

# Building to Meet the New MA State Stretch Code Changes (HERS 42/45): What Builders Need to Know – Session I



## Announcements:

10% Discount on NEHERS Memberships Between 12/1/23 and 1/31/24

Member Category	Annual Dues <sup>2</sup> <i>(Paid after January 31st)</i>	Early Bird Dues <i>(Must be paid by January 31st)</i>
Certified HERS Rater	\$120.00	\$108.00
Dual Rater & RESNET-Accredited Independent Trainer	\$240.00	\$216.00
Accredited Rating Provider	\$350.00 + \$66.50/Rater <sup>1</sup> (capped at 50)	10.0% Discount off Annual Calculated Fee
Dual Accredited Rating & Training Provider	\$700.00 + \$66.50/Rater <sup>1</sup> (capped at 50)	10.0% Discount off Annual Calculated Fee
ASSOCIATE – Student/Individual	\$60	\$54
ASSOCIATE – Sponsor	\$500	\$450
HERS Program	\$500 - \$5,000 (\$ .90 per rating done in state suggested)	10.0% Discount off Annual Calculated Fee

(1) Rating Provider variable fee is calculated from Certified Rater count on Jan 1. Providers may opt to include independent raters associated with their providership in this count.  
(2) Members joining after July 1 pay 50% of Annual Dues. This discount does not apply to the ASSOCIATE- Sponsor or Program membership levels.  
(3) For additional information on the benefits and incentives for Sponsor Membership, contact Betsy Ames at [info@nehers.org](mailto:info@nehers.org) or call/text 978-633-3013.

<https://nehers.org/membership>



## Announcements:

Please contact us at [info@nehers.org](mailto:info@nehers.org) if you'd like to join the NEHERS Alliance **Energy Codes Committee!**

We review the Residential Energy Code with respect to HERS Raters concerns and take actions where appropriate to attempt to improve the clarity and implementation of Residential Energy Code.

**Next Meeting is January 9<sup>th</sup> at 1PM EST.**  
(Meets quarterly).



## Announcements:

**NEHERS**  
NORTHEAST HOME ENERGY RATING SYSTEM ALLIANCE

# HERS RATER TRAINING

January 22 – February 2 and February 12 - 16, 2024  
TRAINERS: Performance Systems Development **PSD** Moving Energy Efficiency Forward

**SCHOLARSHIP DEADLINE: December 18<sup>th</sup> at 5 PM (EST)**  
**Final Registration Deadline is January 8<sup>th</sup>**

[REGISTER TODAY](https://nehers.org/hers-rater-trainings)

<https://nehers.org/hers-rater-trainings>



## Audience Reminders:

- Participating in listen-only mode
- Submit a question by typing it into the Questions Pane at the right of your screen any time
- Download the Handout from the Handout Pane
- Provide feedback through our electronic survey following the webinar.
- The recording of this webinar will be posted on our website by Friday. <https://nehers.org/webinars>



## Speakers:



**Nick Falkoff**  
Principal  
Auburndale Builders  
*nick@auburndalebuilders.com*



**Andrew Popielarski**  
Senior Home Energy Rater  
Home Energy Raters  
*andrew@energycodehelp.com*



**Bob Ryley**  
Director of Construction  
Habitat for Humanity  
of Cape Cod  
*bobryley@habitatcapecod.org*



## SERIES OVERVIEW

- 11/30**      **Session 1: Overview Home Performance Summary**
- 12/7**        **Session 2: Orientation, Windows and Doors, and PV**
- 12/14**      **Session 3: Mechanicals, Ventilation, Envelope and Appliances**
- 12/21**      **Session 4: Review/Summary and Questions**



## SESSION ONE Agenda: Overview Home Performance Summary

- Course Overview
- Client Expectations
- Set and Verify Goals
- Design Phase Options
- Windows and Doors
- Mechanicals
- Matching System to Home



**HERS® Index**

More Energy

Existing Homes

Reference Home

100

65

This Home

Zero Energy Home

0

Less Energy

©2013 RESNET

## WHAT IS THE HERS INDEX?

## HERS® Activity by IECC Climate Zone

Climate Zone	Number of HERS Ratings in 2022	Average HERS Index Score
1A	1,184	53
1B	52	85
2A	82,289	59
2B	26,110	55
3A	59,018	60
3B	13,025	44
3C	182	19
4A	55,950	61
4B	2,853	56
4C	1,828	53
5A	54,121	59
5B	26,101	59
6A	13,901	50
6B	949	58
7B	399	54

2021 =  
313,153  
Homes Rated

2022 =  
337,962  
Homes Rated

Total =  
3.6 Million  
Homes Rated

<https://www.resnet.us/wp-content/uploads/2022-HERS-Activity-by-climate-zone.pdf>

# HERS® Activity by State

FOR THE CALENDAR YEAR OF 2022		
State	HERS Rated Homes	Average HERS Index Score
Connecticut	1,717	51
Maine	32	50
Massachusetts	10,189	50
New Hampshire	1,769	51
New Jersey	3,775	55
New York	4,879	51
Ohio	9,558	61
Pennsylvania	7,681	59
Rhode Island	298	64
Vermont	288	40

<https://www.resnet.us/wp-content/uploads/2022-HERS-Activity-by-State.pdf>



# MAXIMUM HERS INDEX SCORE

(MODELED WITHOUT RENEWABLE ENERGY) PV Will Drop the HERS Score Dramatically

	New Construction			Alterations, Additions, and Changes of Use	
	Until 1/1/23	1/1/23 through 6/30/24	As of 7/1/24	Until 1/1/23	As of 1/1/23
Mixed-fuel Building	55	52	42	65	52
Mixed-fuel Building with Solar Electric Generation*	60	55	45*	70	55
All-Electric Building	60	55	45	70	55
All-electric Buildings with Solar Electric Generation*	65	58	45	75	58

\* Solar Electric Generation = Solar photovoltaic array rated at 4kW or higher





# Client Expectations:



# Defining Success: What's the Game Plan?



## Get Your HERS Rater Onboard Early in the SD Design Phase

Design Stages:	Architect/Design	HERS
1) <b>Concept:</b>	Layout 1-10% of drawings (no specs)	
2) <b>Schematic Design (SD):</b>	10-25% of drawings (some specs)	Windows, MEP, Ventilation (Set it up for success at this stage!)
3) <b>Design Development (DD):</b>	50-75% of drawings (plans and specs and narrative)	Insulation, Sizing Systems.
4) <b>Construction Drawings (CD):</b>	Use for getting permits. Supposed to be 75-100% but usually not.	Finalize Windows/ MEP/ Ventilation Preliminary HERS with HP mechanicals specified.
<b>Construction Stages:</b>		
5) <b>Foundation and Frame</b>		
6) <b>MEP:</b> Mechanicals/ Electrical/ Plumbing		
7) <b>Envelope:</b> Insulation (Interior/Exterior)		
8) <b>Finishes:</b> Interior/Exterior		



## Risks for Failure with Typical Workflow

### Typical Workflow with Builder/HERS Rater:

Only a few check-ins and not a lot of specifications, generic analysis.

- 1) Builder has construction documents ready. CD plans. (RISK: Orientation is wrong)
- 2) Email to HERS Rater, can I get rating? Need HERS rating for permit application next week.
- 3) HERS Rater generic model, accounts for house footprint and size of windows/walls/floor area. Generic High Efficiency equipment and High R value insulation to get to HERS 55 or 52. If so, send it to them. Usually not same as planned. (RISK: Wrong equipment costs 10-20 HERS points).
- 4) Permit issued
- 5) Builder does foundation/frame rough in work. Insulation work done.
- 6) HERS Rater does insulation inspection. HVAC testing.
- 7) Builder finishes building.
- 8) Calls HERS rater, can you rate building?

OLD method worked for HERS 65 or 55, to meet code, but with HERS 42 and 45, there is little to no leeway. This method leaves a lot to risk. Much smaller margin for error, less low hanging fruit.





# Recommended Workflow to Reduce Risks

## Recommended Workflow for 42/45:

- 1) More check-ins, earlier in **SD/DD/CD design phases** before you get to construction.
- 2) Keep value engineering options open. Do not design your team into a corner that could require expensive corrections to reach your HERS Score.
- 3) Focus on: high efficiency heating/cooling, DHW, ERV/HRV, and windows- making the right decisions with these four items makes the biggest impact on overall HERS rating.
- 4) Allows builder/architect to play with insulation type and level, which home-owner may not have preferences about.
- 5) Once you have this formula down, you can repeat it for similar builds, or go through it step-by-step each time for custom builds.



# Dialing In on Targets



ORIENTATION



WINDOWS/DOORS



PV



MECHANICALS



INSULATION

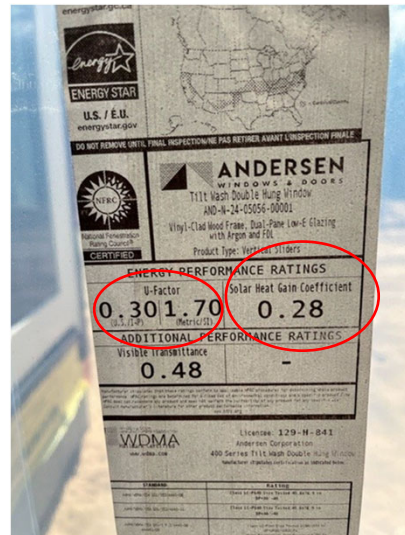


APPLIANCES





# Windows and Doors Overview:



AUBURNDALE BUILDERS HIGH PERFORMANCE HOMES | HOME ENERGY RATERS BUILDING PERFORMANCE TESTING | Cape Cod | NEHERS 25th Anniversary | 21

# Matching the System to the Home: All-Electric Mechanicals Overview



Ducted ASHP



Four Exterior Heat Pump Condensers



Ductless Mini-Split (Indoors)



Ducted ASHP Hot Water Unit



AUBURNDALE BUILDERS HIGH PERFORMANCE HOMES | HOME ENERGY RATERS BUILDING PERFORMANCE TESTING | Cape Cod | NEHERS 25th Anniversary | 22



# Matching the System to the Home: Gas Mechanicals Overview

Gas Furnace



Tankless  
On-Demand  
Hot Water



# ERV for Balanced Ventilation Overview

Ductless ERV



CFM Flow Rate



Ducted ERV



kWH Usage



Sensible Heat  
Recovery



## Framing Systems Overview



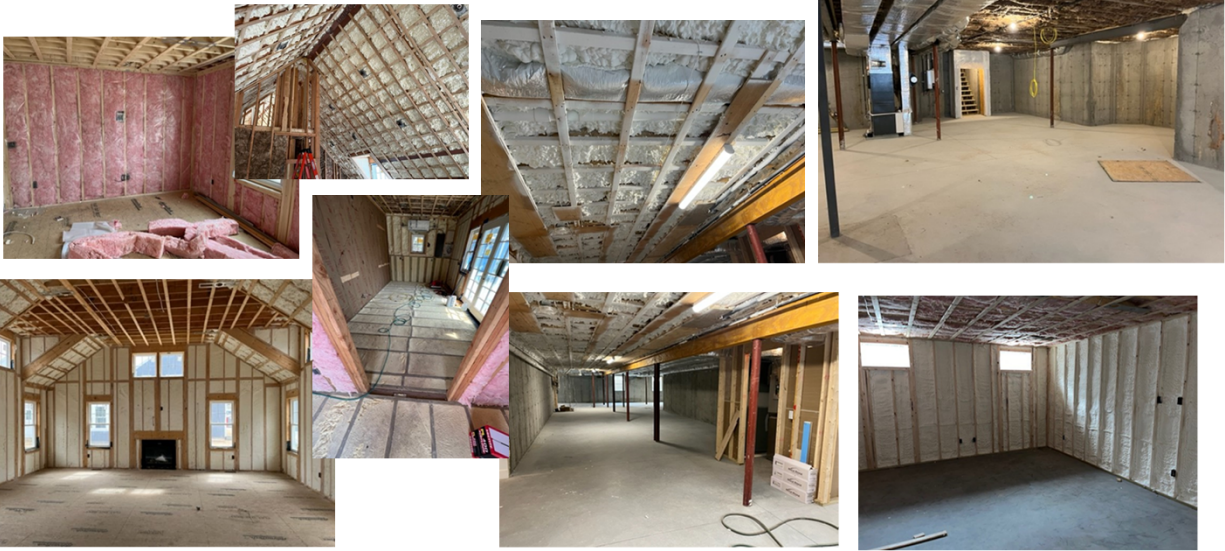
Framing Factor: modeling accounts for assemblies, not just insulation



2 x 10 rafter



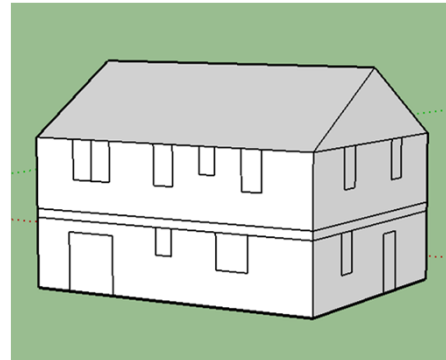
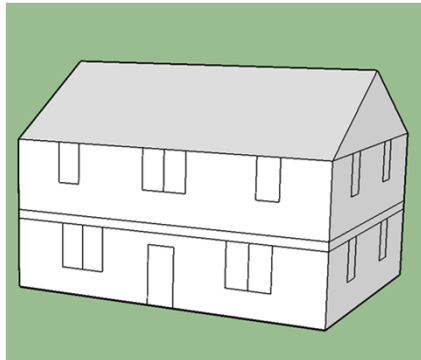
## Insulation Systems Overview



## Generic Model Sketchup:



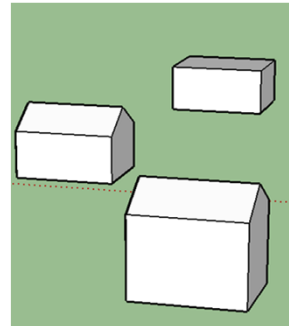
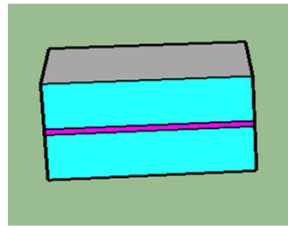
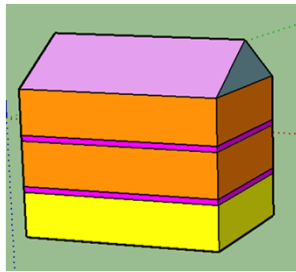
## Elevation View for Determining Window Sizes and Alignment



Source: AP 5-1-23



# Identical Home with Different Insulation Options



## Chart of Differences

### Type of Construction

- Electric – Insulated on Flat Ceiling with Unconditioned Basement
- Electric – Insulated on Flat Ceiling with Conditioned Basement
- Electric with Spray Foam Ceiling with Unconditioned Basement
- Electric with Spray Foam Ceiling with Conditioned Basement
- Gas with Double Pane Windows and Solar
- Gas with Triple Pane Windows (NO Solar)
- Gas with Spray Foam Ceiling, Conditioned Basement and Triple Pane Windows (NO Solar)

# Electric – Insulated on Flat Ceiling with Unconditioned Basement

## Building Specification Summary

Property	Organization	Inspection Status
Norwell, MA 02061	Home Energy Raters Chris Mazzola 508-833-3100	Results are projected
SF Template - Nick F. Class - Flat w/ uncond base		
<b>Builder</b>		
Building Information		Rating
Conditioned Area [ft <sup>2</sup> ]	2,016.00	HERS Index 45
Conditioned Volume [ft <sup>3</sup> ]	17,136.00	HERS Index w/o PV 45
Thermal Boundary Area [ft <sup>2</sup> ]	4,192.00	
Number Of Bedrooms	3	
Housing Type	Single family detached	
Building Shell		
Ceiling w/ Attic	R52,CE,14",4x24,G1; U-0.019	Windows (largest) U-Value: 0.27, SHGC: 0.43
Vaulted Ceiling	None	Window / Wall Ratio 0.14
Above Grade Walls	R21,FG,6x16,G1; U-0.057	Infiltration 1.3 ACH50
Found. Walls	None	Duct Lkg to Outside 80 CFM @ 25Pa (3.97 / 100 ft <sup>2</sup> )
Framed Floors	R30,FG,10x16,G1; R-30	Total Duct Leakage 80 CFM @ 25Pa (Post-Construction)
Slabs	None	
Mechanical Systems		
Heating	Air Source Heat Pump • Electric • 11.6 HSPF	
Cooling	Air Source Heat Pump • Electric • 21 SEER	
Water Heating	Residential Water Heater • Electric • 3.75 UEF	
Programmable Thermostat	Yes	
Ventilation System	80 CFM • 50 Watts • ERV	
Whole House Fan	N/A	



Source: AP 5-1-23

# Electric - Insulated on Flat Ceiling with Conditioned Basement

## Building Specification Summary

Property	Organization	Inspection Status
Norwell, MA 02061	Home Energy Raters Chris Mazzola 508-833-3100	Results are projected
SF Template - Nick F. Class - Flat w/ cond base		
<b>Builder</b>		
Building Information		Rating
Conditioned Area [ft <sup>2</sup> ]	2,016.00	HERS Index 45
Conditioned Volume [ft <sup>3</sup> ]	26,208.00	HERS Index w/o PV 45
Thermal Boundary Area [ft <sup>2</sup> ]	5,344.00	
Number Of Bedrooms	3	
Housing Type	Single family detached	
Building Shell		
Ceiling w/ Attic	R52,CE,14",4x24,G1; U-0.019	Windows (largest) U-Value: 0.27, SHGC: 0.43
Vaulted Ceiling	None	Window / Wall Ratio 0.15
Above Grade Walls	R21,FG,6x16,G1; U-0.057	Infiltration 1.2 ACH50
Found. Walls	R15,HDF,2.25",Continuous; R-15	Duct Lkg to Outside 80 CFM @ 25Pa (3.97 / 100 ft <sup>2</sup> )
Framed Floors	None	Total Duct Leakage 80 CFM @ 25Pa (Post-Construction)
Slabs	Uninsulated; R-0	
Mechanical Systems		
Heating	Air Source Heat Pump • Electric • 11.6 HSPF	
Cooling	Air Source Heat Pump • Electric • 21 SEER	
Water Heating	Residential Water Heater • Electric • 3.75 UEF	
Programmable Thermostat	Yes	
Ventilation System	80 CFM • 50 Watts • ERV	
Whole House Fan	N/A	



Source: AP 5-1-23

# Electric with Spray Foam Ceiling, Conditioned Basement

## Building Specification Summary

<b>Property</b> Norwell, MA 02061	<b>Organization</b> Home Energy Raters Chris Mazzola 508-833-3100	<b>Inspection Status</b> Results are projected
<b>Builder</b>		
<b>Building Information</b>		
Conditioned Area [ft <sup>2</sup> ]	2,016.00	<b>Rating</b> HERS Index 45
Conditioned Volume [ft <sup>3</sup> ]	30,240.00	HERS Index w/o PV 45
Thermal Boundary Area [ft <sup>2</sup> ]	5,497.00	
Number Of Bedrooms	3	
Housing Type	Single family detached	
<b>Building Shell</b>		
Ceiling w/ Attic	None	Windows (largest) U-Value: 0.27, SHGC: 0.43
Vaulted Ceiling		Window / Wall Ratio 0.15
R50,HDF+LDF,2" x10",10x16,G1,C,Unfinished; U-0.023		Infiltration 0.9 ACH50
Above Grade Walls R21,FG,6x16,G1; U-0.057		Duct Lkg to Outside 80 CFM @ 25Pa (3.97 / 100 ft <sup>2</sup> )
Found. Walls R15,HDF,z.25",Continuous; R-15		Total Duct Leakage 80 CFM @ 25Pa (Post-Construction)
Framed Floors	None	
Slabs	Uninsulated; R-0	
<b>Mechanical Systems</b>		
Heating	Air Source Heat Pump • Electric • 11.6 HSPF	
Cooling	Air Source Heat Pump • Electric • 21 SEER	
Water Heating	Residential Water Heater • Electric • 3.75 UEF	
Programmable Thermostat	Yes	
Ventilation System	80 CFM • 50 Watts • ERV	
Whole House Fan	N/A	



Source: AP 5-1-23

# Electric with Spray Foam Ceiling, Unconditioned Basement

## Building Specification Summary

<b>Property</b> Norwell, MA 02061	<b>Organization</b> Home Energy Raters Chris Mazzola 508-833-3100	<b>Inspection Status</b> Results are projected
<b>Builder</b>		
<b>Building Information</b>		
Conditioned Area [ft <sup>2</sup> ]	2,016.00	<b>Rating</b> HERS Index 45
Conditioned Volume [ft <sup>3</sup> ]	21,168.00	HERS Index w/o PV 45
Thermal Boundary Area [ft <sup>2</sup> ]	4,569.00	
Number Of Bedrooms	3	
Housing Type	Single family detached	
<b>Building Shell</b>		
Ceiling w/ Attic	None	Windows (largest) U-Value: 0.27, SHGC: 0.43
Vaulted Ceiling		Window / Wall Ratio 0.13
R50,HDF+LDF,2" x10",10x16,G1,C,Unfinished; U-0.023		Infiltration 1 ACH50
Above Grade Walls R21,FG,6x16,G1; U-0.057		Duct Lkg to Outside 80 CFM @ 25Pa (3.97 / 100 ft <sup>2</sup> )
Found. Walls	None	Total Duct Leakage 80 CFM @ 25Pa (Post-Construction)
Framed Floors	R30,FG,10x16,G1; R-30	
Slabs	None	
<b>Mechanical Systems</b>		
Heating	Air Source Heat Pump • Electric • 11.6 HSPF	
Cooling	Air Source Heat Pump • Electric • 21 SEER	
Water Heating	Residential Water Heater • Electric • 3.75 UEF	
Programmable Thermostat	Yes	
Ventilation System	80 CFM • 50 Watts • ERV	
Whole House Fan	N/A	



Source: AP 5-1-23

# Gas with Double Pane Windows and Solar

## Building Specification Summary

**Property**  
 Norwell, MA 02061

**Organization**  
 Home Energy Raters  
 Chris Mazzola  
 508-833-3100

**Inspection Status**  
 Results are projected

**Builder**

### Building Information

Conditioned Area [ft<sup>2</sup>] 2,016.00

Conditioned Volume [ft<sup>3</sup>] 17,136.00

Thermal Boundary Area [ft<sup>2</sup>] 4,192.00

Number Of Bedrooms 3

Housing Type Single family detached

### Rating

HERS Index 45

HERS Index w/o PV 45

### Building Shell

Ceiling w/ Attic | R59,CE,16",4x24,G1; U-0.017

Vaulted Ceiling | None

Above Grade Walls | R21,FG,6x16,G1; U-0.057

Found Walls | None

Framed Floors | R30,FG,10x16,G1; R-30

Slabs | None

Windows (largest) | U-Value: 0.27, SHGC: 0.3

Window / Wall Ratio | 0.14

Infiltration | 0.8 ACH50 !!!

Duct Lkg to Outside | 80 CFM @ 25Pa (3.97 / 100 ft<sup>2</sup>)

Total Duct Leakage | 80 CFM @ 25Pa (Post-Construction)

### Mechanical Systems

Heating Furnace • Natural Gas • 96.5 AFUE

Cooling Air Conditioner • Electric • 15 SEER

Water Heating Residential Water Heater • Natural Gas • 0.95 UEF

Programmable Thermostat Yes

Ventilation System 83 CFM • 50 Watts • ERV

Whole House Fan N/A



Source: AP 5-1-23

# Gas with Triple Pane Windows (NO Solar)

## Building Specification Summary

**Property**  
 Norwell, MA 02061

**Organization**  
 Home Energy Raters  
 Chris Mazzola  
 508-833-3100

**Inspection Status**  
 Results are projected

**Builder**

### Building Information

Conditioned Area [ft<sup>2</sup>] 2,016.00

Conditioned Volume [ft<sup>3</sup>] 17,136.00

Thermal Boundary Area [ft<sup>2</sup>] 4,192.00

Number Of Bedrooms 3

Housing Type Single family detached

### Rating

HERS Index 42

HERS Index w/o PV 42

### Building Shell

Ceiling w/ Attic | R59,CE,16",4x24,G1; U-0.017

Vaulted Ceiling | None

Above Grade Walls | R21,FG,6x16,G1; U-0.057

Found Walls | None

Framed Floors | R30,FG,10x16,G1; R-30

Slabs | None

Windows (largest) | U-Value: 0.19, SHGC: 0.42

Window / Wall Ratio | 0.14

Infiltration | 0.8 ACH50

Duct Lkg to Outside | 80 CFM @ 25Pa (3.97 / 100 ft<sup>2</sup>)

Total Duct Leakage | 80 CFM @ 25Pa (Post-Construction)

### Mechanical Systems

Heating Furnace • Natural Gas • 96.5 AFUE

Cooling Air Conditioner • Electric • 15 SEER

Water Heating Residential Water Heater • Natural Gas • 0.95 UEF

Programmable Thermostat Yes

Ventilation System 83 CFM • 50 Watts • ERV

Whole House Fan N/A



Source: AP 5-1-23

# Gas with Spray Foam Ceiling, Conditioned Basement and Triple Pane Windows (NO Solar)

## Building Specification Summary

**Property**  
Norwell, MA 02061

**Organization**  
Home Energy Raters  
Chris Mazzola  
508-833-3100

**Inspection Status**  
Results are projected

SF Template - Nick F. Class -  
Vaulted w/ cond base - GAS w/triple

**Builder**

### Building Information

Conditioned Area [ft<sup>2</sup>] 2,016.00

Conditioned Volume [ft<sup>3</sup>] 30,240.00

Thermal Boundary Area [ft<sup>2</sup>] 5,497.00

Number Of Bedrooms 3

Housing Type Single family detached

### Rating

HERS Index 42

HERS Index w/o PV 42

### Building Shell

Ceiling w/ Attic None

Vaulted Ceiling

R50,HDF+LDF,2"x10",10x16,G1,C,Unfinished; U-0.023

Above Grade Walls R21,FG,6x16,G1; U-0.057

Found. Walls R20,HDF,3",Continuous; R-20

Framed Floors None

Slabs Uninsulated; R-0

Windows (largest) U-Value: 0.19, SHGC: 0.42

Window / Wall Ratio 0.15

Infiltration 0.9 ACH50

Duct Lgk to Outside 80 CFM @ 25Pa (3.97 / 100 ft<sup>2</sup>)

Total Duct Leakage 80 CFM @ 25Pa (Post-Construction)

### Mechanical Systems

Heating Furnace • Natural Gas • 96.5 AFUE

Cooling Air Conditioner • Electric • 16 SEER

Water Heating Residential Water Heater • Natural Gas • 0.96 UEF

Programmable Thermostat Yes

Ventilation System 80 CFM • 50 Watts • ERV

Whole House Fan N/A



Source: AP 5-1-23

37

## Exception to Rule is Tons of Glass



### Design Stages:

- 1) Concept- Layout
- 2) Schematic Design (SD)
- 3) Design Development (DD)
- 4) Construction Drawings (CD)

### Construction Stages:

- 5) Foundation and Frame
- 6) Envelope: Insulation (Interior/Exterior)
- 7) MEP
- 8) Finishes Interior/Exterior



38



# Recommended Workflow to Reduce Risks

## Recommended Workflow for 42/45:

- 1) More check-ins, earlier in **SD/DD/CD design phases** before you get to construction.
- 2) Keep value engineering options open. Do not design your team into a corner that could require expensive corrections to reach your HERS Score.
- 3) Focus on: high efficiency heating/cooling, DHW, ERV/HRV, and windows- making the right decisions with these four items makes the biggest impact on overall HERS rating.
- 4) Allows builder/architect to play with insulation type and level, which home-owner may not have preferences about.
- 5) Once you have this formula down, you can repeat it for similar builds, or go through it step-by-step each time for custom builds.



# Questions and Answers:



**Nick Falkoff**  
Principal  
Auburndale Builders  
[nick@auburndalebuilders.com](mailto:nick@auburndalebuilders.com)



**Andrew Popielarski**  
Senior Home Energy Rater  
Home Energy Raters  
[andrew@energycodehelp.com](mailto:andrew@energycodehelp.com)



**Bob Ryley**  
Director of Construction  
Habitat for Humanity  
of Cape Cod  
[bobryley@habitatcapecod.org](mailto:bobryley@habitatcapecod.org)

Please type your questions into the Questions Pane.





## Thank You for Participating in Today's Webinar

Please take a moment to complete the brief survey.  
Your feedback is very important to us.

## Upcoming Stretch HERS 42/45 Webinars:

**December 7th: Session II** - Site Orientation, Windows and Doors, and Photovoltaics (PV)

**December 14th: Session III** - Mechanicals, Ventilation, Envelope and Appliances

**December 21st: Session IV** - Review/Summary, Recipes for Success, and Questions

<https://nehers.org/ma-stretch-hers-4245-series>

## Upcoming NEHERS Monthly Webinar Series:

**December 6<sup>th</sup> - Completing a PHIUS Project After Design Certification  
of Single-Family Projects: A Guide to Raters**

with Isaac Elnecave of PHIUS

**December 13<sup>th</sup> - RESNET Conference Recap and Looking Ahead to 2024**

with RESNET Staff

<https://nehers.org/webinars>

