A Cost-Effective Path to Healthy, Affordable, Net Zero Housing with DOE’s Zero Energy Ready Home Program

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Energy Burden

For low-to-moderate-income households

0%  Percent of Income Going to Energy Costs  50%
AVERAGE ENERGY BURDEN (% OF INCOME) BY CENSUS TRACT

For low to moderate income households
True Affordability – A Tale of Two Houses

Lowest first cost HUD home

A DOE ZERH home

Life cycle cost = not just affordable to buy, but affordable to own.
A Path to Zero Energy Ready Homes

How to Achieve a DOE Zero Energy Ready Home

- START WITH ENERGY STAR Certified Homes Ver. 3.0, 3.1, or 3.2
- ENVELOPE meets or exceeds 2012, 15, or 18 IECC
- DUCT SYSTEM located within the home’s thermal boundary
- WATER EFFICIENCY meets EPA WaterSense hot water distribution spec.

- LIGHTING AND APPLIANCES ENERGY STAR qualified
- INDOOR AIR QUALITY meets or exceeds the EPA Indoor airPLUS Verification Checklist
- HVAC, HW, and ACH50 meet specs or tradeoff
- SOLAR meets PV Ready Checklist
- BUILD, Label, Sell
Top 10 Design Tips

1. Use RemDesign or similar tool.
2. Design on a 2-foot grid.
3. Design for solar.
4. Use engineered wood solutions.
5. Use advanced framing.
7. Bring ductwork into conditioned space.
8. PEX Plumbing with Central Manifold.
9. Specify air sealing details in plans.
10. Build a Box, then decorate it.
1. Use RemDesign or similar tool

RemDesign uses the same inputs as RemRate for raters. There is little chance for errors for translating from plans to actual RemRate compliance report.
2. Design on a Two-Foot Grid

Design your house on a two-foot grid
• Stacked framing
• Most efficient use of materials
• Best labor savings
3. Orient the house for solar and simplify the roof design

Simple!

Complex!
3. Orient the house for solar and simplify the roof design
4. Use engineered wood solutions

Use engineered solutions
• Roof trusses
• Floor trusses
• I-joists
• Laminated veneer lumber (LVL) beams and headers
• Stronger, less warping, less waste, less labor

Engineered Solutions:
• SIPs
• laminated beams
• engineered rim joist
• metal “stud” spacers for service chase

Parallel chord roof trusses provide deep cavity for significant insulation.

T-studs =
• High R-value
• Thermal break
• Faster, less wood than a double-stud wall
5. Advanced Framing

Advanced Framing Saves Time and Money
- Single top plates
- Two and three-stud corners
- Ladder blocking at intersecting walls
- Open and insulated headers
- Advanced framing can save $1,000 per home.
5. More Advanced Framing

Traditional Framing

Advanced Framing Techniques

Exterior sheathing

Studs

Drywall

24-inch on center

King stud

Jack stud

Cripple stud

Single top plate

Jack studs eliminated

King stud

Studs

Drywall clip

Drywall
6. Understand Manuals J, D, S, and T and design mechanical systems upfront

Great HVAC design
• All ducts in conditioned space
• Short straight duct runs
• Interior throws
• = Lower cost, better comfort
7. Bring ductwork into conditioned space

- Reduce thermal losses through ducts
- Lessen duct exposure to hot and cold
- Reduce risk of condensation in hot climates and ice dams in cold climates
7. Bring ductwork into conditioned space, more

Trunk duct is tucked into an insulated chase built into trusses.
7. Bring ductwork into conditioned space, more

Mini-split fits in insulated chase built into trusses.
7. Bring ductwork into conditioned space, more

Mini-split options are proliferating!
8. PEX Plumbing with Central Manifold

PEX central manifold plumbing design
• Simple, flexible, simple quick home run water distribution.
• Gets hot water to taps quicker, less hot water down the drain.
A homerun PEX line to each device.
9. Specify air sealing details in plans

Sealing air leaks
• Saves energy
• Stops drafts
• Keeps out moisture
• Keeps out bugs
10. The Basic Box is the Most Efficient Design

Think Farmhouse!

Pretty it up with
- a front porch
- a gable over the entry
- windows
- stone or brick facade
- good landscaping

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Affordable ZERH – Cold Climate 5A

**Walls:** 2x6, 24" o.c., R-31 total: 5.5" open-cell spray foam in cavity, 1.5" R-6.5 insulated coated OSB sheathing, vinyl siding.

**HVAC:** 2 single-head ductless heat pumps, 14.2 HSPF, 33.0 SEER. In-wall transfer fans.

**Solar:** 7.75-kW rooftop panels
Affordable ZERH – Cold Climate 5A

Net Monthly Cash Flow to Home Buyer without PV: $135

Net Monthly Cash Flow to Home Buyer with PV: $220

Added Cost before PV: $12,290

Hartford Habitat for Humanity
Hartford, CT
hartfordhabitat.org
Project: Roosevelt Zero Energy Home
Hartford, CT

1,280 ft²
3 bedrooms, 1.5 bath, 2 floors
5A cold, Affordable

HERS -7
This home’s score with PV

$10
Average Monthly Energy Bill
Calculated

$4,000
Annual Savings
Calculated versus typical new homes

$167,000
Saved in the First 30 Years
Includes fuel escalation rate, 2019 EIA Energy Outlook
Affordable ZERH – Mixed Humid 4A

Walls: 2x6, 24" o.c., R-33 total: 1-1/8" graphite EPS foam topped by 1/2" OSB, textured house wrap, spruce and engineered wood siding and trim.

HVAC: Ducted and ductless mini-split heat pumps, 9.6 HSPF, 15.5 SEER.

Solar: 9.2-kW PV
Affordable ZERH – Cold Climate 5A

Net Monthly Cash Flow to Home Buyer without PV: $96

Net Monthly Cash Flow to Home Buyer with PV: $284

Added Cost before PV: $18,000
Affordable ZERH – Marine Climate 3C

**Walls:** Panelized walls, R-21 total: 2x6, 24" o.c., R-21 cavity insulation, structural sheathing, 2-ply draining house wrap, cement plaster or fiber cement lap siding.

**HVAC:** Mini-split heat pump, 9.5 HSPF, 19 SEER

**Solar:** 2.5-kW, battery storage
Affordable ZERH – Marine Climate 3C

Net Monthly Cash Flow to Home Buyer without PV: 
$-29

Net Monthly Cash Flow to Home Buyer with PV: 
$-18

Added Cost before PV: $8,000
Affordable ZERH – Hot Dry 3B

Walls: 2x6, 16" o.c., R-23 total: blown fiberglass cavity insulation, OSB sheathing, house wrap, composite siding.

HVAC: Mini-split heat pump, 10 HSPF, 23 SEER

Solar: 166.4 kW, community solar
Affordable ZERH – Hot Dry 3B

Net Monthly Cash Flow to Home Buyer without PV: $26

Net Monthly Cash Flow to Home Buyer with PV: $66

Added Cost before PV: $3,200

Mutual Housing California
Sacramento, CA
mutualhousing.com
Project: Mutual Housing at Spring Lake Phase 2
Woodland, CA

ZERO ENERGY READY HOME
U.S. DEPARTMENT OF ENERGY

943* ft²
2 bedrooms, 2 bath, 1 floor
3B hot-dry, Affordable Multifamily [*Average per unit]
HERS 29%
better than 2016 CA Title 24

$2
Average Monthly Energy Bill
Calculated

$1,700
Annual Savings
Calculated versus typical new homes

$70,200
Saved in the First 30 Years
Includes fuel escalation rate, 2019 EIA Energy Outlook
Section II: Why a DOE Zero Energy Ready Home is Affordable
True Affordability

Are homes affordable if they don’t help minimize:

- Comfort Expenses;
- Maintenance Expenses; and
- Health Expenses

...while Optimizing Future Value?
Habitat for Humanity and DOE ZERH

- **Chapters Registered as Builder Partners**
  - 22 Affiliates
  - 14 States

- **Certified Homes**
  - ~95 Homes
  - 13 Affiliates
  - 10 States

- **Housing Innovation Awards**
  - 12 Awards
  - 6 Affiliates
  - 3 States
DOE ZERH HIA Grand Winners - Affordable
DOE ZERH and QAPs

The Zero Energy Ready Home program is always working to find new opportunities for builders and developers to introduce new single and multi-family high performance homes into the market all across the country.

- One unique policy effort to do this is through getting ZERH directly referenced in individual state Qualified Allocation Plans, or QAP’s. Over 70% of states currently award points for Energy Efficiency through their QAP’s.*

- The QAP outlines housing priorities of each state and creates the rules by which Low Income Housing Tax Credits (LIHTC) applications are scored and credits awarded.

* - Source: National Housing Trust. “Low Income Housing Tax Credits & Energy Efficiency Policies.”
DOE ZERH is recognized by the following states:

- Colorado
- Connecticut
- Delaware
- Ohio
- Georgia
- New Jersey
- Ohio
- Pennsylvania
- Virginia
- Washington, D.C.
DOE ZERH will be recognized in these states in 2021

DOE ZERH will be added to the QAP for the following states in 2021:

• Minnesota (15 additional LIHTC application points)
• Maryland (6 additional LIHTC application points)
THANK YOU

Join the conversation:
#2020EEBAVirtualSummit #eeba #goeeeba

Save the dates for next year!
**SEPT 14 – 16 2021**
Denver, CO