Swarthmore College Energy Use Status Report For 2015

- Progress on energy savings and cost avoidance
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Gross Square Feet Added to the Campus

Year Blds. Added			
2000	**Total Sq. Ft.***		**1,283,558**
2001	Mullan Tennis & Fitness Center	28,275	1,311,833
2003	Chiller Plant	4,415	1,316,248
2003	Kyle House	5,010	1,321,258
2004	Science Center	134,281	1,455,539
2004	Alice Paul	34,471	1,490,010
2004	Septa Station	2,324	1,492,334
2007	Lang Center	9,642	1,501,976
2007	David Kemp	26,333	1,528,309
2010	Wister Education Center	5,400	1,533,709
2013	101 S. Chester Road	32,703	1,566,412
2014	Matchbox	21,000	1,587,412
2015	DanaWell Infill	23,770	1,611,182
	Increased square footage	**327,624**	

After a decade of renovation and new construction between 1990 and the year 2000 the College had grown to 1,283,558 Gross Square Feet.

From the year 2000 to date we have added an additional 327,624 GSF. The the New Palmer/Pitt/ Roberts Dorm slated for start in the spring of 2016 will add 120+ beds and the swing space for the BEP construction will start in the spring of 2016 as well.

* 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	1,283,558
2000-2001	121,855	1.45	1,311,833
2001-2002	108,255	1.39	1,311,833
2002-2003	123,792	1.63	1,321,258
2003-2004	110,673	1.51	1,321,258
2004-2005	114,738	1.74	1,492,334
2005-2006	109,738	1.89	1,492,334
2006-2007	109,270	1.73	1,492,334
2007-2008	103,740	1.89	1,528,309
2008-2009	95,930	1.63	1,528,309
2009-2010	104,406	1.46	1,533,709
2010-2011	95,970	1.38	1,533,709
2011-2012	88,503	1.21	1,533,709
2012-2013	91,681	1.34	1,566,412
2013-2014	99,844	1.41	1,587,412
2014-2015	96,456	1.38	1,611,182

From a historical perspective we have done a very good job of containing the energy units required to heat, cool and light our Campus. Even with the growth we've experienced over the past fifteen years, we have driven the average Btu per square foot rate below 100,000 Btu.

As we add buildings it is critical that the energy profiles are designed well below that 100KBtu average to stay in sync with the College's carbon neutrality goals. NPPR is being designed with a 50KBtu target. The benefit of reducing energy intensity is illustrated on the next page. We have limited control over energy market prices so our costs need to be controlled by limiting use.

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

Fiscal Year Ending	Gross Square Feet	Dollar Cost for Energy per GSF	BTU Rate of Energy Use per GSF (Energy Intensity)	Potential Cost at 2010 Rate of Energy use	Actual Cost	Savings by Reducing Energy Intensity from 2010 rate
2010	1,533,709	$1.46	104,406	$2,236,836	$2,236,835.55	$-
2011	1,533,709	$1.38	95,970	$2,298,650	$2,112,912.00	$185,737.66
2012	1,533,709	$1.21	88,503	$2,190,349	$1,856,711.00	$333,637.68
2013	1,566,412	$1.34	91,681	$2,391,171	$2,099,741.00	$291,429.84
2014	1,587,412	$1.41	99,844	$2,333,364	$2,231,395.00	$101,968.72
2015	1,611,182	$1.38	96,456	$2,411,727	$2,228,080.00	$183,646.57
						$1,096,420.46

Actual use for 2014-2015/Facilities Management Only

			Equivalent Heat Value	
•Heat Plant Fuel Oil #2	43,229	Gallons	6,009	mmBtu
•Heat Plant Nat. Gas	82,631	mcf	82,631	mmBtu
•Diesel	1,281	Gallons	138	mmBtu
•Gasoline	18,137	Gallons	2,177	mmBtu
•Plant Electricity	13,491,204	kWh	46,034	mmBtu
•Auxiliary Electricity[1]	711,863	kWh	2,444	mmBtu
•Auxiliary Nat. Gas[1]	14,635	mcf	14,928	mmBtu
•Auxiliary #2 Fuel[1]	0	Gallons	0	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 Wind Energy Credits to offset carbon contribution of electricity use

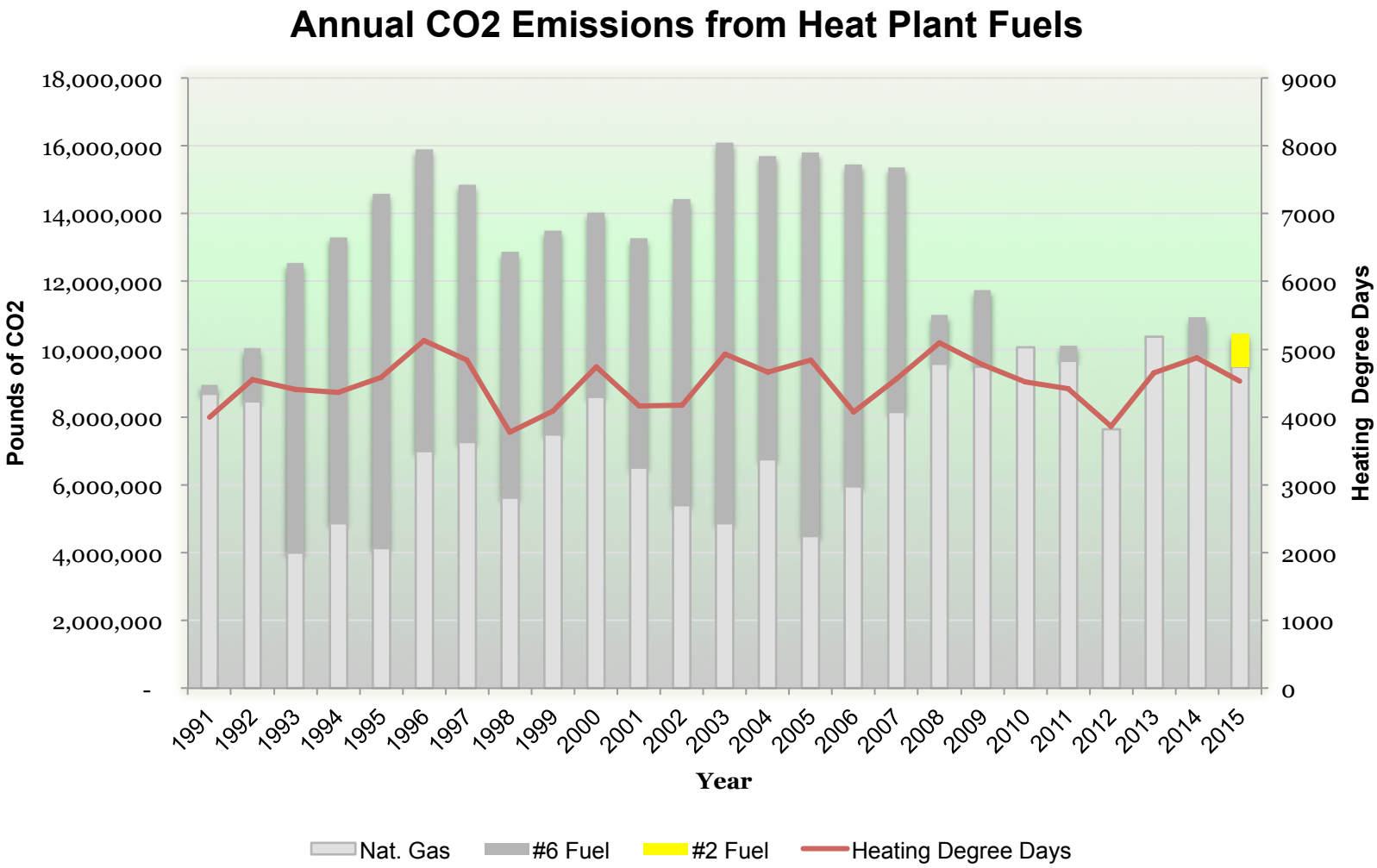
Excludes faculty/staff housing

Carbon Emissions By Source - Facilities Management

• Scope 1-Direct Emissions	4,724	MT eCO2
• Scope 2-Indirect Emissions	6,780	MT eCO2
• Scope 3-Travel/Commuting*	3,809	MT eCO2
• Offsets-Wind Power	-8,228	MT eCO2
• Net Emissions	7,085	MT eCO2

Calculations from Clean Air Cool Planet factors

*Estimated from 2014


Annual CO2 Emissions from Heat Plant Fuels
Pounds of CO2
18,000,000
16,000,000
14,000,000
12,000,000
10,000,000
8,000,000
6,000,000
4,000,000
2,000,000
-
Heating Degree Days
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
1991
1992
1993
1994
1995
1996
1997
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2003
2004
2005
2006
2007
2008
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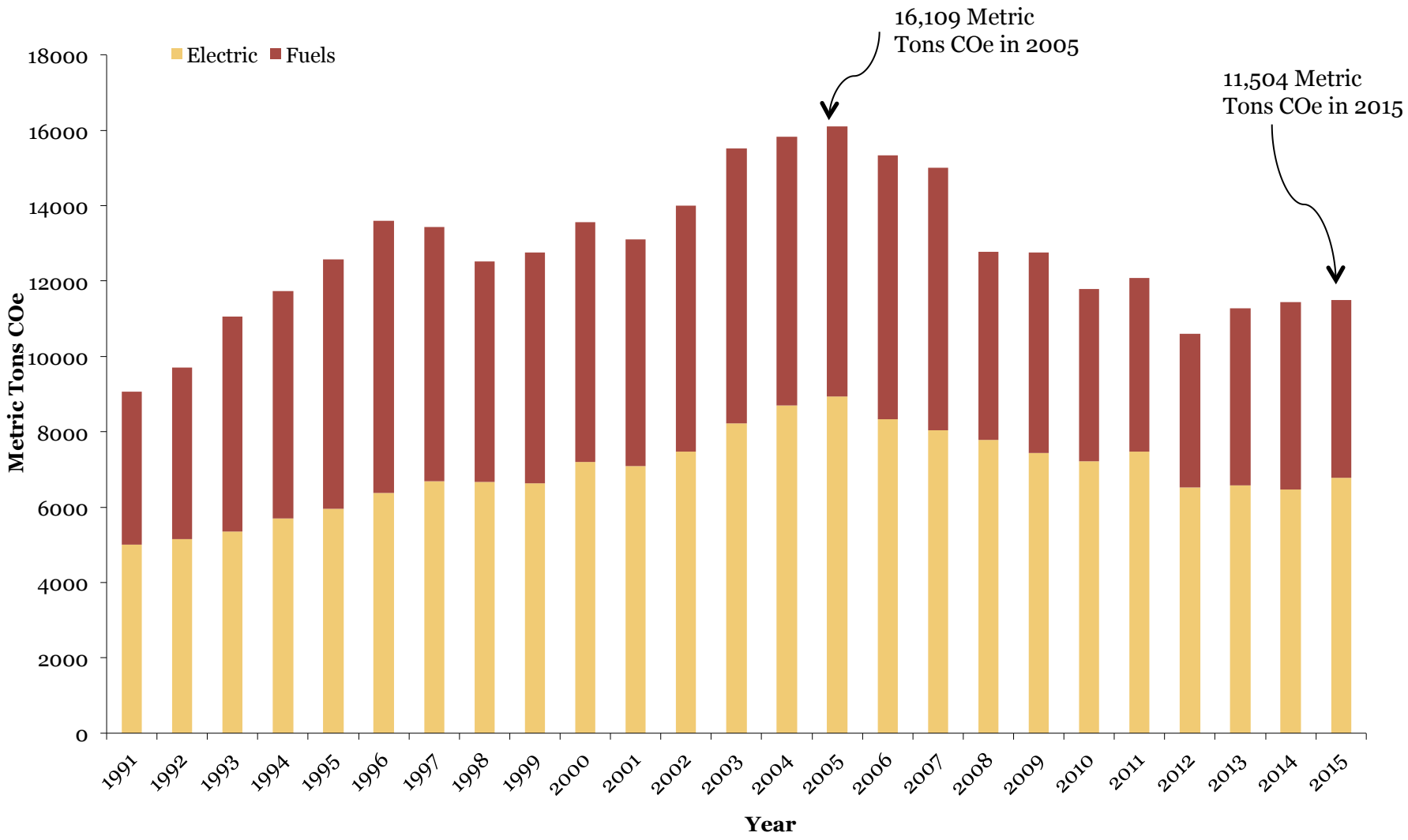
2012
2013
2014
2015
Year
Nat. Gas
#6 Fuel
#2 Fuel
Heating Degree Days

Scope 1&2 Gross Combined Emissions From Heat Plant



Accomplishments in 2015

The College established a fully funded Director of Sustainability position and hired Laura Cacho as the College's first Director of Sustainability in 2014 but was unfortunately unable to retain her. In her short tenure she was able to move several important initiatives forward. Those included establishing the Green Advisors as paid positions, arranging for an assistant to the sustainability office and organizing a College wide charrette on sustainability that led to the adoption of a Sustainability Framework document to guide construction and renovation decisions with an emphasis on storm water management and energy conservation. Laura's successor, Aurora Winslade, was selected after a nationwide search and looks forward to continuing the momentum of the Sustainability Office.

Facilities Management continues to manage energy effectively placing the college in the top ten percent of peer institutions in terms of minimizing energy intensity on a square foot basis as well as one of the lowest costs. Planned construction will clearly have an impact on the College energy profile but the aforementioned Sustainability Framework will be guiding the design teams to build highly efficient buildings. That efficiency will have a positive impact going forward when energy prices recover from their current historic lows.

Facilities Management also made an important statement when renewing the EPA Title V operating permit. Title V covers stationary plants and operations with the potential to emit 25 tons or more of NOx and other air pollutants. The College was place in that category through dint of the #6 fuel it had used as the alternate fuel. With the switch to #2 fuel this year we were able to qualify as a Synthetic Minor operation. It may seem like a small paper victory but this south east region of Pennsylvania is a severe non-attainment zone for air pollution so every limit on emissions we can muster is a plus.

Challenges for 2016

The need for skilled HVAC technicians is going to be a top concern for the College maintenance operation going forward. Recent construction has added new technologies and the Siemens building management system that allows us to observe and control what is happening in our machine rooms is slated for a major upgrade to their basic operating system. This is going to require an agile workforce to keep pace with new construction while keeping the older equipment operating efficiently. Routine Preventative Maintenance is as effective as scheduling for containing energy costs. Blocked filters or coils, passing steam traps and leaks can add a significant cost to operations. Frankly we have experienced a drop in our ability to keep up with all that the PM program requires. The sheer volume of equipment is taxing our ability to meet all the needs as well as make timely repairs. We are relying more and more on outside service for repairs which is effective but costly.

Training is also a top priority. Technology that used to change on a ten year cycle seems barely settled before something better replaces it. As we move toward reducing reliance on the Heat Plant in favor of independent high efficiency boilers and water heaters it comes with the demand for tools and training to troubleshoot the equipment. Off site training takes time out of the work week but if we are to keep up with technological advances it's a demand we have to accept.

Challenges for 2016, Cont.

The College is also pursuing the possibility of adding electric generation capacity to support the entire campus. Currently only the Dining Hall is fully supported and other buildings for life safety only. One of the realities of climate change is weather is becoming less predictable and severe weather events have the potential for taking out the power grid for days at a time. In the winter that could be disastrous. Part of our charge is to have the resilience to recover from weather events quickly and get back to the business of education. While we can rent generators for power during an outage, the time it takes get the equipment on site and wired in is generally eight to ten hours and there is always the risk that in a widespread outage, equipment might not be available. On site generation, a micro grid, would add an important tool to our ability to sustain the campus if the power goes down. It is especially important as many of the buildings currently in design rely heavily on electricity for ground source heat pumps as well as power and light.

The system the College is looking over would be a 4000 kW natural gas fired generator set, owned and operated by a third party, that would enable us to drop off PECO power and essentially operate as an island for as long as necessary. Ancillary benefits would be a substantial reduction to our Peak Load Contribution (PLC) reducing costs on our utility bill and a reduction to our carbon profile. Utility transmission and line losses would not apply when the system was in operation.