Helping Massachusetts Municipalities Create a Cleaner Energy Future

COMMONWEALTH OF MASSACHUSETTS

Charles Baker, Governor
Matthew Beaton, Secretary
Judith Judson, Commissioner

What's New with MA Building Energy Code:

A Review of the 2015 IECC Requirements and Updated Stretch Code

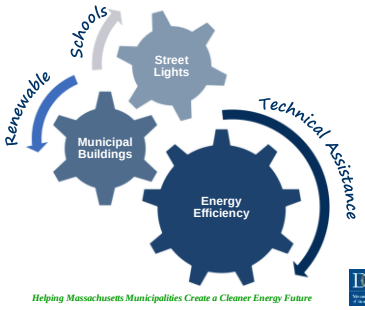
Green Communities Division Webinar

October 11, 2016

1

Green Communities Division

The energy hub for ***all*** Massachusetts cities and towns, not just designated "Green Communities."



2

Helping Massachusetts Municipalities Create a Cleaner Energy Future

Green Communities Division - Programs & Resources for Municipalities

- Green Communities Designation and Grant Program
- MassEnergyInsight energy tracking and analysis tool
- Municipal Energy Technical Assistance
- Energy Management Services Procurement Oversight
- Website filled with tools & resources: www.mass.gov/energy/greencommunities

Email updates via e-blasts – Sign up by sending an email to:
join-ene-greencommunities@listserv.state.ma.us

3

Helping Massachusetts Municipalities Create a Cleaner Energy Future

Outreach - Regional Coordinators

- Regional Coordinators act as direct liaisons with cities and towns on energy efficiency and renewable energy activities
- Located at each of the DEP Regional Offices:

WERO – SPRINGFIELD: Jim Barry
Jim.Barry@state.ma.us

NERO – WILMINGTON: Joanne Bissetta
Joanne.Bissetta@state.ma.us

CERO – WORCESTER: Kelly Brown
Kelly.Brown@state.ma.us

SERO – LAKEVILLE: Seth Pickering
Seth.Pickering@state.ma.us

4

Helping Massachusetts Municipalities Create A Greener Energy Future

Recording & Presentation

- The webinar is being recorded and will be available on our website in approximately 48 hours at: http://www.mass.gov/eea/energy-utilities-clean-tech/webinars.html
- Click on the camera icon top right of your screen to save any slides for future reference
- Use the Q & A icon on your screen to type in questions
- The slide presentation will also be posted at: http://www.mass.gov/eea/energy-utilities-clean-tech/webinars.html

5

Helping Massachusetts Municipalities Create A Greener Energy Future

Presenters

Ian Finlayson
Deputy Director, Energy Efficiency Division
Department of Energy Resources

Michael Berry
Senior Manager
ICF International

6

Helping Massachusetts Municipalities Create a Cleaner Energy Future

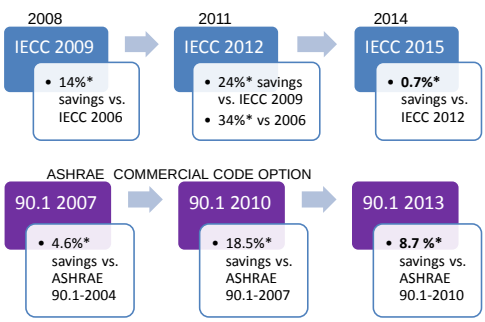
Outline

- MA Building Energy Code – IECC2015 update
  - Background –model code + MA amendments
  - Overview of changes and where to find them
- MA Stretch Energy Code – 2015 update
  - Background – code timeline, change in scope
  - Overview of code changes
  - Incentives and case studies

Base Energy Code in Statute

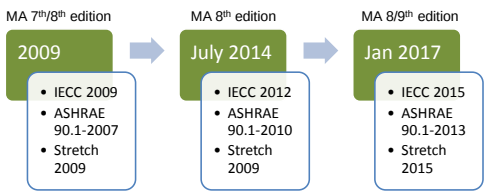
- MGL CH143 Section 94:
  - "To adopt and fully integrate the latest International Energy Conservation Code as part of the state building code, together with **any more stringent energy-efficiency provisions that the board, in consultation with the Department of Energy Resources**, concludes are warranted."

National Model code development



* National savings are higher than MA (zone 5) savings, but illustrative

MA Energy Code timeline



Massachusetts 9th edition in development

- Adopted in July 2016- Effective Jan 1, 2017
  - IECC 2015 (IRC 2015 energy chapter)
  - ASHRAE 90.1-2013
  - MA amendments (inc. Stretch code)
- Balance of 9th edition – 2015 IBC/IRC/Fire code & electric code coming soon
  - Public hearing & comment: next 6 months
- Adoption date estimate: July 1, 2017
- Remaining Energy topics
  - EV charger ready
  - Solar ready roofs

What just got adopted? – baseline code

Where to find the new energy code:

- IECC 2015 (online viewer)
  - http://codes.iccsafe.org/app/book/toc/2015/I-Codes/2015%20IECC%20HTML/index.html
- ASHRAE 90.1-2013 (online viewer)
  - https://ashrae.iwrapper.com/ViewOnline/Standard_90.1-2013_I-P
- MA amendments on DPS website:
  - http://www.mass.gov/eopss/consumer-prot-and-bus-lic/license-type/buildings/amendments-to-780-cmr-effective-august-12-2016.html

What has changed from 2012 and 2015 IECC?

Section	Residential Changes
R403.2.1	Increases insulation requirements for return ducts in attics from R-6 to R-8.
R403.4.1.1 (NEW)	Adds language on heated water circulation systems and heat trace systems.
R403.4.1.2 (NEW)	Makes IECC, IRC, and IPC consistent.
R403.4.2-Table R403.4.2	Deletes requirement for insulation on DHW pipes to kitchen and the generic requirement on long/large-diameter pipes. Adds DHW pipe insulation for all 3/4-inch pipes.
R403.4.2 (NEW)	Adds demand control requirements for recirculating systems that use a cold water supply pipe to return water to the tank.
R403.2 (New)	Requirement for outdoor setback control on hot water boilers to control boiler water temperature based on the outdoor temperature.

13

What are the MA Amendments to 2015 IECC?

Section	Residential Changes
R401.2 (NEW) R406.1.1 (NEW)	Allows for alternatives to HERS ERI a. Certified RESNET HERS rating with MA amendments b. Certified Energy Star Homes, Version 3.1 c. Certified Passivehaus performance method
R401.3 (NEW)	Specifies that mandatory certificate must include final HERS index if HERS approach is used
Table R402.1.2	Reduces maximum fenestration U-factor from 0.32 to 0.30
R403.3.3 (NEW)	Specifies that duct leakage testing must be done by a HERS Rater, HERS Rating Field Inspector, or BPI Certified Professional
R406.4/R406.4.1	Specifies that ERI must be satisfied without credits for onsite renewable electricity generation and allows higher ERI if using renewables
R502.1.2	Adds an exception allowing HERS index approach to be used for compliance of additions to an existing building

14

What has changed on the Commercial Energy Code?

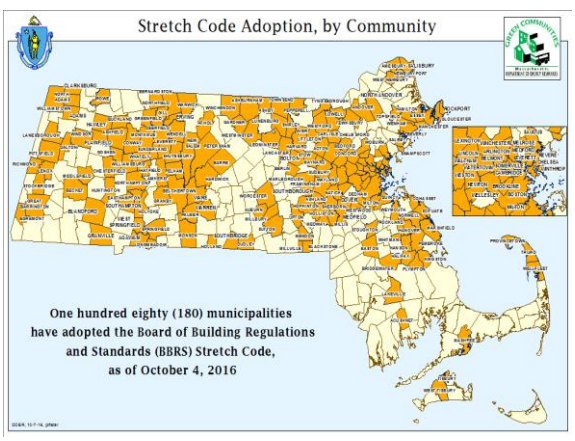
Section	Commercial Changes
C403.2.8 (NEW)	Introduces new requirements for all kitchen exhaust systems.
C403.2.14 (NEW)	New performance requirements for refrigeration equipment reflect changes to national manufacturing standards (10 Code of Federal Regulations (CFR) part 431) which went into effect on January 1, 2012.
C403.2.15 (NEW)	Adds requirement for walk-in coolers and freezers, and refrigerated warehouse coolers and freezers. The requirements are for cover doors, insulation, evaporator fan motor, lighting, anti-sweat heater, condenser fan motor, and their controls.
C403.4.1.1 and Table C403.4.1.1 (NEW)	Requires two stages of fan control for DX units (capacity larger than 65,000 Btu/h) that control cooling capacity directly based on space temperature (usually serving a single zone)..
C403.4.2.5 (NEW)	Adds a boiler turndown requirement that boiler systems with design input of 1,000,000 Btu/h or more comply with different turndown ratios, per Table C403.2.5, using multiple single input boilers, one or more modulating boilers, or a combination of single input and modulating boilers.
C403.4.4.4 (NEW)	Requires motors from 1/12 horsepower (hp) to under 1 hp to be EC motors or have a minimum efficiency of 70%.
C403.4.4.6 (NEW)	Requirement for multiple-zone VAV system ventilation optimization controls to reduce outdoor air intake flow from the design rates in response to dynamic system ventilation efficiency as defined by the 2015 International Mechanical Code (IMC) (ICC 2015b).
C405.2.3 (NEW)	Requires automatic daylight responsive controls for sidelight daylight area as opposed to manual controls (an allowed option in the 2012).
C405.9.1 (NEW)	Adds three new requirements for elevators: • the cab lighting to have efficacy of not less than 35 lumens per Watt, • ventilation fans in elevators without air-conditioning systems shall not consume more than 0.33 watts/cfm at the maximum fan speed, • cab lighting and ventilation should be off when the elevator is not used for over 15 minutes
C405.9.2 (NEW)	Requires that speed of escalators and moving walkways be reduced when not conveying passengers.

15

What are the MA Commercial Amendments?

Section	Commercial Changes
C401.2	Adds option for residential buildings up to 5 stories to follow the residential energy efficiency provisions, and makes other administrative changes to allow for Massachusetts-specific compliance paths.
C401.2.2	Adds allowance for using source energy method when demonstrating compliance via ASHRAE 90.1 Appendix G, and provides details on calculating combined heat and power systems.
C402.6 (NEW)	Notes which compliance tools are approved for demonstrating compliance.
C406.1	Requires two Additional Efficiency Package Options (vs only one option needed in IECC). Add two exceptions to the Additional Efficiency Package Options: 1) Buildings in municipalities not served by a participating Mass Save utility provider must comply with at least one option. 2) Projects using ASHRAE 90.1 must comply with option #2 and at least one other item.
C406.5	Add two compliance options to the on-site renewable energy ratings requirements.
C407.6.1.1 through C407.6.1.5	Adds alternative Energy Performance Methods of HERS, Passive House, and ENERGY STAR Homes.
Chapter 5	Changes references from clerestory to roof monitor. Modifies daylighting definitions
HVAC	*Additional focus on commercial refrigerators, freezers, and refrigeration equipment along with sizing and efficiencies on humidity controls, ventilation, motors and distribution.*
Power and Lighting	*Section 8 and 9 focuses on lighting and lighting controls*

16



Residential

2009 Stretch Code

New Homes (HERS 65 or 70)	Retrofits and additions	~~Existing and Historic~~

IECC 2009 Base Energy Code – Mandatory Requirements

18

Residential

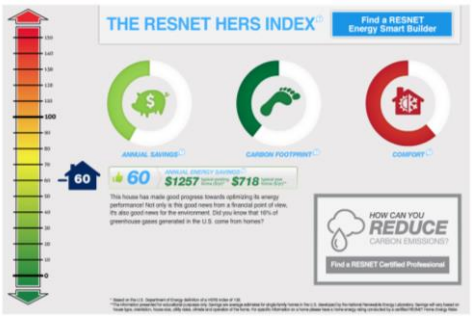
2015 Stretch Code

New Homes (HERS 55-67)	~~Retrofits and additions~~	~~Existing and Historic~~

IECC 2015 Base Energy Code – Mandatory Requirements

19

HERS – Home Energy Rating System



A Lower HERS Index Score Means a More Energy Efficient Home

20

Residential Stretch -HERS timeline

- **IECC 2009**
  - HERS 75 option
- **IECC 2012**
  - HERS 65 option
- **IECC 2015**
  - HERS option 57-67 with Renewables
- **Stretch 09**
  - HERS 65 >3000 sq ft
  - HERS 70 <3000 sq ft
- **Stretch 09**
  - HERS 65 >3000 sq ft
  - HERS 70 <3000 sq ft
- **Stretch 15**
  - HERS 55
  - 57-67 with Renewables

21

Commercial

2009 Stretch Code

~~New under 5000 sq ft~~	New 5,000 – 100,000 sq ft (Prescriptive)	New Over 100,000 sq ft (ASHRAE Performance model)	Retrofits and additions

IECC 2009 Base Energy Code – Mandatory Requirements

22

Commercial

2015 Stretch Code

~~New under 5000 sq ft~~	~~New 5,000 – 100,000 sq ft~~	New Over 100,000 sq ft (ASHRAE Performance model)	~~Retrofits and additions~~

IECC 2015 Base Energy Code – Mandatory Requirements

23

MA Commercial Code timeline

- **IECC 2009**
  - 90.1- 2007
- **IECC 2012**
  - 90.1-2010
- **IECC 2015**
  - 90.1-2013
- **Stretch 09**
  - 15-20% vs. IECC 2009
  - 20% vs. 90.1-2007
- **Stretch 09**
  - Same as IECC 2012
  - ~2% vs. 90.1-2010
- **Stretch 15**
  - Same as IECC 2015
  - 10% vs 90.1-2013

24

Residential Stretch energy code – 2016

- Residential new homes require HERS rating
  - Or EnergyStar Homes v3.1, or PHIUS Passivehaus
  - HERS 55 up to 67 (same as base 9th option)
  - Higher HERS rating allowed with renewable energy

Table N1106.4.1 (R406.4.1). Maximum HERS Index Scores with Onsite Renewable Energy Systems

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

Multi-family Stretch code - 2016

- Multi-family buildings up to 4-stories required to follow the residential stretch code for all 'dwelling units'.
  - EPA Energy Star Homes 3.1 or
  - PHIUS Passivehaus or
  - HERS 55-67 with renewables trade-off
- Dwelling units: kitchens, bathroom, sleeping spaces
  - i.e. not dormitories, hotels, etc.

26

Commercial Stretch energy code – 2016

- Large Commercial = Annual Energy use 10% below ASHRAE 90.1-2013 - Appendix G modeling
  - Appendix G also used for LEED certification
- Applies to:
  - New construction over 100,000 sqft
  - Labs, Supermarkets, conditioned warehouses over 40,000 sqft

Stretch code documentation

- Residential HERS rater requirements
  - Permit – plan review submittal with projected HERS rating 'based on plans'
  - Certificate of Occupancy – Certified HERS index score based on final blower-door, duct testing
- Large Commercial – Energy Model requirements
  - Plan review – ASHRAE 90.1 Appendix G energy model submitted with plans
  - Certificate of Occupancy – Final energy model showing as-built building meets 10% savings

28

Massachusetts Residential New Construction Program

- Almost the same as the Stretch Code
  - Over 30% of new homes in MA
- Builder incentives/rebates per unit
  - Single and Multi-Family $350 - $4,500
- HERS raters per unit
  - Single and Multi-Family $50-$1,200
- Additional Equipment Rebates per measure
  - Heating – up to $1,500
  - Water Heating – up to $800
  - Cooling – up to $500
  - Lighting – free LEDS
- Incentives also available for low, mid and high-rise residential new construction

29

Commercial Incentives

- Incentives available for commercial:
  - New Construction/Major Renovation and Replacing Failed Equipment
    - The New Construction Program is for business customers who are building new facilities, undergoing major renovations of an existing facility, or replacing failed equipment.
  - Large Retrofit Program
    - The Retrofit Program is designed for business customers who want to replace or refit aging, inefficient equipment and systems with energy efficient technologies.
  - Small Business Program
    - The Small Business Program offers technical and financial assistance to help small businesses find ways to become more energy efficient and save money.
  - Multi-Family Buildings Program
    - Mass Save® offers energy efficiency improvement or replacement opportunities for facilities with five (5) or more dwelling units.

http://www.masssave.com/en/business/incentive-programs

30

9th Edition Stretch Code Modeling Analysis

2200 sq. ft. 3 BR Single Family Electric Heat
Worcester, MA

2015 BASE CODE Three Compliance Options

HERS Index (ERI)	
Base	57

Energy Rating Index (HERS)	PASS ☐
Cost Alternative	PASS ☐
REScheck – UA Alternative	PASS ☑

Electric Heat Pump ERI compliance requires a HERS Index of max. 55 and a Certified HERS Rating

2015 STRETCH CODE HERS (ERI) Compliance Option

HERS Index (ERI)	
Stretch	49

Energy Rating Index (HERS)	PASS ☑

Changes to meet STRETCH CODE		Cost or (Savings)
Builder Costs	Estimated cost of adjustments + HERS Rater fee	$2,066
	Utility rebates[1]	($4,793)
	Cost compared to BASE CODE	($2,727)
Homebuyer Costs	Estimated reduced energy cost per year[2]	($567)
	Change to downpayment[3]	($273)
	Change to annual mortgage payment[3]	($141)
	Year 1 cash flow	($980)
	Year 2+ cash flow	($708)

1 - Incentives revised annually around July 1

2 - Energy costs are based on 21 cents/kWh / $1.01/therm, savings are compared with BASE CODE home

3 - 30 Year Mortgage assumes 10% downpayment at 4% APR

March 2016

9th Edition Stretch Code Modeling Analysis

2200 sq. ft. 3 BR Single Family Electric Heat
Worcester, MA

BASELINE FEATURES

FOUNDATION	*Unconditioned, uninsulated basement*
FLOOR	*R30 fiberglass Grade 1*
WALLS	*R21 fiberglass Grade 1*
WINDOWS (U-VALUE/SHGC)	*0.30/0.30*
CEILING – FLAT	*R-19 + R-30 fiberglass cross*
CEILING – SLOPED	*R-30 fiberglass Grade 1*
HEATING	*10 HSPF Heat Pump*
COOLING	*19 SEER Heat Pump*
DHW	*0.95 EF Tank Electric Resistance WH*
DUCT LEAKAGE TO OUTSIDE	*N/A Ductless*
AIR INFILTRATION	*3.0 ACH50*
LED/CFL LIGHTING	*75%*

2015 STRETCH CODE HERS (ERI)

HERS Index (ERI)	
Base	57
Stretch	49

Adjusted Features	Construction Cost/(savings)
HERS Rating	$1,350
Floor R30 Grade 2	($64)
Walls R21 Grade 2	($120)
Ceiling – Sloped R30 Grade 2	($20)
11.3HSPF/19.1SEER Heat Pump	$500
3.25 EF Heat Pump DHW	$419
LED Lighting 100%	$0
Total Cost	$2,066

MassSave Incentive Breakdown	Incentive
RNC Program Tier II	$1,250
Heat Pump – MassSave and MassCEC	$2,593
Heat Pump Water Heater Incentive	$750
RNC Program LED light bulbs[4]	$200
Total Incentive	$4,793
Total Cost compared to BASE CODE	($2,727)

March 2016 4 – LED value assumed at $10/bulb for 20 bulbs

9th Edition Stretch Code Modeling Analysis

2200 sq. ft. 3 BR Single Family Natural Gas Heat
Worcester, MA

2015 BASE CODE Three Compliance Options

HERS Index (ERI)	
Base	62

Energy Rating Index (HERS)	PASS ☐
Cost Alternative	PASS ☐
REScheck – UA Alternative	PASS ☑

Natural Gas Heat ERI compliance requires a HERS Index of 55 and a Certified HERS Rating

2015 STRETCH CODE HERS (ERI) Compliance Option

HERS Index (ERI)	
Stretch	55

Energy Rating Index (HERS)	PASS ☑

Changes to meet STRETCH CODE		Cost or (Savings)
Builder Costs	Estimated cost of adjustments + HERS Rater fee	$2,017
	Utility rebates[1]	($2,050)
	Cost compared to BASE CODE	($33)
Homebuyer Costs	Estimated energy cost change per year[2]	($165)
	Change to downpayment[3]	($33)
	Change to annual mortgage payment[3]	$0
	Year 1 cash flow	($198)
	Year 2+ cash flow	($165)

1 - Incentives revised annually around July 1

2 - Energy costs are based on 21 cents/kWh / $1.01/therm, savings are compared with BASE CODE home

3 - 30 Year Mortgage assumes 10% downpayment at 4% APR

March 2016

9th Edition Stretch Code Modeling Analysis

2200 sq. ft. 3 BR Single Family Natural Gas Heat
Worcester, MA

BASELINE FEATURES

FOUNDATION	*Unconditioned, uninsulated basement*
FLOOR	*R30 fiberglass Grade 1*
WALLS	*R21 fiberglass Grade 1*
WINDOWS (U-VALUE/SHGC)	*0.30/0.30*
CEILING – FLAT	*R-19 + R-30 fiberglass cross*
CEILING – SLOPED	*R-30 fiberglass Grade 1*
HEATING	*92% Furnace x1*
COOLING	*13 SEER x1*
DHW	*0.62 EF 40 gallon tank*
DUCT LEAKAGE TO OUTSIDE	*4%*
AIR INFILTRATION	*3.0 ACH50*
HIGH EFFICACY LIGHTING	*75%*

2015 STRETCH CODE HERS (ERI)

HERS Index (ERI)	
Base	62
Stretch	55

Adjusted Features	Construction Cost/(savings)
HERS Rating	$1,350
Floor R30 Grade 2	($64)
95% Furnace x1	$639
0.95 Tankless DHW	$92
100% LED lighting	$0
Total Cost	$2,017

Incentive Breakdown	Incentive
MassSave RNC Program Tier I	$750
MassSave RNC Program LED light bulbs[4]	$200
Furnace ≥95% AFUE rating equipped with ECM	$300
On-Demand, Tankless Water Heater with an Energy Factor ≥0.94 and electronic ignition	$800
Total Incentive	$2,050
Total Cost compared to BASE CODE	($33)

March 2016 4 – LED value assumed at $10/bulb for 20 bulbs

Conclusion

- New 2015 Stretch code takes effect Jan 1, 2017
- Represents an incremental increase in energy savings
- Reduced scope for small-midsize commercial, residential additions
- Introduces incentives/trade-offs for renewable energy

35

Resources

- Mass Save sponsored code trainings $0-$20

http://www.masssave.com/en/professionals/massachusetts-energy-code-technical-support

- Mass Save hotline: 855-757-9717 technical assistance for people **who have attended** an energy code training session.
- Residential cash flow analysis: http://www.mass.gov/eea/energy-utilities-clean-tech/energy-efficiency/policies-regs-for-ee/stretch-code-residential-cash-flow-analysis.html

36