



Trends in HERS® Rated Homes

A STATISTICAL ABSTRACT



Prepared for RESNET's Suppliers Advisory Board

Ryan Meres | RESNET | April 26, 2021

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Executive Summary

Each year more than one-fifth of all new homes built in the U.S. are rated for their energy efficiency using the Residential Energy Services Network's (RESNET) Home Energy Rating System (HERS) Index. The HERS Index is comparable to a miles-per-gallon rating for homes where a lower score means less energy use. A score of 100 on the index represents a home built using standard construction practices from 2006, while a score of zero represents a home that produces as much energy as it uses on an annual basis. This report is an annual look at the trends across all homes receiving a HERS rating in 2020. The report was completed on behalf of RESNET's Suppliers Advisory Board.

The report first looks at broad national level trends in the number of HERS ratings and average index scores. Next, the report covers state level trends, including the total number of HERS ratings in each state and the percent of new homes that received a HERS Rating. After the state level data, the report looks into trends of HERS ratings in cities, including the top 25 cities for single family and multi-family ratings.

The remainder of the report focuses on individual trends across HERS ratings, including a breakdown of the basic characteristics of rated homes and individual building components. A variety of building envelope components are covered as well as air leakage rates, equipment efficiencies and the use of solar on HERS rated homes.

Another Record Year

In 2020, HERS Raters rated 299,755 homes. This represents a 24 percent increase over the number of ratings in 2019 and marks the ninth straight year-over-year increase in HERS ratings. In addition to the record number of HERS ratings, the efficiency of HERS rated homes also improved. The average HERS Index in 2020 was a 58, representing a 42 percent improvement in efficiency over a home built in 2006. Since 2013, the average HERS index score has decreased by five points. Seventy-seven percent of all homes rated last year were one- and two-family dwellings and 23 percent were multi-family units.

HERS Ratings by State

RESNET conducted an analysis of the percentage¹ of new one- and two-family dwellings compared to the number of HERS ratings in each state in 2020. The clear stand-out for the highest percentage of new homes receiving a HERS Rating is Massachusetts. The commonwealth saw 87 percent of all new homes receive a HERS Rating. Only one other state, Indiana, had more than half of all new homes HERS Rated last year, while 14 states saw between 25 and 49 percent of new homes HERS Rated. Figure 1 shows the percent of homes HERS rated by state.

¹ Based on the number of HERS Ratings on one- and two-family dwellings in RESNET's National Buildings Registry and permit data from the U.S. Census Bureau

Trends in HERS® Rated Homes, 2021

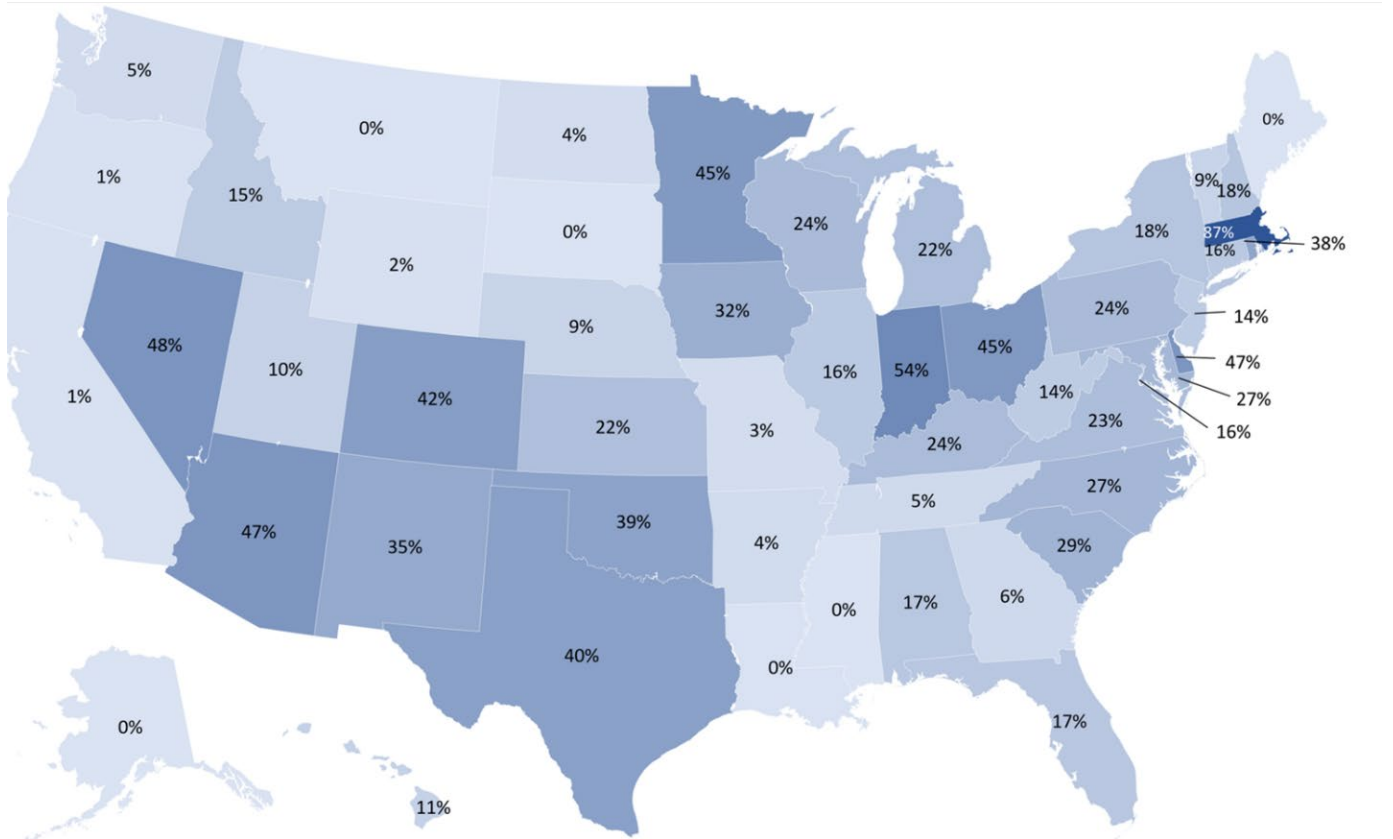


Figure 1. Percent of New Homes HERS Rated by State, 2020

When looking at the total number of ratings, for all home types, by state, Texas comes out on top with more than 65,000 homes HERS rated. Nine states recorded more than 10,000 ratings last year. Figure 2 shows the total number of HERS Ratings for all home types by state in 2020.

Trends in HERS® Rated Homes, 2021

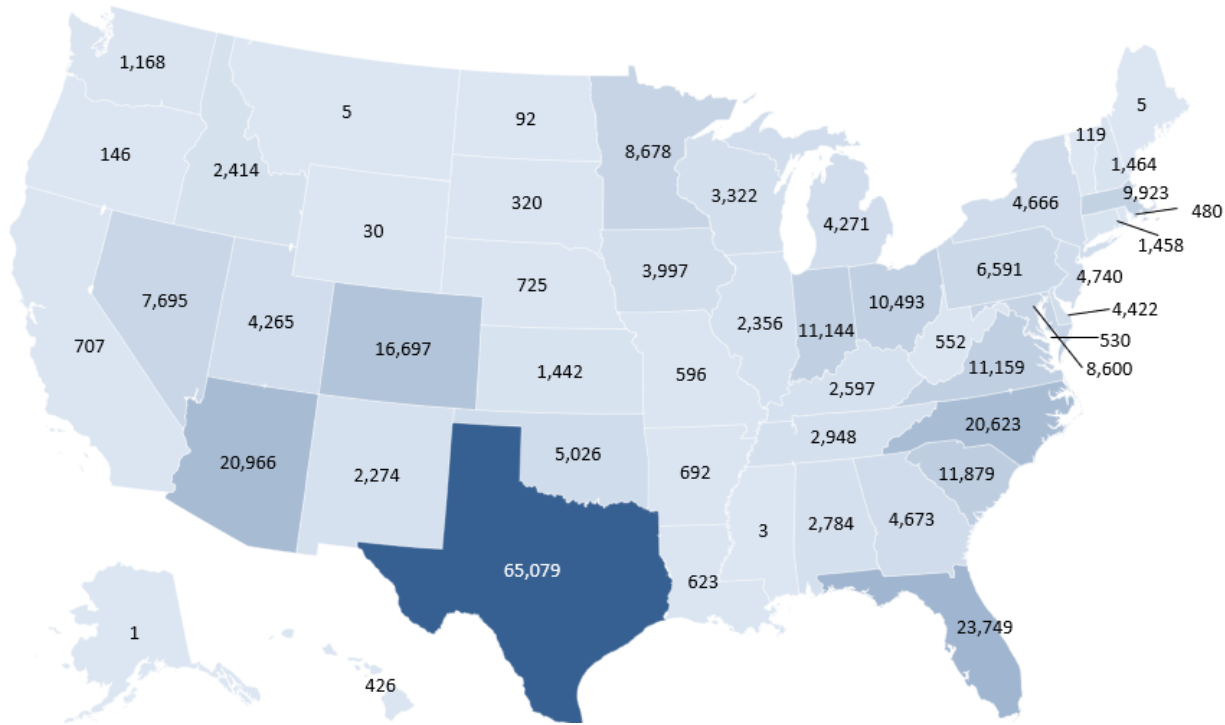


Figure 2. Number of HERS Ratings by State, 2020

HERS Ratings by City

In 2020 there were HERS Ratings completed in more than 4,000 individual municipalities. For the second year in a row, San Antonio, Texas tops the list of municipalities with the highest number of HERS Ratings at nearly 6,700 homes. The top 25 municipalities are located across seven states and are responsible for nearly one-fifth of HERS Ratings last year. Figure 3 shows the top 25 municipalities for HERS Ratings in 2020.

State	City	Number of Ratings
Texas	San Antonio	6,689
Nevada	Las Vegas	3,713
Texas	Katy	3,208
Texas	Richmond	2,892
Colorado	Colorado Springs	2,745
Arizona	Phoenix	2,367
North Carolina	Charlotte	2,355
Texas	Houston	2,332
Texas	Austin	2,279
Colorado	Aurora	2,159

Trends in HERS® Rated Homes, 2021

Nevada	North Las Vegas	1,902
Texas	Cypress	1,826
Arizona	Surprise	1,766
Nevada	Henderson	1,724
Florida	Kissimmee	1,697
Texas	Conroe	1,675
Florida	Orlando	1,576
Arizona	Buckeye	1,477
Texas	Spring	1,467
Arizona	Queen Creek	1,341
Arizona	Tucson	1,331
Texas	Georgetown	1,298
Arizona	Goodyear	1,292
Arizona	Mesa	1,222
Florida	Winter Garden	1,087

Figure 3. Top 25 Municipalities for HERS Ratings, 2020

When considering only multi-family ratings, there were HERS rated dwelling units in more than 1,000 municipalities, with Charlotte, North Carolina topping this year's list at over 1,000 units rated. The top 25 municipalities for multi-family ratings are located across 14 states and the District of Columbia and are responsible for more than one-fifth of all multi-family HERS Ratings last year. Figure 4 shows the top 25 municipalities for multi-family HERS Ratings last year.

State	City	Number of Ratings
North Carolina	Charlotte	1,058
Utah	Salt Lake City	930
Florida	Orlando	688
North Carolina	Durham	582
Florida	Kissimmee	514
District of Columbia	Washington	492
Virginia	Richmond	489
Maryland	Frederick	487
Arizona	Phoenix	455
Massachusetts	Boston	450
Nevada	Las Vegas	446
Virginia	Fredericksburg	437
Colorado	Denver	426
Virginia	Virginia Beach	426
New Mexico	Albuquerque	384
Louisiana	Lake Charles	379

North Carolina	Fayetteville	368
Ohio	Delaware	361
Maryland	Baltimore	341
North Carolina	Raleigh	339
North Carolina	Apex	334
Virginia	Midlothian	323
Maryland	Hanover	319
Iowa	Waukee	315
Georgia	Atlanta	314

Figure 4. Top 25 Municipalities for Multi-Family HERS Ratings, 2020

Components of HERS Rated Homes

This section will address various national construction trends across HERS Rated homes last year. Both single-family and multi-family home types will be addressed.

Note: duplex ratings are included with single-family data.

As a national aggregate, the average single family HERS Rated home had the following basic characteristics in 2020:

- HERS Index Score: **58**
- Number of bedrooms: **3.7**
- Conditioned floor area: **2,732 ft²**
- Annual energy cost: **\$1,668**
- Annual energy cost savings: **\$800**

The average multi-family dwelling unit had these basic characteristics in 2020:

- HERS Index Score: **58**
- Number of bedrooms: **2.3**
- Conditioned floor area: **1,468 ft²**
- Annual energy cost: **\$1,130**
- Annual energy cost savings: **\$542**

In understanding the data presented in this section, it will be helpful to provide some context for the number of homes rated in each climate zone². This context is useful when considering the insulation R-values and other construction practices characterized below. Climate zones 2 (a & b) and 3 (a & b) cover most of the southern states from Texas and Oklahoma, east to the southern half of North Carolina and south to Florida and the Gulf Coast. They also cover the southern portions of Arizona and New Mexico. These states are primarily in warmer climates and make up roughly 50 percent of all ratings in 2020. Most of the rest of the ratings were in climate zones 4a and 5 (a & b).

² Climate zone as defined in the 2018 International Energy Conservation Code

These climate zones run roughly from the mid-Atlantic and lower northeast states, west to Nevada and north to Oregon and Washington.

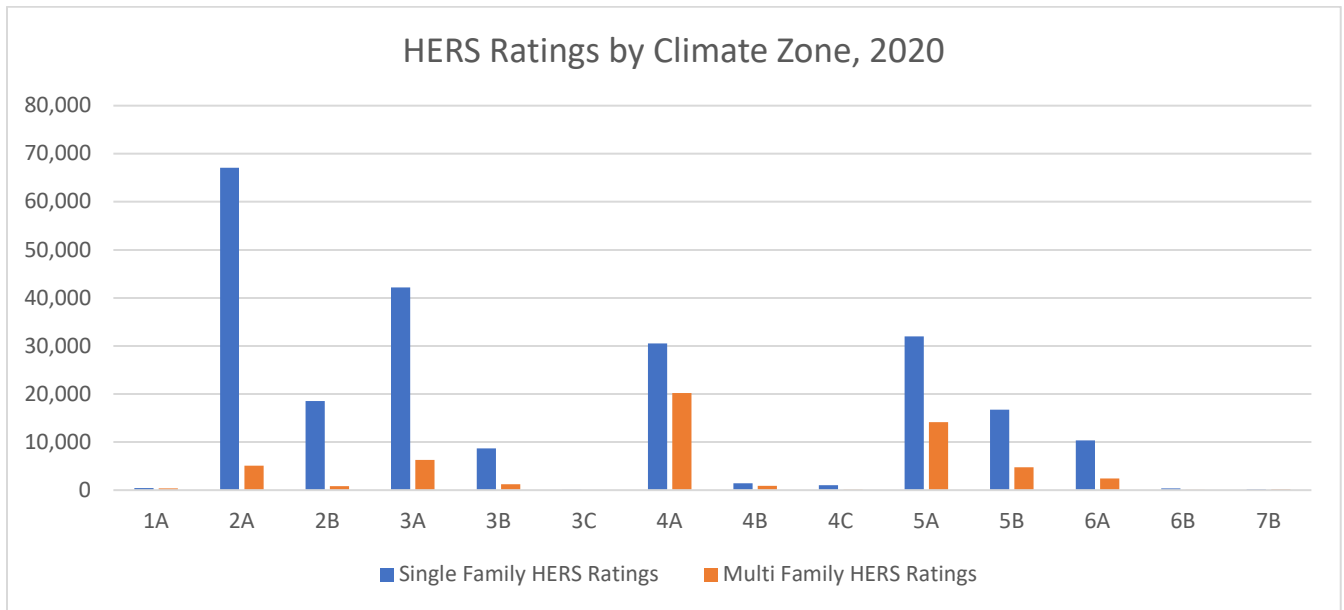


Figure 5. HERS Ratings by Climate Zone, 2020

Foundation Types

Figures 6 and 7 display the foundation types for HERS Rated homes last year. Nearly two-thirds of single family rated homes were built with a slab-on-grade last year while three-quarters of multi-family ratings had the same type.

Trends in HERS® Rated Homes, 2021

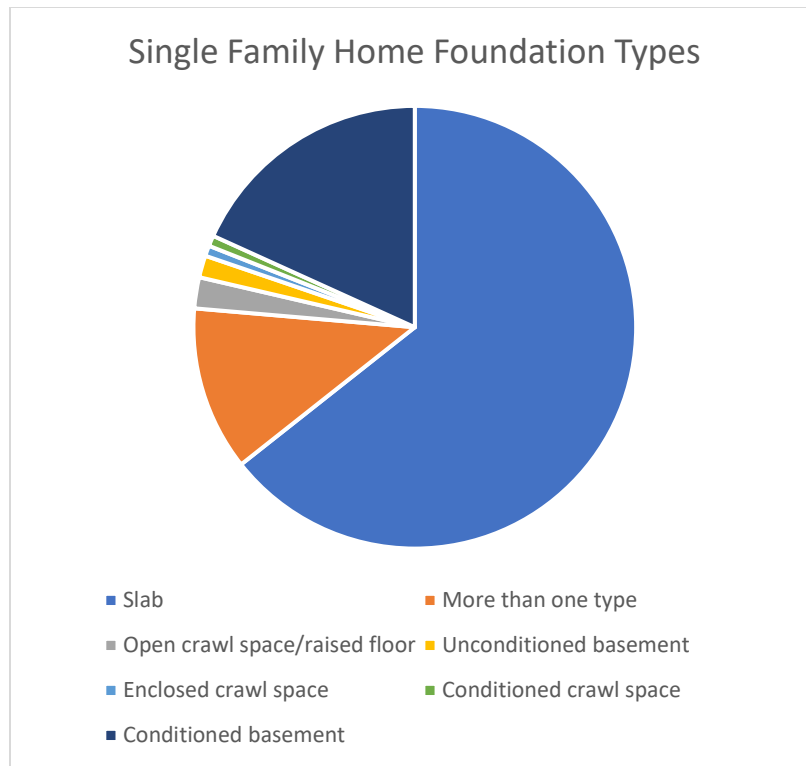


Figure 6. Single Family Foundation Types, 2020

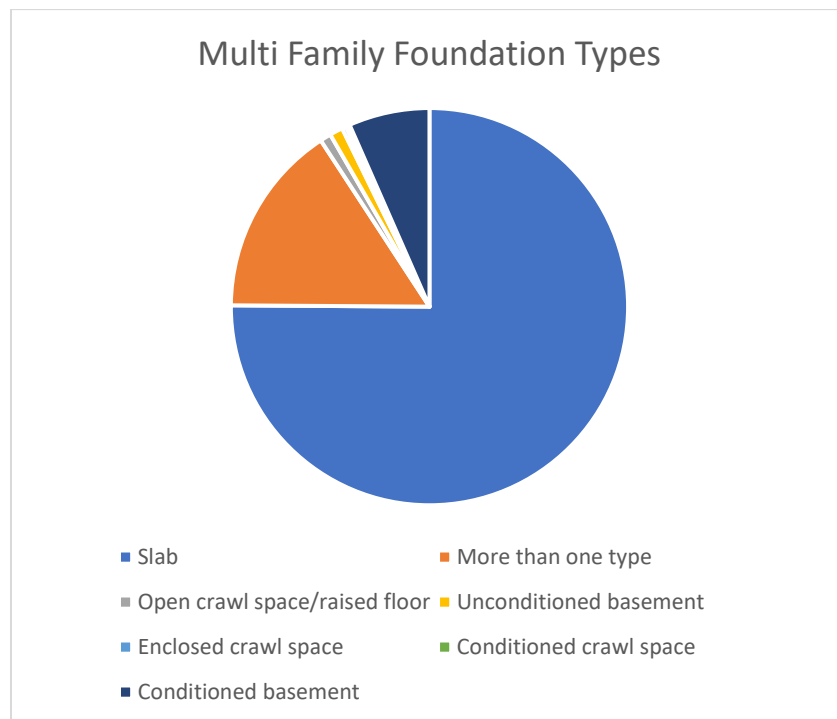


Figure 7. Multi-Family Foundation Types, 2020

Above Grade Wall Insulation

Above grade wall insulation looks at cavity versus continuous insulation for single and multi-family homes and at state average *R*-values. Figures 8 and 9 show how many homes in each category had cavity only compared to cavity and continuous insulation. Continuous insulation is included in these figures if it is greater than R-1 insulation. Figures 10 and 11 look at average above grade wall insulation values for single family and multi-family construction for cavity and continuous insulation combined.

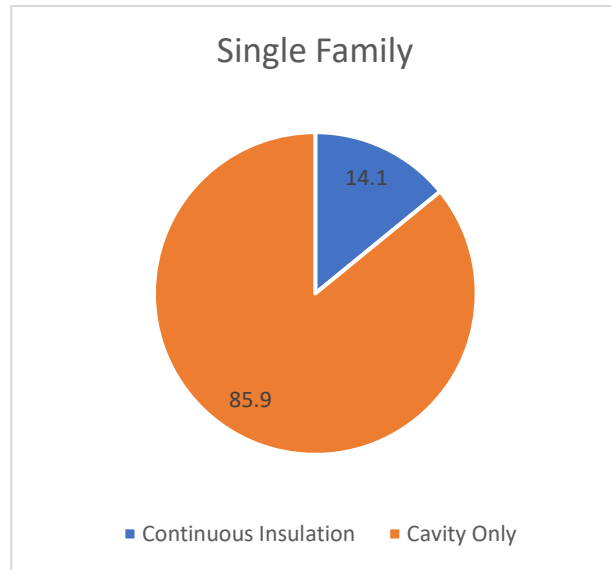


Figure 8. Single Family Cavity vs. Continuous Wall Insulation.

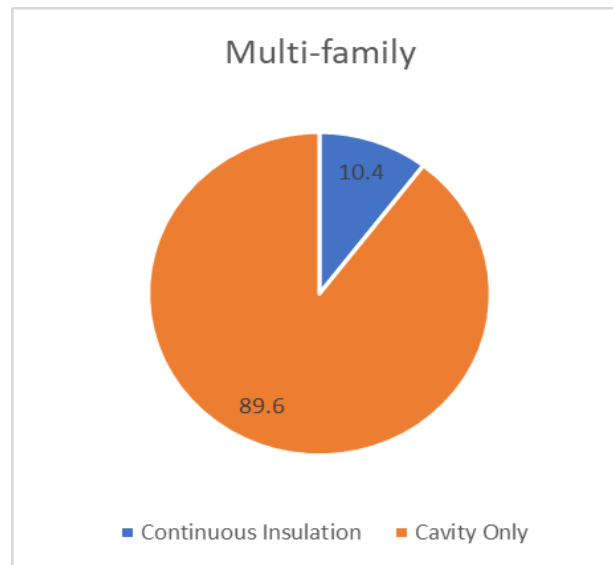


Figure 9. Multi-family Cavity vs. Continuous Wall Insulation

Trends in HERS® Rated Homes, 2021

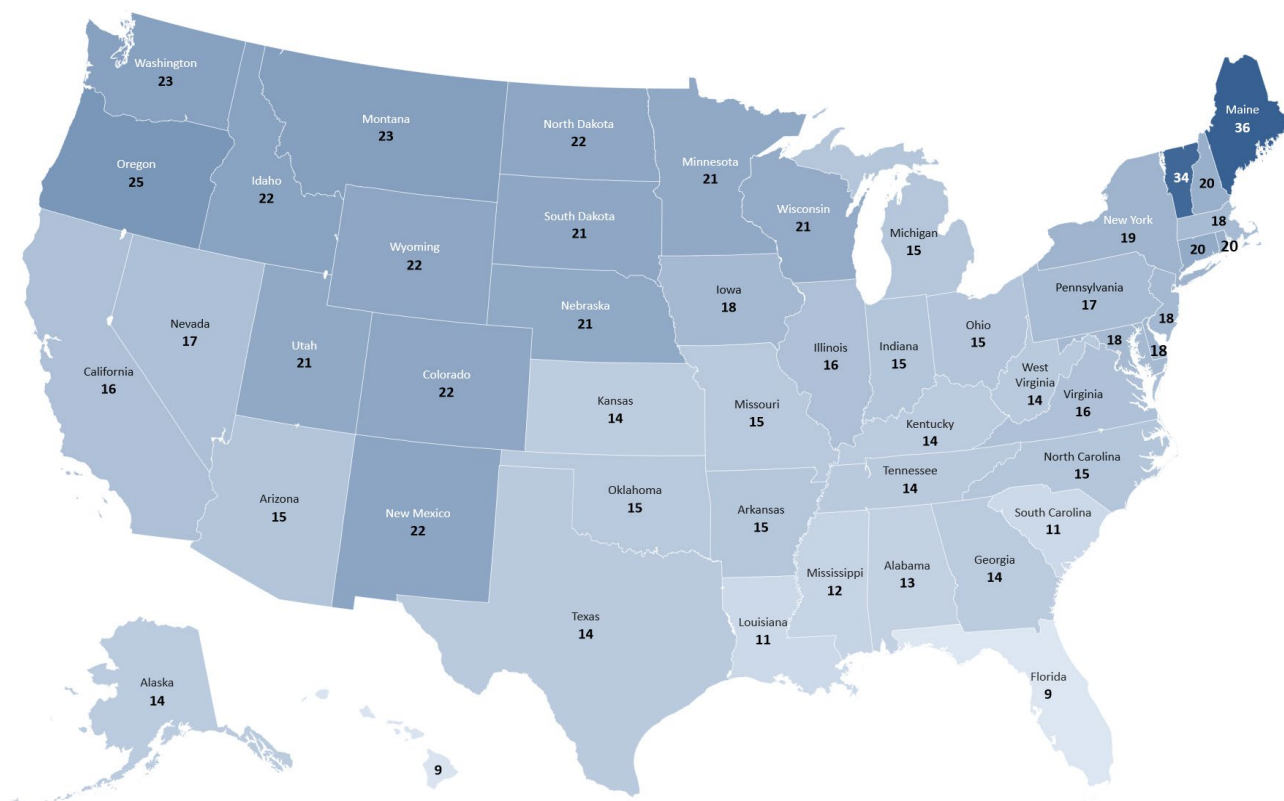


Figure 10. Single Family Avg. Wall R-Value by State, 2020

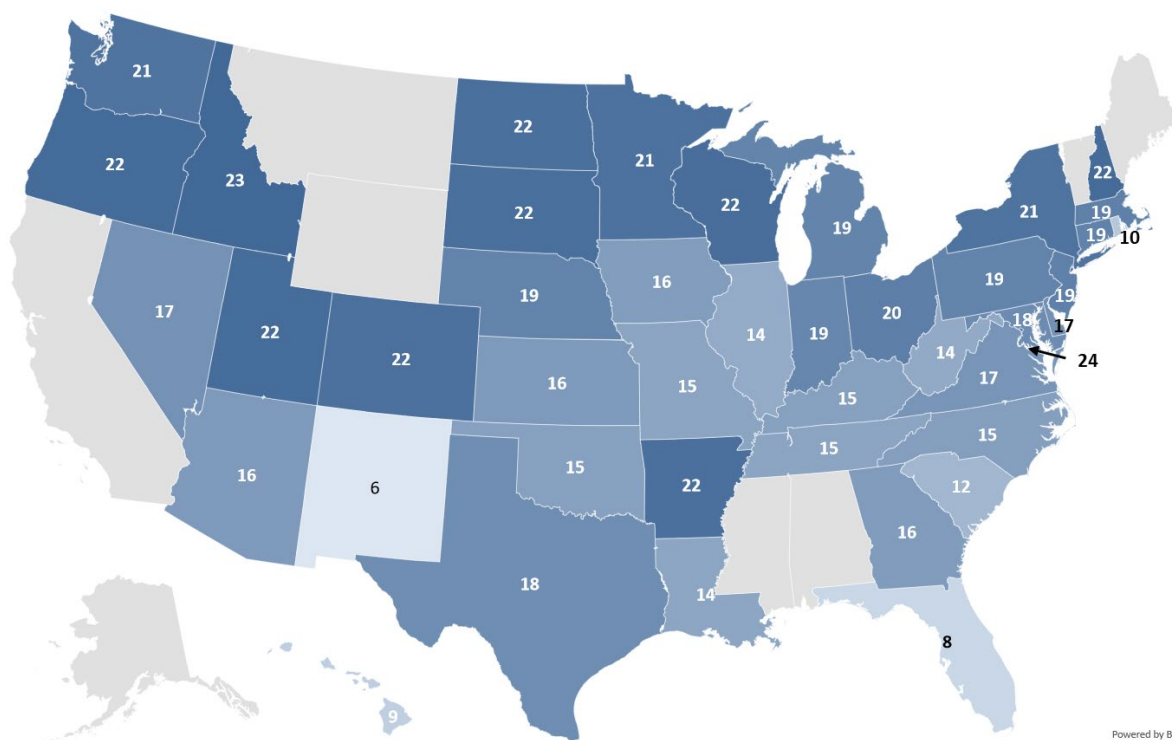


Figure 11. Multi-family Avg. Wall Insulation R-values, 2020

Ceiling Insulation and Radiant Barriers

In 2020, 87 percent of single family and 83 percent of multi-family HERS Rated homes used blow-in insulation in ceilings while the remaining used batt insulation. When it comes to the use of radiant barriers, 41 percent of single family and just 7 percent of multi-family rated homes indicated having a radiant barrier, as shown in Figures 12 and 13.

Average ceiling insulation R-values by state are shown in Figure 14 for single family homes and Figure 15 for multi-family homes.

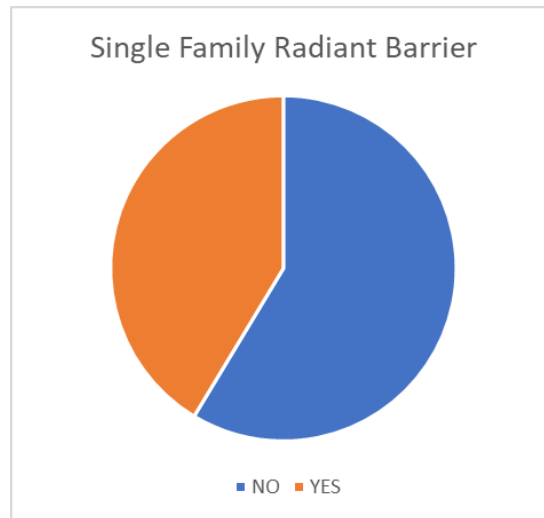


Figure 12. Single Family Homes with Radiant Barriers, 2020

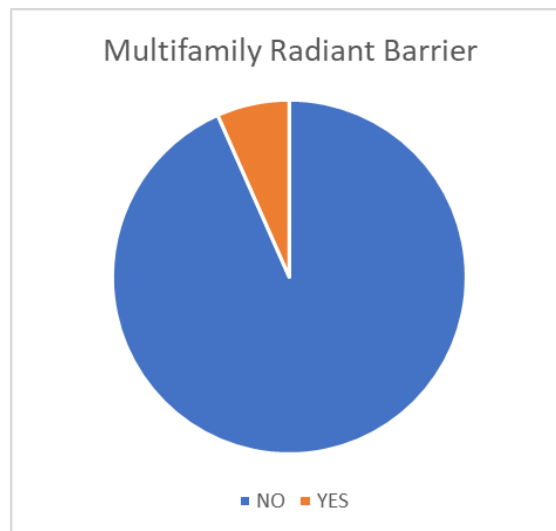


Figure 13. Multi-family Homes with Radiant Barriers, 2020

Trends in HERS® Rated Homes, 2021

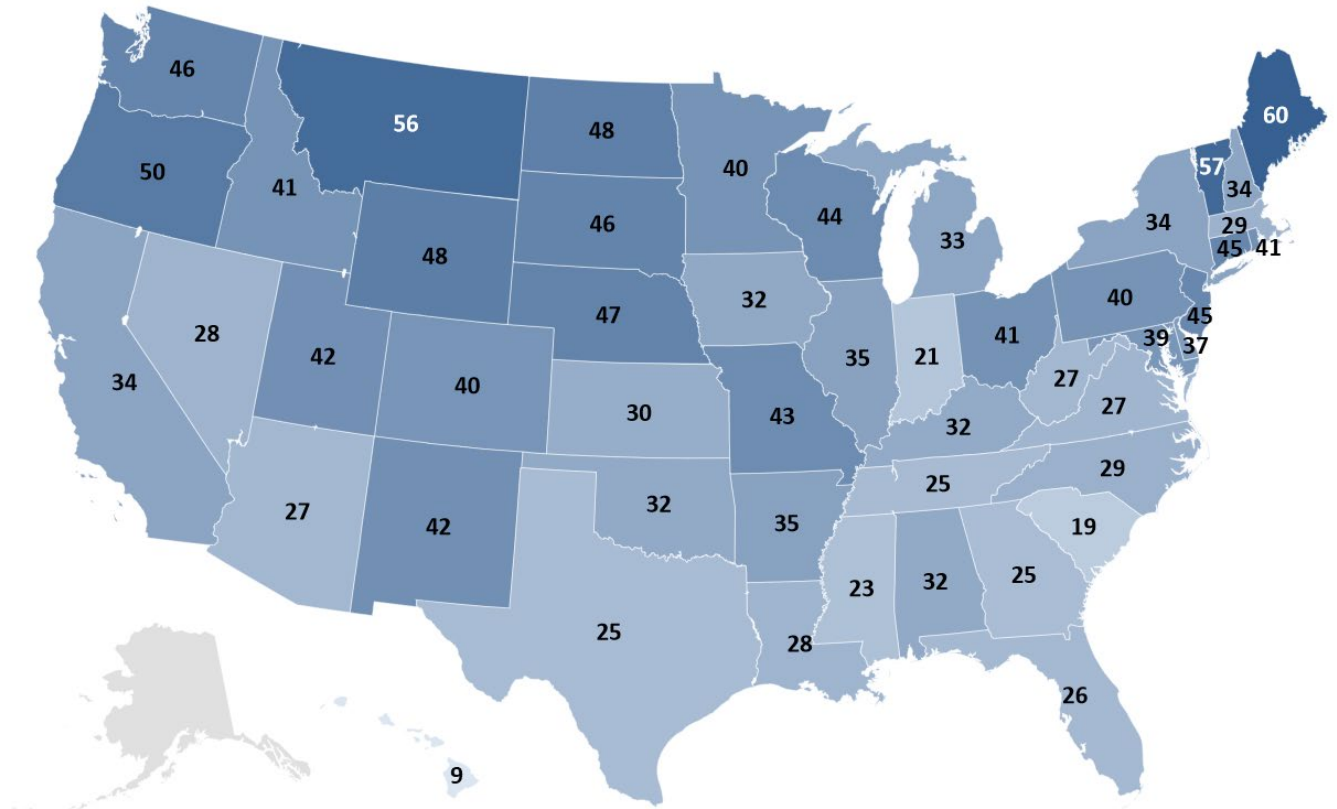


Figure 14. Single Family Avg. Ceiling Insulation R-Values, 2020

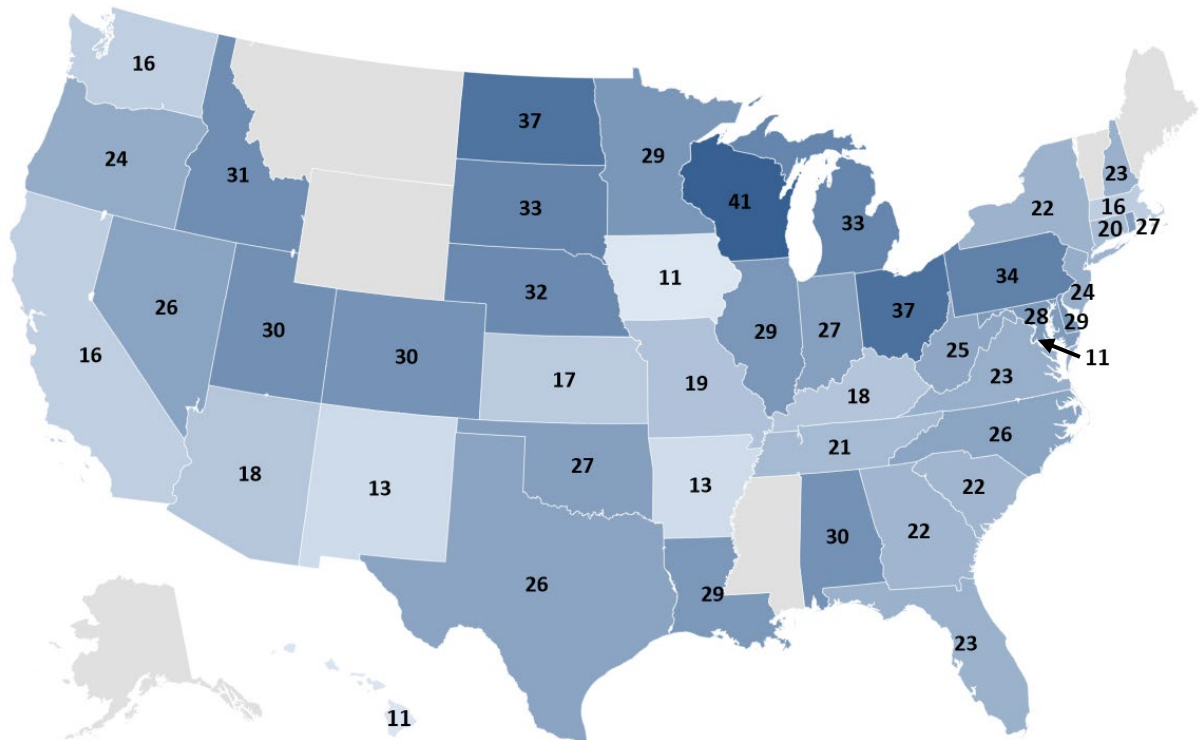


Figure 15. Multi-family Avg. Ceiling Insulation R-values, 2020

Window U-Value and SHGC

Data on window U-Values shows that 60 percent of windows have a U-Value between 0.31-0.35. Window solar heat gain coefficient (SHGC) shows a similar trend with about 60 percent of windows having an SHGC of 0.2-0.25. Figure 16 shows the breakdown of window U-Values and solar heat gain coefficients for single family ratings last year. Figure 17 shows multi-family window U-Values and SHGC where 57 percent of homes had window U-Values between 0.31 and 0.35. Unlike single family homes, multi-family homes were roughly split on SHGC with 40 percent having between 0.2 and 0.25 and another 40 percent having between 0.26 and 0.30.

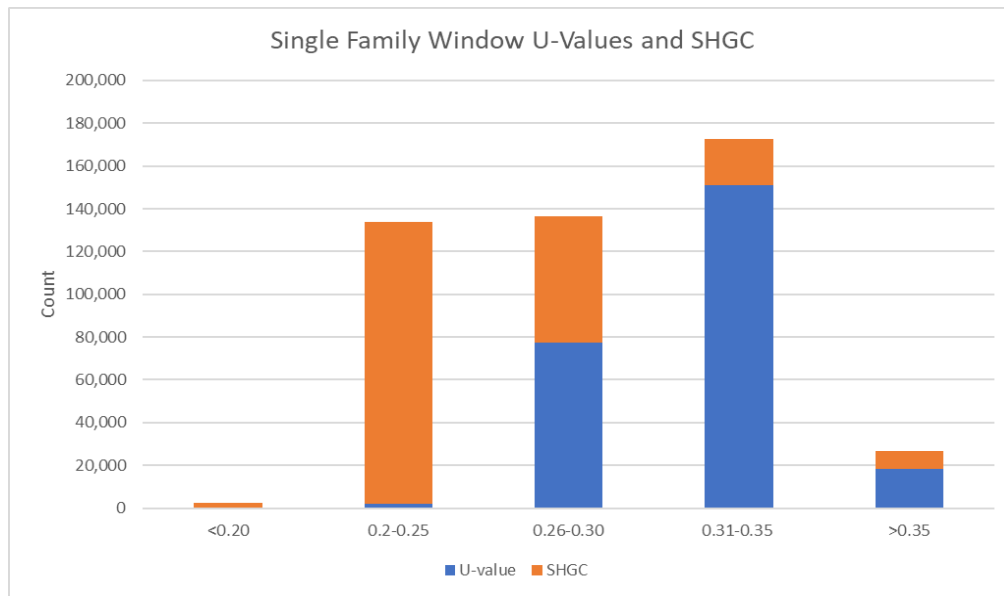


Figure 16. Single Family Window U-Value and SHGC, 2020

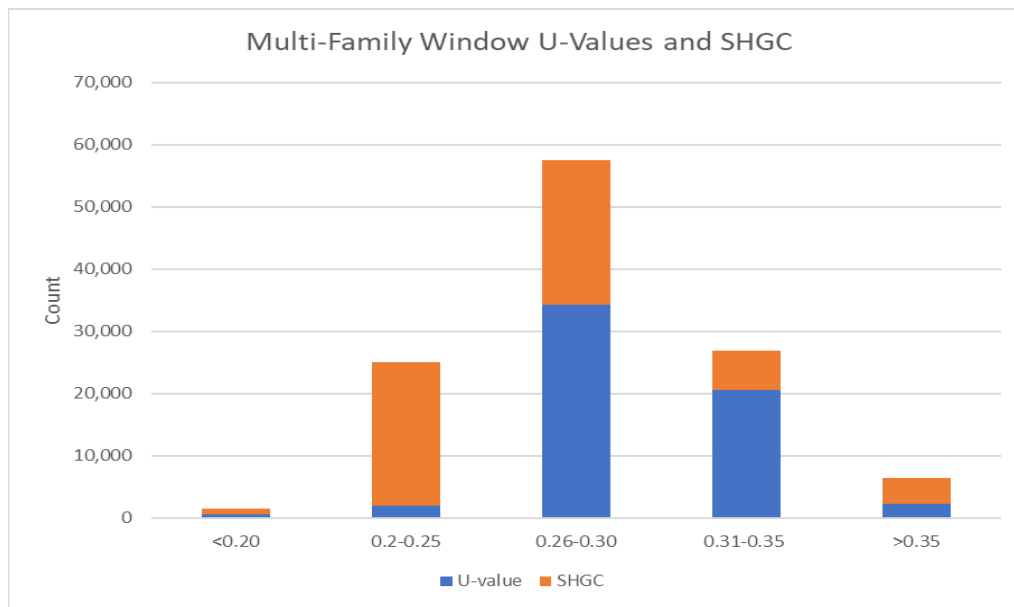


Figure 17. Multi-Family Window U-Value and SHGC, 2020

Envelope Air Leakage Rates

In 2020, nearly 80 percent of all single family HERS Rated homes had an envelope leakage rate of between 2 and 5 air changes per hour at 50 Pascals, while only 60 percent of multi-family projects fell within that threshold. Impressively, more than 30,000 single family homes had an air leakage rate of less than 2 ACH50. Figure 18 shows the breakdown of air leakage rates for rated homes last year.

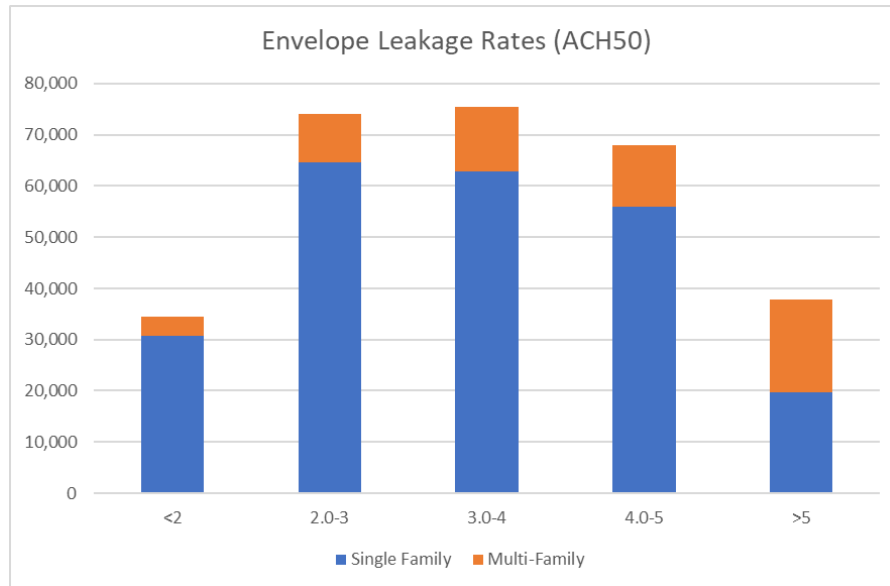


Figure 18. Air Leakage Rates of HERS Rated Homes, 2020

Ventilation Types

Data on mechanical ventilation types shows that exhaust only ventilation strategies are still the most common for HERS Rated homes. For homes with mechanical ventilation, the second most common strategy for single family homes is the use of the air handler for ventilation air, while the second most common strategy for multi-family is supply only. Figure 19 shows the breakdown of ventilation types for HERS Rated homes last year.

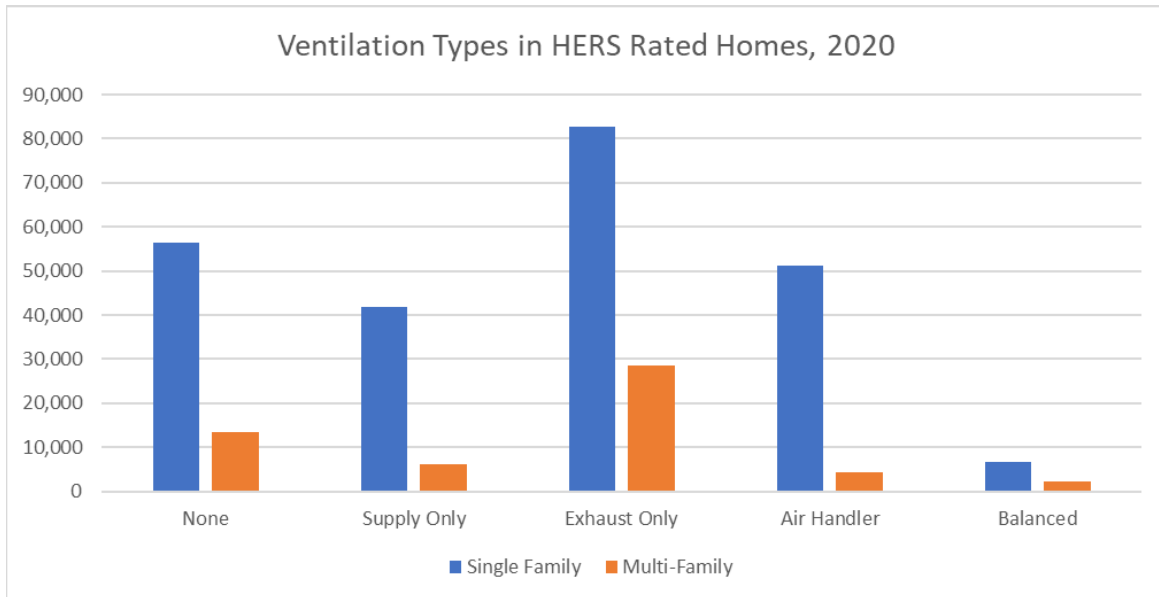


Figure 19. Ventilation Types in HERS Rated Homes, 2020

Heating, Cooling and Water Heating Equipment

RESNET looked at data trends for furnace and air conditioner efficiencies as well as types of water heaters and the fuel sources for water heaters and furnaces. Looking at furnace efficiencies, about 45 percent of all single family homes with a fuel-fired furnace used a standard efficiency furnace (less than 90 AFUE), while 55 percent used a high-efficient furnace as shown in Figure 20. However, for multi-family units, very few used a standard efficiency furnace while about 85 percent of units with fuel-fired furnaces used a high-efficiency type.

For air conditioner efficiency, 63 percent of single family homes used either a 14 or 16 SEER unit, while 14 and 15 SEER were the most common for multi-family, representing 62 percent. As you might expect, when looking at air conditioner and furnace efficiency across warm versus cold climates, the northern half of the U.S. uses high-efficient furnaces while the southern half tends to use standard efficiency furnaces with higher efficiency air conditioners.

Trends in HERS® Rated Homes, 2021

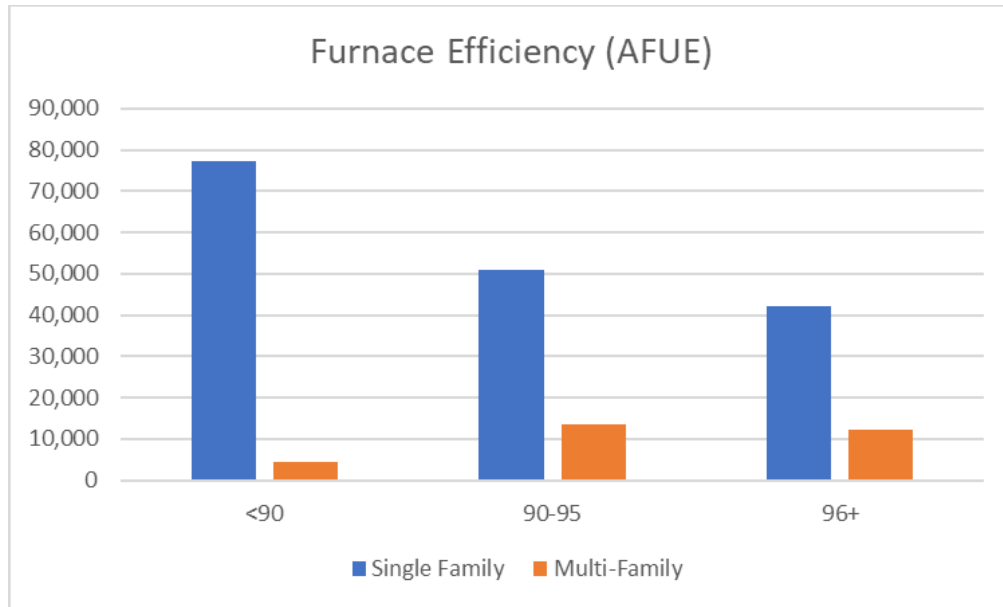


Figure 20. Furnace Efficiency in HERS Rated Homes, 2020

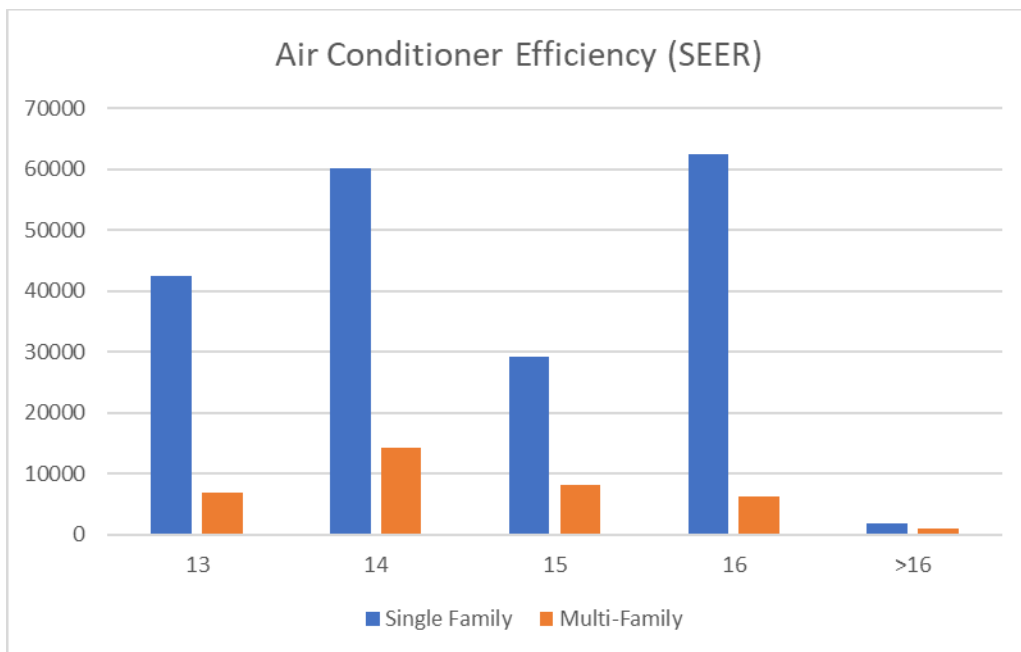


Figure 21. Air Conditioner Efficiency in HERS Rated Homes, 2020

When looking at the fuel type for furnaces, natural gas has the largest share of HERS Rated homes with nearly 90 percent for single family and 85 percent for multi-family, as shown in Figures 22 and 23. It should come as no surprise that fuel-fired air distribution heating systems are far-and-away the most popular in both housing types, as shown in Figure 24. Air-source heat pumps come in a distant second while all other heating system types have fewer than one thousand ratings each.

Figures 25 and 26 look at water heater fuel types and show that natural gas is still the most popular for single family homes, but electric water heaters take a bigger chunk with nearly thirty percent of the market. The multi-family sector shows a different trend with 55 percent of the homes using electric water heaters.

Finally, data on hot water heater types shows that conventional, storage-type water heaters are the most used, with 65 percent of the single family market using that type and nearly three-quarters of the multi-family sector using the same. Instant water heaters are the second most common in both housing types, while heat pump water heaters are increasing in use, but still a small market share as shown in Figure 27.

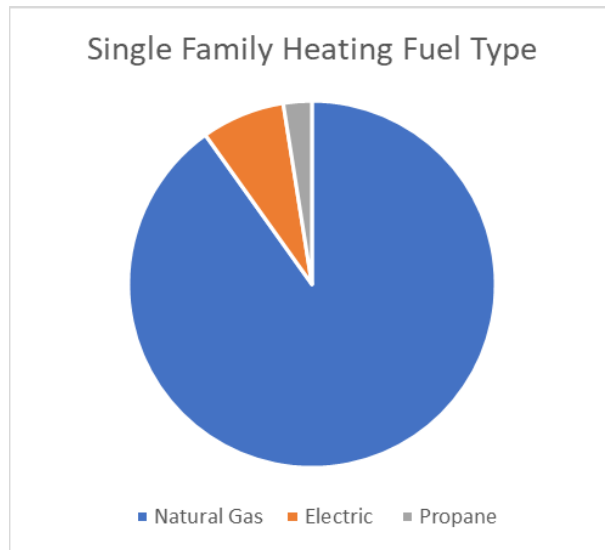


Figure 22. Single Family Heating Fuel Type, 2020

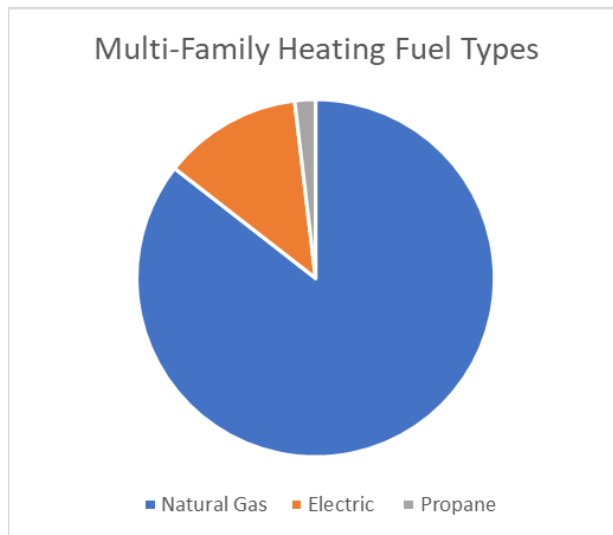


Figure 23. Multi-Family Heating Fuel Type, 2020

Trends in HERS® Rated Homes, 2021

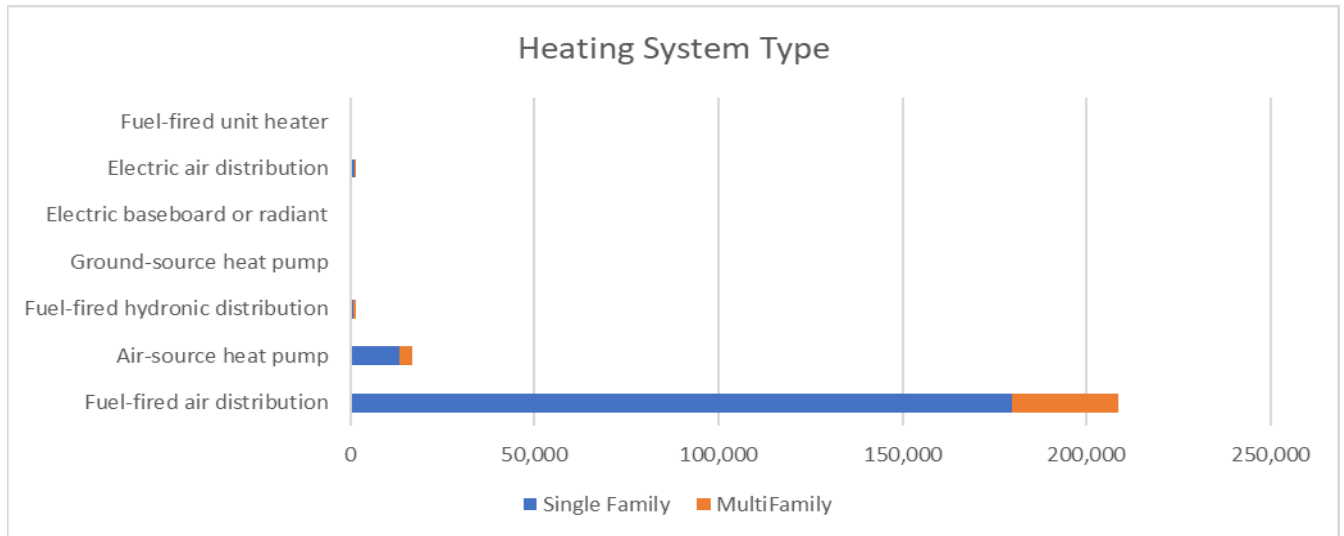


Figure 24. Heating System Types, 2020

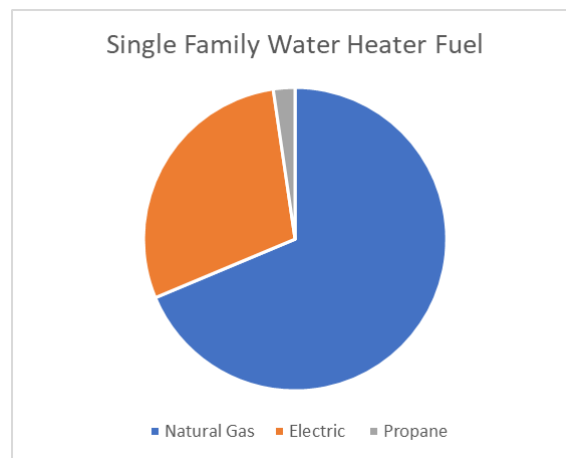


Figure 25. Single Family Water Heater Fuel Type, 2020

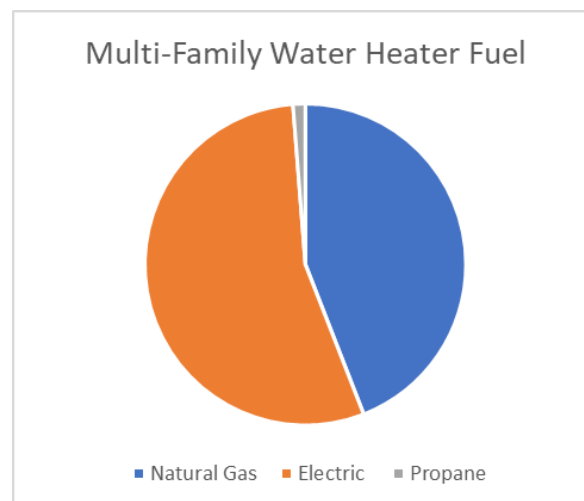


Figure 26. Multi-Family Water Heater Fuel Type, 2020

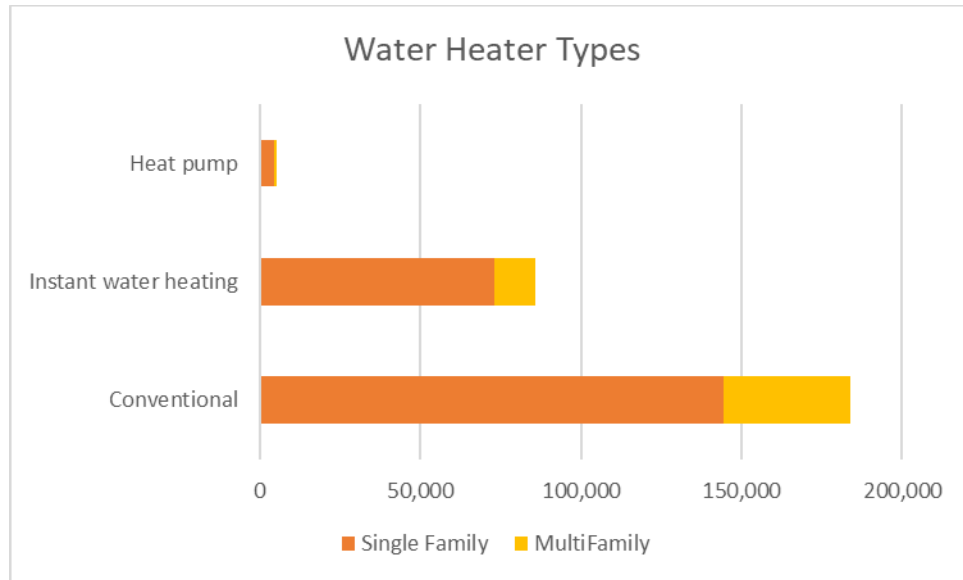


Figure 27. Water Heater Types for HERS Rated Homes, 2020

The Use of Solar PV on HERS Rated Homes

In 2020 there were just shy of 5,000 HERS Rated homes that had solar PV. A total of 4,081 were installed on single family and duplex homes and the remainder were on multi-family. The following are some statistics for HERS Rated homes using solar:

- The average solar PV system produces 5,969 kWh per year.
- Average HERS Index before accounting for solar was a 56.
- Average impact on the HERS Index for homes with solar was a 28.

The following are the top 10 states for the use of solar on HERS Rated homes, last year. One-third of all HERS Rated homes with solar were in Colorado.

State	# Homes with Solar
CO	1,665
FL	849
CA	537
TX	322
AZ	293
NY	213
CT	174
MA	160
NH	108
HI	81

2020 Special Feature: Trends Toward Net-Zero Homes

The trend toward net zero HERS Rated homes is accelerating. Even though rated homes achieving a zero or less is a low percentage of overall ratings, the number achieving a HERS scores of 50 or less has been steadily increasing since RESNET began tracking HERS Ratings in its National Buildings Registry in 2013. As shown in Figure 28, just 4 percent of HERS Ratings were scoring a 50 or less in 2013 and in 2020 nearly 12 percent achieved that score.

The remainder of this section will review some of the trends in HERS Ratings last year as they relate to net-zero construction.

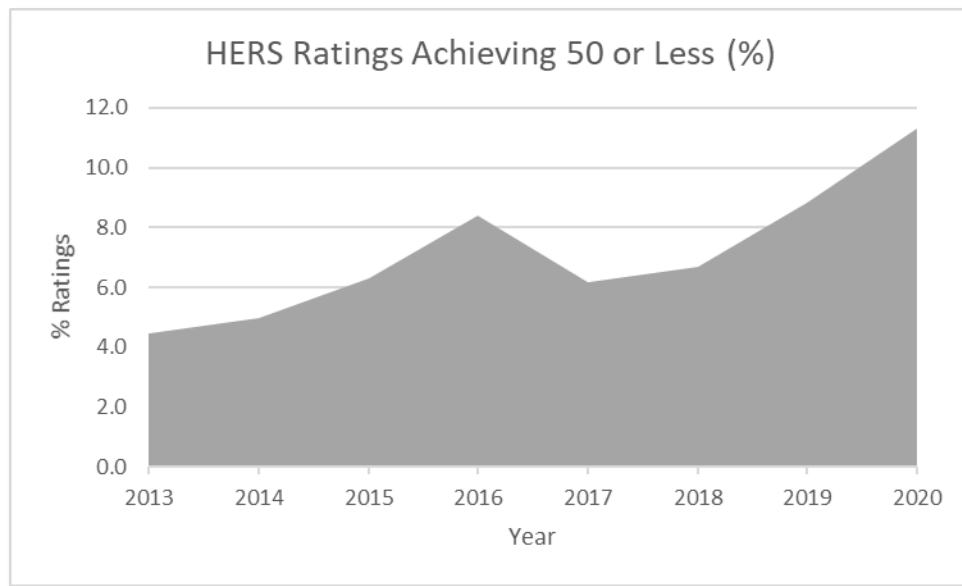


Figure 28. HERS Ratings Achieving 50 or Less

HERS Data Used for This Analysis

RESNET used single family HERS Rating data for all ratings submitted to the RESNET National Registry in 2020. The data was broken down into three categories:

1. Net-Zero: Homes achieving a Zero or less.
2. Net-Zero Ready: Homes scoring between 30 and 45, but without any contribution from solar.
3. National Average: Homes scoring at the 2020 national average score of 58 or higher.

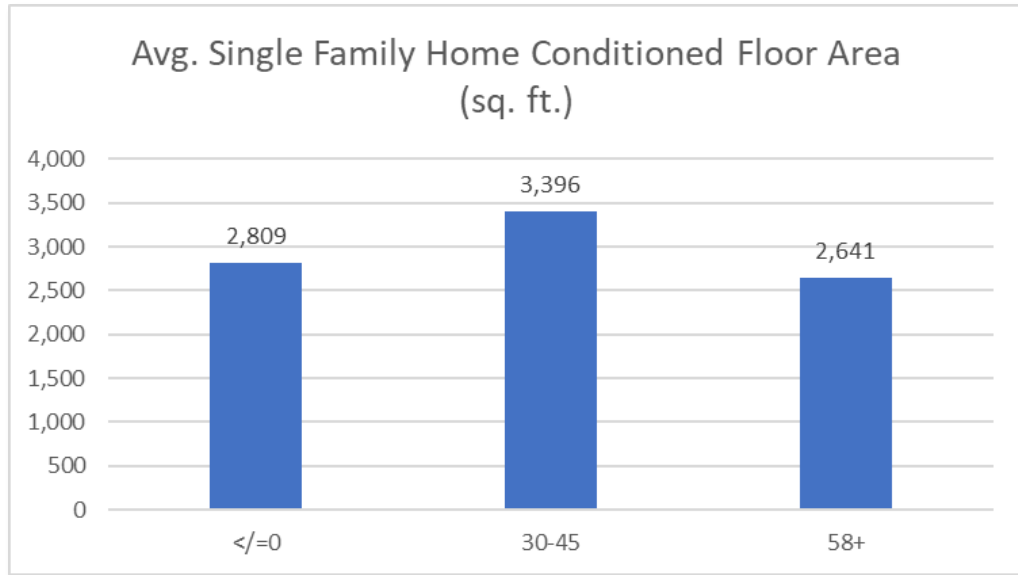
The following are the number of HERS Ratings in each category:

HERS Score	Number of Single-Family Homes in Sample
≤ 0 (w/ Solar)	173

Trends in HERS® Rated Homes, 2021

30-45 (No Solar)	2,444
58+ (No Solar)	103,739

The average conditioned floor area for each of these categories is as follows:



Insulation R-Values and Window U-values

RESNET looked at insulation R-values across four different building assemblies: walls, floors, foundations and ceilings. Figure 29 compares insulation levels across each of these assemblies for each of the three categories.

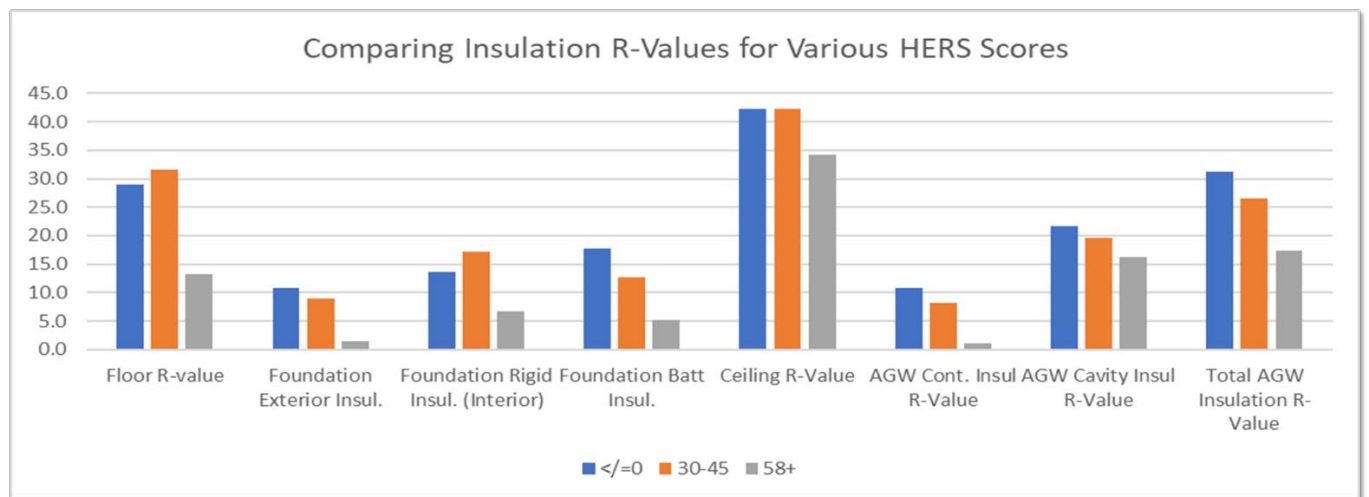


Figure 29. Single Family Insulation R-values for Various Building Assemblies and HERS Score Ranges, 2020

As expected, most assemblies have higher R-values as HERS scores decrease. One area of particular interest is the difference between the use of continuous and cavity insulation for above grade walls (AGW). Homes achieving a zero or less are using an R-10 continuous insulation on average, while homes achieving a 58 or higher are using almost no continuous insulation, on average.

When looking at window U-values, it is clear that homes with lower scores are using more efficient windows. Figure 30 shows the average window U-values for each category. A look at solar heat gain coefficients (SHGC) revealed that the average is nearly the same across all three categories.

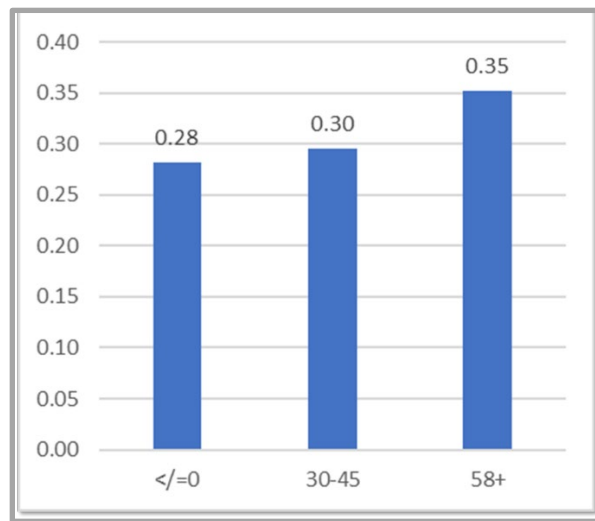


Figure 30. Window U-Values for Single Family HERS Rated Homes, 2020

Envelope Leakage Rates and Equipment Efficiencies

Next, RESNET compared envelope leakage rates and equipment efficiencies for heating, cooling and hot water. When comparing envelope leakage rates across the three categories, Figure 31 shows the differences in average leakage rates. This graphic makes it clear that homes with lower scores achieve lower envelope leakage rates.

Trends in HERS® Rated Homes, 2021

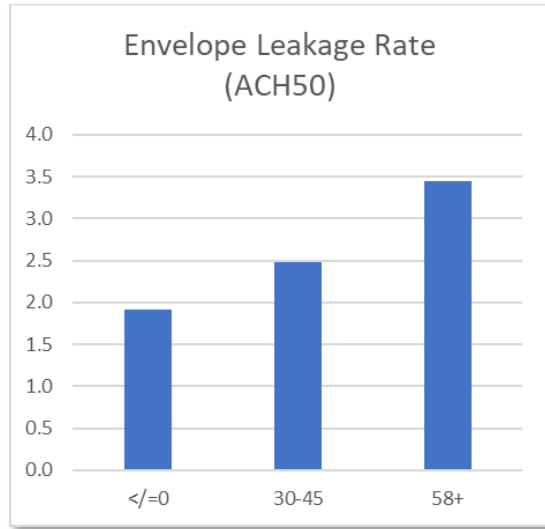


Figure 31. Envelope Leakage Rates for Single Family HERS Rated Homes, 2020

Gas furnace and air conditioner efficiencies show similar trends. As homes achieve lower HERS scores, they are using equipment with higher efficiencies. Figures 32 and 33 show furnace and air conditioner efficiencies.

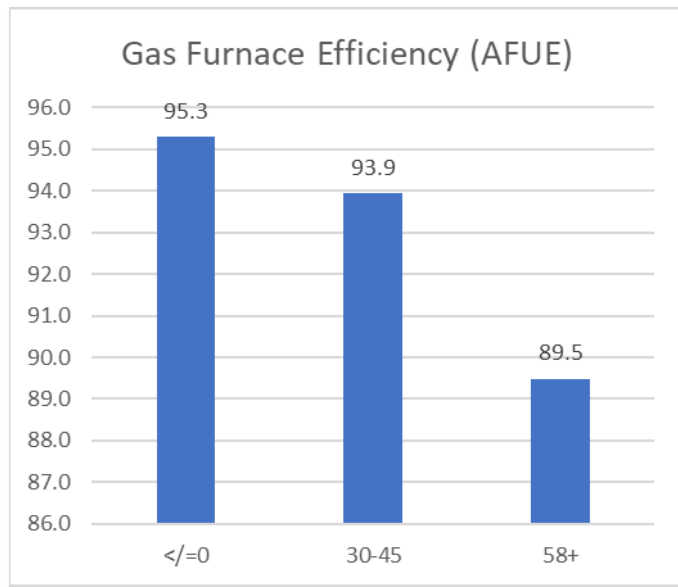


Figure 32. Average Gas Furnace Efficiency for HERS Rated Homes, 2020

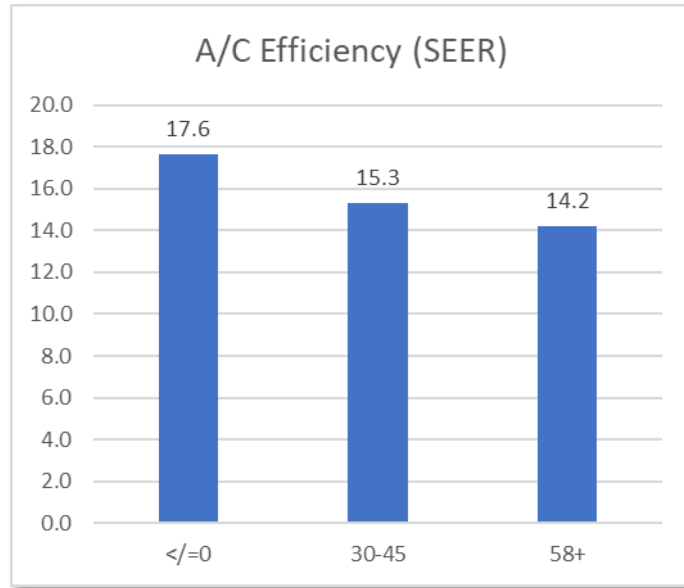


Figure 33. Average Air Conditioner Efficiency for HERS Rated Homes, 2020

The last comparison across these three categories of HERS scores was for water heaters. The average energy factor for homes scoring a zero or less is an impressive 2.6. This is largely attributable to the increased use of heat pump water heaters across net-zero homes.

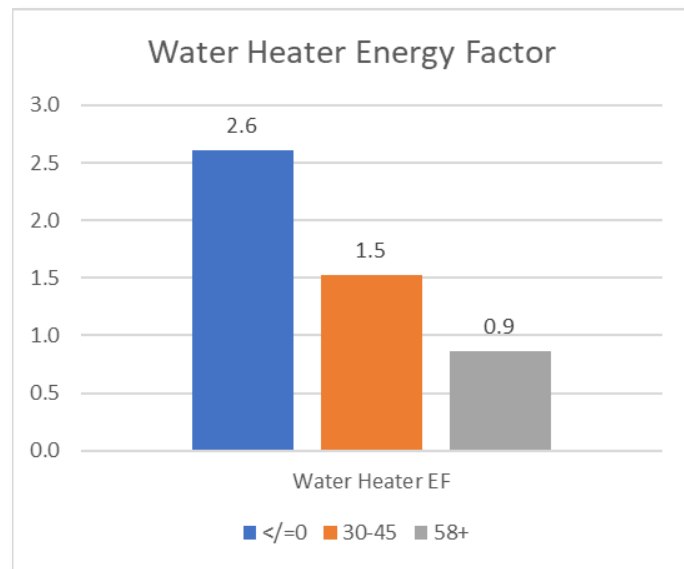


Figure 34. Average Water Heater Energy Factor for HERS Rated Homes, 2020

A Few Key Differences Among Net-Zero Homes and All Other Ratings

When comparing data on the features of net-zero homes and all other single family ratings last year, there are a few key components that stand out. Figure 35 shows the percent of net-zero ratings with these four key features compared to all other single

family ratings. As shown earlier in Figure 27, heat pump water heaters are a small percentage of overall water heater types used in HERS Rated homes, however, they represent two-thirds of homes achieving net-zero. Similarly, Figure 24 showed that heat pumps had a fairly small market penetration of overall heating equipment types, but nearly one-third of homes achieving net-zero have one. Balanced ventilation and continuous insulation are also much more prominent in net-zero homes than other single family HERS Ratings.

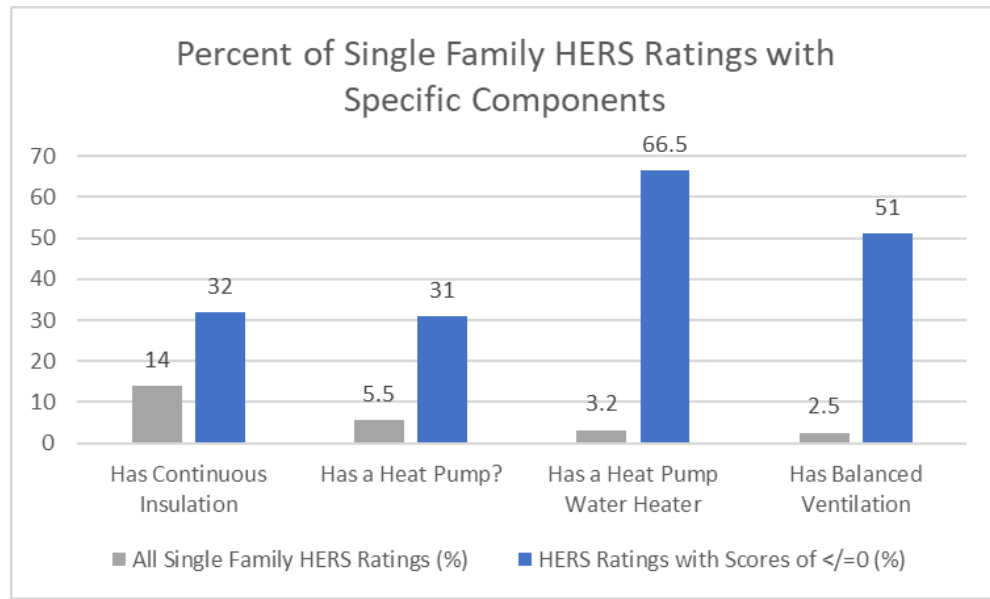


Figure 35. Comparison of Select Building Components for Net-Zero Homes, 2020

Comparison of Fuel Types

The last comparison of net-zero homes and all other single family ratings looked at fuel types. Figures 36 and 37 show the breakdown of fuel types for all single family ratings and net zero ratings last year. This comparison reveals that homes achieving net zero are far more likely than all other homes to be all electric.

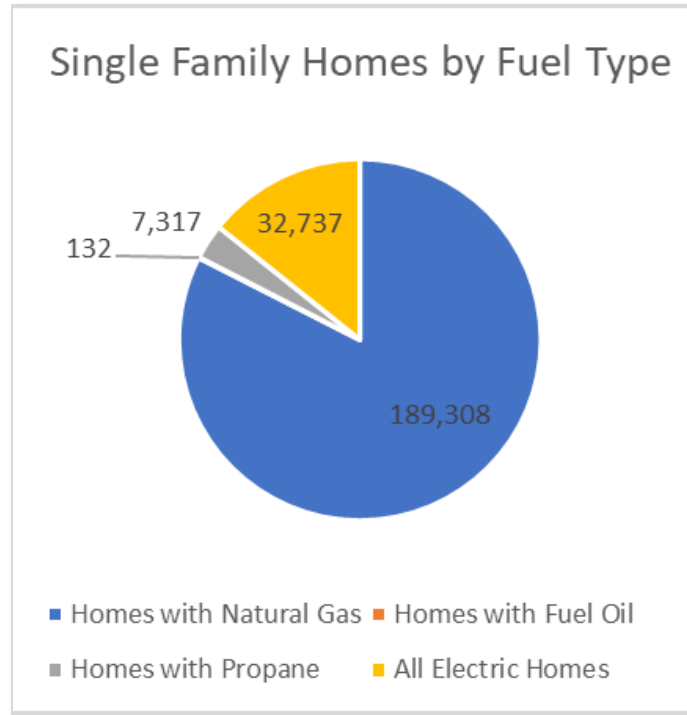


Figure 36. Single Family HERS Ratings by Fuel Type, 2020

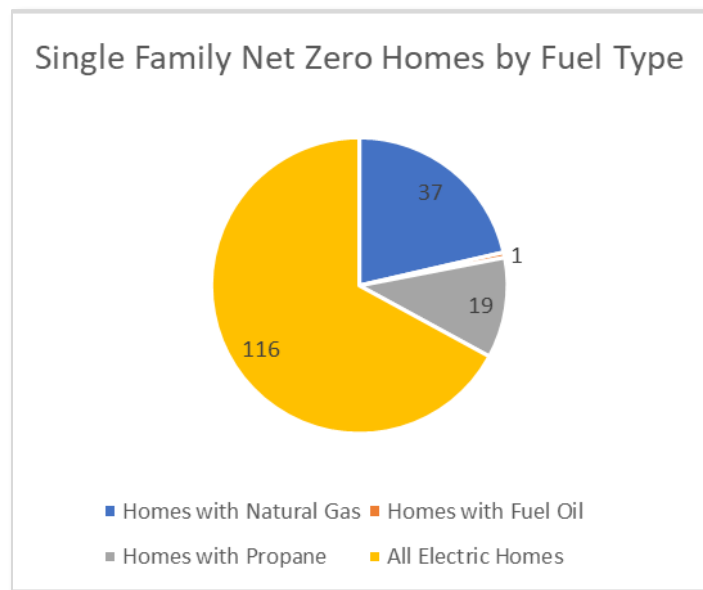


Figure 37. Single Family Net Zero HERS Ratings by Fuel Type, 2020

Closing Remarks

This is the second installment of RESNET's *Trends in HERS Rated Homes* report. The 2021 report built off last year's report and added data for multi-family HERS Ratings. RESNET intends to make this an annual tradition and welcomes feedback on data

trends you would like to see analyzed for next year's report. Feedback can be sent to RESNET's Program Director, Ryan Meres at ryan@resnet.us.

This report is made possible by support from RESNET's Suppliers Advisory Board members. If you are a supplier of goods or services to the homebuilding market, you can join RESNET's Suppliers Advisory Board and receive additional access to RESNET's HERS Rating data. See below for more information about the SAB.

About RESNET's Suppliers Advisory Board



The purpose of the RESNET Suppliers Advisory Board is to provide an opportunity for suppliers to better understand RESNET; network with other suppliers, customers and HERS raters; and to provide supplier input to the RESNET Board of Directors. Membership is open to all suppliers of goods and services to the homebuilding market. Visit <https://www.resnet.us/about/sab/> for more information and the benefits of becoming a member of the SAB.