An EQC Report on Fluorescent Lighting

> "If every American home replaced just one light bulb with a [compact fluorescent], we would save enough energy to to light more than 2.5 million homes for a year and prevent greenhouse gasses equivalent to to the emissions of nearly 800,000 cars."[1]

Introduction

Lighting accounts for twenty percent of the total energy expenditures in the United States, and about fifteen percent of the energy consumed by the average American household. The current popular method of lighting houses is the use of incandescent light bulbs, which heat a filament to produce light. These light bulbs are known to be highly inefficient, wasting up to ninty percent of the energy they consume as heat. Compact fluorescent light bulbs (CFLs) produce the same light for a fraction of the energy. Reducing energy consumption means a lower energy bill, less pollution from power generation, and a chance to support green technology.

This semester, the Environmental Quality Committee was refused funding from town meeting to increase fluorescent lighting at Marlboro College, due largely to a lack of information about the benefits and hazards of CFLs. This report attempts to educate the campus on this issue. The EQC recognizes that other technologies can greatly contribute to reducing Marlboro's light-specific energy use (especially motion sensors and timers), but feels that the structure is in place now to buy low cost fluorescent lighting.

Light Bulbs

Fluorescent light bulbs have two main parts: a glass tube and a ballast. Fluorescent tubes contain a gas mixture of mercury vapor and argon. The inside of these tubes are also coated with a white phosphor. The ballast can either be magnetic or electronic, and allows an electronic current to flow through the gas in the tube. When electricity is turned on, it excites the gas within the tube, which emits ultraviolet light. When the ultraviolet light excites the phosphor coating, a visible light is given off. CFLs that flicker when turned on use a magnetic ballast, but electronic ballasts are much more common.[2]

CFLs burn out in two ways. If the tube becomes weak and cracks, or was made with an imperfect

[1] "Buy Products That Make a Difference." *Energy Star*, <www.EnergyStar.gov>.
[2] "Compact Fluorescent Lamp." *Wikipedia*, <http://en.wikipedia.org/wiki/Main_Page>.

seal, the gas can be released and the light will stop working. If the cathode material on the ballast wears out, the lights will also stop functioning, and a black material will appear on the inside of the tubing.[3]

Light quality depends on the quality of the CFL. Mono-phosphor lamps emit poor quality light of a single color and give off a very unnatural feel. By combining multiple phosphors inside the lights, a wide range of light colors can be produced. Good quality CFLs combine three or four phosphors.[4]

Compact-fluorescent light bulbs can replace incandescent light bulbs almost anywhere. On average, CFLs use one-quarter to one-third of the electricity for comparable incandescent light bulbs. CFLs also last from six to thirteen times longer than comparable incandescence.[5] Newer models of CFLs have also reduced the noise and flickering usually associated with fluorescent lighting. Unfortunately, light output does vary from model to model and there is no standardization yet for fluorescent light bulbs. Also, CFLs have problems operating in very cold conditions.[6]

Because fluorescent light bulbs use less energy than incandescent bulbs, they can greatly reduce carbon dioxide emissions where electricity is generated from heavily polluting sources, like coal. Conservation of energy can also translate into economic savings. A $15 or $20investment in a 20-Watt CFL can save the consumer the cost of up to ten 75 Watt incandescent replacements and $45 in energy savings over the life of the light bulb. This translates into a 25% to 40% yearly return on investing in CFLs.

Mercury and Recycling

CFLs contain mercury, a hazardous element. In the environment, mercury affects animals' kidneys and neurological systems, leading to impaired reproduction, growth, neuro-development, and learning ability, as well as increasing mortality rates in wildlife. Mercury builds up concentrations within animals over the course of their lives ("bioaccumulation"). Concentrations also increase dramatically as mercury moves up the food chain, an occurrence known as "biomagnification."[7] Compact fluorescent light bulbs contain an average of 4 milligrams (mg) of mercury, about one-fifth of what a watch battery contains.[8]

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[3] Ibid.
[4] Ibid.
[5] *Institute for Research in Construction*, (<http://irc.nrc-cnrc.gc.ca/index_e.html>) and *Efficiency Vermont* (<http://www.efficiencyvermont.com/pages/>).
[6] *Institute for Research in Construction.*
[7] <www.MERCvt.org>.
[8] *Efficiency Vermont.*

Health and environmental concerns arise when the process through which fluorescent light bulbs are recycled. CFLs are considered hazardous waste and must be stored separately from incandescent light bulbs and normal trash. According to the Mercury Education and Reduction Campaign (MERC) of Vermont, all mercury containing light bulbs produced after November 30, 2003 will have written on them that they contain mercury, either directly or in the form of 'Hg' (the elemental symbol for mercury) somewhere on the light bulb. In storing fluorescent light bulbs, every effort should be made to avoid breakage. Breaking fluorescent light bulbs can release mercury into the environment, and requires special procedures for cleaning. Mercury containing lamps can usually be dealt with at the town dump or local solid waste district.[9] In fact, Vermont law requires dumps and solid waste districts to collect mercury containing consumer products.[10]

It has been argued that fluorescent lighting actually reduces the amount of mercury entering the environment. Power plants that run on heavily polluting fuels, like coal and oil, produce mercury when generating electricity. About 10 mg of mercury are produced to run one 60-Watt incandescent light bulb. For a fluorescent light bulb of comparable brightness (but less wattage), the energy saved over the course of its lifetime will save about 7.6 mg of mercury from being produced at the power plant. Adding the 4 mg or mercury contained within the fluorescent bulb, and net mercury reduction is about 3.6 mg.[11]

Marlboro College

Marlboro College seems to be in a good position for incorporating more fluorescent light bulbs into its energy plan. We have facilities set up to handle fluorescent lighting at Marlboro, and we already use an impressive amount of fluorescent light bulbs, about fifty a semester. We dispose of these light bulbs about every 6 months. According to electrician KP Peterson, the college uses CFLs almost exclusively in Mather and individual students who have purchased their own, scattered around the college's dorms.

Marlboro College can dispose of our fluorescent light bulbs at the Windham Solid Waste Management District (327 Old Ferry Road) in Brattleboro (802.257.0272).

[9] <www.MERCvt.org>

[10] "Environmental Fact Sheet." Vermont Department of Environmental Conservation. <www.anr.state.vt.us/dec/dec.htm>.

[11] "Information About Mercury and Energy Efficient Lighting." *Efficiency Vermont.*

Marlboro is also in a good position to use more florescent lighting because of the organizations around Vermont that are willing to educate and supply lights to institutions and colleges. Energy Star and Efficiency Vermont teamed up for October and November to supply 20-Watt CFLs (equivalent to a 75-Watt incandescent bulb) for only $.99. The bulbs are to be supplied through Green Mountain Electric Supply, and come with a two year warranty. Additionally, these organizations offer up to a $1.50 rebate on additional fluorescent light bulbs (including ones that can be dimmed).[12] With the right planning, Marlboro College can buy energy efficient lighting for very cheap and save money by reducing its energy consumption. The EQC feels that this is the appropriate course of action for the college.

[12] For more information, visit <http://www.efficiencyvermont.com/pages/>.