BUILDING ENERGY 15
MARCH 3-5, 2015 AT THE SEAPORT WORLD TRADE CENTER

Community Energy Footprints: Taking Residential Efficiency to Scale

Northeast Sustainable Energy Association

March 5, 2015

Henry MacLean, JB Clancy, Keith Burrows & Brian Butler

AIA Credit

Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Copyright Materials

Henry MacLean, JB Clancy, Keith Burrows & Brian Butler

Course Description

For all the Non Net Zero Homes out there, how can energy tracking at the community level help achieve 2030 goals?

Four diverse building pros share lessons learned from their experience tracking the energy use of a typical Boston suburb using several benchmarking methods, and discuss how cross referencing tools and technologies can help create community buy-in for achieving C02 reduction targets. The session will close with an open discussion of how to scale up expertise to the community level.

Objective 1:

Participants will learn how the baseline energy consumption of a home and a community are established. They will learn how percentages of a town's carbon footprint relates to the various building types and energy uses.

Objective 2:

Participants will explore a pathway to achieve the energy reduction goals set forth in agendas like Mass Clean Energy and Climate Plan for 2020, the Architecture 2030 Challenge, and through the process of one Massachusetts Green Community.

Objective 3:

Participants will learn about a new operational rating for residential buildings and how these type of assessments can be used to reduce energy consumption in our buildings and communities.

Objective 4:

Participants will learn how asset ratings can form the foundation of ***relative*** home performance baselines and provide key measurement-verification of the cost/benefit improvements to help energy efficiency programs be more effective & accountable.

Part I.

Henry MacLean AIA, LEED AP, Principal Timeless Architecture

John Baron Clancy, AIA, Partner Architect Albert, Righter and Tittmann

Sharing results from the Milton Alternate Energy Committee (MAEC), Green Community designation process, ICLEI greenhouse gas protocol, progress w/ residential MassSave Program & benchmarking for the Town of Milton, MA.

Part II.

Keith Burrows LEED AP, Founder Resynergy Systems

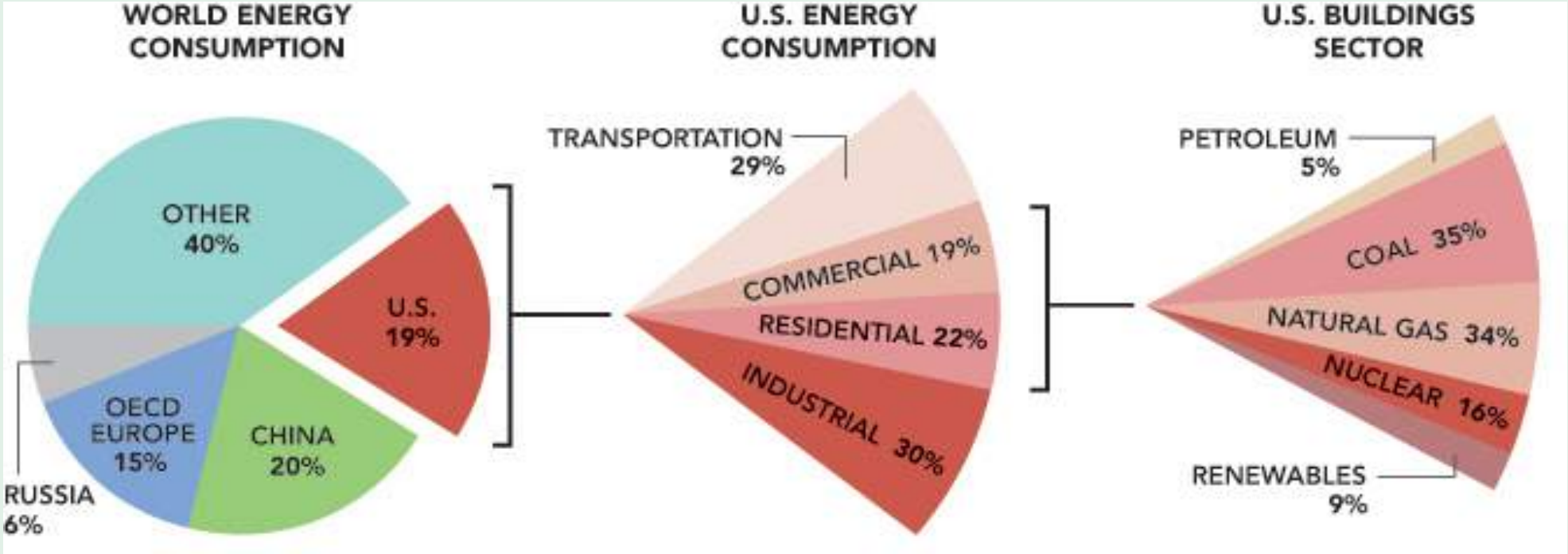
Overview of an operational rating system for homes and a look at how it can help reduce energy consumption in communities like Milton and beyond.

Part III

Brian Butler, Founder: EnerScore

An overview of an energy rating plug-in for real estate websites. In the way that "Walk Score" has rated the pedestrian friendliness of homes and businesses as a widget in real estate websites, EnerScore will offer this level of convenience and transparency to the estimated performance rating of all residential dwellings.

Our Building Community is engaged w/ 41% of US energy consumption, while residential alone is 22% of the problem and potential solution!

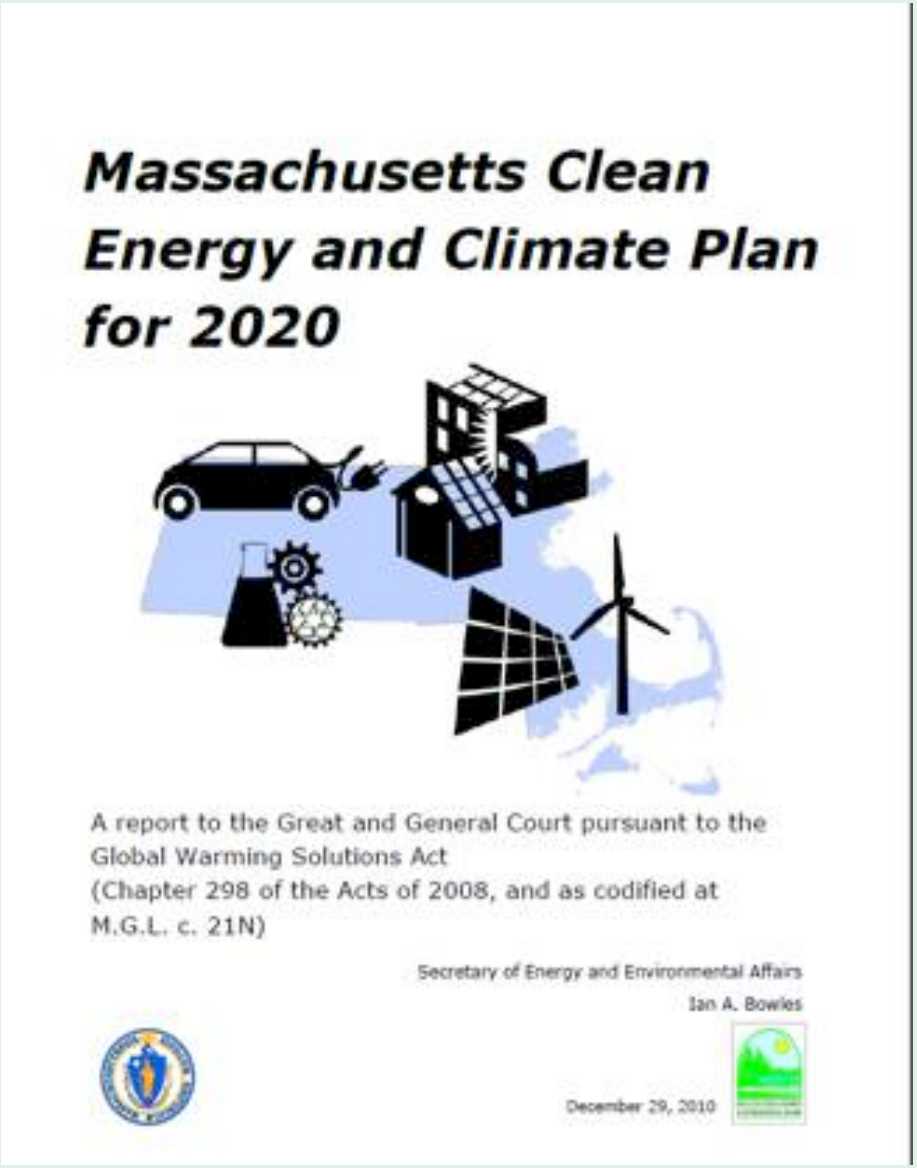


Homes in Massachusetts
make up about 2.5% of that residential slice of the 113.5 million homes in the US.

Milton's 9,000 +/- households
is a .04% sampling of the Commonwealth.

Massachusetts Clean Energy and Climate Plan for 2020

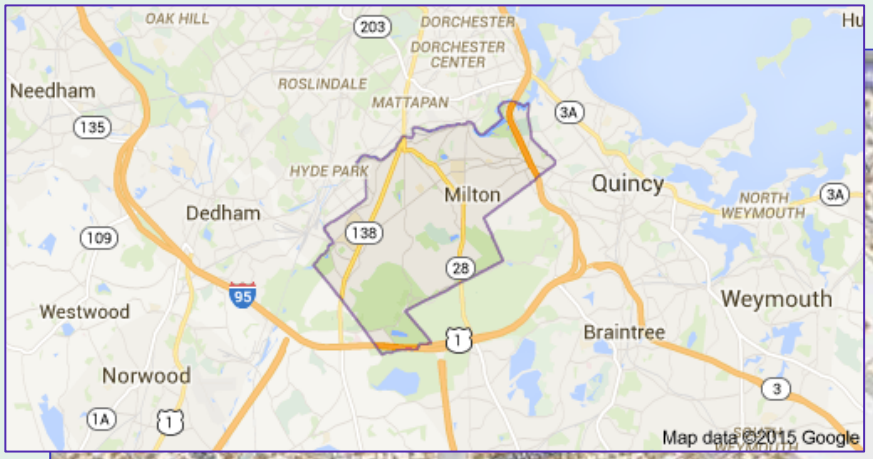
Town of Milton Energy Targets



The Global Warming Solutions Act of 2008 requires a statewide limit on greenhouse gas (GHG) emissions of between 10 percent and 25 percent below 1990 levels for 2020 — on the way toward an 80 percent reduction in emissions by 2050.

MA has set the 2020 limit at 25%

Town of Milton Flood Hazard Map



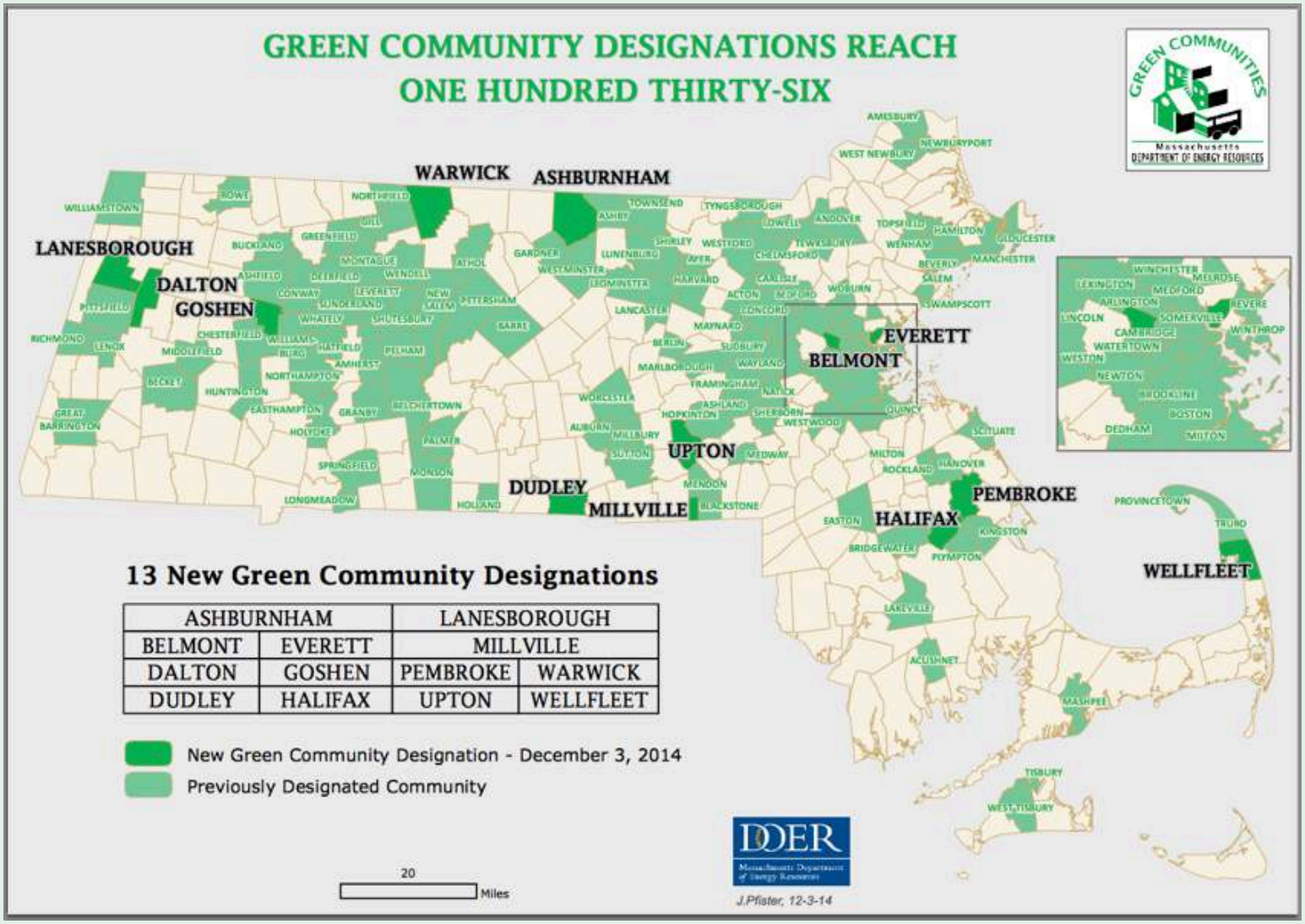
Pine Tree Brook, tributary of the Neponset River that runs through Milton.

Orange rim is 200 year flood line, and 30 foot elevation above sea level.

BOSTON LIVING WITH WATER

CITY OF BOSTON
Martin J. Walsh, Mayor

Green Communities Program

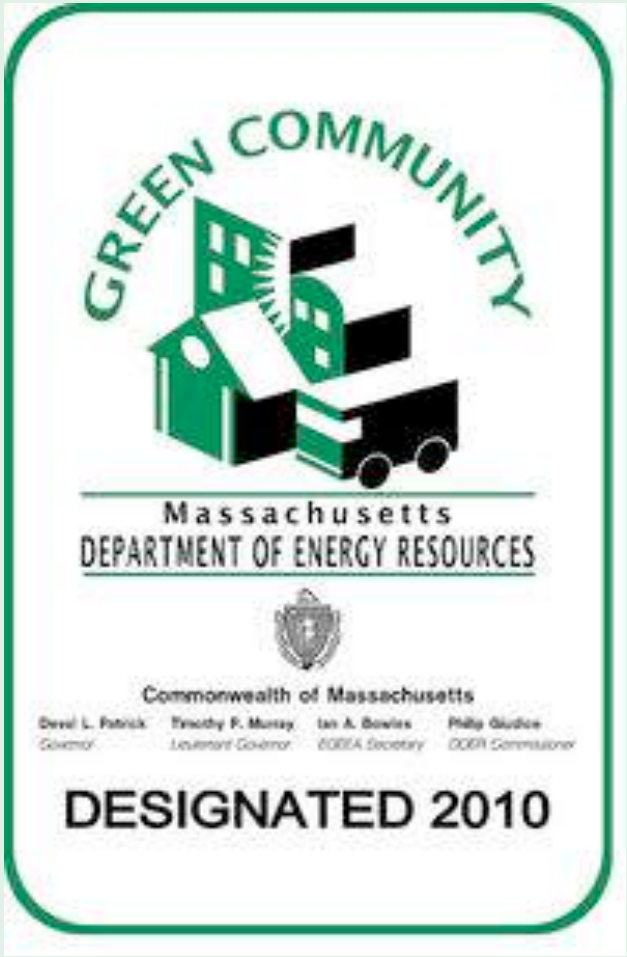


The Green Communities Division strives to help all 351 Massachusetts cities and towns find clean energy solutions that reduce long-term energy costs and strengthen local economies. (39% of MA communities now designated)

Green Communities Program

Town of Milton Energy Baseline

For Milton Town Meeting Review and Vote



Criterion 1

Provide as-of-right siting in designated locations for renewable/ alternative energy generation, research & development, or manufacturing facilities.

Criterion 2

Adopt an expedited application and permit process for as-of-right energy facilities.

Criterion 3

Establish an energy use baseline and develop a plan to reduce energy use by twenty percent (20%) within five (5) years.

Criterion 4

Purchase only fuel-efficient vehicles.

Criterion 5

Set requirements to minimize life-cycle energy costs for new construction; one way to meet these requirements is to adopt the new Board of Building Regulations and Standards (BBRS) Stretch Code.

Non Mass Centric Programs in other Northeast States

Northeast Energy Efficiency Partnerships

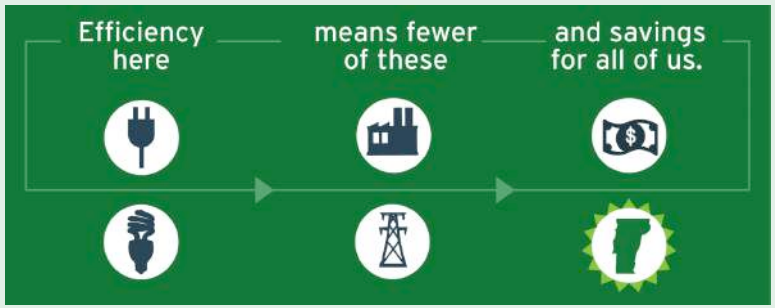
Non-profit with mission to serve the Northeast and Mid-Atlantic States to accelerate energy efficiency in the building sector...

energize CONNECTICUT

Empowering you to make smart energy choices

Efficiency Vermont

efficiency MAINE



NEW YORK STATE OF OPPORTUNITY. | NYSERDA

NEW YORK STATE

Residents and homeowners can take action to increase the comfort of their homes while lowering energy bills and reducing energy waste.

Green Communities Program

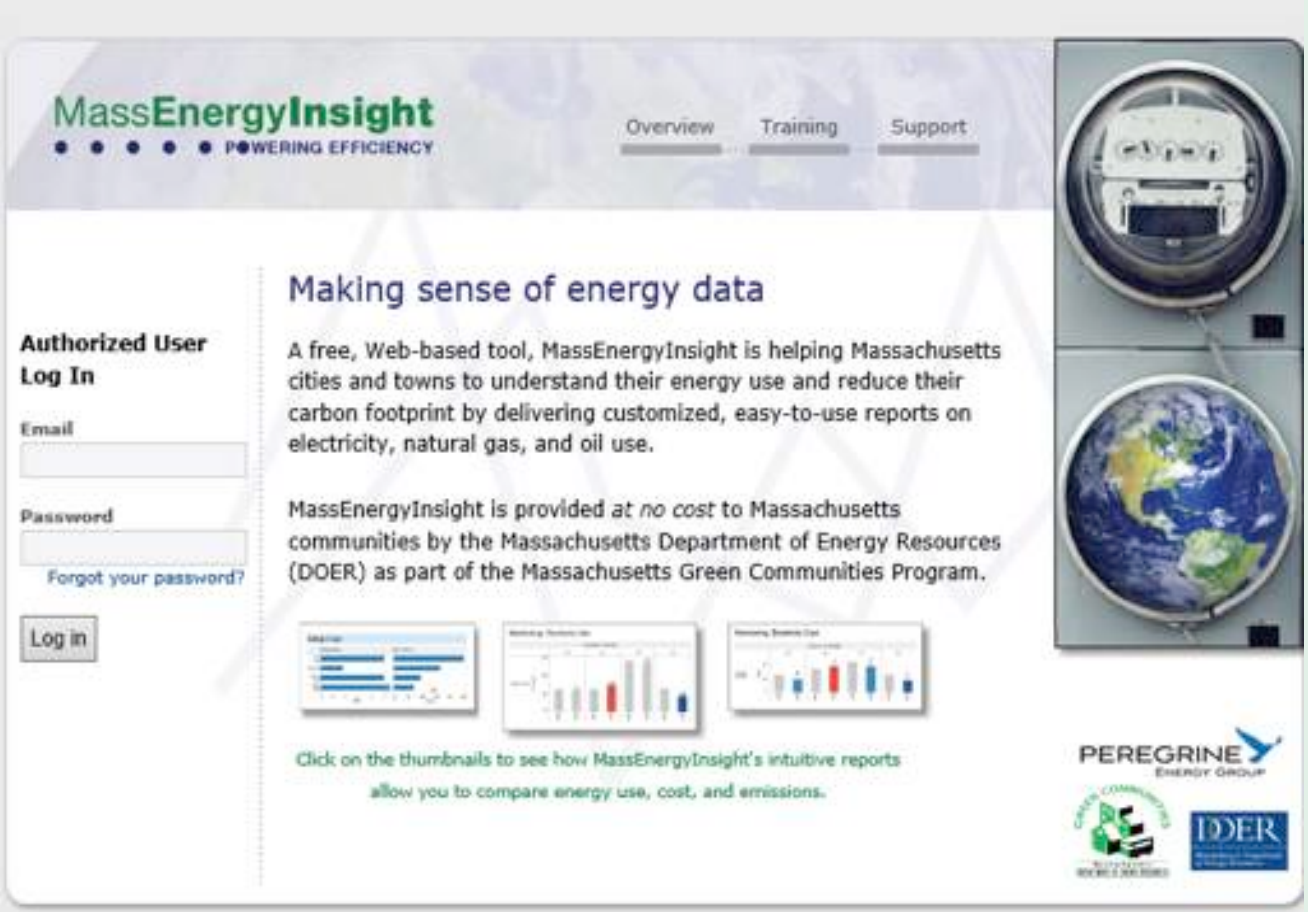
Town of Milton Energy Baseline

In late 2010, the Milton Alternate Energy Committee (MAEC) worked with the Town Planner to apply for Green Community Status in the Commonwealth of Mass, which was awarded by the MA DOER to the Town in early 2011.

As part of commitment to program, the Town was awarded funding of over $170,000 that went towards efficiency measures and renewable energy projects. Milton is now in the process of completing its 2014 Annual Reporting, looking at significant combined funding from the DOER and Utility incentives and rebates.

Town of Milton Energy Baseline

MassEnergyInsight



The MAEC began working with Mass Energy Insight (MEI) in the spring of 2011, set up by the Commonwealth to track all energy reporting for communities. The program provided flexibility in selecting the benchmark year and target completion year for the 20% energy reduction target in protocol #3, 2008 for Milton. Just a handful of communities have met that target in 1st 5 years.

The Massachusetts Department of Energy Resources (DOER) has made MassEnergyInsight available at no cost to every Massachusetts city, town, and regional entity.

Town of Milton Energy Reductions

Breakdown of building tracking Solar PV online starting in 2010.

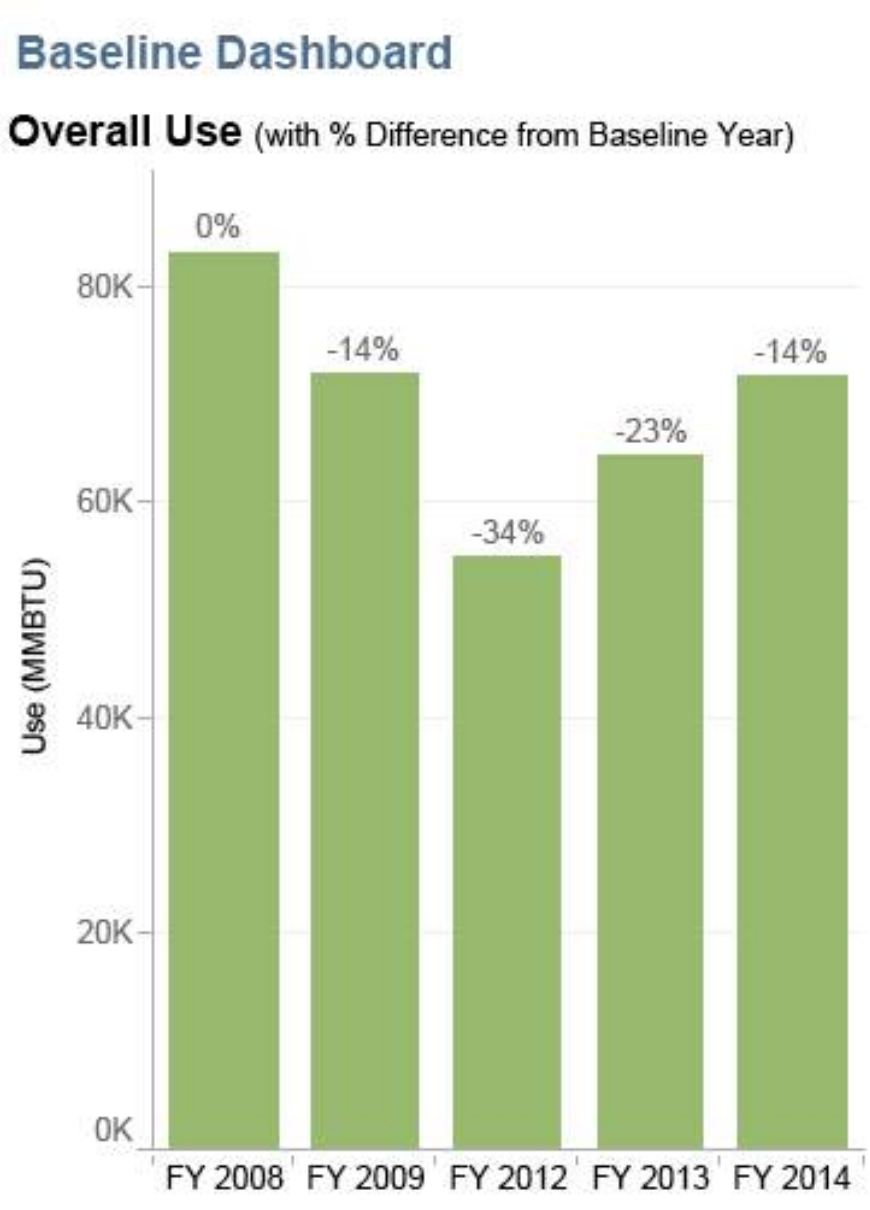
ERP Guidance Table 3b - Municipal Energy Consumption for 2008, 2013, 2014 (MMBTU)

Please make sure that any data submitted to DOER contains complete Data!

		2008							2013							2014					
		Diesel	Electric	Gas	Gasoline	Oil	Propane	Total	Diesel	Electric	Gas	Gasoline	Propane	Solar Electric	Total	Diesel	Electric	Gas	Gasoline	Solar Electric	Total
Null	Collicott/Cunningham fire pump		2					**2**		1					**1**		1				**1**
	Total		**2**					**2**		**1**					**1**		**1**				**1**
Building	Glover ES		1,981	3,220				**5,201**		29	3,227			710	**3,965**		29	3,610		676	**4,314**
	Tucker ES		1,627	2,610				**4,236**		1,005	1,984			72	**3,061**		1,251	2,239		70	**3,560**
	Milton HS		8,917	14,435				**23,352**		4,106	7,706			1,630	**13,442**		4,126	9,603		1,631	**15,360**
	Central library									1,293	444				**1,737**		1,514	492			**2,005**
	New DPW Garage - 631 Rand..		7	253				**260**		8					**8**		10				**10**
	Atherton Fire		105	473				**577**		108	446				**554**		115	529			**643**
	Kidder library		79	8				**87**													
	Police HQ		719	704				**1,422**		708	705				**1,413**		646	733			**1,379**
	Central Fire		133	914				**1,046**		124	722				**846**		145	756			**901**
	Town Hall		648	992				**1,640**		495	1,174			106	**1,776**		492	1,218		102	**1,812**
	Chemical Building		6	74				**80**		12	73				**85**		13	93			**107**
	East Milton library (oil)		79			192		**271**		7					**7**		12				**12**
	East Milton Fire		59	799				**858**		89	530				**619**		87	628			**715**
	Police evidence shed		14	23				**36**		10	21				**31**		7	33			**40**
	Council on Aging		163	575				**738**		175	481				**655**		178	521			**698**
	DPW Main Office 629 RANDO..			166				**166**			147				**147**			172			**172**
	Water/Erickson Garages 649+..		26	168				**194**		24	191				**215**		23	236			**259**
	Gilbane 629A Randolph			76				**76**			21				**21**			48			**48**
	Pierce MS		4,544	7,547				**12,091**		2,433	4,679			563	**7,674**		3,271	7,099		543	**10,913**
	Collicot-Cunningham ES		3,999	9,092				**13,091**		2,864	7,206			232	**10,302**		2,774	8,554		232	**11,560**
	Upper Bldgs: DPW 625,625A,..		44	217		414		**675**		52	481				**534**		52	747			**799**
	Central Maintance 633 Randol..		141	273				**414**		250	421				**671**		243	448			**691**
	Civil defense shack - no heat		0					**0**													
	Salt Shed - no heat		0					**0**		0					**0**		0				**0**
	Maintenance office/lunchroom..		22				37	**59**													
	House care taker		51	34				**85**		36	165				**200**		34	174			**208**
	Maintenance Bldg - elec. shar..		19					**19**		21					**21**		21				**21**
	Office/Barn			41				**41**			42				**42**			41			**41**
	Milton Animal Shelter (propane)		79				122	**202**		60			48		**107**		59				**59**
	Total		**23,460**	**42,693**		**606**	**160**	**66,919**		**13,908**	**30,865**		**48**	**3,313**	**48,134**		**15,101**	**37,972**		**3,253**	**56,326**

School buildings , 70% (+/-) of Town footprint (703,000 sf,) have an average EUI of 69.3 KBTU/sf. with 2 schools achieving Energy Star status at 55.7 KBTU/sf.

Town of Milton Energy Baseline
MassEnergyInsight



Drill down by Department (showing Use (MMBTU)
Hover over Department, Complex, etc. and click the plus or minus signs to expand and collapse the table.

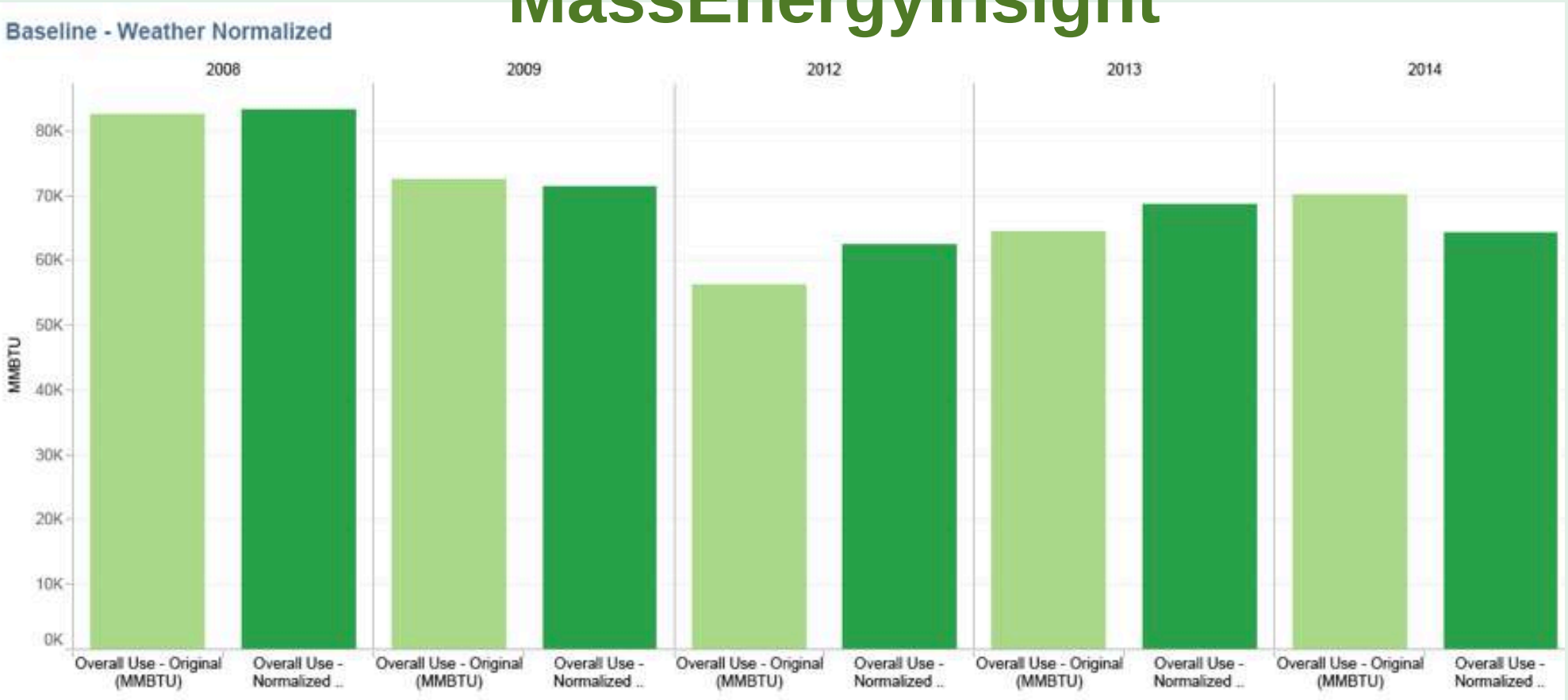
Department	FY 2008	FY 2009	FY 2012	FY 2013	FY 2014
Cemetery	205	329	241	263	270
Council on Aging	738	770	502	655	698
DPW	1,785	1,723	1,179	1,596	1,978
DPW - Traffic Lights	135	144	134	139	150
Fire	2,562	2,254	1,974	2,104	2,366
Library	358	1,533	1,407	1,744	2,017
Lights	3,687	3,751	559	1,192	71
Parks and Recreation	35	68	87	92	93
Police	1,665	1,597	1,481	1,562	1,488
Schools	57,973	46,832	35,400	38,445	45,707
Sewer Pumps	629	855	693	676	648
Town Hall	1,640	1,580	1,295	1,776	1,812
VEHICLES	11,725	10,474	10,055	13,990	14,403

Direct Energy Use Data

Drill down by Facility Category (showing Use (MMBTU)
Hover over Facility Category and Subcategory and click the plus or minus signs to expand and collapse the table.

Facility Category	FY 2008	FY 2009	FY 2012	FY 2013	FY 2014
Null	2	1	1	1	1
Building	66,919	56,608	43,466	48,134	56,326
Open Space	27	54	72	77	78
Street/Traffic Ligh..	3,834	3,918	719	1,357	247
Vehicle	11,725	10,474	10,055	13,990	14,403
Water/Sewer	629	855	693	676	648

Town of Milton Energy Baseline
MassEnergyInsight



		Diesel	Electric	Gas	Gasoline	Oil	Propane	Grand Total
2008	Overall Use - Normalized (MMBTU)	3,361	27,372	43,169	8,364	640	169	83,075
	Overall Use - Original (MMBTU)	3,361	27,338	42,640	8,364	636	167	82,507
2009	Overall Use - Normalized (MMBTU)	4,274	25,351	34,757	6,200	557	168	71,308
	Overall Use - Original (MMBTU)	4,274	25,419	35,833	6,200	557	172	72,455
2012	Overall Use - Normalized (MMBTU)	3,818	19,436	32,867	6,238		142	62,500
	Overall Use - Original (MMBTU)	3,818	18,856	27,241	6,238		123	56,275
2013	Overall Use - Normalized (MMBTU)	5,510	19,531	34,988	8,482		95	68,606
	Overall Use - Original (MMBTU)	5,510	19,531	30,882	8,482		45	64,451
2014	Overall Use - Normalized (MMBTU)	5,549	17,658	32,029	8,853			64,090
	Overall Use - Original (MMBTU)	5,549	17,658	37,979	8,853			70,040

Weather Normalized Data

Town of Milton Energy Reductions

Milton Town Hall (28 KW installed in 2011)

Proposed 5 MegaWatt Solar PPA in 2015

Progress energy reduction based on Weather Normalized Data

2008 - 2013

* Reduction from 83,075 to 68,606 MM BTU = 13 % reduction from 2008
* includes 7 PV installations of 3,313 MM BTU = 4 % reduction w/ solar

Total Co2 reduction = 17 % in 2013

2014-15 Update

* Decrease from 68,606 to 64,090 MM BTU = 19 % reduction from 2008
* includes 7 PV installations of 3,313 MM BTU = 4 % reduction w/ solar

Total Co2 reduction = 23 % in 2014

* w/ expected 5 Megawatts planned for 2015

deduct 19,836 MM BTU = 24 % reduction w/ solar

44,254 MM BTU

* Potential Co2 reduction 83,075 to 44,354 = 47 % reduction in 7 years

Town of Milton Energy Baseline

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 www.icleiusa.org
International Council for Local Environmental Initiatives

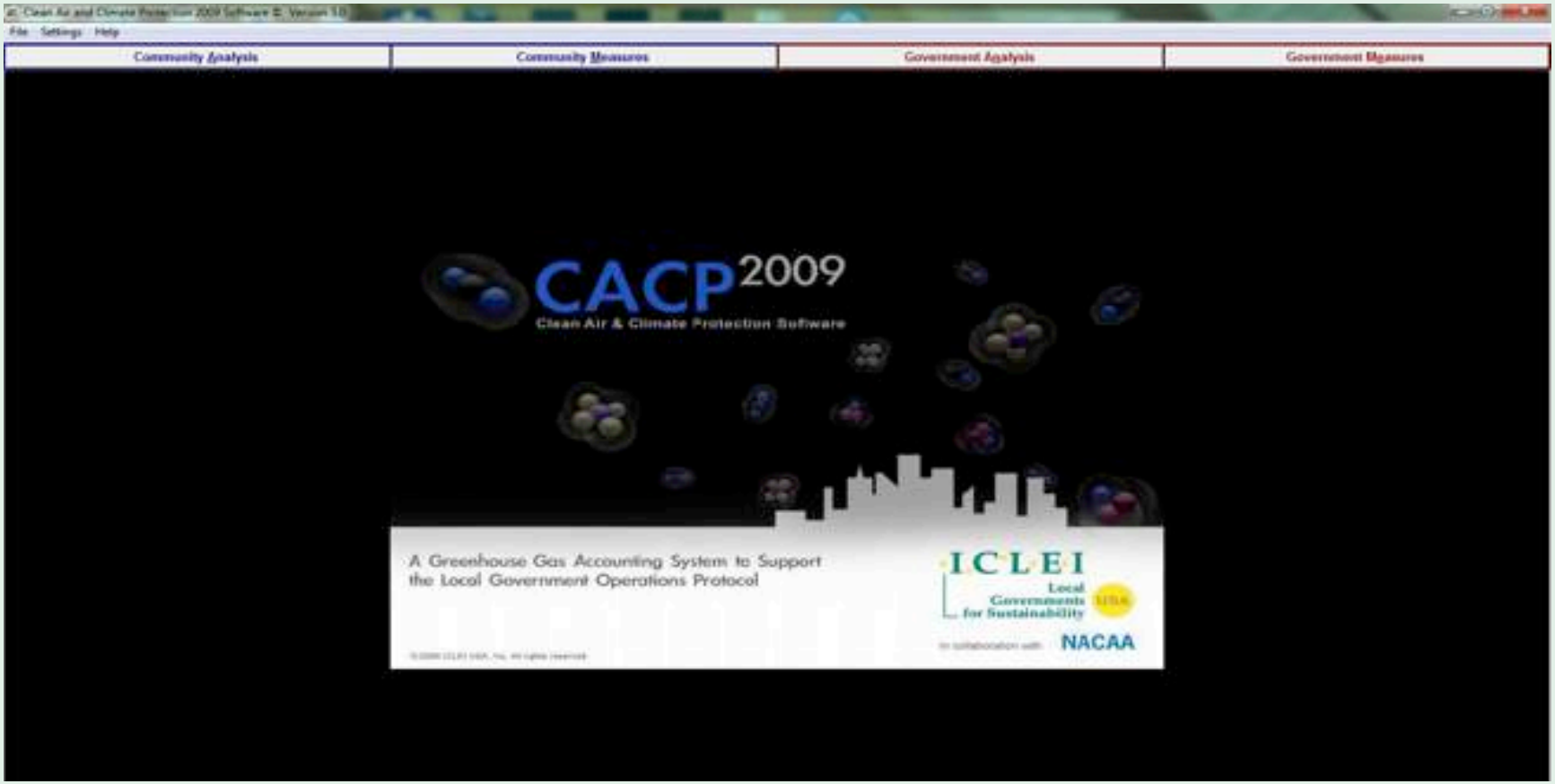
Established in 1990, more than 1,100 members, 43 countries, to advance deep reductions in greenhouse gasses and tangible improvements in local sustainability.

Sustainability Plan

Town of Milton Energy Baseline

ICLEI CACP 2009

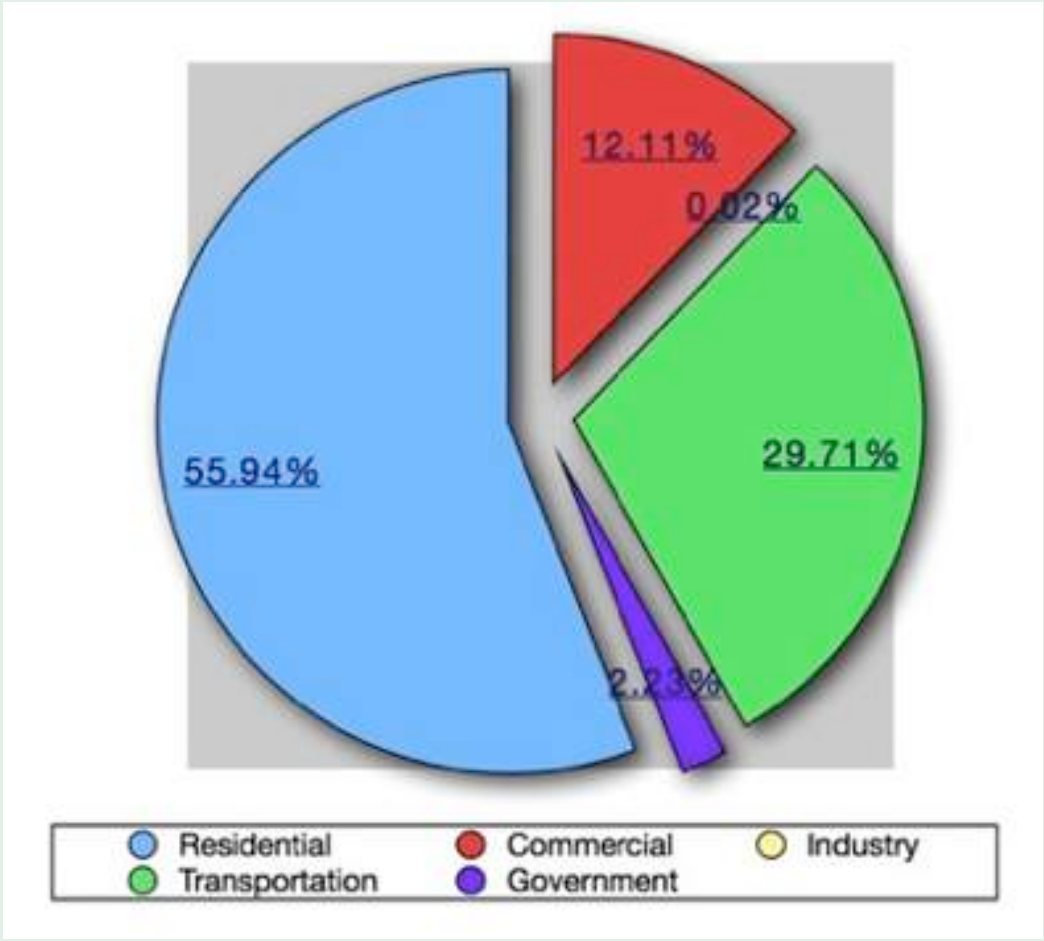
It is a GHG accounting package specifically designed to support climate action planning.



The total energy footprint of the Town of Milton for 2013 was 2,633,313 MMBTU.

Town of Milton Energy Baseline

CO2 Emissions from Entire Town

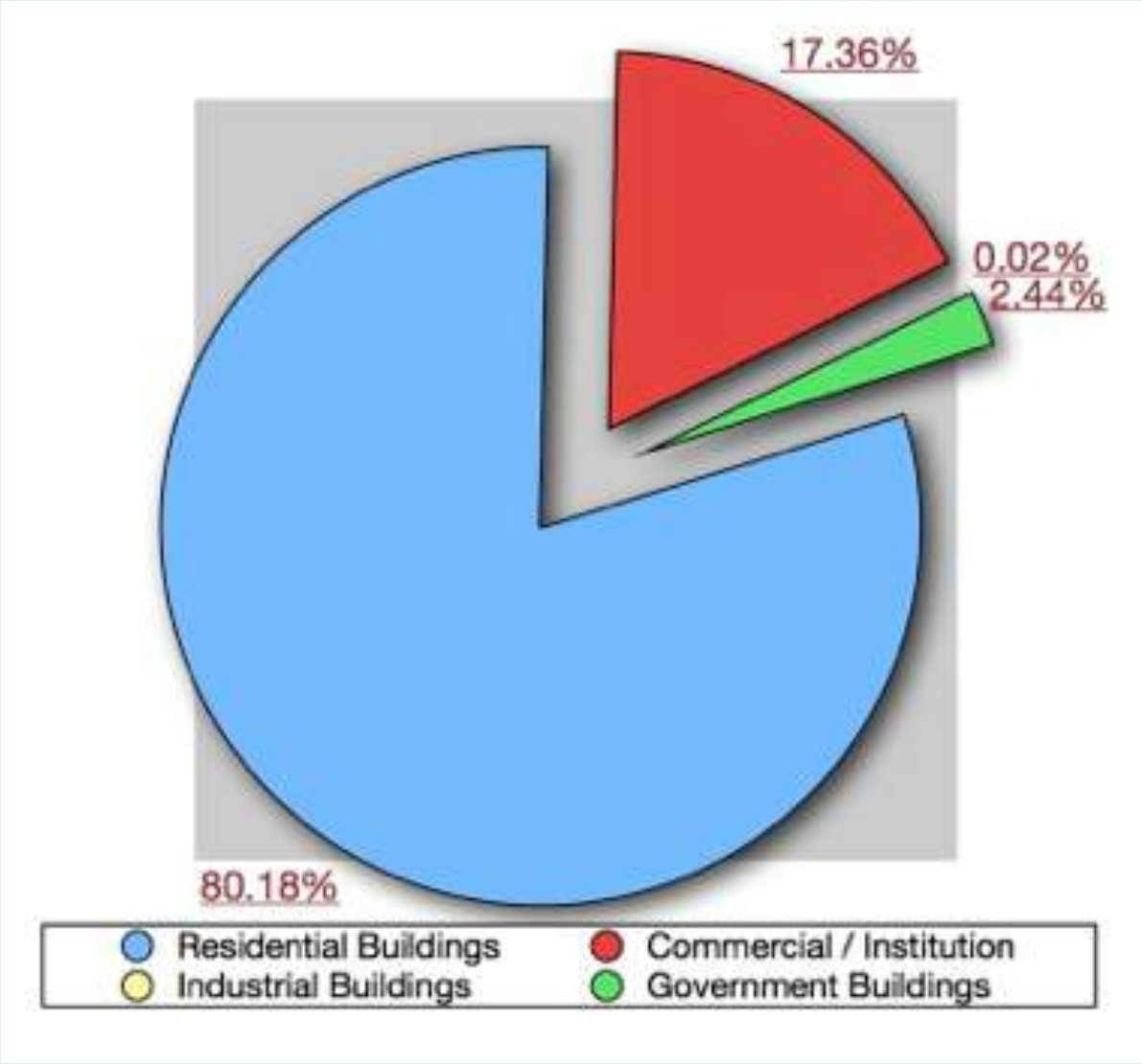


One of the main drivers for the MEAC in taking on this larger Town Energy study with ICLEI was to better understand the relationship between the Municipal Energy footprint and the Town as a whole. The second reason (as the MEI data showed such promising results) was to highlight the Town's energy saving accomplishments as an incentive and success story and model for the rest of the Town.

It turns out that only 2.2% of Milton's town wide GHG footprint is being emitted by municipal services. The bulk of the energy consumption is from the houses.

Town of Milton Energy Baseline

Emissions from Entire Town



Residential buildings in Milton account for 80% of the building emissions.

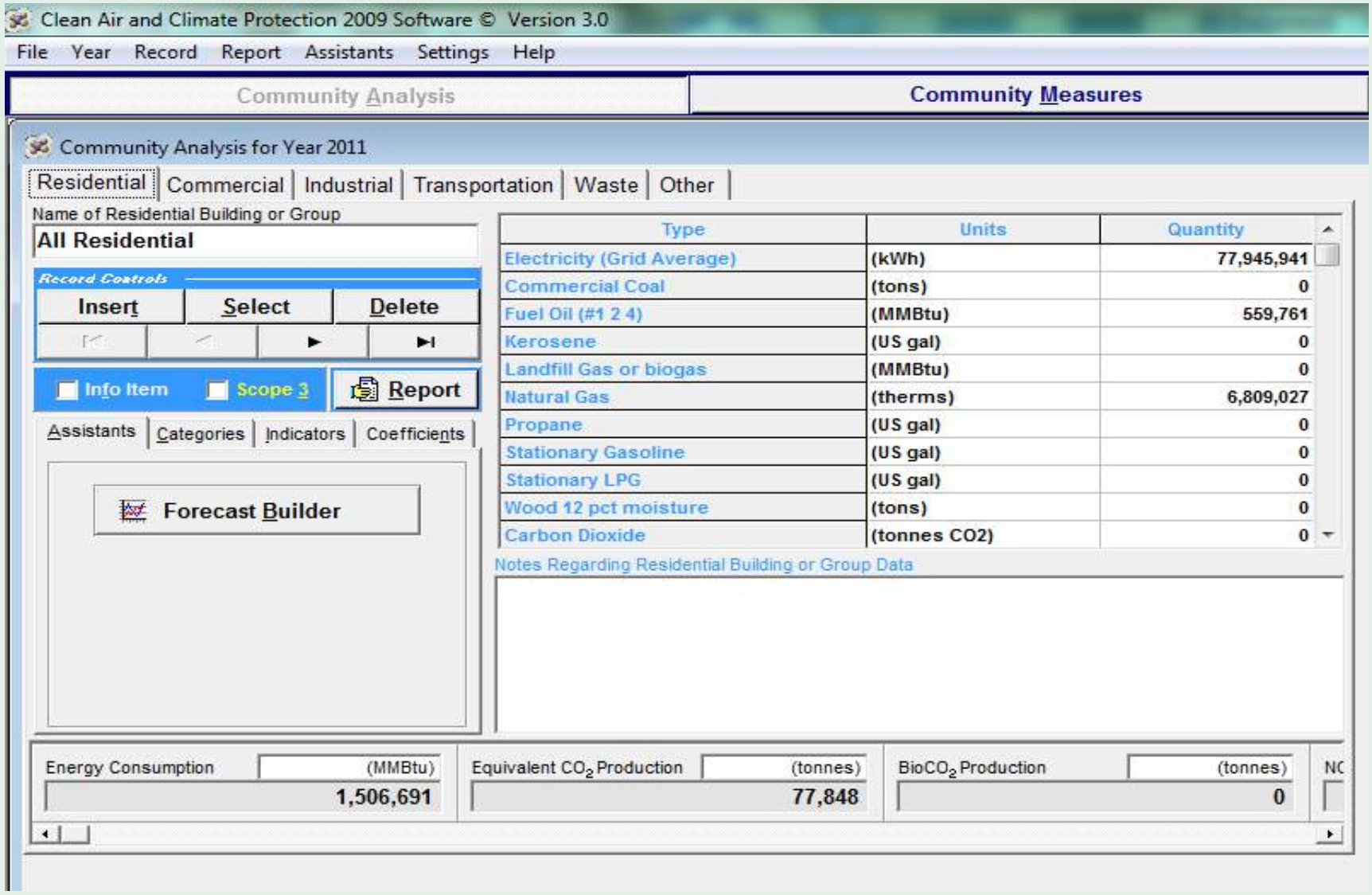
The residential buildings emitted 77,501 tonnes of CO2 in 2011. Remember We have over 20,000,000 sf of housing stock in Milton. (1 tonne =1.1 tons)

1 tonne CO2 is emitted when you…

- Burn 84 gallons of diesel
- fly to Paris 7 times

Town of Milton Energy Baseline

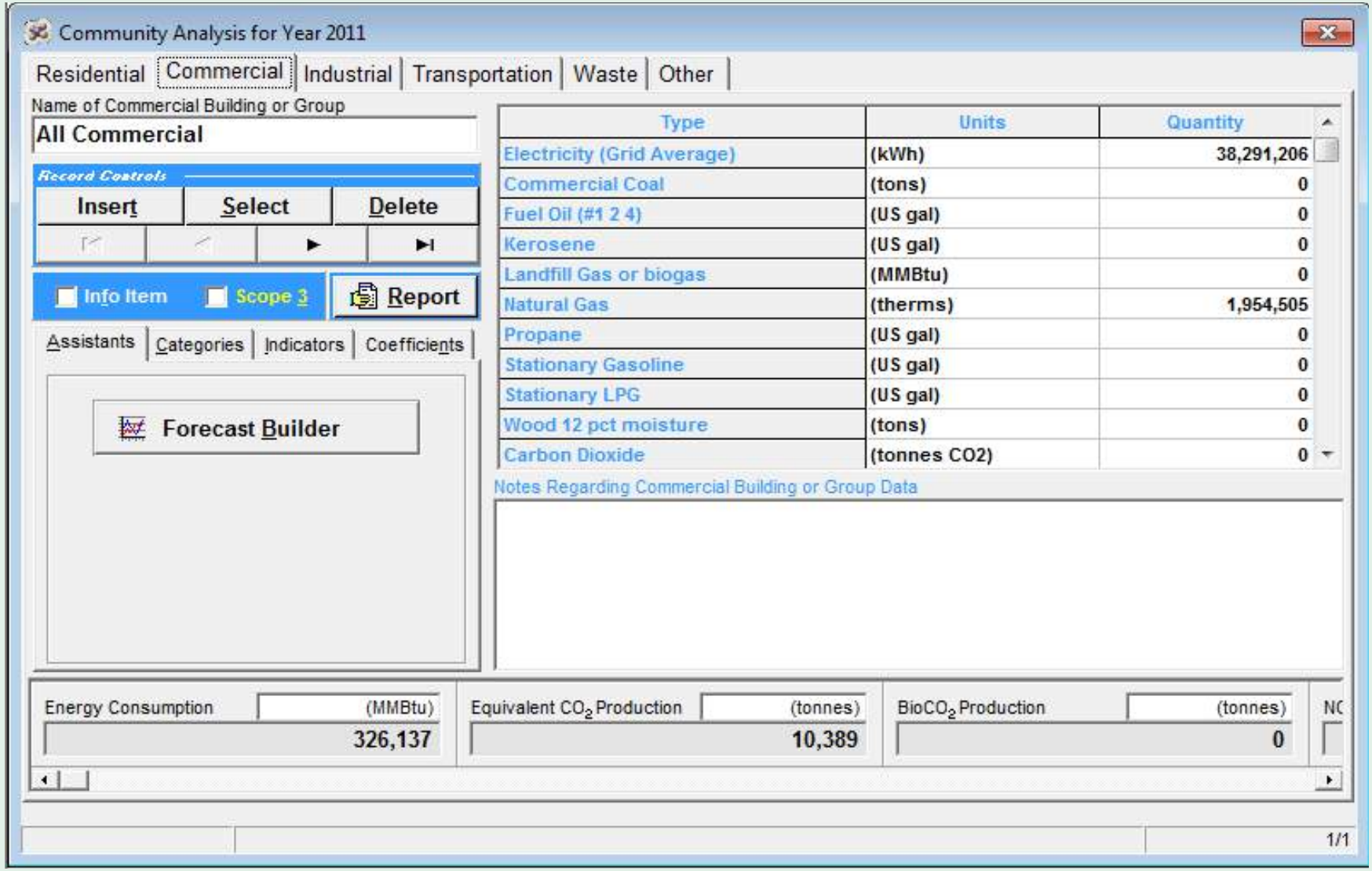
ICLEI CACP 2009



All Residential Buildings

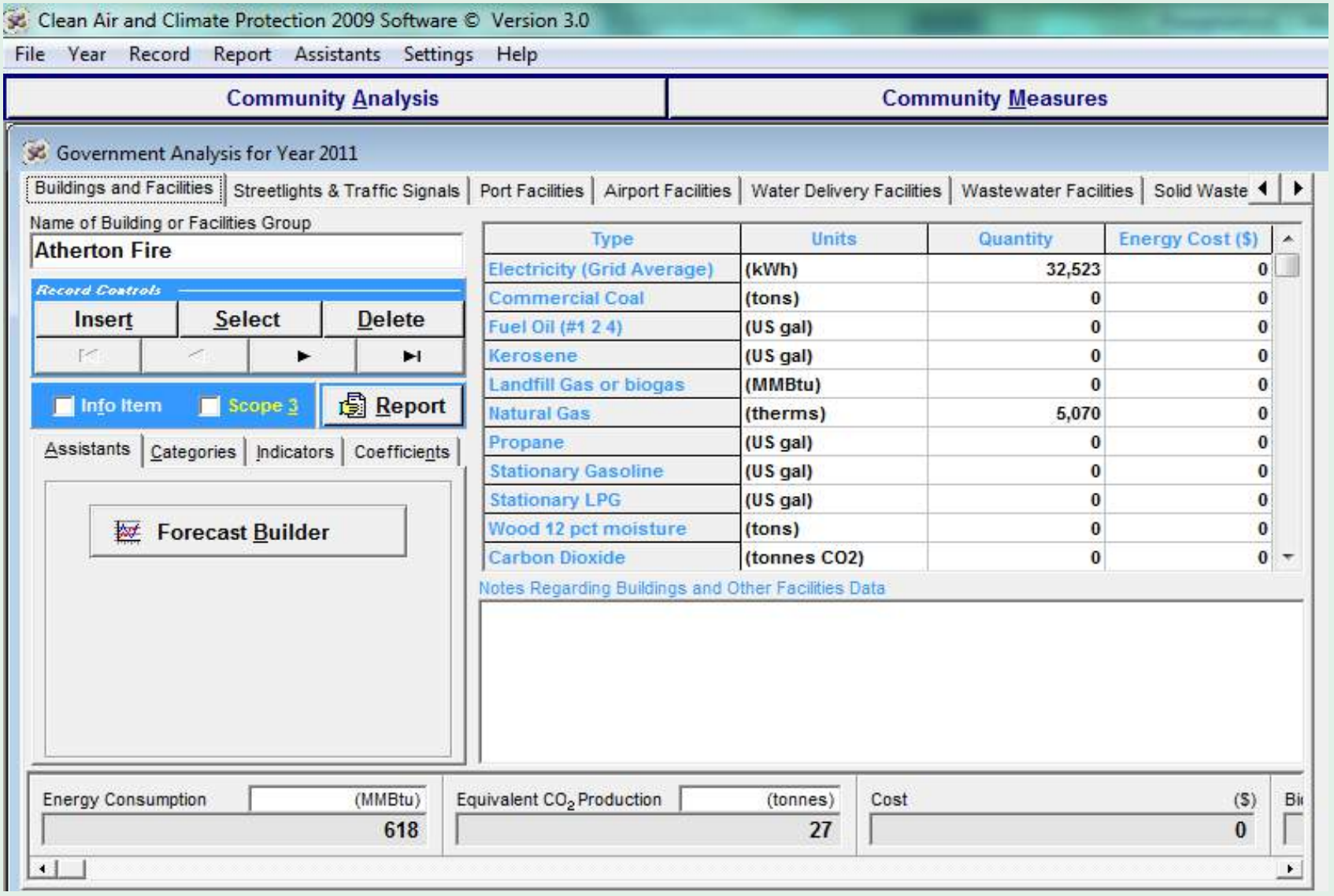
Town of Milton Energy Baseline

ICLEI CACP 2009



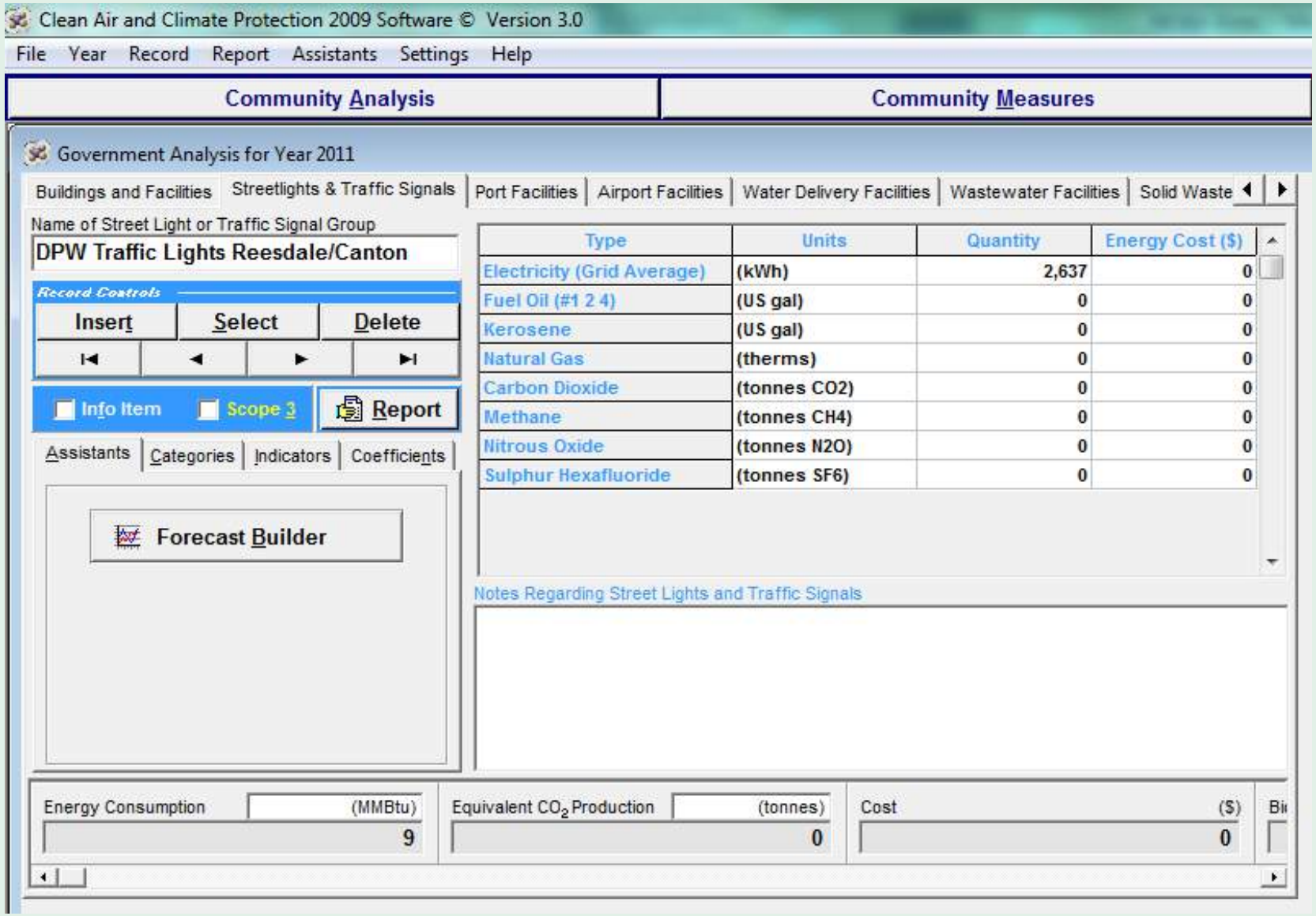
All Commercial Buildings

Town of Milton Energy Baseline
ICLEI CACP 2009



Drilling down to individual building

Town of Milton Energy Baseline
ICLEI CACP 2009



Drilling down to individual facility

Town of Milton Energy Baseline
ICLEI CACP 2009

Milton

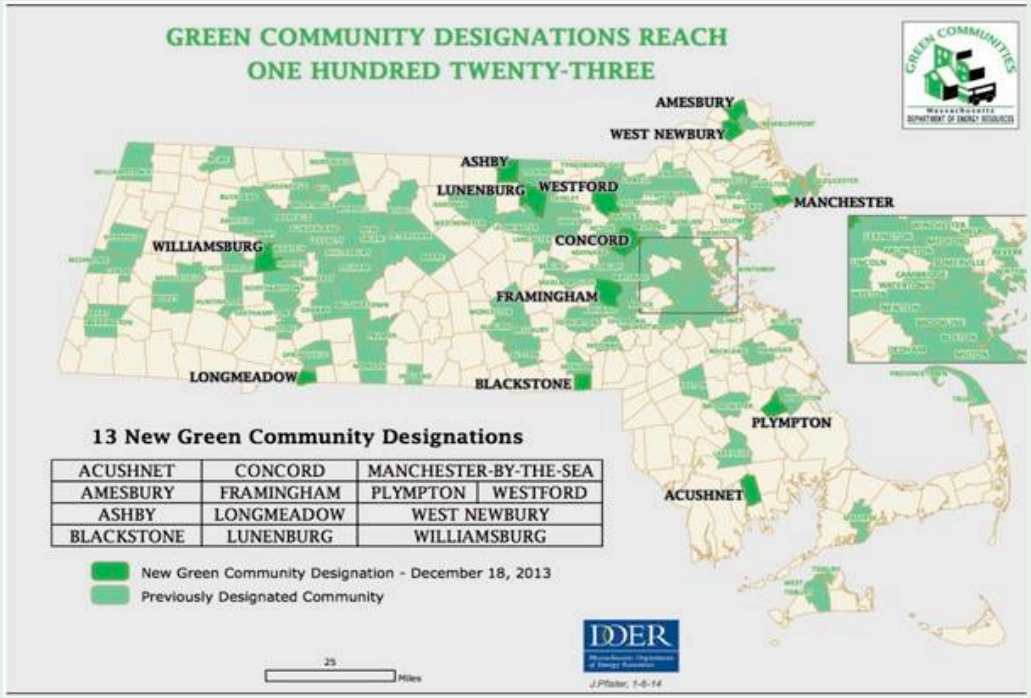
Community Greenhouse Gas Emissions in 2011

Summary Report

Scope 1 + Scope 2

	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	Equiv CO_2 (tonnes)	Bio CO_2 (tonnes)	Energy (MMBtu)
Residential	77,501	474	9,489	77,848	0	1,506,623
Commercial	10,363	20	977	10,389	0	326,137
Industrial	0	0	0	0	0	442
Transportation	56,694	3,185	2,710	57,738	0	800,111
Waste	0	0	103,395	2,171	0	
Total	144,558	3,679	116,571	148,146	0	2,633,313

Town of Milton Energy Reductions



The total energy footprint of the Town of Milton for 2013 was 2,633,313 MMBTU.

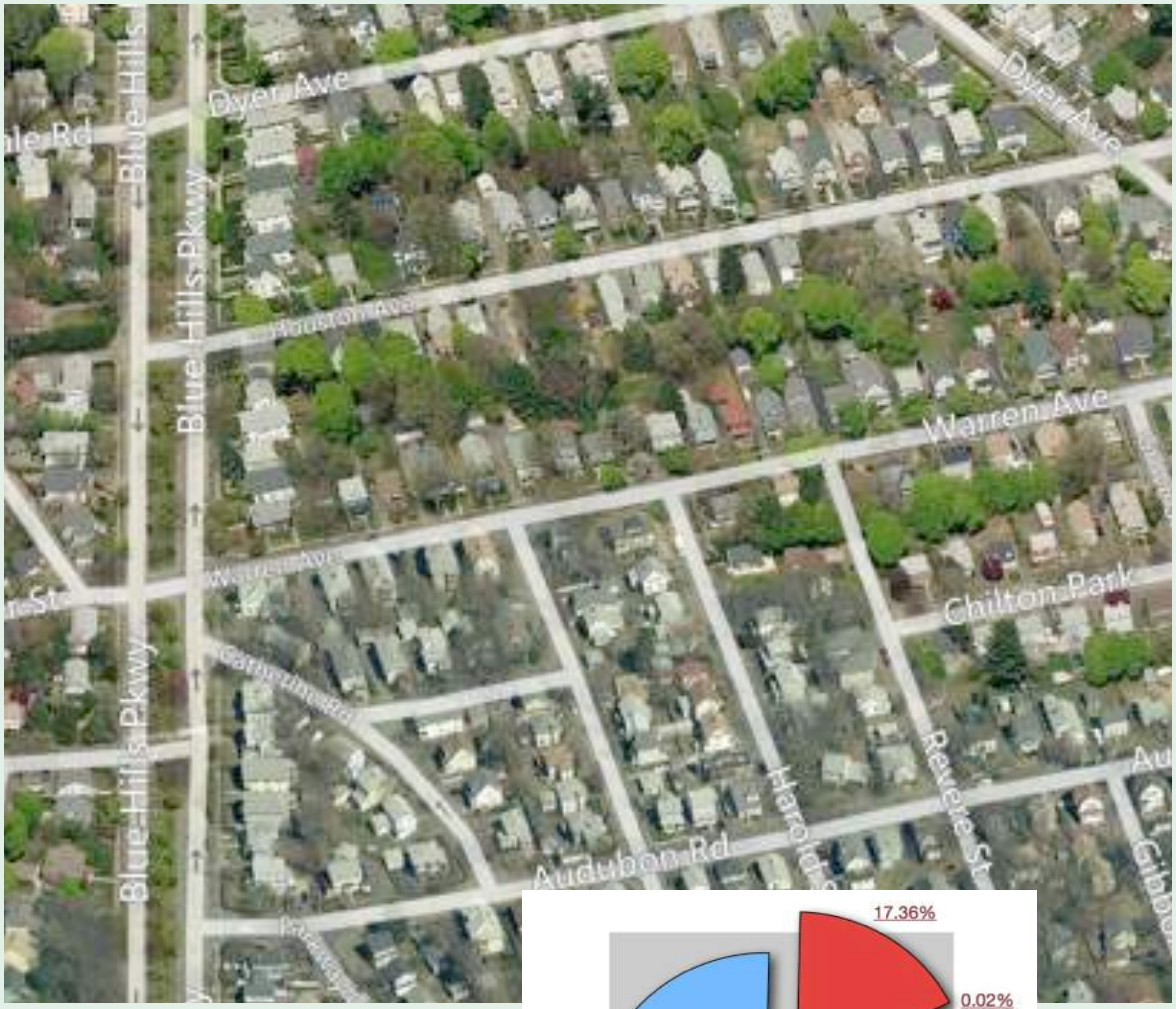
A town-wide goal in Residential efficiency and renewables to match the Municipal reduction of 47% (19 % efficiency, 28% renewables) since 2008 would be

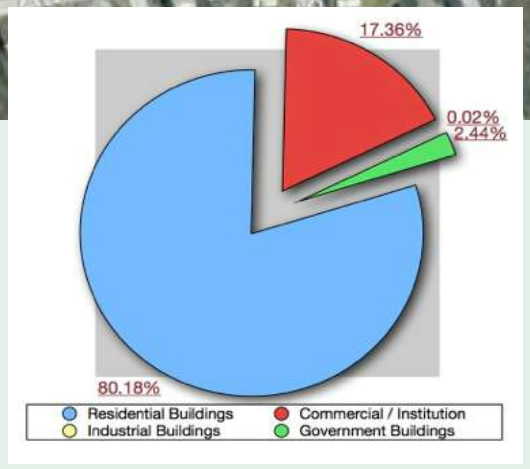
(1,500,000 MM BTU x .47) 705,000 MMBTU

10 (+/-) times the 2014 municipal baseline of Milton, and

18 (+/-) times the total Town Co2 savings of 38,721 MMBTU since 2008.

Town of Milton Energy Reductions





Residential

80% of residential building stock is houses

8,657 houses/units in Milton (7,138 single family houses).

20,620,398 SF of private residential space

1,500,000 MMbtu of energy consumed by houses. 77,000 tonnes of CO2.

This is 72. 7 KBTU/SF/YR

Town of Milton Energy Reductions

Sustainable Milton, MassSave and Next Step Living

- Public campaign to weatherize as many houses in Milton as possible in association with Sustainable Milton, MassSave and Next Step Living.
- Have been organizing a Green Home Fair every year to promote energy efficiency measures.
- Held a public workshop in November 2014 w/ Next Step Living
- Next Step Goal: 600 houses for 2015
- 600 houses per year would yield 3,000 houses by 2020

Town of Milton Energy Reductions

MA Targets

25% by 2020 – 80% by 2050 – 8,657 units of housing

Will we make it ????

MassSave Energy Reduction

(Efficiency and Renewables)

- Existing average house: 70 kBtu/sf/yr
- Envelope: 15%
- HVAC: 3%
- Lights/Plug loads: 2%

- Solar PV(personal or community): 15%

- Result: 45.5 kBtu/sf/yr (35% reduction)
- 505,000 MMBtu savings

Town of Milton Home Weatherization Data

Next Step Living, 2014 (NSL provides 60% of HPC work in the Greater Boston Area)

Number of Houses		110	
TOTAL Savings	$	59,957	
Savings per house	$	545.06	
Heat/Hot Water			
Total Savings per heat	$	436.05	
Total Savings in Therms per house		311.46	therms
Therms to BTU		31,146,494	BTUs
Plug Loads			
Total Savings per electric	$	109.01	
Total savings in kWh		495.51	kWh
kWh to BTU		1,691,184	BTUs
Total Savings		32,837,677	BTUs
Typical House		168,000,000	BTUs
70 kBTU/sf			
2400 sf			
Total Savings		19.55%	

Town of Milton Home Weatherization Data
Next Step Living, 2014

Given 9,000 houses in Milton, with 110 weatherizations a year, it would take 82 years to complete the town.

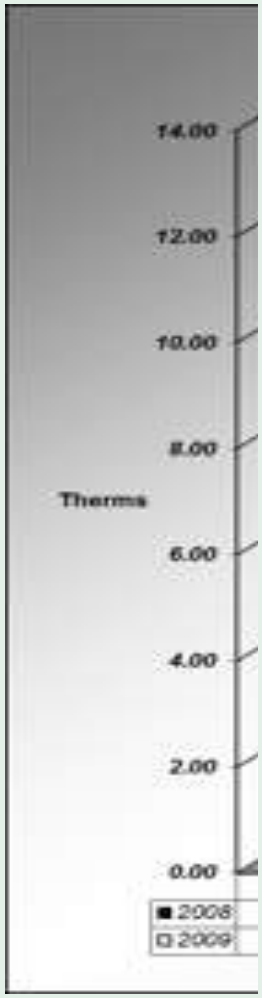
The big question is how do we ramp up the numbers of those participating ??

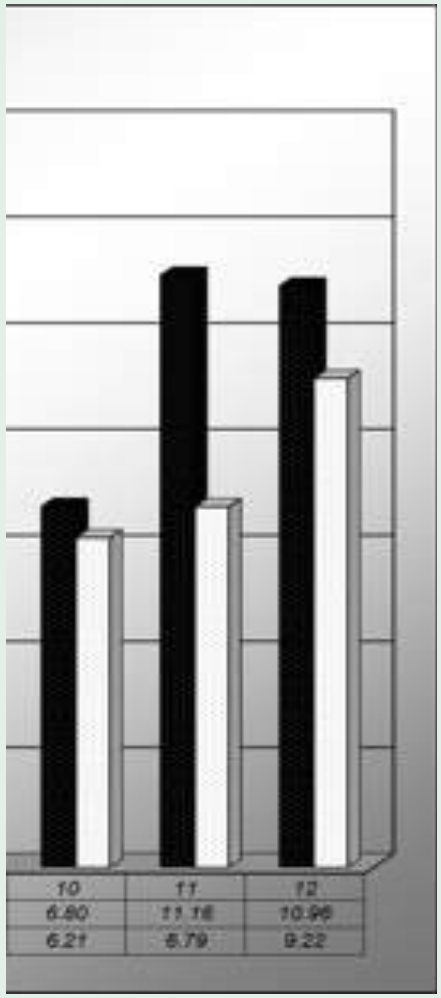
The answer is both participating and accounting!!

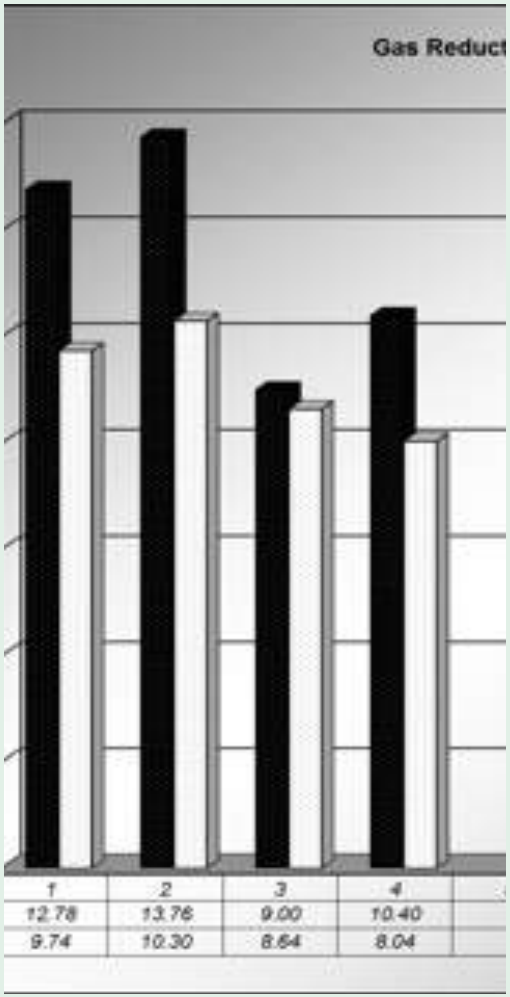
Energy Benchmarks for 2,400 SF Home in Boston Area

Type Home	KBTU /sf/yr	MM/BTU/yr	Energy costs/yr	HERS score
Average Existing	70	168	+/- $5,000	130
House Built to Code	54	130	+/- $4,000	90
Energy Star Home	45	108	+/- $3,000	70
Deep Energy Retrofit (DER)	17	41	+/- $1,300	35
DER w/ Solar	8.5	21	+/- $ 950	25
Passive House	7.4	17	+/- $ 800	35
Net Zero Energy Home	0	0	$ 0	0
Energy Plus Home	- ??	- ??	+ $	- ??

Clancy House Energy Reductions





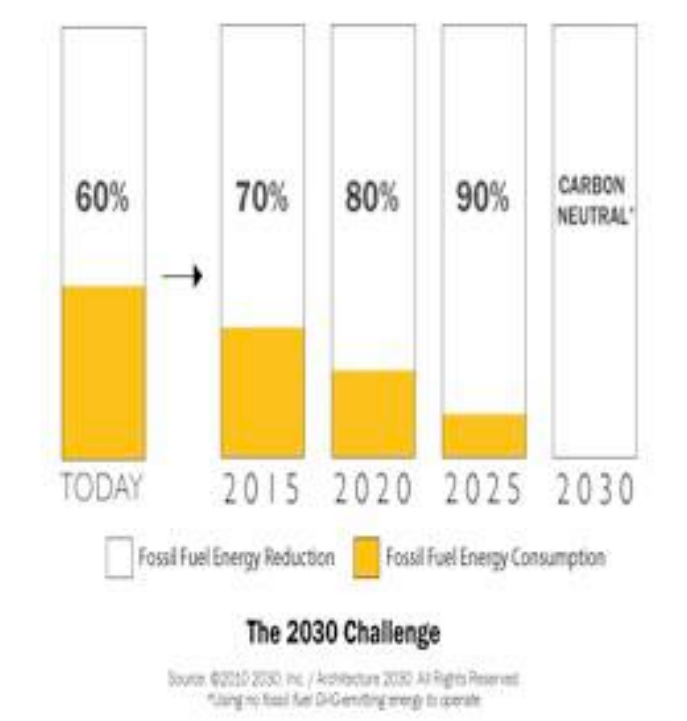


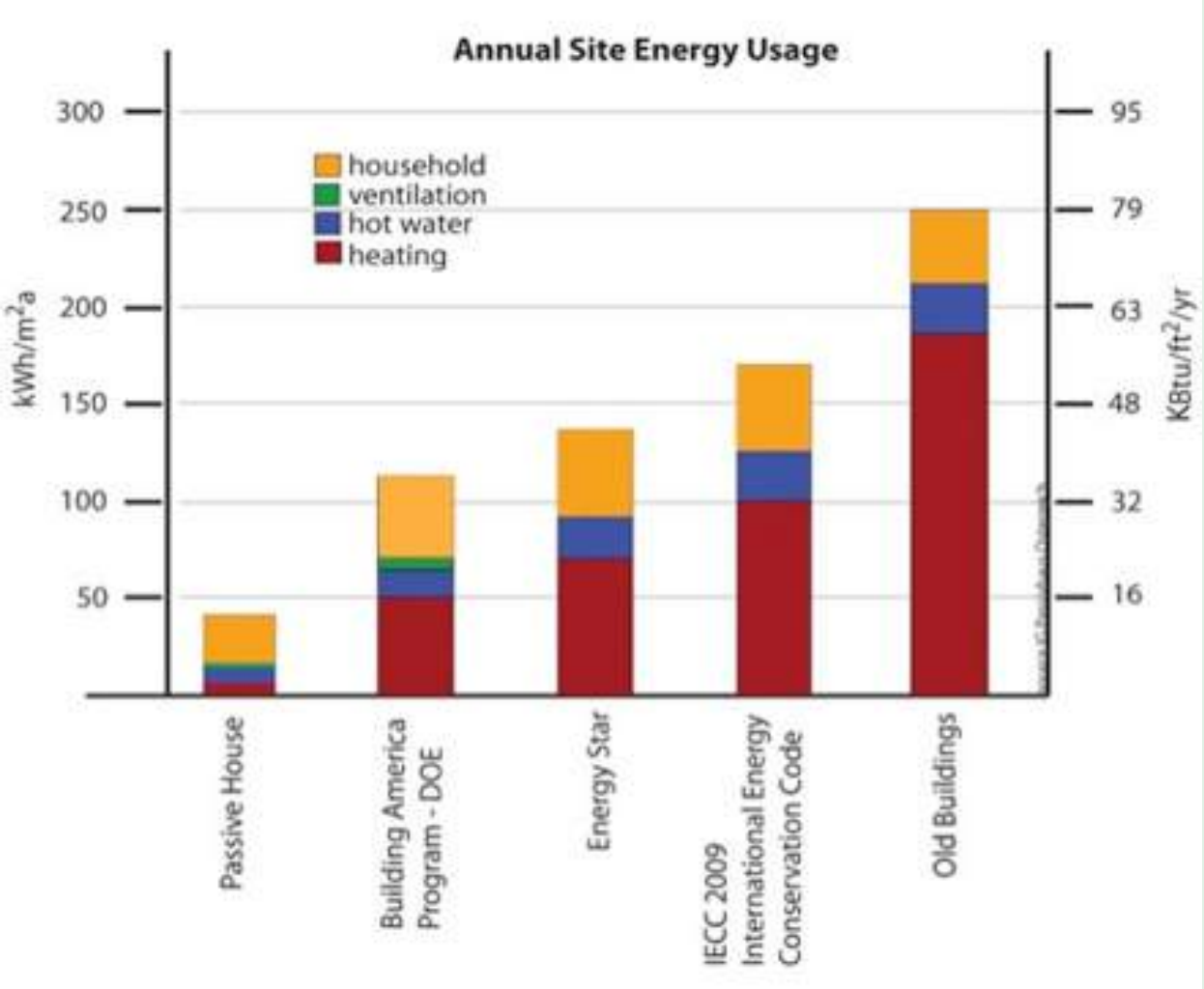
- Clancy House (post wall insulation)
- Envelope: 2,959 cfm50 to 2,150 cfm50: 27% reduction
- Gas usage (adjusted for HDD): 24% reduction

Town of Milton Energy Reductions

Architecture 2030 Challenge - Think Bigger

Deep Energy Retrofit Passive House Net Zero Energy Plus

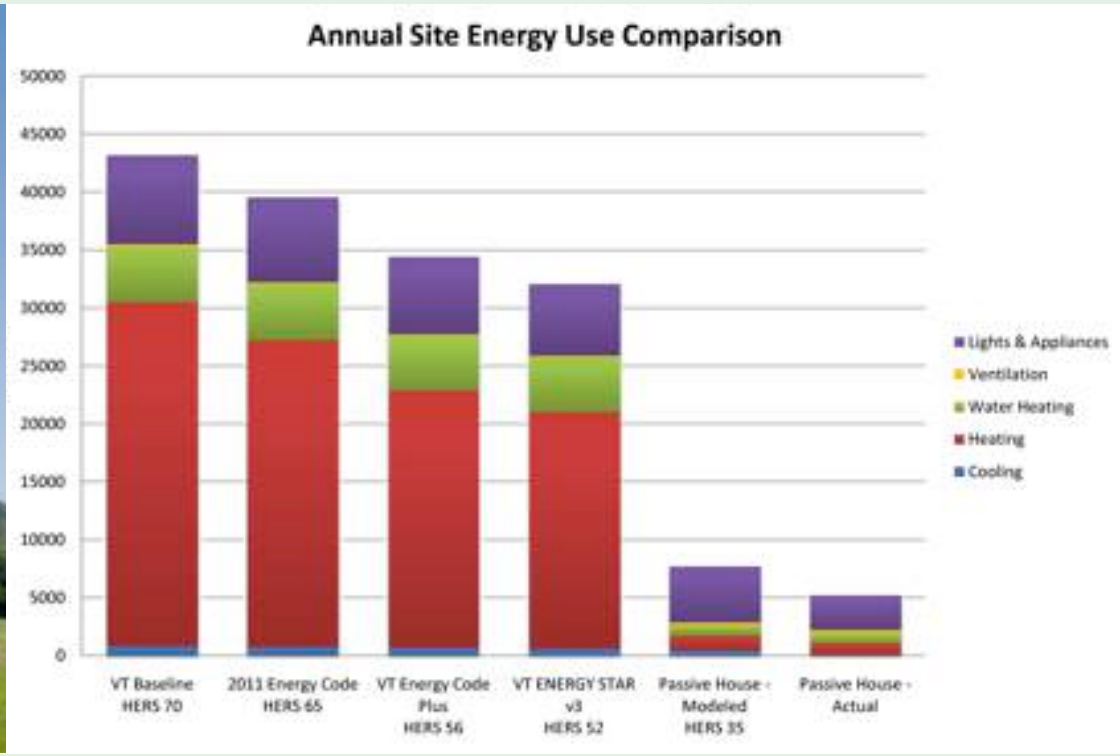




Town of Milton Energy Reductions

Passive House

Walls: R59 Roof: R90 Fdn Walls: R57 Slab: R61 Windows: U.21 Air Tightness: .4ACH50

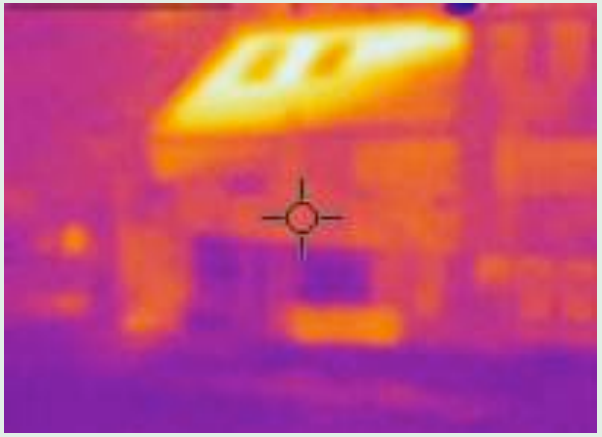


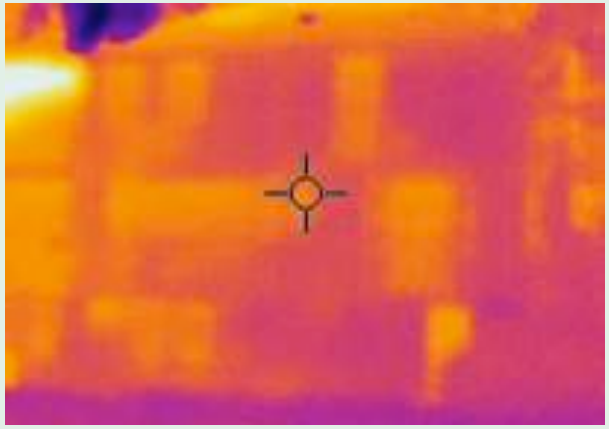
5,200 kWh per year
8 kBtu/sf/yr (using RECS method of building area)
12 kBtu/sf/yr (using Passive House method of area)

Energy Star Rehab

Southwest face of Building

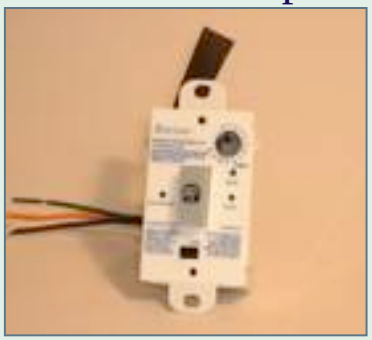
<u>Typical 1945 Milton Home,</u> Increase of 38% of conditioned space between 1998-2008, w/ home office in existing footprint (1,606 to 2,590 sf). Drop in energy use from 90 to 45 KBTU/ SF/ YR (net 20% drop in energy use) w/ ongoing Mass save work & 2kW PV coming in 2015.





Transforming 670 SF of wasted, cold and damp ground level space to new comfortable living area.

New EPS expanded polystyrene foam direct on concrete walls w. insulated stud wall cavity, total R-24 .



Fan Switches

Hygrometer RH Meter

Description	Qty	Estimated Cost ($)	Estimated Incentive ($)	Estimated Cost to Customer ($)	Estimated Annual Savings ($)	Estimated Payback Years
Air Sealing						
Perform Air Sealing at Estimated 62.5 CFM50 Per Hour	6	$462.00	$462.00	$0.00	$44.90	Immediate
Door Sweep	2	$42.34	$42.34	$0.00	N/A	Immediate
Exterior Door Weather Stripping	2	$50.40	$50.40	$0.00	N/A	Immediate
	Subtotal	$554.74	$554.74	$0.00	$44.90	Immediate
Weatherization						
Replace Bath Fan Hose	1	$22.00	--	--	N/A	N/A
Attic Floor Open Blow Cellulose 6"	516	$691.44	--	--	$22.97	7.52
Dumming	58	$107.30	--	--	N/A	N/A
Attic Floor Enclosed Cellulose Dense Pack 6"	30	$62.10	--	--	$10.74	1.45
	Subtotal	$882.84	$662.13	$220.71	$33.71	6.55
	Totals	$1,437.58	$1,216.87	$220.71	$78.61	2.81

Thermal Bypass Checklist & Home Energy Rating System Blower Door Test of 1402 CFM50

Attic insulation options

National Grid Deep Energy Retrofit Pilot Program

Home producing 60% of annual fuel needs with Solar , PV and Hot water. HERS of 25 from CSG.

1000 Homes Challenge, from 2011-2012. Threshold for home was 11,007 kWh/YR for all energy needs, (adjusted to 11,522)

= 8,560 BTU/ SF/YR, or 1.4 BTU/ SF/DD/ YR.

New National Grid DER program, clients able to do partial measures, streamlined for simplicity and rigor.

Transformation of 1905 bungalow to 4 story, 21st century home with carbon footprint 15% of the average home in the Boston area.

Boston Deep Energy Retrofits @3 Scales (w/goal of 80% reduction by 2050)

http://timearch.com/assets/NE-Sun-GBOH-2011.pdf

Quincy DER, 85% savings over typical home and 34 MM BTU/ YR with EUR @1.7 BTU/SF /DD/ YR.

www.castledeepenergy.com/

Boston South End, 192 unit apartment building with energy savings of 72% and 10,791 MM BTU/ YR with new EUR of 3.45 BTU/SF /DD/ YR.

www.basea.org/GreenBCH.php

Greening of Boston City Hall, modeled for energy savings of 70% @ 61,200 MM BTU/ YR , dropping EUR from 10.5 to 3.15 BTU/SF /DD/ YR .

How do we achieve DER's for the vast majority of existing buildings w/ limits to renewables?

Part II

Benchmarking of Residential Energy Use Intensity

Keith Burrows, LEED-AP

Resynergy Systems

The Need

Why is Benchmarking Residential Energy Use Important?

Residential Buildings in the U.S. Account for 18% of Total CO2 Emissions

And Consume Over 50% of all Building Energy Used in the Country

Existing Building Stock:
Efficiency Not Improving Quickly Enough

Subsidizing Energy Efficiency: Increase Supply

The American Recovery and Reinvestment Act of 2009:
5 billion dollars for weatherization

1 million homes retrofitted in under 3.5 years

Approximately 290,000 homes annually

130,000,000 ÷ 290,000 = **449 YEARS!**

How do we Improve?

Provide Meaningful Feedback

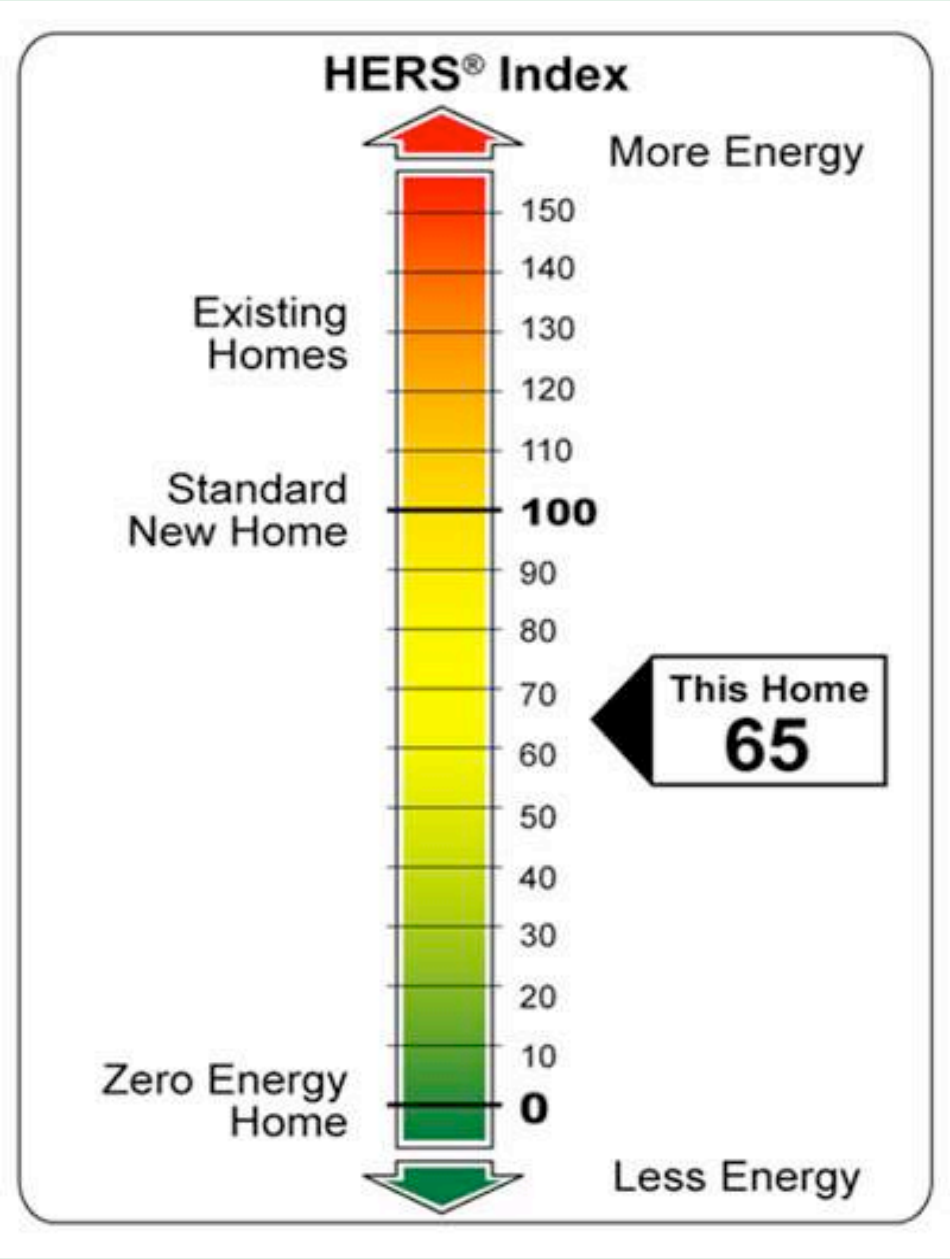
Most People Don't Know Much Energy They Use

Or if the Amount they Use is Good or Bad

“If you can’t measure it, you can’t manage it”

– Peter Drucker

Don’t We Already Have a Way to Measure Efficiency?



HERS Limitations

Time Consuming

Expensive ($600 – $1,000)

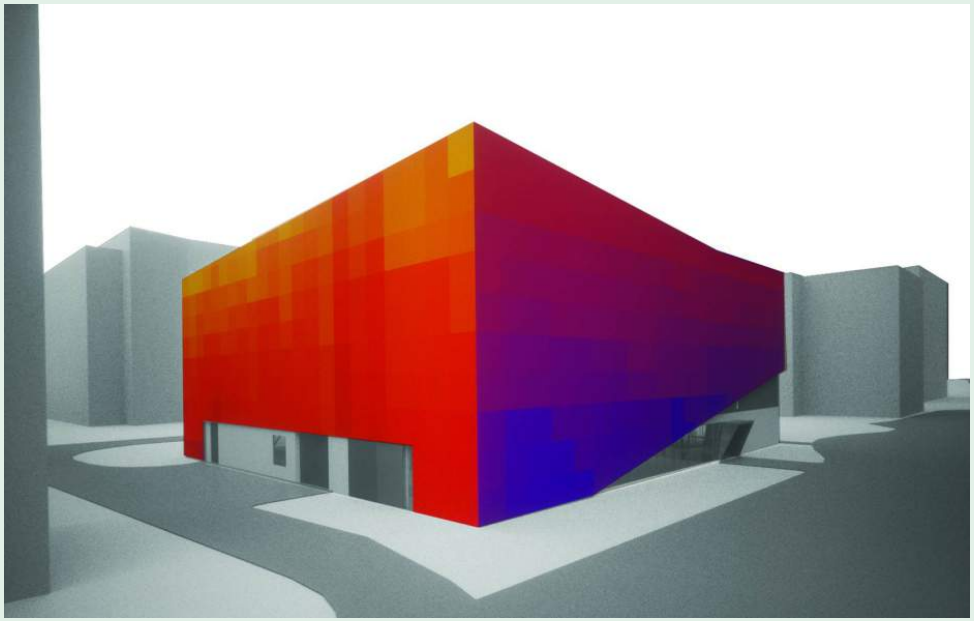
Not always accurate

Bias in Favor of Larger Homes

Removes Occupants from Equation

Asset Assessments

Image source: www.oppd.com



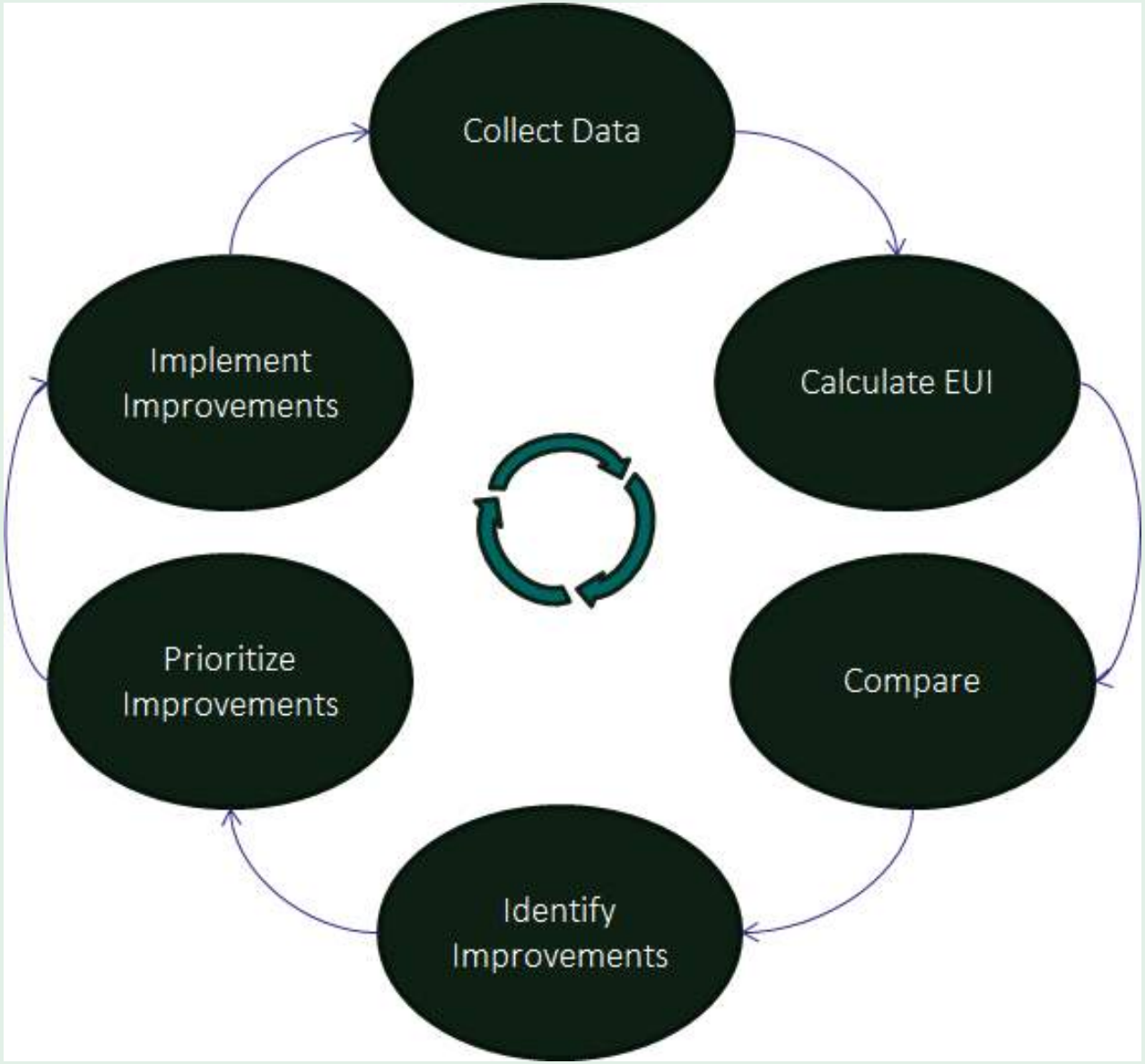
Home MPG
Springfield Area Program

Image source: www.masssave.com

Asset Assessments

Image source: Wes Stanhope

An Operational Assessment: Benchmarking EUI



Regression Models for Benchmarking

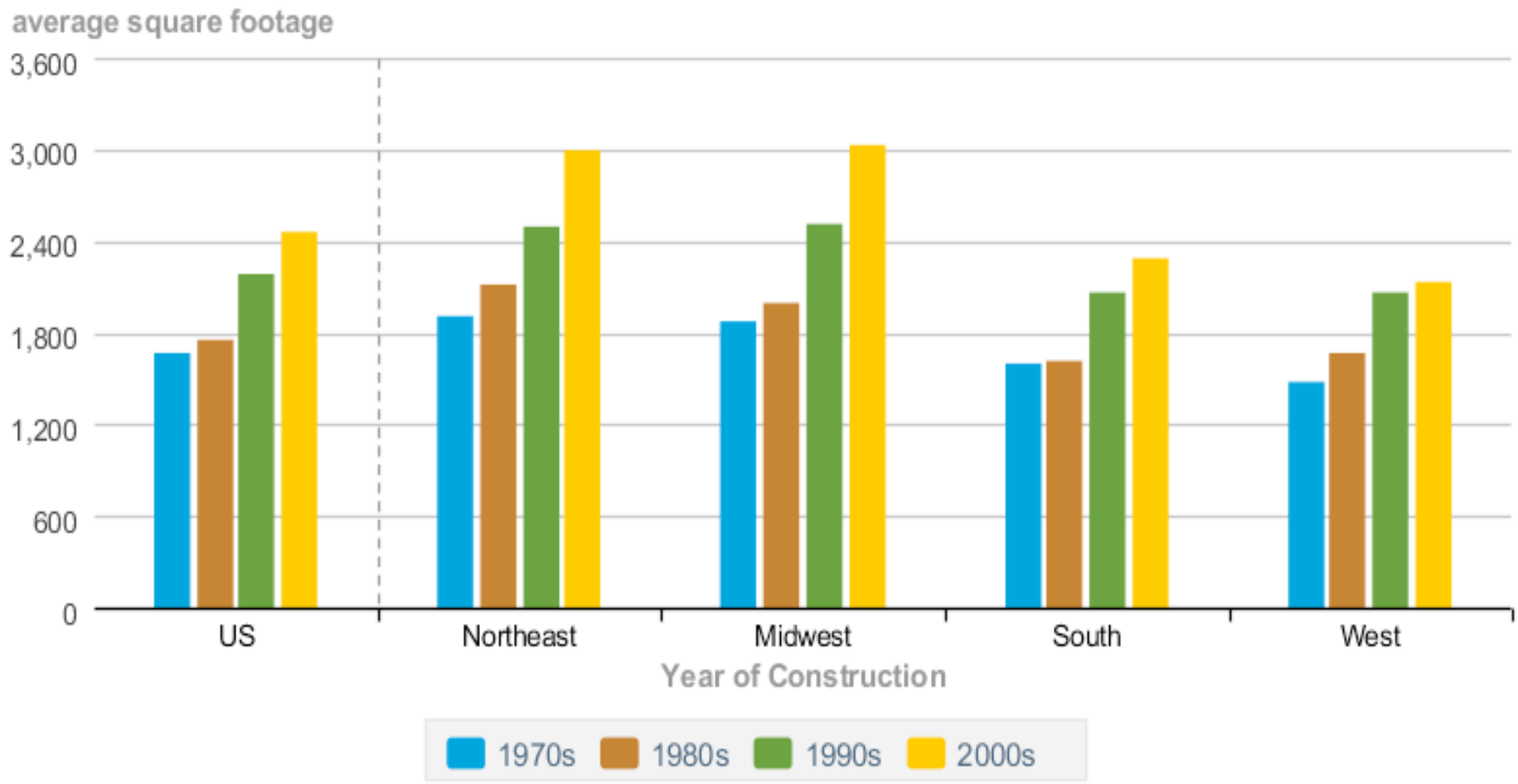
Model Parameters

$$y = mx + b$$

Total Building Area

Year Constructed

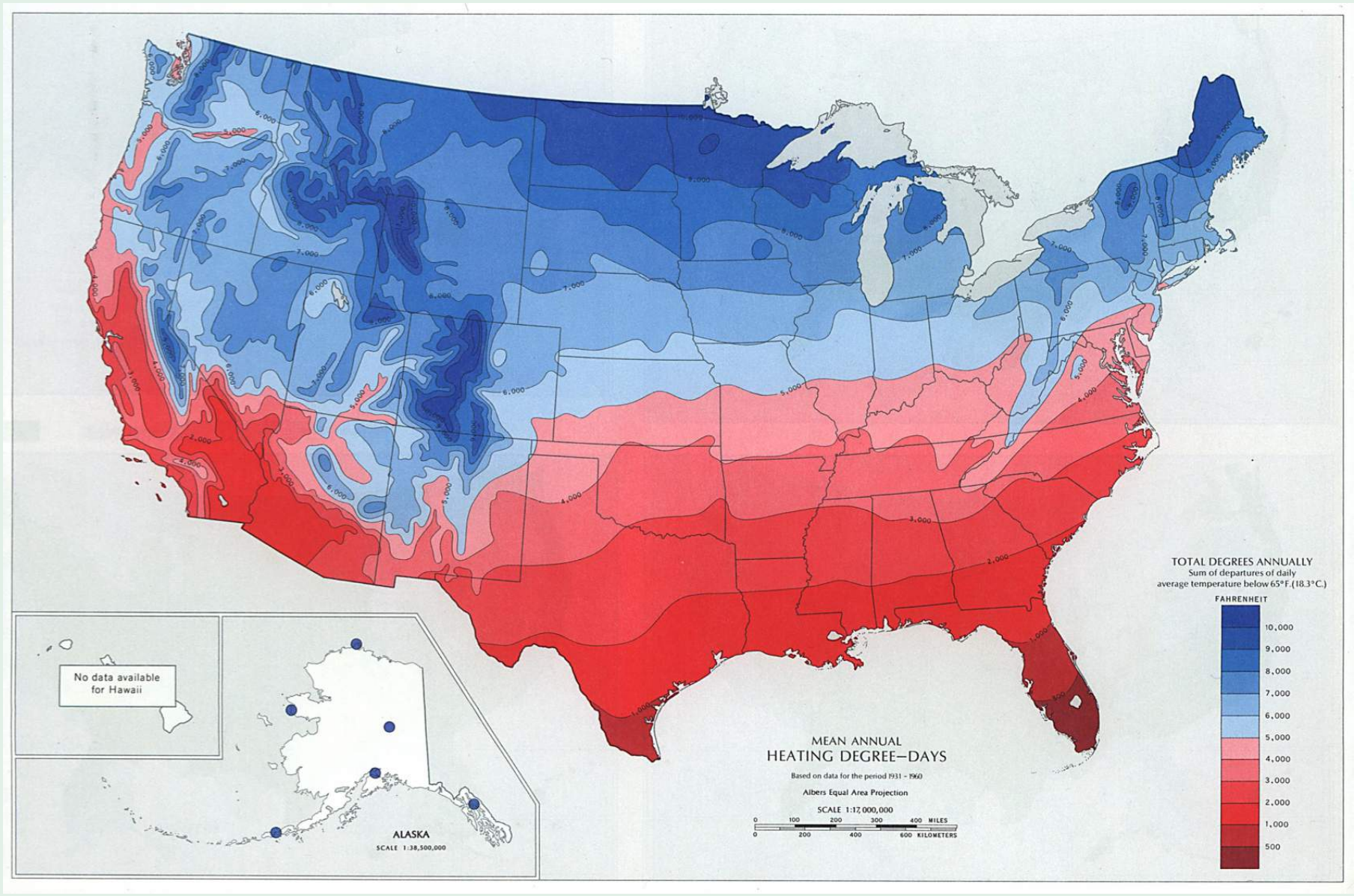
Figure 1. Newer homes trend larger in all regions of the country



eia 2009 RECS: Housing Characteristics, Square Footage

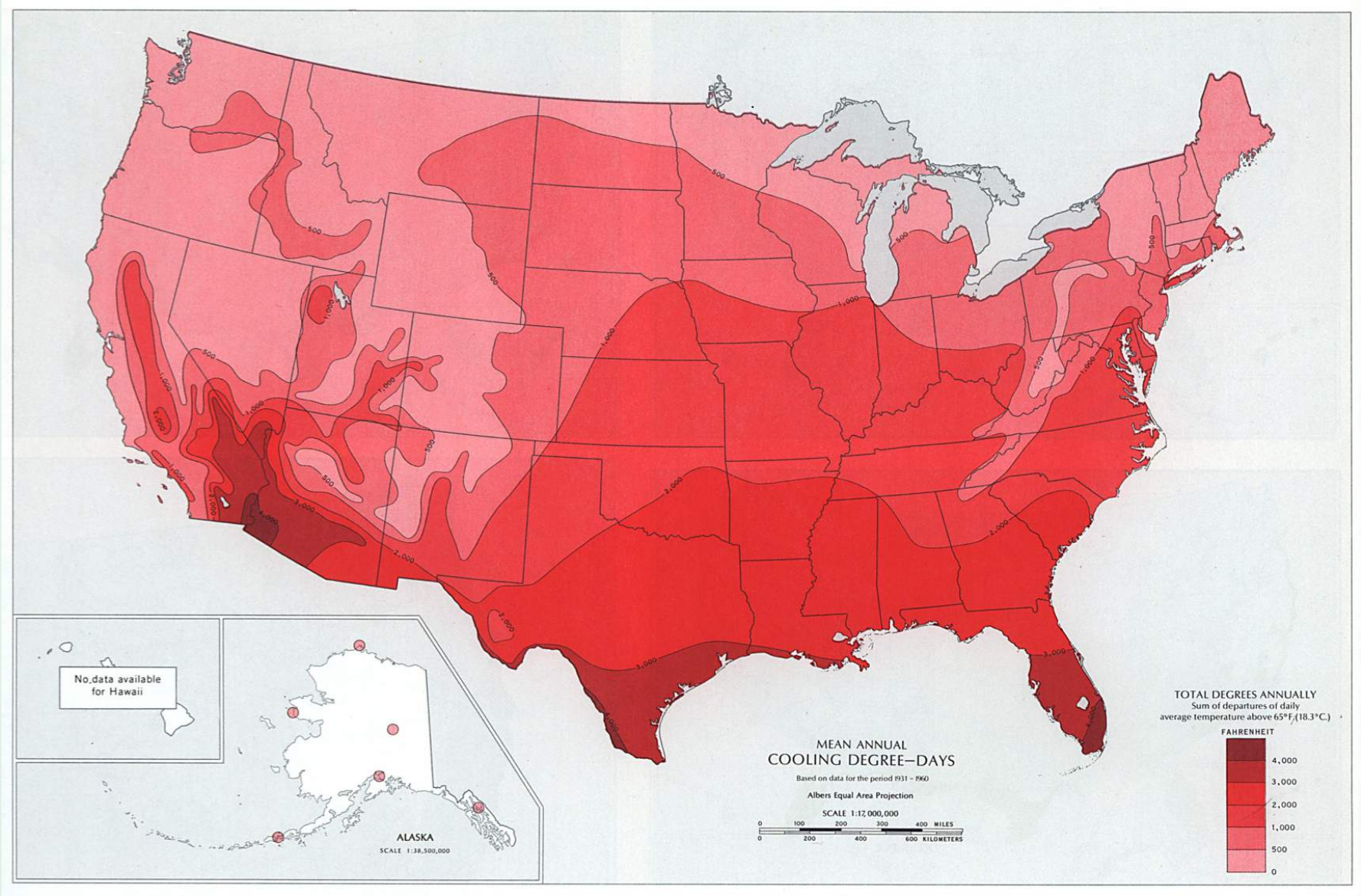
Number of Occupants

Heating Degree Days (HDD)



Source (National Oceanic and Atmospheric Administration)

Cooling Degree Days (CDD)



Source (National Oceanic and Atmospheric Administration)

Building Type

Single Family Attached

Single Family Detached

Small multi-family (2-4 units)

Large multi-family (5+ units)

Benchmarking Steps:

1. Gather Data
2. Calculate Actual Site EUI of Target Home
3. Calculate Model EUI
4. Determine the Efficiency Ratio (Actual / Model)
5. Determine Where Home's Efficiency Ratio Falls
6. Generate Rating (0 – 100)


Home Benchmark Ratings
Using
Weighted RECS Single Family Efficiency Ratio Distribution
Percent Less Efficient
1.2
1
0.8
0.6
0.4
0.2
0
0
1
2
3
4
5
Efficiency Ratio
Home A
80 (Very Good)
Home B
16 (Poor)
RECS Single Family Survey Samples

Does it Work?

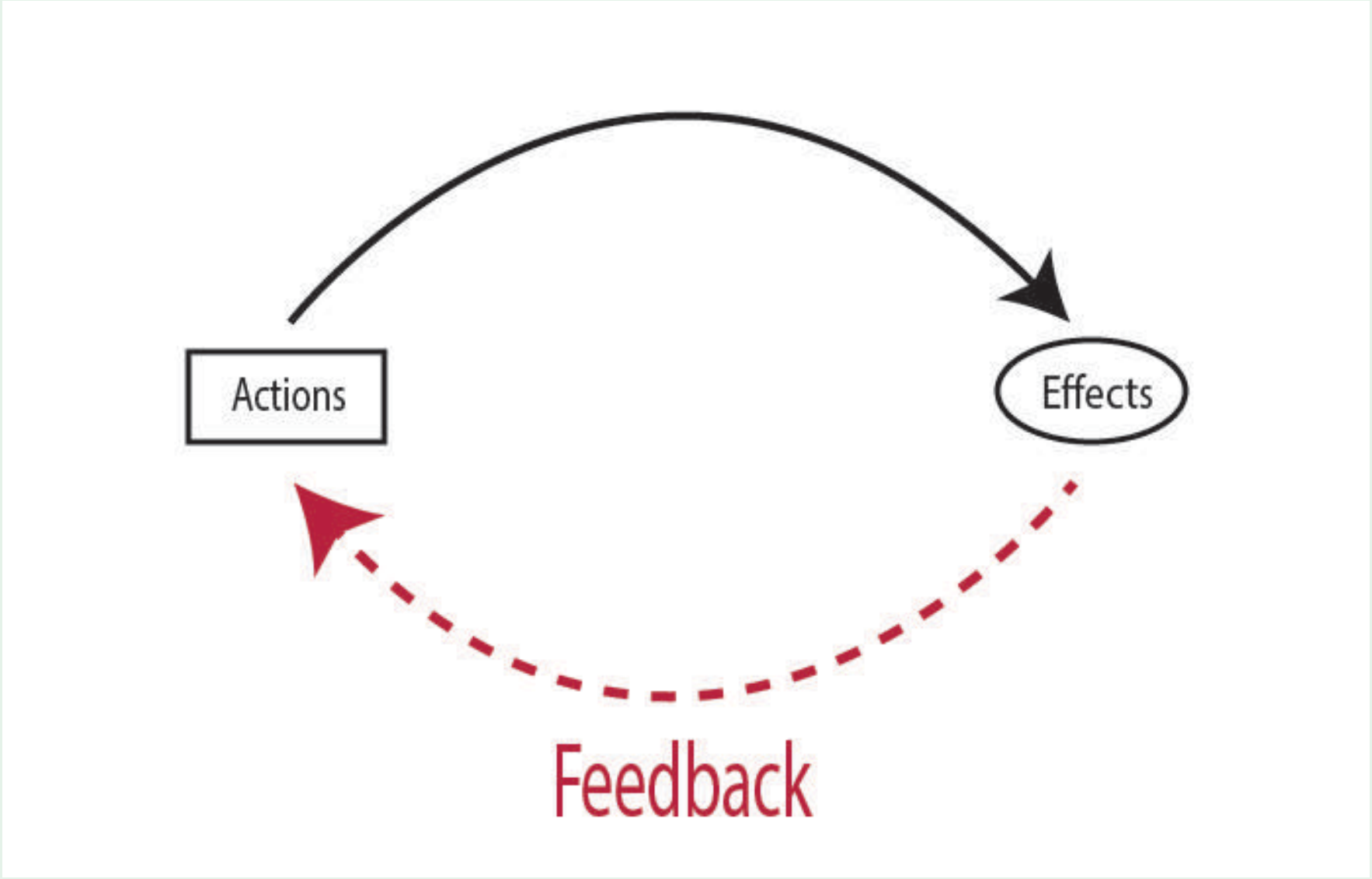
RECS Efficiency Ratings – All Homes		
Benchmark Rating	Single Family Average Site kBTU	Apartment / Condo Average Site kBTU
Greater than 75	61,155	25,694
Between 51 and 75	93,349	46,759
Between 25 and 50	117,844	65,156
Less than 25	165,071	84,888

Does it Work?

RECS Efficiency Ratings – 2 Occupants		
Benchmark Rating	Single Family Average Site kBTU	Apartment / Condo Average Site kBTU
Greater than 75	63,265	27,800
Between 51 and 75	90,833	46,929
Between 25 and 50	111,850	66,951
Less than 25	163,656	83,427

Milton Pilot

Image Credit: www.365thingssouthshore.com

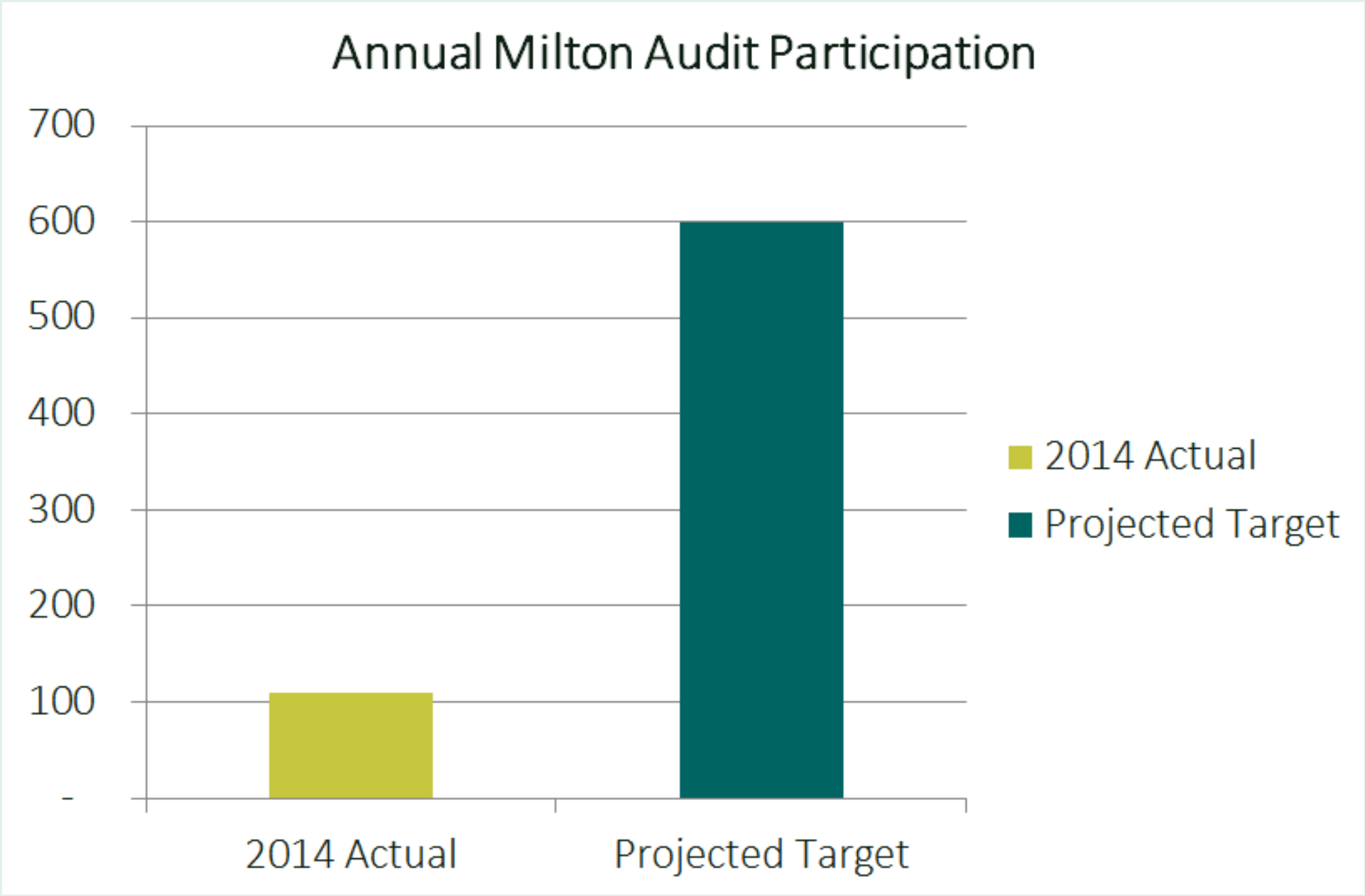

Actions
Effects
Feedback

Work With Homeowners:
Behavioral Changes

Work With Homeowners:
Structural Improvements


Verify!

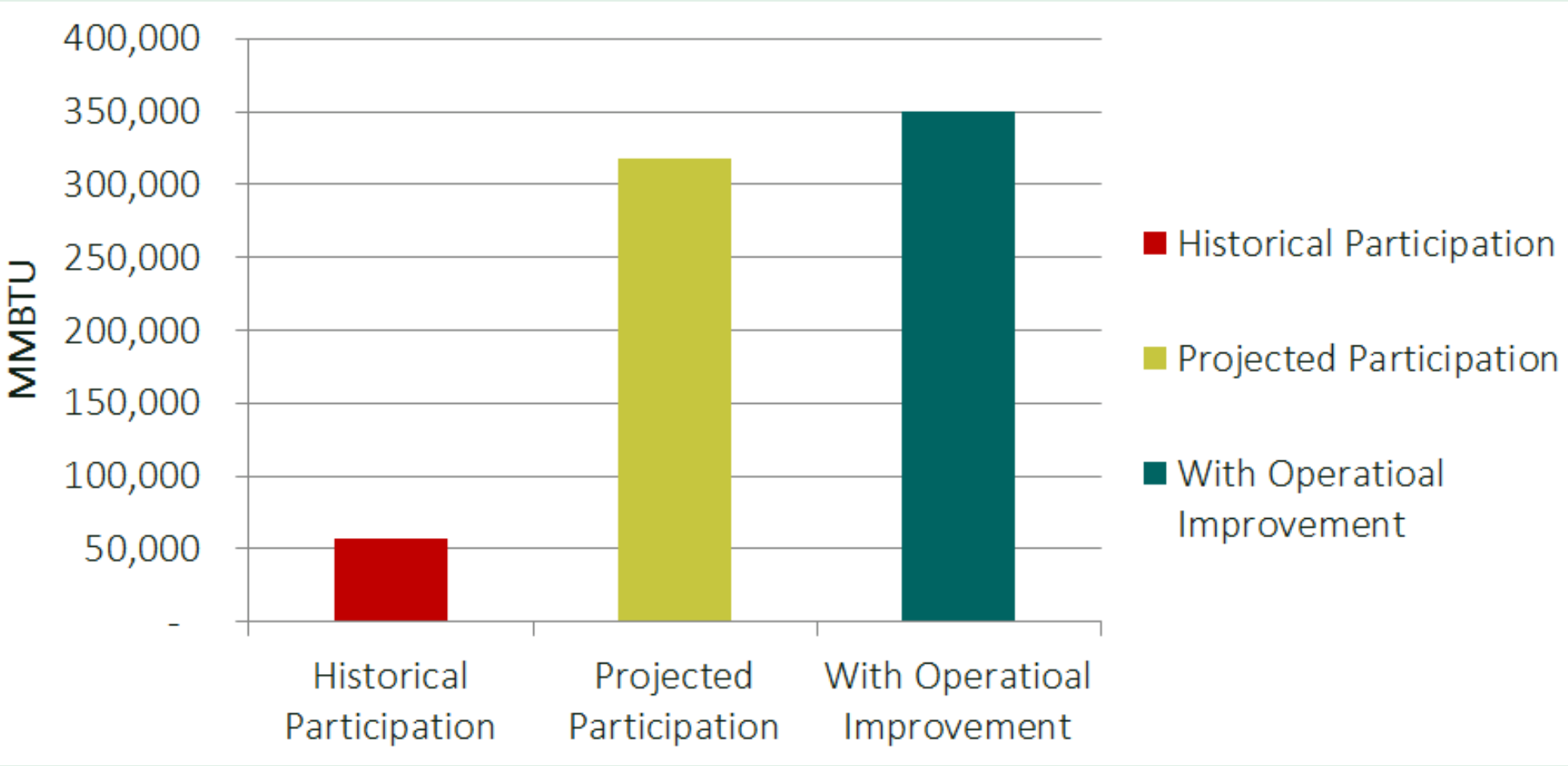
Improve Participation Rates



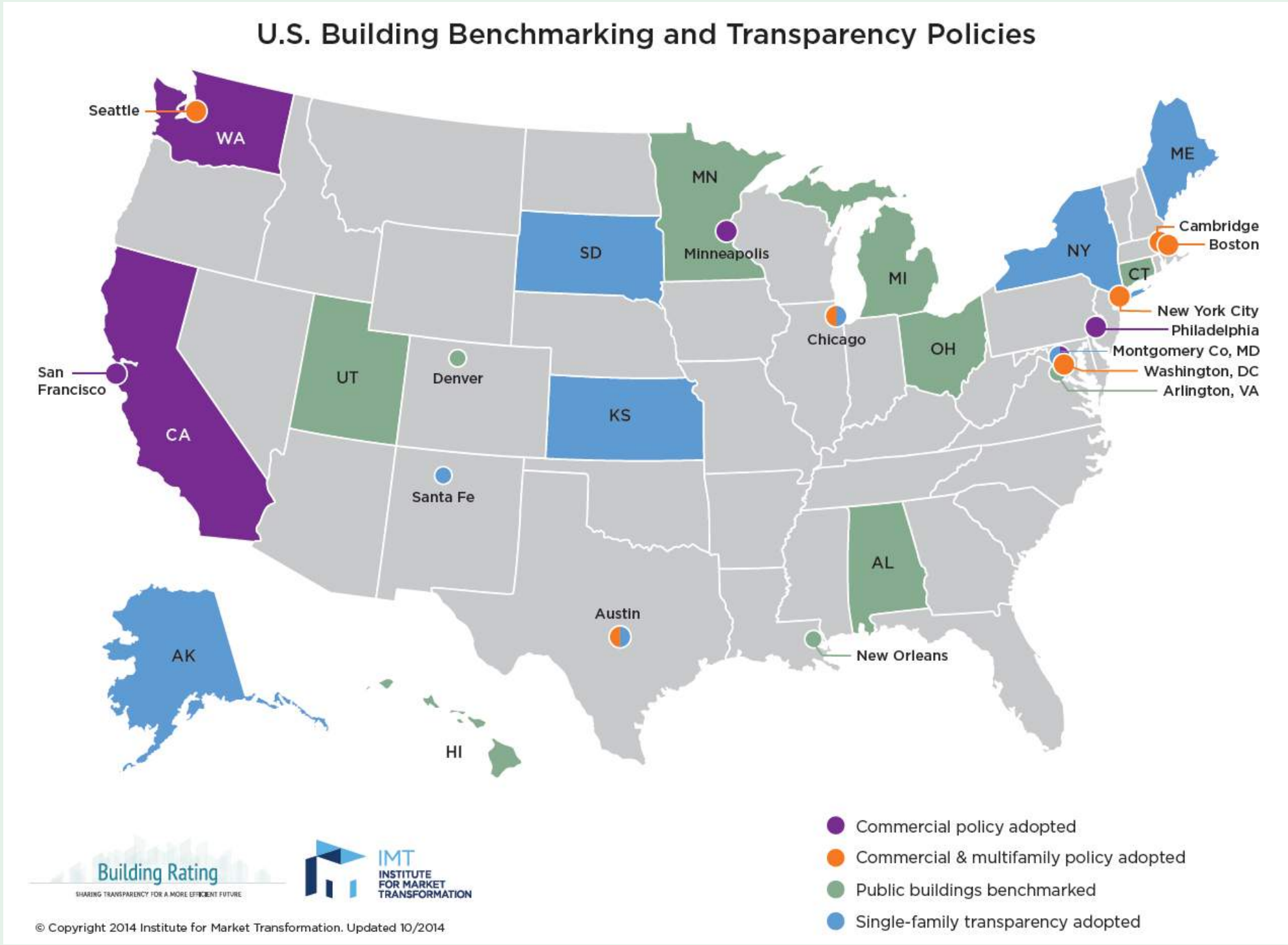
Operational Efficiency Improvement

2%

Milton 2020 Projected Energy Savings



How Else Can We Use Operational Ratings?


U.S. Building Benchmarking and Transparency Policies
Seattle
WA
MN
Minneapolis
SD
ME
Cambridge
Boston
NY
CT
MI
New York City
Philadelphia
Chicago
OH
Montgomery Co, MD
Washington, DC
Arlington, VA
San Francisco
CA
UT
Denver
KS
Santa Fe
AL
Austin
New Orleans
AK
HI
Commercial policy adopted
Commercial & multifamily policy adopted
Public buildings benchmarked
Single-family transparency adopted
Building Rating
SHARING TRANSPARENCY FOR A MORE EFFICIENT FUTURE
IMT
INSTITUTE FOR MARKET TRANSFORMATION
© Copyright 2014 Institute for Market Transformation. Updated 10/2014

Transactional Disclosure

Public Disclosure

Zillow Homes Rentals Mortgage Rates Advice Find a Pro Local Info Digs™

Location: City, State, or ZIP

Massachusetts

123 Main Road, Anywhere, MA, 00000

Sold on 10/24/12: $320,000

Zestimate®:$306,768

Est. Mortgage: $1,127/mo

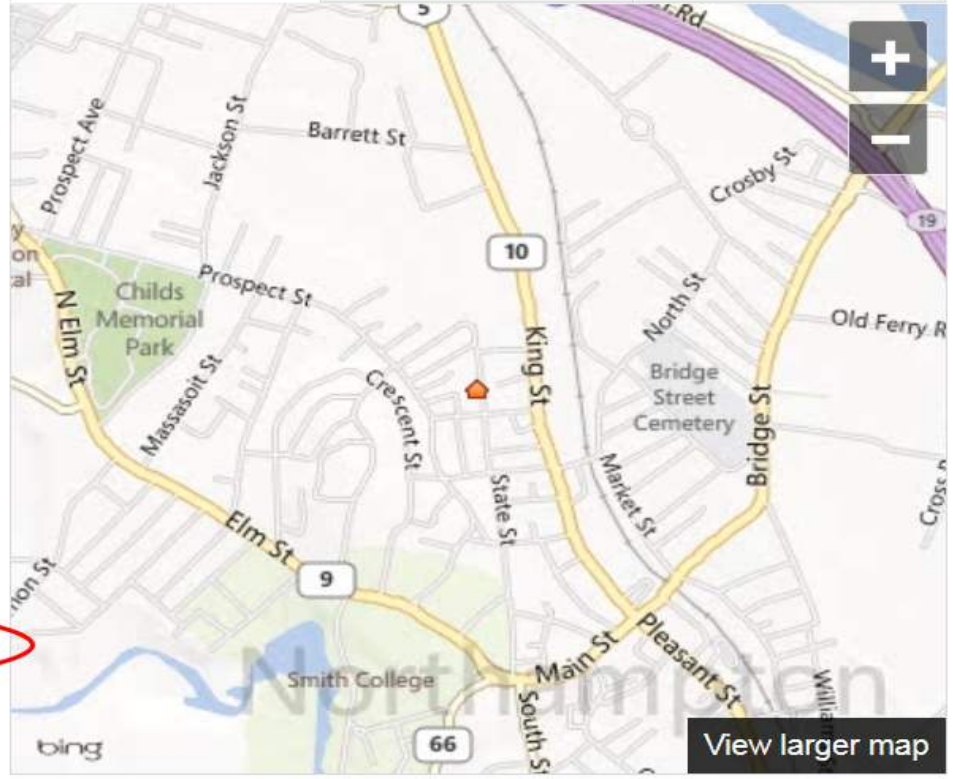
See current rates on Zillow

Guard your credit, $4.95 the first month.

Bedrooms:	3 beds
Bathrooms:	1.5 baths
Single Family:	1,338 sq ft
Lot:	3,049 sq ft
Year Built:	1900
Last Sold:	Oct 2012 for $320,000
Heating Type:	Contact for details

Energy Efficiency Rating™ 93 (Excellent)

Map | Bird's Eye | Street View

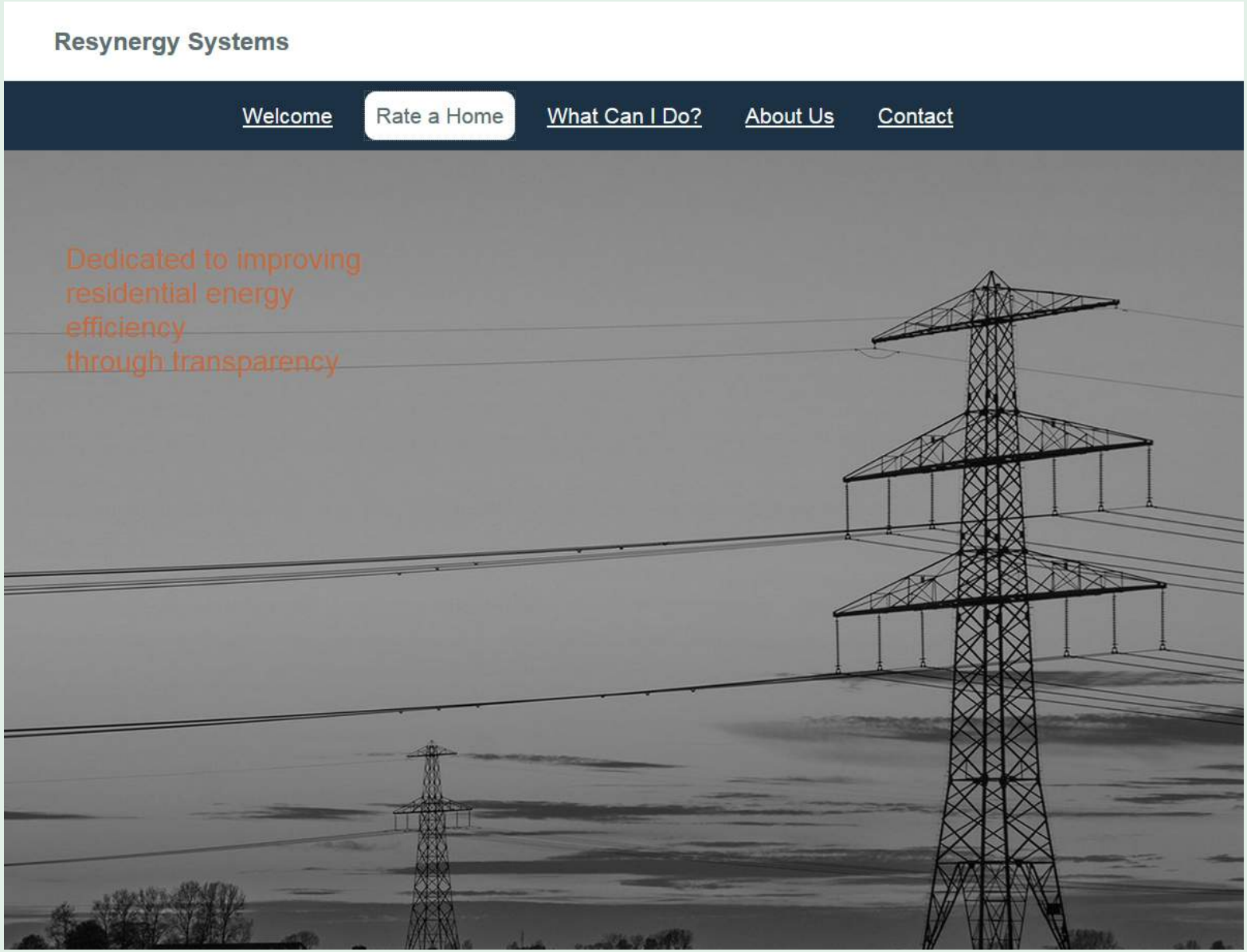


Correct home facts | Saved | Add note | Get updates | Email | more

Federal and State Tax Incentives

Want to Rate a Home?

Coming April 2015: www.resynergysystems.com



Part III

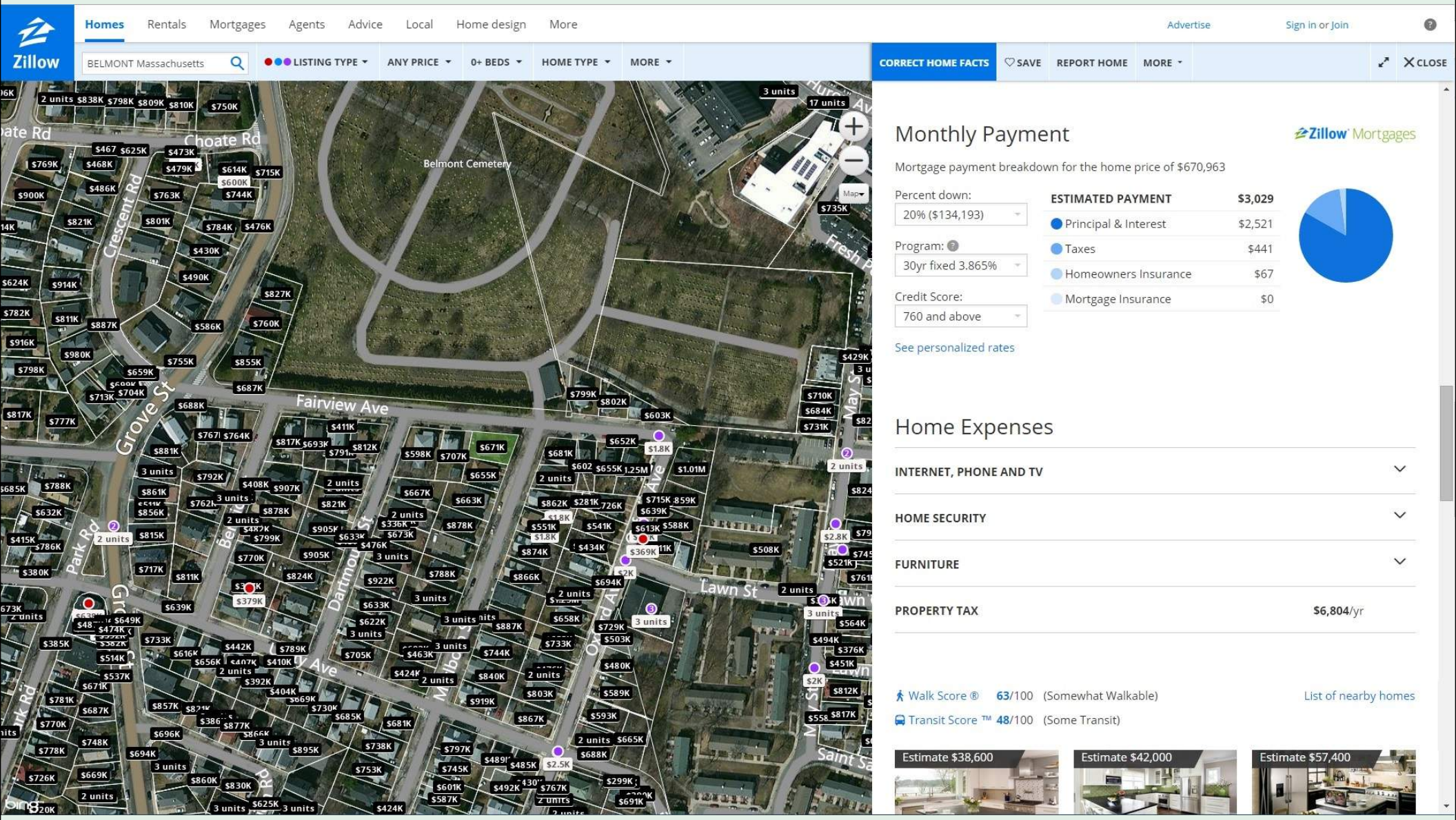
Introduction to “EnerScore” ™

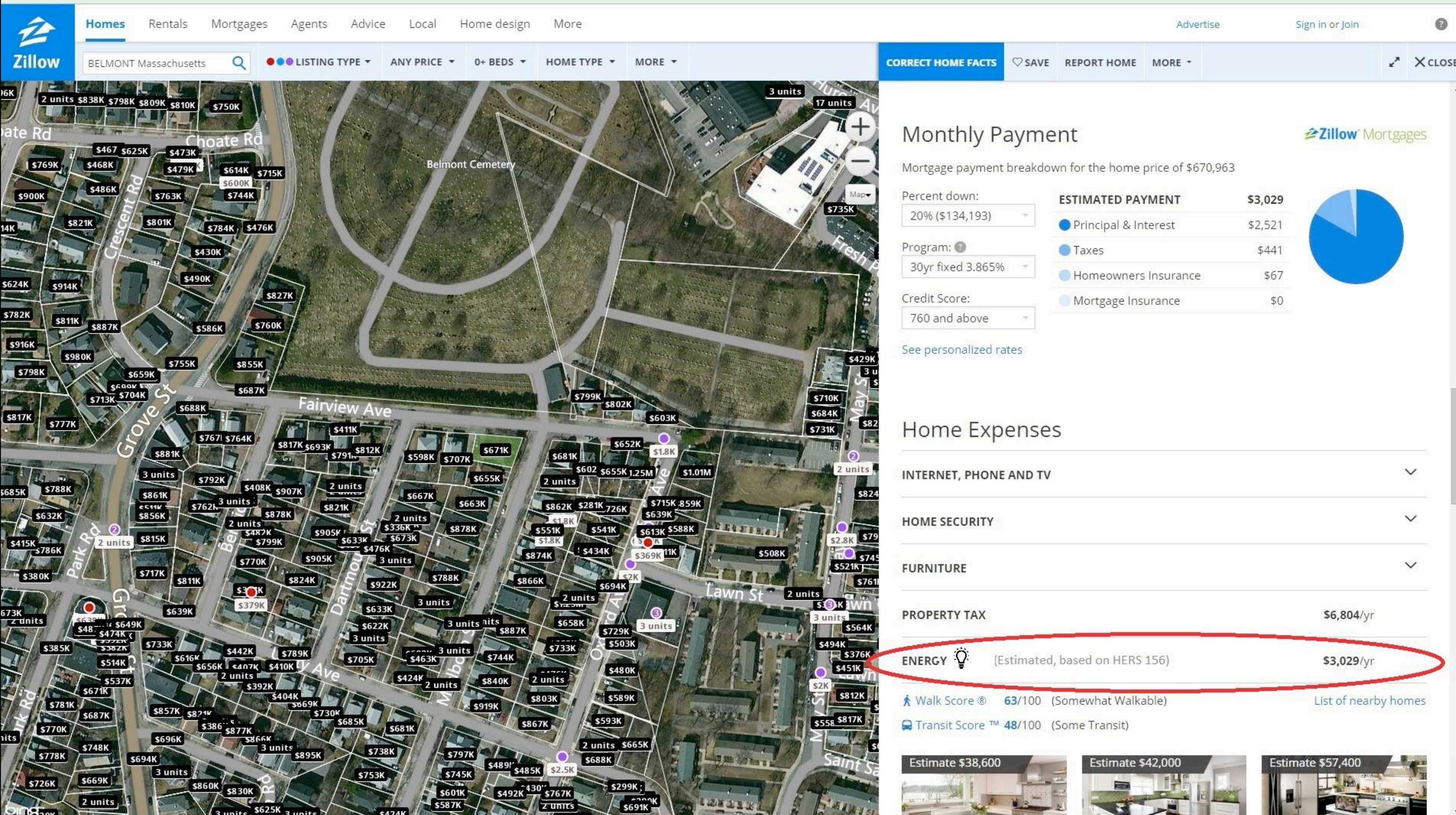
Brian Butler

EnerScore™

Energy Efficiency Ratings widget for:

- ✓Real Estate Listing Websites
- ✓Utility Energy Efficiency Program Managers
- ✓Community level Energy Efficiency Program Planners


Zillow
Homes
Rentals
Mortgages
Agents
Advice
Local
Home design
More
Advertise
Sign in or Join
BELMONT Massachusetts
LISTING TYPE
ANY PRICE
0+ BEDS
HOME TYPE
MORE
CORRECT HOME FACTS
SAVE
REPORT HOME
MORE
CLOSE
Belmont Cemetery
Choate Rd
Crescent Rd
Fairview Ave
Grove St
Lawn St
Park Rd
Dartmouth St
Oxford Ave
Monthly Payment
Zillow Mortgages
Mortgage payment breakdown for the home price of $670,963
Percent down:
20% ($134,193)
Program:
30yr fixed 3.865%
Credit Score:
760 and above
See personalized rates
ESTIMATED PAYMENT $3,029
Principal & Interest $2,521
Taxes $441
Homeowners Insurance $67
Mortgage Insurance $0
Home Expenses
INTERNET, PHONE AND TV
HOME SECURITY
FURNITURE
PROPERTY TAX $6,804/yr
Walk Score ® 63/100 (Somewhat Walkable)
Transit Score ™ 48/100 (Some Transit)
List of nearby homes
Estimate $38,600
Estimate $42,000
Estimate $57,400


Zillow
Homes
Rentals
Mortgages
Agents
Advice
Local
Home design
More
Advertise
Sign in or Join
BELMONT Massachusetts
LISTING TYPE
ANY PRICE
0+ BEDS
HOME TYPE
MORE
CORRECT HOME FACTS
SAVE
REPORT HOME
MORE
CLOSE
Belmont Cemetery
Fairview Ave
Grove St
Crescent Rd
Choate Rd
Lawn St
Monthly Payment
Zillow Mortgages
Mortgage payment breakdown for the home price of $670,963
Percent down:
20% ($134,193)
Program:
30yr fixed 3.865%
Credit Score:
760 and above
See personalized rates
ESTIMATED PAYMENT $3,029
Principal & Interest $2,521
Taxes $441
Homeowners Insurance $67
Mortgage Insurance $0
Home Expenses
INTERNET, PHONE AND TV
HOME SECURITY
FURNITURE
PROPERTY TAX $6,804/yr
ENERGY (Estimated, based on HERS 156) $3,029/yr
Walk Score ® 63/100 (Somewhat Walkable)
List of nearby homes
Transit Score ™ 48/100 (Some Transit)
Estimate $38,600
Estimate $42,000
Estimate $57,400

195 Grove St
Cambridge, MA 02138
Status: Active

$1,975,000	5	4.5	5,849 Sq. Ft.
Price	Beds	Baths	$338 / Sq. Ft.

Built: 1960 **Lot Size:** 0.46 Acres **Cumulative:** 31 days **On Redfin:** 31 days

Favorite X-Out Share... Tour Home

Overview | Property Details | Tour Insights | Property History | Public Records | Activity | Schools | Neighborhood & Offer Insights | Similar Homes

Terry McCarthy, Coldwell Banker Residential Brokerage - Belmont MLS PIN

Redfin last checked: 8 minutes ago | **Last updated:** 3 weeks ago Redfin has the best data. Why?

Nearby Similar Homes

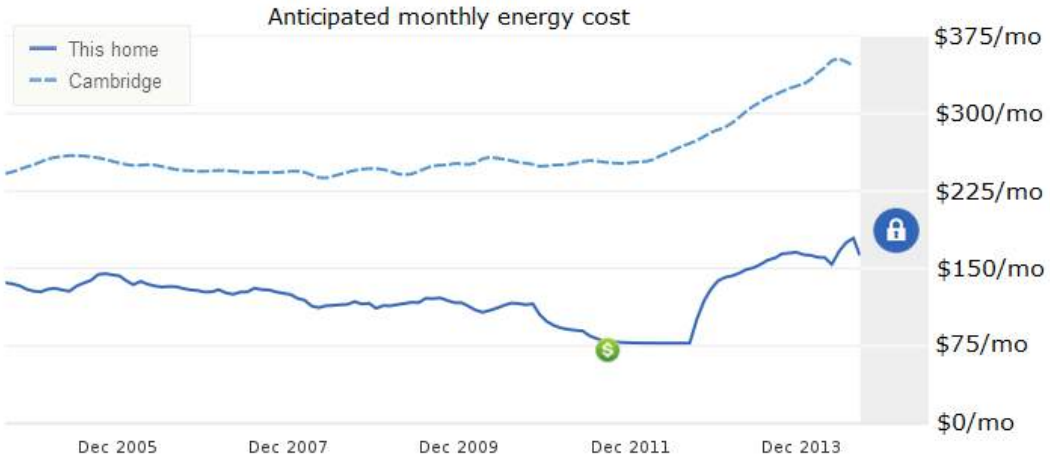
Map These Listings

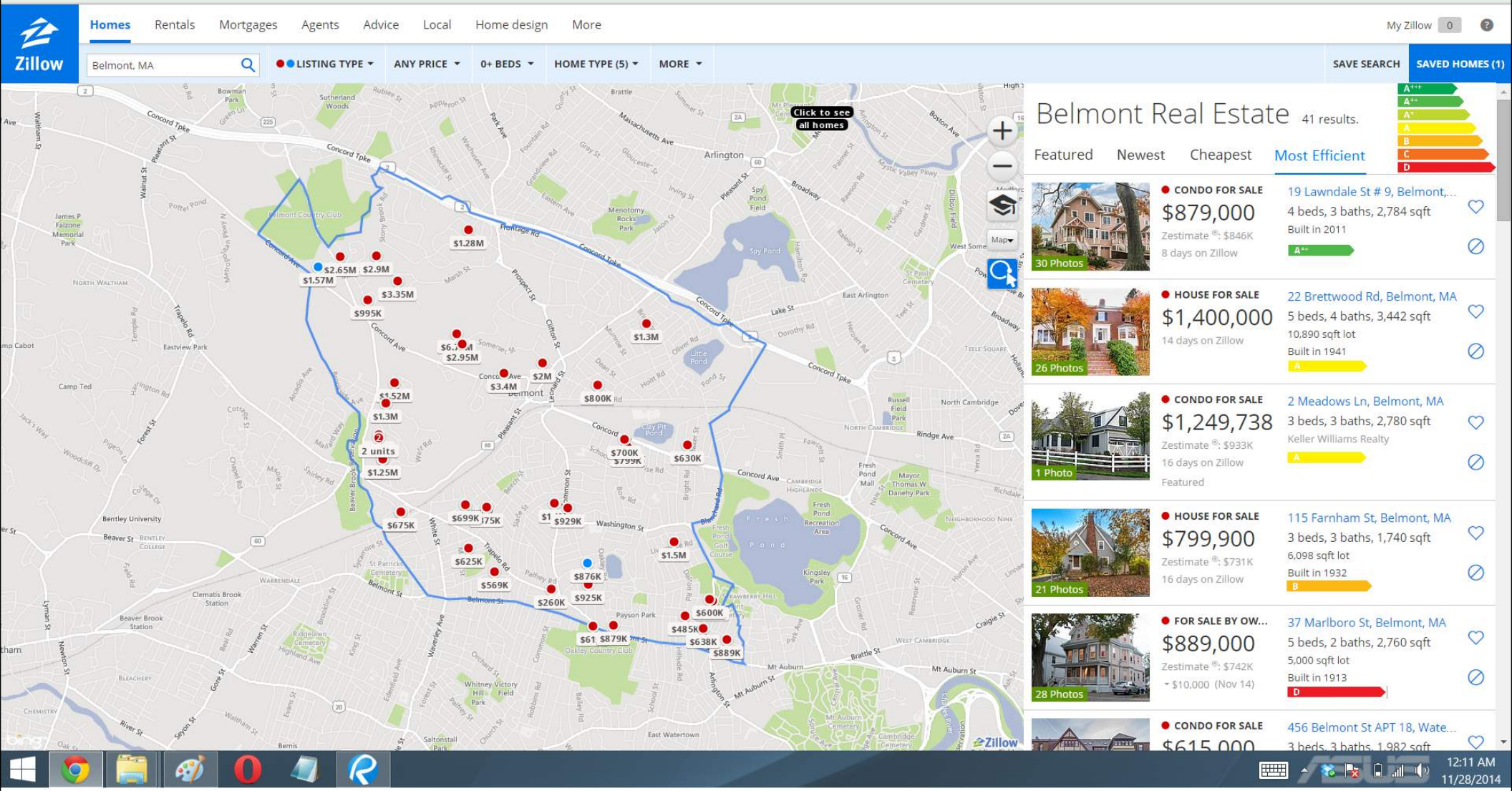
185 Dalton Rd Belmont, MA 02478	61 Grozier Rd Cambridge, MA 02138	22 Fayerweather St Cambridge, MA 02138	74 Russell Ave Watertown, MA 02472	529 Concord Ave Belmont, MA 02478
				
$1,695,000 · 0.21 mi	$2,400,000 · 0.92 mi	$3,575,000 · 1.15 mi	$995,000 · 1.25 mi	$2,595,000 · 1.39 mi
4 Beds · 2.5 Baths · 4,040 Sq. Ft.	5 Beds · 4.5 Baths · 4,455 Sq. Ft.	6 Beds · 3.5 Baths · 4,707 Sq. Ft.	7 Beds · 3.5 Baths · 4,515 Sq. Ft.	5 Beds · 4.5 Baths · 5,664 Sq. Ft.

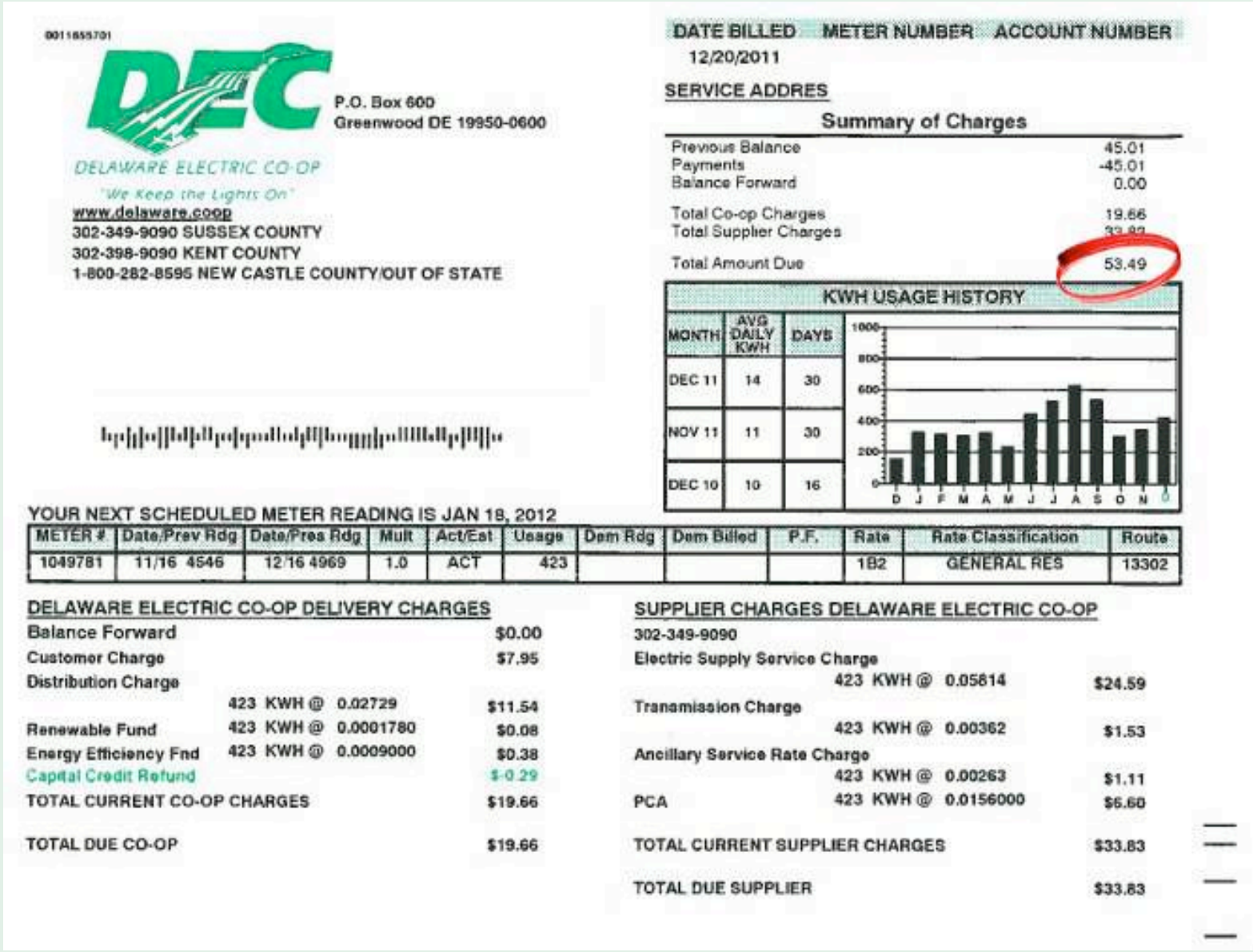
Energy Information

This home's energy rating:

What does this mean?




Zillow
Homes
Rentals
Mortgages
Agents
Advice
Local
Home design
More
My Zillow 0
Belmont, MA
LISTING TYPE
ANY PRICE
0+ BEDS
HOME TYPE (5)
MORE
SAVE SEARCH
SAVED HOMES (1)
Click to see all homes
Belmont Real Estate 41 results.
Featured
Newest
Cheapest
Most Efficient
CONDO FOR SALE
$879,000
Zestimate®: $846K
8 days on Zillow
30 Photos
19 Lawndale St # 9, Belmont,...
4 beds, 3 baths, 2,784 sqft
Built in 2011
HOUSE FOR SALE
$1,400,000
14 days on Zillow
26 Photos
22 Brettwood Rd, Belmont, MA
5 beds, 4 baths, 3,442 sqft
10,890 sqft lot
Built in 1941
CONDO FOR SALE
$1,249,738
Zestimate®: $933K
16 days on Zillow
Featured
1 Photo
2 Meadows Ln, Belmont, MA
3 beds, 3 baths, 2,780 sqft
Keller Williams Realty
HOUSE FOR SALE
$799,900
Zestimate®: $731K
16 days on Zillow
21 Photos
115 Farnham St, Belmont, MA
3 beds, 3 baths, 1,740 sqft
6,098 sqft lot
Built in 1932
FOR SALE BY OW...
$889,000
Zestimate®: $742K
▾ $10,000 (Nov 14)
28 Photos
37 Marlboro St, Belmont, MA
5 beds, 2 baths, 2,760 sqft
5,000 sqft lot
Built in 1913
CONDO FOR SALE
456 Belmont St APT 18, Wate...
12:11 AM
11/28/2014



0011655701

DELAWARE ELECTRIC CO-OP
"We Keep the Lights On"

P.O. Box 600
Greenwood DE 19950-0600

www.delaware.coop
302-349-9090 SUSSEX COUNTY
302-398-9090 KENT COUNTY
1-800-282-8595 NEW CASTLE COUNTY/OUT OF STATE

DATE BILLED METER NUMBER ACCOUNT NUMBER
12/20/2011

SERVICE ADDRES

Summary of Charges

Previous Balance	45.01
Payments	-45.01
Balance Forward	0.00
Total Co-op Charges	19.66
Total Supplier Charges	33.83
Total Amount Due	53.49

KWH USAGE HISTORY

MONTH	AVG DAILY KWH	DAYS
DEC 11	14	30
NOV 11	11	30
DEC 10	10	16

1000 800 600 400 200 0
D J F M A M J J A S O N D

YOUR NEXT SCHEDULED METER READING IS JAN 18, 2012

METER #	Date/Prev Rdg	Date/Pres Rdg	Mult	Act/Est	Usage	Dem Rdg	Dem Billed	P.F.	Rate	Rate Classification	Route
1049781	11/16 4546	12/16 4969	1.0	ACT	423				1B2	GENERAL RES	13302

DELAWARE ELECTRIC CO-OP DELIVERY CHARGES

Balance Forward			$0.00
Customer Charge			$7.95
Distribution Charge			
	423 KWH @	0.02729	$11.54
Renewable Fund	423 KWH @	0.0001780	$0.08
Energy Efficiency Fnd	423 KWH @	0.0009000	$0.38
Capital Credit Refund			$-0.29
TOTAL CURRENT CO-OP CHARGES			$19.66
TOTAL DUE CO-OP			$19.66

SUPPLIER CHARGES DELAWARE ELECTRIC CO-OP

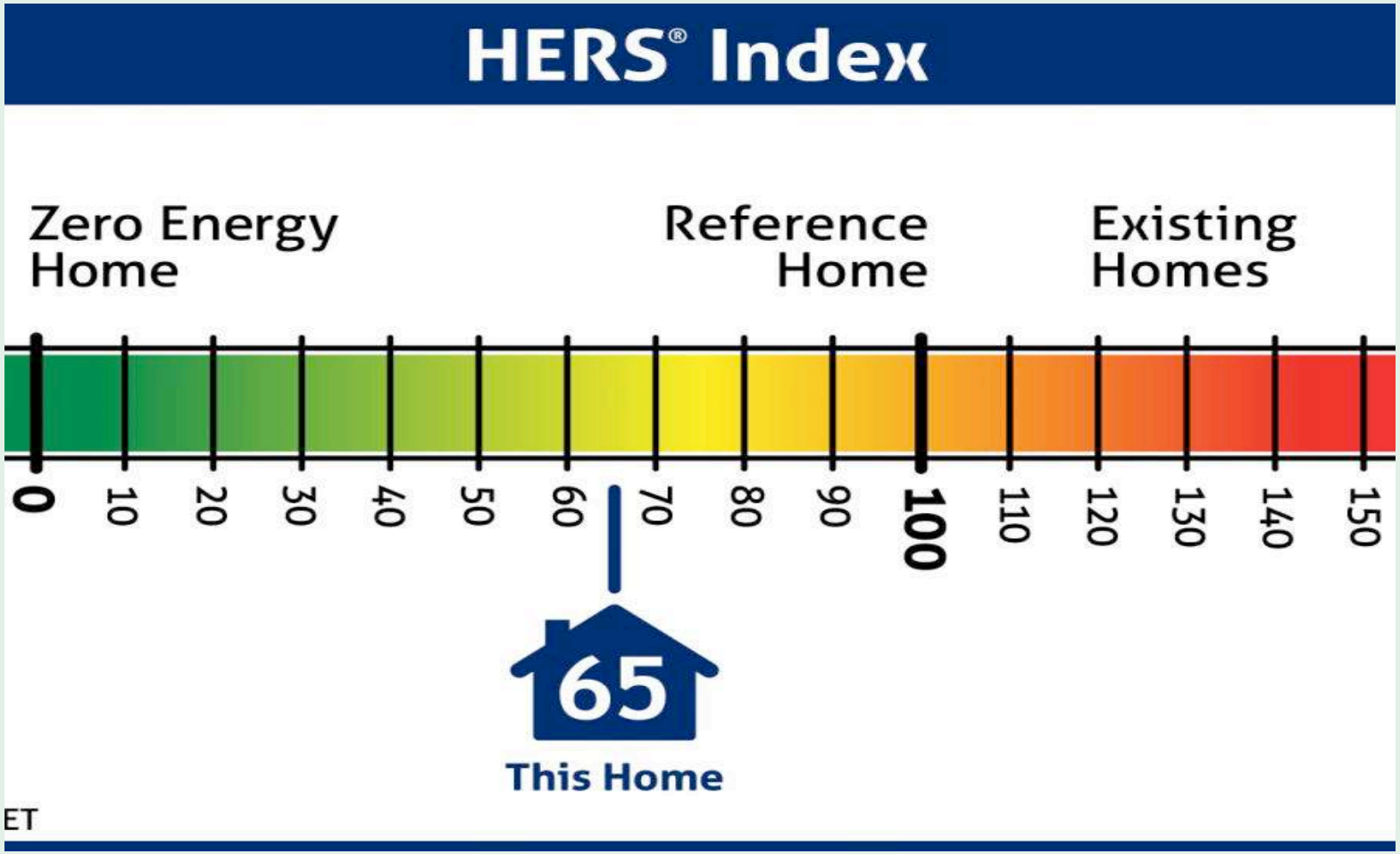
302-349-9090

Electric Supply Service Charge			
	423 KWH @	0.05814	$24.59
Transmission Charge			
	423 KWH @	0.00362	$1.53
Ancillary Service Rate Charge			
	423 KWH @	0.00263	$1.11
PCA	423 KWH @	0.0156000	$6.60
TOTAL CURRENT SUPPLIER CHARGES			$33.83
TOTAL DUE SUPPLIER			$33.83

Energy Bills show usage…
But usage is tied to occupancy

MPG analogy


76
Snack Shop



MOST ESTABLISHED STANDARD

For: EPA, IECC (for 2015), many cities and states, Mortgage industry, LEED for Homes

INPUTS:

- Walls (R value)
- Roof (R value)
- Framed floors (R value)
- Foundation (R value)
- Slab (R value)
- Rim joist (R value)
- Windows (U-value)
- Doors (U-value)
- Skylights (U-value)
- Overall envelope (total CFM50 air leakage reduction scheme as a "component")
- Mechanical ventilation (CFM ventilation rate)
- Lighting (kwh)
- Solar PV (kwh)
- Other renewables (kwh / BTU)
- Space heating system (BTU)
- Water heating system (BTU)
- Cooling system (SEER, tonnage)

BUILD FAX®
PROPERTY HISTORY

Registry of Deeds

William Francis Galvin, Secretary of the Commonwealth

CoreLogic®

RESNET®
RESIDENTIAL ENERGY SERVICES NETWORK

Triple Deck

Bungalow

Dutch Col

1909

- Triple

Deck

- 2nd fl
- 1100sf
- HW oil
- EYB 2006

1897

- Triple

Deck

- 1st fl
- 1100sf
- FHA NG
- EYB 1897

1903

- Triple

Deck

- 3rd fl
- 1200sf
- HW NG
- EYB 1982

Windows

- Single pane: u-0.60 average

Walls

- R5 Average

Roof

- R13 Average

ACH

- 7 ACH infiltration avg.

Foundation

- R1 Average

Floor slab

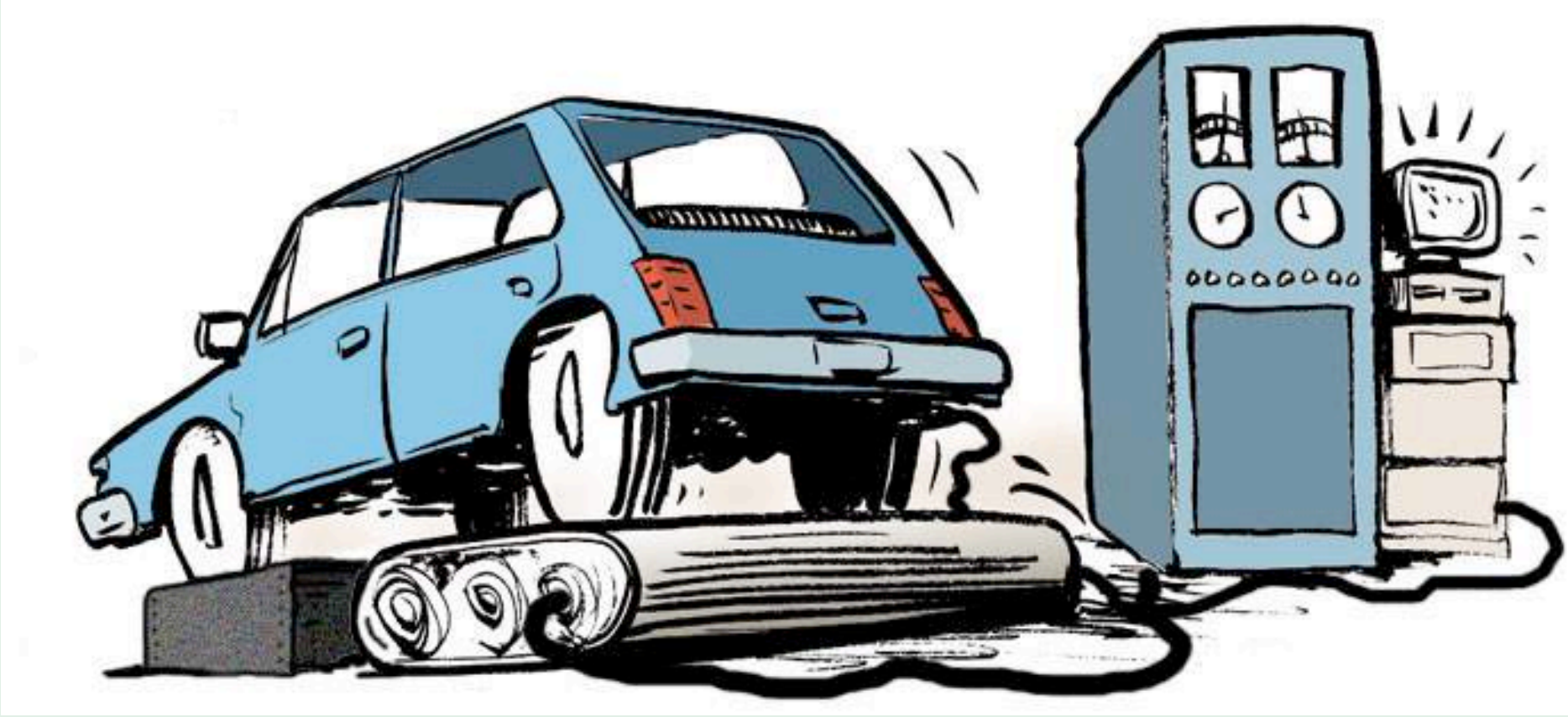
- R1 Average

MPG...?


AMC


Coffee
to go...

Controlled laboratory conditions = normalized ratings



1909

- Triple Deck

1897

- Triple Deck

1903

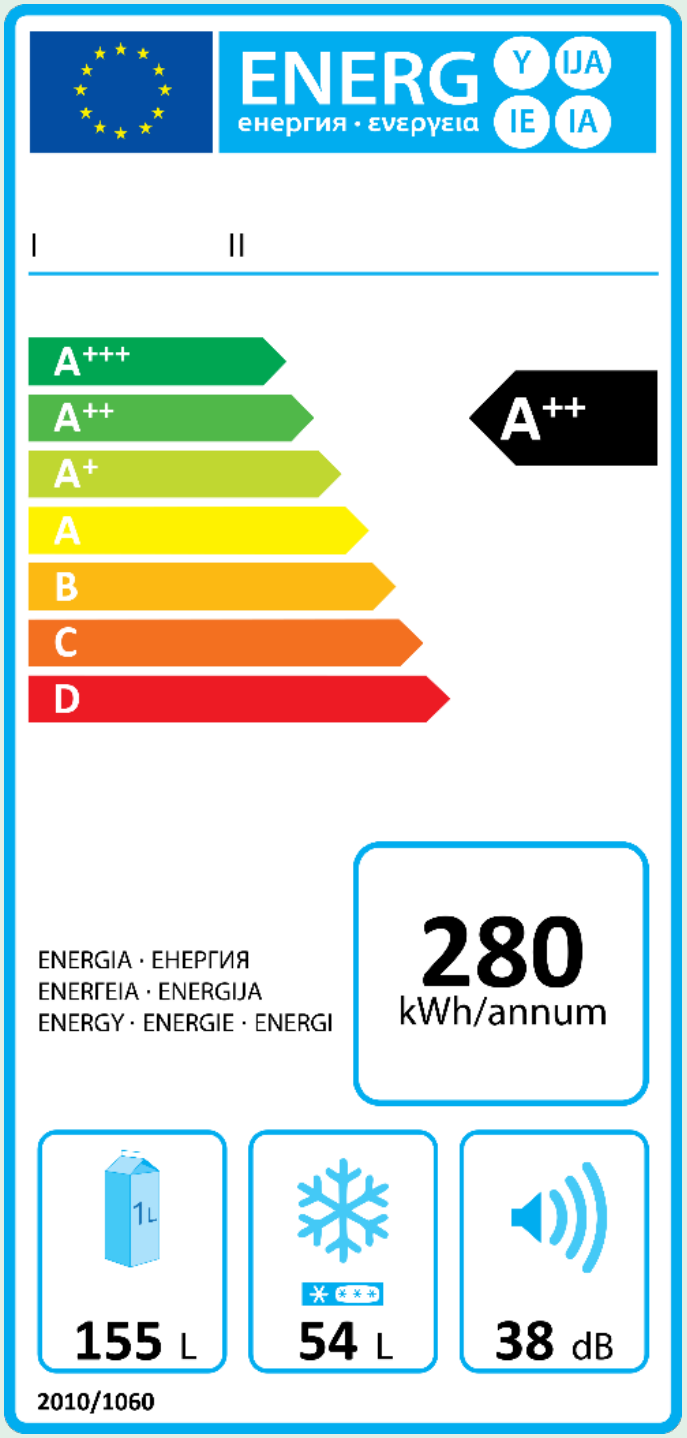
- Triple Deck

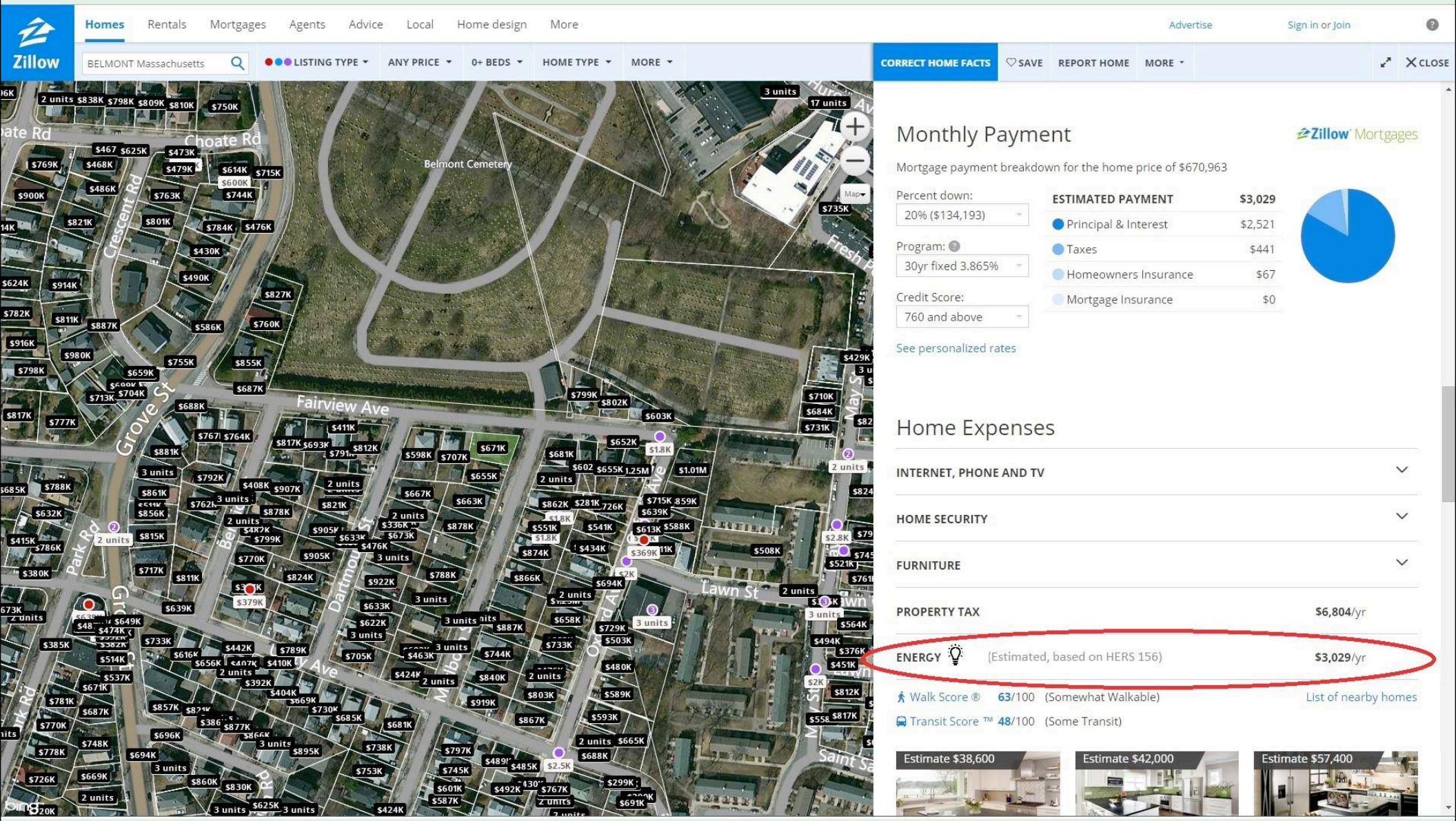
HERS 106

HERS 124

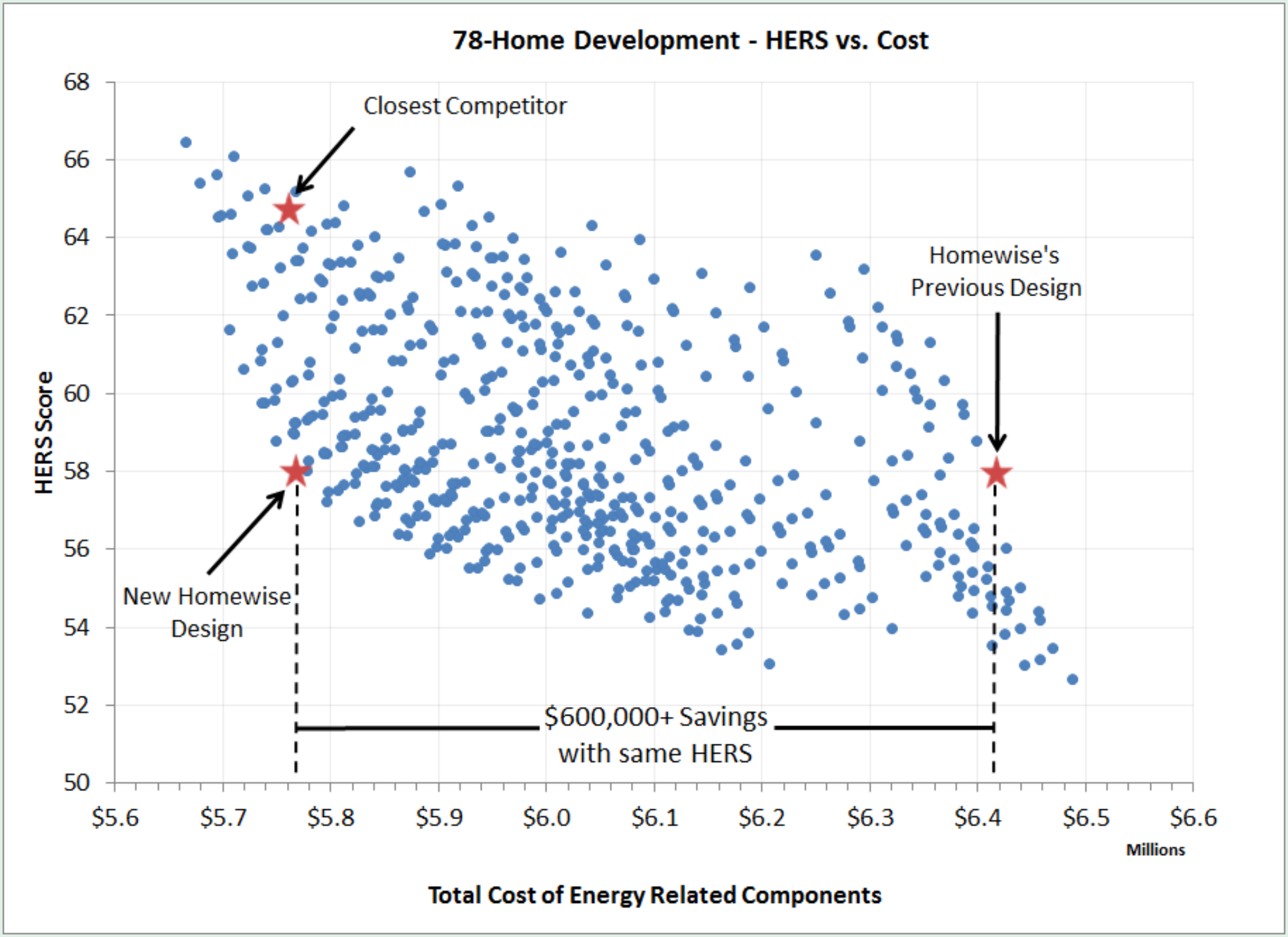
HERS 155

Europe's Standardized Ratings:




Zillow
Homes
Rentals
Mortgages
Agents
Advice
Local
Home design
More
Advertise
Sign in or Join
BELMONT Massachusetts
LISTING TYPE
ANY PRICE
0+ BEDS
HOME TYPE
MORE
CORRECT HOME FACTS
SAVE
REPORT HOME
MORE
CLOSE
Belmont Cemetery
Choate Rd
Crescent Rd
Grove St
Fairview Ave
Dartmouth St
Lawn St
Park Rd
Monthly Payment
Zillow Mortgages
Mortgage payment breakdown for the home price of $670,963
Percent down:
20% ($134,193)
Program:
30yr fixed 3.865%
Credit Score:
760 and above
See personalized rates
ESTIMATED PAYMENT $3,029
Principal & Interest $2,521
Taxes $441
Homeowners Insurance $67
Mortgage Insurance $0
Home Expenses
INTERNET, PHONE AND TV
HOME SECURITY
FURNITURE
PROPERTY TAX $6,804/yr
ENERGY (Estimated, based on HERS 156) $3,029/yr
Walk Score ® 63/100 (Somewhat Walkable)
Transit Score ™ 48/100 (Some Transit)
List of nearby homes
Estimate $38,600
Estimate $42,000
Estimate $57,400


ekotrope
Design decisions that drive business.


78-Home Development - HERS vs. Cost
HERS Score
68
66
64
62
60
58
56
54
52
50
Closest Competitor
Homewise's
Previous Design
New Homewise
Design
$600,000+ Savings
with same HERS
$5.6
$5.7
$5.8
$5.9
$6.0
$6.1
$6.2
$6.3
$6.4
$6.5
$6.6
Millions
Total Cost of Energy Related Components

COST / BENEFIT ANALYSIS

- Utility Energy Efficiency Programs require cost/benefit be proven
- Few such analyses of existing home populations exist.

Two ways to account for EE Program performance:

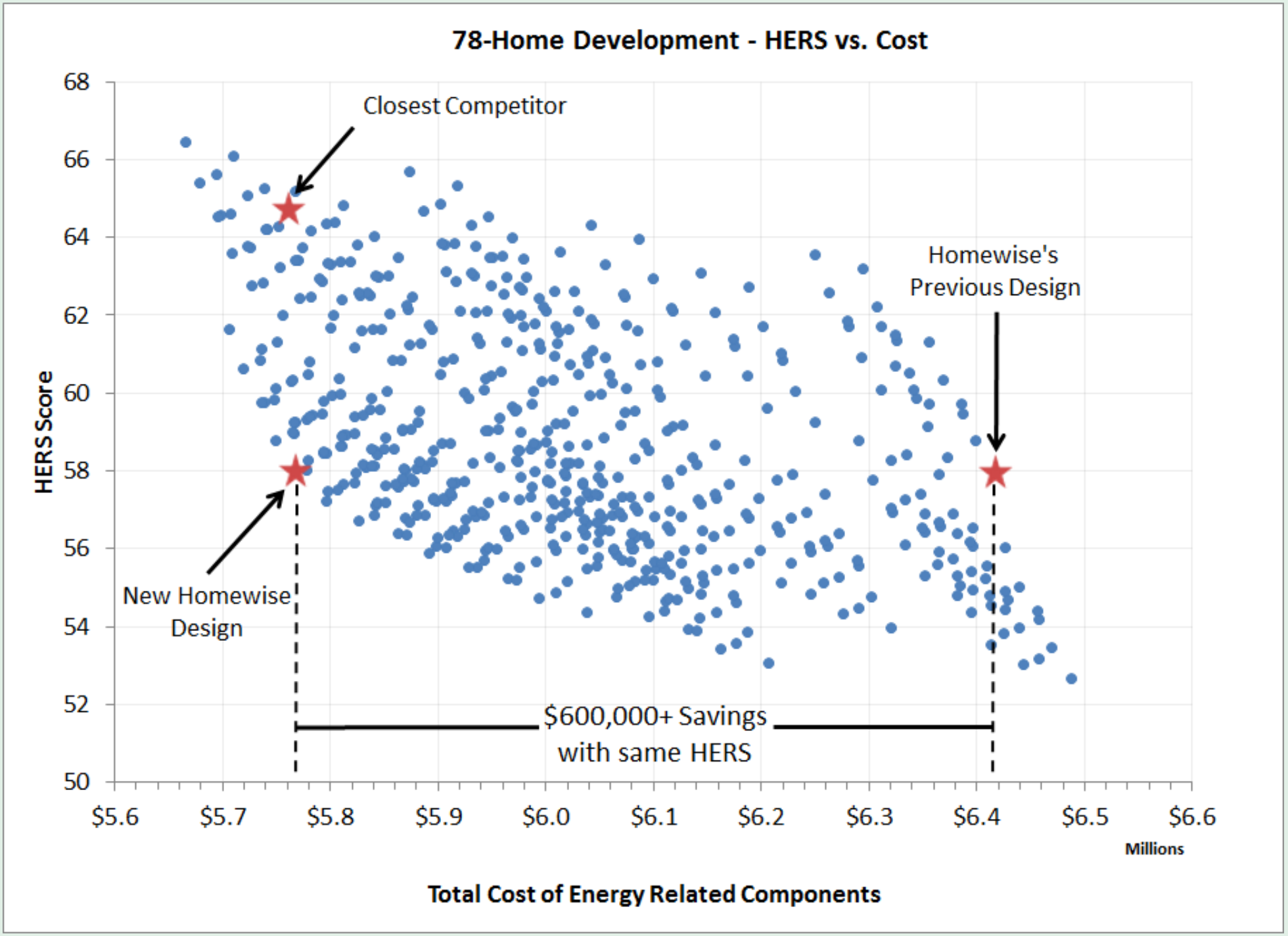
(1) count participation in programs, and

(2) measure ***performance improvement*** per participant

MA EE Program data are based on **participation rates.**

* What kind of Energy Efficiency Programs do we want…?

http://www.byggmeister.com/our-world/blog/whats-missing-mass-save


78-Home Development - HERS vs. Cost
HERS Score
68
66
64
62
60
58
56
54
52
50
Closest Competitor
Homewise's
Previous Design
New Homewise
Design
$600,000+ Savings
with same HERS
$5.6
$5.7
$5.8
$5.9
$6.0
$6.1
$6.2
$6.3
$6.4
$6.5
$6.6
Millions
Total Cost of Energy Related Components

www.EnerScore.com

Thank You

This concludes The American Institute of Architects
Continuing Education Systems Course