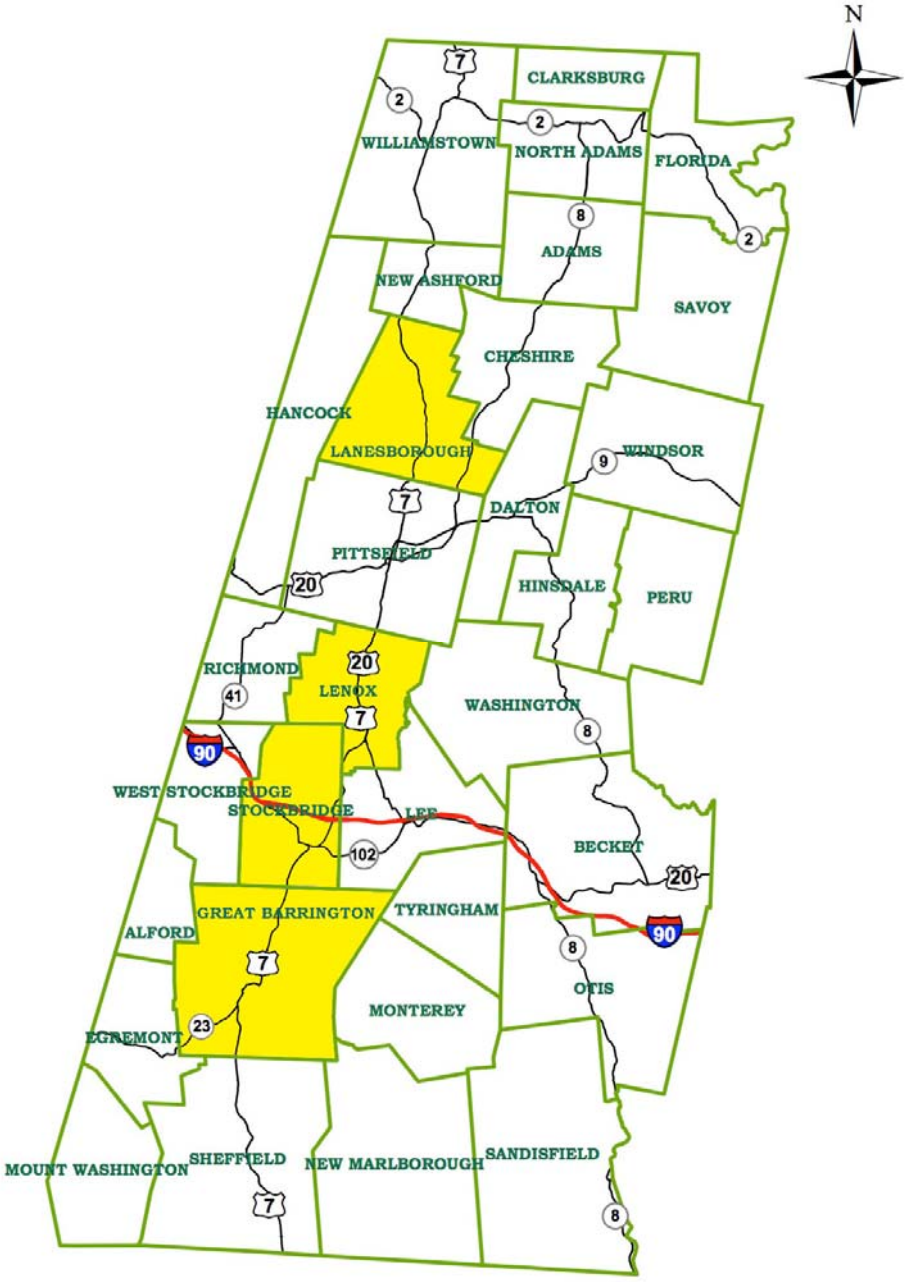
CO2 Emissions Data, Analysis, and Recommendations for Great Barrington, Lanesborough, Lenox, and Stockbridge, Massachusetts



Submitted by Jonathan L. Earle
Williams College ‘09
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INTRODUCTION

The purpose of this report is, first and foremost, to help the four towns begin to reduce their CO2 emissions by providing data in a concise and meaningful form, useful analysis, and preliminary recommendations that focus attention where it is most urgently needed and can do the most good.

The four towns were not picked at random. All have ratified, or expressed interest in ratifying the International Council for Local Environmental Initiatives (ICLEI)'s Cities for Climate Protection (CCP) initiative and/or the Mayors Climate Protection Agreement[1]. Both voluntary, non-binding protocols lay out actions which towns can follow to achieve CO2 emissions reductions, but as the four towns can attest to, ratifying an agreement and following through on it are two very different things. Momentum tends to die out unless steps are taken to form a widely representative, permanent committee that works exclusively on achieving CO2 emissions reductions.

The CCP methodology consists of five milestones—goals which all member towns can undertake. They are:

1. Conduct a baseline emissions inventory and forecast
2. Adopt an emissions reduction target for the forecast year
3. Develop a local action plan
4. Implement policies and measures

[1] Mayors Agreement was launched in 2005 by Seattle Mayor Greg Nickels. Towns that ratify it (over 500 already have) pledge to reduce town-wide emissions by seven percent below 1990 levels by 2020. The CCP was launched in 1993 and presently has 686 members worldwide. Unlike the Mayor's Agreement, it allows towns to establish their own CO2 reduction targets.

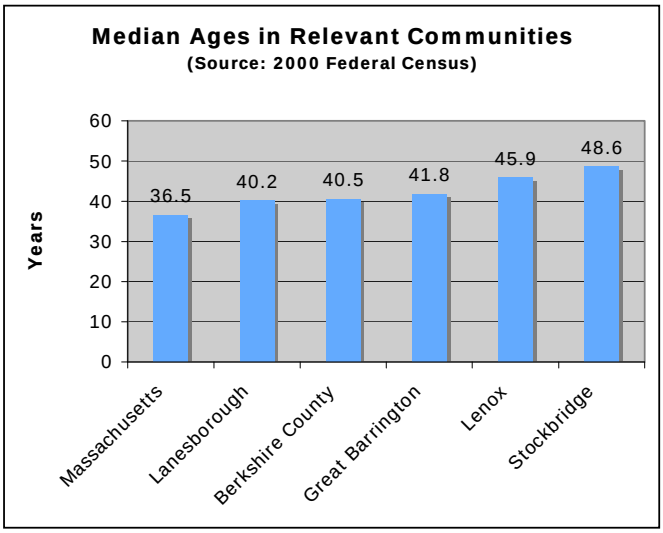
5. Monitor and verify results

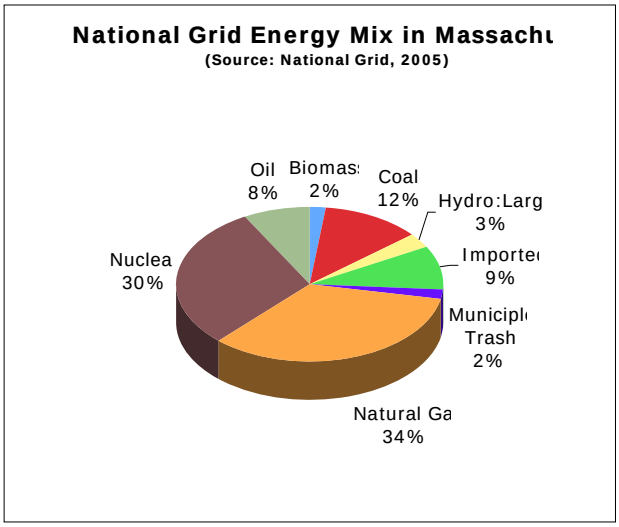
This report deals mostly with Milestones 1, 3, and 5. First, it establishes a baseline emissions level for the present. The analysis and recommendations contained within speak to milestone 3, although this report heavily favors the idea of empowering towns with the information they need to make wise decisions about which measures are best for them. Lastly, by fully documenting its sources, this report attempts to be fully replicable, so that when the time comes to measure progress, it requires not months but hours to compile. Within the report are also recommendations which we hope will simplify and streamline the everyday organizing of information, making it still easier to monitor progress.

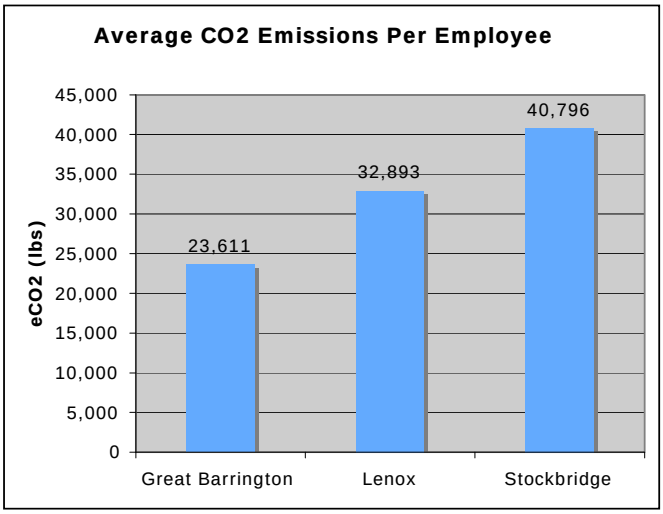
Our hope is that once the four have CO2 committees up and running—which would make five in the Berkshires including Williamstown's COOL committee—others in the region will be inspired to follow suit. Already, 51% of Berkshire County's population lives in towns which have ratified the CCP agreement (Pittsfield, Williamstown, Great Barrington, Lenox, and Stockbridge).

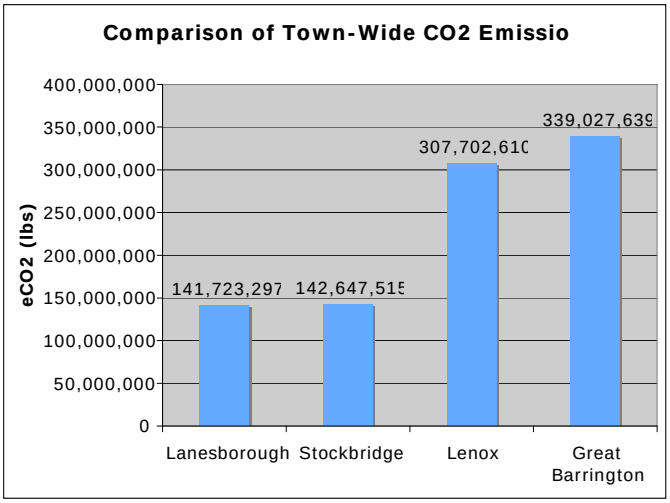
Reducing CO2 emissions is no longer a fringe concern. Climate change affects all of us, and thus requires the urgent attention of the biggest and smallest towns alike. Our dream is for CO2 reduction committees to become as commonplace and mainstream as planning and finance boards, drawing talent and ideas from all sectors of society (residential, municipal, and commercial.

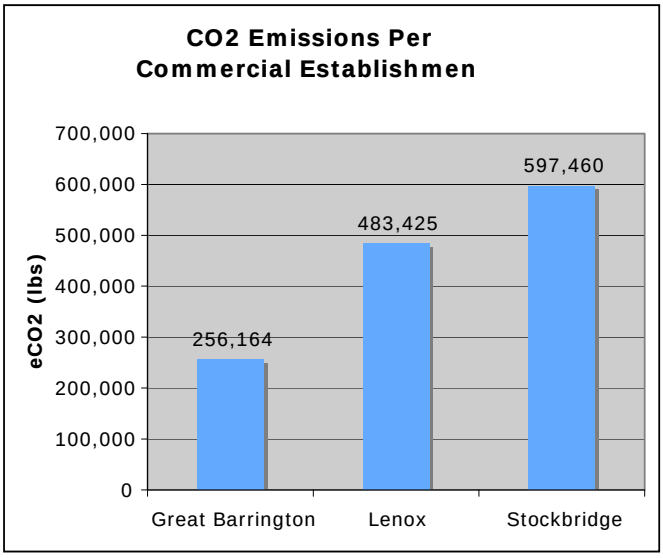
REGIONAL FACTS AND CITIES COMPARISON

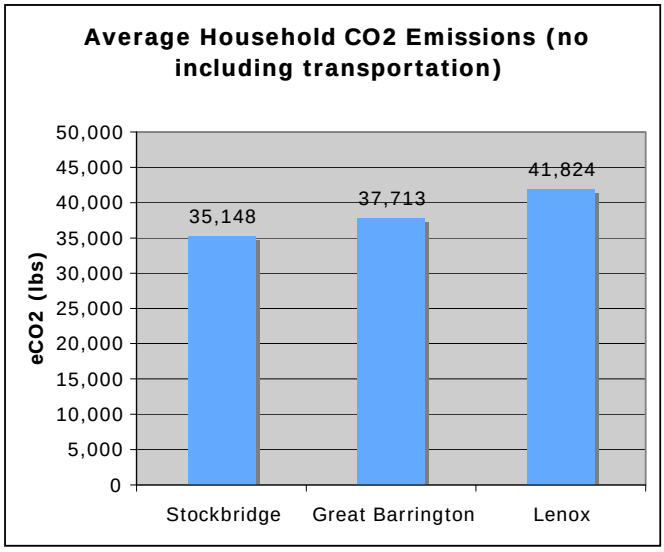


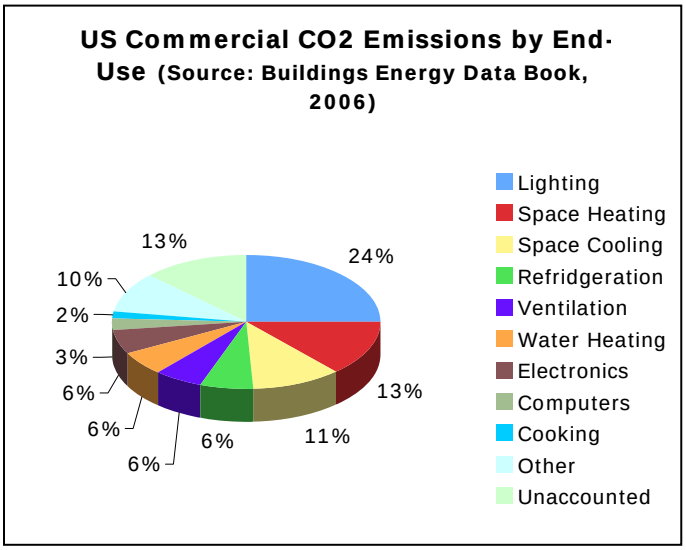


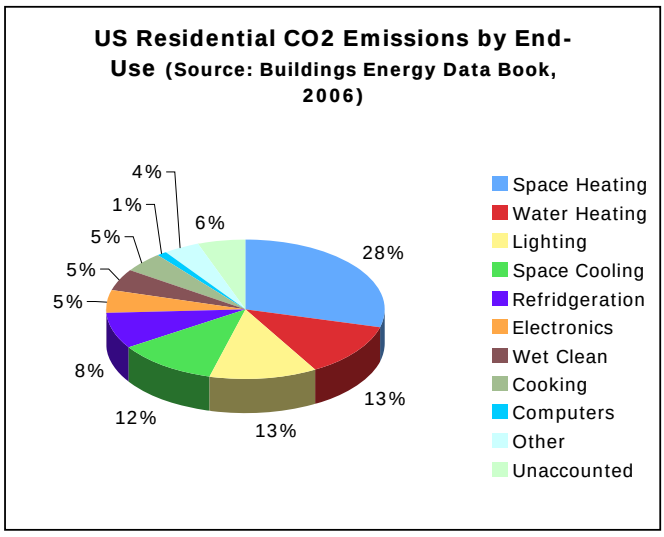

Average CO2 Emissions Per Employee
eCO2 (lbs)
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
23,611
32,893
40,796
Great Barrington
Lenox
Stockbridge

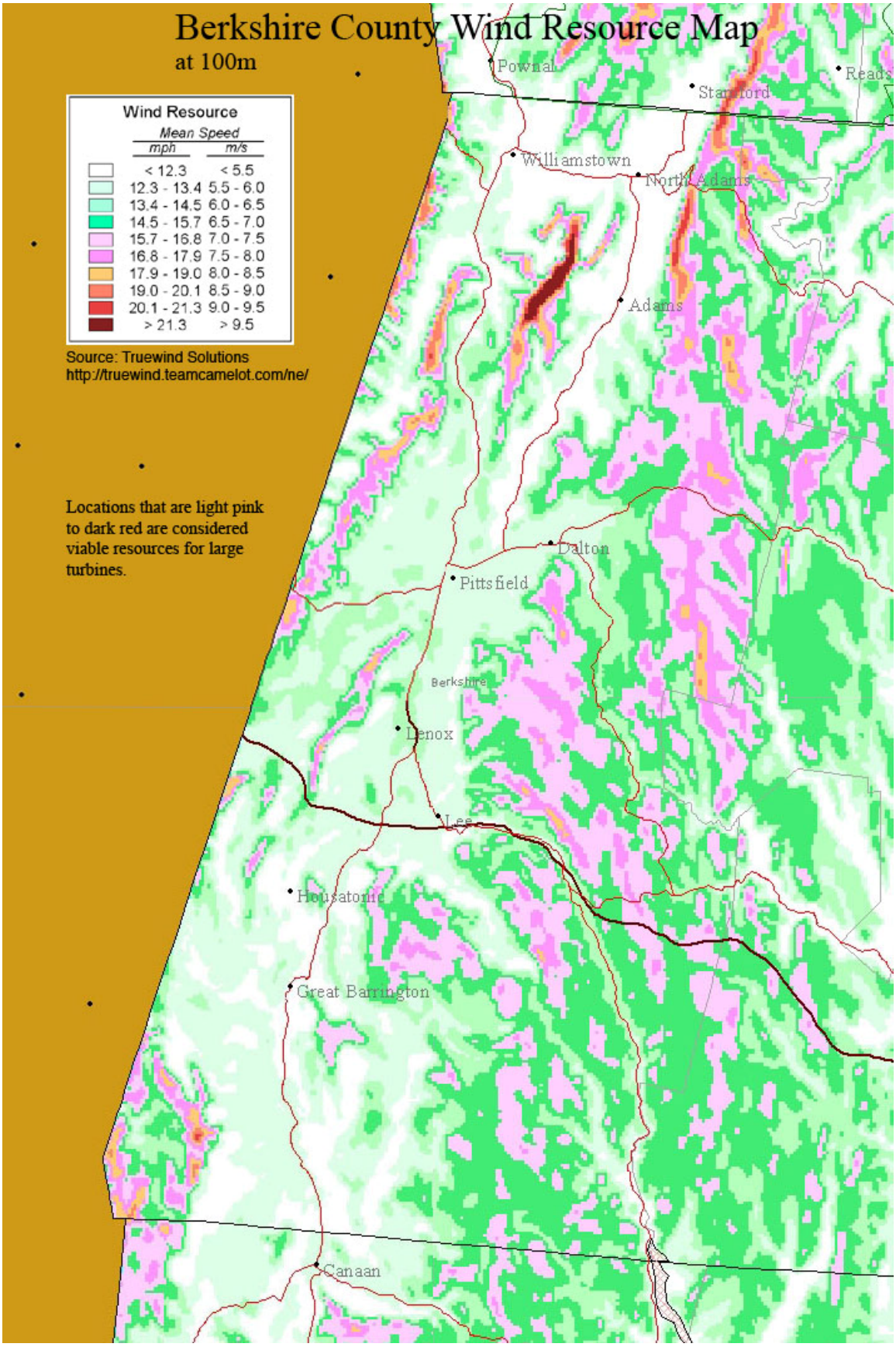

Comparison of Town-Wide CO2 Emissio
eCO2 (lbs)
400,000,000
350,000,000
300,000,000
250,000,000
200,000,000
150,000,000
100,000,000
50,000,000
0
141,723,297
142,647,515
307,702,610
339,027,639
Lanesborough
Stockbridge
Lenox
Great Barrington


CO2 Emissions Per Commercial Establishmen
eCO2 (lbs)
700,000
600,000
500,000
400,000
300,000
200,000
100,000
0
256,164
483,425
597,460
Great Barrington
Lenox
Stockbridge


Average Household CO2 Emissions (no including transportation)
eCO2 (lbs)
50,000
45,000
40,000
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
35,148
37,713
41,824
Stockbridge
Great Barrington
Lenox


US Commercial CO2 Emissions by End-Use (Source: Buildings Energy Data Book, 2006)
24%
13%
11%
6%
6%
6%
3%
2%
10%
13%
Lighting
Space Heating
Space Cooling
Refridgeration
Ventilation
Water Heating
Electronics
Computers
Cooking
Other
Unaccounted

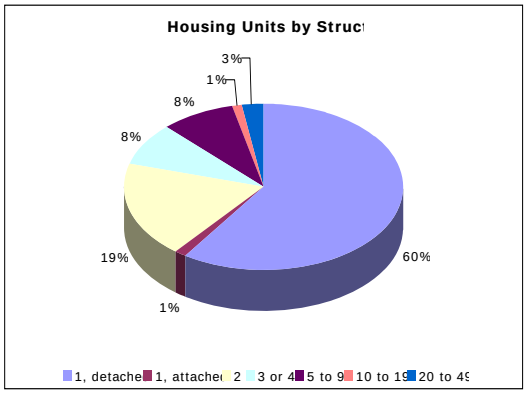

US Residential CO2 Emissions by End-Use (Source: Buildings Energy Data Book, 2006)
28%
13%
13%
12%
8%
5%
5%
5%
1%
4%
6%
Space Heating
Water Heating
Lighting
Space Cooling
Refridgeration
Electronics
Wet Clean
Cooking
Computers
Other
Unaccounted


Berkshire County Wind Resource Map
at 100m
Wind Resource
Mean Speed
mph
m/s
< 12.3 < 5.5
12.3 - 13.4 5.5 - 6.0
13.4 - 14.5 6.0 - 6.5
14.5 - 15.7 6.5 - 7.0
15.7 - 16.8 7.0 - 7.5
16.8 - 17.9 7.5 - 8.0
17.9 - 19.0 8.0 - 8.5
19.0 - 20.1 8.5 - 9.0
20.1 - 21.3 9.0 - 9.5
> 21.3 > 9.5
Source: Truewind Solutions
http://truewind.teamcamelot.com/ne/
Locations that are light pink to dark red are considered viable resources for large turbines.
Pownal
Stamford
Reads
Williamstown
North Adams
Adams
Dalton
Pittsfield
Berkshire
Lenox
Lee
Housatonic
Great Barrington
Canaan

GREAT BARRINGTON

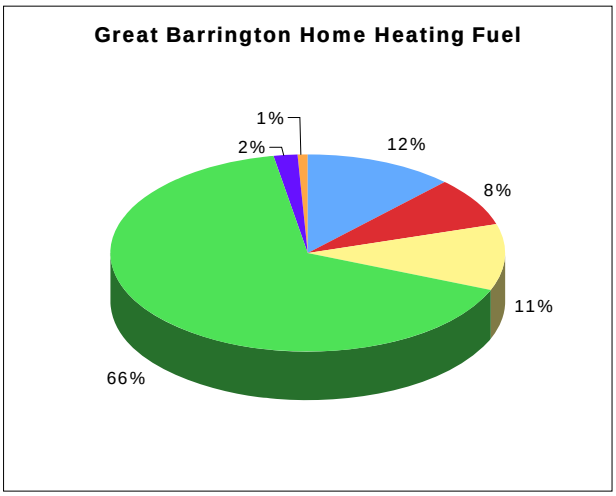
Pop. 7,008[i]

Great Barrington ratified the CCP and Mayor's Agreement at a town meeting on May 14, 2007, and the inaugural meeting of Green Barrington, the town's CO2 lowering committee, took place on July 31, 2007 at town hall. According to ICLEI, the town has one clean energy project installed (a PV project on Berkshire Hills Middle School, installed 2005) with an annual capacity of 70,047 kWh. Its use offsets 26 tons of CO2 per year.[ii] Last year 105 Great Barrington households (3% of all households[iii]) purchased a total of 551,250 kWh of clean power from National Grid, thereby avoiding 207 tons of CO2 emissions.



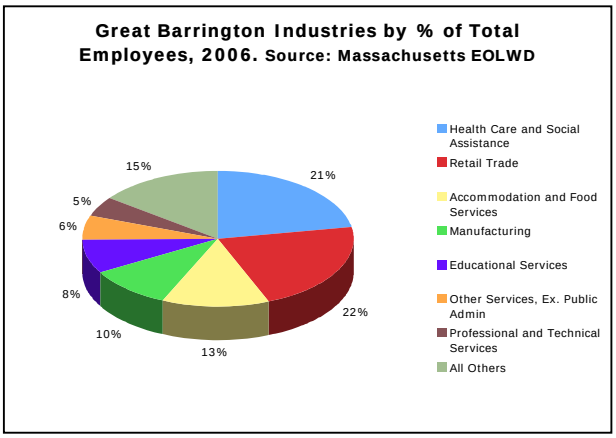
Demographic

- Age statistics almost match Berkshire County averages. The median age, 41.8 years, is about five years older than the Massachusetts average.
- Approximately 19% of Great Barrington residents are over 65, while 22.6% are under 18.



Housing

- 52% of housing units were built before 1940, and only 15% were built since 1979.
- 10.6% of housing units still heat with electricity, the most inefficient and costly method.
- 7% of occupied housing is for seasonal, recreational, or other use.
- Owner occupied housing constitutes 62% of housing units, but more than 70% of indoor residential space[iv] (also 68.5% of the population lives in owner-occupied dwellings[v]). Add to that the fact that 83% of owner-occupied housing units are single-detached homes, it is clear that Barrington should focus on achieving reductions in these settings.

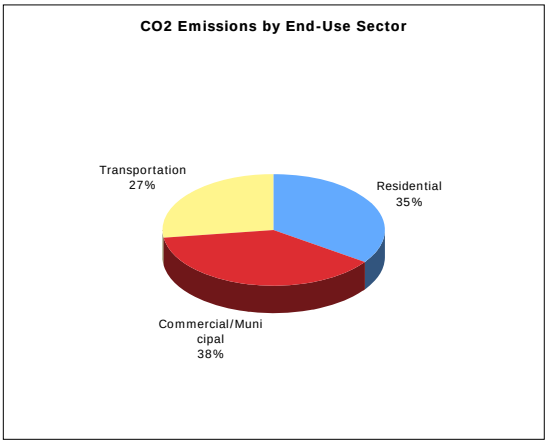


Economy

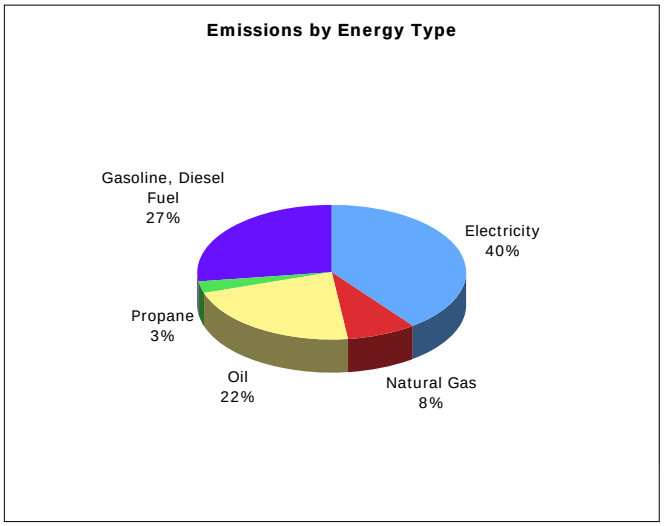
- The four biggest commercial sectors by employment are (in order): healthcare and social assistance, retail trade, accommodation and food services, and manufacturing. The largest employer in town is Fairview Hospital, followed by the following (in alphabetical order):

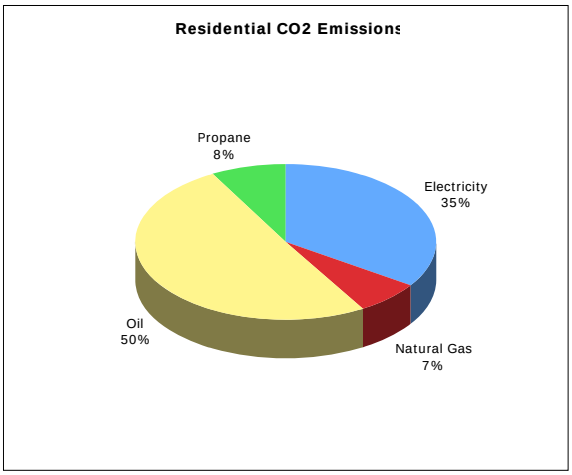
Big Y Supermarket, Butternut Ski School, Fairview Commons (Formerly Willowood), Great Barrington Rehab & Nursing Center, Housatonic Curtain Co., Justice Resource Institute (Berkshire Meadows), Simon's Rock College of Bard, Timberlyn Nursing Home. Combined, these nine establishments employ at least 19% and as high as 46% of the town's workforce (resident and non-resident).

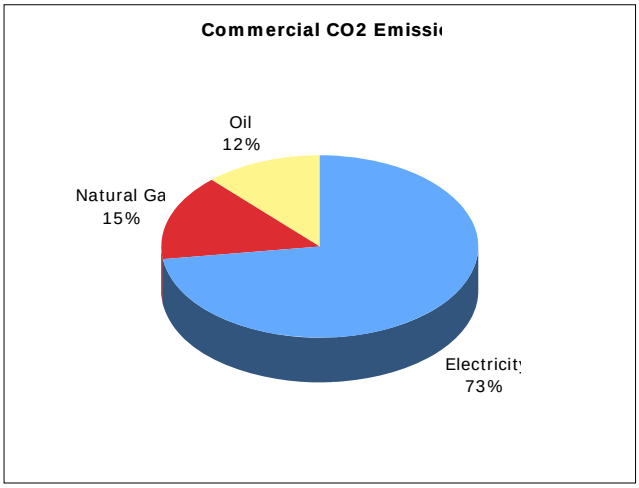
ENERGY CONSUMPTION AND CO2 EMISSIONS



- Since 2000, electricity consumption has risen 9.6%, or about 1.5% annually (residential consumption rose 1.4% per year, commercial/municipal rose 1.6% per year), despite the fact that the number of electricity customers only rose 5.6%, or .9% annually. This is consistent with regional and national trends (national residential growth is 1.4% per year since 1990[vi]).
- Based on municipal data from other towns, one can estimate that municipal emissions constitute no more than 5% of total emissions.
- Great Barrington emits approximately 339,027,639 lbs (169,514 tons) of CO2 per year.
- Average Great Barrington household, 2006[vii]: 117,665,329 lbs / 3120 households = 37,713 lbs (electricity 13,019; oil/gas 24,693) + 23,370 lbs (transportation[viii]) = 61,083 lbs CO2 total (30 tons)
- Per capita emissions: 48,377 lbs CO2 (24 tons)
- Per capita emissions (residential only): 16,790 lbs CO2 (8.4 tons)
- Average employee/yr (not including transportation): 23,611 lbs CO2 (11.8 tons)
- Average business/yr (not including transportation): 256,164 lbs CO2 (128 tons)







GREAT BARRINGTON DATA

Note: This section is intended for those who want to verify, improve, update, and/or duplicate the data and analysis. See endnotes and "Source" section for more information.

Population

- 2000…….....7,527
- 1990…….....7,725

Age

- Median age 41.8 yrs (BC avg. 40.5; MA avg. 36.5 yrs)
- <18: 1,699 or 22.6% (BC avg. 22.4%; MA avg. 23.6%)
- 65+: 1,413 or 18.8% (BC avg. 17.9%; MA avg. 13.5% yrs)
    - 2020 estimate: 28%

Housing and Households

- Total Housing Units: 3,352
    - Occupied housing units: 3,008 or 89.7%
        - Owner-occupied: 1,859 or 61.8% (of occupied housing)
        - Renter-occupied: 1,148 or 38.2% (of occupied housing)
        - For seasonal, recreational, or other use: 7% (of occupied housing)
    - Vacant: 344 or 10.3%
- Total households: 3,008
    - Family households: 1,826 or 60.7%
    - Single person households: 980 or 32.6%

Labor & Employment, 2006[ix]

- Average # of establishments: 504
- Average Employment: 5,468

Major Employers

- 249-499
    - Fairview Hospital
- 100-249 Employees
    - Big Y Supermarket
    - Butternut Ski School
    - Fairview Commons (Formerly Willowood)
    - Great Barrington Rehab & Nursing Center
    - Housatonic Curtain Co.
    - Justice Resource Institute (Berkshire Meadows)
    - Simon's Rock College of Bard

- Timberlyn Nursing Home

Transportation

- Road Miles, 2006: 96.02 miles
- Number of registered vehicles, Jan. 2005: 8,051
- Average age of vehicles 9.33 yrs

	miles/day miles/year	Gallons/day Gallons/year[x]	Lbs of CO2/day Lbs of CO2/year
Per Vehicle (New England averages)	33.7 12,300[xi]	1.6 586	31.4 11,459
Town Overall, Jan 2005	271,307 99,027,300	12,919 4,715,586	252,755[xii] 92,255,719

ELECTRICITY

- National Grid
  - Per customer, 2006: 7,498 kWh
  - Per capita, 2006 (residential/population): 3,764 kWh
  - Per household per year, 2006 (residential/housing units): 28,009 kWh
  - Per employee, 2006 (commercial,municipal/employees): 14,228 kWh

Town-Wide Electricity Usage, 2000

	Customers	kWh Sales	kWh/Customer
Residential	3391	24,276,255	7,159
Commercial/Municipal	854	55,096,110	64,515
Street Lighting	10	332,119	x
TOTAL	4255	79,704,484	18,732

Source: National Grid

Town-Wide Electricity Usage, FY2006

	Customers	kWh Sales	kWh/Customer
Residential	3518	26,377,663	7,498
Commercial/Municipal	964	60,511,384	62,771
Street Lights	10	499,810	X
TOTAL	4492	87,388,857	19,454

Source: National Grid

Change in Town-Wide Electricity Usage, 2000-2006

	Change in # of Customers	% Change in number of Customers	Average yearly change in customers (%)	Change in # of kWh	% Change in kWh	Average yearly change kWh (%)
Residential	127	3.7%	.6%	+2,101,408	8.7%	1.4%
Commercial/Municipal	110	12.9%	2%	+5,415,274	9.8%	1.6%

Street Lights	0	0%	0%	+167,691	50.5%	7%
TOTAL	237	5.6%	.9%	+7,684,373	9.6%	1.5%

NATURAL GAS

- Berkshire Gas, sole provider

	Ccfs (therms)	CO2
Residential non heating	14,526 (14,875)	181,038
Residential heating	633,818 (649,030)	7,899,274
Commercial/Industrial/Municipal	1,597,128 (1,635,459)	19,905,006
TOTAL	2,245,472 (2,299,363)	27,985,317

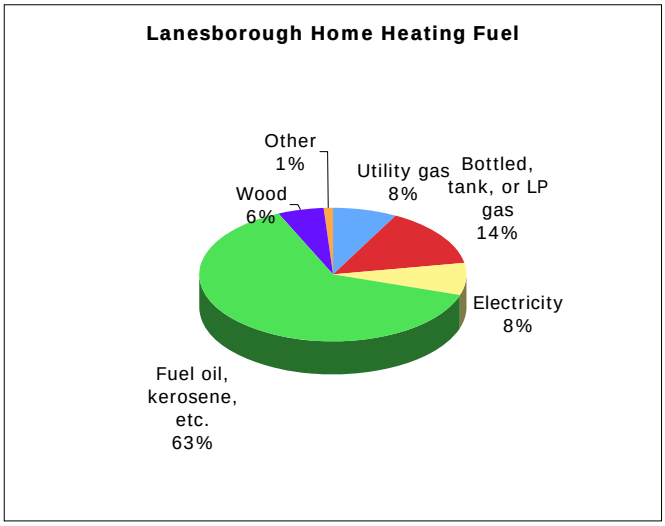
	Electricity Source: National Grid, 2006		Oil/Gas/Propane[xiii] Source: Berkshire Gas, 2005 Oil and LPG estimates		Transportation (2005)	
	Cons. (kWh)	CO2 (lbs)	Cons.[xiv]	CO2[xv] (lbs)	Cons.	CO2
Residential	26,377,663	40,621,601	Gas:663,905therms Oil: 2,663,476gal LPG: 477,645	G:8,079,724 t O:59,619,247 g L:9,344,647 g	4,715,586 gallons	92,255,719
Commercial/ Municipal	61,011,194	93,957,239	Gas:1,635,459therm Oil: 681,108gallons	G:19,903,536 t O:15,245,926 g		
TOTALS	87,388,857	134,578,840	G: 2,299,364therm O: 3,344,584gal L: 477,645	G:27,983,259.88 O:74,865,168 g L: 9,344,647 g All:112,193,075	4,715,586	92,255,719
TOTAL PER CAPITA PER YEAR[xvi]	12,470 kWh	19,204 lbs	x	14,369 lbs	673 gallons	13,164 lbs

Residential Total: 117,665,219
Commercial Total: 129,106,701
Transportation Total: 92,255,719
Town Total: 339,027,639 lbs

LANESBOROUGH

Pop. 2,898[xvii]

Lanesborough has expressed interest in joining the CCP. For the past year an energy committee led by Gae Elfeinbein has been examining electricity efficiency in municipal buildings.

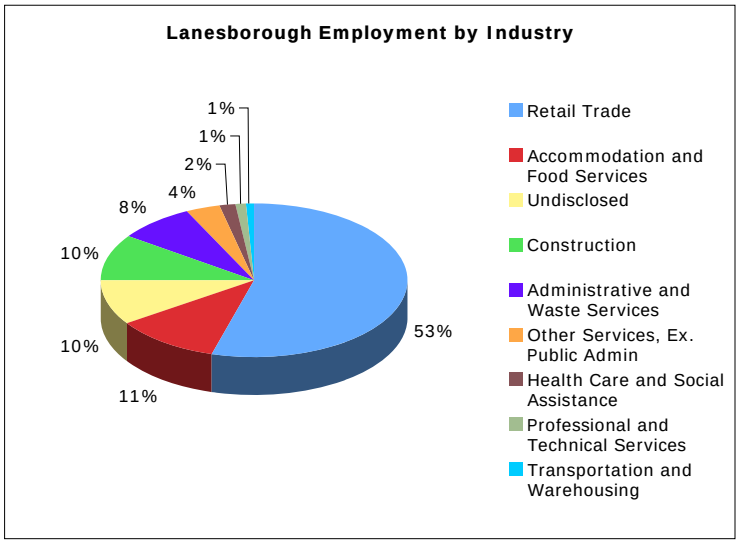


Demographic

- The median age in Lanesborough is 40.2 years, the youngest of the four towns and two years younger than the median in Berkshire County.
- Approximately 13% of the population is over 65, the lowest figure in the four towns. It is projected to rise to 20% by 2020.

Housing Units

- The median year of construction for owner-occupied houses is 1954; for renter-occupied it is 1946. This means that there could be significant potential for CO2 emissions reductions in residential efficiency upgrades.
- 8% of Lanesborough homeowners heat their homes with electricity—the most polluting and expensive method. This is among the lowest figures in the four towns, but needs to be reduced further.
- 88% of Lanesborough housing units are owner occupied, 12% are renter occupied. 87% of all housing units are single, detached units—the most inefficient type. Thus, CO2 emissions reductions in the residential sector must come from this group. Unfortunately, this means dealing with a large number of individual homeowners.

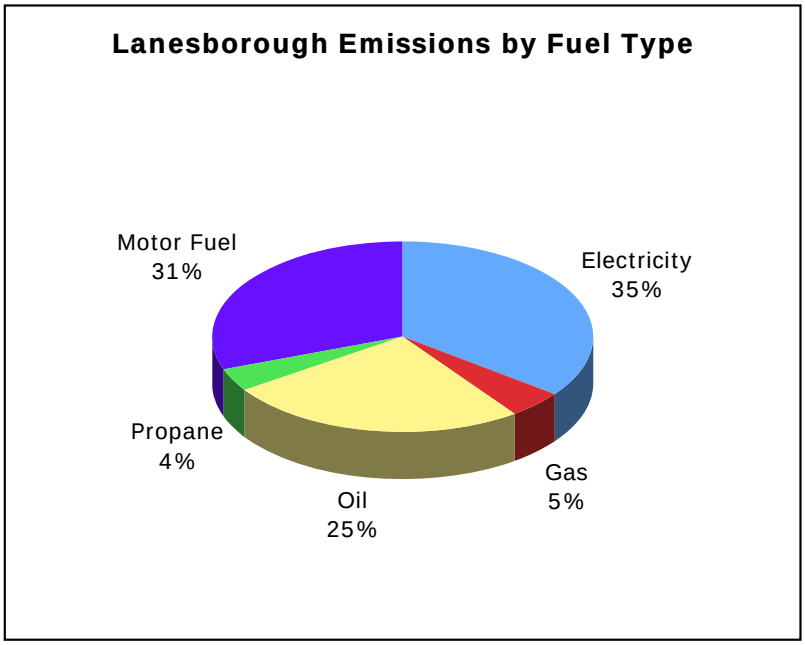


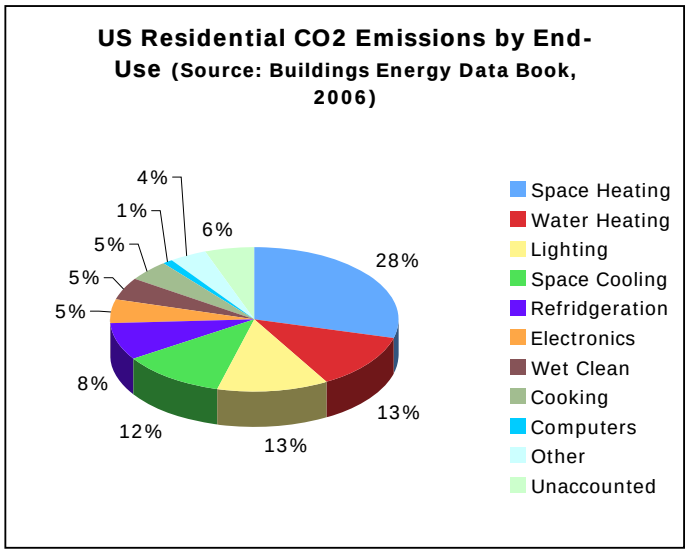
Economy

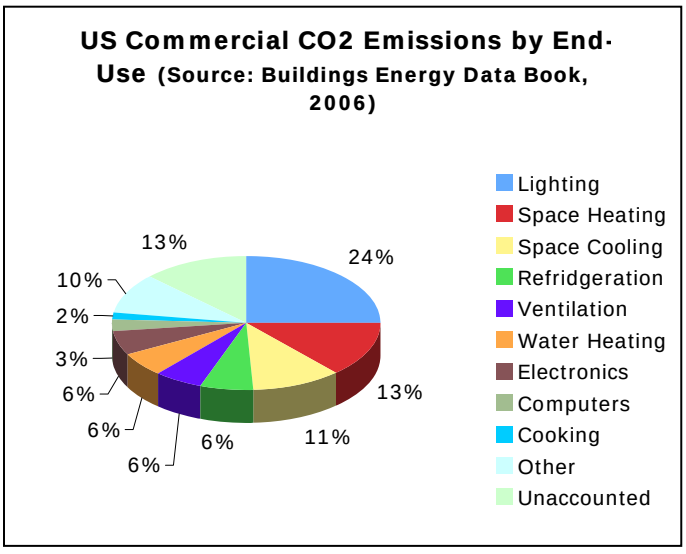
- 53% of Lanesborough employees work in the retail trade sector, centered around the Berkshire Mall. The town should engage the owners of the Berkshire Mall and explore the possibility of reducing consumption and increasing efficiency. Swaying only a few decision-makers could produce significant emissions reductions.

ENERGY CONSUMPTION AND CO2 EMISSIONS

- I was unable to obtain updated electricity consumption information from WMECO, and therefore unable to look at trends in Lanesborough. Nationally, electricity consumption is increasing by about 1.3% annually. In the four towns, the average is about 1.66% per year. Lanesborough probably falls somewhere in-between.
- Based on municipal data from other towns, we can estimate that municipal emissions constitute no more than 5% of total emissions.
- Lanesborough emits approximately 141,723,297 lbs/yr (70,862 tons/yr) of CO2.
- Per capita CO2 emissions: 48,904 lbs/yr (24.4 tons/yr)







LANESBOROUGH DATA

Note: This section is intended for those who want to verify, improve, update, and/or duplicate the data and analysis. See endnotes and "Source" section for more information.

Historic Population

- 2000…….....2,990
- 1990…….....3,032

Age

- Median Age 40.2 yrs (BC avg. 40.5; MA avg. 36.5 yrs)
- <18: 716 or 23.9% (BC avg. 22.4%; MA avg. 23.6% yrs)
- 65+: 390 or 13% (BC avg. 17.9%; MA avg. 13.5% yrs)

Households

- Total housing units 1,382
- Occupied housing units 1,203
    - Owner occupied 1,059 (88%)
    - Renter occupied 144 (12%)
- Housing Units for seasonal, recreational, or occasional use 83 (6%)

Labor & Employment

- Total civilian labor force, 11/06[xviii]: 1,770
    - Unemployment rate 4.0%

Major Employers

- Berkshire Mall
- 100-249
    - Filene's Dept. Stores
    - Sears, Roebuck & Company
- Transportation[xix]
- Road miles 62.54
- Number of registered vehicles (Jan. 2005) 3,790
- Avg. age of vehicles 9.18 yrs

	miles/day miles/year	Gallons/day Gallons/year[xx]	Lbs of CO2/day Lbs of CO2/year
Per Vehicle (New England averages)	33.7 12,300[xxi]	1.6 586	31.4 11,459
Town Overall, Jan 2005	127,718 46,617,000	6,082 2,219,857	118,984 43,429,285

Electricity

- WMECO

	kWh consumption	kWh consumption per capita	CO2 emissions	CO2 emissions per capita

Lanesborough, 2000 est.	30,132,777	10,078	46,404,477	15,520
Lanesborough, 2005 est.[xxii]	32,461,559	10,856	49,990,801	16,720

Oil/Gas/Propane

- Berkshire Gas (2005)

	Ccfs (therms)	CO2
Res. Non heating	2,749 (2,815)	34,261
Res. Heating	208,809 (213,820)	2,602,383
Commercial & Industrial	331,889 (339,854)	4,136,330
Total	543,447 (556,489)	6,772,974

- Heating Oil, 2005 est.

	Gallons	CO2
Residential	1,281,760	28,690,917
Commercial	327,774	7,336,883
TOTAL	1,609,534	36,027,800

- Propane, 2005 est.: 429,710 gallons; 5,502,437 CO2

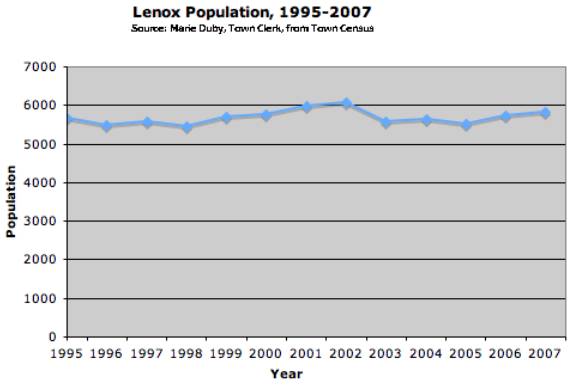
Lanesborough Renewable Projects

- 2.4 kW PV system on private home

LENOX

Pop. 5,808[xxiii]

Lenox ratified the CCP agreement in 2002. Since then, its efforts to reduce CO2 emissions have been lead by the Lenox Environmental Committee (LEC), which works with residents, municipal departments and local businesses to achieve its mission of "promot(ing) environmentally sound policies and practices in the town of Lenox."



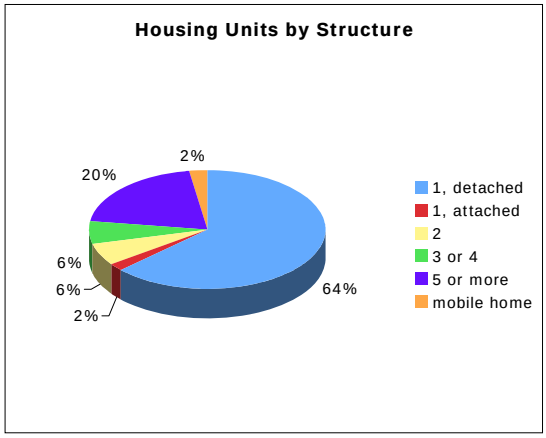
TOWN INFORMATION

Demographic

- Stable population
- Residents tend to be older, wealthier, and better educated that Berkshire County average.
- Town is aging—by 2020 it is estimated that 38.2% of the population will be 65 years or older.

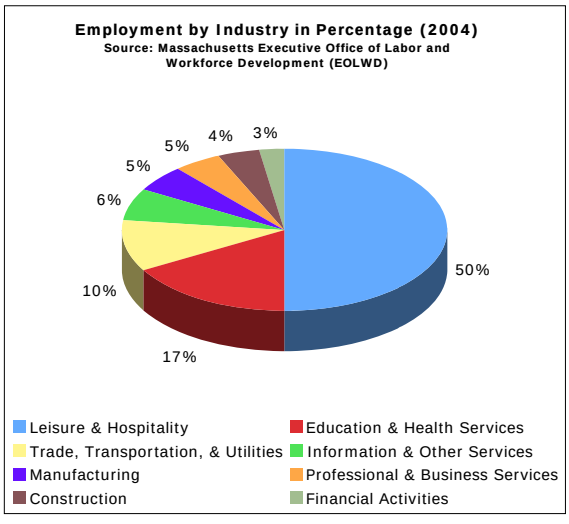
Housing

- Approximately twenty new housing units are added each year.
- 64% of Lenox housing units are single, detached units—the most energy intensive. But given that the average household contains 2.17 people, achieving reductions might be as simple as turning down the thermostat while household members are away at work. 20% are part of structures which include 5 or more units.
- The median age of owner-occupied homes is 47 years (1960), for renter-occupied homes 43 years. This leads one to believe that there is significant room for improved energy efficiency.
- 13% of housing units are exclusively seasonal—a potential opportunity for CO2 reductions, given that vacant houses require less energy but are often left in conditions which are less than optimal for efficiency.
- The average household size consists of 2.17 persons, the average family is 2.84.



Economy

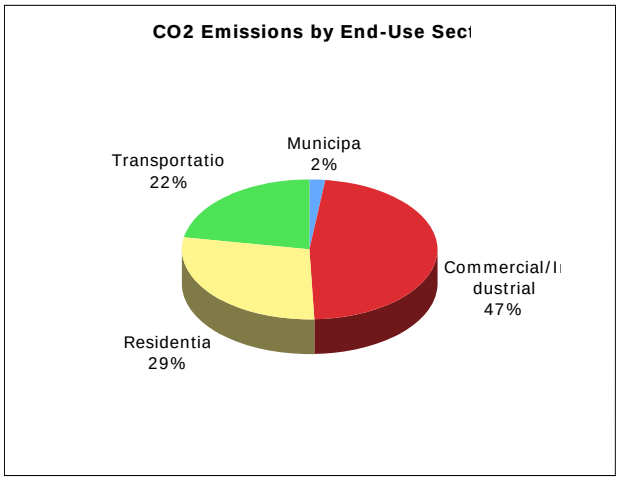
- Concentrated in three sectors: accomodation and food services (39% of employees), health care and social assistance (19%), and retail trade (9%).

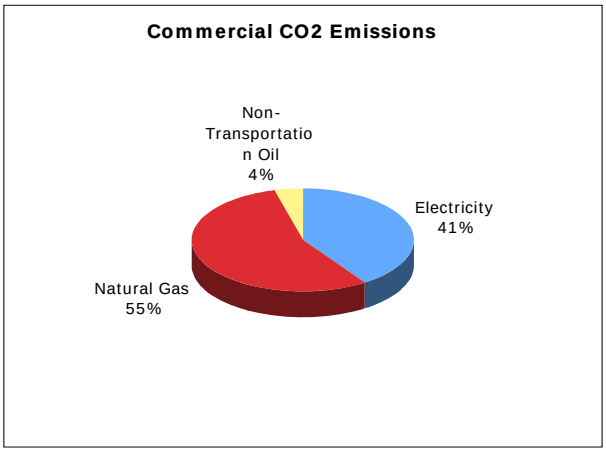


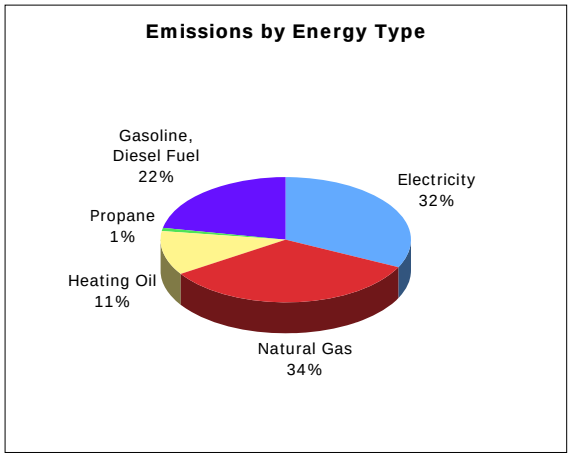
- There are approximately 300 businesses in town, yet the top seven largest employers employ almost 35% of the total workforce (resident and non-resident). Canyon Ranch is the largest of these with 658 staff members. [xxiv] Such consolidation means that swaying a small number of key decision-makers can lead to significant emissions cuts that are felt on the town-wide level.

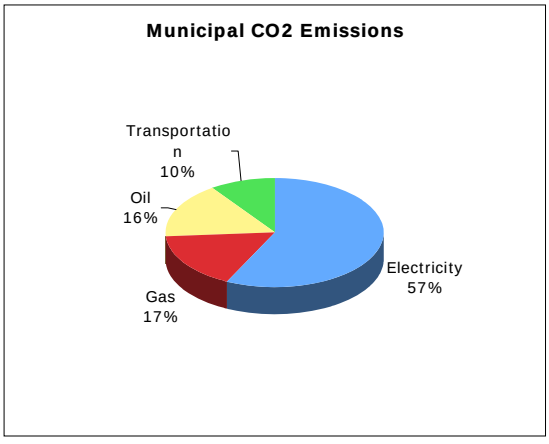
ENERGY CONSUMPTION AND CO2 EMISSIONS SUMMARY

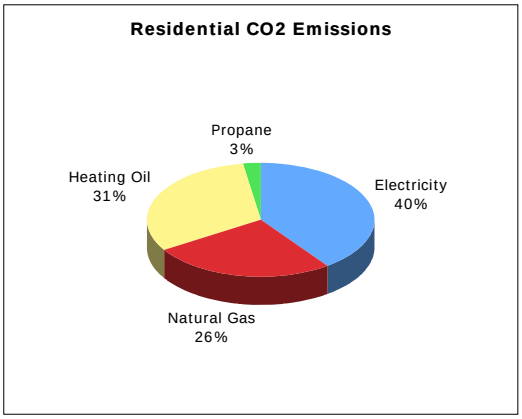
- Town-wide electricity consumption is growing at approximately 1.7% per year. Consumption has jumped almost 11% since 2000.
- According to 2000 Federal Census, 13% of Lenox households heat with electricity—the most inefficient method.
- The school system is by far the largest municipal energy user and emitter.
- The town emits approximately 307,702,610 lbs or 153,851 tons of CO2 per year.
- Average Lenox Household (including transportation)[xxv]: 63,596 lbs (31.8 tons)
- Per capita emissions: 52,334 lbs (26 tons)
- Per capita emissions (residential only) [xxvi]: 15,360 lbs (7.7 tons)
- Average employee/yr (not including transportation)[xxvii]: 32,893 lbs (16.4 tons)
- Average business/yr: 483,425 lbs (242 tons)



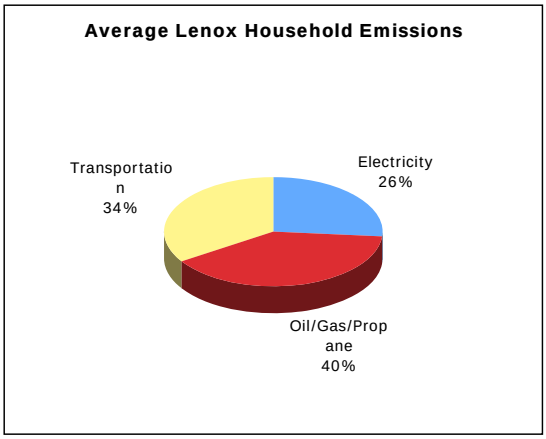




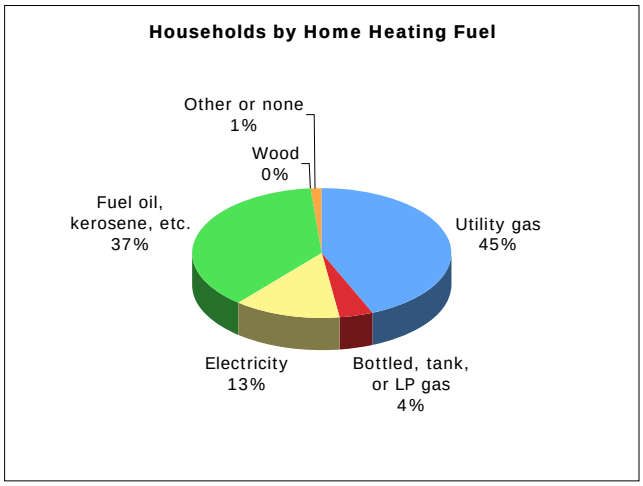




WHAT'S GOING ON IN LENOX



- CO2 Point Person: Greg Federspiel, Town Manager
- 3% currently signed up for green power
- Environmental Committee (est. '03-'04)
    - Idle-free campaign (led by Rick Greg)
    - CCP
    - Live Earth Concert Event
    - Biodiesel for municipal vehicles
    - Planned
        - Compact Fluorescent Campaign
        - Green Building Bylaw
        - Carbon Diet Initiative
- School board has made responsible environmental stewardship one of its priorities
- Installations
    - Renewables
        - Solar hot water system installed on the roof of the Methodist Church on Holmes Road (Contractor: Jim Sheratt of Sun Energy)
        - Solar PV system on roof of high school on East Street (Contractor: Solar Works)
        - 1.2 kW solar array on private home on Pine Knoll Rd.
    - Efficiency Upgrades
        - Town replaced inefficient boilers at town hall and community center
        - Town installed more efficient heating system for Department of Public Works garage
        - Replaced inefficient electric motors at water and sewage treatment plant



LENOX DATA

Population[xxviii]

- 2007……..5,808[xxix]
- 2000…….....5776
- 1990…….....5069
- 1980…….....6511

Age

- Median age.....45.9 yrs (BC 40.5 yr, MA 36.5 yrs) 36.5
- <18…….....1,058 or 20.8% (BC 22.4%, MA 23.6% yrs)
- 65+…….....1,237 or 24.4% (BC 17.9%, MA 13.5% yrs)
- By 2020 it is estimated that 38.2% of the town population (1,585 people) will be 65 or older.

Housing

- 2,713 Housing Units
    - Total Occupied…….....2,212 (81.5%)
        - Owner Occupied…….....1,491 (67.4%)
        - Renter Occupied…….....721 (33%)
    - 94.6% live in households (5.4% institutional)
    - Avg. household size…….....2.17
    - Avg. family size…….....2.84
    - Vacant: Seasonal Use…….....359 units (13%)
- Median Age of Housing Unit: Renter-occupied: 1960 Owner occupied: 1964
- New Construction (single family homes): Since 1996: 223 (20/yr)

Economic

- Approximately 300 businesses. In 2006 it fluctuated between 295 and 304. The total number of workers fluctuated from 3991 (February) to 5164 (July).
- Avg. Resident Labor Force in 2005: 2,710 (4.1% unemployment)
- Avg. Employment in 2005: 4,409 (4,016 under private ownership)[xxx]
    - 39% work in Accommodation and Food Services
    - 16% work in Health Care and Social Assistance
    - 9% work in Retail Trade
- Major Employers[xxxi]
    - Canyon Ranch of the Berkshires (Health Spa) 658
    - Hillcrest Center (Medical Care) 300
    - Cranwell (Resort/Conference Center) 215
    - G.L.&V. (Manufacturers of Paper Machinery) 109
    - Kimball Farms (Elderly Care) 100
    - Eastover (Resort) 90
    - Edgecombe [Providence Care] (Elderly Care) 80

- TOTAL COMBINED: 1552 (**35% of the workforce**)

- Ten Largest Taxpayers (in order)
  - 1. CR Resorts, LLC (Health Resort)
  - 2. Berkshire-Cranwell Ltd. Ptshp (Resort/Conference Center)
  - 3. Lenox Retirement Residence (Retirement Housing)
  - 4. Lenox Heights Housing (Cooperative Housing)
  - 5. Twelve Oaks, LLC (Condominiums)
  - 6. Mec Lenox Assoc. Limited (Supermarket)
  - 7. Fitzpatrick Holding LLC (resort)
  - 8. Berkshire Gas Co. (utility)
  - 9. Individual (Private Home)
  - 10. Individual (Private Home)

Transportation

- 2006 Road miles 64.86[xxxii]
- Number of registered vehicles (Jan. 2005) 5,877[xxxiii]
- Avg. of vehicles (Jan. 2005) 8.5yrs [xxxiv]
- Of Lenox's 2,368 workers, 95.3% work within BC (BC avg. is 92.7%), and the avg. commute, 15.5 minutes, is the second lowest in the county, and below the BC avg. of 19.2 min.[xxxv]

	miles/day miles/year	Gallons/day Gallons/year[xxxvi]	Lbs of CO2/day Lbs of CO2/year
Per Vehicle	33.7 12,300[xxxvii]	1.6 586	31.4 11,459
Town Overall	198,047 72,287,100	8,289 3,442,243	165,778 67,344,039[xxxviii]

Oil/Gas/Propane

- Berkshire Gas
- Various oil and propane gas (LPG) providers (see appendix)

Town-Wide Natural Gas Consumption and Emissions, 2005

		Ccfs	lbs CO2 (12.46)
Lenox	Res. Non-heating	37,599	468,596
	Res. Heating	1,654,485	20,619,846
	Commercial, Industrial, Municipal	5,514,182	68,723,247
Lenoxdale	Res. Non-heating	6,877	85,708
	Res. Heating	172,355	2,148,060
	Commercial, Industrial, Municipal	908,228	11,319,244

TOTAL		8,293,726	103,364,701

Source: Berkshire Gas, 2005

Electricity

- Natl. Grid (Primarily in Lenox) and WMECO (Primarily in Lenoxdale)

Electricity Usage, WMECO, 2000

	kWh Sales	CO2 (lbs)[xxxix]	My 2006 estimates[xl]
Lenox	1,523,651	2,346,423	1,683,634 kWh
Lenoxdale	5,514,511	8,492,347	6,093,535 kWh
Total	7,038,162	10,838,770	7,777,169 kWh

Town-Wide Electricity Usage, National Grid, 2000

	Customers	kWh Sales	kWh/ customer	CO2 (lbs)	CO2 (lbs/customer)
Residential	2,385	18,313,128	7,678	28,202,217	11,825
Commercial/Municipal	478	32,350,231	67,678	49,819,355	104,225
Street Lighting	9	184,565	20,507	284,230	31,581
TOTAL	2,872	50,847,924	17,704	78,305,802	27,265

Town-Wide Electricity Usage, National Grid, FY2006

	Customers	kWh Sales	kWh / customer	kWh per capita	CO2 (lbs)	CO2 (lbs/customer)
Residential	2,523	20,395,655	8,083	3,568	31,409,309	12,449
Commercial/Municipal	536	35,521,937	66,272	x	54,703,783	102,059
Street Lighting	9	265,722	29,524	x	409,212	45,468
TOTAL	3,068	56,183,314	18,312	x	86,522,304	28,202

Change in Town-Wide Electricity Usage, National Grid, 2000-FY2006

	change in # of customers	% change in number of customers	average yearly change in customers (%)	change in # of kWh	% change in kWh	average yearly change in kWh (%)
Residential	+138	+5.8%	+.94%	+2,082,527	+11.4%	+1.8%
Commercial/Municipal	+58	+12.1%	+1.9%	+3,171,706	+9.8%	+1.6%
Street Lights	0	0	0	+81,157	+44%	+6.3%
TOTAL	+196	+6.8%	+1.1%	+5,335,390	+10.5%	+1.7%

MUNICIPAL ENERGY DATA (FY 2007)[xli]

	Municipal (w/o schools)	Schools	School as % of Municipal Total	Total Municipal	
Electricity (kWh)	1,352,026	1,164,940	46%	2,516,966	
Heating Oil (gallons)	9,174	40,220	81%	49,394	
Diesel Fuel (gallons)	12,923	2,530[xlii]	16%	15,453	
Natural Gas (therms)	33,226	59,428	64%	92,654	
Gasoline (gallons)	16,346	n/a	n/a	16,346	

CONSUMPTION & EMISSION SUMMARY WITH SECTOR BREAKDOWN

	Electricity Source: National Grid, FY 2006 WMECO 2006 est. Municipal Data		Oil/Gas/Propane[xliii] Source: Berkshire Gas, 2005 Oil and LPG estimates		Transportation (2005)	
	Cons. (kWh)	CO2 (lbs)	Cons.[xliv]	CO2[xlv] (lbs)	Cons.	CO2
Residential	Natl.G: 20,395,655 + WMECO est.: 2,823,266 = 23,218,921	35,757,139[xlvi]	Gas:1,916,228 therms Oil (heating): 1,241,695 gal LPG(heating): 182,458 gallons	Gas: 23,322,210 Oil (est): 27,794,101 LPG (est): 2,336,375	3,442,243 gallons – 31,799 Municipal = 3,410,444 gallons	66,721,926 lbs
Commercial	Natl.G: 35,787,659[xlvii] + 4,917,120 (WMECO est)[xlviii] – 2,516,966 (municipal)[xlix] = 38,187,813	58,809,232	Gas:6,576,548 therms Oil (est): 317,528[l]gal. – 49,394 (municipal) = 268,134	Gas: 80,042,491 Oil (est): 6,175,880		
Municipal	2,516,966 kWh	3,876,128	Gas: 92,654 therms Oil: 49,394 gallons	Gas:1,127,599 Oil: 1,105,635	Gasoline: 16,346 Diesel[li]: 15,453	319,793 + 345,900 = 665,693 lbs

TOTALS	= 63,923,700 kWh	98,442,498 Or 17,219lbs[lii] per capita	Gas: 8,585,430 Oil: 1,559,223 LPG: 182,458	Gas: 103,364,701 Oil: 34,901,648 LPG: 2,311,560 All: 138,123,391 Or 25,004 lbs per capita[liii]	3,426,790 gallons of gasoline, 15,453 gallons of diesel	67,387,619 lbs/ year Or 11,602 lbs per capita[liv]

Residential Total: 89,209,825 lbs
Commercial Total: 145,027,603 lbs
Municipal Total: 6,077,563 lbs
Transportation Total: 67,387,619 lbs
Town Total: 307,702,610 lbs

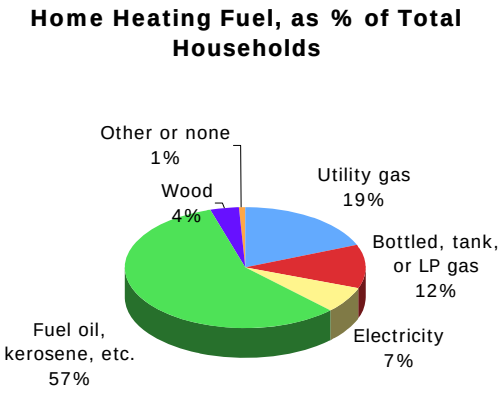
STOCKBRIDGE

Pop. 2,259[lv]

Stockbridge recently ratified the CCP. Thirty-seven households purchased 194,250 kWh of green power last year from National Grid, thereby avoiding seventy-three tons of CO2 emissions. The next step for Stockbridge is to establish a CO2 reduction committee.[lvi]

Demographic

- The median age in Stockbridge is 48.6 years, six years older than the median age for Berkshire County and the oldest of the four towns.
- Approximately 22.5% of the town's population is currently over 65, and by 2020 that number is projected to be 40%.



Housing

- The housing units in Stockbridge are also the oldest of the four towns. The median year of construction for both owner and renter occupied units is pre-1940. This means that there could be significant potential for CO2 emissions reductions in residential efficiency upgrades.
- 6.9% of Stockbridge households heat with electricity—the most polluting and expensive method. This is the lowest figure in the four towns.
- 32.1% of Stockbridge households are for seasonal, recreational, or occasional use. This is by far the highest in the four towns and could be a significant opportunity for emissions reductions. Seasonal houses often consume much more energy than they need to.

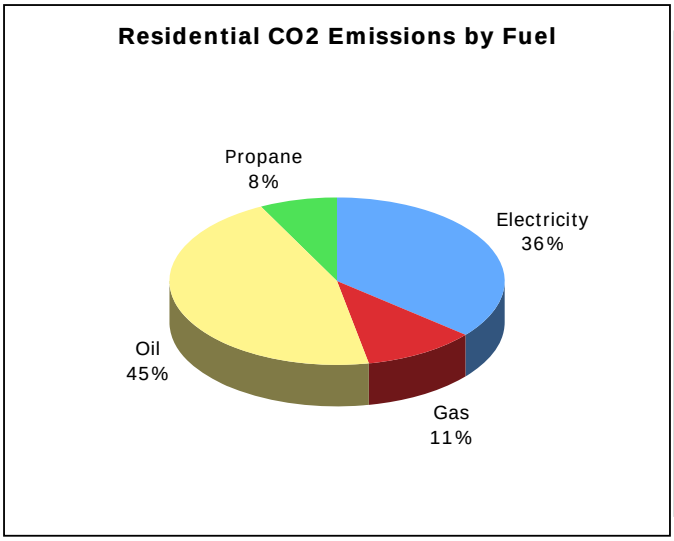
Economy

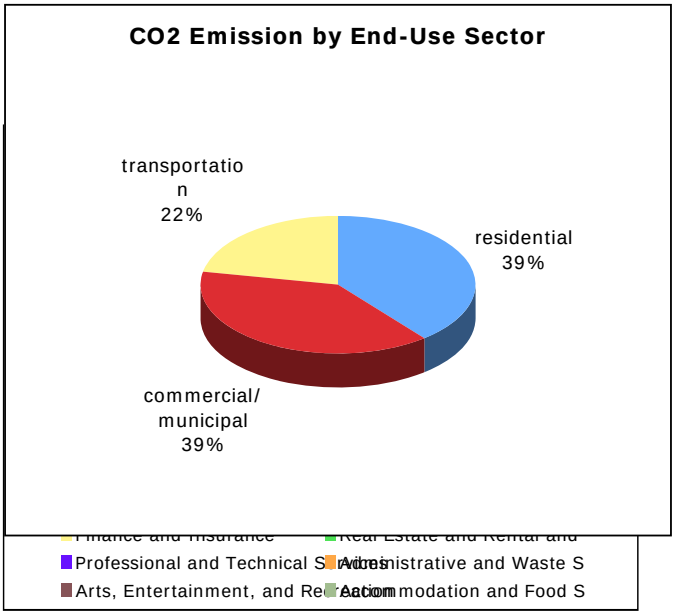
- 70% of Stockbridge employees are employed in the 'accommodation and food service' and 'arts, entertainment, and recreation' sectors.

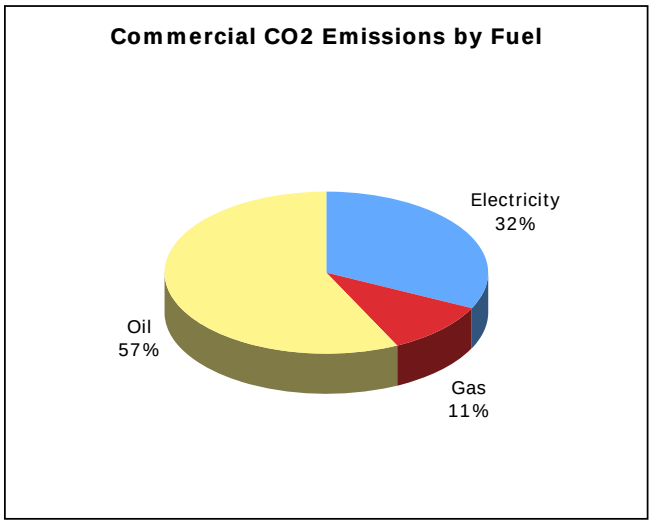
- To two largest employers in town, the Austen Riggs Center and the Red Lion Inn, employ somewhere between 200 and 498 workers, or between 14% and 37% of the town's workforce. In the absence of a heavy industrial sector, it is also likely that they are the two largest commercial emitters, and should be engaged on the issue of CO2 reductions.

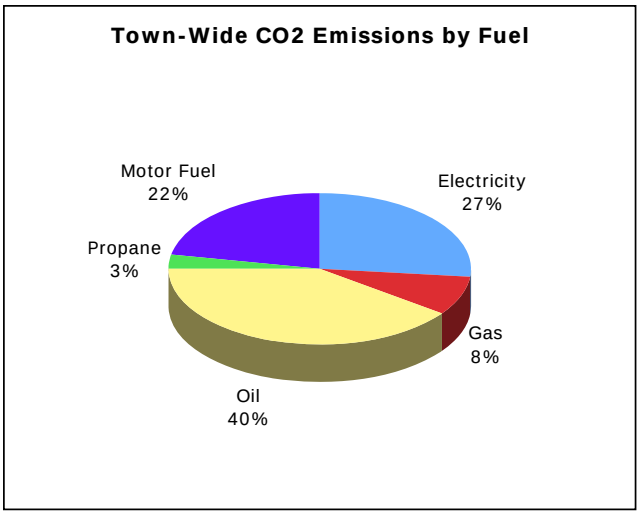
ENERGY CONSUMPTION AND CO2 EMISSIONS

- Since 2000, electricity consumption has risen 11.5% (or 1.8% annually) which is consistent with the other three towns (the national average is 1.3%[lvii]). Residential consumption has grown slowly (.86% annually) relative to residential sector in other towns. The commercial sector, however, has grown rapidly at about 3% annually—about double the rate in Lenox and Great Barrington. Yet as the electricity charts in the data section indicate, the consumption per commercial customer has actually decreased, but the number of customers that has jumped 20%. In the residential sector too, it seems that growth in demand is not driven by more individual consumption, but an increase in the number of individuals.
- It is estimated that municipal emissions constitute no more than 5% of total emissions.
- Stockbridge emits approximately 142,647,515 lbs (71,323 tons) of CO2 per year.
- The average Stockbridge household (not including transportation) emits 35,148 lbs (18 tons) per year.
- Per capita emissions: 63,146 lbs (31.6 tons)
- Per capita emissions (residential only, not including transportation): 24,676 lbs (12.3 tons)
- Average employee/yr (not including transportation): 40,796 lbs (20.4 tons)
- Average business/yr (not including transportation): 597,460 lbs (299 tons)









STOCKBRIDGE DATA

Population

- 2000……..... 2,276
- 1990…….. 2,408

Age

- Median Age 48.6 yrs (BC avg. 40.5; MA avg. 36.5 yrs)
- <18: 347 or 15.2% (BC avg. 22.4%; MA avg. 23.6%)
- 65+: 512 or 22.5% (BC avg. 17.9%; MA avg. 13.5% yrs)

Households

- Total housing units: 1,571 (2007 est. 1,586)[lviii]
    - Total households (i.e. occupied housing units): 991
        - With persons over 65+ : 359 or 36.2%
        - Family households: 568 or 57.3%
        - Single person households: 364 or 36.7%
    - For seasonal, recreational, or occasional use: 32.1%
- Persons per household: 2.1
- Persons per family: 2.7

Labor & Employment

- Average employment, 2006: 1,362 (high 1,495 July ; low 1,356 March)
    - Number of establishments (private and public), 2006: 93
    - Unemployment rate: 3.5%

Major Employers

- 100-249
    - Austen Riggs Center
    - Red Lion Inn

Transportation

- Road miles (2006) 55.59
- Number of registered vehicles (January 2005) 2,735
- Average Age of Vehicles (January 2005) 10.02 yrs
- Massachusetts per capita miles per year avg. in 2005: 8,667 miles[lix]
- Massachusetts per capita gallons consumed per year avg. in 2005: 445.1 gallons

	miles/day miles/year	Gallons/day Gallons/year[lx]	Lbs of CO2/day Lbs of CO2/year
Per Vehicle (New England average)[lxi]	33.7 12,300[lxii]	1.6 586	31.4 11,459
Town Overall, Jan 2005	92,166 33,640,500	4,389 1,601,929	85,863 31,340,131

Natural Gas

Natural Gas Use and Emissions

	Ccfs (therms)	CO2
Res. Non heating	12,521 (12,822)	156,049
Res. Heating	479,180 (490,680)	5,972,023
Commercial & Industrial	469,023 (480,280)	5,845,428
TOTAL	960,724 (983,781)	11,973,500

Source: Berkshire Gas, 2005

Home Heating Fuel

Type of Fuel	Number of Households	Percent of Households
Utility gas	188	19
Bottled, tank, or LP gas	115	11.6
Electricity	68	6.9
Fuel oil, kerosene, etc.	573	57.8
Wood	40	4
Other or none	8	0.8

Source: 2000 Federal Census

Electricity

- National Grid
  - Per Capita, 2000 (Total/population) = 9,791 kWh
    - 2006 = 11,001 kWh
  - Per Household, 2000 (Residential/# housing units) = 7,901
    - 2006 = 8,237

- Per Business, Municipal Establishment, 2001 = 10,034,007 / 114 = 88,018 kWh/yr
  - 2006 = 11,656,470 / 93 = 125,338 kWh/yr
  - Up 42%
- Per Employee, 2001 = 10,034,007 / 1,487 = 6,748 kWh/yr
  - 2006= 11,656,470 / 1,362 = 8,558 kWh/yr
  - Up 26%

Town-Wide Electricity Usage, 2000

	Customers	kWh Sales	kWh/customers
Residential	1506	12,411,992	8,241
Commercial/ Municipal	250	9,741,755	38,967
Street Lighting	2	130,783	x
TOTAL	1,758	22,284,530	12,676

Source: National Grid

Town-Wide Electricity Usage, FY 2006

	Customers	kWh Sales	kWh/customers
Residential	1,574	13,063,439	8,300
Commercial/Municipal	305	11,656,470	38,218
Street Lighting	1	130,241	x
TOTAL	1,880	24,850,150	13,218

Source: National Grid

Change in Town-Wide Electricity Usage, 2000-FY2006

	Change in # of Customers	% Change in number of Customers	Average yearly change in customers (%)	Change in # of kWh	% Change in kWh	Average yearly change kWh (%)
Residential	68	4.5%	.74%	651,447	5.2%	.86%
Commercial/ Municipal	55	22%	3.4%	1,914,715	19.7%	3%
Street Lights	-1	-50%	-10.9%	-542	-.04%	-.07%
TOTAL	122	6.9%	1.1%	2,565,620	11.5%	1.8%

	Electricity Source: National Grid, 2006		Oil/Gas/Propane[lxiii] Source: Berkshire Gas, 2005 Oil and LPG estimates		Transportation (2005)	
	Cons. (kWh)	CO2 (lbs)	Cons.[lxiv]	CO2[lxv] (lbs)	Cons.	CO2
Residential	13,063,439	20,117,696	Gas:503,502ther Oil:1,130,187ga LPG:328,011ga	Gas: 6,127,619 Oil: 25,298,113 LPG: 4,200,189	1,601,929	31,340,131

Commercial/ Municipal	11,656,470	17,950,964	Gas:480,280ther Oil: 1,419,200	Gas: 5,845,428 Oil: 31,767,375		
TOTALS	24,719,909	38,068,660	Gas:983,782ther Oil:2,549,387gal LPG:328,011gal	Gas:11,973,047 Oil: 57,065,488 LPG: 4,200,189 ALL:73,238,724	1,601,929	31,340,131
TOTAL PER CAPITA PER YEAR[lxvi] (all sectors)	10,943	16,852	x	32,421	709 gal	13,873 lbs
TOTAL PER HOUSEHOLD PER YEAR (Residential only!)	8,237	12,685	x	22,463	x[lxvii]	x

Residential Total: 55,743,617
Commercial Total: 55,563,767
Transportation Total: 31,340,131
Town Total: 142,647,515

Local Renewable Projects

- 1.2 kW PV system on private home (installed in June 2006)
- 1.21 kW PV system on private home (installed in May 2006)

RECOMMENDATIONS

1. Improve Data Collection Mechanisms
    a. Explore ways to get utilities to do their part—especially WMECO and Berkshire Gas.
    b. Explore ways that the municipal sector can streamline and modify its practices so that these numbers can be obtained quickly and painlessly.
    c. Consider adding questions to the town census to facilitate annual emissions assessments. (For example, # of miles driven per year, # of vehicles, home heating fuel, etc. Or, in a somewhat different vain, use it to test public opinion on a local renewable project such as a wind turbine.)
2. Efficiency, not renewables, must be the first priority.
    a. Heating is the biggest culprit—explore ways to achieve efficiency upgrades in the residential and commercial sectors: better insulation, more efficient equipment, programmable thermostats.
    b. Work on converting the 10.6% of homes that, as of 2000, heat with electricity to cleaner natural gas, propane, or oil.
    c. Explore potential in green building code.
    d. Green aggregated electricity. National Grid customers currently have the opportunity to opt-in to green power, but few are doing so—perhaps deterred by combination of higher costs, inertia, and lack of awareness. Address these issues, or better yet, explore the possibility of making green power the default for Great Barrington customers (through the aggregation agreement between the town and National Grid), and give customers the option to opt-out. Then find a way to factor emissions reductions through green power into the revised town-wide emissions graph.
    e. Seek efficiency upgrades among the biggest employers first.
    f. Consider a green business program, whereby local businesses would receive recognition and incentives for reducing emissions.
    g. Compact fluorescent light drive. However, don't forget that lighting is responsible for only 12.4% of residential CO2 emissions nationwide, behind water heating (12.5%) and space heating (29.8%). On the other hand, lighting is the biggest source of emissions in the commercial sector (24.9%), so the focus needs to be on getting businesses to switch.[lxviii]
    h. Promote solar hot water (as mentioned above, water heating is responsible for 12.5% of residential emissions).
    i. Don't expect great gains in the transportation sector. Nationwide it has been by far the least responsive sector to efforts aimed at reducing CO2 emissions. Three possible actions are: 1) leading by example (by buying hybrid vehicles, etc.) 2) educating the public 3) making alternatives to driving more attractive (bike paths/racks, sidewalks, etc.). If you're interested in a rebate program for hybrid vehicles, I recommend you talk with members of the Williamstown CO2

Lowering (COOL) Committee first—Williamstown had a hybrid rebate program, but no longer does.

j. Focus on the largest employers first when seeking reductions in the commercial sector.

3. Outreach
    a. Publicize and elucidate myriad incentive programs for the public.
    b. Solar panels on schools—they're impact on emissions themselves are small, but they are valuable as an education and demonstrational tool. Tie into school science curriculum.
    c. Make sure the committee receives input from all sectors: residential, municipal, and commercial.
    d. Keep abreast on CO2 lowering efforts on the regional, state, and federal level to learn strategies, but also to identify when letters to newspapers and policy makers might make a difference.
    e. Public awareness campaign
4. Renewable generation
    a. There are some potential wind turbine sites in the four towns. Proceed cautiously and with broad support. Consider smaller scale turbines first, as well as those which are tied to a single load—the experience has been that people tend to be more receptive to the idea of a turbine powering a tangible public facility like a sewage plant, rather than the abstract idea of tying it to the electricity grid.

SOURCES AND METHODOLOGY

Unless otherwise specified, the data for all towns within this report was obtained in the following manner:

Population data:
Collected by the decennial federal census and annual local censuses. The first can be accessed in depth at census.gov, the second is easily accessible through town clerks and town reports usually contain population counts going several years back. Both need to be treated with skepticism. I have found that the federal census, in particular, can be very misleading and more than one town clerk has told me not to trust it. For example, the 2000 census (the most recent), understated Lenox's population by about 700 people (12% of the population at that time). This led UMass MISER to conclude that the population is declining rapidly, when in fact it is stable.

Age, Educational Attainment, Income & Poverty: census.gov

Housing:
Almost all housing data came from census.gov. Town assessors are usually able to provide the zoning information but not housing units. On the other hand, Lenox was able to produce an entire inventory of indoor space, broken up by commercial and industrial.

Labor and Employment:

The most up-to-date labor and employment information comes from the Massachusetts Executive Office of Labor and Workforce Development (EOLWD). They provide labor force and unemployment data, as well as employment statistics by municipality, industry, and occupation. For the links, go to the Berkshire Regional Planning Commission (BRPC) website (berkshireplanning.org), click on the "Data" link on the left hand side, then scroll down to "Regional Economy" section.

Major Employers:
A list of major employers, as of 2002, was provided by the BRPC at http://berkshireplanning.org/8/download/MajEmp1_02x.pdf. If the link doesn't work, follow the instructions listed in the above paragraph—"Major Employers" also appears under the section "Regional Economy." Lenox was able to provide a list of the largest taxpayers in town, which can help to clarify the results. Be careful to check with towns to make sure that all the businesses listed are still operating. I was surprised to discover that Rising Paper, listed among the largest employers in 2002, has since closed. People I spoke with in Barrington were also surprised that Price Chopper, which they insisted was larger than another supermarket on the list, was absent.

Transportation:
I acquired road miles from Anuja Koirala, the senior transportation planner at BRPC. Number of registered vehicles can sometimes be obtained from town tax collectors, but many were able to give only estimates, because while they processed excise taxes as they came in, they never conducted a complete tally (they insisted that the number changed frequently). Updated vehicle counts, road miles, and the average ages of vehicles can be obtained through the Massachusetts Department of Revenue (DOR) website's "At a Glance" reports, which are brief town profiles. They are available at http://www.mass.gov/?pageID=dorterminal&L=3&L0=Home&L1=Local+Officials&L2=Municipal+Data+and+Financial+Management&sid=Ador&b=terminalcontent&f=dls_mdmstuf_aag_aagindex&csid=Ador. If the link doesn't work, go to the DOR website http://www.mass.gov/?pageID=dorhomepage&L=1&L0=Home&sid=Ador and click on the tab which says "For Local Officials," then on "Municipal Data and Financial Management" and scroll down to the bottom of the page to find "At a Glance Reports."

There is a lot of room for improvement in the way I went about calculating transportation emissions. I simply multiplied the per vehicle average for New England, 12,300 (Source: http://www.eia.doe.gov/emeu/rtecs/nhts_survey/2001/index.html), by the number of vehicles in town, unless I had a figure for municipal vehicles. The National Household Travel Survey (nhts.ornl.gov/index.shtml) seems to be the most promising—it offers a variety of GIS tools which can track vehicle trips (VT), vehicle miles traveled (VMT), per trips (PT), and person miles of travel by trip purposes in the context of regional or local geographies (available at http://www.fmip.gov/nhts/). The miles per gallon number, 21 mpg, also came from the website where I got the 12,300 number. The CO2 coefficient for a gallon of gasoline, 19.564 lbs/ gallon, is from the EIA website, www.eia.doe.gov/oiaf/1605/factors.html.

Electricity:
Electricity data was supplied by National Grid and WMECO. Laura McNaughton at National Grid supplied the data to Nancy Nylen at CET for FY2000 and FY2006. WMECO supplied "approximate" data in 2000 to Nancy. They did not reply to repeated requests over the course of the summer to provide more current information. To calculate average yearly change in kWh and

customers, I used the following equation: $f = i (1 + x)^y$ where i = initial quantity, f = final quantity, x = fractional growth per year, and y = # of years (in this case, 6).

Natural Gas:
Natural gas data was supplied by Ken Sadlowski at Berkshire Gas in 2005. When I requested 2006 information, I was informed that Berkshire Gas is no longer willing to supply this information. It is extremely important for towns to continue to obtain this information in order to track future consumption and emissions. Town committees need to make this a top priority for all major energy sources—electricity, natural gas, heating oil, and propane. I converted the ccfs to therms by multiplying by 1.024 (this number came from the Berkshire Gas website). The CO2 rate of 12.46 lbs/ccf was supplied by Ken in 2005. I calculated the rate for therms to be 12.17lbs/therm.

Oil and Propane:
Oil and propane are the trickiest of all. Unlike electricity and natural gas, there are numerous small suppliers serving multiple towns, with less significant government oversight. In the past, oil and propane companies have refused to hand over town-wide information for two main reasons: a) Because they don't gather information by towns, so it would require extra work in order to reorganize their books and b) Because they consider sales information to be proprietary. I calculated town-wide usage in the following way: first I located the house heating energy mix for each of the four towns (available on the 2000 census), which reported what percentage of households heated with which fuel source. Then I took the Berkshire Gas number for residential home heating and with the two extrapolated the numbers for oil and propane. I determined the total number of total btus used, added 5.8% to the tally for oil (which is 5.8% less efficient than gas, see www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12330?print). Using the tables reprinted below in the "Useful Information" section, I determined the number of gallons and emissions. That was all for residential heating usage. To get commercial consumption I located the Massachusetts ratio for the amount of gas sold to the amount of distillate oil (which includes, but unfortunately is not limited to, heating oil) in the EIA report entitled "Fuel Oil and Kerosene Sales 2005" and simply carried it over to the towns. The results that emerged seemed reasonable, so I kept them (not a great reason at all). There is a lot of room for improvement here.

Average Household Emissions:
Electricity and heating fuel percentages were generated by dividing total emissions from each of those by the total number of households. In some cases I tried to factor out vacant households, and I should have done it for all of them or none, but it turns out not to have changed the result much. The fact is that homes across the four towns display very similar emissions characteristics. Transportation was a bit trickier, because while I had a total vehicle count, I didn't know which vehicles belonged to which sector (except in some cases I knew municipal). What I ended up doing was generate a new number. I multiplied the number of households by 1.9 vehicles per household (New England average. Source: http://www.fhwa.dot.gov/policy/ohpi/) and then figured out how much that number of vehicles would emit during a year, using the New England average of 12,300 miles per vehicle (same source).

USEFUL INFORMATION

Average Btu Content of Fuels

Fuel Type	**No. of Btu/Unit**
Fuel Oil (No. 2, includes gasoline and diesel)	140,000/gallon
Electricity	3,412/kWh
Natural Gas	100,000/therm
Propane	91,330/gallon
Wood (air dried)	20,000,000/cord or 8,000/pound
Pellets (for pellet stoves; premium)	16,500,000/ton
Kerosene	135,000/gallon
Coal	28,000,000/ton

Source: US Dept of Energy – Energy Efficiency and Renewable Energy (EERE)[lxix]

Fuel and Emission Coefficients

	Emission Coefficients	
Fuel	**Pounds CO2 per Unit Volume or Mass**	**Pounds CO2 per Million Btu**
Distillate Fuel (No. 1, No. 2, No. 4 Fuel Oil and Diesel)	22.384 per gallon 940.109 per barrel	161.386
Kerosene	21.537 per gallon 904.565 per barrel	159.535
Liquefied Petroleum Gas (LPG)	12.805 per gallon 537.804 per barrel	139.039
Motor Gasoline	19.564 per gallon 822.944 per barrel	156.425
Natural Gas (Pipeline)	120.593 per 1000ft3	117.080
Propane	12.669 per gallon 532.085 per barrel	139.178
Electricity (National Grid and WMECO)[lxx]	1.54 per kWh	451.348

Source (except electricity): www.eia.doe.gov/oiaf/1605/factors.html

Major Oil Suppliers

Brown Oil 33 Daly Ave. Dalton, MA 684-0078	Clifford Oil 40 Willow Creek Lenox 637-0810	Lee Oil 19 Ferncliff Lee 243-0977	Lipton Energy 458 South St. Pittsfield 443-9191

O'Connell Oil
Pittsfield
499-4800

Oil Express
18 Crystal Street
Lenoxdale
637-1834

Sweatland Oil
25 Industrial Drive
Pittsfield
443-6461

Major Propane Suppliers

Amerigas
Van Deusenville Rd.
Housatonic
274-6012

HA George
651 Ashland St.
North Adams
663-6652

Osterman Propane
800 790-3402

Whiting Energy
11 Cleveland Rd.
Dalton
684-0004

Clifford Propane
40 Willow Creek Rd.
Lenox
637-8130

INTERNET LINKS

Utilities
National Grid of MA http://www.nationalgridus.com/masselectric/index.asp
Western Mass Electric Co. (WMECO) http://www.wmeco.com/
Berkshire Gas http://www.berkshiregas.com/

Town Websites
Great Barrington http://www.townofgb.org/Pages/index
Lanesborough http://www.lanesborough-ma.gov/
Lenox http://www.townoflenox.com/Public_Documents/index
Stockbridge http://www.townofstockbridge.com/Public_Documents/index

Data
Berkshire Regional Planning Commission (BRPC) http://www.berkshireplanning.org/
US Energy Information Administration (EIA) http://www.eia.doe.gov/
US Census Bureau www.census.gov/
Massachusetts Division of Energy Resources (DOER) http://www.mass.gov/doer/

Climate Change
Union of Concerned Scientists http://www.ucsusa.org/
Intergovernmental Panel on Climate Change http://www.ipcc.ch/

Conservation and Incentives

MassSave http://www.masssave.com/

Other

US Dept of Energy: Energy Efficiency and Renewable Energy (EERE) Consumer Information
http://www.eere.energy.gov/consumer/
ICLEI http://www.iclei.org/index.php?id=800
Mayors Climate Protection Center http://www.usmayors.org/climateprotection/agreement.htm
CET http://cetonline.org/
Williamstown CO2 Lowering Committee (COOL) http://coolwilliamstown.org/
Massachusetts Technology Collaborative http://www.mtpc.org/
Database of Climate Change Policies from Around the World
http://www.iea.org/textbase/envissu/pamsdb/index.html

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[i] 2006 town census
[ii] "Municipal Clean Energy Qualification Report" by Massachusetts municipalities. March 2007. Developed by Massachusetts Technology Collaborative (MTC), by ICLEI- Local Governments for Sustainability. Available at http://www.iclei.org/documents/USA/services/NERCC/MTC_Quantification_Report.pdf
[iii] Using estimate of 3,474 households (2000 Census # + est. # of homes built since 2000)
[iv] 2000 Federal Census data sheet for Great Barrington, "QT-H8. Rooms, Bedrooms, and House Heating Fuel: 2000." The 70% figure is approximate because I could not calculate average number of rooms for housing units with seven or more rooms. Instead, I used the median for an average, and determined that

approximately 70% of the residential rooms in were in owner-occupied dwellings. This is a very low estimate, given that fully half of housing units contain seven or more rooms.

[v] US Federal Census, 2000. Great Barrington "QT-H3. Household Population and Household Type by Tenure: 2000"

[vi] Source: EIA

[vii] I estimated the number of occupied households in 2006 in this way: I found the 2000 Census number, 3,008 and added 18.3 houses a year (1.52 per month for the period April 2001 through 2006). This rate was derived from looking at the number of housing units built from 1995 to March 2000 (63 months), during which time, according to the 2000 Federal Census, 96 housing units were built. Thus, the estimated number of housing units added from April 2000 through 2006 is 12.16 (for the rest of 2000) + 110 (2001-2006) + 3,008 (existing) = or 3120.

[viii] Using statistic of 1.90 vehicles per household. See http://www.fhwa.dot.gov/policy/ohpi/. 10% of households are vacant. So 3120-312= 2,808 x 1.90 = 5335.2. 5335 x 12,300 (miles per vehicle) / 2,808 (occupied housing units) = 23,270 per household

[ix] MA EOLWD

[x] Assuming average vehicle gets 22.1mpg, which is the current national average.

[xi] This is the average distance traveled for a household vehicle in New England in 2001. Source: EIA "Table A3. U.S. Per Vehicle Average Miles Traveled, Vehicle Fuel Consumption and Expenditures." http://www.eia.doe.gov/emeu/rtecs/nhts_survey/2001/index.html

[xii] When burned, a gallon of gasoline produces 19.564 lbs of CO2. See conversion chart in "Useful Information" section of report.

[xiii] All ccf figures have been converted into therms, the industry standard measurement, when necessary. The conversion rate of ccfs to therms is 1.024:1, and therms to CO2 is approximately 1:12.17. See http://www.berkshiregas.com/pdf/ccftotherms1102.pdf. The oil and propane numbers are only for heating

[xiv] Thus 1,600,997 therms of "oil". Divided by 1.3869 therms of natural gas per gallon to get gallons of oil that would produce required amount of therms. For LPG I used 166,949.

[xv] Energy coefficients available at http://www.eia.doe.gov/oiaf/1605/factors.html.

[xvi] Using 2007 town census: 7,008 people.

[xvii] Town Clerk

[xviii] Massachusetts Department of Revenue

[xix] MA Dept of Revenue, Division of Local Services

[xx] Assuming average vehicle gets 22.1mpg, which is the current national average.

[xxi] This is the average distance traveled for a household vehicle in New England in 2001. Source: EIA "Table A3. U.S. Per Vehicle Average Miles Traveled, Vehicle Fuel Consumption and Expenditures." http://www.eia.doe.gov/emeu/rtecs/nhts_survey/2001/index.html

[xxii] Assuming 1.5% annual growth

[xxiiixxiii] Town Census Data (Federal Census data from 2000 severely underestimates the population). Town officials report that the population is more or less stable. Current figure is for January 2007.

[xxiv] From "Municipal Secondary Market Disclosure Information Sheet." The list of Top Taxpayers is also from this source.

[xxv] Sum of residential energy use (w/o transportation) = 89,209,825 lbs/yr + 46,439,542 (transportation)= 135,649,367/ 2133 households = 63,596. Then I added 21,772 lbs of CO2 to the total to factor in transportation (see Methodology section). The number of households (2133) was supplied by Greg Federspiel.

[xxvi] Using 2006 Town Census tally of 5,717

[xxvii] 153,436,717 lbs CO2 / 4,409 = 34,801

[xxviii] Town Census Data (Federal Census data from 2000 severely underestimates the population). Town officials report that the population is more or less stable.

[xxix] Town Census Data (Federal Census data from 2000 severely underestimates the population). Town officials report that the population is more or less stable. Current figure is for January 2007.

[xxx] Mass. Labor and Workforce Development, http://lmi2.detma.org/lmi/lmi_town.asp
[xxxi] From "Municipal Secondary Market Disclosure Information Sheet." The list of Top Taxpayers is also from this source.
[xxxii] MA Dept of Revenue, Division of Local Services
[xxxiii] Diana Kirby (tax collector)
[xxxiv] MA Dept of Revenue, Division of Local Services
[xxxv] "Berkshire Workforce: Residents and Commuters" Dec/Nov 2003, BRPC, based on 2000 census data. See http://berkshireplanning.org/8/download/cg_insert_nov_dec_03.pdf.
[xxxvi] Assuming average vehicle gets 21.0 mpg, which is the New England average as of 2001. See Footnote v.
[xxxvii] This is the average distance traveled for a household vehicle in New England in 2001. Source: EIA "Table A3. U.S. Per Vehicle Average Miles Traveled, Vehicle Fuel Consumption and Expenditures." http://www.eia.doe.gov/emeu/rtecs/nhts_survey/2001/index.html
[xxxviii] When burned, a gallon of gasoline produces 20.35 lbs of CO2. See http://www.fueleconomy.gov/feg/co2.shtml for explanation.
[xxxix] CO2/kWh ratio of 1.54:1 was supplied by National Grid and WMECO.
[xl] Using National Grid's growth average between 2000 and 2006 of 10.5%. I'm assuming WMECO demand grew at the same rate.
[xli] Greg Federspiel
[xlii] Not including school buses, which are operated by Dufour Bus Company, which could be a significant omission.
[xliii] All ccf figures have been converted into therms, the industry standard measurement, when necessary. The conversion rate of ccfs to therms is 1.024:1, and therms to CO2 is approximately 1:12.17. See http://www.berkshiregas.com/pdf/ccftotherms1102.pdf. The oil and propane numbers are only for heating
[xliv] Thus 1,600,997 therms of "oil". Divided by 1.3869 therms of natural gas per gallon to get gallons of oil that would produce required amount of therms. For LPG I used 166,949.
[xlv] Energy coefficients available at http://www.eia.doe.gov/oiaf/1605/factors.html.
[xlvi] Using recent NG data (HOW RECENT?) I determined that given National Grid's energy mix, the rate between kWh and CO2 (lbs) was 1:1.54. I carried this rate over to calculate the emission for more recent consumption data. WMECO's numbers yielded an equivalent 1:1.54 rate.
[xlvii] Including Streetlights
[xlviii] Figured out the ratio of commercial to the total in National Grid data and transferred it over to WMECO data. This assumption should be checked
[xlix] In National Grid reporting data, municipal is not distinguished from commercial, so it has to be deducted. The municipal figures were supplied by Greg Federspiel.
[l] 2005, residential to commercial sales: 1:0.25572155141
[li] Not including diesel school buses, which is potentially very significant.
[lii] Used 2005 population figure of 5,524
[liii]Used 2006 population figure of 5,717
[liv] Used 2005 population figure of 5,524
[lv] Massachusetts Dept. of Revenue, Division of Local Services
[lvi] "Municipal Clean Energy Qualification Report" by Massachusetts municipalities. March 2007. Developed by Massachusetts Technology Collaborative (MTC), by ICLEI- Local Governments for Sustainability. Available at http://www.iclei.org/documents/USA/services/NERCC/MTC_Quantification_Report.pdf
[lvii] 2006 Energy Data Book.
[lviii] Extrapolated using construction rate from 1995 to March 2000 of .19 housing units/month, thus .19 x 78 months (April 2000 through 2006) = 14.82 units, rounded up to 15.
[lix] Massachusetts Municipal Profiles 2007
[lx] Using New England vehicle average: 21 mpg.

[lxi] Using 2000 Federal Census data.
[lxii] This is the average distance traveled for a household vehicle in New England in 2001. Source: EIA "Table A3. U.S. Per Vehicle Average Miles Traveled, Vehicle Fuel Consumption and Expenditures." http://www.eia.doe.gov/emeu/rtecs/nhts_survey/2001/index.html
[lxiii] All ccf figures have been converted into therms, the industry standard measurement, when necessary. The conversion rate of ccfs to therms is 1.024:1, and therms to CO2 is approximately 1:12.17. See http://www.berkshiregas.com/pdf/ccftotherms1102.pdf. The oil and propane numbers are only for heating
[lxiv] Thus 1,600,997 therms of "oil". Divided by 1.3869 therms of natural gas per gallon to get gallons of oil that would produce required amount of therms. For LPG I used 166,949.
[lxv] Energy coefficients available at http://www.eia.doe.gov/oiaf/1605/factors.html.
[lxvi] Using current population of 2,259.
[lxvii] The method I used on the other towns yielded a number of residential vehicles that exceeded the total number of vehicles in the town.
[lxviii] 2006 Buildings Energy Data book
[lxix] http://www.eere.energy.gov/consumer/your_home/space_heating_cooling/index.cfm/mytopic=12330
[lxx] Data supplied by National Grid, 2005 and WMECO