

Residential Stretch Code

Massachusetts Energy Code Technical Support Program

Who Is Mass Save®?

- Mass Save® is an initiative sponsored by Massachusetts' gas and electric utilities and energy efficiency service providers, including
 - The Berkshire Gas Company
 - Blackstone Gas Company
 - Cape Light Compact
 - Columbia Gas of Massachusetts
 - Eversource Energy
 - Liberty Utilities
 - National Grid
 - Unitil

- The Sponsors of Mass Save work closely with the Massachusetts Department of Energy Resources to provide a wide range of services, incentives, trainings, and information promoting energy efficiency that help residents and businesses manage energy use and related costs.



Presented by:
Performance Systems Development

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Residential Stretch Code

Massachusetts Energy Code Technical
Support Program



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Agenda



- Green Communities Act
- Massachusetts Stretch Code Purpose
- Changes to Stretch Code
- Pathways to Compliance
- Stretch Code and Existing Building

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Green Communities Act of 2009

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Green Communities Act



- Passed by the MA Legislature and signed into law in 2009
- Requires the Program Administrators to submit EE plans every 3 years – must be approved by the Dept. of Public Utilities
- Requires adoption of the International Energy Conservation Code and subsequent updating to the latest version within 1 year of its publication
- Created the Energy Efficiency Advisory Council of DOER
- Created the Green Communities Program
 - Provides \$10 million per year statewide in technical and financial help to municipalities to promote energy efficiency and the financing, siting and construction of renewable and alternative energy facilities.
 - Municipalities must adopt the Stretch Energy Code and meet a variety of other energy efficiency policies.

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STRETCH CODE: PURPOSE

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Stretch Code Purpose

What do the MA amendments say?

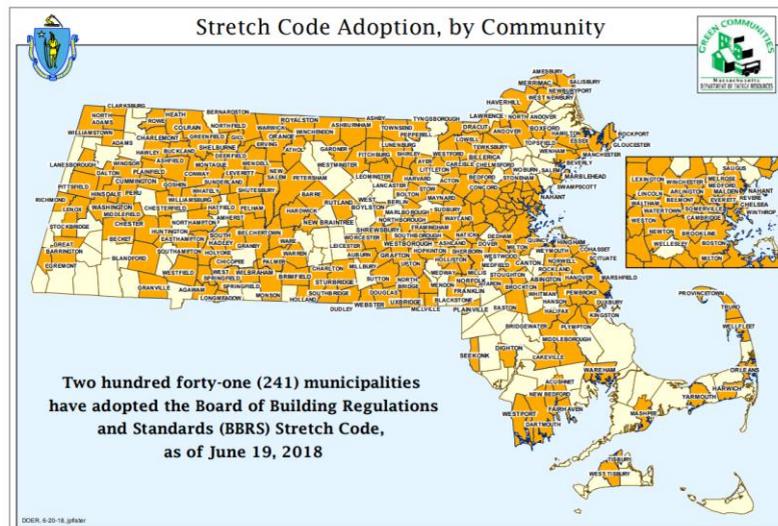


MA Amendment Appendix AA

- **Purpose and Adoption (AA101)**
 - The purpose of the stretch energy code is to provide a more energy efficient code alternative for new buildings. The stretch energy code maybe adopted or rescinded by any municipality in the commonwealth in the manner prescribed by law.
- **Applicability (AA102)**
 - Municipalities that have adopted the stretch energy code shall use the energy efficiency requirements of this appendix as provided below. These requirements replace all previous stretch energy code requirements.
- **R-use Buildings (AA103.1)**
 - In all R-use buildings, of four stories or less above grade plane with one or more dwelling units, each dwelling unit shall comply with section R406

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Stretch Code Communities



<https://www.mass.gov/files/documents/2018/08/15/stretch-code-towns-adoption-by-community-map-and-list.pdf>

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Stretch Code Communities

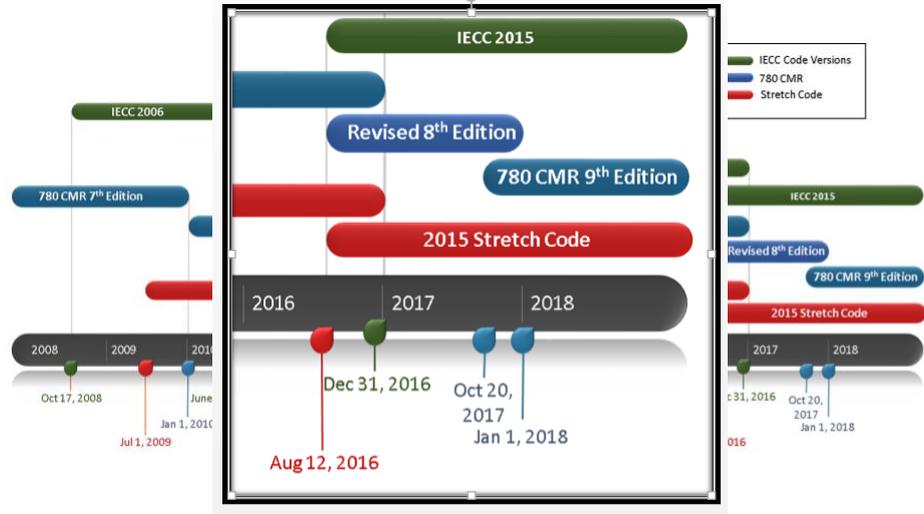
Municipality	Effective Date	Municipality	Effective Date	Municipality	Effective Date	Municipality	Effective Date
Abington	7/1/2012	Essex	1/1/2015	Milton	7/1/2011	Tisbury	1/1/2012
Acton	1/1/2011	Fitchburg	1/1/2017	Monson	1/1/2012	Topfield	1/1/2012
Acushnet	1/1/2015	Franklin	1/1/2018	Montausse	1/1/2011	Townsend	7/1/2012
Adams	1/1/2016	Ware	7/1/2015	Natick	1/1/2011	Truro	1/1/2012
Agawam	1/1/2017	Framingham	1/1/2014	New Bedford	7/1/2017	Tyngsborough	1/1/2011
Amesbury	1/1/2014	Gardner	7/1/2011	New Braintree	1/1/2016	Upton	1/1/2015
Amherst	1/1/2012	Gill	1/1/2011	New Salem	7/1/2011	Walham	7/1/2012
Andover	1/1/2011	Glocester	7/1/2011	Newburyport	7/1/2011	Ware	1/1/2017
Arlington	7/1/2011	Goshen	7/1/2015	Norwell	1/1/2016	Warren	1/1/2017
Ashburnham	7/1/2014	Grafton	7/1/2017	Newton	7/1/2010	Warwick	7/1/15
Ashby	1/1/2014	Granby	1/1/2012	North Adams	7/1/2011	Waketown	7/1/2011
Ashfield	7/1/2012	Granville	1/1/2017	North Andover	1/1/2017	Wayland	7/1/2011
Ashland	1/1/2013	Great Barrington	1/1/2012	Northampton	1/1/2011	Webster	1/1/2018
Athol	1/1/2011	Greenfield	1/1/2011	Northborough	7/1/2017	Wellesley	1/1/2012
Auburn	7/1/2013	Halifax	1/1/2015	Northbridge	1/1/2017	Wellesley	1/1/2012
Ayer	1/1/2012	Hamilton	1/1/2011	Northfield	7/1/2013	Wenham	1/1/2011
Barre	1/1/2012	Hanover	1/1/2011	Orange	1/1/2018	Wendell	1/1/2014
Becket	1/1/2011	Hanson	7/1/2011	Palmer	1/1/2014	West Newbury	1/1/2014
Bedford	1/1/2012	Hardwick	7/1/2016	Pelham	1/1/2013	West Springfield	7/1/2016
Belchertown	1/1/2011	Harvard	1/1/2012	Pembroke	7/1/2011		
Belmont	1/1/2012	Hatfield	1/1/2011	Pepperell	1/1/2016		
Bellingham	1/1/2012	Haverhill	1/1/2012	Rehoboth	1/1/2013		

As of June 19, 2018, 241 Municipalities have adopted the Stretch Code, covering 69% of Massachusetts municipalities and representing 77% of Massachusetts residents.

Beverly	1/1/2012	Leicester	7/1/2012	Saugus	1/1/2016	Whitot	1/1/2016
Charlton	1/1/2011	Leverett	1/1/2011	Scituate	7/1/2011	Winthrop	1/1/2011
Chelmsford	1/1/2011	Lexington	1/1/2011	Sharon	7/1/2017	Woburn	1/1/2012
Chelsea	7/1/2012	Lincoln	1/1/2011	Shelburne	1/1/2018	Worcester	7/1/2011
Chester	1/1/2018	Littleton	1/1/2016	Shirburn	1/1/2012		
Chesterfield	1/1/2012	Longmeadow	7/1/2014	Shirley	7/1/2012		
Chicopee	1/1/2011	Lowell	1/1/2011	Shrewsbury	7/1/2018		
Clarksbury	1/1/2012	Lunenburg	7/1/2014	Shutesbury	7/1/2011		
Cohasset	1/1/2016	Malden	1/1/2017	Somerville	1/1/2012		
Concord	1/1/2011	Manchester	1/1/2014	South Hadley	7/1/2017		
Conway	7/1/2014	Marlborough	1/1/2012	Southborough	1/1/2017		
Cummington	10/30/2017	Martinez	7/1/2016	Southbridge	1/1/2017		
Dalton	7/1/2015	Mashpee	1/1/2011	Southampton	1/1/2017		
Dartmouth	1/1/2017	Mattituck	7/1/2012	Springfield	1/1/2011		
Dedham	1/1/2011	Medfield	1/1/2017	Stockbridge	1/1/2012		
Deerfield	1/1/2012	Medford	1/1/2011	Stonham	7/1/2017		
Douglas	7/1/2012	Medway	7/1/2011	Stoughton	7/1/2015		
Dover	1/1/2017	Melrose	1/1/2011	Stow	1/1/2016		
Duxbury	7/1/2017	Mendon	1/1/2012	Sudbury	1/1/2011		
Duxbury	7/1/2017	Middleborough	7/1/2017	Sunderland	1/1/2013		
Easthampton	1/1/2011	Middlefield	1/1/2012	Sutton	1/1/2012		
Easton	1/1/2011	Millbury	1/1/2012	Swampscott	1/1/2011		
Eastmont	1/1/2015	Millis	7/1/2016	Tewksbury	1/1/2012		
Erving	1/1/2011	Milwida	1/1/2011				

<https://www.mass.gov/files/documents/2018/08/15/stretch-code-towns-adoption-by-community-map-and-list.pdf>

MA Code Timeline



STRETCH CODE: CHANGES

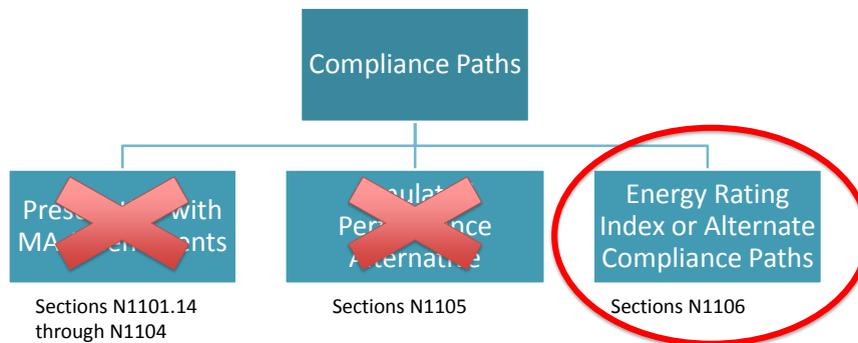
What has changed?

Simplified for 9th Edition

8 th Edition Stretch Code requirements for New Construction (3 stories or less)		9 th Edition Stretch Code for New Construction (4 stories or less)
Dwelling unit size(CFA)	Maximum HERS score	Maximum HERS Score of 55 for New Construction (can be higher if renewables are installed)
Units ≥ 3000sq.ft.	65	Passive House Institute US (PHIUS) Approved Software
Units < 3000sq.ft.	70	ENERGY STAR Homes v3.1 Path
Must also comply with Energy Star Thermal Bypass Inspection Checklist		Must also comply with Mandatory Air leakage requirements of IECC 2015 and Table R402.4.1.1

STRETCH CODE: PATHWAY TO COMPLIANCE

Compliance Paths



Sections marked as “mandatory” are required for all compliance paths.

Stretch Code Mandatory Provisions



Projects shall comply with all Sections marked “Mandatory”:

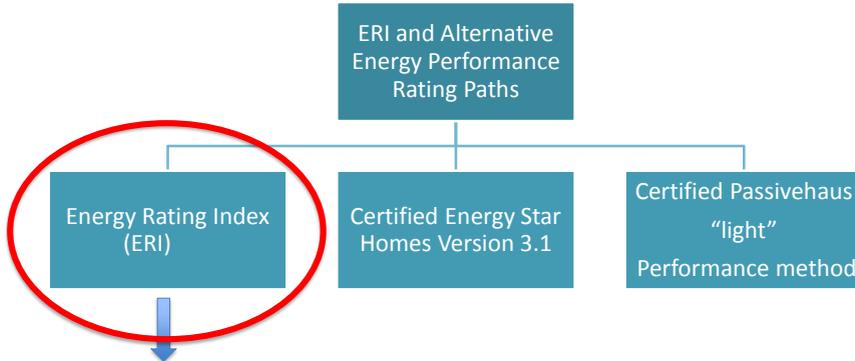
- Certificate (R401.3)
- Air leakage (R402.4)
- Maximum fenestration U-factor and SHGC area-weighted average (402.5)
- Systems (R403) (Controls, Heat pump/boiler controls, Duct sealing, Duct testing, No building cavities as returns, Pipe insulation, Service Water Heating, Ventilation, Equipment sizing, Snow & ice melt systems, Pools, Portable spas)
- Lighting Equipment (R404.1 & R404.1.1)

Stretch Code Compliance Options



N1106.3 (R406.3) Add the following sentence to the end of the paragraph:
The RESNET Home Energy Rating System (HERS) index is the approved ERI approach in the Commonwealth

Stretch Code HERS Index Option



N1106.3 (R406.3) Add the following sentence to the end of the paragraph:
The RESNET Home Energy Rating System (HERS) index is the approved ERI approach in the Commonwealth



What Is a HERS Rating?



- A home energy rating is an in-depth energy performance assessment of a home
- Consists of:
 - Inspections (pre-drywall and final)
 - Diagnostic testing including:
 - Blower door test
 - Duct leakage test
 - Combustion safety analysis
 - Infrared cameras (sometimes)
 - Software modeling

Source: <http://www.resnet.us/energy-rating>

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What Is a HERS Rating?



- Software modeling includes:
 - Floors over unconditioned spaces (like garages or cellars)
 - Attics, foundations and crawlspaces
 - Windows and doors, vents and ductwork
 - Water heating system and thermostats
 - The comprehensive HERS rating provides:
 - A computerized simulation analysis utilizing RESNET Accredited Rating Software to calculate a rating score on the HERS Index.
 - A cost/benefit analysis for the recommended improvements and expected return on investment.

Source: <http://www.resnet.us/energy-rating>

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Approved HERS Rating Modeling Tools



Ekotrope, V1.9.0, V2.1 V2.2, V3.0 & 3.1

Ekotrope
50 Congress St.
Suite 1025
Boston, MA 02109
Phone: 617.453.8043
Fax: 617.401.3645
Email: cy@ekotrope.com
Website: ekotrope.com
Contact: Cy Kilbourn, Director of Engineering
Date of Expiration: December 31, 2018

REM/Rate v14.6.4, v15.2, v15.3, v15.4, v15.5, v15.6 & 15.7

NORESCO
2540 Frontier Avenue
Suite 100
Boulder, CO 80301
Phone: 303.459.7414
Email: bchristensen@noresco.com
Website: www.remrate.com
Contact: Brian Christensen
Date of Expiration: December 31, 2018

EnergyGauge® USA Version 4.0, 5.1, 6.0 & 6.1

Florida Solar Energy Center
1679 Clearlake Road
Cocoa, FL 32922-5703
Phone: 321.638.1437
Fax: 407.638.1010
Email: tkucharski@fsec.ucf.edu
Website: www.energygauge.com/usares
Contact: Tei Kucharski
Date of Expiration: December 31, 2018

Right-Energy HERS

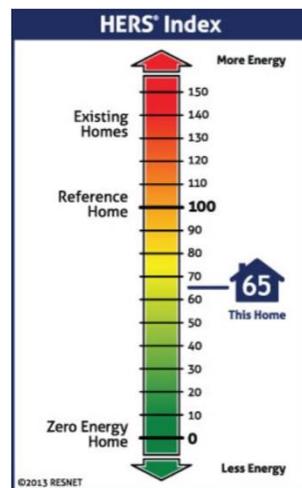
Wrightsoft Corporation
131 Haetwell Ave.
Lexington, MA 02421
Phone: 781.862.8719
Fax: 781.861.2058
Email: ecroteau@wrightsoft.com
Website: www.wrightsoft.com
Contact: Ethan Croteau, Right-Energy Project Director
Date of Expiration: December 31, 2018

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What Is the HERS Index



- The lower the number, the more energy efficient the home.
- Data from HERS Rating compared against a 'reference home'
 - Reference home: A design modeled home of the same size and shape as the actual home, based on a home built in 2006
- A home with a HERS Index Score of 55 is 45% more energy efficient than a standard new home
- Index developed by the Residential Energy Services Network and introduced in 2006
 - Industry standard by which a home's energy efficiency is measured.
 - Government agencies such as the Department of Energy (DOE), Department of Housing and Urban Development (HUD) and the Environmental Protection Agency (EPA) recognize the HERS Index as an official verification of energy performance.



Source: <http://www.resnet.us/energy-rating>

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Who Conducts a HERS Rating?



- All HERS Ratings must be conducted by a Certified HERS Rater
 - A Certified rater completes RESNET Rater training provided by a RESNET certified organization. They are trained on:
 - Building science principles
 - Blower door & duct leakage testing procedures
 - Other on-site inspection processes
 - All HERS Raters must be affiliated with a HERS Quality Assurance Provider

Source: <http://www.resnet.us/energy-rating>

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HERS Rating Quality Assurance



- Rater candidates must accurately complete five probationary ratings overseen by a RESNET Candidate Field Assessor
 - 3 of the 5 must include field verification completed in the presences of the Assessor
- Once certified
 - 10% of all homes rated must receive a file review by a certified RESNET Quality Assurance Designee
 - 1% of all homes rated must receive an in-field review
- RESNET performs annual audits of HERS QA Provider
- HERS Rater Code of Ethics, Rating Standards of Practice, and Compliance Complaint Resolution Process

Source: <http://www.resnet.us/energy-rating>

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Where Can I Find a HERS Rater?



Northeast HERS Alliance

<http://nehers.org/find-hers-rater>



RESNET 'Find a Contractor' directory:

<http://www.resnet.us/directory/search>



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Renewable Energy Offsets



- **N1106.4 (R406.4) ERI-based Compliance.** Compliance based on an ERI analysis requires that the rated design be shown to have an ERI less than or equal to the appropriate value listed in Table N1106.4 (R406.4) when compared to the ERI reference design **prior to credit for onsite renewable electric generation.**

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HERS Index Renewable Offset Summary



1. Solar photovoltaic array ≥ 2.5 kW
 2. Renewable primary heating systems
 - Clean biomass heating system
 - Solar thermal array
 - Geothermal heat pump
 3. Solar domestic hot water and biomass stoves
 - Solar thermal array for domestic water heating
 - Clean biomass stove
- Offset 5 HERS points
- Offset 2 HERS points

Clean Biomass stove offset cannot be combined with primary heating system offset.

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HERS Index Clean Biomass Systems



- **CLEAN BIOMASS HEATING SYSTEM.** Wood-pellet fired central boiler and furnace with a thermal efficiency of at least 80% and ≤ 0.15 lb/MMBtu particulate matter emissions. (5 HERS points)
- **CLEAN BIOMASS STOVE.** Wood- or pellet-fired stoves that are EPA certified; and have a particulate matter emissions rating of no more than 3.5 g/hr for non-catalytic wood and pellet stoves; or 2.0 g/hr for catalytic wood and pellet stoves. (2 HERS points)

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HERS Index

Max HERS Index with Onsite Renewable Energy Systems



The building should have a HERS score less than or equal to the score listed in the table **prior to credit for onsite renewable electric generation.**

Table R406.4.1 (N1106.4.1): Max. HERS index with onsite renewable energy systems

Renewable Energy Source	Maximum HERS Index	
	New Construction	Whole House Renovations; Additions
None	55	65
1 Renewable System: Solar PV > 2.5 kW, or Renewable primary heating system	60	70
2 Renewable Systems: Solar PV + Solar thermal DHW, or Renewable primary heating + solar thermal DHW	62	72
3 Renewable Systems: Solar PV + Renewable primary heating + solar thermal DHW	67	77

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HERS Index

Documentation



IECC Section R406.6: Some of the documentation requirements are:

- Building identification
- Checklist documenting building characteristics of the rated building
- Name of the individual performing the analysis
- Compliance tool/software used with version
- The code official can also ask for ERI reference building design characteristics & documentation of actual values used in the software calculations for proposed design.

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HERS Index Documentation – Projected Rating



Home Energy Rating Certificate

Property: 123 Main Street, Swansea, MA 02777
 Mass Builder: 123 Main Street, Swansea, MA 02777
 HERS Rating Type: Projected Rating
 Rating Date: 6/2/17
 Registry ID: 518686332
 Certified Energy Rater: Ethan MacCormick
 Rating Number: MassSaveDemo

Projected Rating: Based on Plans - Field Confirmation Required.

HERS Index: 58

General Information			
Conditioned Area	2533 sq. ft.	House Type	Single-family detached
Conditioned Volume	23523 cubic ft.	Foundation	Unconditioned basement
Bedrooms	4		

Mechanical Systems Features			
Heating:	Fuel-fired air distribution, Propane, 95.0 AFUE.		
Heating:	Fuel-fired air distribution, Propane, 95.0 AFUE.		
Cooling:	Air conditioner, Electric, 16.0 SEER.		
Duct Leakage to Outside	94.0 CFM25.		
Ventilation System	Exhaust Only: 62 cfm, 20.0 watts.		
Programmable Thermostat	Heat=Yes; Cool=Yes		

Building Shell Features			
Ceiling Flat	R-48.0	Slab	None
Sealed Attic	NA	Exposed Floor	R-30.0
Vaulted Ceiling	NA	Window Type	U-value: 0.300, SHGC: 0.190
Above Grade Walls	R-21.0	Infiltration Rate	1/163 CIP; 1/163 CFM50
Foundation Walls	R-0.0	Method	Blower door test

Lights and Appliance Features			
Percent Interior Lighting	100.00	Range/Oven Fuel	Propane
Percent Garage Lighting	100.00	Clothes Dryer Fuel	Electric
Refrigerator (kWh/yr)	717	Clothes Dryer CEF	3.42
Dishwasher (kWh/yr)	260	Ceiling Fan (ctm/Watt)	0.00

Estimated Annual Energy Cost			
Use	MMBtu	Cost	Percent
Heating	53.6	\$1762	50%
Cooling	1.9	\$112	3%
Hot Water	12.2	\$387	11%
Lights/Appliances	22.8	\$1254	36%
Photovoltaics	-0.0	\$-0	-0%
Service Charges		\$0	0%
Total	90.5	\$3515	100%

Criteria
 This home meets or exceeds the minimum criteria for the following:
 Massachusetts Stretch Energy Code*
 * Compliance is determined by the rater.

Performance Systems Dev
 124 Brindley St
 Ithaca, NY 14850
 607-277-6240

REM/Rate - Residential Energy Analysis and Rating Software v15.5
 This information does not constitute any warranty of energy costs or savings. © 1985-2017 NREL/RESCO, Boulder, Colorado.
 The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

HERS Index Documentation – Confirmed Rating



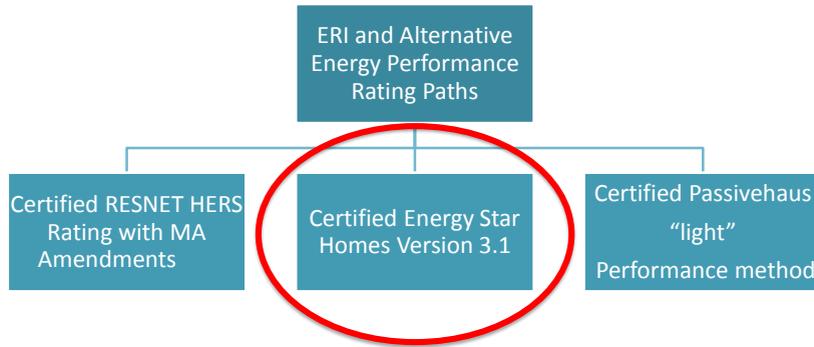
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Criteria
 This home meets or exceeds the minimum criteria for the following:
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 * Compliance is determined by the rater.

Property: 123 Main Street, Swansea, MA 02777
 Mass Builder: 123 Main Street, Swansea, MA 02777
 HERS Index: 58
 General Information: Conditioned Area
 Mechanical Systems: Heating: Heating:
 Building Shell Features: Ceiling Flat, Sealed Attic, Vaulted Ceiling, Above Grade Walls, Foundation Walls
 Dishwasher (kWh/yr) 260

REM/Rate - Residential Energy Analysis and Rating Software v15.5
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 The Home Energy Rating Standard Disclosure for this home is available from the rating provider.

Stretch Code Pathway Certified Energy Star Homes



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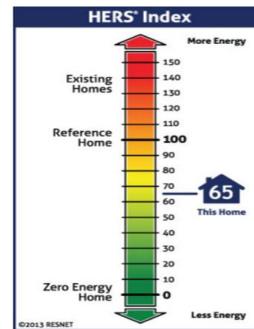
ENERGY STAR V3.1 Pathway



ENERGYSTAR is a label that certifies a home has undergone testing and verification to meet requirements set by US EPA. It is a voluntary certification.

Requirements can be found here:
<https://www.energystar.gov/newhomes>

Getting a HERS Rating is a part of ENREGY STAR. But there is no fixed HERS Rating required to get ENERGYSTAR label



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ENERGY STAR V3.1 Pathway



- Homes achieve this level of performance through a complete package of building science measures including:
- A Complete Thermal Enclosure System — Comprehensive air sealing, properly installed insulation, and high-performance windows work together to enhance comfort, improve durability, reduce maintenance costs, and lower monthly utility bills.
- A Complete Heating and Cooling System — High-efficiency systems that are engineered and installed to deliver more comfort, better moisture control, improved indoor air quality, and quieter operation.
- A Complete Water Management System — A comprehensive package of best building practices and materials protects roofs, walls and foundations from water damage, provides added protection, and reduces the risk of indoor air quality problems.
- Energy-Efficient Lighting and Appliances — ENERGY STAR qualified lighting, appliances, and fans are commonly installed throughout ENERGY STAR certified homes, helping to reduce monthly utility bills, while providing high-quality performance.

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ENERGY STAR V3.1 Pathway



- **More detailed verification of efficiency measures:** The inspection checklists allow for a high level of verification that provide sponsors with greater assurance that efficiency measures are being properly installed and that ENERGY STAR certified homes meet performance and quality expectations.
 - The Thermal Enclosure checklist helps ensure that there are no thermal defects.
 - The HVAC Quality Installation checklists helps ensure that HVAC systems are installed using industry best practices and perform at rated efficiencies.
 - The Water Management builder checklist helps ensure roofs, walls, and foundations are fully protected from water intrusion.
- **Greater savings per home:** ENERGY STAR certified homes are approximately 20% more efficient than homes built to the 2009 International Energy Conservation Code (IECC). Further, the size adjustment factor ensures that larger homes include additional energy efficiency measures to account for their added size.
- **More definitive savings:** Demand and peak savings will be much more reliable with every certified home due to greater rigor of the Reference Design and mandatory checklists. As a result, there will be less opportunity for builders to omit important energy efficiency improvements, and utilities can more confidently quantify the specific savings associated with ENERGY STAR certified homes.
- **Leverage nationally recognized ENERGY STAR name:** ENERGY STAR makes it easy for homebuyers to select energy-efficient homes with its high consumer brand recognition. Efficiency programs based on ENERGY STAR benefit from this level of awareness and builder partners also benefit from being able to leverage ENERGY STAR for effective differentiation from the resale market.

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ENERGY STAR V3.1 Pathway Documentation



N1106.1.2 (R406.1.2) Documentation.

- Prior to issuance of the permit:
 - Copy of preliminary HERS rating based on plans

- Prior to issuance of CO:
 - Copy of Final ENERGY STAR Homes certificate
 - Copy of certified HERS rating
 - Copy of signed ENERGY STAR Thermal Enclosure System Checklist

- Verification by Approved Agency: Certified HERS Rater

ENERGY STAR V3.1 Pathway Projected Rating



ENERGY STAR v3.1 Home Report

Property Mass Builder 123 Main Street Seabrook, MA 02777	Organization Mass Save Rater Corp 799-555-5555 Ethan MacCormick	HERS Projected Rating 6/21/17 Rating No: Mass/Gov/Demo Rater ID: 1963955
Weather: New Bedford 47, MA Sharp Lot, Bld	Builder MA Builder	

Projected Rating: Based on Plans - Field Confirmation Required.

	ENERGY STAR	As Designed
Heating	21.0	29.6
Cooling	9.8	5.6
Water Heating	12.5	3.8
Light & Appliances	25.7	22.8
Total	69.0	61.8

HERS Index of Reference Design Home	65	58 HERS Index w/o PV
HERS Index Target	65	58 HERS Index

ENERGY STAR v3.1 Mandatory Requirements

<input checked="" type="checkbox"/>	Duct leakage at joint construction better than or equal to ENERGY STAR v3.1 requirements.
<input checked="" type="checkbox"/>	Envelope insulation levels meet or exceed ENERGY STAR v3.1 requirements.
<input checked="" type="checkbox"/>	Slab on Grade Insulation must be ≥ R-5, and at IECC 2009 Depth for Climate Zone: 4 and above.
<input checked="" type="checkbox"/>	Envelope Insulation achieves RESNET Grade 1 installation, or Grade II with Insulated sheathing.
<input checked="" type="checkbox"/>	Windows meet the 2009 IECC Requirements Table 402.1.1.
<input checked="" type="checkbox"/>	Duct Insulation meets the EPA minimum requirements of R-4.
<input checked="" type="checkbox"/>	Mechanical ventilation system is installed in the home.
<input checked="" type="checkbox"/>	ENERGY STAR Checklist fully verified and complete.

This home MEETS or EXCEEDS the energy efficiency requirements for designation as an EPA ENERGY STAR Version 3.1 Qualified Home.

HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

Pollution Prevented	Reduction	Energy Cost Savings	\$/yr
Type of Emissions		Heating	214
Carbon Dioxide (CO2) - tons/yr	4.0	Cooling	167
Sulfur Dioxide (SO2) - lbs/yr	6.6	Water Heating	127
Nitrogen Oxides (NOx) - lbs/yr	8.0	Light & Appliances	496
		Total	1794

The energy cost savings and pollution prevented are calculated by comparing the Rated Home to the Reference Home as defined in the Mortgage Industry National Home Energy Rating System Standards as promulgated by the Residential Energy Services Network (RESNET). In accordance with these guidelines, building input affecting setbacks, infiltration rates, window shading and the existence of mechanical systems may have been changed prior to calculating loads.

RESNET - Residential Energy Analysis and Rating Software v3.1.0
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ENERGY STAR V3.1 Pathway

Rater Design Review Checklist



ENERGY STAR		Rater Design Review Checklist	
ENERGY STAR		ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)	
Home Address: _____ City: _____ State: _____		Permit Date: _____	
1. Partnership Status		Must Correct	Rater Verified
1.1 Rater has verified that builder is an ENERGY STAR partner using energystar.gov/partnerlocator		<input type="checkbox"/>	<input type="checkbox"/>
1.2 Rater has verified that HVAC contractor holds credential required to complete the HVAC Commissioning Checklist, unless all equipment to be installed in home to be certified is an exempted type, in which case check "N/A" <input type="checkbox"/> N/A HVAC Contractor Company Name: _____		<input type="checkbox"/>	<input type="checkbox"/>
2. High-Performance Fenestration			
2.1 Specified fenestration meets or exceeds 2009 IECC requirements ³		<input type="checkbox"/>	<input type="checkbox"/>
3. High-Performance Insulation			
3.1 Specified ceiling, wall, floor, and slab insulation levels comply with one of the following options:		<input type="checkbox"/>	<input type="checkbox"/>
3.1.1 Meets or exceeds 2009 IECC levels ^{4, 5, 6} OR:		-	-
3.1.2 Achieves ≤ 133% of the total UA resulting from the U-factors in 2009 IECC Table 402.1.3, per guidance in Footnote 4d, AND specified home infiltration does not exceed the following: ^{5, 4} 3 ACH50 in CZs 1, 2 2.5 ACH50 in CZs 3, 4 2 ACH50 in CZs 5, 6, 7 1.5 ACH50 in CZ 8		-	-
4. Review of HVAC Design Report⁷			
4.1 HVAC Design Report collected for records, with no items left blank		<input type="checkbox"/>	<input type="checkbox"/>
4.2 HVAC Design Report reviewed by Rater for the following parameters (HVAC Design Report Item # indicated in parenthesis): 4.2.1 Cooling season and heating season outdoor design temperatures used in loads (3.3) are within the limits defined at energystar.gov/hvacdesigntemps for the State and County where the home will be built, or the designer has provided an allowance from EPA to use alternative values ⁸		<input type="checkbox"/>	<input type="checkbox"/>

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ENERGY STAR V3.1 Pathway

Confirmed Rating



ENERGY STAR v3.1 Home Report

Property Mass Builder 123 Main Street	Organization Mass Save Rater Corp 781-555-8282	HERS Confirmed 6/2/17
Normalized, Modified End-Use Loads (MMBtu/yr)		
	ENERGY STAR	As Designed
Heating	21.0	29.6
Cooling	9.8	5.6
ENERGY STAR v3.1 Mandatory Requirements		
<input checked="" type="checkbox"/>	Duct leakage at post construction better than or equal to ENERGY STAR v3/3.1 requirements.	
<input checked="" type="checkbox"/>	Envelope insulation levels meet or exceed ENERGY STAR v3/3.1 requirements.	
<input checked="" type="checkbox"/>	Slab on Grade Insulation must be > R-5, and at IECC 2009 Depth for Climate Zones 4 and above.	
<input checked="" type="checkbox"/>	Envelope insulation achieves RESNET Grade I installation, or Grade II with insulated sheathing.	
<input checked="" type="checkbox"/>	Windows meet the 2009 IECC Requirements - Table 402.1.1.	
<input checked="" type="checkbox"/>	Duct insulation meets the EPA minimum requirements of R-6.	
<input checked="" type="checkbox"/>	Mechanical ventilation system is installed in the home.	
<input checked="" type="checkbox"/>	ENERGY STAR Checklists fully verified and complete.	

This home MEETS or EXCEEDS the energy efficiency requirements for designation as an EPA ENERGY STAR Version 3.1 Qualified Home.
HERS Index w/o PV <= HERS Index of Reference Design Home AND HERS Index <= HERS Index Target to comply.

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ENERGY STAR V3.1 Pathway Certificate


Energy Code Technical Support Program

Thermal Enclosure System

A complete thermal enclosure system that includes comprehensive air sealing, quality-installed insulation and high-performing windows to deliver improved comfort and lower utility bills.



Air Infiltration Test: **Htg: 1163 Cig: 1163 CFM50**

Primary Insulation Levels:
Ceiling: R-48.0 FndWall: R-0.0
AGWall: R-21.0 Floor: R-30.0

Rating Company: Mass Save Rater Corp
Rater Identification Number: 1863955
Rating Date: 6/2/17
Version: 3.1

ENERGY STAR

Address: **123 Main Street
Swansea, MA**

Heating, Cooling, and Ventilation System

A high-efficiency heating, cooling system, and ventilation system that is designed and installed for optimal performance.

Total Duct Leakage:
200.00 CFM25.

Duct Leakage to Outdoors:
94.00 CFM25.

Primary Heating (System Type • Fuel Type):
Fuel-fired air distribution, Propane, 95.0

Primary Cooling (System Type • Fuel Type):
Air conditioner, Electric, 16.0 SEER.

Energy Efficient Lighting and Appliances

Energy efficient products to help reduce utility bills, while providing high-quality performance.



ENERGY STAR Qualified Lighting: **100%**

ENERGY STAR Qualified Appliances and Fans:
Refrigerators: 0 Dishwashers: 0
Ceiling Fans: 0 Exhaust Fans: 0

Primary Water Heater (System Type • Fuel Type • Efficiency):
Instant water heater, Propane, 0.92 EF, 0.0 Gal.

ENERGY STAR V3.1 Pathway Rater Field Checklist


Energy Code Technical Support Program



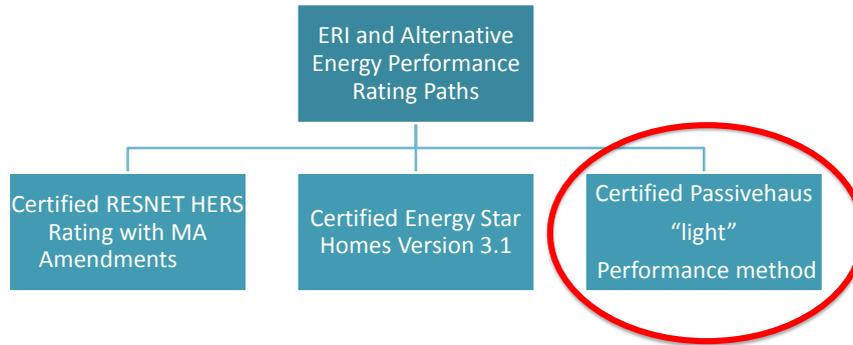
Rater Field Checklist

ENERGY STAR Certified Homes, Version 3 / 3.1 (Rev. 08)

HVAC System ³⁰ (HVAC Design Report Item # indicated in parenthesis)	Must Correct	Rater Verified ²	N/A ³
5. Heating & Cooling Equipment			
5.1 HVAC manufacturer & model number on installed equipment matches either of the following (check box): ³¹ <input type="checkbox"/> HVAC Design Report (4.3, 4.4, & 4.17) <input type="checkbox"/> Written approval received from designer	<input type="checkbox"/>	<input type="checkbox"/>	-
5.2 External static pressure measured by Rater at contractor-provided test locations and documented below: ³² Return-Side External Static Pressure: _____ IWC Supply-Side External Static Pressure: _____ IWC	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.3 Permitted, but not required: HVAC Commissioning Checklist collected, with no items left blank	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Duct Quality Installation - Applies to Heating, Cooling, Ventilation, Exhaust, & Pressure Balancing Ducts, Unless Noted in Footnote			
6.1 Ductwork installed without kinks, sharp bends, compressions, or excessive coiled flexible ductwork ³³	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.2 Bedrooms pressure-balanced using any combination of transfer grills, jump ducts, dedicated return ducts, and / or undercut doors to achieve a Rater-measured pressure differential ≤ 3 Pa with respect to the main body of the house when all bedroom doors are closed and all air handlers are operating. See Footnote 34 for alternative. ³⁴	<input type="checkbox"/>	<input type="checkbox"/>	-
6.3 All supply and return ducts in unconditioned space, including connections to trunk ducts, are insulated to ≥ R-6 ³⁵	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.4 Rater-measured total duct leakage meets one of the following two options. See Footnote 37 for alternative: ^{36, 37, 38}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.4.1 Rough-in: The greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM, with air handler & all ducts, building cavities used as ducts, & duct boots installed. In addition, all duct boots sealed to finished surface. Rater-verified at final. ³⁹	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.4.2 Final: The greater of ≤ 8 CFM25 per 100 sq. ft. of CFA or ≤ 80 CFM, with the air handler & all ducts, building cavities used as ducts, duct boots, & register grilles atop the finished surface (e.g., drywall, floor) installed ⁴⁰	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.5 Rater-measured duct leakage to outdoors the greater of ≤ 4 CFM25 per 100 sq. ft. of CFA or ≤ 40 CFM25 ^{36, 38, 41}	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Whole-House Mechanical Ventilation System			
7.1 Rater-measured ventilation rate is within either ± 15 CFM or ± 15% of design value (2.3) ⁴²	<input type="checkbox"/>	<input type="checkbox"/>	-
7.2 A readily-accessible ventilation override control installed and also labeled if its function is not obvious (e.g., a label is required for a standalone wall switch, but not for a switch that's on the ventilation equipment)	<input type="checkbox"/>	<input type="checkbox"/>	-

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Stretch Code Pathway Passivehaus



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Passive House Pathway



- Passive House is a rigorous voluntary certification standard that results in ultra-low energy buildings
- Builders/owners may choose PHIUS or PHI
- PHIUS is an American offshoot of the German PHI



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Passive House Pathway

What is Passive House?

- MA Stretch Code does NOT require certification (although this might change)
- Specific **Space Heat Demand** should be less than 10 kBtu/sq ft/year
- Extremely air-tight, superinsulated homes
- Modeled using software packages specially tailored for Passive House
- Modeling must be performed by a Certified Passive House Consultant



Taking the Passive House route to show compliance is rare.

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Passive House Pathway Documentation



Prior to issuance of the permit:

- List of compliance features
- A statement that the Estimated Specific Space Heat Demand is “based on plans”

Prior to issuance of CO:

- Copy of final report, submitted on a form that is approved to document compliance with current PHIUS or PHI standards
 - The report should indicate that the finished building achieves a certified passive house consultant-verified Specific Space Heat Demand less than or equal to 10 kBtu/sq ft/year

Verification by Approved Agency: Certified Passive House Consultant

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Passive House Pathway Building Information



BUILDING INFORMATION		
Category:	Residential	
Status:	In planning	
Building type:	New construction	
Year of construction:		
Units:	1	
Number of occupants:	4 (Design)	
Boundary conditions		Building geometry
Climate:	BOSTON MA	Enclosed volume: 25,298.6 ft³
Internal heat gains:	0.9 Btu/hr ft²	Net-volume: 16,326 ft³
Interior temperature:	68 °F	Total area envelope: 5,332.2 ft²
Overheat temperature:	77 °F	AV ratio: 0.2 1/ft
		Floor area: 1,931.6 ft²

Source: <http://www.phius.org/software-resources/additional-resources>

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Passive House Pathway Heating & Cooling Demand

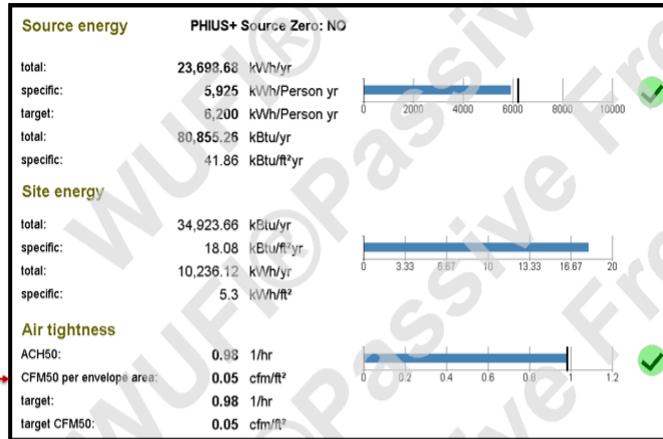


Certificate criteria:		PHIUS+ 2015 Standard
Heating demand		
specific:	4.17 kBtu/ft²·yr	
target:	5 kBtu/ft²·yr	
total:	8,061.8 kBtu/yr	
Cooling demand		
sensible:	2.08 kBtu/ft²·yr	
latent:	0.02 kBtu/ft²·yr	
specific:	2.09 kBtu/ft²·yr	
target:	5.9 kBtu/ft²·yr	
total:	4,044.46 kBtu/yr	

Source: <http://www.phius.org/software-resources/additional-resources>

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Passive House Pathway Source/Site Energy & Air Tightness



Source: <http://www.phius.org/software-resources/additional-resources>

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Passive House Pathway Building Envelope Summary



Summary building envelope			
	Total area / length	Average U-value / Psi value	Transmission losses
Exterior wall ambient:	2,554.9 ft²	0.017 Btu/hr ft² °F	6,849.7 kBtu/yr
Exterior wall ground:	0 ft²	0 Btu/hr ft² °F	0 kBtu/yr
Basement:	1,151.4 ft²	0.019 Btu/hr ft² °F	1,113.5 kBtu/yr
Roof:	1,151.4 ft²	0.011 Btu/hr ft² °F	2,030.8 kBtu/yr
Windows:	474.5 ft²	0.155 Btu/hr ft² °F	11,771.1 kBtu/yr
Doors:	0 ft²	0 Btu/hr ft² °F	0 kBtu/yr
Thermal bridge ambient:	0 ft	0 Btu/hr ft² °F	0 kBtu/yr
Thermal bridge perimeter:	0 ft	0 Btu/hr ft² °F	0 kBtu/yr
Thermal bridge floor slab:	0 ft	0 Btu/hr ft² °F	0 kBtu/yr

Source: <http://www.phius.org/software-resources/additional-resources>

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Passive House Pathway Ventilation

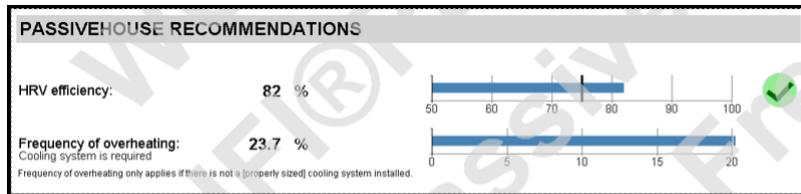


VENTILATION	
Infiltration pressure test ACH50:	0.98 1/hr
Total extract air demand:	106 cfm
Supply air per person:	17.99 cfm
Occupancy:	4
Average air flow rate:	81.71 cfm
Average air change rate:	0.3 1/hr
Effective ACH ambient:	0.12 1/hr
Effective ACH ground:	0 1/hr
Energetically effective air exchange:	0.12 1/hr
Infiltration air change rate:	0.07 1/hr
Infiltration air change rate (heating load):	0.17 1/hr

Source: <http://www.phius.org/software-resources/additional-resources>

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Passive House Pathway Recommendations



Source: <http://www.phius.org/software-resources/additional-resources>

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STRETCH CODE: EXISTING & OTHER BUILDINGS

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Stretch Code & Other Buildings

AA103.2 Large Area and High Energy Use Buildings

- All buildings over 100,000 ft² and new supermarkets, laboratories and conditioned warehouses over 40,000 ft² shall comply with 780 CMR 13.00 and shall demonstrate energy use per ft² at least 10% below the energy requirements of ANSI/ASHRAE/IESNA 90.1 APPENDIX G Performance Rating Method on either a site or source energy basis.

AA103.3 Other New Buildings

- New buildings not covered in AA103.1 and AA103.2 shall comply with 780 CMR 13.00 or Chapter 11 of 780 CMR 51.00: Massachusetts Residential Code as applicable based on the use and occupancy of the building

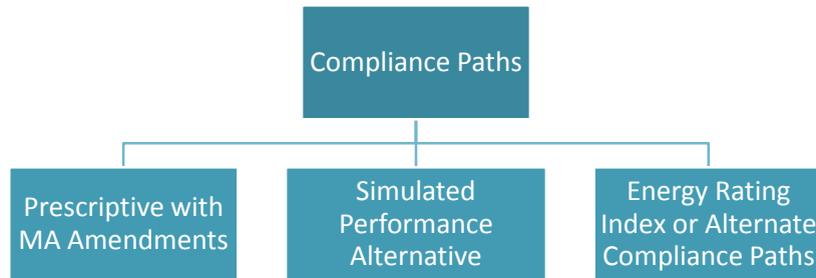
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Stretch Code & Existing buildings



AA104 Existing Buildings

- For alterations, renovations, additions, or repairs of existing buildings in these municipalities the energy efficiency requirements of 780 CMR 12.00 or chapter 11 of 780 CMR 51.00: Massachusetts Residential Code shall be used as applicable based on the use and occupancy of the building



Sections marked as “mandatory” are required for all compliance paths.

Stretch Code & Existing buildings



MA Amendment:

Existing plus addition compliance (Simulated Performance Alternative) (R502.1.2)

- Exception: Alternatively, the addition and any alterations that are apart of the project shall comply with R406 and shall achieve a maximum HERS index using table R406.4.1

Renewable Energy Source	Maximum HERS Index	
	New Construction	Whole House Renovations; Additions
None	55	65
1 Renewable System: Solar PV > 2.5 kW, or Renewable primary heating system	60	70
2 Renewable Systems: Solar PV + Solar thermal DHW, or Renewable primary heating + solar thermal DHW	62	72
3 Renewable Systems: Solar PV + Renewable primary heating + solar thermal DHW	67	77

Summary



- The purpose of the stretch energy code is to provide a more energy efficient code alternative for new buildings
- Three pathways to compliance under the stretch code:
 - HERS Rater
 - ENERGY STAR HOME v3.1
 - Passive House “light”
- Using HERS Rater pathway a maximum HERS Score of 55 for New Construction (can be higher if renewables are installed)
- Stretch code does not apply to Existing Buildings
 - 780 CMR 12.00 or chapter 11 of 780 CMR 51.00: Massachusetts Residential Code apply

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Energy Code Support



Questions about the energy code?

Energy Code Support Hotline:

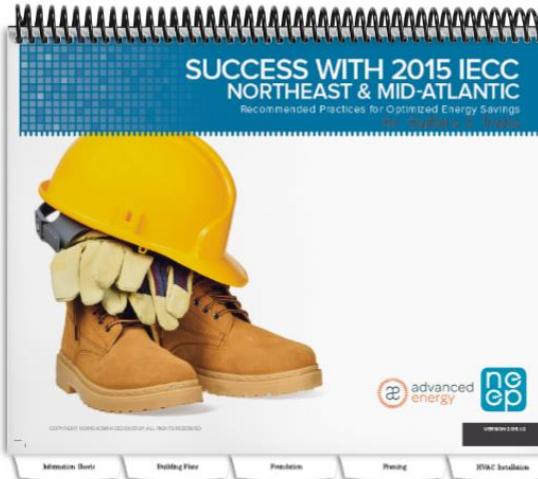
855-757-9717

Energy Code Support Email:

energycodesma@psdconsulting.com

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Energy Code Field Guides



Field Guides for Code Officials
and Builders/Trades at:

SuccessWithEnergyCode.com

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Residential New Construction

Incentives for energy efficient building and renovating



- **Low-Rise New Construction**

- Performance Path – based upon Electric and Fuel savings, plus a % adder as compared to MA baseline – incentives up to \$10,000

- **High-Rise New Construction and all Master Metered Natural Gas**

- Incentives based upon modeling by Program Manager

Incentives also offered for existing buildings.
Visit www.MassSave.com for the details.

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Residential New Construction – Incentives



Blended Savings Approach (BSA)

Single Family BSA Incentive Calculation	
A	Electric Savings * \$0.35 / kWh
B	Fuel Savings * \$35 / MMBtu
C	Percent Savings * \$3,000
Participant Incentive	A + B + C
Rater Incentive	\$350

Multifamily BSA Incentive Calculation	
A	Electric Savings * \$0.35 / kWh
B	Fuel Savings * \$35 / MMBtu
C	Percent Savings * \$2,000
Participant Incentive	A + B + C
Rater Incentive	\$100

Details at:
www.masssave.com/en/saving/residential-rebates/new-construction

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Thanks!

Massachusetts Energy Code Technical Support Program

