

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

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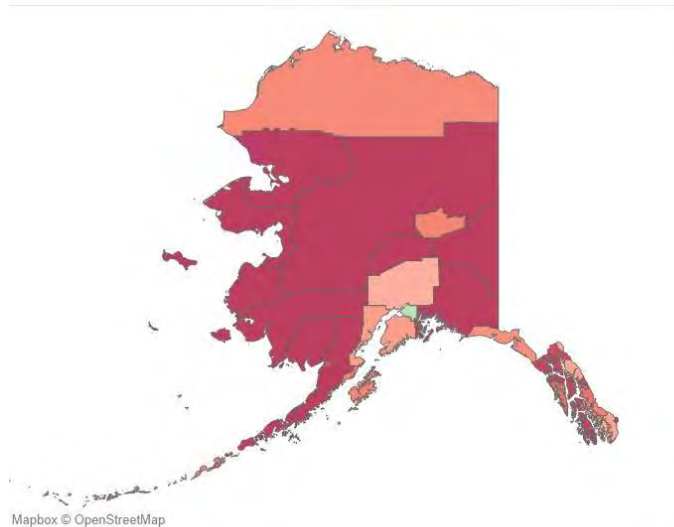
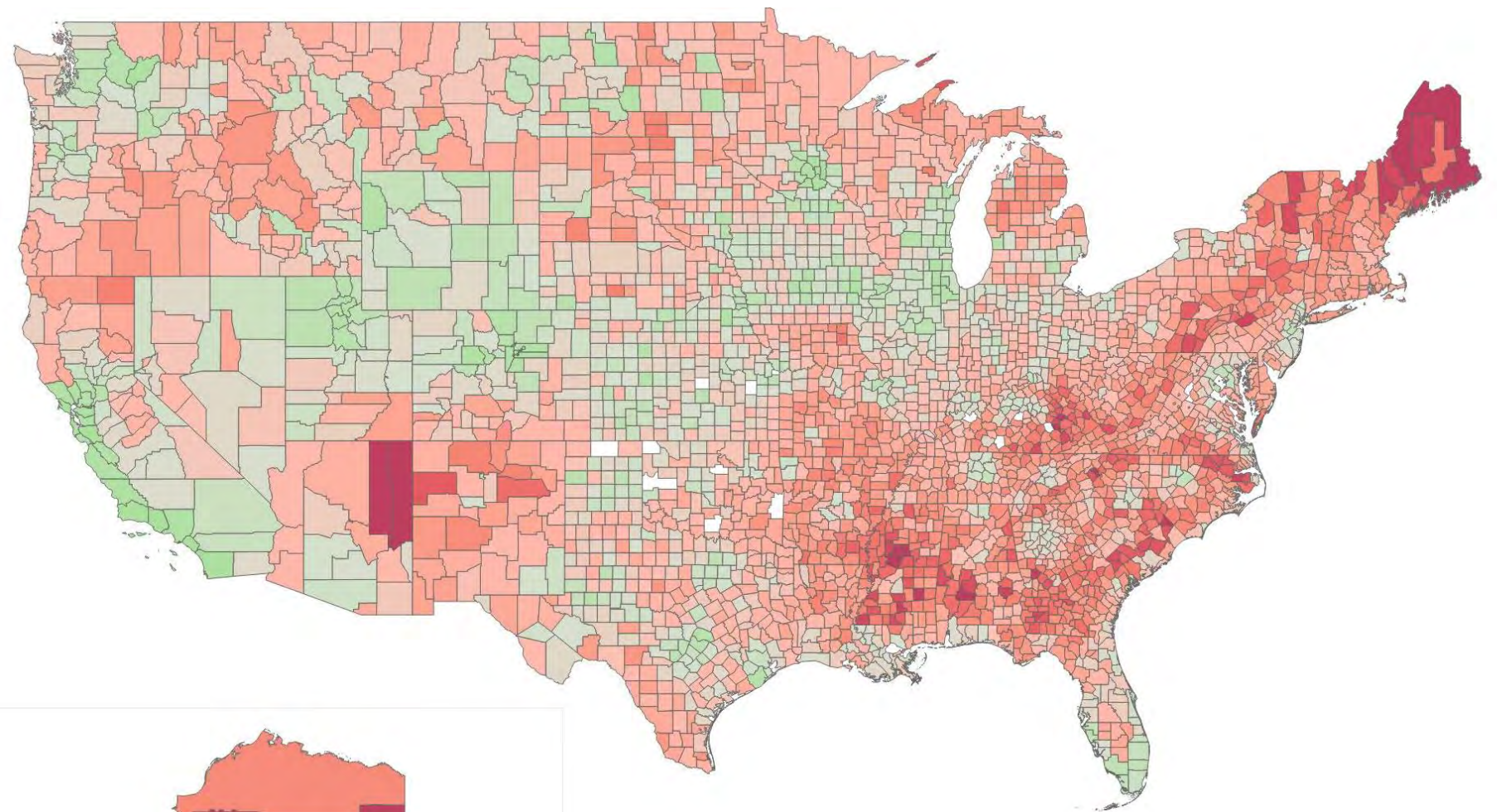
Nov. 2, 2020, Virtual



VIRTUAL HIGH PERFORMANCE
HOME SUMMIT 2020

SEPT 29 - OCT 9 | ONLINE VIA WHOVA

Energy Burden



For low-to-moderate-income households



0% Percent of Income Going to Energy Costs 50%



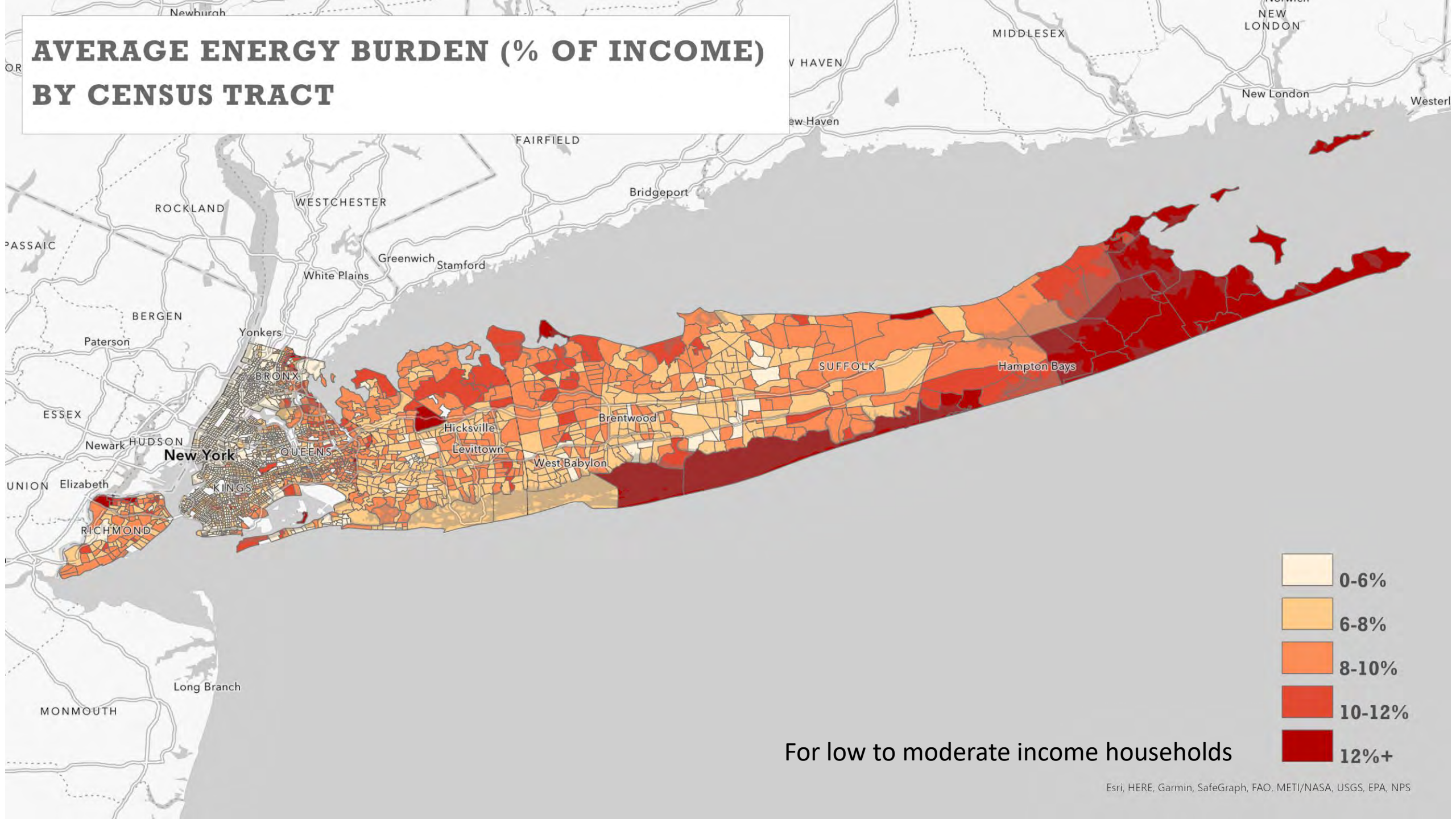
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AVERAGE ENERGY BURDEN (% OF INCOME) BY CENSUS TRACT



For low to moderate income households

True Affordability – A Tale of Two Houses



Lowest first cost HUD home



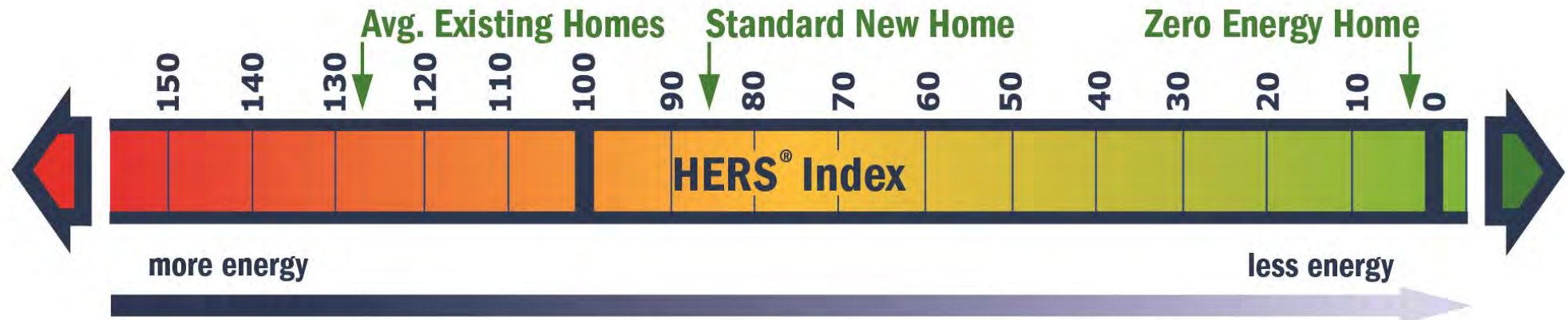
A DOE ZERH home

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.
6. Understand Manual J, D, S, and T, and design mechanicals upfront.
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.

The screenshot displays the REM/Design v 16.0.2 software interface. The main window is titled "REM/Design v 16.0.2 - HighEfficiency.blg". The menu bar includes File, Building, View, Extras, Libraries, Reports, Tools, and Help. The toolbar contains various icons for file operations and analysis. The "Floor Properties Summary" table shows one entry: "1 Frame Floor" with Type "R-30" and Area "1500". Below this table are buttons for "New", "Delete", and "Copy". The "Floor Properties" section includes fields for Name ("Frame Floor"), Area (sq ft) ("1500"), Type ("R-30" with a dropdown arrow), and Location ("Between conditioned space and enclosed crawl space" with a dropdown arrow). The "Analysis" panel on the right shows results updated at 02:06:11 PM. It includes sections for Design Loads (kBtu/hr), Annual Loads (MMBtu/yr), Annual Consumption (MMBtu/yr), and Annual Energy Costs (\$/yr). The bottom status bar indicates "Detailed" mode and the location "Denver Intl AP, CO" with the date "11/02/20".

#	Name	Type	Area
1	Frame Floor	R-30	1500

Design Loads (kBtu/hr)	
Heating	16.1
Cooling	17.7

Annual Loads (MMBtu/yr)	
Heating	11.1
Cooling	13.2
Water Heating	6.5
WH w/out Ta...	14.3

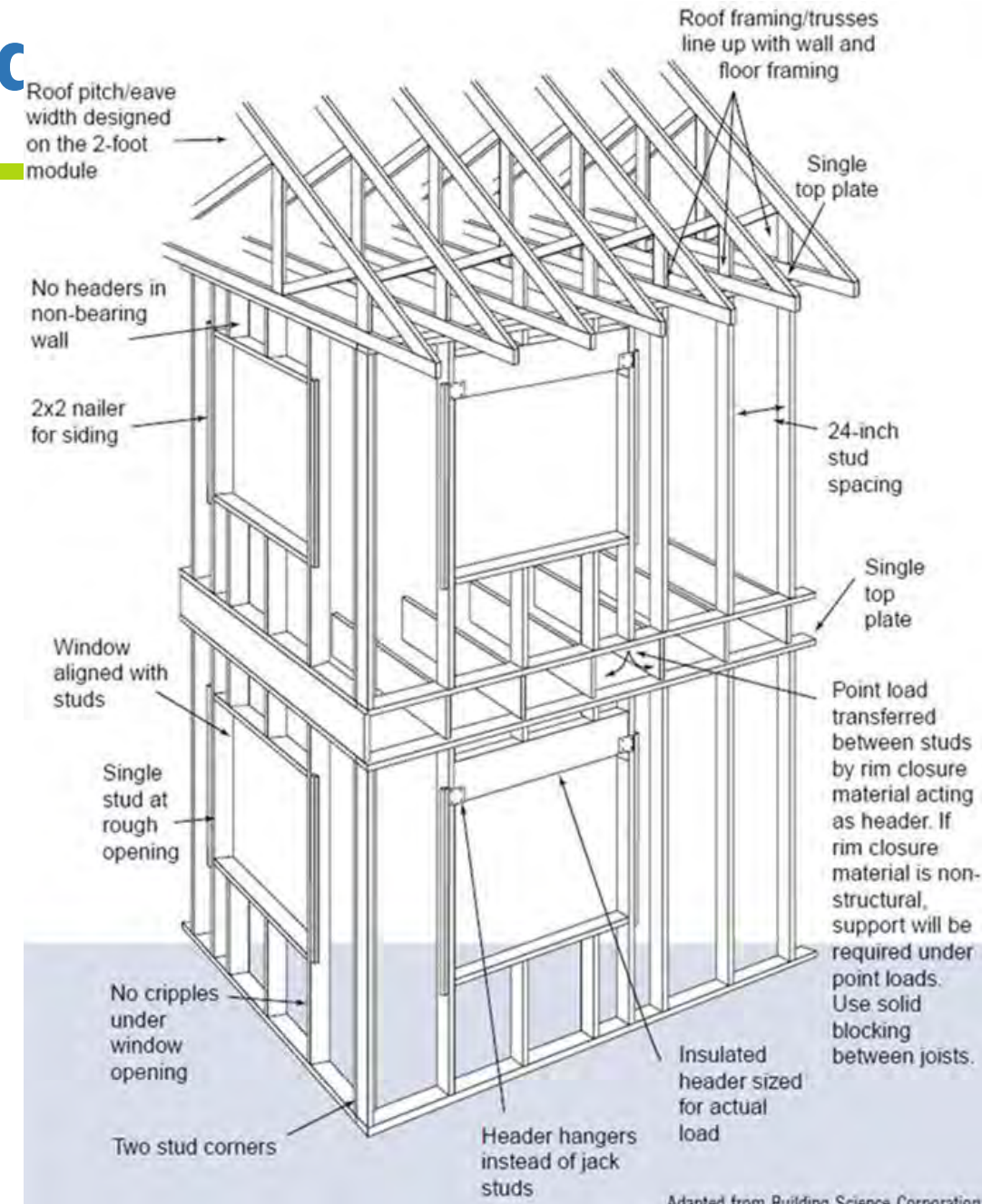
Annual Consumption (MMBtu/yr)	
Heating	12.6
Cooling	3.6
Water Heating	8.1
Lights and Ap...	28.8
Photovoltaics	-5.1
Total	47.9

Annual Energy Costs (\$/yr)	
Heating	72
Cooling	84
Water Heating	40
Lights and Ap...	674
Photovoltaics	-119
Service Charge	120
Total	872

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

Parallel chord roof trusses provide deep cavity for significant insulation.



Engineered Solutions:

- SIPs
- laminated beams
- engineered rim joist
- metal “stud” spacers for service chase



T-studs =

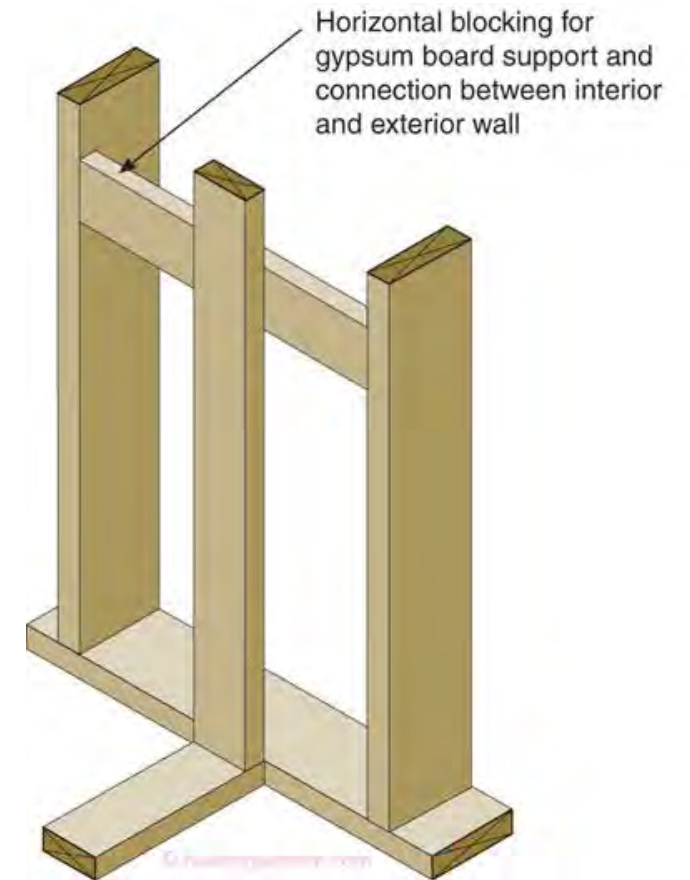
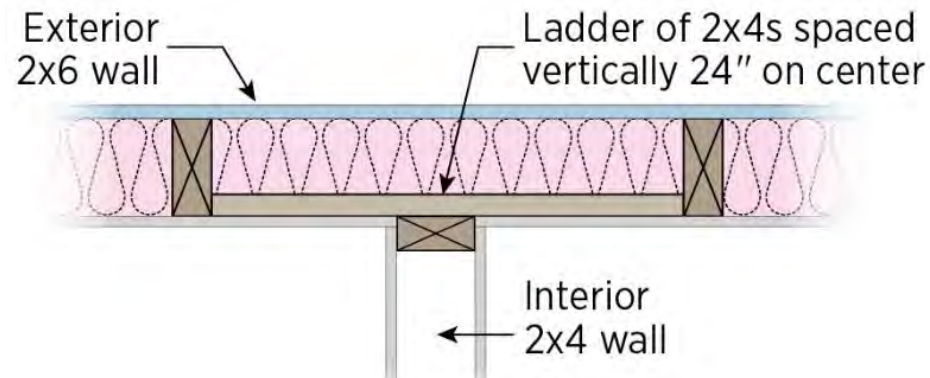
- High R-value
- Thermal break
- Faster, less wood than a double-stud wall



5. Advanced Framing

Advanced Framing Saves Time and Money

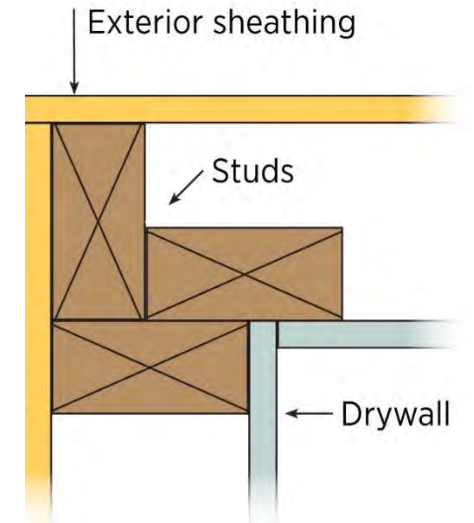
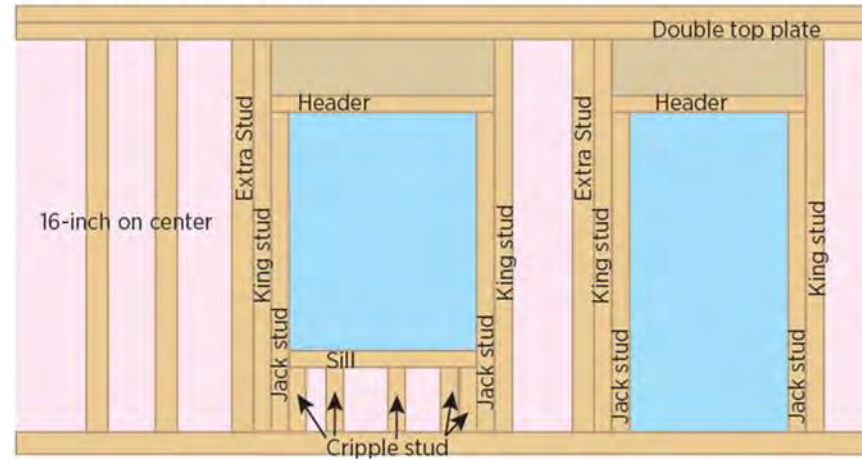
- Single top plates
- Two and three-stud corners
- Ladder blocking at intersecting walls
- Open and insulated headers
- Advanced framing can save \$1,000 per home.



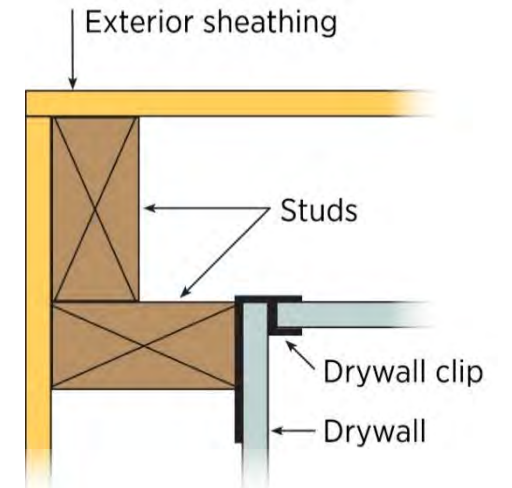
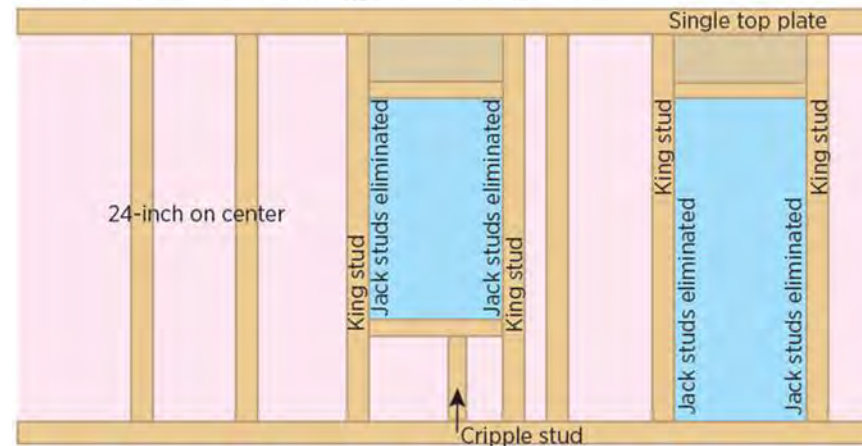
5. More Advanced Framing



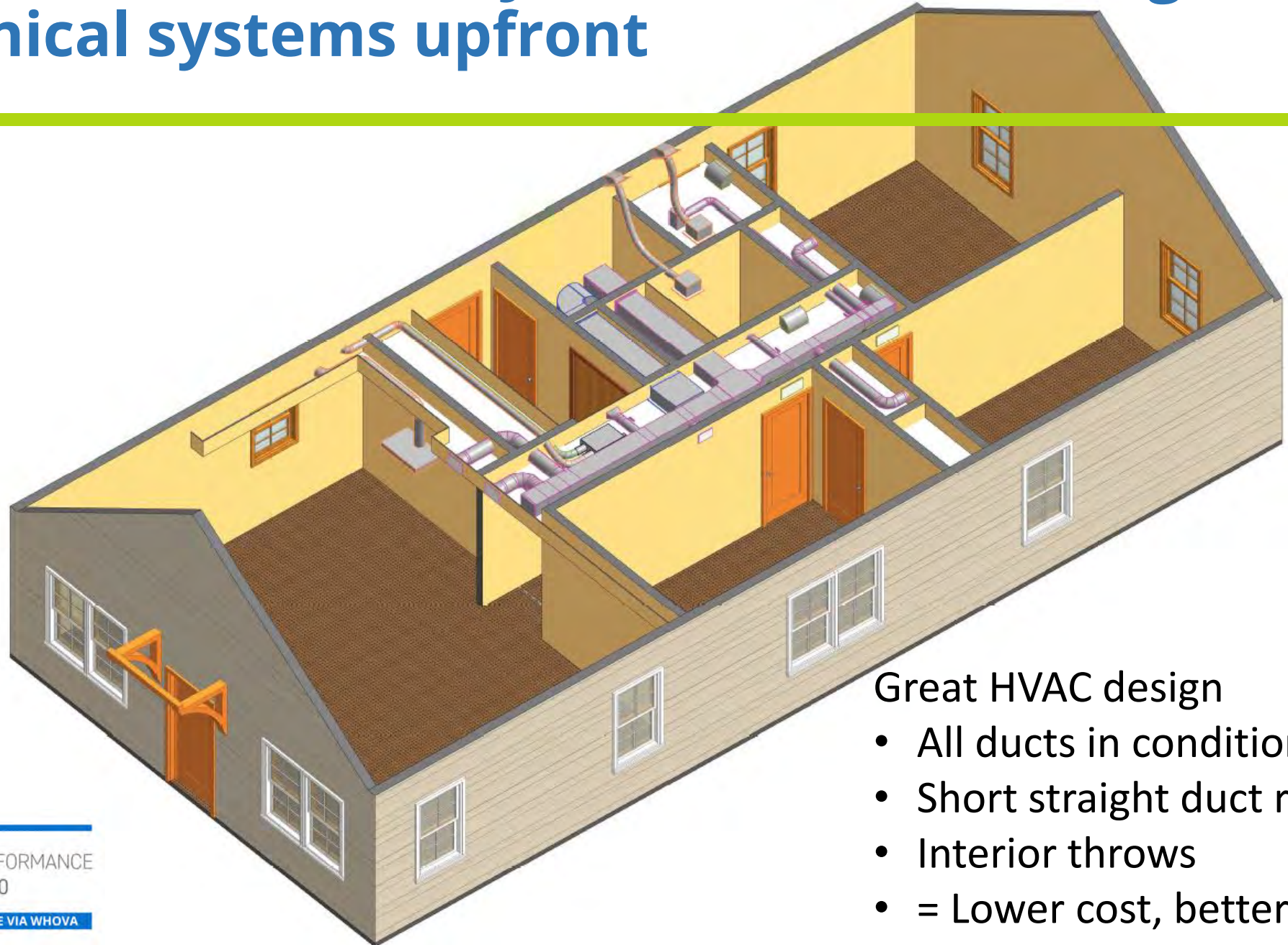
Traditional Framing



Advanced Framing Techniques



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



Great HVAC design

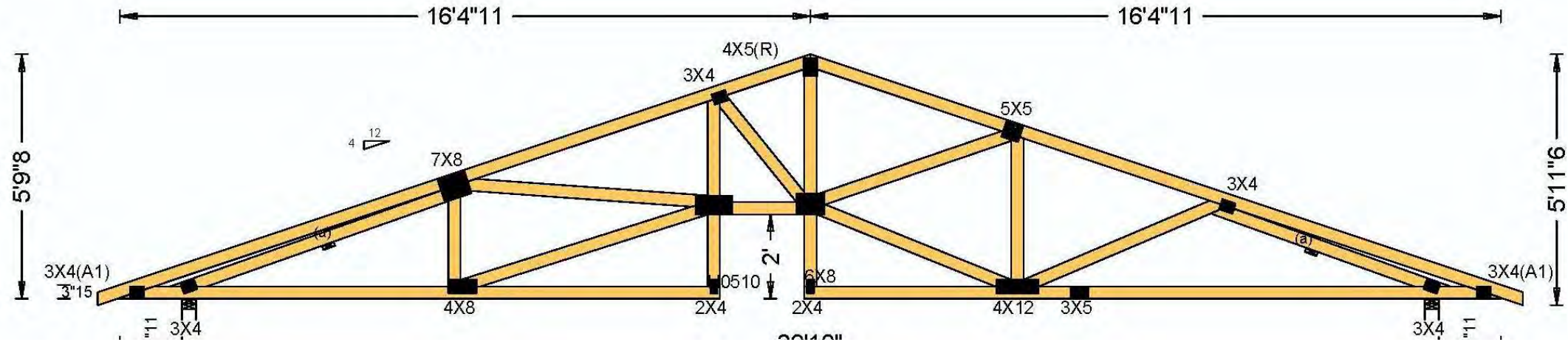
- All ducts in conditioned space
- Short straight duct runs
- Interior throws
- = Lower cost, better comfort

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!



NEW CONSTRUCTION RECOMMENDED UNIT HORIZONTAL-DUCTED

Save space and energy with a low-profile ducted system that can help you manage the comfort conditions of each room independently.

OTHER NEW CONSTRUCTION SOLUTIONS



WALL-MOUNTED
HEATING AND COOLING



RECESSED CEILING
CASSETTES AND
CEILING SUSPENDED



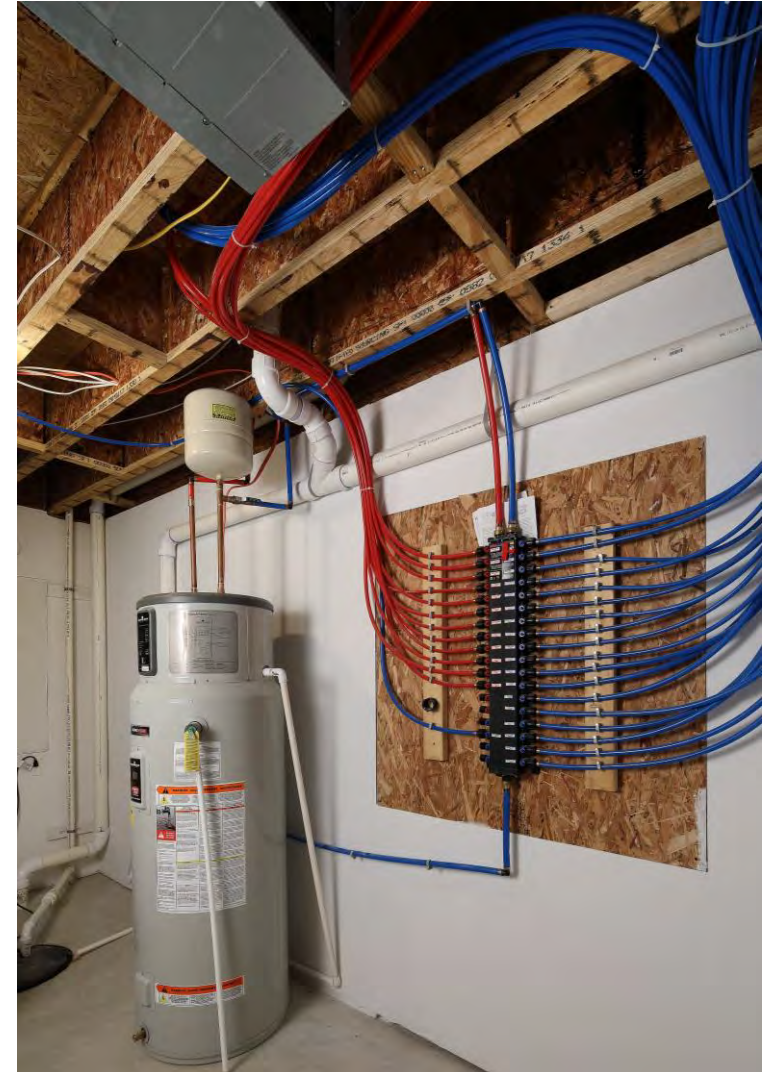
DUCTED AIR HANDLER

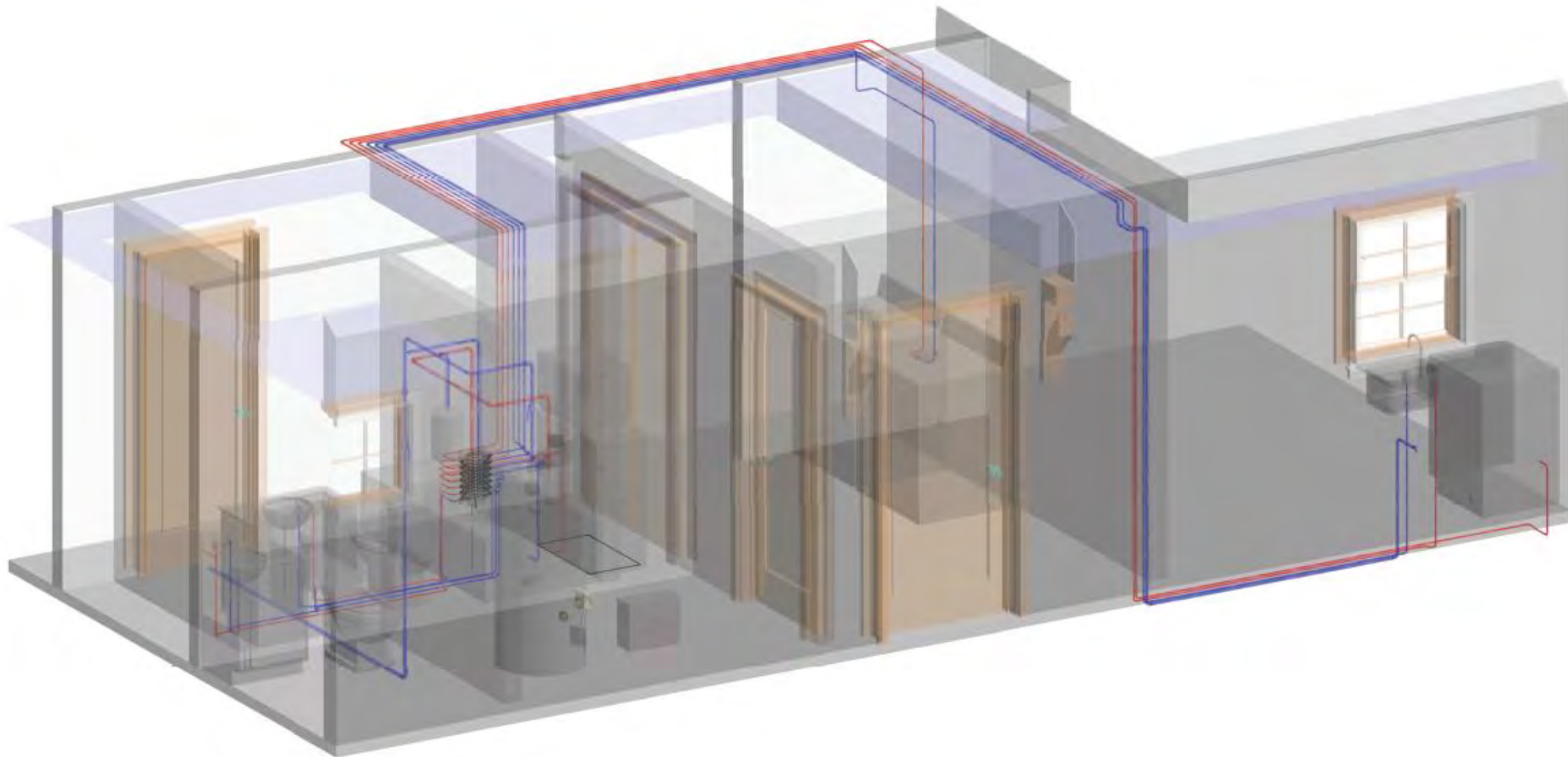


FLOOR-MOUNTED

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.



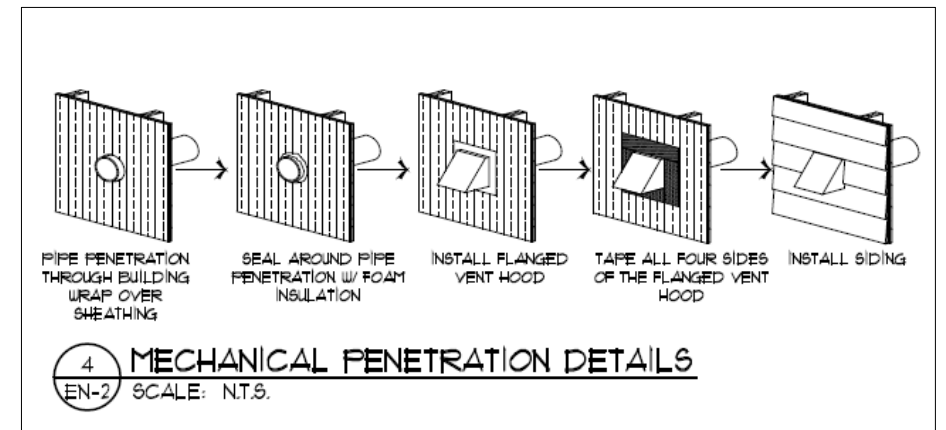
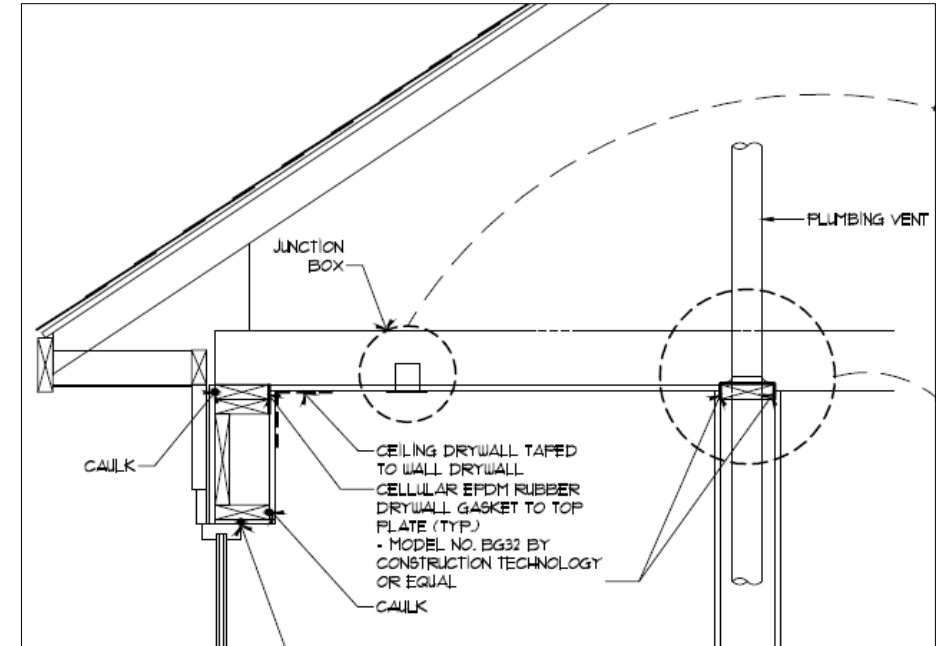
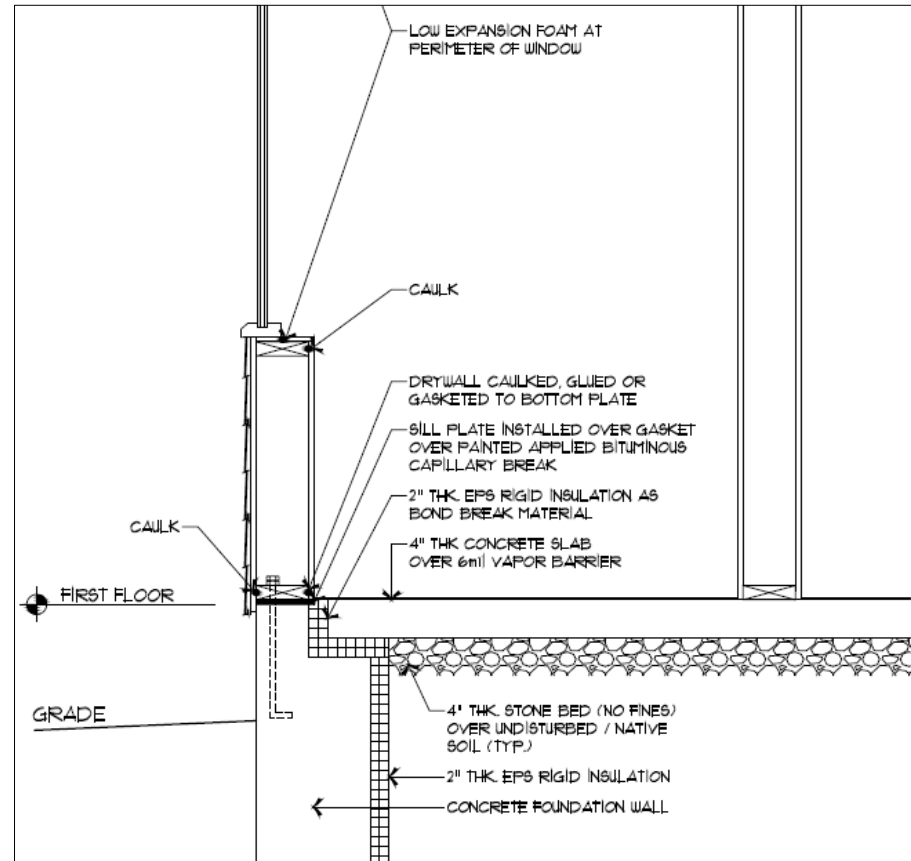


A homerun PEX line to each device.

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



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



\$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**



United Way of Long Island

Deer Park, NY

UnitedWayLI.org

Project: Net-Positive All-Electric Home
Port Jefferson Station, NY



2,500 ft²

5 bedrooms, 2 bath, 2 floors
4A mixed-humid, Affordable Multifamily

HERS -2



This home's score with PV



\$0

Average Monthly Energy Bill

Calculated

\$5,250

Annual Savings

Calculated versus typical new homes

\$218,800

Saved in the First 30 Years

Includes fuel escalation rate, 2019 EIA Energy Outlook



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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



Housing Authority of the City of San Buenaventura
Rancho Verde Apartments | Ventura, CA | HACityVentura.org



"Aggregating all the metrics of the built environment...to leverage the greatest returns." Green Dinosaur



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



**Housing Authority of the
City of San Buenaventura**

Ventura, CA

HacityVentura.org

Project: Rancho Verde Apartments
Ventura, CA



1,107 ft²

2 bedrooms, 1 bath, 1 floor
3C marine, Affordable Multifamily

HERS 0 est.

This home's score with PV



\$0

Average Monthly Energy Bill
Calculated

\$800

Annual Savings

Calculated versus typical new homes

\$32,900

Saved in the First 30 Years

Includes fuel escalation rate, 2019 EIA Energy Outlook

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



943* ft²

2 bedrooms, 2 bath, 1 floor
3B hot-dry, Affordable Multifamily [*Average per unit]

HERS 29%

better than 2016 CA Title 24

This home's score with PV ▼



\$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



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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 #goeeba

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

