High Performance Houses

Agenda

- Introduction
- What makes a High Performance Home
- Healthy homes
- Comfortable homes
- Energy efficient homes
- Identifying a HPH / Rating Systems
- Examples of HPH
- Intro to Heat Pumps and key systems
- Housing Envelope
- Listing and marketing HPH
- Solar / Electric Cars / Misc

What makes a High Performance House?

Heathy

Comfortable

Energy Efficient

Affordable

Sustainable

Resilient

https://www.rateitgreen.com/green-building-community/discussions/what-is-a-high-performance-home/1634

Healthy Indoor Air Quality (IAQ)

Humidity control- Moisture contributes to mold and mildew, as well as mites, roaches and rodents. Houses should be kept between 30-50%.

Reducing pollutant sources- Asbestos, radon, natural gas byproducts, dust control.

Carbon Monoxide less than 35ppm

PM2.5 / formaldehyde / vocs – vent outside

Radon – mitigation system

https://www.epa.gov/air-quality/indoor-air-quality

Healthy Indoor Air Quality (IAQ)

Ventilated- Respiratory health is dependent on fresh, clean air. Monitor indoor air quality (IAQ). Promotes continuous fresh air.

Use bath fans, kitchen fans, ERV. ERV in winter helps bring in moisture. ERV in summer helps keep out moisture.

https://www.greenbuildingadvisor.com/article/why-you-probably-need-an-erv-not-an-hrv

IAQ Monitoring

Comfort

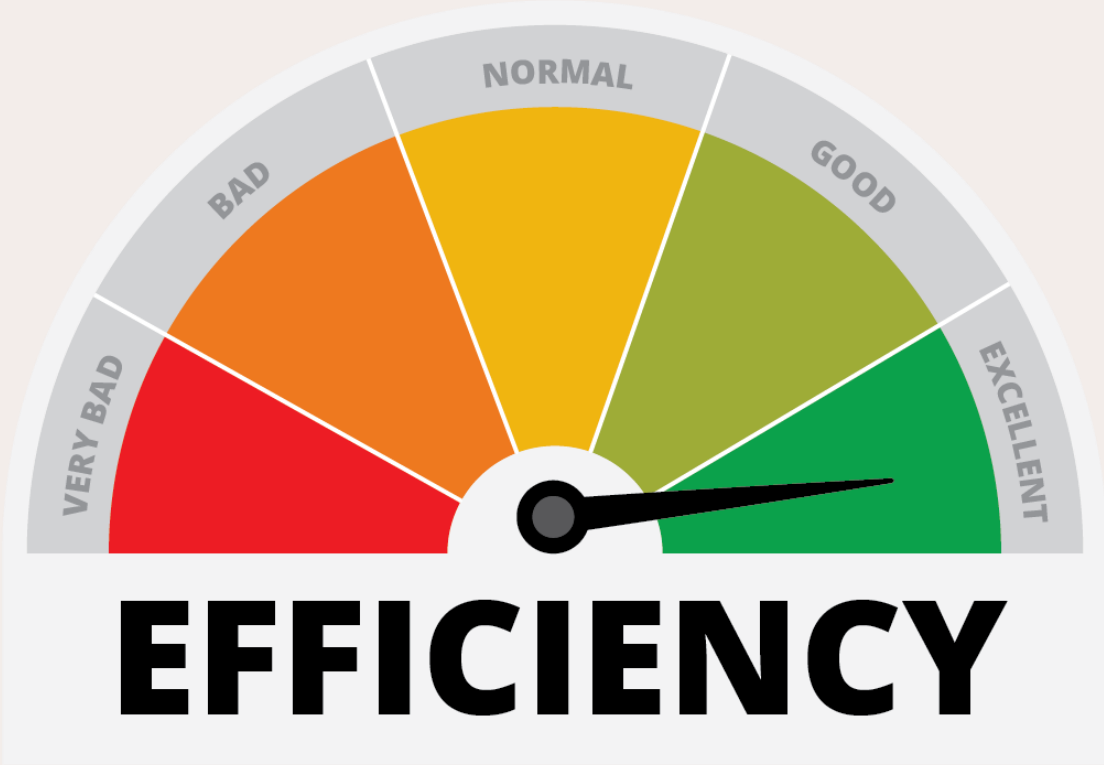
The primary focus of a house is to maintain comfort. In order to do so, we want the walls, the ceilings, and floors to be above 68 degrees in the winter, and below 78 in the summer (greenbuildingadvisor.com).

https://www.energy.gov/energysaver/home-comfort

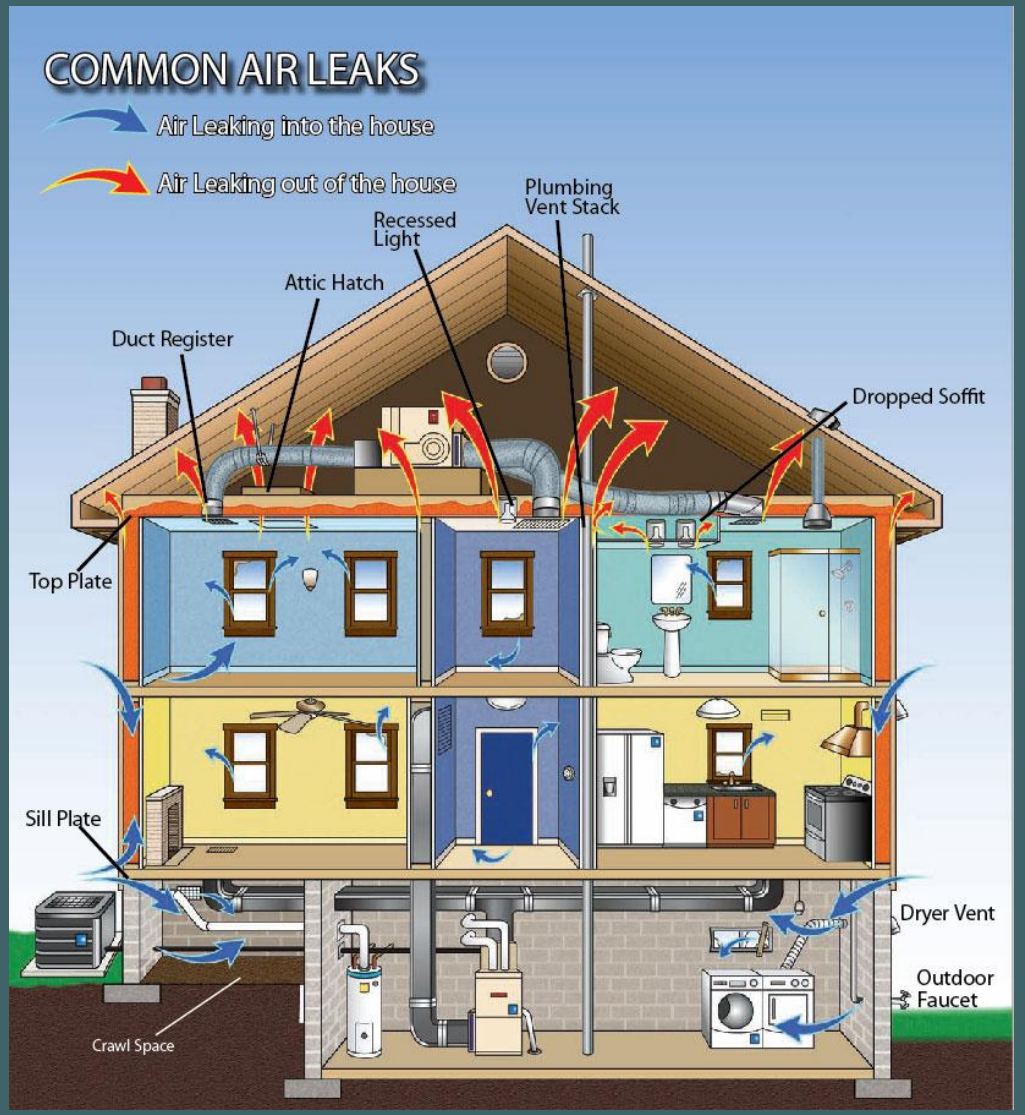
Efficient

When we create a more efficient house, we can have smaller systems to condition the house. Smaller air conditioners, smaller furnaces, etc.

Being more efficient also leads to lower running costs because you are using less energy.



Where do we lose energy in a house?



https://www.energy.gov/ (note this image has since been removed from EPA website)

Heat Loss

Heat Created:

- Furnace / boiler
- Water heater
- Appliances (stove, dryer)
- Humans
- Solar gain

Heat Loss:

- Windows / Doors
- Roof
- Attic Bypasses
- Cracks
- Lack of insulation
- Gaps in insulation
- Exhaust fans
- Attic hatch

Stopping Heat loss

- Attic bypasses (electrical fixtures, plumbing lines, attic hatch)
- Add Attic insulation
- Seal penetrations and cracks
- Add sill plate insulation
- Seal air leaks around doors and windows
- Install triple-pane windows
- Add wall insulation
- Seal attic hatch. Add weather stripping to the opening, and insulation to the hatch itself.

Temperatures

Days	Temp	2021	2022	2023	2024	2025	Average
Temp below	60	1	4	7	1	2	3
Temp below	55	8	5	2	5	8	5.6
Temp below	50	9	7	5	8	14	8.6
Temp below	45	15	7	8	19	12	12.2
Temp below	40	17	14	12	18	16	15.4
Temp below	35	44	26	18	30	26	28.8
Temp below	30	30	18	29	44	24	29
Temp below	25	25	13	29	27	10	20.8
Temp below	20	18	12	18	9	14	14.2
Temp below	15	16	13	17	4	10	12
Temp below	10	6	16	11	5	13	10.2
Temp below	5	7	15	14	4	9	9.8
Temp below	0	3	14	3	4	12	7.2
Temp below	-5	4	8	6	2	5	5
Temp below	-10	5	3	3	0	3	2.8
Temp below	-15	2	2	0	0	2	1.2
Temp below	-20	0	0	0	0	0	0

https://www.dnr.state.mn.us/climate/historical/daily-data.html?sid=mspthr&sname=Minneapolis/St%20Paul%20Threaded%20Record&sdate=2020-01-01&edate=por

What is a Heat Pump?

Heat Pump

A unit that moves heat from one place to another. This involves a compressor and refrigerant, rather than burning fuel to generate heat.

Energy Cost Comparison: gas vs electric

Natural Gas furnace is typically 90% to 95% efficient.

Electric resistance heat (baseboard radiator) is 100% efficient.

But natural gas is about 1/3 the cost of electricity per heating unit

Natural Gas $1.258 / therm (100,000 btu or 29kwh) = $0.043 / kwh

Electricity $0.13/kwh

Therefore, electric resistance heat is 3x the cost of natural gas heat.**

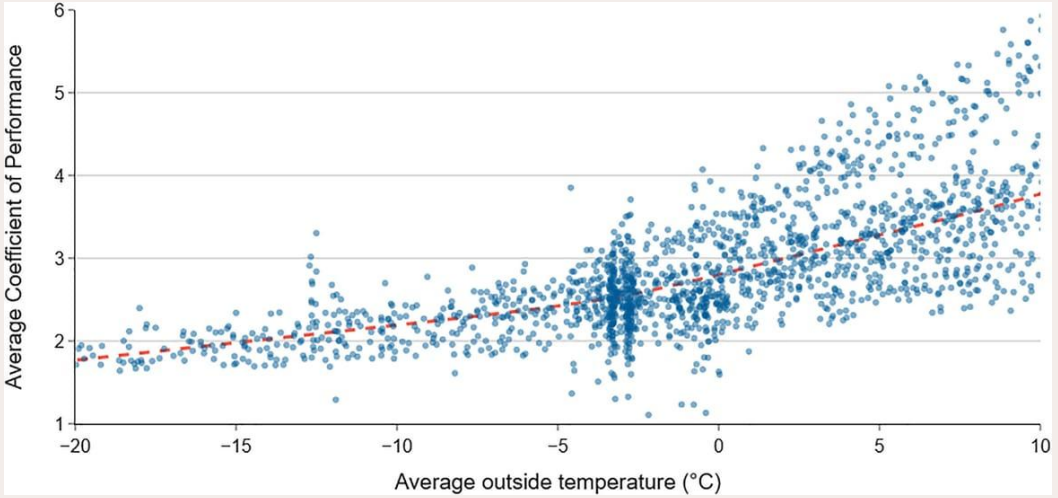
** Electric space heating rate, Oct-May $0.06537/kwh and Jun-Sep $0.13069. This makes electricity ½ of normal electricity rate, but still a little bit higher than gas.

Heat Pump Efficiency

Heat pump is 300% to 400% efficient, meaning you can move 3 to 4 times the amount of heat with 1 unit of energy at higher temps, i.e. 75 to 85 degrees. This is because heat pumps don't create heat. They move heat.

The efficiency drops as the temperature outside lowers, down to 150% - 300%

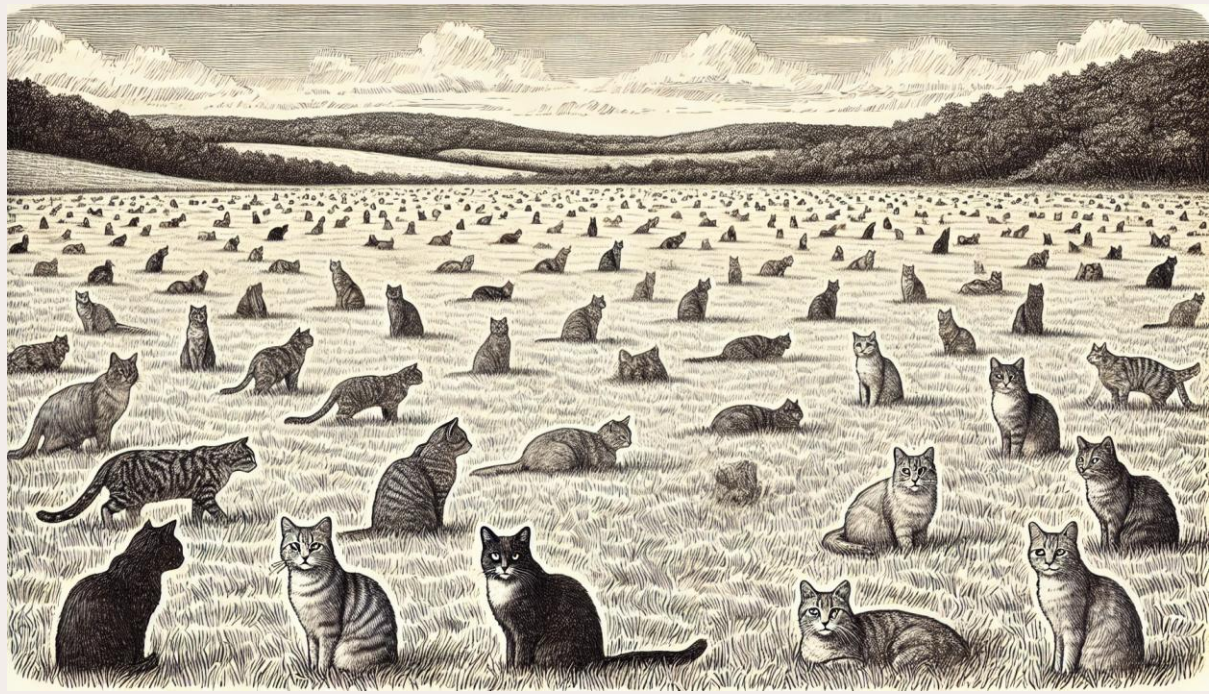
85 degrees = 450% efficient
40 degrees = 320%
30 degrees = 275%
20 degrees = 230%
10 degrees = 208%
0 degrees = 180%
-10 degrees = 170%
-20 degrees = 150%



https://www.energy.gov/energysaver/heat-pump-systems
https://spectrum.ieee.org/heat-pumps-explained

Heat Pump Efficiency

It’s like herding cats.



Heat Pump Air Conditioners

A heat pump air conditioner, is an air conditioner that can run in reverse. This means it can cool a house, just like a normal air conditioner, but it can also heat a house.

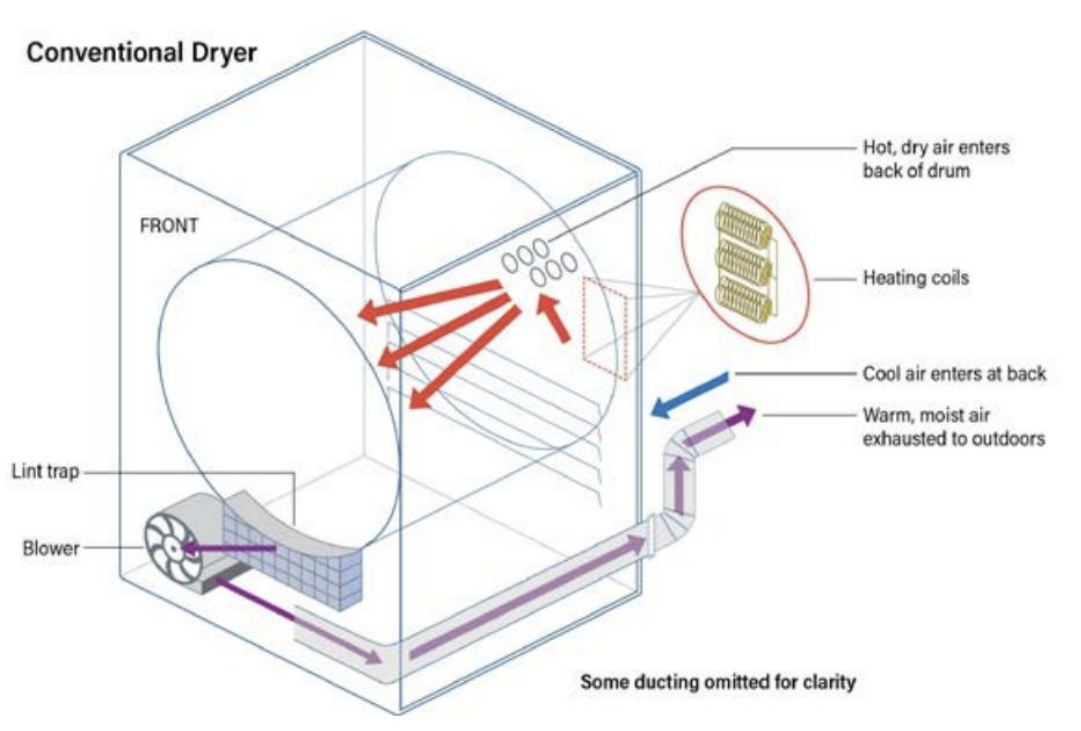
This is called a “Heat Pump” instead of an air conditioner. When you hear “we have a heat pump” this is what people are referring to.

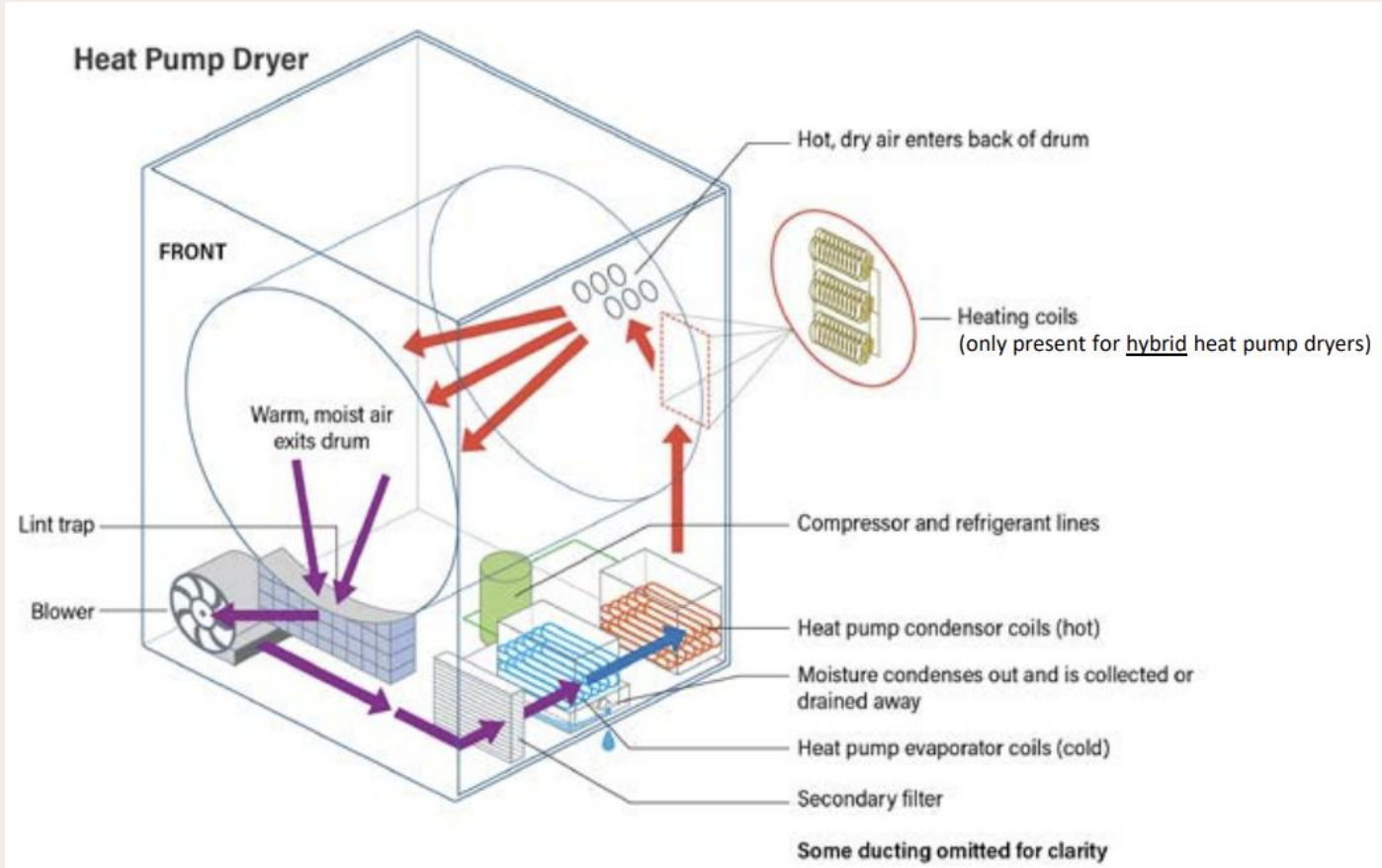
Heat Pump Air Conditioners – heating mode

Furnace Type	BTU/hr		Hours/day	day/mo	btu/mo	kwh/mo	$/kwh	Total/mo
Natural gas	120000	95%	7	30	25,200,000	7385.70	0.043	$ 317.58
Std Electric	120000	100%	7	30	25,200,000	7385.70	0.13	$ 960.14
Heat Pump	42857	280%	7	30	9,000,000	2637.75	0.06537	$ 172.43

Heat pump dryer

Conventional vs Heat pump dryer





Gas Dryer / Electric Dryer / Heat Pump Dryer

- Gas dryer 19,000 BTUs per load = 2.9 * 2 = 5.9 kwh per load
- Elect dryer 5.6 kwh per load
- Heat pump dryer 1.9 kwh per load

- Dryer uses 9000 cubic feet per hour of air
- 45,000 btu to heat house 1000sqft per hour, 9000 cu ft, 13 kwh

- Gas dryer = 19.7 kwh
- Electric dryer = 18.7 kwh
- Heat pump dryer = 1.9 kwh

https://www.energystar.gov/sites/default/files/asset/document/ENERGY_STAR_Scoping_Report_Residential_Clothes_Dryers.pdf

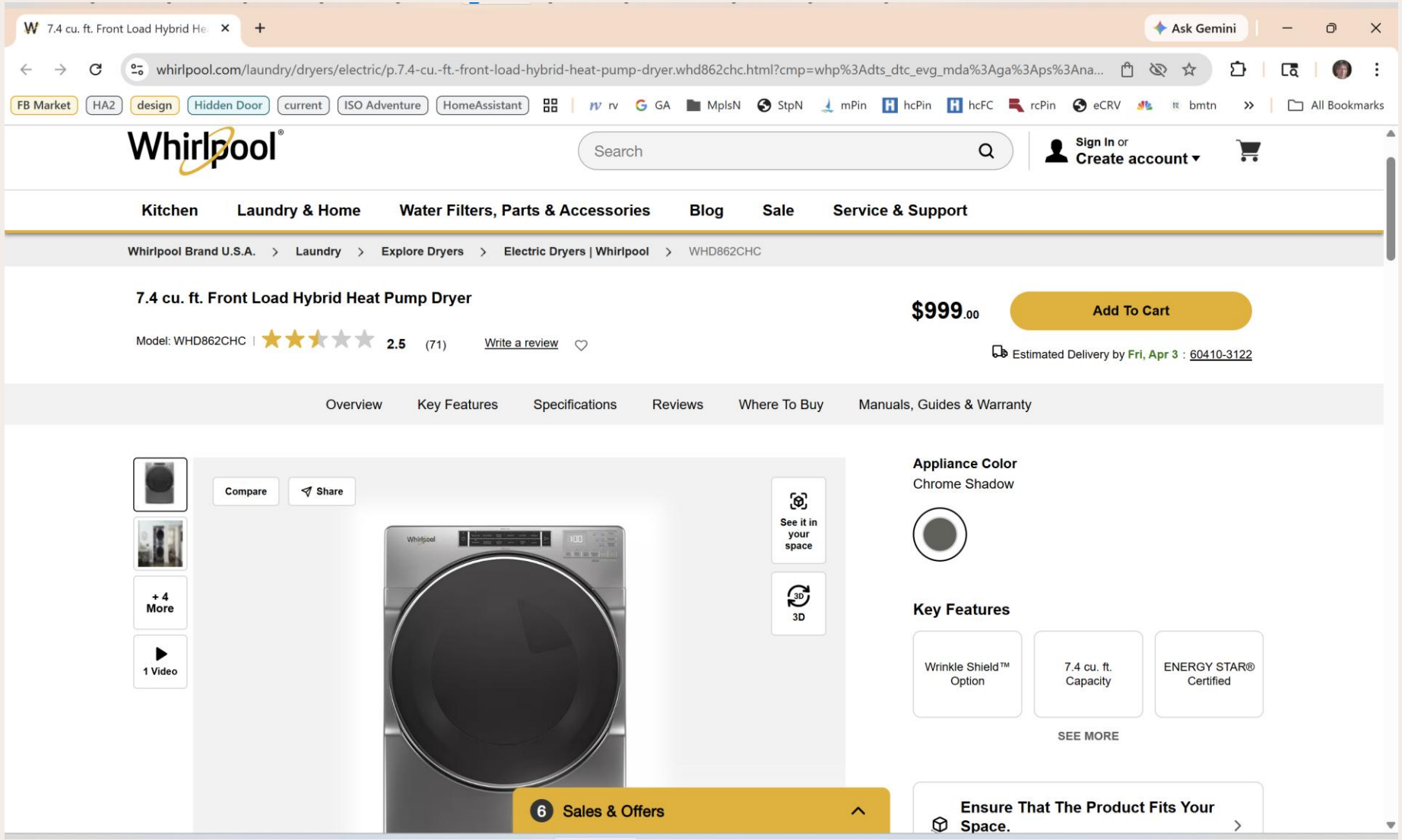
Gas Dryer

Dryer Type	BTU	efficiency	hours/day	days	btu/mo	kwh/mo	$/kwh	Total cost
Natural gas	19,000	95%	1	1	20,000	5.86	0.043	$ 0.25
Std Electric	19,000	100%	1	1	19,000	5.57	0.13	$ 0.72
Heat pump	4,750	400%	1	1	4,750	1.39	0.13	$ 0.18

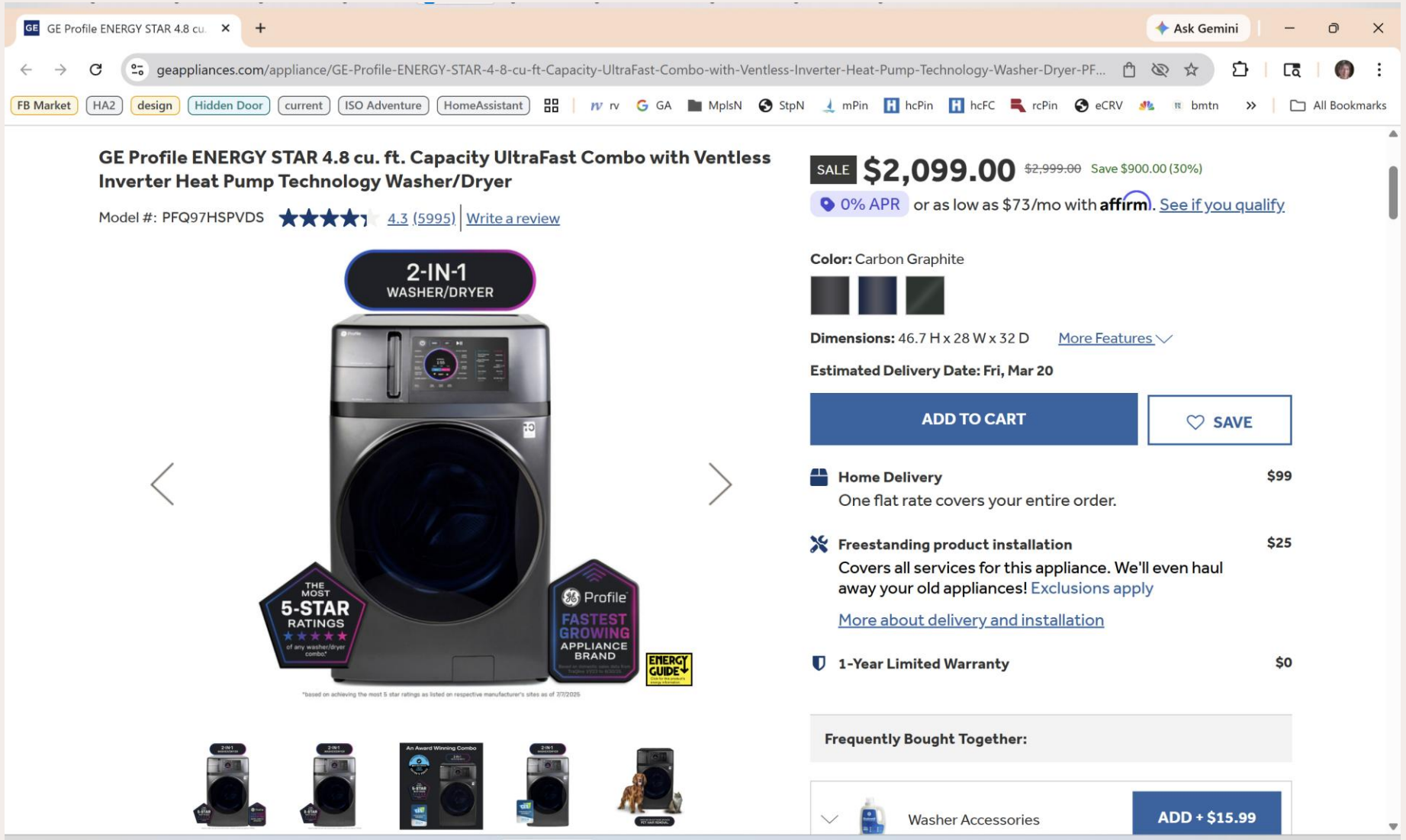
Dryer incl. heating	BTU	efficiency	hours/day	days	btu/mo	kwh/mo	$/kwh	Total cost
Natural gas	64,000	95%	1	1	67,368	19.74	0.043	$ 0.85
Std Electric	64,000	100%	1	1	64,000	18.76	0.13	$ 1.32
Heat pump	4,750	400%	1	1	4,750	1.39	0.13	$ 0.18

Over the course of 10 years, 4.16 loads per week, 2163 loads, gas dryer will cost $1839 in fuel, heat pump dryer will cost $390. This is a $1449 savings.

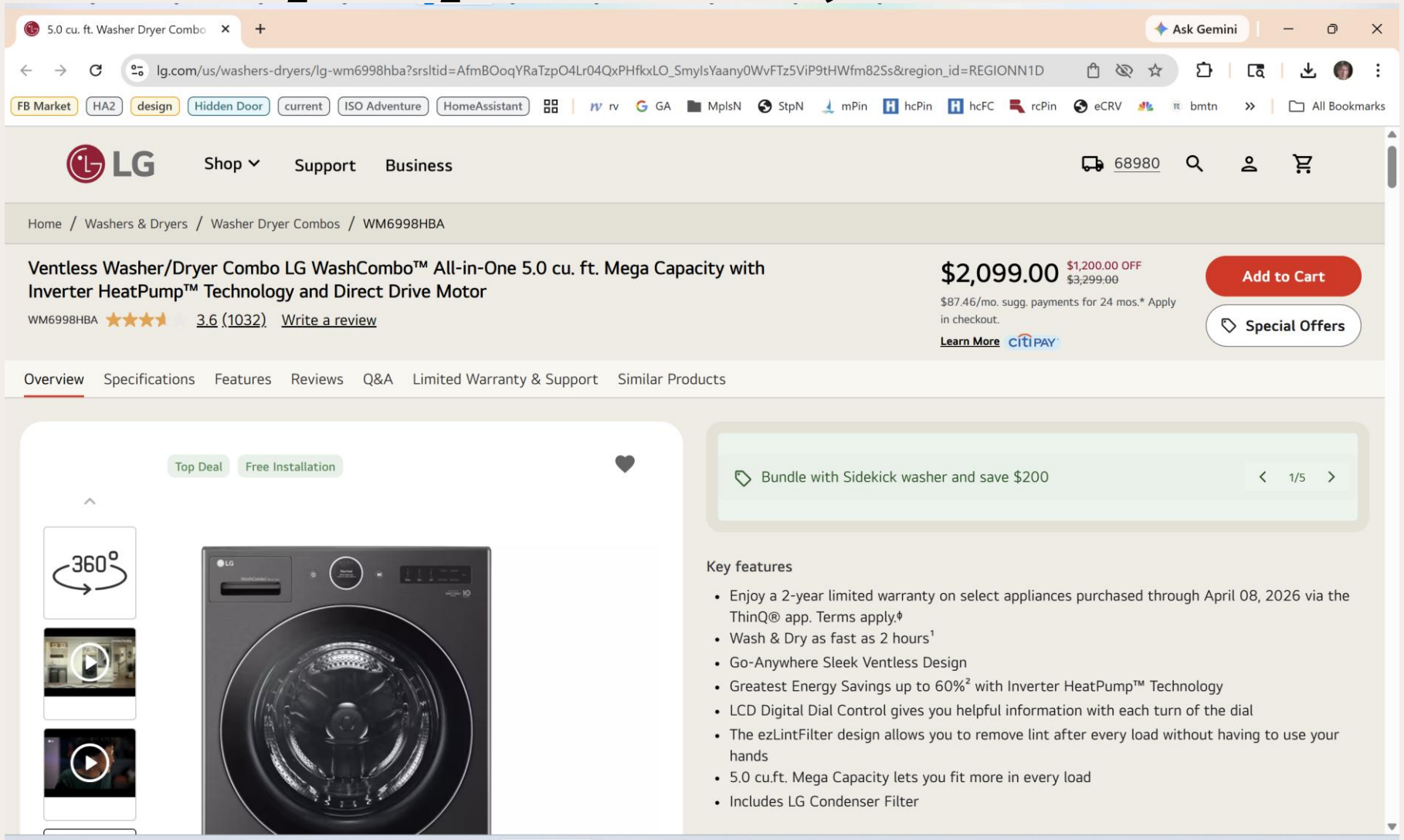
Whirlpool heat pump dryer



GE Heat pump washer dryer combo



LG Heat pump washer dryer combo



Stoves / Ranges

- Gas stoves: Most people like them. They think they are the best since they have high heat and are very responsive.
- Electric stoves: Everybody universally hates them. They are slow to heat up, and they are very non-responsive.
- Induction: Mostly mis-understood. Most people think they are electric stoves. Although they are electric, they perform far better than gas. Faster heat up times, and as responsive to heat changes as a gas stove.

Gas stoves:

- Most of the heat from gas stoves goes around the pan. It is estimated that 40% of the heat goes into the pan / food, and 60% is wasted.
- Byproducts of combustion are harmful. We always vent water heaters and furnaces, but why not ALWAYS vent stoves? It's optional for the homeowner to have an exterior vent for stoves, and optional for them to turn it on. This puts a lot of dangerous fumes into the house unless the vent is turned on every time.
- You can accidentally touch the grate and get a burn from it.
- You can reach over a pan and get a burn from the excess heat.

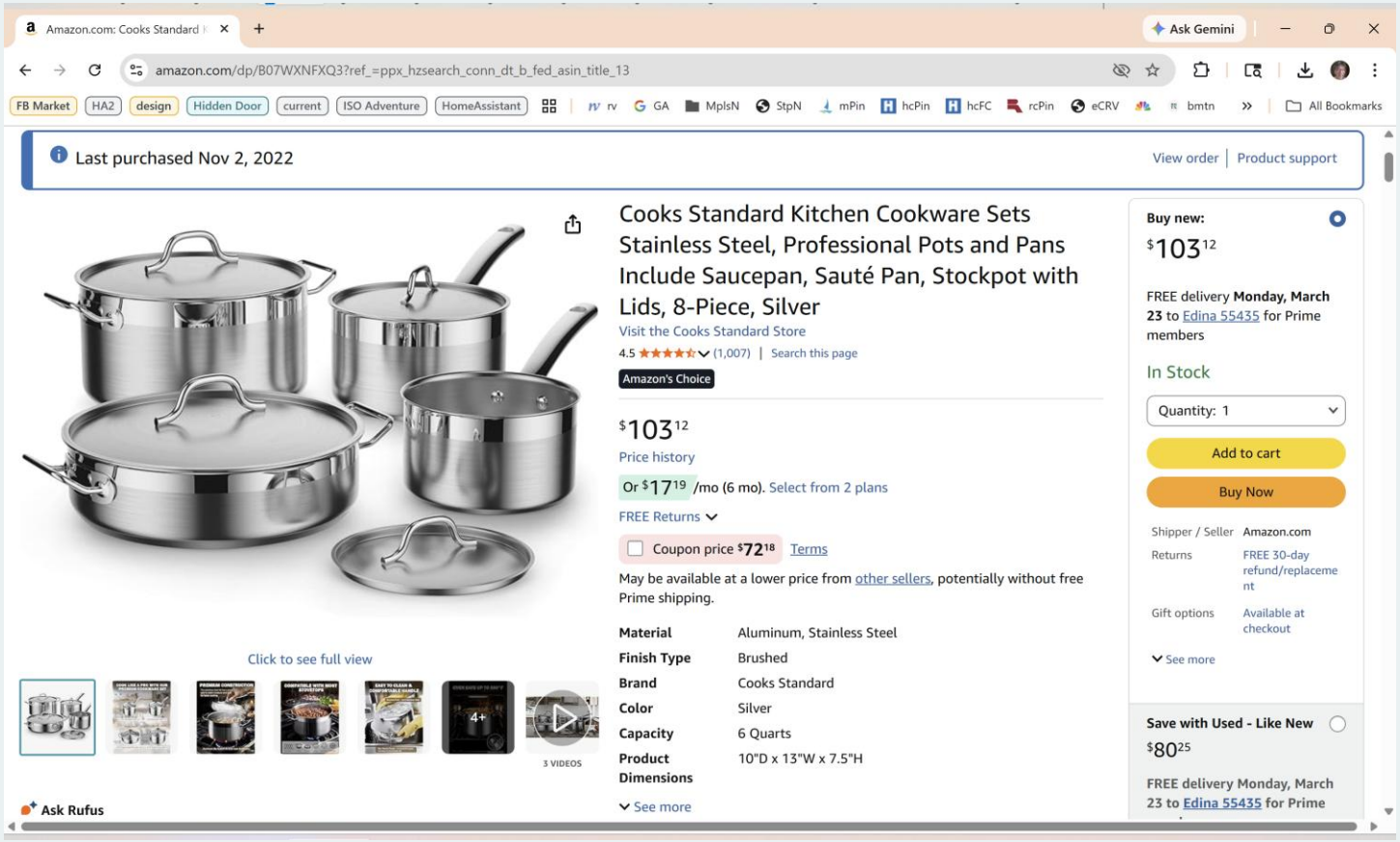
https://oregoncub.org/news/blog/busting-gas-myths-induction-stoves-vs-gas-stoves/2522/
https://www.greenbuildingadvisor.com/article/efficient-cooking

Induction Stove benefits:

- Heats faster than gas stoves, by far. Way faster.
- The pan is the heating element. This means you can touch the surface right next to the pan and not get burnt. This also means that it's about 100% efficient.
- Since the pan is the heating element, if there is no pan, there is no heat. The stove will only "turn on" if there is a pan in the right position. This is safer for kids.
- Extremely responsive heating. Turning it down, it immediately turns down.
- No carbon monoxide. No other gas burning byproducts.
- Safer for kids and pets

Induction Stove detriments:

- Need steel / iron pans.



Induction Stove demo:

- 4 cups of water on gas stove takes about 7 minutes 50 seconds to boil.
- 4 cups of water on induction stove takes about 1 minute 50 seconds to boil.

Frigidaire Induction Range

FRIGIDAIRE

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Home /FCFI3082BS-A1

Best Seller

1 of 13

Frigidaire 30" Front Control Induction Range with Air Fry, Includes Free Air Fry Tray

FCFI3082BS-A1

4.7 (276)

$1,013.50 40% Off

~~$1,699~~

As low as $57.30/mo. Learn more

From **$49/month**, or 4 payments at 0% interest with **Klarna**
Check purchase power

Only at Frigidaire.com: Air Fry Tray Included, $65.49 value!

Color Stainless Steel

Induction Stove:

- You can try induction (albeit low power induction) for $70 from Amazon. This is only a 1800w induction burner, vs an induction cooktop or range that is 3600w.
- This device would take 4 minutes to heat up that same 4 cups of water. (instead of 2 minutes for induction range, or 8 minutes for gas range)

Heat Pump Water Heater

Unit	Purchase Price	Install Cost	Rebate	Net Cost	3-year Fuel Cost	Total	Total 14-year
50-gal NG	$ 799	$ 1,000		$ 1,799	$ 864	$ 2,663	$ 5,831
50-gal Elect	$ 799	$ 1,000		$ 1,799	$ 1,482	$ 3,281	$ 8,715
On-demand	$ 733	$ 1,000		$ 1,733	$ 411	$ 2,144	$ 3,651
50-gal Heat Pump	$ 1,512	$ 1,000		$ 2,512	$ 351	$ 2,863	$ 4,150

Unit	Purchase Price	Install Cost	Rebate	Net Cost	3-year Fuel Cost	Total	Total 14-year
50-gal NG	$ 799	$ 1,000		$ 1,799	$ 864	$ 2,663	$ 5,831
50-gal Elect	$ 799	$ 1,000		$ 1,799	$ 1,482	$ 3,281	$ 8,715
On-demand	$ 733	$ 1,000		$ 1,733	$ 411	$ 2,144	$ 3,651
50-gal Heat Pump	$ 1,512	$ 1,000		$ 2,512	$ -	$ 2,512	$ 2,512

Over the course of 14 years, the heat pump water heater will save about $3300.

Heat Pump Water Heater example

Richmond® 50 Gallon Hybrid Electric Heat Pump Water Heater with Wi-Fi - 15 Amp

Model Number: 10E50-HP5U15 | Menards ® SKU: 6835556

EVERYDAY LOW PRICE $1,699.00

11% REBATE* Good Through 3/22/26 $186.89

VALUE AFTER REBATE* $1,512.11 each

You Save $186.89 After Mail-In Rebate*

ADD TO CART

Mail-In Rebate is a merchandise credit check, not a point-of-sale discount, redeemable on future in-store purchases only, not on future purchases on MENARDS.COM®. "Value After Rebate*" is the Price or Sale Price minus the Mail-In Rebate* savings. Valid on merchandise. Excludes purchase of gift cards, rentals, service plans, delivery charges and processing fees. See bottom of page for details.

$141.59 / mo. payments (total $1699) with 12 equal monthly payments Terms Apply

- Combines the technology of a traditional electric water heater with the energy efficiency of a heat pump
- Flexible installation with Top and Side water connections

Identifying High Performance Houses (HPH)

What makes a High Performance House (HPH)?

Energy Efficiency:	Insulation, air sealing, energy efficient windows/doors, efficient HVAC
Water Efficiency:	Low flow fixtures, rainwater harvesting, gray water systems
Indoor Air Quality:	Proper ventilation systems, air filtration, air exchange systems
Renewable Energy Integration:	Solar generation, wind, geothermal
Passive Design:	Solar orientation
Durability and Resilience:	Built to withstand climate. Reduce maintenance cost

High Performing Home Rating Systems

LEED (US GBC)

Passive House (PHIUS)

Energy Star (US EPA)

National Green Building Standard (NGBS)

WaterSense (US EPA)

Net Zero Energy Certification (living future institute)

Zero Energy Ready Homes (US DOE)

HERS – Home Energy Rating System (RESNET)

Minnesota Green Path (Housing First MN)

Energy Fit Homes (CEE)

LEED

Administered by US Green Building Council

Focuses on green building practices, energy efficiency, water conservation, IAQ

Various levels: Silver, Gold, Platnium

Hire a LEED rater

- Perform on-site inspection
- Verify home meets LEED
- Submit documents to GBCI
- Earn points for various efficiencies

LEED

LEED:
Certified 40-49 points

Silver 50-59 points

Gold 60-79 points

Platinium 80+ points

Points:
Integrative process (up to 2 pts)
Location and transportation (<=16pts)
Sustainable site (<=10pts)
Water efficiency (<=11pts)
Energy and atmosphere (<=38pts)
Materials and resources (<=13pts)
IAQ (<16=pts)
Innovation and regional priority (<=6pts)

Passive House

Administered by PHIUS

Focus on ultra-low energy buildings

EnerPHit is for remodel

Usually is obtained by tight housing envelope, which means all air leaks sealed, and super insulation

Hire a Passive House rater:

- Detailed energy audit
- Blower door test
- Thermal imaging
- Must meet < 0.6 ACH50
- Retrofitting is EnerPHit and must meet <1.0 ACH50

Energy Star

Administered by EPA

Focuses on energy efficiency

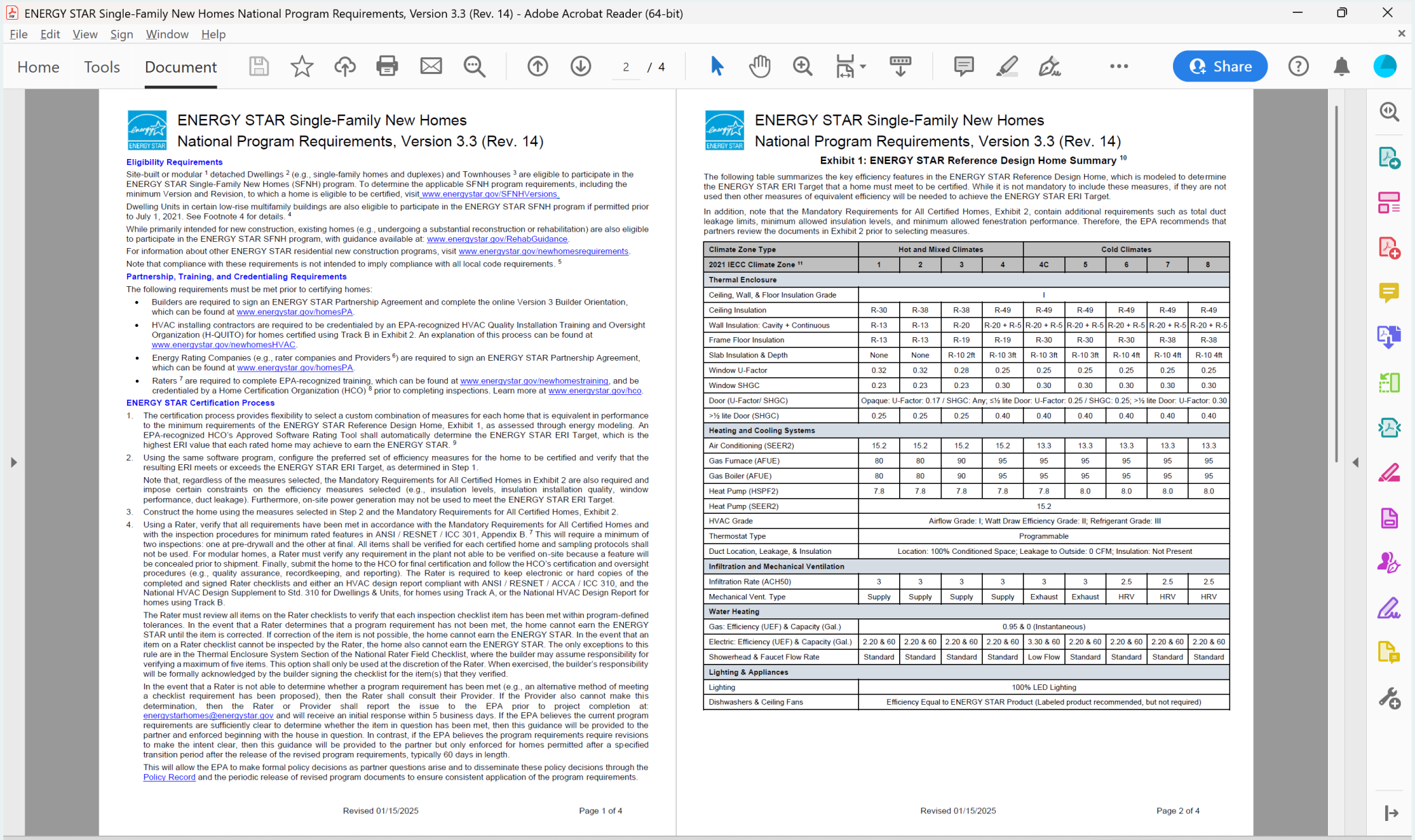
Typically performing 10-20% better than standard new homes

To get EnergyStar:
* Use EnergyStar certified products
    * appliances
    * windows and doors
    * HVAC
    * Insulation

Implement energy efficient design:
* High performance building envelope
* Proper air sealing
* Efficient lighting and ventilation

Hire a rater:
* Blower door test
* Duct blaster test
* Inspection of energy efficient features

Energy Star Certified Home



ENERGY STAR Single-Family New Homes National Program Requirements, Version 3.3 (Rev. 14) - Adobe Acrobat Reader (64-bit)

File Edit View Sign Window Help

Home Tools Document 2 / 4 Share

ENERGY STAR Single-Family New Homes National Program Requirements, Version 3.3 (Rev. 14)

Eligibility Requirements

Site-built or modular [1] detached Dwellings [2] (e.g., single-family homes and duplexes) and Townhouses [3] are eligible to participate in the ENERGY STAR Single-Family New Homes (SFNH) program. To determine the applicable SFNH program requirements, including the minimum Version and Revision, to which a home is eligible to be certified, visit www.energystar.gov/SFNHVersions.

Dwelling Units in certain low-rise multifamily buildings are also eligible to participate in the ENERGY STAR SFNH program if permitted prior to July 1, 2021. See Footnote 4 for details. [4]

While primarily intended for new construction, existing homes (e.g., undergoing a substantial reconstruction or rehabilitation) are also eligible to participate in the ENERGY STAR SFNH program, with guidance available at: www.energystar.gov/RehabGuidance.

For information about other ENERGY STAR residential new construction programs, visit www.energystar.gov/newhomesrequirements.

Note that compliance with these requirements is not intended to imply compliance with all local code requirements. [5]

Partnership, Training, and Credentialing Requirements

The following requirements must be met prior to certifying homes:

- Builders are required to sign an ENERGY STAR Partnership Agreement and complete the online Version 3 Builder Orientation, which can be found at www.energystar.gov/homesPA.
- HVAC installing contractors are required to be credentialed by an EPA-recognized HVAC Quality Installation Training and Oversight Organization (H-QUITO) for homes certified using Track B in Exhibit 2. An explanation of this process can be found at www.energystar.gov/newhomesHVAC.
- Energy Rating Companies (e.g., rater companies and Providers [6]) are required to sign an ENERGY STAR Partnership Agreement, which can be found at www.energystar.gov/homesPA.
- Raters [7] are required to complete EPA-recognized training, which can be found at www.energystar.gov/newhomestraining, and be credentialed by a Home Certification Organization (HCO) [8] prior to completing inspections. Learn more at www.energystar.gov/hco.

ENERGY STAR Certification Process

1. The certification process provides flexibility to select a custom combination of measures for each home that is equivalent in performance to the minimum requirements of the ENERGY STAR Reference Design Home, Exhibit 1, as assessed through energy modeling. An EPA-recognized HCO's Approved Software Rating Tool shall automatically determine the ENERGY STAR ERI Target, which is the highest ERI value that each rated home may achieve to earn the ENERGY STAR. [9]
2. Using the same software program, configure the preferred set of efficiency measures for the home to be certified and verify that the resulting ERI meets or exceeds the ENERGY STAR ERI Target, as determined in Step 1.

   Note that, regardless of the measures selected, the Mandatory Requirements for All Certified Homes in Exhibit 2 are also required and impose certain constraints on the efficiency measures selected (e.g., insulation levels, insulation installation quality, window performance, duct leakage). Furthermore, on-site power generation may not be used to meet the ENERGY STAR ERI Target.
3. Construct the home using the measures selected in Step 2 and the Mandatory Requirements for All Certified Homes, Exhibit 2.
4. Using a Rater, verify that all requirements have been met in accordance with the Mandatory Requirements for All Certified Homes and with the inspection procedures for minimum rated features in ANSI / RESNET / ICC 301, Appendix B. [7] This will require a minimum of two inspections: one at pre-drywall and the other at final. All items shall be verified for each certified home and sampling protocols shall not be used. For modular homes, a Rater must verify any requirement in the plant not able to be verified on-site because a feature will be concealed prior to shipment. Finally, submit the home to the HCO for final certification and follow the HCO's certification and oversight procedures (e.g., quality assurance, recordkeeping, and reporting). The Rater is required to keep electronic or hard copies of the completed and signed Rater checklists and either an HVAC design report compliant with ANSI / RESNET / ACCA / ICC 310, and the National HVAC Design Supplement to Std. 310 for Dwellings & Units, for homes using Track A, or the National HVAC Design Report for homes using Track B.

   The Rater must review all items on the Rater checklists to verify that each inspection checklist item has been met within program-defined tolerances. In the event that a Rater determines that a program requirement has not been met, the home cannot earn the ENERGY STAR until the item is corrected. If correction of the item is not possible, the home cannot earn the ENERGY STAR. In the event that an item on a Rater checklist cannot be inspected by the Rater, the home also cannot earn the ENERGY STAR. The only exceptions to this rule are in the Thermal Enclosure System Section of the National Rater Field Checklist, where the builder may assume responsibility for verifying a maximum of five items. This option shall only be used at the discretion of the Rater. When exercised, the builder's responsibility will be formally acknowledged by the builder signing the checklist for the item(s) that they verified.

   In the event that a Rater is not able to determine whether a program requirement has been met (e.g., an alternative method of meeting a checklist requirement has been proposed), then the Rater shall consult their Provider. If the Provider also cannot make this determination, then the Rater or Provider shall report the issue to the EPA prior to project completion at: energystarhomes@energystar.gov and will receive an initial response within 5 business days. If the EPA believes the current program requirements are sufficiently clear to determine whether the item in question has been met, then this guidance will be provided to the partner and enforced beginning with the house in question. In contrast, if the EPA believes the program requirements require revisions to make the intent clear, then this guidance will be provided to the partner but only enforced for homes permitted after a specified transition period after the release of the revised program requirements, typically 60 days in length.

   This will allow the EPA to make formal policy decisions as partner questions arise and to disseminate these policy decisions through the Policy Record and the periodic release of revised program documents to ensure consistent application of the program requirements.

Revised 01/15/2025 Page 1 of 4

ENERGY STAR Single-Family New Homes National Program Requirements, Version 3.3 (Rev. 14)

Exhibit 1: ENERGY STAR Reference Design Home Summary [10]

The following table summarizes the key efficiency features in the ENERGY STAR Reference Design Home, which is modeled to determine the ENERGY STAR ERI Target that a home must meet to be certified. While it is not mandatory to include these measures, if they are not used then other measures of equivalent efficiency will be needed to achieve the ENERGY STAR ERI Target.

In addition, note that the Mandatory Requirements for All Certified Homes, Exhibit 2, contain additional requirements such as total duct leakage limits, minimum allowed insulation levels, and minimum allowed fenestration performance. Therefore, the EPA recommends that partners review the documents in Exhibit 2 prior to selecting measures.

Climate Zone Type	Hot and Mixed Climates				Cold Climates				
2021 IECC Climate Zone [11]	1	2	3	4	4C	5	6	7	8
Thermal Enclosure									
Ceiling, Wall, & Floor Insulation Grade	I								
Ceiling Insulation	R-30	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49
Wall Insulation: Cavity + Continuous	R-13	R-13	R-20	R-20 + R-5	R-20 + R-5	R-20 + R-5	R-20 + R-5	R-20 + R-5	R-20 + R-5
Frame Floor Insulation	R-13	R-13	R-19	R-19	R-30	R-30	R-30	R-38	R-38
Slab Insulation & Depth	None	None	R-10 2ft	R-10 3ft	R-10 3ft	R-10 3ft	R-10 4ft	R-10 4ft	R-10 4ft
Window U-Factor	0.32	0.32	0.28	0.25	0.25	0.25	0.25	0.25	0.25
Window SHGC	0.23	0.23	0.23	0.30	0.30	0.30	0.30	0.30	0.30
Door (U-Factor/ SHGC)	Opaque: U-Factor: 0.17 / SHGC: Any; ≤½ lite Door: U-Factor: 0.25 / SHGC: 0.25; >½ lite Door: U-Factor: 0.30								
>½ lite Door (SHGC)	0.25	0.25	0.25	0.40	0.40	0.40	0.40	0.40	0.40
Heating and Cooling Systems									
Air Conditioning (SEER2)	15.2	15.2	15.2	15.2	13.3	13.3	13.3	13.3	13.3
Gas Furnace (AFUE)	80	80	90	95	95	95	95	95	95
Gas Boiler (AFUE)	80	80	90	95	95	95	95	95	95
Heat Pump (HSPF2)	7.8	7.8	7.8	7.8	7.8	8.0	8.0	8.0	8.0
Heat Pump (SEER2)	15.2								
HVAC Grade	Airflow Grade: I; Watt Draw Efficiency Grade: II; Refrigerant Grade: III								
Thermostat Type	Programmable								
Duct Location, Leakage, & Insulation	Location: 100% Conditioned Space; Leakage to Outside: 0 CFM; Insulation: Not Present								
Infiltration and Mechanical Ventilation									
Infiltration Rate (ACH50)	3	3	3	3	3	3	2.5	2.5	2.5
Mechanical Vent. Type	Supply	Supply	Supply	Supply	Exhaust	Exhaust	HRV	HRV	HRV
Water Heating									
Gas: Efficiency (UEF) & Capacity (Gal.)	0.95 & 0 (Instantaneous)								
Electric: Efficiency (UEF) & Capacity (Gal.)	2.20 & 60	2.20 & 60	2.20 & 60	2.20 & 60	3.30 & 60	2.20 & 60	2.20 & 60	2.20 & 60	2.20 & 60
Showerhead & Faucet Flow Rate	Standard	Standard	Standard	Standard	Low Flow	Standard	Standard	Standard	Standard
Lighting & Appliances									
Lighting	100% LED Lighting								
Dishwashers & Ceiling Fans	Efficiency Equal to ENERGY STAR Product (Labeled product recommended, but not required)								

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Energy Star Certified Home

ENERGY STAR Single-Family New Homes National Program Requirements, Version 3.3 (Rev. 14) - Adobe Acrobat Reader (64-bit)

File Edit View Sign Window Help

Home Tools Document 3 / 4 Share

ENERGY STAR Single-Family New Homes National Program Requirements, Version 3.3 (Rev. 14)

Two tracks are provided for satisfying the mandatory requirements for all certified homes, Exhibit 2. Track A - HVAC Grading utilizes ANSI / RESNET / ACCA / ICC 310 [12], a standard for grading the installation of HVAC systems. Track B - HVAC Credential utilizes an HVAC contractor credentialed by an EPA-recognized H-QUITO. Either track may be selected, but all requirements within that track must be satisfied for the home to be certified.

Exhibit 2: Mandatory Requirements for All Certified Homes

Party Responsible	Mandatory Requirements
Requirements Applicable to Track A & B	
Rater	• Completion of SFNH National Rater Design Review Checklist, Version 3.1 / 3.2 / 3.3 • Completion of SFNH National Rater Field Checklist, Version 3.1 / 3.2 / 3.3
Requirements Only Applicable to Track A - HVAC Grading [12]	
HVAC System Designer	• Completion of an HVAC design report compliant with ANSI / RESNET / ACCA / ICC 310, plus the SFNH / MFNC National HVAC Design National HVAC Design Supplement to Std. 310 for Dwellings & Units, All Versions.
HVAC Installing Contractor	• While the HVAC contractor plays a critical role in properly installing and commissioning a system, the Rater is the party responsible for assessing its installation quality, per ANSI / RESNET / ACCA / ICC 310. However, the installing contractor may be required to provide documentation to support the Rater's assessment (e.g., regarding the refrigerant system).
Requirements Only Applicable to Track B - HVAC Credential	
HVAC System Designer	• Completion of SFNH National HVAC Design Report, Version 3.1 / 3.2 / 3.3
HVAC Installing Contractor	• Completion of SFNH National HVAC Commissioning Checklist, Version 3.1 / 3.2 / 3.3

Footnotes:

1. A modular home is a prefabricated home that is made of multiple modules or sections that are manufactured and substantially assembled in a manufacturing plant. These pre–built sections are transported to the building site and constructed by a builder to meet all applicable building codes for site–built homes.
2. A Dwelling, as defined by ANSI / RESNET / ICC 301, is any building that contains one or two Dwelling Units used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied, or that are occupied for living purposes. ANSI / RESNET / ICC 301 defines a Dwelling Unit as a single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.
3. A Townhouse, as defined by ANSI / RESNET / ICC 301, is a single-family Dwelling Unit constructed in a group of three or more attached units in which each unit extends from the foundation to roof and with open space on at least two sides.
4. If permitted prior to July 1, 2021, the following are also eligible to participate in the ENERGY STAR SFNH program:
   - Dwelling units [2] in any multifamily building with 4 units or fewer; OR
   - Dwelling units in multifamily buildings with 3 stories or fewer above-grade; OR
   - Dwelling units in multifamily buildings with 4 or 5 stories above-grade where dwelling units occupy 80% or more of the occupiable square footage of the building. When evaluating mixed–use buildings for eligibility, exclude commercial / retail space when assessing whether the 80% threshold has been met.

   Any above-grade story with 20% or more occupiable space, including commercial space, shall be counted towards the total number of stories for the purpose of determining eligibility to participate in the program. The definition of an 'above-grade story' is one for which more than half of the gross surface area of the exterior walls is above-grade. All below-grade stories, regardless of type, shall not be included when evaluating eligibility.

   Per ASHRAE 62.2-2010, occupiable space is any enclosed space inside the pressure boundary and intended for human activities or continual human occupancy, including, but not limited to, areas used for living, sleeping, dining, and cooking, toilets, closets, halls, storage and utility areas, and laundry areas.
5. While certification will result in compliance with many code requirements, a Rater is not responsible for ensuring that all code requirements have been met prior to certification. For more information about how these program requirements help satisfy code requirements, visit: www.energystar.gov/newhomesguidance. In the event that a code requirement, a manufacturer's installation instructions, or an engineering document conflicts with a requirement of the ENERGY STAR program, then the conflicting requirement within these program requirements shall not be met. Certification shall only be allowed if the Rater has determined that no equivalent option is available that could meet the conflicting requirement. Note that a home must still meet its ENERGY STAR ERI Target. Therefore, other efficiency measures may be needed to compensate for the omission of the conflicting requirement.
6. The term 'Provider' refers to an Approved Rating Provider, as defined by ANSI / RESNET / ICC 301, that is approved by an HCO.
7. The term 'Rater' refers to the person(s) completing the third-party verification required for certification. The person(s) shall: a) be a Certified Rater or Approved Inspector, as defined by ANSI / RESNET / ICC 301, or an equivalent designation as determined by an HCO; and, b) have attended and successfully completed an EPA-recognized training class. See www.energystar.gov/newhomestraining.

ENERGY STAR Single-Family New Homes National Program Requirements, Version 3.3 (Rev. 14)

8. HCOs are independent organizations recognized by the EPA to implement an ENERGY STAR certification program for single-family and multifamily homes and apartments using an Energy Rating Index (ERI) compliance path. Learn more and find a current list of HCOs at www.energystar.gov/hco.
9. The software program shall automatically determine (i.e., without relying on a user-configured ENERGY STAR Reference Design) this target for each rated home by following the National ERI Target Procedure, Version 3.3 (Rev. 14), available at www.energystar.gov/newhomesrequirements.
10. While the corresponding ERI Target Procedure specifies air conditioners and heat pumps using SEER and HSPF, in this document they have been converted to the current rating metrics, SEER2 and HSPF2, assuming a ducted split system. Note that the efficiency levels of ENERGY STAR certified products aligned with these product specifications when this Version was first released. These efficiency features form the basis of the ENERGY STAR ERI target, regardless of any subsequent revisions to ENERGY STAR certified product specifications. The EPA recommends, but does not require, that current ENERGY STAR products be included in ENERGY STAR homes. For current ENERGY STAR products, visit www.energystar.gov/products.
11. 2021 IECC Climate Zone designations, as defined and illustrated in Section R301 of the code, are used to configure the ENERGY STAR Reference Design Home. Note that some locations have shifted to a different Climate Zone in the 2021 IECC compared to prior editions.
12. Track A – HVAC Grading shall use ANSI / RESNET / ACCA / ICC 310 including all Addenda and Normative Appendices, with new versions and Addenda implemented according to the schedule defined by the HCO that the home is being certified under.

HERS – Home Energy Rating System

0 – 100+ rating scale

Average home is 100

New construction is around 40-60

Net Zero house = 0 (best)

Administered by RESNET

Focus on energy efficiency

Hire a certified HERS rater

They perform energy assessment

- Visual inspection
- Blower door test
- Duct blaster test
- Thermal imaging
- Receive report

Blower Door Test

Blower Door Test

Blower Door Test Results

In the prior example, it showed 1500 cfm.
1500 cfm * 60 = 90,000 cfh
90,000 / 28,560 (volume of home) =
3.2 air changes per hour (ACH50)

National Code (2012) looks for 3 ACH50.

2nd example:
2438 cfm * 60 = 146,280 cfh
146,280 / 22,744 = 6.43 ACH50
This is a leaky 1930's house.

EXAMPLE: Passive House EnerPHit

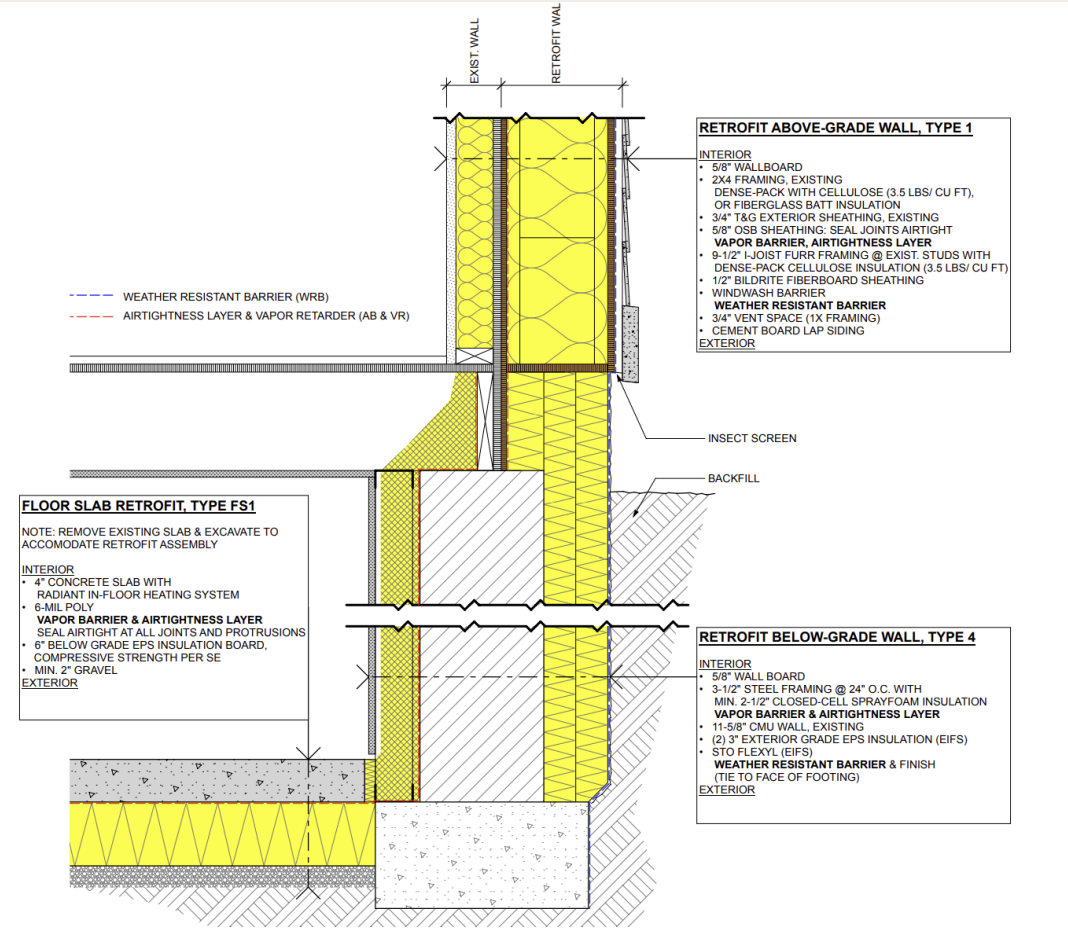
South Minneapolis deep remodel. This family took their whole house down to the studs. To achieve EnerPHit, they built a house within a house. Double exterior studs to remove thermal bridging. They also made sure all seams were taped and sealed tightly.
They used high quality windows and doors, not Anderson, Marvin, or Pella. They bought windows from Germany, Optiwin Alu2Wood, on the order of $4000 per window. About R-6.

This house needs only 3.8kw to heat the house, about 3 hair dryers.

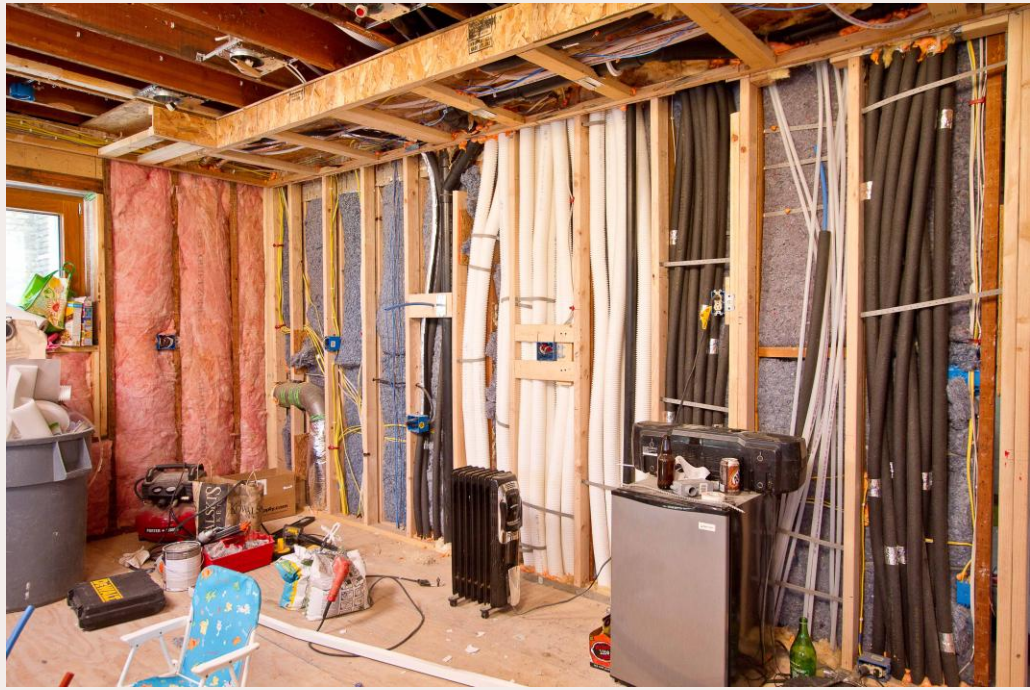
Blower door was 8.5 before the rehab, and 0.65 ACH50 after. It needed to meet <1.0 ACH50. PASSED!

https://passivehousenetwork.org/wp-content/uploads/2024/02/eph_Eian_Minneapolis_2069-1.pdf

Double wall – house within a house



EXAMPLE: Passive House EnerPHit



https://www.testudio.com/projects/minnephit-house/

EXAMPLE: Net Zero House “Ohm Sweet Ohm”

EXAMPLE: Net Zero House “Ohm Sweet Ohm”

EXAMPLE: Net Zero House “Ohm Sweet Ohm”

This house reached HERS score of -49, far lower than net zero.

They also harvest rainwater from the street funneling it into their yard through curb cuts.

Anderson A-series triple pane windows, Geothermal heating and cooling, double stud 2x4 walls, closed cell spray foam insulation, 61 solar panels 310w each.

https://salaarc.com/project-types/featured/ohm-sweet-ohm/

EXAMPLE: Net Zero House “Ohm Sweet Ohm”

LEED for Homes v4 – Platinum Level
Living Building Challenge – Zero Energy
GreenStar Home Certification -Gold Level
GreenStar Zero Energy Capable

R37 wall insulation
R83 roof/ceiling insulation
R47 floor insulation
No gas line to the house

0.91 ACH50

https://salaarc.com/project-types/featured/ohm-sweet-ohm/


GeoComfort
Geothermal Systems

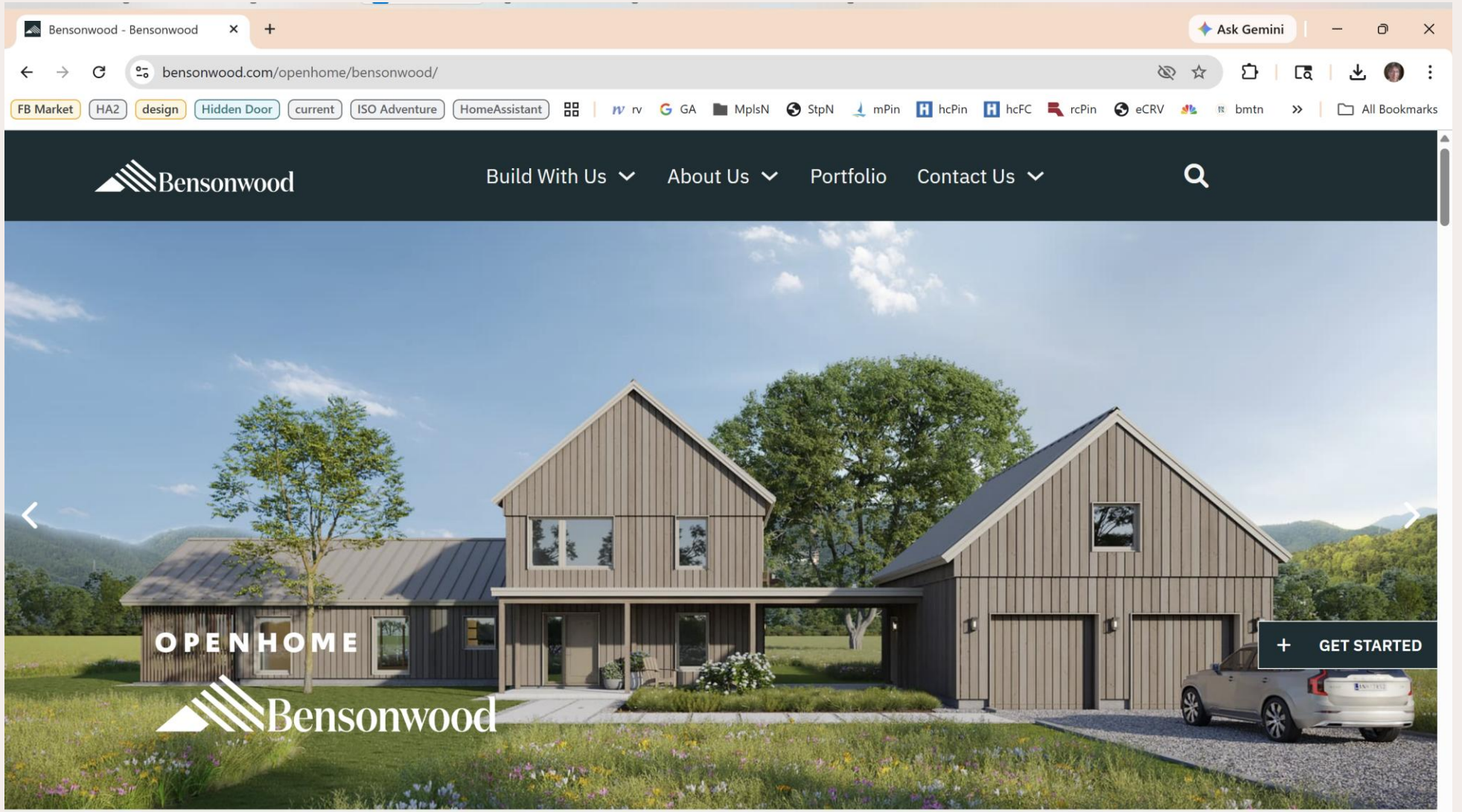
Minneapolis Victorian Net Zero

54 solar collectors, 17kW capacity produces $3000 of electricity per year
Gas line disconnected
4x 250’ deep geothermal wells

R40 walls insulation
R80 roof insulation
R30 basement exterior insulation
Triple glazed windows
ERV (from 3 bathrooms, kitchen, and laundry)

HERS -9 (on a scale of 0 to 100)

EXAMPLE: Builder



Passive House first, Net-Zero second

You can make any house Net Zero by adding enough solar or wind generation.

Focus on making the house efficient as possible and then adding solar or wind to make the house net zero.

Listing in MLS

- Use Green Energy Addendum and put as page 11 on Seller's Disclosure.
- Emphasize the energy savings in real dollars for each device.
- Have energy efficiency sheets detailing the savings per device.
- There are lots of energy efficient fields in MLS related to the certifications. USE THEM.

NorthstarMLS Add/Edit

Ask Gemini

add-edit.northstarmls.com/listing/7033742/edit

FB Market | HA2 | design | Hidden Door | current | ISO Adventure | HomeAssistant | rv | GA | MplsN | StpN | mPin | hcPin | hcFC | rcPin | eCRV | bmtn | All Bookmarks

Green Building

Green Energy Efficient

Green Indoor Air Quality

Green Sustainability

- Appliances
- Construction
- Doors
- Exposure/Shade
- HVAC
- Incentives
- Insulation
- Lighting
- Roof
- Thermostat
- Water Heater

tion

erification

Verification Body

Verification Source

Verification URL

Verification Version

Complete | In Process

E.g. https://energy-score-api.mncee.org/

Verification Year

Need help?

Green Building Power Production

Green Building Verification

Verification 1

Verification Type

Verification Body

Verification Source

- Certified Passive House
- ENERGY STAR Certified Homes
- EnerPHit
- GreenStar Homes Certification
- Home Energy Rating System (HERS)
- Home Energy Score
- Home Energy Upgrade Certificate of Energy Efficiency Improvements
- Home Energy Upgrade Certificate of Energy Efficiency Performance
- Home Performance with ENERGY STAR
- Indoor airPLUS
- LEED For Homes

RL

nergy-score-api.mncee.org/

Verification Version

Power Production Type

Solar | Wind

Power Production Size

Year Installed

Annual Power Production (kWh)

Value | Measurement

NorthstarMLS Add/Edit

Ask Gemini

add-edit.northstarmls.com/listing/7033742/edit

FB Market | HA2 | design | Hidden Door | current | ISO Adventure | HomeAssistant | rv | GA | MplsN | StpN | mPin | hcPin | hcFC | rcPin | eCRV | bmtn | All Bookmarks

Green Building Power Production

Power Production 1

Power Production Type

Solar | Wind

Power Production Size

Year Installed

Annual Power Production (kWh)

Value | Measurement

Optional Property Information - Condo/Townhouse

Amenities Shared

Approved Financing (Assoc.)

Restrictions/Covenants

Shared Rooms

Townhouse Characteristics

Property Information - Hobby Farm

Agricultural Water

Crop Type

Farm Type

Need help?

Bottom Line:

1. Start with an energy audit. This will show you places you can address problems.
2. Insulate and air sealing, especially attic air bypasses.
3. Windows and doors. Higher performing windows and doors are more expensive but let in a lot less air.
4. Think about going all electric. Upgrade main service panel.
5. Switch most wasteful items first:
    1. Gas car to **electric car**
    2. Dryer to **heat pump dryer**
    3. Water heater to **heat pump water heater**
    4. Air conditioner to **heat pump**
    5. Improve IAQ by adding an **ERV** (or HRV in some cases)
    6. Change to **induction stove**

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Thank you

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