Wh)(180days/year) = 2,6640Wh/year
Total money saved each year from proposed shutdown cycle (1 computer)	(2,6640Wh)(1KWH/1000Wh)($0.24/KWH)=$6.39
Total money saved each year for entire Mac Lab (24 computers)	**($6.39)(24computers) = $153.36**

Griffin Ragoza and Dylan Phillips



Vampire load under current shutdown conditions (9pm-3:00am)	(1Wx6hr) = 6Whr
Vampire load under proposed shutdown cycle (5pm-7:30am)	(1Wx14.5) = 14.5Wh
Total Energy Use between 5pm and 7:30am under current shutdown cycle	((46W)(8hr) + (1W)(6hr) = 374Wh
Total energy saved each day from proposed shut down cycle (1 computer)	374Whr – 14.5Wh = 339.5Wh
Total energy saved each year from proposed shutdown cycle (1 computer)	(359.5Whr)(180days/1year) = 64,710Wh/year
All teacher computers; total energy saved each year from proposed energy shutdown cycle (72 computers)	(64710Whr/year)(1KWhr/1000W)(72 computers) = **4,659KWH/year**
Total annual cost saved from proposed shutdown time	(4,659KWH/year)($0.24/1Kwhr) = **$1,118/year**