

# Tools for Cutting Community Energy, Tracking Homes to Town Hall

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Henry MacLean

Tracking and Greening the Energy Use of a Typical Town, Milton MA

Jay Walter

The Newton Eco-Team Project:

A Model Low Carbon Community Project

Paul Eldrenkamp

A Simple Score-keeping Method for Residential Energy Usage

Fred Gordon

Developing Sound Principles For State Energy Efficiency Programs

A new language of community energy profiles and action plans is emerging to help local communities better understand how they use energy, and what local homeowners and businesses can do to join in the process.

Through case studies and energy audit systems, we will explore a variety of ways in which building professionals can actively participate in Community Scaled energy reduction projects.

Groups across the Commonwealth are connecting the dots between strategies of reducing one's own carbon footprint at home to education programs that help local politicians and grass root educational programs benchmark energy use, develop conservation strategies as well ways to incorporate new carbon neutral technologies.

# Objectives of Workshop

- Objective #1

Understand metrics, targets, and benchmarks for home /residential use, and energy efficient diagnostic techniques.

- Objective #2

Understand metrics, targets, and benchmarks for Town and local business energy efficient use, and effective programs models.

- Objective #3

Develop strategies that engage statewide programs that support and link up Towns, such as the MCAN, Cool Communities and State programs.

# History of Energy in the United States: 1635-2000

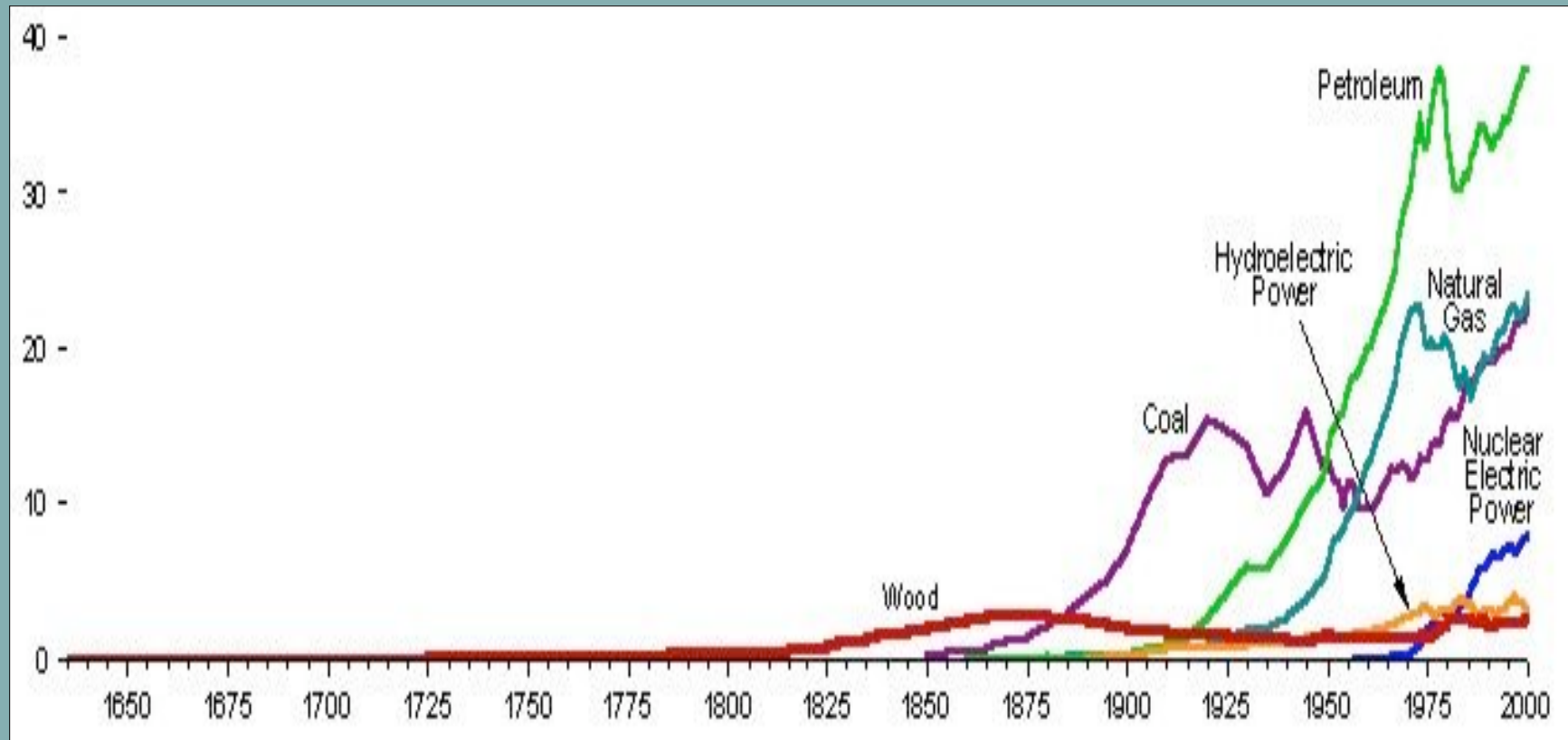


Figure 1. Energy Consumption by Source, 1635-2000  
(Quadrillion Btu)

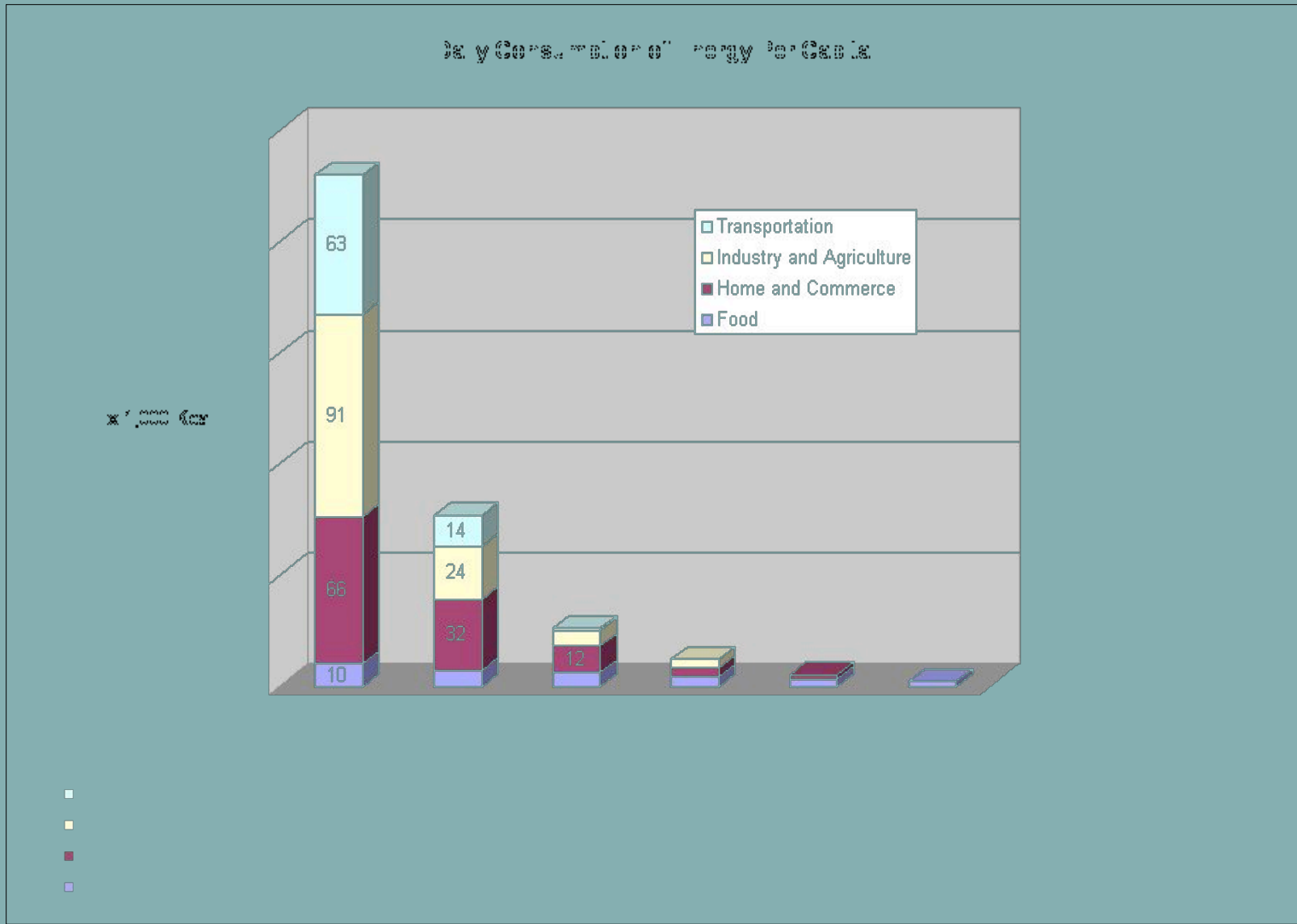
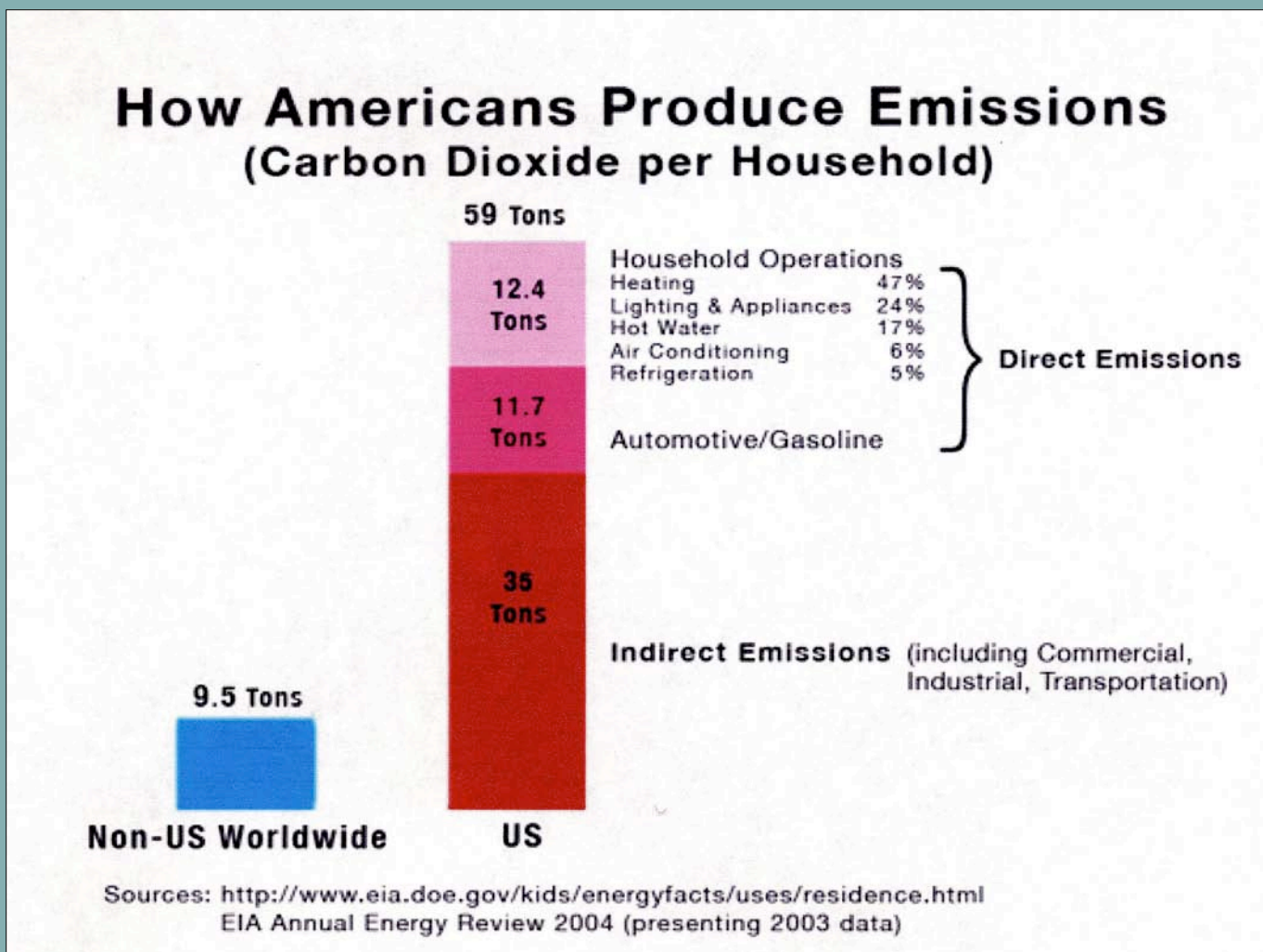


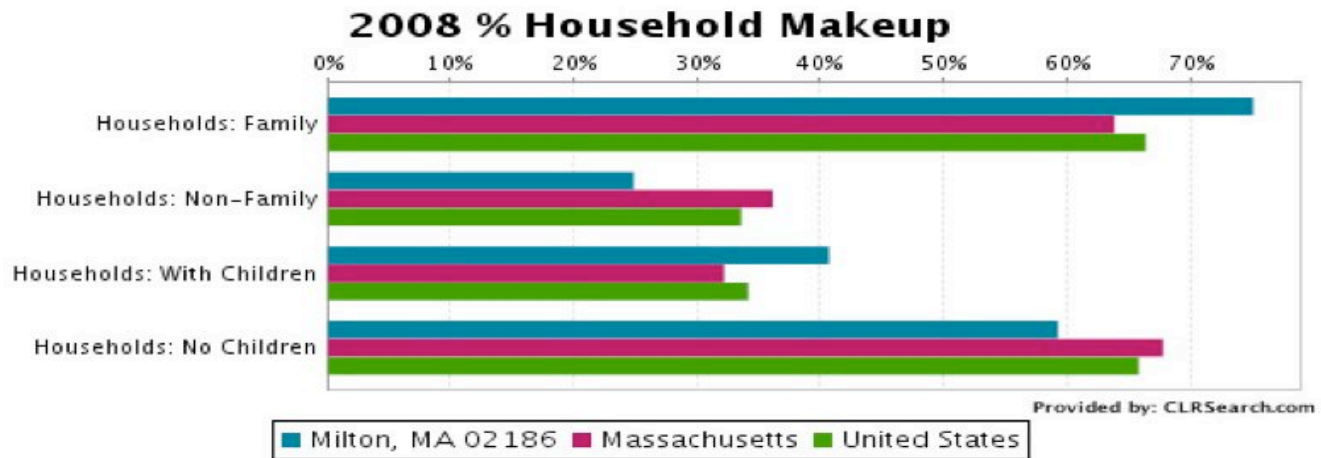
Figure 1. Estimated Daily Consumption of Energy per Capita at Different Historical Points Adapted from: E. Cook, "The Flow of Energy in an Industrial Society" *Scientific American*, 1971 p. 135.

# General Carbon Breakdown for Households

From Household to Town- Municipal is generally about 3-5% of Town  
And Residential is generally about 60% of total town consumption & emissions



## HH Makeup and Average Size



Households Statistics	Milton, MA 02186		Massachusetts		United States	
<b>Average Household Size</b>	3		3		3	
<b>Households: Family</b>	6,660	75.12%	1,562,543	63.84%	75,457,294	66.4%
<b>Households: Non-Family</b>	2,206	24.88%	884,872	36.16%	38,177,134	33.6%
<b>Households: With Children</b>	3,610	40.72%	788,154	32.2%	38,828,280	34.17%
<b>Households: No Children</b>	5,257	59.29%	1,659,261	67.8%	74,806,148	65.83%
<b>Total Households</b>	8,866		2,447,415		113,634,428	

Milton Households make up .04% of Massachusetts Households, which make up about 2.5% of the Nations 113.5 million.

# Sources of Energy and their Carbon Impact

Electricity	2216 BTUs/ lb of CO-2	1 KWH	3,413 BTU's	(1.54 lbs of CO <sub>2</sub> )
Heating Oil	6290 BTUs/ lb of CO-2	1 gallon	139,000 BTU's	(22.1 lbs of CO <sub>2</sub> )
Propane	7165 BTUs/ lb of CO-2	1 gallon	91,000 BTU's	(12.7 lbs of CO <sub>2</sub> )
Nat. Gas	8403 BTUs/ lb of CO-2	1 therm	100,000 BTU's	(11.9 lbs of CO <sub>2</sub> )
Gasoline	5610 BTUs/ lb of CO-2	1 gallon	124,000 BTU's	(22.1 lbs of CO <sub>2</sub> )
Diesel Fuel	7202 BTUs/ lb of CO-2	1 gallon	139,000 BTU's	(19.3 lbs of CO <sub>2</sub> )
Wood/Biomass	Reabsorbed/Renewable	1 full Cord	17- 22,000,000 BTU's	(Carbon Neutral) *

\* If from Sustainable Managed Forests and Replacing Conventional Fuels.

## Trend of Gas Replacing Oil in 2000 vs. 2008 Data:

Milton , MA Household Heating Sources in 2000				
	<u># Households 2000</u>	<u>% of Use</u>	<u>#Households in 2008</u>	<u>% of Use</u>
Fuel oil, kerosene, etc.	4,130	46 %	4,130	39 %
Utility gas	4,088	45 %	4,816	52 %
Electricity	646	7 %	646	7%
Bottled, tank, or LP gas	72	.8 %	72	.8 %
Coal or coke				
Wood				
Solar energy				
Other fuel	46	.5 %		.5 %
<u>Total:</u>	<u>8,982</u>	<u>100 %</u>	<u>9,155</u>	<u>100 %</u>

From 2000 to 2008, the # of Households using Oil in Milton dropped 7% , and Natural Gas usage increased 7%.

## Residential BTU SF / Year in Milton

The Most Recent Town Data shows a population of 26, 227 people, and about 9,155 Households. and an the average house footprint is about 2,383 square feet , or about 21.8 million sf of housing.

The total annual Residential Electrical Use in 2008 was 72,989,225 kWh , (58% of total Town Electrical use)

$72,989,225 \text{ kWh} \times 3,413 \text{ BTU/kWh} = \text{Total \# of BTU's created by electricity}$

With the 21.8 million SF of housing , we get

$2.2911e+11 \text{ BTU} / 21,800,000 \text{ SF}$

10,514 BTU's / sf/yr for Elec use

(this includes all electrical heating as well, 7% of Town)

The total annual Residential Natural Gas Use in 2008 was 7,626,985 therms, 52% of total Home Heating

$7,626,985 \text{ therms} \times 100,000 \text{ BTU/kWh} = \text{Total \# of BTU's by Natural gas}$

$7.6269e+11 \text{ BTU} / 21,800,000 \text{ SF} =$

34,986 BTU's / sf/yr for Gas use

The total annual Residential Oil Use in 2008 was 39 % of total Home Heating

$34,986 \times 39/52 =$

26,239 BTU's / sf/yr for Oil use

Total Residential Energy Use Per Square Foot in Milton

71,739 BTU's / sf/yr for Total use

# What makes up our Quantifiable Carbon Footprints?

## 1. Our Home Energy Use

Average household of 3 people in US, 2500 sq.ft., & 50-75% of energy use.

## 2. Our Automobiles

Calculate the Miles you travel, and factor in the MPG that your auto gets. (20 MPG car produces 1 lb carbon per mile)

## 3. Our Travel

Air Miles , 1 lb of carbon per 1.5 to 2.5 jet miles per person, the shorter the trip the less eco-friendly per mile.

## 4. Our Personal Garbage

A half gallon of garbage produces 1 lb of carbon, average US citizen produces 35 gallons a week.

# Express Method for Estimating Your Home's Energy Use ( EUR or Energy Utilization Rate )

## Step A.

Determine the square footage of all of the conditioned spaces in your home, spaces that you keep warm in the winter and cool in the summer.

## Step B.

Locate your Utility Bills and convert them all to BTU's using the chart on the following page, which will also show you how many BTU's you get for every pound of carbon you produce.

## Step C.

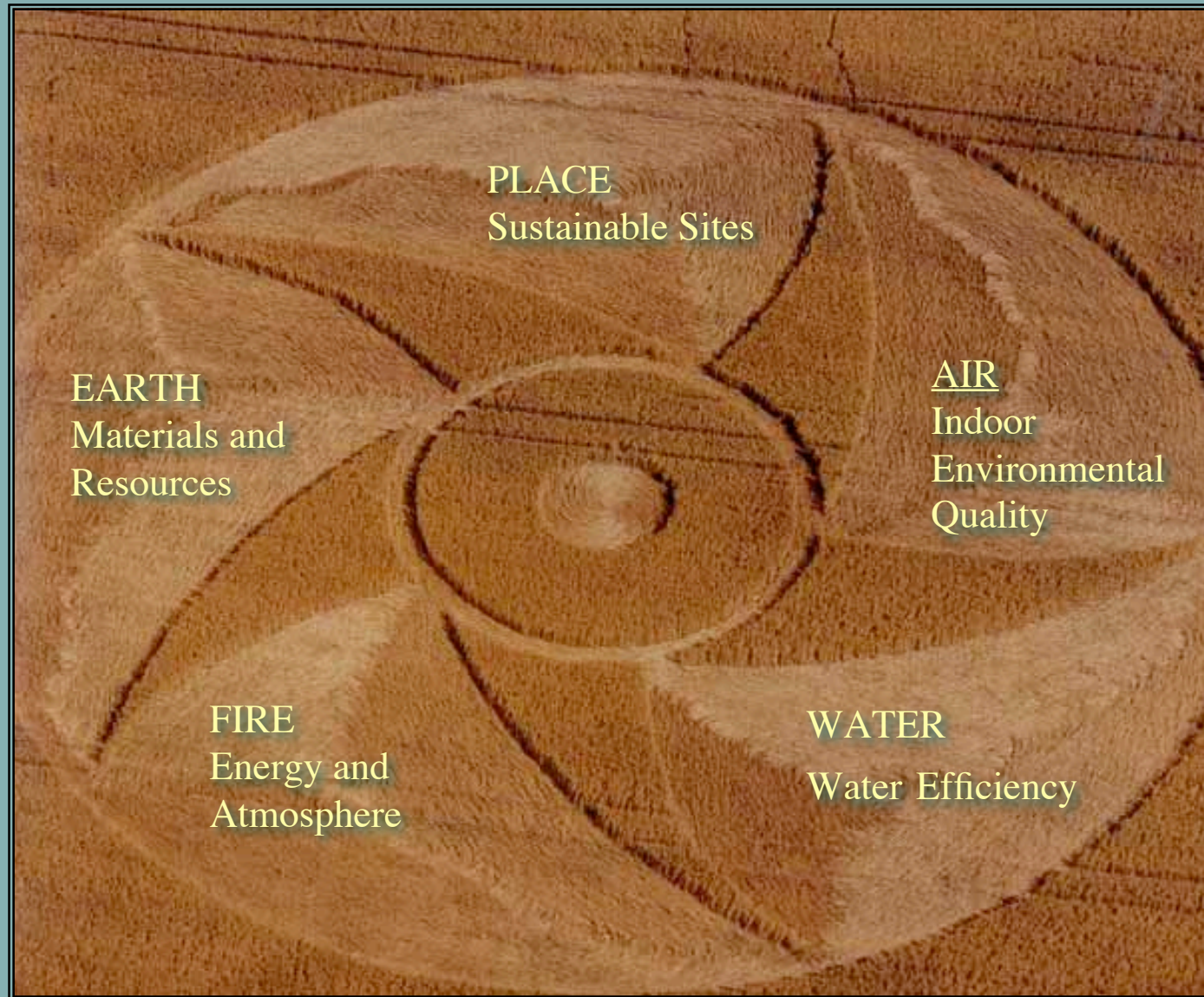
Add up your total use of BTU 's per year and divide that figure by the square feet of your home. This is your EUR, & will range from 30,000 to 100,000 BTU's sf yr.

## Step D.

Divide by degree days ( in Boston 5600 HDD) to get BTU's / sq. ft / yr / Degree Day

# The 5 Point LEED Rating System Model

## Leadership in Energy and Environmental Design





## Climate Action Plan

A Sustainability Plan can be considered a Climate Action Plan with a broader more holistic view of community sustainability.

Getting Leadership Commitment is key either way.

## ICLEI


### Local Governments for Sustainability

[www.icleiusa.org](http://www.icleiusa.org)

Established in 1990, more than 1,100 members, 43 countries, To advance deep reductions in greenhouse gasses and tangible improvements in local sustainability

## Sustainability Plan





**An Excel-based tool to help local governments  
choose emissions reductions measures  
and develop climate action plans**

- ICLEI is proud to release its CAPPAs decision support tool, which plays a key role in helping local governments progress through ICLEI's Five Milestones for Climate Mitigation process.
- It provides a starting point for two major tasks: determining an achievable emissions reduction target (Milestone Two) and selecting strategies to include in a climate action plan (Milestone Three).

## Mass Energy Insight: New Utility Interfaced Monitoring and Planning Tool Released 2010 for Mass Town Energy Use



- MassEnergyInsight, a robust, easy-to-use, energy information tool with customized electricity, natural gas and oil usage details for cities and towns across Massachusetts.
- The tool sorts information from utility companies into a database that will benchmark the consumption of electricity, natural gas, and heating oil in public facilities revealing energy use, costs, and greenhouse gas emissions.
- MassEnergyInsight will enlighten your community with information that has not previously been available, providing municipalities the foundation for critical decision making to cut costs and reduce greenhouse gas emissions.
- This information can empower action, leading your community to embrace efficiency.

# Progress with Massachusetts DOER Green Communities Program

## Developing a Roadmap for the Town to Meet Five Required Criteria and be Eligible for Major Grant Funding

Alternate Energy Committee with Consultant Blue Wave Strategies, LLC

- 1 Adopt As of Right Siting
- 2 Adopt Expedited Permitting for that AOR Site
- 3 Establish Energy use Baseline, and 20% reduction target for 5 yrs
- 4 Fuel Efficiency Program for Fleet Vehicles
- 5 Adoption of the Stretch Code

# Milton & EECEBG Award, 2010

Milton recently awarded \$150,000 for Solar PV Funds made available by the American Recovery and Reinvestment Act (ARRA) of 2009 through the US Department of Energy. Energy Efficiency and Conservation Block grant program. The Commonwealth of Massachusetts Department of Energy Resources (DOER) developed and is responsible for administering this sub-grant program.

The total area of the array will be close to 64% (2,414 sf) of the 3,750 sf, providing close to 30 KW of PV for the well oriented and highly visible South face of the building.

The current EUR of the building is 108,000 BTU/SF, and uses 218,612 kWh a year, This array will provide approx 31,251 kWh annually, or 14% of the electricity of Town Hall.

The electricity is 40% of the buildings energy use, so that the PV will be about 5.6% of the total annual energy needs, though will offset closer to 10% of the Buildings carbon footprint.



# New Wind Turbine for Milton



- Wind Committee, began work in 2007 and recently achieved Town Meeting approval of 6.2 Million \$ Bond for 1.5 megawatt Turbine to be constructed on Town Property next to Granite Links Golf Course.
- Turbine to provide \$800,000 of elec. for the Town in next 20 years
- In rough numbers, the Turbine was calculated to generate about 3 million kWh, half of the municipal electrical use, and about 2.4% of the town's 124.6 million kWh use in 2008.
- As a comparison, if we commit though ICLEI, a 20% reduction town wide in efficiency and conservation, including the residential of course, we would be looking at the equivalent of  $(124.6 \times .2)$  or approx. 25,million kWh, equal to 8.3 windmills of production.



## New Wind Turbine for Milton





Southwest face of Building

Milton Hill 1947, Home Office  
Renovated 1997 to Present 2,597 s.f.

1. 44,529 BTU/ SF/ YR
2. 7.95 BTU.SF/ YR/HDD
3. No Renewable Energy
4. 24,306 lbs of C0-2 / Yr
5. 9.36 lbs of C0-2 / SF /Yr
6. REC's of 25 K lbs C0-2 / Yr
7. CFM @50 = 1450
8. CFM @50 PSF of Shell  
 $1450 / 5550 = .26$
9. ACH @ 50 = 4.78
10. ACH nat = .239





## National Grid Deep Energy Retrofit Pilot Program

Opportunities for major incentives that help pay for up to 75% of the cost of deep energy retrofit work, requiring that buildings reuse at least 50% of the existing floor plate of the building, achieve a min HERS Rating of 50 &/or qualify for a series of related protocol.



# Monitoring Process



Blue Line Monitor



Kill-0-watt Reader



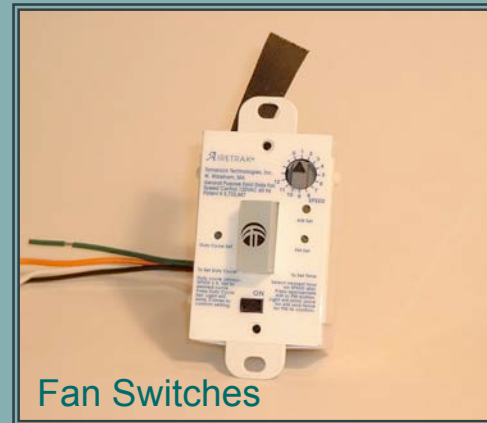
Hygrometer RH Meter



Blower Door Unit



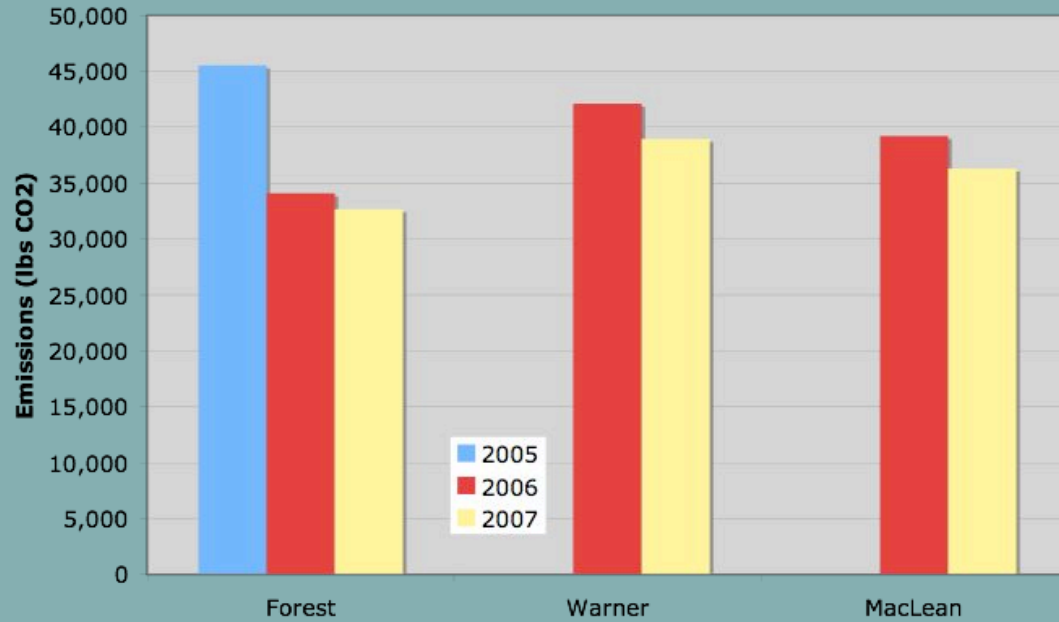
Blue Line Meter Reader



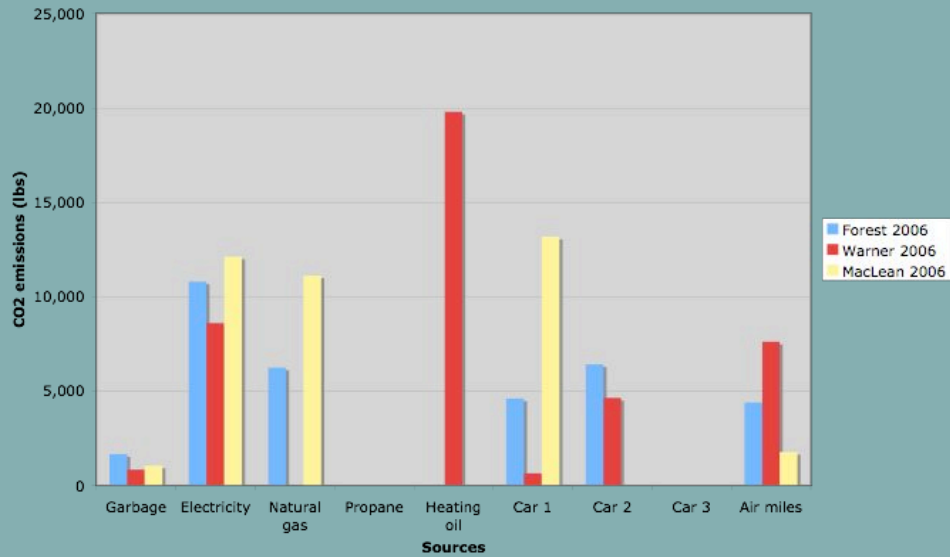
Fan Switches

# Results of Milton Low Carbon Diet Team

## Milton



Milton LCD Group: 2006



Milton LCD Group: 2007

