Swarthmore College Energy Use Status Report For 2014

- Progress on energy savings and cost avoidance
- Growth of Campus-Energy Intensity
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- Carbon Contribution
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Year Blds. Added

2000	**Total Gross Sq. Ft.***		**1,238,593**
2001	Mullan Tennis & Fitness Center	28,275	1,266,868
2003	Chiller Plant	4,415	1,271,283
2003	Kyle House	5,010	1,276,293
2004	Science Center	130,346	1,406,639
2004	Alice Paul	30,321	1,436,960
2004	Septa Station	7,050	1,444,010
2007	Lang Center	9,624	1,453,634
2007	David Kemp	23,226	1,476,860
2010	Wister Education Center	5,200	1,482,060
2013	101 S. Chester Road	32,703	1,514,763
2014	Matchbox	21,000	1,535,763
	Increased square footage	**297,170**	

After a decade of renovation and new construction between 1990 and the year 2000 the College had grown to 1,238,593 Gross Square Feet.

From the year 2000 to date we have added an additional 297,170 GSF. The Dana/Hallowell Infill Dorm space slated for completion in 2015 will add an additional 22,716 GSF

* Excludes faculty staff housing

Budget Year	Btu's Per Square Foot	Btu Cost in Dollars per square foot	Square footage
1999-2000	114,510	1.01	1,238,593
2000-2001	121,855	1.45	1,266,868
2001-2002	108,255	1.39	1,266,868
2002-2003	123,792	1.63	1,276,293
2003-2004	110,673	1.51	1,444,010
2004-2005	114,738	1.74	1,444,010
2005-2006	109,738	1.89	1,444,010
2006-2007	109,270	1.73	1,476,860
2007-2008	103,740	1.89	1,476,860
2008-2009	95,930	1.63	1,476,860
2009-2010	94,416	1.54	1,482,060
2010-2011	90,421	1.47	1,482,060
2011-2012	91,654	1.29	1,482,060
2012-2013	99,380	1.09	1,482,060
2013-2014	103,201	1.21	1,535,763

In spite of steady progress in reducing the energy use per square foot we recognized at some point we would hit a plateau. We appear to have hit the low in 2010-11 in terms of energy intensity and have gradually climbed since that point.

It is fair to note that 101 South Chester which is key to the development of Town Center West, while not a particularly efficient building, is not the culprit in determining the increase in energy intensity. It's fuel and electric use on a square foot basis is actually quite low compared with the institution as a whole.

Reduction in the Energy Intensity of the Campus Nets Substantial Savings both Immediate and Ongoing

Year	Gross Square Feet	Dollar Cost for Energy per GSF	BTU Rate of Energy Use per GSF	$ per BTU**	Energy Rate Reduction/ Increase	Potential Cost at 2005 Rate of Energy Use*	Actual Cost	Net Savings
2005	1,444,010	1.74	114,738	0.0000151650	0	$2,514,737.05	$2,514,737.05	-
2006	1,444,010	1.89	109,738	0.0000172228	-5000	$2,854,381.12	$2,729,989.10	$124,392.02
2007	1,476,860	1.73	109,270	0.0000158323	-468	$2,686,908.48	$2,558,859.08	$128,049.40
2008	1,476,860	1.89	103,740	0.0000182186	-5530	$3,089,028.09	$2,792,934.02	$296,094.07
2009	1,476,860	1.63	95,930	0.0000169916	-7810	$2,884,292.15	$2,411,497.31	$472,794.84
2010	1,482,060	1.54	94,416	0.0000163108	-1515	$2,767,885.56	$2,277,630.66	$490,254.90
2011	1,482,060	1.47	90,421	0.0000162573	-3994	$2,767,177.36	$2,180,720.45	$586,456.91
2012	1,482,060	1.29	91,654	0.0000140747	1233	$2,396,698.29	$1,914,509.82	$482,188.47
2013	1,482,060	1.09	99,380	0.0000109680	7726	$1,865,093.32	$1,617,140.00	$249,915.55
2014	1,535,763	1.21	103,201	0.0000117247	3821	$2,066,012.48	$1,853,515.00	$212,497.48
						$25,892,213.90	$22,851,532.49	$3,042,643.64

*(2005 Btu Rate of Energy Use per Sq.Ft X $ per Btu in current year) X GSF in Current Year

**($ Cost of Energy P/SqFt ÷Btu Rate P/SqFt)

Actual use for 2014-Facilities Management Only

			Equivalent Heat Value	
•Heat Plant Fuel Oil #6	44,553	Gallons	6,683	mmBtu
•Heat Plant Nat. Gas	111,831	mcf	114,068	mmBtu
•Diesel	1,281	Gallons	182	mmBtu
•Gasoline	18,137	Gallons	2,267	mmBtu
•Plant Electricity	13,751,473	kWh	46,922	mmBtu
•Auxiliary Electricity[1]	711,863	kWh	2,429	mmBtu
•Auxiliary Nat. Gas[1]	14,635	mcf	14,928	mmBtu
•Auxiliary #2 Fuel[1]	250	Gallons	31	mmBtu
•Purchased REC's[2]	16,880,000	kWh		

1 Metered Use in buildings (used for College business) off the main campus systems. Includes the addition of 101 South Chester Road.

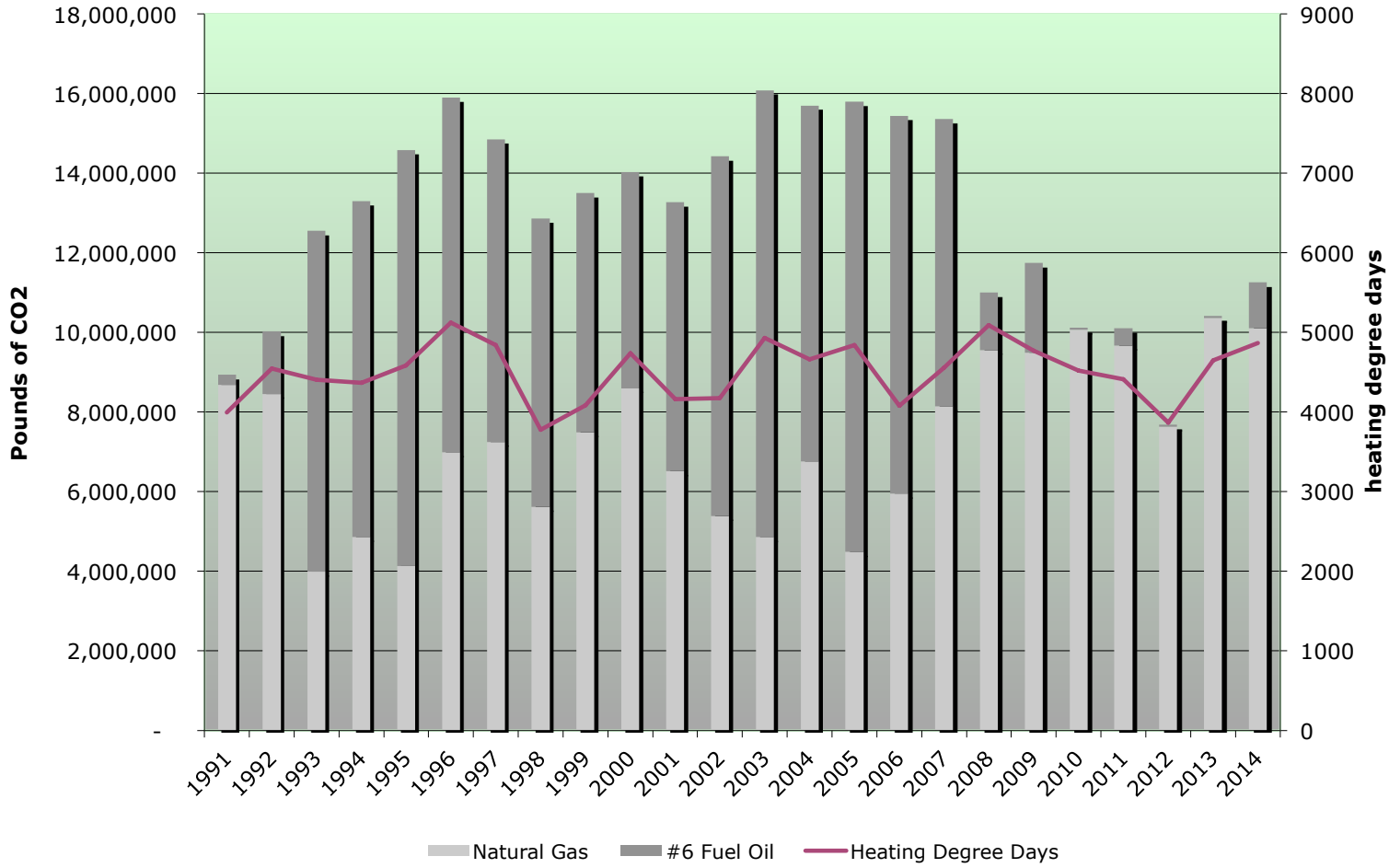
2 Renewable Energy Credits to offset carbon contribution of electricity use

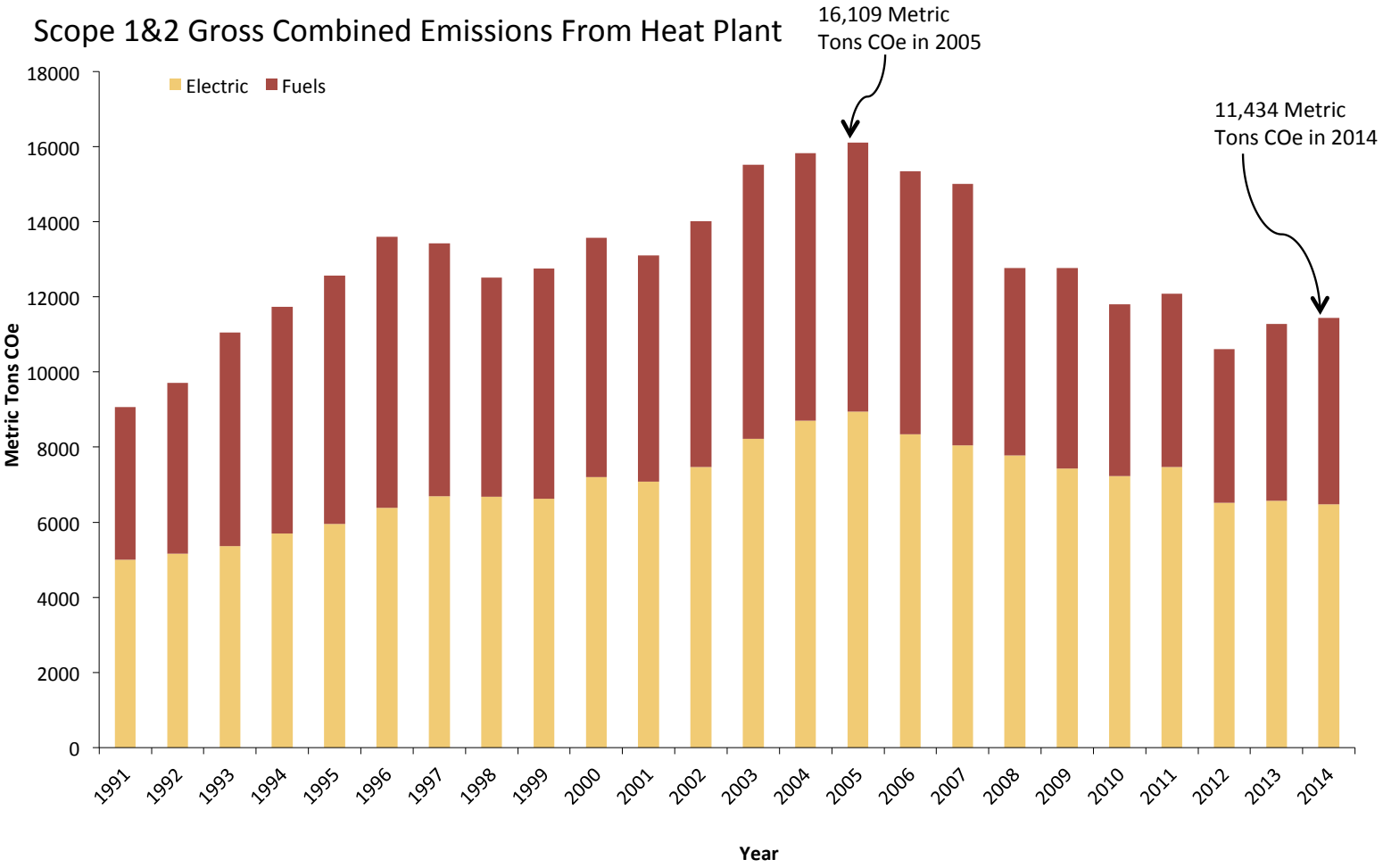
Excludes faculty/staff housing

Carbon Emissions By Source - Facilities Management

- Scope 1 7,547.0MT eCO2
- Scope 2 6,817.0 MT eCO2
- Scope 3 3,809.0 MT eCO2
- Offsets -8,228.0 MT eCO2
- Net Emissions 9,296.0 MT eCO2

Annual CO2 Emissions from Heat Plant Fuels




Scope 1&2 Gross Combined Emissions From Heat Plant
16,109 Metric Tons COe in 2005
11,434 Metric Tons COe in 2014
Electric
Fuels
Metric Tons COe
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
Year

Accomplishments in 2014

The College established a fully funded Director of Sustainability position and hired Laura Cacho as the College's first Director of Sustainability.

Facilities Management successfully converted the Heat Plant to burn #2 low sulfur fuel in place of the heavy fuel oil #6. The primary fuel continues to be natural gas but it was an important statement to select a cleaner fuel to burn as an alternative if our natural gas supply was interrupted. This conversion places us in a better position to experiment with bio-fuels and low nitrogen fuels if we choose to do so.

Willets Hall was taken off the central steam system and fitted with high efficiency condensing boilers and domestic hot water heaters. In the summer of 2015 Dana-Hallowell and the new addition will follow suit. This is part of a larger plan to bring sufficient natural gas lines into the campus to disengage potentially eight additional buildings from the extreme ends of the steam system and have them stand alone with independent heating systems. This will greatly reduce line losses, improve thermal efficiency and reduce carbon load.

The college affirmed its commitment to finding ways to minimize the effect of carbon on climate change by opening up a review of its construction standards.

Lighting retrofits have continued. We are focusing on replacing labor intensive and high wattage applications with LED fixtures and lamps. The quality of LED light, the variety of available fixtures and the lowered costs of operation have pretty much leap frogged other lighting technologies.

Challenges for 2015

The college opened Matchbox and began the construction of the conjoining section of Dana/Hallowell as well as adding parking lots and associated lighting, all of which will have a notable impact on both energy consumed and additional preventative maintenance hours. As was pointed out last year, buildings are increasing in their level of sophistication and sheer numbers of maintainable pieces of equipment. All of this requires a better trained work force or an increased reliance on professional service contracts.

The energy intensity of the college has gradually increased by 13% since its low in 2011. A review of operations revealed a 150% increase in off-schedule academic and public space use from 2011 to the present which accounts for at least some of it. Weather events account for the balance. Spot checks have revealed that many times scheduled rooms never get used or are reserved for more hours than the user will be in them to prevent other groups from messing up the space. Rather than continuing to schedule the rooms through energy management we have decided to try installing user actuated thermostats in heavily scheduled spaces. This will leave it up to the user to push the buttonfor heating/ cooling much as we rely on them to use the light switch.

Lighting is also an area where we have an opportunity to improve. LED has leapfrogged fluorescent and the cost has come down pretty dramatically. It is still a fairly expensive lighting technology but in the right applications the return on investment is fairly high. Setting aside funding would be a priority.

The college's Title V operating permit is coming up for review and now (given that we no longer burn #6 oil) is the time to consider reapplying as a Synthetic Minor operation. There may be a benefit to continuing as a Title V if the college expands. It is an issue we will explore.