In accordance with the Department of Labor and Industry's statute 326.0981, Subd. 11,

"This educational offering is recognized by the Minnesota Department of Labor and Industry as satisfying **1.5 hours** of credit toward **Building Officials and Residential Contractors code /1 hour energy** continuing education requirements."

For additional continuing education approvals, please see your credit tracking card.

Zero Energy Ready Home: Are You Onboard? Why or Why Not?

Brian J. Wimmer



Habitat for Humanity®





U.S. DEPARTMENT OF ENERGY Home Energy Score







ZERH: What is it? The DOE Zero Energy Ready Home



Lives better.



Works better.



Lasts better.



"A DOE Zero Energy Ready Home is a high performance home which is so energy efficient, that a renewable energy system can offset all or most of its annual energy consumption."

ZERH: What is it?

<u>The Twelve Essential</u> <u>Steps to Net Zero</u>



The Twelve Essential Steps to **NET ZERO ENERGY**

Clifton View Homes and Zero Energy Plans founder/CEO Ted Clifton walks us through the twelves steps of building planning and construction that have helped him to design and build the most energy efficient homes in the world.

Video shot and edited by Kyle Porter

Zero Energy Ready Home: Homebuyers

https://youtu.be/sp6eJELZACI

DOE ZERH Requirements



DOE Zero Energy Ready Home National Program Requirements (Rev. 06) April 20, 2017

DOE ZERO ENERGY READY HOME REQUIREMENTS

DOE Zero Energy Ready Homes must meet all <u>DOE Zero Energy Ready Home National Program</u> <u>Requirements (Rev.06)</u> for homes permitted on or after 7/20/2017. Note that the Rev. 06 program requirements may also be used for projects permitted before 7/20/2017.

Homes permitted prior to 7/20/17, but on/after 8/11/2015, have the option of using

the <u>Rev.05 specifications</u>. Homes permitted prior to 8/11/2015 have the option of using the <u>Rev. 04</u> <u>specifications</u>.

DOE Zero Energy Ready Homes must:

 1) Comply with <u>ENERGY STAR for Homes Program Requirements and Inspection</u> <u>Checklists</u> for:

oThermal Enclosure

oHVAC Quality Installation (Contractor and HERS Rater)

•Exceptions for QA-Credentialed HVAC Contractor (December 2016)

•DOE Zero Energy Ready Home 'Hardship' Waiver (May 2018)

oWater Management

oThe target home/size adjustment factor used by ENERGY STAR

- ✓ 2) Feature energy efficient appliances and fixtures that are ENERGY STAR qualified.
- ✓ 3) Use high-performance windows that meet ENERGY STAR v5.0 and v6.0 specifications (depending on climate zone). The required U and Solar Heat Gain Coefficient (SHGC) values are shown below, effective 8/22/2016.

DOE ZERH Requirements



DOE Zero Energy Ready Home National Program Requirements (Rev. 06) April 20, 2017

ENERGY STAR		imates CZ 1-2		Climates except Marine	IECC	limates CZ 5-8 Marine²
Window Specs	U-Value	SHGC	U-value	SHGC	U-Value	SHGC
Required for DOE Zero Energy Ready Home Projects ¹	0.40	0.25	[CZ 3] 0.30 [CZ 4] 0.30	[CZ 3] 0.25 [CZ 4] 0.40	0.30 0.31 0.32	Any ≥0.35 ≥0.40

1. DOE Zero Energy Ready Home offers multiple compliance paths including area weighting and allowances for passive solar design. See the National Program Requirements, Exhibit 1 with footnotes, for details.

2. These U & SHGC values are based on the ENERGY STAR v5.0 Window Specifications. DOE ZERH will review the feasibility of adopting ENERGY STAR v6.0 Window Specifications, which entail lower U values, periodically. Any program update to require the v6.0 window specs will be announced with a minimum 1-year phase-in.

DOE ZERH Requirements

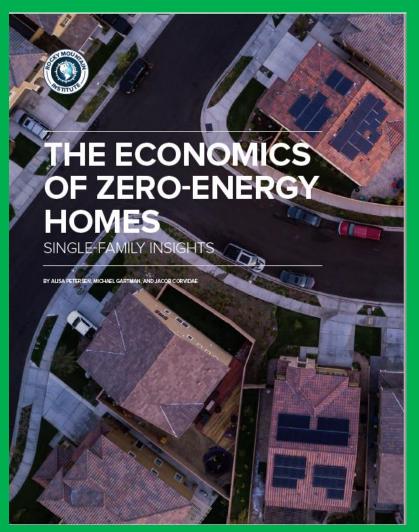
DOE ZERO ENERGY READY HOME REQUIREMENTS (cont.)

- 4) Meet 2012 International Energy Conservation Code levels for insulation. In some states 2015 IECC insulation levels are required see End Note #15 of the Rev.06 specs
- 5) Follow the latest proven research recommendations by installing ducts in conditioned space or in an optimized location as defined in the program specs.
- 6) Conserve water and energy through an efficient hot water distribution system that provides rapid hot water to the homeowner.

Download the <u>WaterSense Excel tool</u> for estimating the stored volume in hot water distribution systems.

- 7) Provide comprehensive indoor air quality through full certification in EPA's <u>Indoor</u> <u>airPlus</u> Program
- 8) Accomplish savings on the cost of future solar PV installations by following the PV-Ready <u>checklist</u>for climates with significant solar insolation. This checklist references EPA's <u>solar electric guide</u>. (Note that the solar-hot water provisions of the checklist are no longer mandatory and can be found below with encouraged items.)

Costs & Savings





Adobe Acrobat Document



Adobe Acrobat Document

Recent Studies/Successes

DOE Zero Energy Ready Home Savings & Cost Estimate Summary October 2015

October 2015

In terms of economic assumptions, energy rates used in this analysis were \$0.11/kWh and \$1.06/therm of natural gas. Monthly net cash flow calculations assumed a 30-year fixed rate mortgage with a 5% interest rate.

RESULTS

Table 1 below provides a summary of the HERS Index, energy savings, incremental costs for upgrades, and net monthly cash flow for the DOE Zero Energy Ready Home models compared to a 2009 IECC baseline home. Table 2 shows the same information for DOE Zero Energy Ready Home relative to a 2012 IECC baseline.

Table 2: DOE Zero Energy Ready Home Energy & Cost Comparison to 2012 IECC Baseline

Climate Zone	Space & Water Heating Energy Source	12 IECC - HERS Index	ZERH - HERS Index	Monthly Energy Cost Savings for ZERH House vs. 12 IECC House (\$)	Estimated Marginal First Cost for ZERH House (\$)	Amortized Marginal First Cost for ZERH House (\$)	Net Monthly Cashflow (\$)
3	ELECTRIC	74	57	\$37	\$4,663	\$25	\$12
3	GAS	72	54	\$37	\$4,216	\$23	\$14
5	ELECTRIC	61	53	\$40	\$4,403	\$24	\$16
5	GAS	59	49	\$33	\$3,896	\$21	\$12

Table 1: DOE Zero Energy Ready Home Energy & Cost Comparison to 2009 IECC Baseline

Climate Zone	Space & Water Heating Energy Source	09 IECC - HERS Index	ZERH - HERS Index	Monthly Energy Cost Savings for ZERH House vs. 09 IECC House (\$)	Estimated Marginal First Cost for ZERH House (\$)	Amortized Marginal First Cost for ZERI House (\$)	Net Monthly Cashflow (\$)
3	Electric	88	57	\$66	\$7,291	\$39	\$26
3	Gas	86	54	\$66	\$6,868	\$37	\$29
5	Electric	78	53	\$101	\$5,590	\$30	\$71
5	Gas	72	49	\$70	\$5,083	\$27	\$43

Costs & Savings Anology

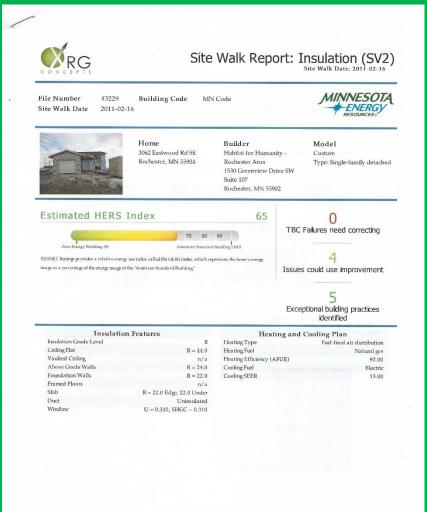




Econo-Car	Luxury Car + 5%
No safety features	Driver Assistance Features
Air leaks	Well-sealed doors
Road noise	Quiet Ride
Poor defroster/heater	Superior Heater/Defroster
Cold spots in compartment	Even Comfort Level
Rust in 5 years	30-year No Rust Warranty

ltem	Econo-Car	Luxury Car 5% More	
Cost	\$14,000.00	\$14,700.00	
Loan Pymt	\$252.00	\$264.60	
MPG	30.00	40.00	
Miles driven/yr	15,000.00	15,000.00	
Total Gallons	500.00	375.00	
Cost/Gallon \$2.50	\$1,250.00	\$937.50	
Per month	\$104.17	\$78.13	
total Cost/Month	\$356.17	\$342.73	
	Montly Savings=	\$13.44	
	Yearly Savings=	\$161.30	

Some of Our Results



•	Building Co File Numbe Site Walk D	r #6653	34			2
	Home 701 Blanch St Mantorville, N	ſN 55955	Builder Habitat for Humar Rochester Area 1530 Greenview I Suite 107 Rochester, MN 55	iity - Drive SW	Model Production Type: Singk Size: 1982 ft	<mark>e-family detache</mark> 2
ENERGY STAR	Requiremen	ts	NO		0	
Checklists Completed No		Meets Testing Standards Yes		TBC Failu	res need	correcting
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page 1 of 8

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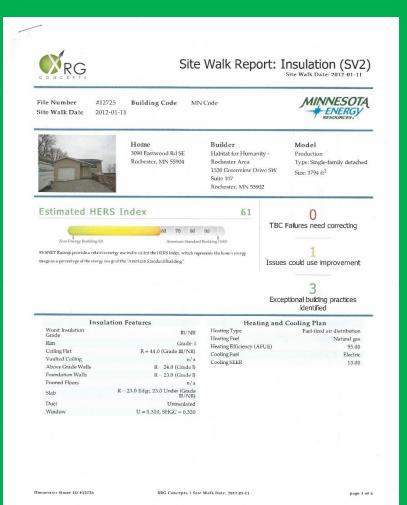
XRG Concepts | Site Walk Date: 2016-12-27

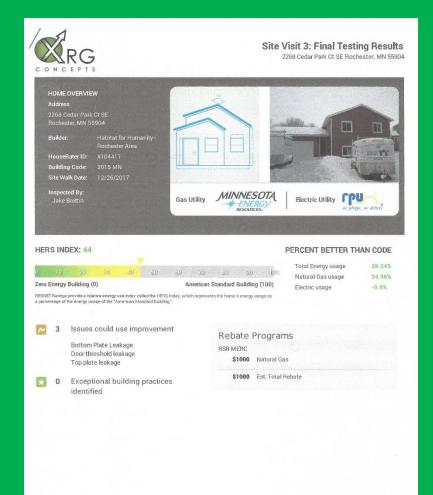
Some of Our Results

*	Building C File Numb Site Walk I	er #12726	5		MIN	INESOTA ENERGY RESOURCES.
	Home 1929 3rd Ave Rochester, M		Builder Habitat for Human Rochester Area 1530 Greenview Dr Suite 107 Rochester, MN 5590	ive SW	Model Production Type: Sing Size: 2078 f	le-family detached
ENERGY STAR	Requireme	nts	NO		0	
Checklists Complete No	ed Checklists Signed No	Meets Testing S Yes	Standards	TBC	Failures nee	ed correcting
			53		0	
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Some of Our Results





Home ID 104411 | Site Walk Date 12/26/2017 | Report Version 1/30/2018

Wall Assembly

BSI-001: The Perfect Wall

Joseph Lstiburek

JULY 15, 2010 The perfect wall is an environmental separator—it has to keep the outside out and the inside in. In order to do this the wall assembly has to control rain, air, vapor and heat. In the old days we had one material to do this: rocks. We would pile a bunch or rocks up and have the rocks do it all. But over time rocks lost their appeal. They were heavy and fell down a lot. Heavy means expensive and falling down is annoying. So construction evolved. Today walls need four principal control layers especially if we don't build out of rocks.



Microsoft Word Document

Rigid Foam Concept

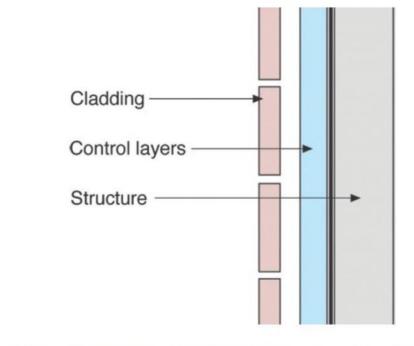


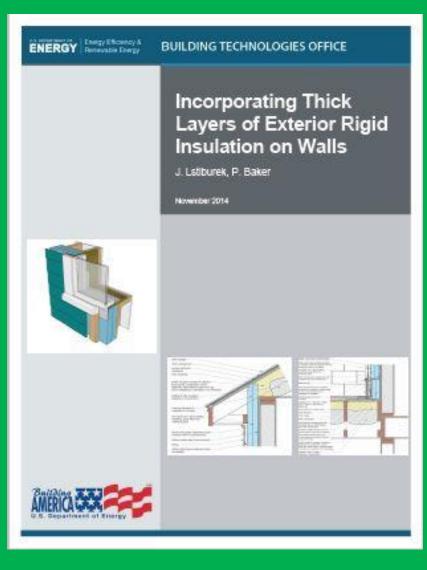
Figure 1. Optimum configuration of control layers

Thermal control layer outside the structure.

- Protecting the structure
- OSB sheathing never reaches dew point
- Dry to the inside Class III vapor retarder

https://www.energy.gov/eere/buildings/downloads/zerh-webinar-gettingenclosures-right-zero-energy-ready-homes

Rigid Foam: choosing a method



Two methods

- Water control layer in front of rigid insulation
- Water control layer behind rigid insulation
- We chose behind rigid insulation.
- *Water control layer must be continuous and uninterrupted!*

ZERH Practices—With or Without Full Certification

Possibilities:

- One layer of foamboard
- Tighter air control
- Durability
- Water Control
- Product selection

Looking to the Future

- Product choices/imrovements
- New technologies
- Tighter control systems
- Simplified processes
- Lower cost/greater efficiency in PV/other renewables

Open Discussion

Questions? Thoughts? Ideas? Concern? Wins? Setbacks?

Educating Customers

Sam Rashkin is Chief Architect of the Building Technologies Office in the Office of Energy Efficiency and Renewable Energy.

https://www.energy.gov/eere/buildings/doezero-energy-ready-home-resources

