

ENERGY INSIGHTS The Future of Energy Use in U.S. Homes

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GREEN BUILDER

Moving Toward a Net Zero Future

The nearly 130 million residential and commercial buildings in America use 39% of the country's energy and account for 74% of its use of electricity, notes the Department of Energy. Buildings account for about 35% of U.S. carbon emissions.

Reaching zero emissions by 2050 and a 50% reduction compared to 2005 levels by 2030 will require an enormous effort. Opportunities for innovation and the transformation of the way buildings operate are unlimited. Private and public investments are already paving the way to a brighter future.

About one-quarter (26%) of all homes in the U.S. are all-electric, according to the U.S. Energy Information Administration, and the transition to electrification is accelerating in many states. However, less than 1% of all homes meet the Department of Energy's Net Zero Ready Home standards.

More than 313,000 homes were rated and given a HERS score (Home Energy Rating Systems) in 2021, the ninth consecutive year that the number of homes rated increased. Better yet, the average HERS Index in 2021 was 58, representing a 42% improvement in energy efficiency compared to a home built in 2006, according to data from RESNET.

This report provides insight into the actions and aspirations of consumers and builders, along with a review of progress towards a net zero economy and the products that contribute to less energy use.



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In This Report

All-electric homes and buildings are increasingly embraced by consumers, builders, and municipalities as the path to a net zero economy.

Components such as heat pumps, water heaters, appliances, demand side energy management systems, solar/battery storage evolve to achieve higher levels of energy efficiency.

3

Government funding and state and local mandates accelerate progress on reduced energy consumption.



Our Findings

Progress has been made on improving the energy efficiency of new homes over the past two decades. While energy efficient products, all-electric homes, and renewable energy are important elements to lower energy consumption, every building-whether newly built or retrofit-needs a tight envelope to ensure energy isn't wasted.

While the median HERS index varies widely by state, every state now has a median HERS index for those homes that are rated below the benchmark of 100 set in 2006. A lower HERS rating demonstrates better energy performance.



California, which has enacted numerous energy-related mandates for new construction, had by far the lowest median HERS index score in 2023, according to data from Ekotrope, a company that provides HERS software. Puerto Rico, Arkansas, Kansas, North Carolina, and Kentucky had the highest median HERS scores.

Electrification Trends

The percentage of homes that rely entirely on electricity across the U.S. varies broadly, with some states making faster progress on these goals than others. For some states, mandates and incentives push consumers and developers to build all-electric homes or convert existing homes to electricity.

Other states with a higher percentage of all-electric homes may be a function of the climate, since regions with colder climates traditionally relied more heavily on fossil fuel for heat. Florida stands out as the state with the highest percentage of all-electric homes, according to Ekotrope data.

Over the past two years, electrification has increased more rapidly in some states, such as Arizona, more quickly than in others, according to Ekotrope data.



Energy Star and Energy Ready Homes

To encourage the development of higher performance homes, the EPA created the Energy Star homes program. Energy Star certified homes go beyond simply including Energy Star appliances. Homes that meet this standard must be at least 20% more energy efficient than local building code requirements. Compliance is based on HERS ratings, with Energy Star 3.1 homes needing a HERS rating of 55 to 65 or less.



Variations in building codes, mandates and incentives affect how many homes meet Energy Star requirements in different states. The top 10 states with the highest percentage of Energy Star 3.1 homes includes New Jersey, Maryland, Arizona, New Mexico, Nevada, New York, Texas, Colorado, Florida and New Hampshire, according to Ekotrope.



Top 10 States by Energy Star v3.1 Pass Rate (2023)

The Department of Energy's Zero Energy Ready Home (ZERH) program, introduced in 2013, takes performance an extra step. To achieve this certification, a home must first meet the standards of the EPA's Energy Star and Indoor Air Plus programs, then increase the energy efficiency to a level typically 40% to 50% higher than the average home. ZERH homes also have better indoor air quality, water efficiency and are designed for easy installation of renewable energy.



As with the Energy Star program, different states have varied levels of participation in the ZERH program. The 10 states with the highest percentage of ZERH certified homes includes New Jersey, Pennsylvania, New York, Colorado, Massachusetts, Arizona, Minnesota, Nevada, Illinois and New Mexico, according to Ekotrope.

Energy Efficient Technology

High-performance buildings require a multilayered approach to achieve net zero status. Everything from windows, a tight envelope, insulation and highly energy efficient components to demand side energy management contributes to the goal of reducing energy consumption.

Eliminating dependence on fossil fuels and converting to allelectric living are essential elements to reach zero emissions goals. Rebates and incentives are available to builders and homeowners from federal, state and local governments and utility companies to accelerate the introduction of energy efficient products. While products and building techniques continue to evolve, here are some key facts to know about components that contribute to a high-performance building.

Water Heaters

Nationally, traditional water heaters with a tank are the most common, but innovations including a tankless—or instantaneous on-demand hot water system—and the newer heat pump water heater are gaining ground. Traditional water heaters can use as much energy as a dishwasher, refrigerator, washing machine and dryer combined.



Three things to know about water heaters:

- 1. Hybrid electric water heaters use heat pump technology to produce hot water by pulling warmth from the surrounding air. Tankless water heaters provide a constant supply of hot water yet save energy because the system isn't storing warm water.
- 2. New hybrid water heaters can be set to heat water in the daytime when energy use is low and store it for an evening shower when energy demand (and costs) may be lower. They often include leak detection and prevention systems.
- 3. Right sizing a water heater for the number of residents can save energy. A small 50–60-gallon water heater is sufficient for a household with one to three people, while a medium (60–80 gallon) system is better for a household with three or four people and a larger heater is needed for a bigger household.



HVAC Systems/Heat Pumps

Heating and cooling accounts for about half of a home's energy use, which makes it a prime candidate for upgrading to an energy efficient system. Heat pumps are considerably more common in the south because of the misconception that they don't work as well in cold weather, but they're increasingly an option to replace traditional furnaces and boilers.

Three things to know about heat pumps:

- 1. Heat pumps consistently perform well in cold climates, with studies showing that they can provide 100% of the heating needs for a household even when temperatures drop to -25° .
- 2. SEER ratings measure heat pump performance in warm weather, while HSPF ratings measure heat pump performance in cold weather. The Energy Star minimum SEER rating is 14.5, while the minimum Energy Start HSPF rating is 8.2. Both are important in climates that experience both cold winters and warm summers, but in areas with cold winters and mild summers, the HSPF rating may be a more important focus.
- 3. Heat pumps are an important element in the path to electrification since they cool and heat air as well as dehumidify it.



Heating Sources By Region

As part of the emphasis on electrification and energy efficiency, the installation of boilers and furnaces is trending down, while the use of air source and ground source heat pumps is increasing, according to Ekotrope data.



Appliances

Installing all-electric appliances is a simple step to electrification. The broad range of appliance options provides energy efficient models at various price points.

Three things to know about appliances:

- 1. Step one for any appliance decision is to look for Energy Star certification, which can save up to 50% of energy use annually compared to an older appliance. The bright yellow Energy Guide label provides detailed information about potential savings from different models.
- 2. When comparing dishwashers and clothes washers, consider water conservation and options for energy saving cycles. Typically, shorter dishwasher cycles will use more energy than a longer cycle because it will use more hot water. Conversely, a shorter cycle on a clothes washer can save energy and water.
- 3. Durability and warranties are just as important as energy efficiency when choosing appliances since you want your equipment to be repairable and last longer.

Many homeowners have already upgraded their appliances to energy efficient models and will therefore expect them in their next home, according to COGNITION data.



Insulation

While high-cost items such as HVAC systems and a complete array of new appliances can make a dent in energy consumption, one of the best and often less-costly investments is insulation.

High performance insulation helps moderate the temperature inside a building to offset heat or cold and therefore reduces energy demand. In addition, buildings with a tight envelope typically have better indoor air quality, especially in areas prone to wildfire smoke and other pollution.

To meet or exceed building codes, new technology such as the <u>Aerobarrier system from</u> <u>Aeroseal</u> finds and seals potential air leaks everywhere, including places that may be otherwise impossible to reach.

The plug-n-play system reduces labor costs and removes the possibility of failed blower door inspections. The quick and effective Aerobarrier process can be used at any phase of building from rough-in to move-in, which allows for flexibility in different climates.

Three things to know about insulation:

- 1. Generally, an R-value of 38 is recommended for buildings in southern climates, while an R-value of 49 is recommended for northern climates. Insulation values for various products are calculated as R-value per inch. For example, fiberglass, the most common insulation product, has an R-value of 2.2 to 3.2 per inch depending on how it's installed, while high density spray foam has an R-value of 6.25 per inch. Cellulose, which typically has a high percentage of recycled materials, has an R-value of 3.1 to 3.7 per inch.
- 2. Whether you are insulating an existing home, such as when replacing siding, or building a new home, most insulation can be blown into place. The cost can vary widely from one product to another, with high density spray foam one of the most effective choices but also among the costliest.
- 3. Some insulation products such as <u>Rockwool</u>, which is made from mineral wool, provides resistance to flame and extreme heat. Cellulose, which is the most sustainable product, can provide fire protection when installed between townhouses and reduces noise and odors.

Windows

Installing high performance windows can save hundreds of dollars in energy costs annually as well as improve the comfort and quiet of a home. While windows are one of the more costly home improvements to make, improvements in window manufacturing have made energy efficient windows available at any price point.

Three things to know about windows:

1. Ideally, you want Energy Star certified windows for a new home or a retrofit, but at a minimum, new windows must meet the local energy code requirements.

2. Double or triple-paned windows have an insulating air pocket that can be filled with gas for greater insulation. Windows with low-E coatings can reduce energy loss by 30% to 50%, according to the Department of Energy.

3. Window frames also impact their performance and durability. Frames made from composite wood products tend to be moisture resistant and yet have the same thermal properties as wood. Wood offers higher insulation value but contracts and expands, which can impact performance. Vinyl frames have a hollow cavity that can be filled with insulation for better performance.



Solar Panels

IWhether solar panels are mandatory, such as for most newly built homes in California, or encouraged by rebates and tax incentives, they provide a way to reduce the carbon footprint of a building, lower utility bills and generate reliable power.

Three things to know about solar panels:

 While still carrying a high upfront cost, the cost of solar panels has dropped by more than 60% since 2010, according to the National Renewable Energy Laboratory.
Depending on whether you store your own electricity or receive a credit on your electricity bill, it can take 7 to 12 years to recoup your investment in solar panels. The array of incentives can accelerate the return on investment. The average homeowner can save \$20,000 over 20 years with solar panels, according to the U.S. Department of Energy.

3. Solar panels are durable and low maintenance, with most including a 25-year warranty.

Battery Storage

While solar panels produce energy and can lower utility bills, a complete solar system with battery storage provides power during outages and reduces dependence on the electrical grid.

Three things to know about battery storage:

 Solar batteries last between 5 and 15 years. Depending on the size of the battery and demand, a typical solar battery can store enough energy to last for one to five days.
Choosing the right battery storage requires analysis of approximate anticipated energy demand. Builders and homeowners can choose between configurations that are designed for backup power during an outage or those designed to store and use excess solar energy strategically to lower utility costs by providing energy during peak times.
Battery storage systems can be independent of the grid and receive only solar power, or they can interact with the grid to charge with grid power as well as solar energy produced by panels. A combination of the systems is also an option.

Nearly six of ten (59.1%) millennials surveyed said they had installed a battery storage system.

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EV Charging

Some jurisdictions mandate new buildings and homes to be EV ready so that an EV charger can be easily installed. As consumers transition to electric transportation, the infrastructure for charging will become even more essential.

Three things to know about EV charging:

1. The Inflation Reduction Act offers \$7,500 in rebates for new EVs and \$4,000 for used vehicles, and it also extends a 30 percent tax credit for EV chargers.

2. A recent COGNITION survey found that 95% of builders have seen an increase in demand for standard and bi-directional chargers in their market.

3. Depending on local requirements and demand, homes can be built as "EV Capable," with electric panel capacity, a dedicated branch circuit and a continuous raceway from the panel to the intended location of the charger; "EV Ready", with a raceway with conduit that ends in a 240-volt outlet that can accommodate a Level 2 charger, or with Level 2 EV charger installed.





Demand-Side Energy Management

Demand-side energy management enables homeowners to reduce energy use during peak hours, shifting energy use to off-peak times. Reducing peak energy use provides both environmental benefits and saves money, since many utility companies charge variable rates based on "time-of-use," with cheaper rates during off-peak times.

Systems such as <u>Leviton's Load Center</u>, an integrated whole house energy management system, include smart circuit breakers and a whole house monitor that allows homeowners to decide when and how to use the energy in their home. The system also provides monitoring for energy produced from up to two sources. Homeowners can use an app to control their breaker box and breaker panel remotely.

Three things to know about demand side energy management:

1. Smart thermostats such as the Ecobee integrate with the grid to automatically determine when variable rates are lowest and when the mix of energy sources has the lowest possible carbon content.

2. Connecting smart thermostats with a solar system that includes battery storage allows homeowners and building owners to manage their use of energy at peak and non-peak times including when to use their stored power.

3. Smart energy demand management can include heating or cooling a space during an optimal time of day to reduce energy consumption and lower bills. More than half of the millennials surveyed by Green Builder in a COGNITION survey said they had installed a demand side energy management system.



Distribution by Generation (Demand side energy management system) Baby Boomer (1946-1964)

Consumer Trends

When asked about the importance of energy efficiency, most consumers surveyed by Green Builder said it was very important or somewhat important to them.



All generations said that the cost of energy-efficient upgrades is worth the money for the longterm savings, although millennials were by far the most likely to give that response.



Green Builder asked consumers to rank the energy-efficient upgrades that they believe are the most important and valuable to make in their homes or the next home they purchase. The top items are upgraded windows, upgraded insulation, an upgraded roof, and a smart thermostat.



Consumers provided information in a recent COGNITION survey about the energy efficient features they've installed in their homes. While the majority (more than 80%) of consumer respondents had numerous energy efficient features in their homes, the most common are solar panels, battery storage, and demand side energy monitoring systems.

ENERGY INSIGHTS



Percentage of Installations in Homes (Consumers Only, Sorted)

Given the enormous level of energy used to heat and cool homes, it's important to review the trends over time in heat pump HVAC system conversions.



ENERGY INSIGHTS

Green Builder asked builders to share their insights into the energy efficiency products and systems they're adding to homes now. While the basics such as energy efficient appliances, smart thermostats and energy efficient lighting top the list, with between 90% and 100% of respondents saying they include those features in the homes they build, the majority of respondents said they're installing a wide range of other items in their client's homes.



More than 80% of builders said they install low flow plumbing fixtures, battery storage systems, heat pump HVAC systems, EV charters, demand side energy management systems, high performance windows, doors, insulation and roofs; water monitoring and leak detection systems, indoor air quality systems such as ERVs, sensors and ventilation fans; heat pump water heaters, solar panels and induction cooktops.

Digging deeper, Green Builder asked builders to share why their buyers asked for battery storage systems (see chart next page). For all generations of buyers, the number one reason to install a battery storage system is for energy cost savings. The second reason given by millennials and Gen Z buyers is for time of energy use optimization, followed by for back-up power supply.



Reason for Buying Battery Storage, By Generation

Green Builder also asked whether buyers are more interested in EV chargers than in the past. More than 50% of builders said they have seen increased demand for either standard or bi-directional EV chargers.



Demand for Standard or Bi-Directional EV Chargers

Perception of Demand for EV Chargers (Own a single family home Category)

Case Study: An Adaptable Energy Management System

Amid the ongoing transition toward electrification, energy management systems are becoming increasingly important.

Energy management systems play a pivotal role in optimizing energy use within homes and buildings. With energy management systems, home and building owners can benefit from cost savings, reduce emissions, contribute to grid stability, and seamlessly integrate renewable energy sources. As technology continues to advance, smart load management systems will become even more critical for an electrified future.

"Leviton continues to equip homeowners with the necessary insights to control their expenses and environmental impact, focused on meeting tomorrow's electrical needs via a single app for lighting, load control, and EV charging," says Justin Berghoff, senior director of business development and product management for Leviton. "As a natural progression of Leviton's expertise, we're excited to give homeowners more power to manage their energy usage and an improved breakdown of total production/consumption via the My Leviton app."

The company is now offering a scalable and modular smart energy management system that is specifically designed for load management to optimize energy consumption and improve overall efficiency. <u>Click here to learn more</u>.



Case Study: Air Sealing's Role in Net Zero Homes

AeroSeal Envelope's AeroBarrier product helps home builders hit air tightness goals, enabling them to more easily achieve code, Net Zero, or any performance standard while reducing embodied and operational carbon footprints.

In the pursuit of sustainable development, the importance of energy-efficient homes cannot be emphasized enough. It's no secret that reducing the energy consumption of homes makes achieving Zero Energy Ready Homes (ZERH) and Net Zero homes easier and more affordable for builders and homeowners.

Aeroseal, a leader in building envelope and HVAC duct air sealing, explains how "creating an airtight building envelope is the best way to reduce energy usage. Thus, reducing the number of PV solar panels needed to provide the renewable energy required and making Net Zero easier and more affordable for builders"

<u>ENERGY STAR</u> estimates that air leakage accounts for a substantial 25 percent to 40 percent of the energy used to heat and cool an average home in the United States. Therefore, sealing air leaks is one of the most impactful strategies to reduce the energy use and operational carbon emissions of a home.

AeroBarrier steps in as the game-changer, simplifying the process for builders by providing an automated, efficient and affordable solution to significantly reduce air leakage in the building envelope. It works to effectively pinpoint and seal all leaks and cracks with a non-toxic, water-based formula.

The beauty lies in the effectiveness and precision of AeroBarrier's technology, which uses pressurized air and atomized sealant sprayed into the interior of the house to find and seal air leaks, ensuring builders hit their air sealing requirement every time. The air tightness achieved is verified immediately via a continuous blower door test run during the sealing process.

With a fully sealed, efficient home, the energy needs are greatly decreased. AeroBarrier makes it more feasible and affordable for builders to construct ZERHs and reach net zero goals. Simultaneously, the lessened energy demands make it more affordable for homeowners to implement the use of solar energy and ultimately achieve Net Zero Energy.

By minimizing uncontrolled air leaks, AeroBarrier not only cuts energy consumption but also reduces the operational carbon footprint of single-family homes. <u>Click here</u> for more information on the benefits of building envelope air sealing and AeroBarrier's advantages.

Case Study: Efficiency Programs Key to Success

Nevada is enhancing the energy efficiency of homes and buildings in the state. The following are some highlights.

The American Council for an Energy-Efficient Economy (ACEEE) ranked Nevada 21st in the 2022 State Energy Efficiency Scorecard, which reported that Important achievements include the 2021 passage of the New Energy Economy Act, which strengthens regional electric grid planning, expands electric vehicle (EV) charging infrastructure, and doubles energy-efficiency funding for low-income customers and public schools in underserved communities.

The state strengthened appliance efficiency standards in 2021 for 13 household and commercial products. Nevada adopted the 2021 IECC for residential buildings. While the code is not being enforced statewide, a significant number of local governments are adopting it. Local governments are not allowed to adopt less efficient energy codes.

On a national scale, Nevada ranks 14th relative to average monthly kilowatt hours, or the amount of energy that is used per hour in homes statewide. The state ranks 13th relative to average therms consumption per month.

Nevada has a median HERS score of 52.3, placing it 14th on national rankings (a HERS score is based on a scale from 0 to 150, with 0 being a net-zero energy home and 150 being a home built to the minimum standards of the 2006 International Energy Conservation Code.) Electrification rates in Nevada is increasing year-over-year, with .07 percent of homes electrified in 2021, growing to .08 percent in 2022 and .1 percent in 2023.

53.3 percent of homes in Nevada were built to the EnergyStar 3.1 program, and 3.75 percent to the Zero Energy Ready Homes program.

NV Energy's PowerShift program offers programs like:

- Free smart thermostats
- Free energy assessments
- Free qualified appliance replacement
- Business energy services
- Home energy savings tools

<u>Click here</u> for energy-savings tips from NV Energy.

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What We've Learned

Some of the important implications for building professionals and manufacturers from this report include:

Highlight 1	All generations of consumers said they believe the money spent on energy efficient upgrades is worth it for the long-term savings. Millennials, the largest current cohort of homebuyers, were by far the most likely to say spending money on energy upgrades is worth it.
Highlight 2	The energy efficient improvements that are most frequently installed in new homes or during a remodel are: energy-efficient appliances, smart thermostats, and energy-efficient lighting.
Highlight 3	Of all generations, Millennials have been the fastest to adopt battery storage and demand side energy management systems.

Let's Talk Data

COGNITION Smart Data combines cutting-edge artificial intelligence technology (that tracks contextual web and social media content based on geolocation, sentiment, and source feeds) with market growth data and our robust database of user-specific metadata (derived from years of tracking our audience's behavior and engagement patterns) to develop comprehensive, proprietary market insights that you can't get anywhere else.



Leading-edge information about the most important sustainability topics and audience segments

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Strategic positioning and effective messaging development Essential sustainable products and services that your business should be offering Set your company up for success, increase sales efficacy, and optimize revenues!

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COGNITION Smart Data

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