

TUFTS UNIVERSITY CLIMATE INITIATIVE

Showing What a Single Dorm Can Do

PROJECT SNAPSHOT

PROJECTS

Residential housing retrofit

TECHNOLOGIES

Photovoltaic panels; solar hot water system; high-efficiency lights with auto-dimming ballasts; Energy Star refrigerator; front-loading washing machine; high-efficiency gas-fired boiler; and insulation of walls and roof

CO₂ EMISSION REDUCTIONS

26 tons per year

INVESTMENT

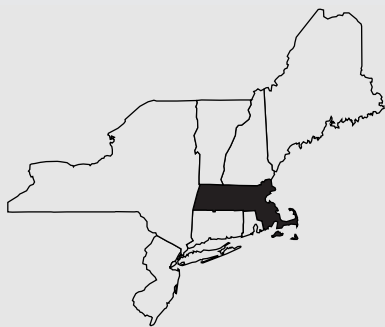
\$58,500

LESSONS LEARNED

Cost-effective carbon reduction can be achieved using proven, off-the-shelf technologies. But institutions like universities must maintain a strong commitment to getting these reductions, and need a tireless advocate working on it day to day. The challenge is to coordinate separate managerial areas and overcome the inertia of existing practices and technologies.

FUNDING SOURCES

Tufts University operating budget and the Tufts Climate Initiative



THE CHALLENGE

Not satisfied with the U.S. government's refusal to commit to even modest reductions in greenhouse gases, Tufts University has set out to become a model of how a large institution can work to protect the climate. Its overarching goal is to demonstrate that the potential for reducing CO₂ in the U.S. is massive, and that achieving these reductions saves money, increases productivity and enhances the quality of life.

PROJECT DESCRIPTION

Twelve students live in Schmalz House, Tufts University's French-language dormitory. It is a three-story, wood-framed building. Until recently, Schmalz House was an energy hog. It was not insulated, the lighting was inefficient, two oil-fired boilers supplied its heat, and hot water came from two inefficient gas-fired hot water tanks. In an effort to demonstrate that clean energy technologies could be effective on campus, the Tufts Climate Initiative (TCI) worked with the Tufts Facilities Department and Tufts graduate students to perform an energy analysis and retrofit at Schmalz House during the summers of 1999 and 2000. Schmalz House was chosen as the demonstration project, both because the building's utilities are separately metered, which means that past energy consumption data is readily available, and because the house, at 3,200 square feet, is relatively small. Importantly, the building was ready for deferred maintenance, including painting and carpet installation, and related work.

Tufts students consulted with Conservation Services Group, an energy conservation company, and Green Power Development, a renewable energy company, to identify the most appropriate and cost-effective energy improvements. The students then put together a list of projects designed to capture the greatest level of CO₂ reductions in the most cost-effective way.

Phase I of the energy retrofit, completed during summer 1999, included installation of a solar hot water system,

high-efficiency lights with auto-dimming ballasts and advanced controls, a refrigerator certified by EPA's Energy Star program, and an energy- and water-saving front-loading washing machine. Phase II, completed the following summer, included the replacement of the old oil boiler with a high-efficiency gas-fired model, conversion to baseboard hot-water heating, and thorough insulation of the walls and roof.

In addition to retrofitting existing campus buildings with new, energy efficient technologies and materials, as in the case of Schmalz House, the Tufts Climate Initiative's projects address many other university activities, including:

- New construction of high-performance buildings.
- Support for personal action strategies (e.g., turning off computers and lights).
- Transportation.
- Phase-in of highly efficient equipment (e.g., task lights, washing machines and lawn mowers).
- Education and outreach.
- New project research, as well as the monitoring of existing projects.

In 2001, TCI will continue its focus on building energy use, while expanding its initiative to address the climate impacts of transportation – and how to mitigate them through education.

RESULTS

The first step in a retrofit is to figure out how much energy a building consumes, then calculate the associated emissions. Tufts students established this baseline by carefully measuring energy use at Schmalz House, and then estimating associated CO₂ emissions. For the latter, they used utility estimates for 1990 and 1998, which they soon hope to supplement with 1999 data, along with emissions estimates for transportation

(including commuting) and solid waste disposal. They concluded that Schmalz House was responsible for 42 tons of CO₂ a year.

The second step is to tally the savings that result from the retrofit. These are shown in the table below. Total estimated CO₂ reductions from both Phase I and II are about 26 tons a year. These are a consequence of lower electricity consumption, fuel-switching from oil to cleaner natural gas, and the more efficient use of gas itself. Even though natural gas is more expensive, the reduction in energy use from insulation, heating controls, solar water heaters and energy-efficient appliances will cut annual utility bills by more than \$900. Carbon dioxide reduction is expected to be about 66 percent (22 tons), which is equivalent to the CO₂ emissions from driving some 50,000 miles in the typical passenger car. In addition, the retrofit will eliminate about 55 pounds of SO₂ a year, and 15 pounds of NO_x.¹ Finally, water consumption will be lower thanks to the new front-loading washing machine. The following table tallies the results:

**ESTIMATED IMPACTS OF
THE SCHMALZ HOUSE RETROFIT**

FUEL	ENERGY SAVINGS	CO ₂ SAVINGS (lbs.)	COST SAVINGS
Electricity	5,930 kWh	8,800	\$718
OIL	2,751 gallons	57,538	\$1,709
GAS	(1,205) therms	(14,086)	(\$1,523)
TOTALS		52,252	\$904

LESSONS LEARNED

Although the retrofit of Schmalz House captures only a small fraction of the carbon reductions that Tufts must achieve to meet Kyoto Protocol goals (see below), the project effectively demonstrates that cost-effective CO₂ reductions are readily available. It also shows that these reductions can be secured using “off-the-shelf” technologies that are dependable and quite easy to install. They include high-

efficiency lights with auto-dimming ballasts; an Energy Star refrigerator; the front-loading washing machine; a high-efficiency gas-fired boiler; and the insulation of the walls and roof. In other words, technologies exist right now in the marketplace that can reduce energy use and greenhouse gas emissions. From high-efficiency lights to simple insulation, these commercially-available products save energy and money, and can be employed when retrofitting an existing structure or building a new one.

Nonetheless, it became obvious that none of these cheap and easy improvements would find its way off the shelf and into use without tireless advocacy from within the university. Even at Tufts, an institution that has made a high-level commitment to emission reductions, day-to-day attention to detail was crucial. The key element that converted broad vision into specific action was the dedication of the energy manager and the facility department. (One surprising challenge involved the solar contractor’s difficulty in responding to the university’s RFP.)

FUTURE COMMITMENTS

As a university, Tufts intends to continue contributing to better public understanding of climate change. It will achieve this through student involvement, as well as through increased research in the fields of engineering, science, economics and policy. For TCI, Schmalz House is just one of 30 wood-framed houses that Tufts owns. All of them offer significant opportunity for similar energy-related improvements and CO₂ reductions. In summer 2000, after a thorough evaluation, three more of these houses were renovated, with efficiencies realized as a result of new insulation, window replacement, lighting improvements and major heating system upgrades.

UNIVERSITY PROFILE

Since its founding in 1852, Tufts University has grown from a small liberal arts college into a university of more than 7,000 students on three campuses: Medford-Somerville, Boston and Grafton,

Massachusetts. The Tufts Climate Initiative was launched in 1998 to help put the university on a cleaner energy path by reducing CO₂ emissions. In 1999, partially due to the educational and advocacy efforts of TCI, the university pledged to “meet or beat” the seven percent greenhouse gas reduction target set for the United States under the Kyoto Protocol. TCI’s initial analysis concluded that the expansion of Tufts over the past ten years had yielded a 16 percent increase in CO₂ emissions. To accommodate continued albeit moderate growth, while meeting its reduction goal, Tufts will have to decrease CO₂ emissions by 6,239 tons a year. At 22 tons (0.03% of the total goal), the Schmalz House reduction is a beginning.

TCI was launched under the sponsorship of the Tufts Institute of the Environment. Its early, rapid progress is the result of the collaboration of the entire Tufts community and the participation of a local foundation. TCI works as both a catalyst for action and as a resource. For instance, the initiative has helped purchase advanced technologies like photovoltaic panels, and underwritten the cost of technical expertise not currently available from within the Tufts community or from its new construction design team.

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¹ These emission reductions are calculated using the New England regional marginal emission rates. See Appendix A for a discussion of related assumptions.

CLEAN AIR-COOL PLANET CASE STUDY RATING

This case study reduces CO₂ emissions equivalent to the following:

Avoiding the consumption of 0.013 barrels of oil per day.

(0.013 barrels per day which is equivalent to 48 barrels per year

OR Taking 4 vehicles off the road per year.



Assumptions: 1,093 lbs of CO₂ per barrel of oil. Vehicles are average passenger cars (approximately 20 lbs CO₂ per gallon of gasoline - 22.5 miles per gallon, averaging 16,000 miles per year)