

Swarthmore College Utility Status Report For 2013

- Ten year progress on energy savings and cost avoidance
- Actual Use Figures for the Calendar Year 2013
- Carbon Contribution
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Year Blds. Added

| 2000 | Total Sq. Ft.* | 1,238,593 | 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 |
| | Increased square footage | 276,170 | |

After a decade of renovation and new construction between 1990 and the year 2000 the College had grown to 1,238,593 square feet. In the decade following, the campus continued to grow adding just under 250,000 square feet of academic, dormitory and additional support space. We are at the cusp of adding additional square footage with the construction of Matchbox and the Dana/Hallowell in-fill projects which will add to our energy profile.

* 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 |

In spite of steady progress in reducing the energy use per square foot we recognized at some point we would hit a plateau. Short of investing in large scale projects to revamp HVAC systems we are very close to that point . We are currently enjoying the benefit of low natural gas prices which also affects the electric generation market but weather conditions will play a large role in how successful we are in restraining the Btu per square foot to our ideal. As previously stated the energy intensity applied to a square foot of space is the critical factor. The price of energy will fluctuate with market demands. The College has lowered the energy costs to some degree by purchasing opportunities in the de-regulated marketplace, but the real savings come when we can avoid using the energy at all.

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 |
| | | | | | | 23,828,163.66 | 20,998,017.49 | 2,830,146.17 |

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



Actual use for 2013-Facilities Management Only

Equivalent Heat Value

| | | |
|--------------------------------------|----------------|--------------|
| • Heat Plant Fuel Oil #6 | 535 gal. | 80 MMBtu |
| • Heat Plant Nat. Gas | 97,268 Mcf | 97,268 MMBtu |
| • Diesel | 2,128 gal. | 300 MMBtu |
| • Gasoline | 16,883 gal. | 2,144 MMBtu |
| • Plant Electricity | 13,431,883 kWh | 45,843 MMBtu |
| • Auxiliary Electricity ¹ | 741,236 kWh | 2,457 MMBtu |
| • Auxiliary Nat. Gas ¹ | 12,752 Mcf | 12,752 MMBtu |
| • Auxiliary #2 Fuel ¹ | 1,508 gal. | 213 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



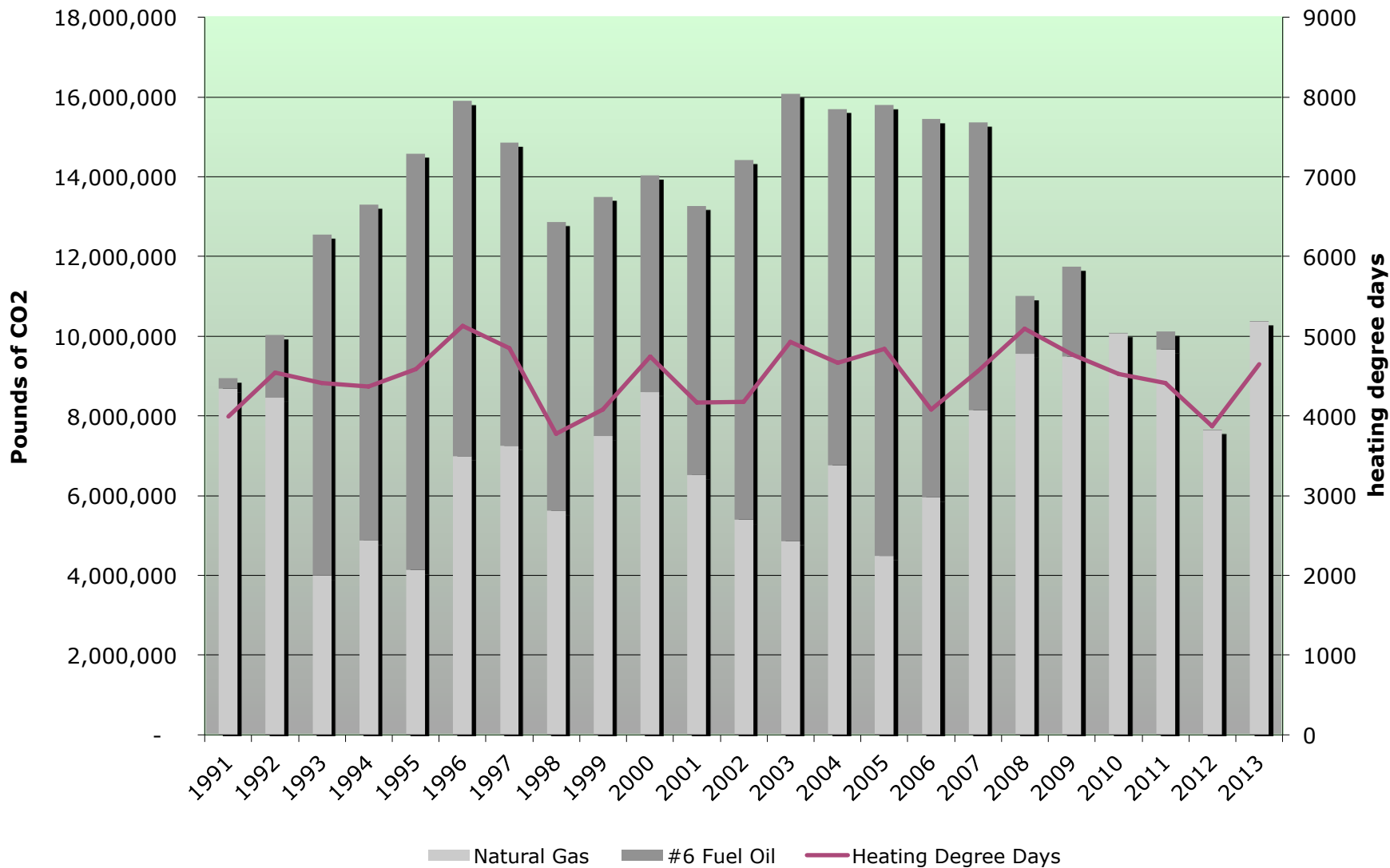
Carbon Emissions By Source - Facilities Management

- Scope 1 5,769.5 MT eCO₂
- Scope 2 7,826.0 MT eCO₂
- Scope 3 3,809.0 MT eCO₂
- Offsets -9,392.5 MT eCO₂
- Net Emissions 8,012.0 MT eCO₂

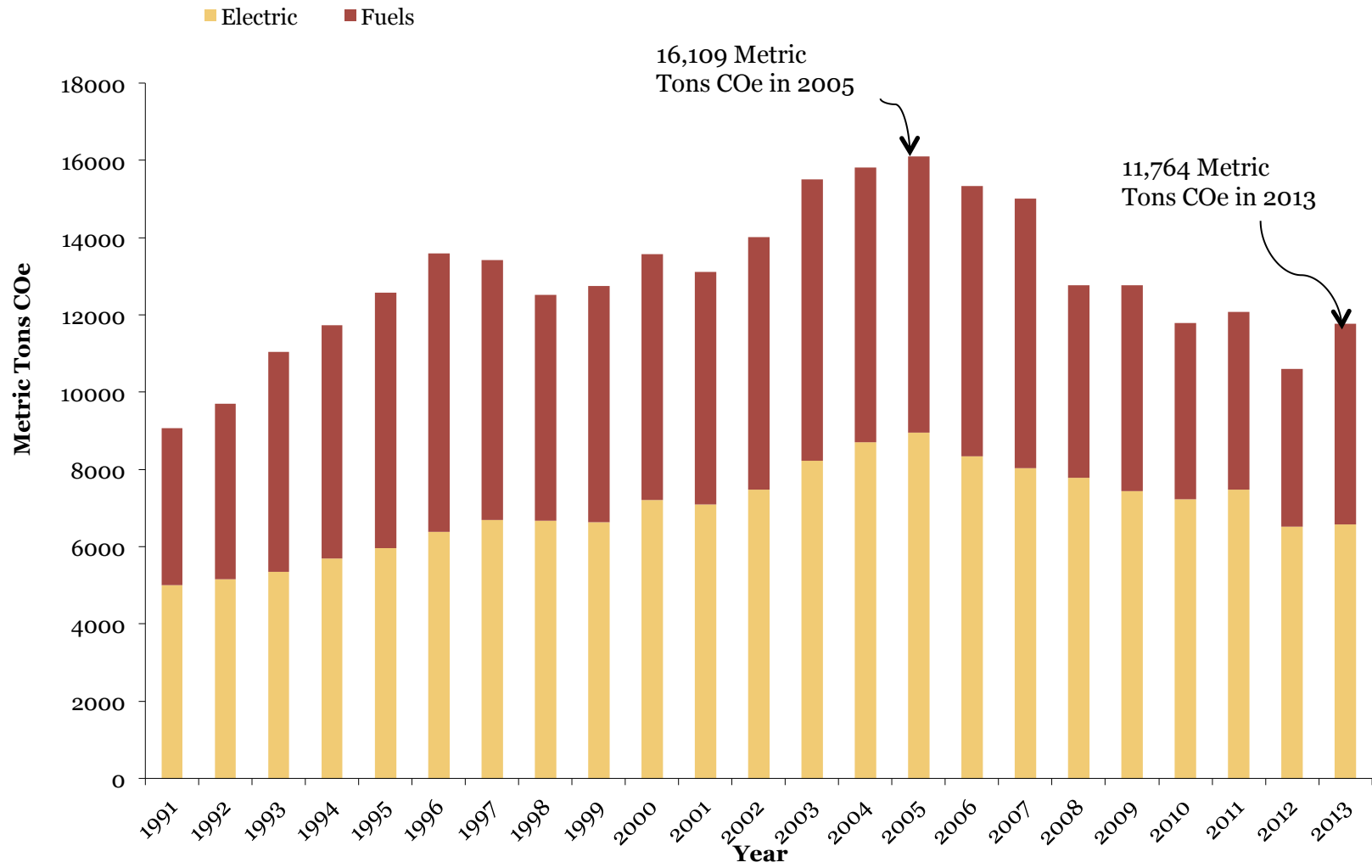
Our stated goal in the Climate Action Plan was a 50% reduction in net emissions by 2015. We are there but can we stay there?



Annual CO2 Emissions from Heat Plant Fuels



Scope 1 & 2 Emissions from Heat Plant





Accomplishments in 2013-14

The College established a fully funded Director of Sustainability position and filled it.

Facilities Management received clearance to abandoned #6 fuel and convert the Heat Plant to burn #2 fuel and natural gas. The conversion will take place over the summer. This will put us in a better position to experiment with bio-fuels and low nitrogen fuels if we choose to do so.

This summer Willets Hall will be the first building to be taken off the central steam system and fitted with high efficiency condensing boilers and domestic hot water heaters. Next summer 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 steam system and have them stand alone with independent heating systems.

The final section of the Daikin variable refrigerant flow system was installed in Parrish over the summer of 2013 greatly reducing the steam load to the building this past winter and increasing the efficiency of the cooling load.

We accelerated lamp change-overs to conserve electricity. Using money accumulated in the Carbon Neutral Fund the second floor of McCabe Library was fitted with stack switches completing the conversion of the main library. Since the start of classes in September to date, the McCabe conversion alone has saved over 150,000 kWh and eliminated 71 tons of carbon. Taken together, all of the lighting conversions we have done since 2008 has put us in a position to save 492,407 kWh and 466,000 pounds of CO₂ annually.

The List Gallery and McCabe Library have both committed to LED lamps for showcasing art work. The LEDs use a fraction of the power of the incandescent lamps they've replaced. The pendant lamps in Shane Lounge have been retrofitted to LED. We will also be replacing the incandescent strip lighting on the perimeter of the Sharples Dining Hall with LED lighting this summer and the BCC has expressed an interest in the technology. LED lighting is showing increasing promise as a dependable, flexible and energy conserving light source. Prices for the technology have been greatly reduced as the market has expanded and new lamps are coming into the supply pipeline all the time. One promising addition is an LED replacement for a four foot T-8 fluorescent tube. It requires no wiring modifications on newer fixtures, uses half the energy and is rated for 55,000 hours of operation.

The Field House has had motion sensors installed in common rooms and offices to turn off the lights when they are unoccupied.

We have completed electric sub-metering in all buildings. We have also installed counters in the McCabe elevator as an extension of our inquiry into how elevators are used on Campus.



Challenges

The campus is growing. Buildings are increasing in their level of sophistication. To continue to shrink our carbon profile or even remain stable will require significant investment in new technologies for heating, cooling and lighting. First cost continues to be a point of contention in the design phase. A renewed interest by some members of the Board of Managers to take a longer view has resulted in an administrative review of a proposal for Campus Sustainability Standards Development. The expressed purpose of that development study is to determine what a sustainable building standard should be for Swarthmore College. This came out of a level of discontent that the College hadn't fully vested in LEED as a building standard and considered LEED Silver as an adequate construction benchmark.

Concurrent with that discussion there needs to be a discussion of the needs of the facilities department to support the steadily increasing count of equipment that needs to be serviced and the increased level of training required to troubleshoot and maintain that equipment.

On a final note the College operates as a small town in and of itself. This past winter(extending into the first quarter of 2014) demonstrated once again the fragility of our infrastructure. Several times our natural gas deliveries were suspended to relieve supply demands on the pipeline system. The electric grid operator PJM also called for voluntary reductions in power use on the coldest days in January. When the main electric service to the College actually went down on February 5, 2014, it pointed up the inherent danger that an extended winter blackout imposes on a facility with a 24/7 student population. It is likely that severe weather hazards are going to be more rather than less of an issue. The College needs to better secure itself against those hazards.