



IMERY HOMES

Healthy • Durable • Efficient

Managing HVAC in High Performance Buildings

- High Performance Custom Builder since 2010
 - New Construction, Renovations, & Additions
 - Recipient of more than 10 housing awards
- ENERGY Raters since 2009
 - LEED, EarthCraft, DOE Zero Energy Ready, Enterprise Green Communities, Energy Star, NGBS to name a few...
 - Certified more than 1,200 units
- Air Sealing Professionals
 - Launched AeroBarrier with supplemental services
- Developers
 - Q2 break ground on Eco-Village , 66 Acre TND +88 plus homes

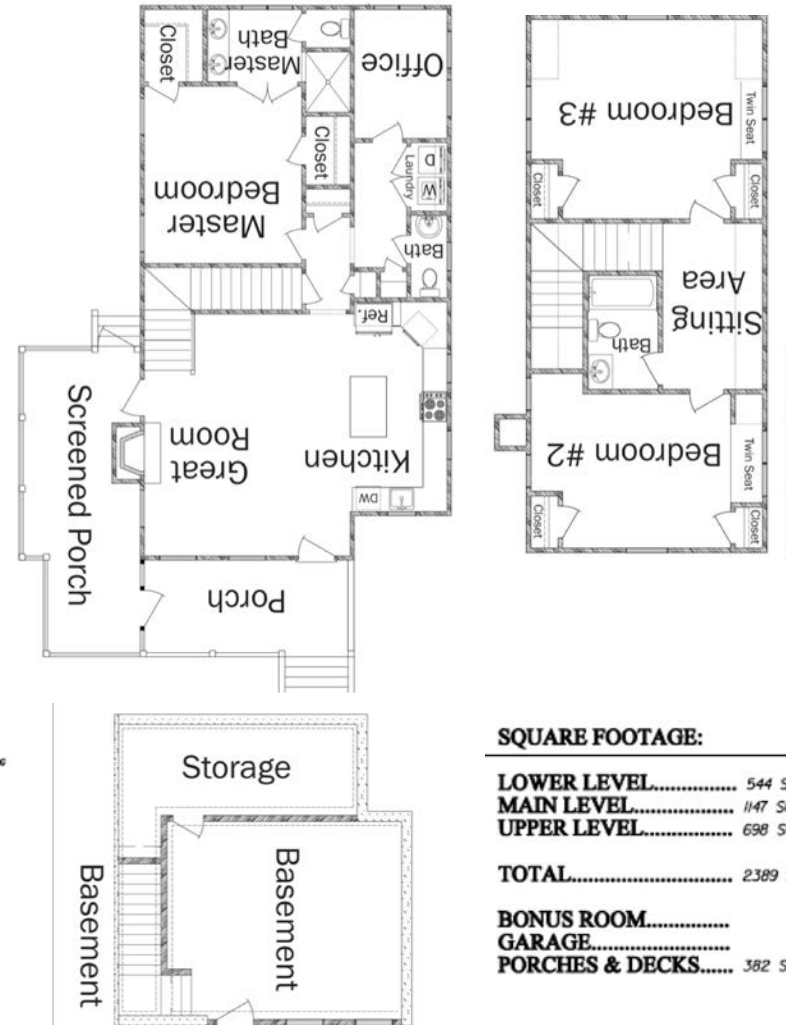
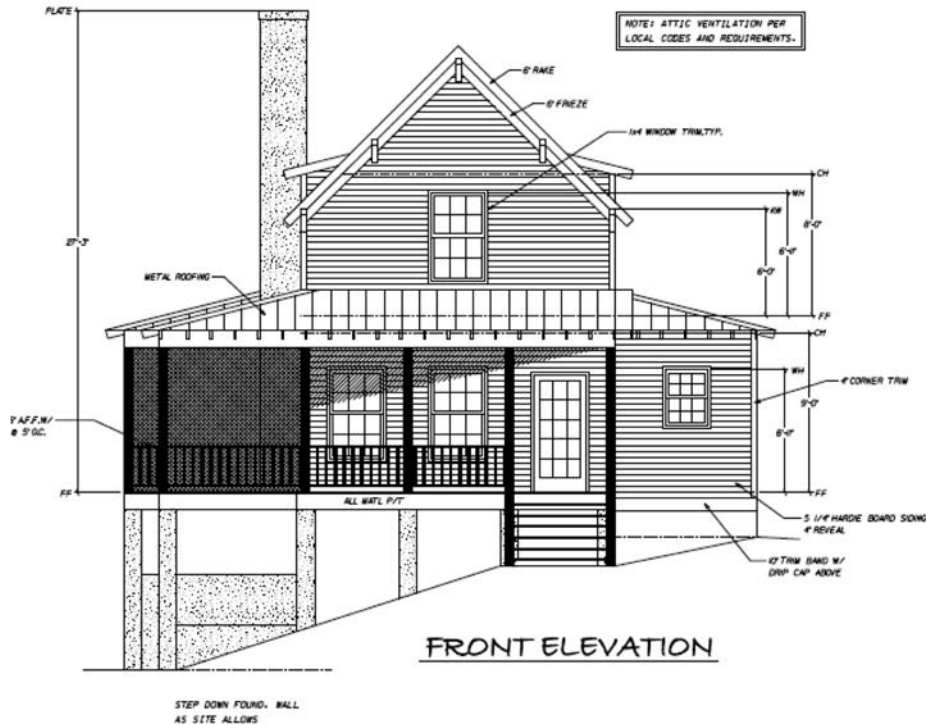
LEARNING OBJECTIVES

- Understand how building design and construction affects HVAC equipment design and capacity
- Define and describe what is meant by the terms “high performance home” & “low load home”
- Identify differences between traditional and high performance residential HVAC system components
- Understand how to control humidity in high performance homes and the benefits to occupants and builders

CASE STUDY 1: Green Shortz Green House

PROJECT DATA

- **Layout:** 3 bdrm, 2.5 bath, 2 fl + bsmt, 2,389 ft²
- **Climate:** IECC 3A, mixed-humid



SQUARE FOOTAGE:

LOWER LEVEL.....	544 SQ.FT.
MAIN LEVEL.....	1147 SQ.FT.
UPPER LEVEL.....	698 SQ.FT.
TOTAL.....	2389 SQ.FT.

BONUS ROOM.....

GARAGE.....

PORCHES & DECKS..... 382 SQ.FT.



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CASE STUDY 1:

Green Shortz Green House



KEY FEATURES

- **Walls:** 2x6 24" o.c., advanced framed; R-23 blown-in fiberglass; R-6 insulated coated taped sheathing; rain screen; fiber cement siding.
- **Roof:** 29-gauge reflective metal roof over furring strips, 15-lb felt; coated roof deck.
- **Attic:** Unvented attic, R-21 open-cell spray foam.
- **Foundation:** Split level with basement and slab on grade; R-5 rigid fiberglass on exterior; R-7 on interior and under slab.
- **Windows:** Double-pane, low-e+, argon-filled, vinyl frames; U=0.26, SHGC=0.19.
- **Air Sealing:** 1.6 ACH 50.
- **Ventilation:** ERV + in-line fan into attic.
- **HVAC:** 16.5 SEER, 9.5 HSPF mini-split heat pumps: 2 ducted air handlers and 2 ductless air handlers connected to one exterior compressor unit.
- **Hot Water:** Heat pump water heater, EF 3.39; manifold plumbing; insulated piping.
- **Lighting:** Interior 90% LED; exterior 100% LED.
- **Appliances:** ENERGY STAR refrigerator, dishwasher, clothes washer.
- **Solar:** Solar ready.
- **Water Conservation:** Followed EPA WaterSense recommendations.
- **Energy Management System:** Smart thermostat.
- **Other:** EPA Indoor AirPLUS, EarthCraft Sustainable Program.



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CASE STUDY 1:

Green Shortz Green House



Project Summary
Entire House
Energy Vanguard

Job: Mills Res., 617 Bruce Wa..
Date: 02/15/2017
By: Andy Bell
Plan: Rev5

1924 Clairmont Rd, Suite 50, Decatur, GA 30033 Phone: (334) 707-2007 Email: andy@energyvanguard.com Web: www.energyvanguard.com

Project Information

For:

Notes: ERV ventilation; R-19+R6.6 cont; BG-R-5 cont ext + R-7 closed cell; R-5 under slab

Design Information

Weather: Dekalb Peachtree, GA, US

Winter Design Conditions

Outside db 25 °F
Inside db 70 °F
Design TD 45 °F

Heating Summary

Structure 21645 Btuh
Ducts 1353 Btuh
Central vent (54 cfm) 903 Btuh

Humidification 0 Btuh
Piping 0 Btuh
Equipment load 23900 Btuh

Infiltration

Method Simplified
Construction quality Semi-tight
Fireplaces 1 (Tight)

	Heating	Cooling
Area (ft ²)	2480	2480
Volume (ft ³)	22803	22803
Air changes/hour	0.22	0.11
Equiv. A/VF (cfm)	84	42

Summer Design Conditions

Outside db 91 °F
Inside db 75 °F
Design TD 16 °F
Daily range M
Relative humidity 50 %
Moisture difference 33 gr/lb

Sensible Cooling Equipment Load Sizing

Structure 13939 Btuh
Ducts 1027 Btuh
Central vent (54 cfm) 329 Btuh

Blower 0 Btuh

Use manufacturer's data n
Rate/swing multiplier 0.96
Equipment sensible load 14745 Btuh

Latent Cooling Equipment Load Sizing

Structure 1913 Btuh
Ducts 171 Btuh
Central vent (54 cfm) 766 Btuh

Equipment latent load 2084 Btuh
Equipment total load 16829 Btuh
Req. total capacity at 0.75 SHR 1.6 ton

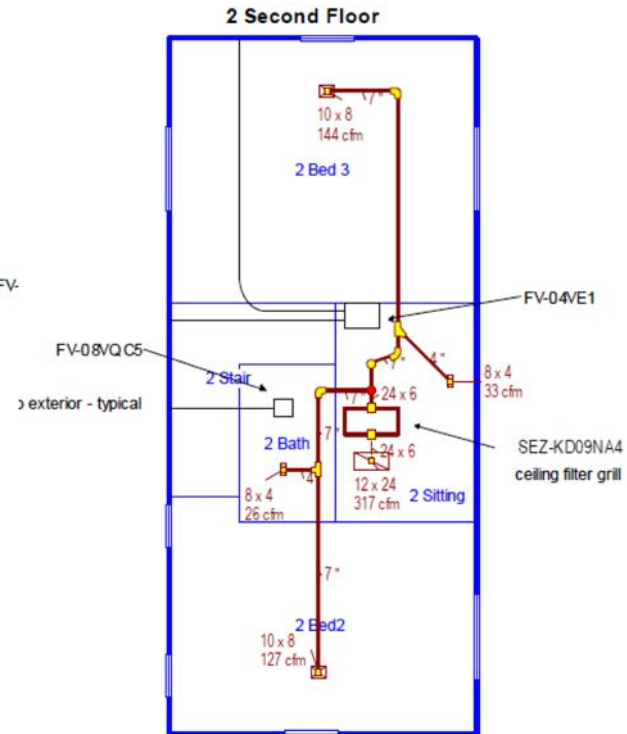
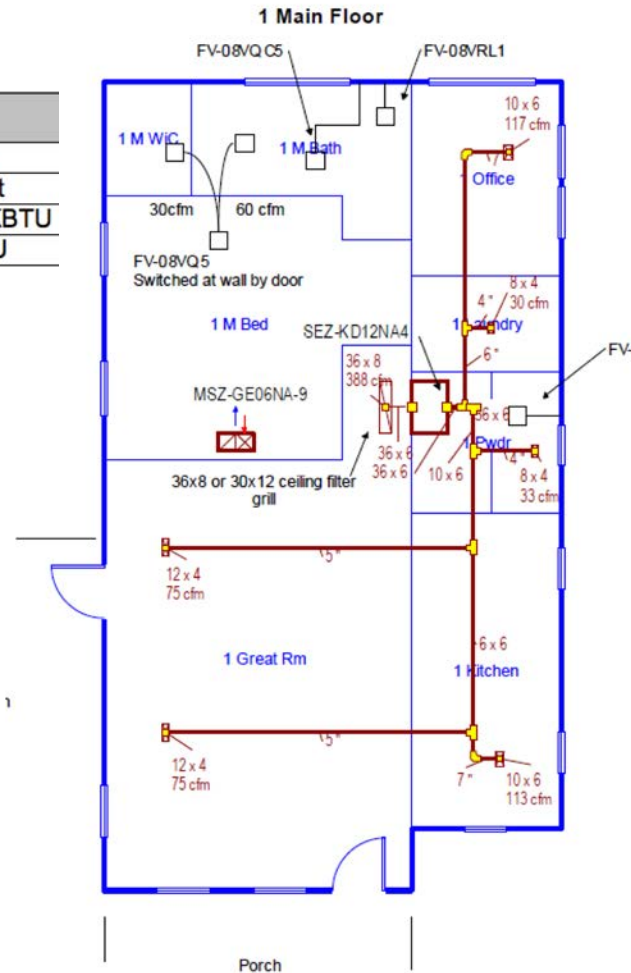
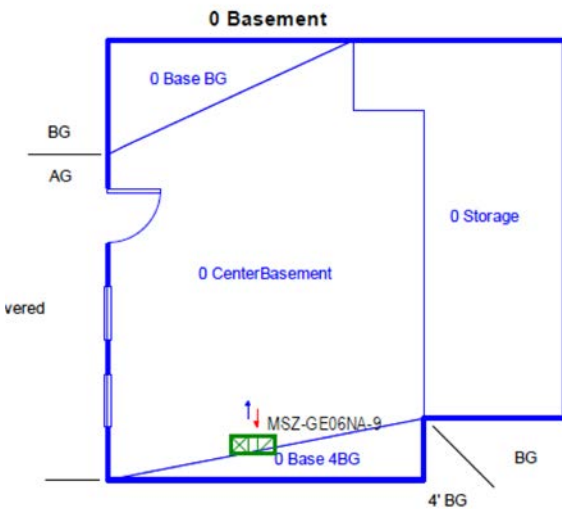
Four Zones - Ducted + Ductless

Zones	Rev5		Previous size
	Load btuh		
	Htg	Clg	
1 Basement	4,658	2,045	1/2 ton ductless
2 Living Area	8,470	9,323	1 ton ducted
3 Master Suite	4,076	1,703	1/2 ton ductless
4 Floor2	6,705	4,757	3/4 ton ducted
	23,909	17,828	-

Outdoor Units	Heads
	4

CASE STUDY 1: Green Shortz Green House

PANASONIC MODEL#	DESCRIPTION
CS-E9SD3UAW	Indoor 9K BTU Low Profile Duct
CS-E12SD3UAW	Indoor 12K BTU Low Profile Duct
CS-ME7RKUA	FLEXI HP I/D WALL MOUNT 7 KBTU
CU-5E36QBU	5 ZONE MULTI HP O/D 36 KBTU





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CASE STUDY 1:

Green Shortz Green House

Ductless (Basement + Master Bed)



PRODUCT SPECIFICATIONS

Capacity Cooling (BTU/H)	6,900 [6,100-9,900]
Capacity Heating (BTU/H)	10,900 [4,100-14,000]
Moisture Removal - High (pints/H)	0.8

Zones	Rev5		Previous size
	Load btuh		
	Htg	Clg	
1 <i>Basement</i>	4,658	2,045	1/2 ton ductless
2 <i>Living Area</i>	8,470	9,323	1 ton ducted
3 <i>Master Suite</i>	4,076	1,703	1/2 ton ductless
4 <i>Floor2</i>	6,705	4,757	3/4 ton ducted
	23,909	17,828	

Ducted (Main + 2nd Floor)



PRODUCT SPECIFICATIONS

Capacity Cooling (BTU/H)	11,500 [4,100-13,300]
Capacity Heating (BTU/H)	13,800 [4,100-16,300]
Moisture Removal - High (pints/H)	1.7

PRODUCT SPECIFICATIONS

Capacity Cooling (BTU/H)	9,000 [4,100-10,200]
Capacity Heating (BTU/H)	12,000 [4,100-14,100]
Moisture Removal - High (pints/H)	1.3

Walking into a trap !?

- Jumper ducts
- Transfer grills

Let us see...



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CASE STUDY 1:

Green Shortz Green House

Bath Exhaust & Transfer

WhisperValue with Condensation Control



3-3/8"
Depth

Lowest profile,
perfect fit
in a 2 x 4!

Fits in nearly every ceiling cavity.

SPOT ERV

FV-04VE1 40/20 CFM or 20/10 CFM Two 4" Ducts



7-7/8"
Depth

Make Up AIR (hood & supplement)

FV-04WS2 20 CFM/40 CFM/Off switch 6" Duct



- What's missing?



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CASE STUDY 1: Green Shortz Green House



The industry's most complete line of whole house ventilating dehumidifiers and accessories.

How did the house perform?



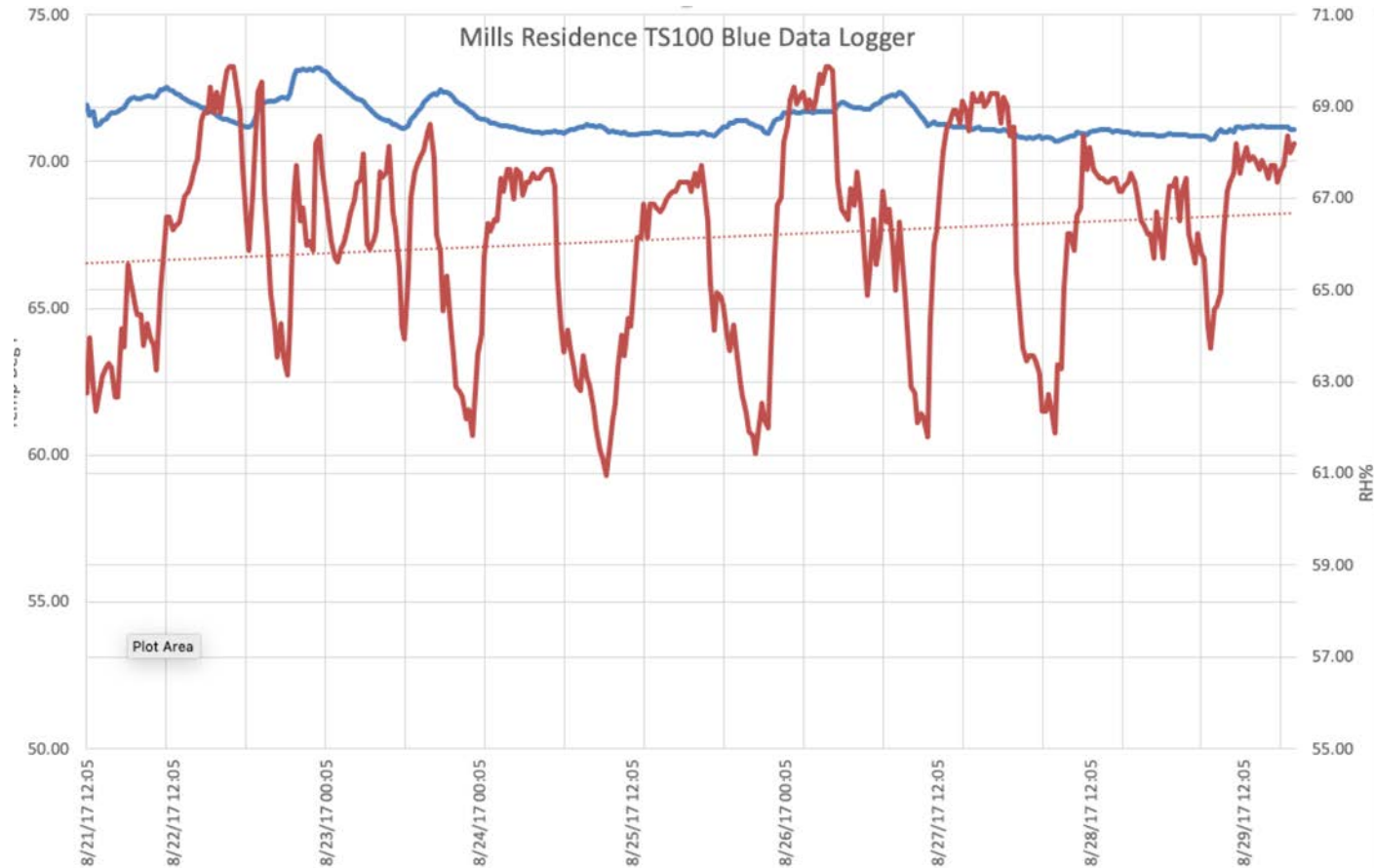
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2nd FLOOR

- Average %HR 67
- Thermostat Set Homeowner 78 F
- 1 week sampled

CASE STUDY 1: Green Shortz Green House





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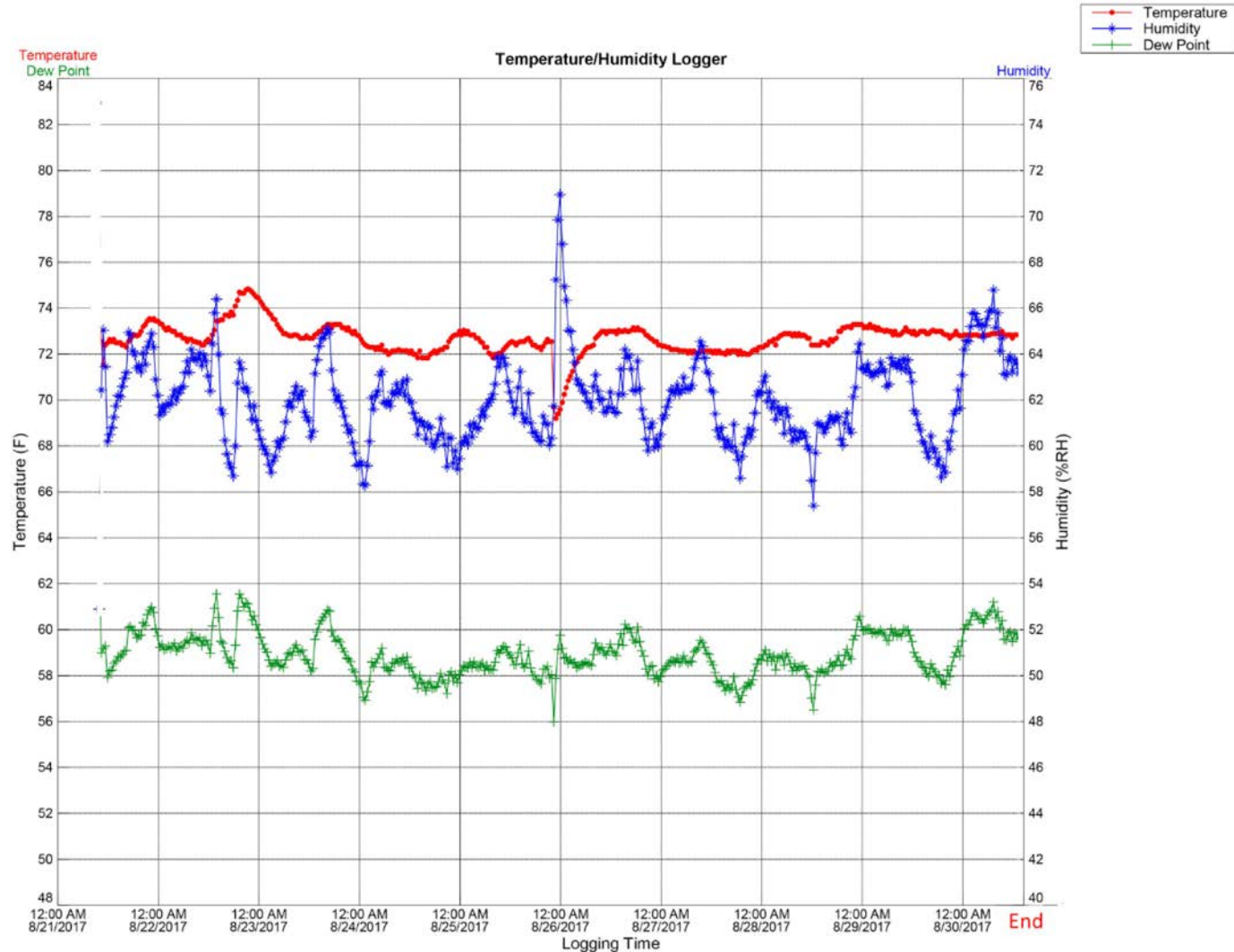
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MAIN FLOOR

- Average %HR 62
- Thermostat Set Homeowner @ 78 F
- 1 week sampled



CASE STUDY 1: Green Shortz Green House





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CASE STUDY 1:

Green Shortz Green House

- What was driving this high RH in home?
 - Low tolerance to cool temp by homeowners, thermostat set above design condition 74 F (78 F)
 - VERY long showers by teenagers
 - Upgraded Huber Zip Sheathing from R-3 to R-6
 - HVAC ran ONLY 21 minutes in one week (August in Atlanta, GA)
- Solutions:
 - Adjusted Thermostat to 74 F, problem stabilized but then added permanently an OFF THE SHELVES dehumidifier on unvented attic

BUT AT THE END...



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CASE STUDY 1: Green Shortz Green House

Home Energy Rating Certificate

Final Report

Rating Date:
Registry ID: 655978001
Ekotrope ID: ILXEMBad

HERS® Index Score:

39

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.hersindex.com

Annual Savings

\$1,722

*Relative to an average U.S. home

Home:

119 1st Avenue, Lilburn, GA 30047

Builder:

Imery Group

Your Home's Estimated Energy Use:

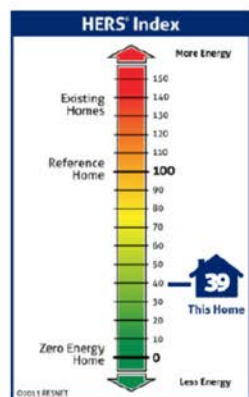
	Use [MBtu]	Annual Cost
Heating	10.4	\$243
Cooling	2.7	\$64
Hot Water	1.6	\$38
Lights/Appliances	21.0	\$493
Service Charges		\$60
Generation (e.g. Solar)	0.0	-\$0
Total:	35.7	\$898

This home meets or exceeds the criteria of the following:

Energy Star v3
Energy Star v3.1
2009 International Energy Conservation Code
2012 International Energy Conservation Code



ZERO
ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY



Home Feature Summary:

Home Type:	Single family detached
Conditioned Floor Area:	2,392 sq. ft.
Number of Bedrooms:	3
Primary Heating System:	Air Source Heat Pump • Electric • 9.5 HSPF
Primary Cooling System:	Air Source Heat Pump • Electric • 16.5 SEER
Primary Water Heating:	Water Heater • Electric • 3.39 Energy Factor
House Tightness:	692 CFM50 (1.6 ACH50)
Ventilation:	80.0 CFM • 44.0 Watts
Duct Leakage to Outside:	0 CFM25
Above Grade Walls:	R-23
Ceiling:	Vaulted Roof, R-19
Window Type:	U-Value: 0.260, SHGC: 0.190
Foundation Walls:	R-11

Rating Completed by:

Energy Rater: Carl Seville
RESNET ID: 9857482

Rating Company: SK Collaborative
333 Adams Street, Decatur, GA 30030
404-480-4600

Rating Provider: Energy Vanguard
533 W Howard, Suite E, Decatur, GA 30030
678-662-4332



Carl Seville, Certified Energy Rater
Date: 6/15/18 at 1:49 PM

ekotrope™

Ekotrope RATER - Version: 2.2.0.1948

The Home Energy Rating Standard Disclosure for this house is available from the rating provider.
This report does not constitute any warranty or guarantee.



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CASE STUDY 2:

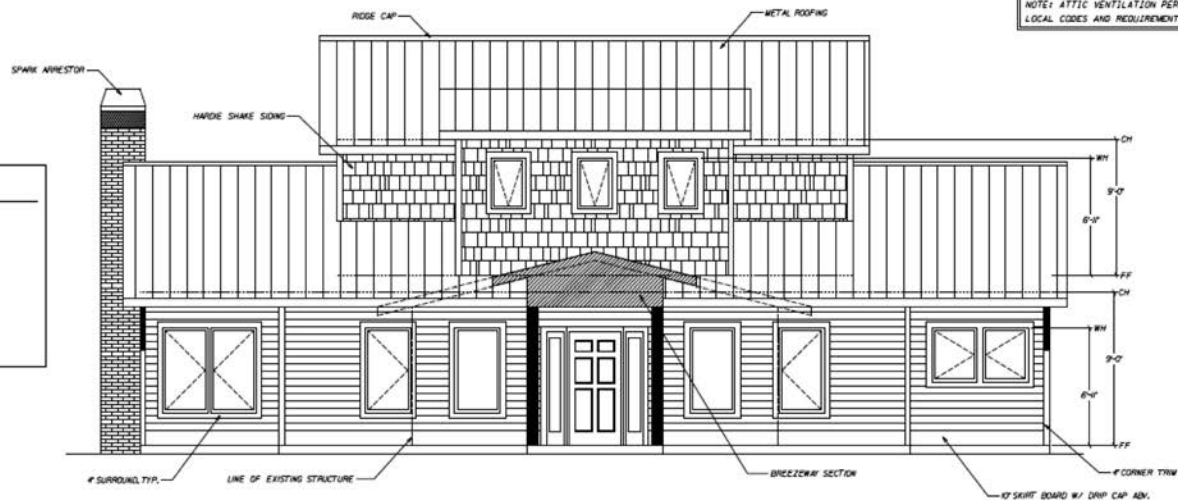
Kuntz Mitsubishi Residence

SQUARE FOOTAGE:

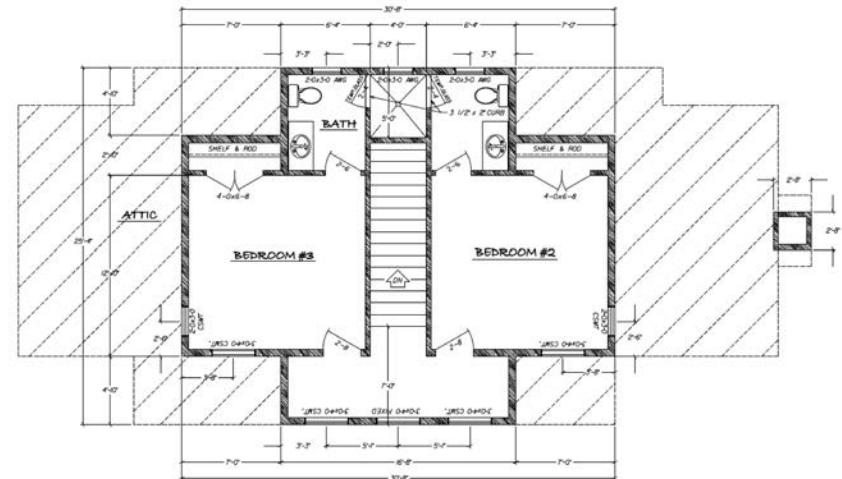
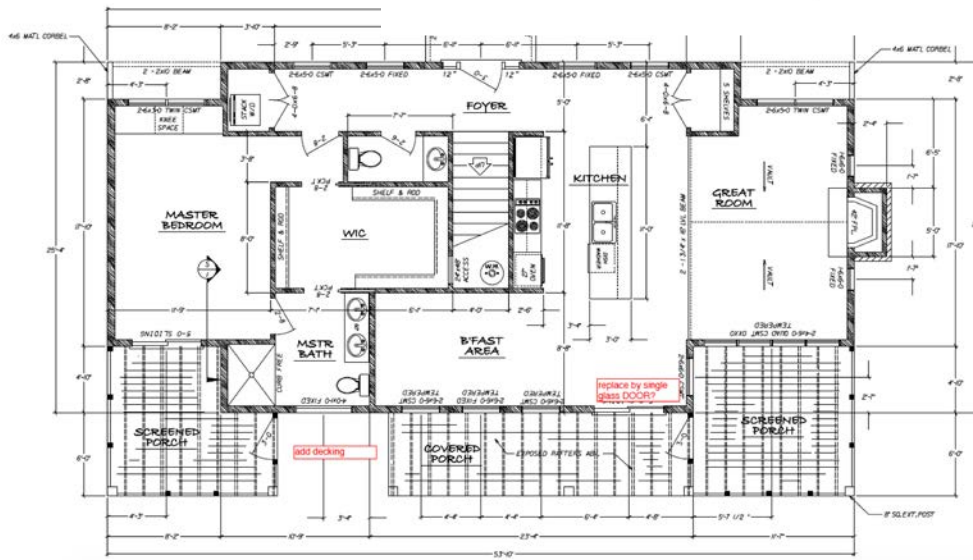
LOWER LEVEL.....
MAIN LEVEL..... 1225 SQ.FT.
UPPER LEVEL..... 642 SQ.FT.

TOTAL..... 1867 SQ.FT.

BONUS ROOM.....
GARAGE..... 638 SQ.FT. (EXISTING)
PORCHES & DECKS..... 450 SQ.FT.



FRONT ELEVATION





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Kuntz Mitsubishi Residence



KEY FEATURES

- **Walls:** 2x6 plates with 2x4 staggered studs 24" OC, R-19 blown-in cellulose, R-3 Zip R-board
- **Roof:** 26- gauge reflective standing seam roof.
- **Attic:** Vented, with R-50 blow-in cellulose
- **Foundation:** Above grade insulated slab R-10
- **Windows:** 3 pane, low-e, argon filled, vinyl frames U=.19, SHGC=0.23
- **Air Sealing:** 2.69 ACH50
- **Ventilation:** ERV – balanced
- **HVAC:** 20 SEER, 10 HSPF mini-split heat pumps, 3 ductless, and 1 dusted connected two 2 outdoor units
- **Hot Water:** Prototype Split Heat Pump water heater, EF 2.3; manifold plumbing, insulated piping
- **Lighting:** 100% LED
- **Appliances:** ENERGY STAR refrigerator, dishwasher, clothes washer
- **Solar:** 2 strings of 15 panels - 8.1 Kw
- **Water Conservation:** Followed EPA WaterSense
- **Energy Management:** 2 energy monitoring systems
- **Other:** EPA IndoorAirPlus, EarthCraft House



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Kuntz Mitsubishi Residence

Project Information

For: Imery Group
Kuntz Res, Athens, GA

Notes:

Design Information

Weather: Athens Municipal, GA, US

Winter Design Conditions

Outside db 27 °F
Inside db 70 °F
Design TD 44 °F

Heating Summary

Structure 19537 Btuh
Ducts 0 Btuh
Central vent (77 cfm) 1253 Btuh

Humidification 0 Btuh
Piping 0 Btuh
Equipment load 20789 Btuh

Infiltration

Method Simplified
Construction quality Tight
Fireplaces 1 (Tight)

	Heating	Cooling
Area (ft ²)	1861	1861
Volume (ft ³)	17770	17770
Air changes/hour	0.18	0.09
Equiv. A/VF (cfm)	53	27

Summer Design Conditions

Outside db 93 °F
Inside db 75 °F
Design TD 18 °F
Daily range M
Relative humidity 50 %
Moisture difference 34 gr/lb

Sensible Cooling Equipment Load Sizing

Structure 13137 Btuh
Ducts 0 Btuh
Central vent (77 cfm) 518 Btuh

Blower 0 Btuh

Use manufacturer's data n
Rate/swing multiplier 0.98
Equipment sensible load 13382 Btuh

Latent Cooling Equipment Load Sizing

Structure 1197 Btuh
Ducts 0 Btuh
Central vent (77 cfm) 1121 Btuh

Equipment latent load 1197 Btuh

Equipment Total Load (Sen+Lat) 14579 Btuh
Req. total capacity at 0.70 SHR 1.6 ton

Area	Htg Load	Clg Load	Minisplit
Master Bed	4,670	1,524	¾ Ton ductless
Bed 2	1,539	1,056	½ Ton ductless
Bed 3	2,822	1,978	½ Ton ductless
Main	13,758	10,021	1 ½ ton ducted
	20,789	14,579	



Kuntz Mitsubishi Residence





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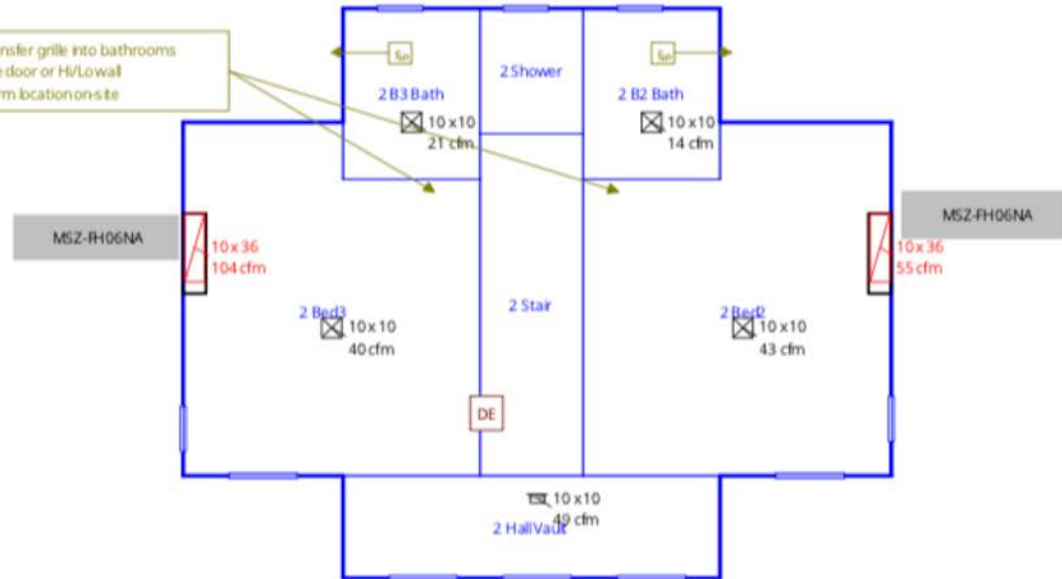
CASE STUDY 2:

Kuntz Mitsubishi Residence

2nd Floor

Room CFM Load (informational only)
R-50 attic/ R/20 vault R-23 2x6 (stagger 2x4) + R-6 Ducts (if any) in cond space
Exhaust fans in ceiling Panasonic Models recommended Se=FV-0510VS1 (low profile) -4" duct to exterior typical
DE = Proposed location for in-wall dehumidifier Ultra-Aire MD-33

Provide for transfer grille into bathrooms
above door or Hi/Low wall
confirm location on-site





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CASE STUDY 2:

Kuntz Mitsubishi Residence

Mitsubishi Electric Equipment Installed

- ▶ (3) MSZ-FH Wall-Mounted Indoor Units
- ▶ (1) MXZ-3C24NAHZ2 Multi-zone Outdoor Unit
- ▶ (1) PEAD-A18AA7 Horizontal-Ducted Indoor Unit
- ▶ (3) PAC-USWHS002-WF-1 Wireless Interfaces
- ▶ (1) PUZ-PW30NHA Hot Water Heat Pump and Space Conditioning Outdoor Unit Prototype



Ductless:

Master Bedroom
2nd & 3rd Bedroom



Ducted:

Rest of House



Outdoor Unit: MXZ-3C24NAHZ2

Outdoor Units:



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Kuntz Mitsubishi Residence

Bath Exhaust & Transfer

WhisperValue with Condensation Control
WhisperValue with Condensation Control



3-3/8"
Depth

Lowest profile,
perfect fit
in a 2 x 4!

Fits in nearly every ceiling cavity.

ERV BROAN ERVS100S (%RH sensor)



MD33 L



Front Cover



Internal Components

Zones	Rev5		Previous size
	Load btuh		
	Htg	Clg	
1 <i>Basement</i>	4,658	2,045	1/2 ton ductless
2 <i>Living Area</i>	8,470	9,323	1 ton ducted
3 <i>Master Suite</i>	4,076	1,703	1/2 ton ductless
4 <i>Floor2</i>	6,705	4,757	3/4 ton ducted
	23,909	17,828	



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CASE STUDY 2:

Kuntz Mitsubishi Residence

Home Energy Rating Certificate

Final Report

Rating Date: 2018-10-13

Registry ID: 447646362

Ekotrope ID: yvPmKoK2

HERS® Index Score:

-13

Your home's HERS score is a relative performance score. The lower the number, the more energy efficient the home. To learn more, visit www.energystar.gov

Annual Savings

\$2,837

*Relative to an average U.S. home

Home:

2376 Troy Smith Rd

30656

Builder:

Imery Group

Zones

- 1 Basement
- 2 Living Area
- 3 Master Suite
- 4 Floor2

Rev5		Previous size
Load btuh		
Htg	Clg	
4,658	2,045	1/2 ton ductless
8,470	9,323	1 ton ducted
4,076	1,703	1/2 ton ductless
6,705	4,757	3/4 ton ducted
23,909	17,828	

Your Home's Estimated Energy Use:

	Use [MBtu]	Annual Cost
Heating	5.3	\$196
Cooling	1.8	\$65
Hot Water	3.3	\$122
Lights/Appliances	19.8	\$735
Service Charges		\$120
Generation (e.g. Solar)	38.7	-\$1,118
Total:	30.1	\$120

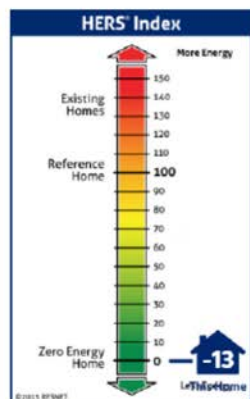
This home meets or criteria of the follow

Energy Star v3

Energy Star v3.1

2012 International Energy Conservation Code

2009 International Energy Conservation Code



Home Feature Summary:

Home Type:	Single family detached
Conditioned Floor Area:	1,863 sq. ft.
Number of Bedrooms:	3
Primary Heating System:	Custom • Electric • 10 HSPF
Primary Cooling System:	Custom • Electric • 20 SEER
Primary Water Heating:	Custom • Electric • 2.3 Energy Factor
House Tightness:	831 CFM50 (2.69 ACH50)
Ventilation:	97.0 CFM • 103.0 Watts
Duct Leakage to Outside:	14 CFM25
Above Grade Walls:	R-29
Ceiling:	Attic, R-52
Window Type:	U-Value: 0.19, SHGC: 0.23
Foundation Walls:	N/A

Rating Completed by:

Energy Rater: Brian Young
RESNET ID: 5098900

Rating Company: Home Performance Solutions
1101 Red Oak Court Watkinsville, GA 30677
706-248-0821

Rating Provider: Southface Energy Rated Homes
241 Pine St NE
404-604-3637



Brian Young

Brian Young, Certified Energy Rater
Digitally signed: 12/6/18 at 8:55 AM



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Ekotrope RATER - Version: 2.2.1.2058

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Kuntz Mitsubishi Residence

Energy production peaked at 5.1 kW. The little energy usage spike is the hot water heater.



Here's one from the weekend showing me charging my EV. Almost a perfect match of production and consumption – free fuel!

