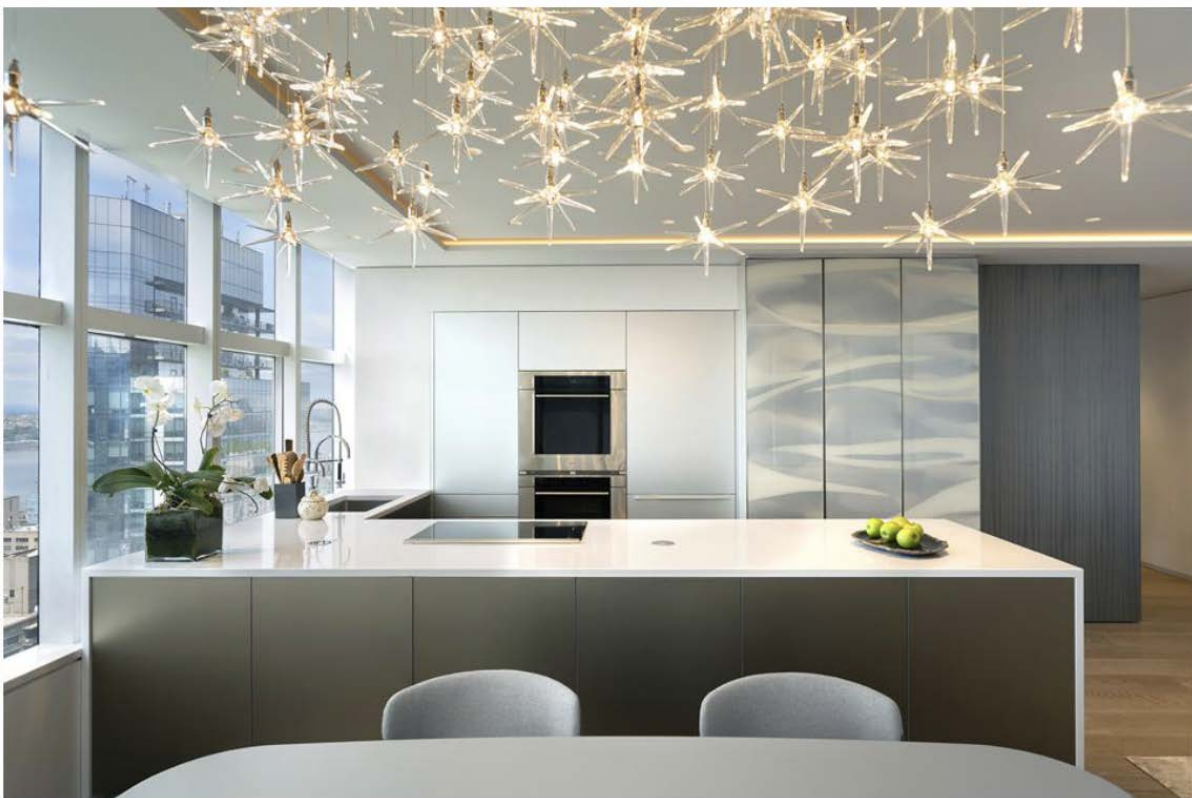


## The Blooming Economy Of Home Energy Retrofits Means New Technology, New Jobs, Cleaner World

Jennifer Castenson Contributor 

*I focus on innovation in the built environment.*

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PJCArchitecture has noticed rising consumer demand for more sustainable solutions, like this induction cooktop, along with positive impact that codes can play in the process. [-] BJORG MAGNEA

While builders struggle to bring new housing online, the rest of the country's housing stock is aging. Of the approximately 124 million housing units, the [ABC Collaborative](#) counts more than 21 million single family homes that were built before 1980 that need a retrofit,

spurring a huge new industry focused on energy improvements.

Energy retrofits are appealing for several reasons—to meet the nation’s 2050 sustainability goals, to meet a growing social consciousness, to improve home equity, and to reduce home energy costs and energy use.

## Meeting Sustainability Goals

Meeting the country’s sustainability goals isn’t just a checklist, it’s an integrated process that will take all housing stakeholders along with the right levers for public participation in addition to the pressure of regulations.

Katrin Klingenberg is the co-founder and executive director at [Phius](#), a non-profit organization committed to creating a framework for climate-specific and adaptable building standards to achieve a zero-carbon built environment. Her Phius program is working its way into state code and is currently part of New York’s and Massachusetts’s zero energy stretch codes.

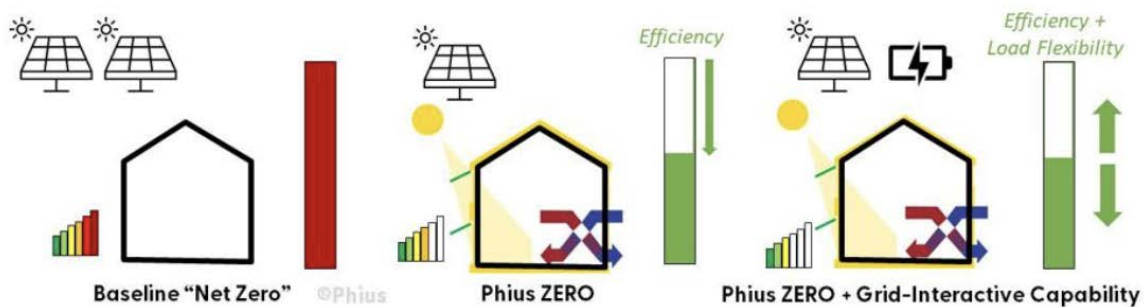
She said that Washington DC and Illinois are both considering adopting the code as well, plus several cities and states are flirting with a ban on natural gas that would go as far as requirements for equipment replacements.

Phil Consalvo is the principal at architecture firm [PJCArchitecture](#) and shared some examples of the gravity of codes.

“The example that I like to use was a 1920s gut renovation on Long Island where we had to comply to energy code,” he said. “It was a challenge on the exterior wall because we had to meet a certain rating on the R-value of the insulation. We had to come up with a creative way to meet the code and not build it out to a two-foot wall. It forced us to put on creative caps.”

His colleague and associate at the firm, Juliana Sorzano, added that the envelope update wasn't part of the original scope of work, but it was required by code.

“In the long term they are going to thank the code because they are going to save on the energy bills,” she said. “This gesture made a big impact on the energy savings. The challenge was that the contractor was doing it the regular way and we had to stop them and educate them on a new process.”



Phius works on projects to achieve various levels of energy efficiency with a strategic design process. [-] PHIUS

Klingenberg is indefatigable in driving Phius's efforts to decarbonize the built environment, facing the challenges of applying it to our aged infrastructure head on. The organization is participating in the retrofit exploration program REALIZE to facilitate market adoption of net zero carbon at scale.

“We want to transition the existing grid to become a renewable grid,” she said. “We need to reduce the load in existing buildings otherwise the grid will become completely unreliable.”

There is an intricate strategy to reducing that load.

“The design process is very important—it is important to map out measures so that they are synergistic with each other,” she shared.

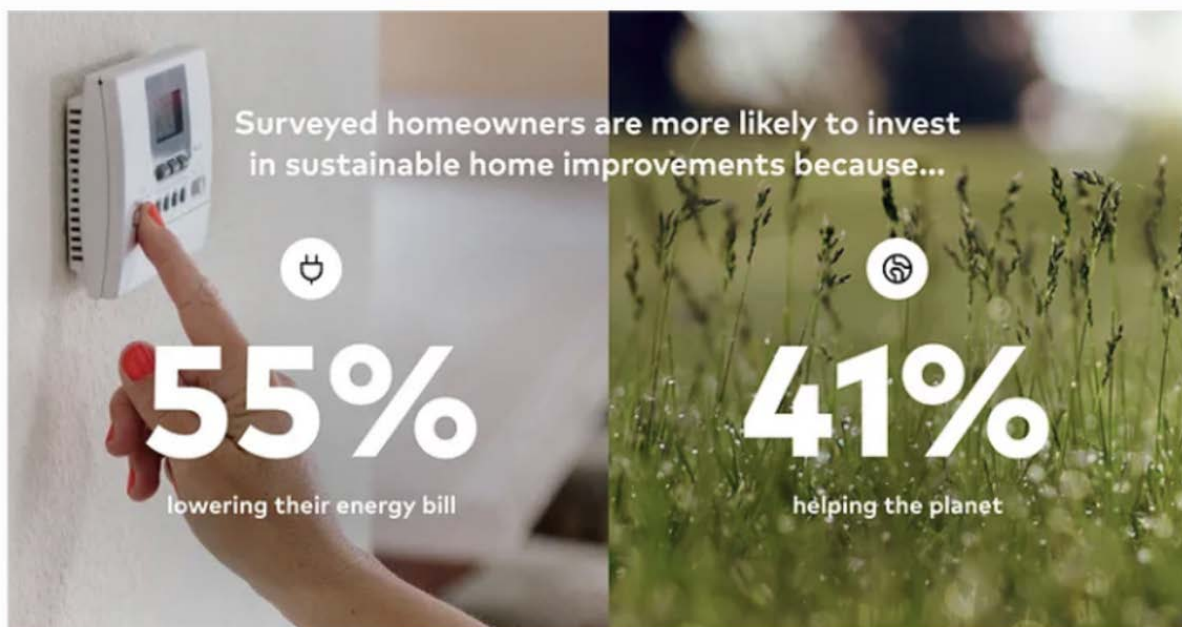
“First step is the assessment; you have to check if there are deficiencies to be fixed. Then, identify measures to get the building as close to zero



as possible. If you do the wrong measure first, you close the door to some things that might be the optimal process and you may end up with stranded assets.”

With a design-first approach, the stakeholders can consider what is most cost effective, what drives the best efficiencies, and what the local jurisdiction might be implementing in the future so that the solution has a long-life span.

## Homeowner Demand



Consumers want to make sustainable home improvements and their motivations vary as shown by this recent Thumbtack survey of more than 1,000 homeowners. [-] THUMBTACK

Online home care platform Thumbtack surveyed 1,000 homeowners to find the top reasons they want to engage in energy retrofits. Most important was the feeling of neighborly pressure at 70%; next, 55% said lowering energy bills was most important; and 41% said it was altruistic, and they just want to help the planet.

Consalvo interacts with residential clients who take the work very personally and found that the pandemic motivated people to get more educated about their environment.

“When we approach a project, recently it comes easier because it is more in people’s awareness,” he said. “It is one of the good things that came out of the pandemic.”

Sorzano added that before the pandemic, studies showed that people spent 90% of their time indoors between the home and office, and when they started working from home, it became 90% at home.

“So, now they are more conscious about it,” she said. “Now they want to make sure their indoor quality is healthy. They are starting to associate gas ranges to allergies and sickness. A client recently was in planning and changed a gas range in the middle of the job to induction.”

Consalvo agrees.

“It’s not prompted by us, but the biggest roadblock is the additional cost if you are working on a job with a tight budget,” he said. “We have read that project costs have escalated by 12%. In the end, it may pay off or pay for itself but when you are in the midst of it and trying to tighten up the numbers, it becomes a tossup.”

## **Building Home Equity**

Olivia Mariani serves as the chief marketing officer at [Curbio](#), a company that focuses on renovations to sell homes, and is now talking to sellers about cashing in on energy updates to sell their home faster and to attract environmentally conscious, millennial homebuyers who will pay more for these upgrades.

“Across all markets, according to Zillow housing trends report, 60% of buyers overall wanted energy efficiency, which was very or extremely important,” she said. “And, they will pay up to \$15,000 more for a solar powered home.”

Curbio has completed 2,000 projects across the country and is collecting data on what updates drive a return on investment. The company is educating their realtor customer base by sharing out that information, sharing both the pricing of the as is value of the home from the agent and then help them see the return on investment that they will get.

On project “refreshes” that don’t require a high level of contractor work, they are observing a 214% average ROI. The data is available on their mobile app, where a user can put in any project to see what it would cost in that geographic area and what the expected ROI would be.

Curbio also notices that buyers are calculating energy costs into the overall expense of the home and asking their agent about areas that may have been identified during the inspection and what upgrades should or could be made.

## **Product and Design Innovation**

In preparations for a recent SXSW session on net zero housing I got to hear some of the industry’s top minds talk about ideas that took me a minute to fully absorb. Eric Werling from the U.S. Department of Energy pointed out that we have been able to build net zero for more than 30 years, which means now we have three decades of building science advancements making it a reality, and with federal incentives, we are poised for rapid transformation.

The products and technologies for energy retrofits are advancing at an exponential pace. Sean Armstrong is partner at energy consulting firm Redwood Energy and recently posted his thoughts on the improvements in heat pumps.

Some of the main enhancements he has seen include more efficient compressors, refrigerants that are 35% more efficient than they were 13 years ago, and the introduction of computer controls that enable performance at very cold temperatures.

In terms of building envelope, manufacturers such as [LP SmartSide](#) are creating products that can perform in new ways, such as siding that is the only carbon-negative engineered wood siding available. The company has adopted intentional processes to be able to produce products that store 10 times more carbon than fiber cement-based products with a manufacturing process that produces 54% less greenhouse gas emissions.

Sometimes it isn't the technology, but how the product is applied.

Chris Gray serves as the chief technology officer at real estate retrofit company [RENU Communities](#) and has held several other roles in the industry. In his current role, he evaluates energy use at acquired properties and then designs and executes a tailored retrofit to improve its carbon footprint, aiming for net zero and targeting a minimum 30% reduction in energy costs.

He has been able to replace the internals of every toilet in a 400-unit complex to save 30% of the property's water consumption – a project that paid back in less than a year. In another project, he combined a state incentive program with toilet replacements to save more than 3.5M gallons per year and make a pay back in less than a year.

While these are large scale, the example certainly shows what can happen in a neighborhood or community of single family homes. No matter the size of the property, Gray says the process should start with a model of current and past energy consumption.

“Start with the envelope since it is the separation between indoors and



outdoors to minimize communication between indoor and outdoor air,” he said. “Then, look at roof line, how much insulation is in the roof with the solar beating down. Also, look at the exterior walls because windows and doors can leak over time changing the airflow and effectiveness. Evaluating the envelope is the most cost-effective place to start before you replace mechanical systems to minimize the equipment that you have to replace.”

After the energy evaluation, a budget has to be put in place, understanding up-front costs, along with when where and how rebates and tax credits may come into play. Sometimes it may mean creating a multi-year plan.

Two new technologies are helping simplify that process for homeowners and contractors. Online permitting and rebate evaluation site [Symbium](#) easily finds the rebates relevant to a project, including heat pumps, stovetops, furnaces, as well as larger home renovation projects including solar panels, and electric vehicle charging stations. The site identifies what is required to apply for a rebate, submits a completed application directly to the rebate provider, helps manage communication until the reimbursement is received, and even consolidates rebate programs from different providers and surfaces rebates that are applicable to a specific project.

DR Richardson is the founder at consulting and project management firm [Elephant Energy](#) that helps design the right energy system, procures the equipment, connects the work to available rebates, and then sets up the work with a vetted contractor.

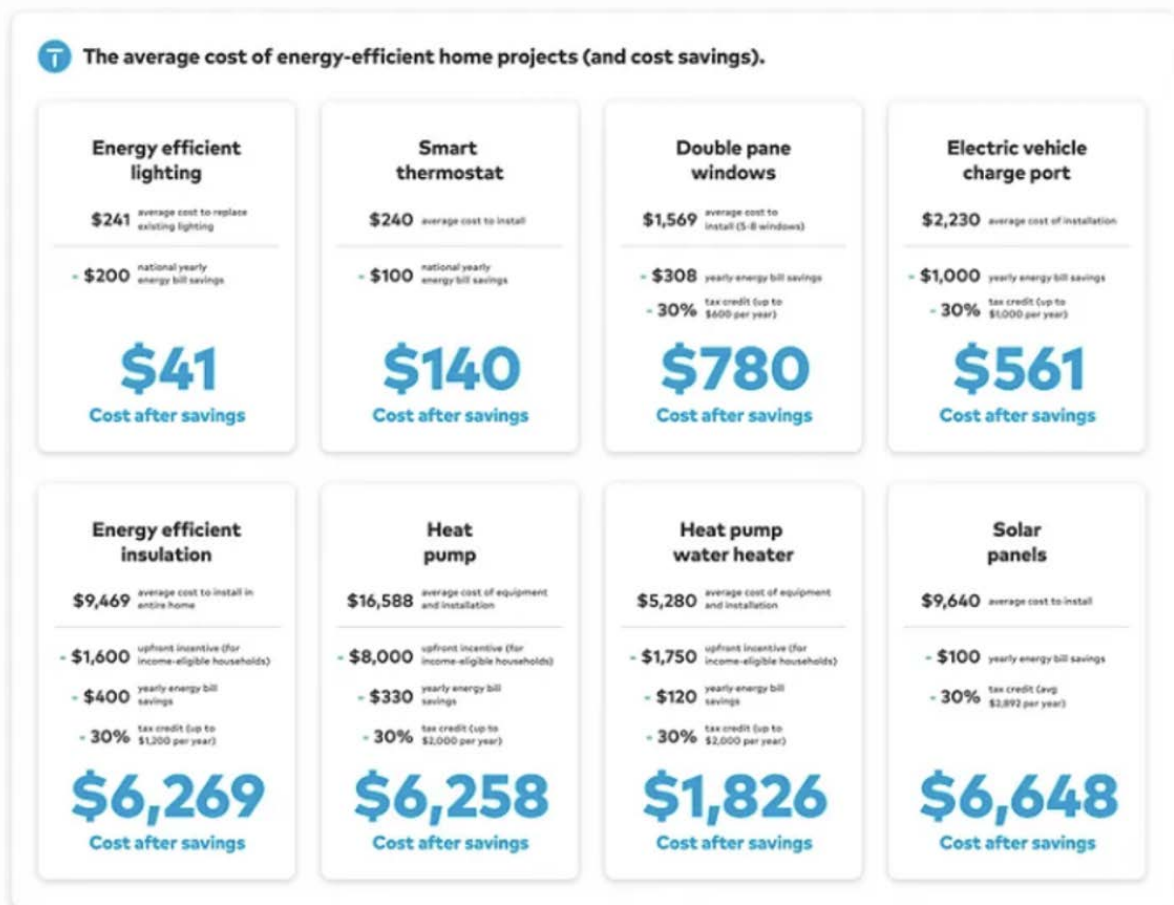
“We make electrification super easy, accessible and affordable by integrating all the refunds and tax credits and by designing systems so they apply for the rebates also with a focus on the total cost of ownership,” Richardson said. “We can drive costs down by working with installer partners and offer the training and system design.”



In this difficult labor environment, Elephant Energy is providing contractors with reliable repeatable revenue, where they don't have to do some of the work because the system design is provided. Amid a lot of misinformation, the company is highlighting the capabilities of cold weather heat pumps, and making it all work without upgrading electric service, since rewiring a home can be an intensive process. R

Richardson says that upgrading to a 200 amp panel usually costs between \$6,000 and \$10,000, and is sometimes not feasible for logistical reasons. Fortunately, he says that a panel upgrade is needed less than 5% of the time.

Contractors have to understand the hard costs and the future savings to make the right presentation to a home owner.



Homeowners can validate the spend on an energy upgrade through the long term cost savings.

[Thumbtack](#) breaks down the investment with help from nonprofit data group Rewiring America. Heat pumps require a large up-front investment at an average cost of \$16,588 but can be up to five times more efficient than traditional heating and cooling systems. Plus, there are government incentives for up to \$8,000 in upfront costs, up to \$2,000 in a tax credit, and another \$330 in average annual energy bill savings.

If homeowners could budget for all energy efficiency projects at once, it would come in at an average total spend of \$23,000 after incentives and rebates. But it could pay off in less than a decade by delivering average energy savings of \$2,500 per year, plus the benefit of reducing the home's carbon footprint.

Messages around these money savings are making a mark, especially when they are married with social impact.

“Consumers are savvier and more environmentally conscious than ever,” Mariani said. “We have been asked by them about materials, so we have an entire sourcing team staying up to date on these trends. I wouldn't be surprised if we had an entire green portfolio by next year.”

In addition to solar panels, Curbio notices growing demand for options like bamboo flooring. The company is sourcing product from volume discount vendors and adding more sustainable products to its portfolio.

Home sellers are making bank on going energy efficient before putting their home on the market.

“Energy efficiency is an ROI positive decision,” she added. “Sellers are making sure windows are efficient and well designed. In markets where lawns are not as common, the lawn is on its way out. They require a lot of water and so are very unsustainable. So, we are looking for hardscape instead of a traditional green lawn.”

Water is becoming a more critical topic in many large markets. Greywater systems are in early adopter mode, but are a more intensive retrofit that might require re-piping the house, Gray pointed out. In larger retrofits where the walls are opened, it becomes feasible, but Gray warns that it's still necessary to evaluate local regulations to understand greywater restrictions.

## The Labor Challenge

So, technology exists, demand is strong, and incentives are in place. However, there is still a missing element – how all of it will be delivered.

In some cases, tools exist for contractors to educate themselves, which is mildly humorous because even if the tools exist how many contractors can stop what they are doing to educate themselves? They are in high demand and not only need training, but Gray says they also need behavior modification.

For instance, they need to change their knowledge about sizing a heat pump system, and the load capacity degradation that happens with temperature changes, along with new, evolving technologies that address that.

Plus, there is a lot to learn regarding heat pump water heaters.

“Heat pump water heaters use an air conditioning cycle to cool the air around the water heater and pull that air into the tank,” he said. “They can recover air and use it to heat the water. Contractors have to educate on where they can be located and how much air flow they need. They cannot be in a closet, and they are larger than standard water heaters. There also are different voltages, and an electric circuit is needed. Some can now run off a standard 150W, but that means less capacity of hot water, so it needs to be applied appropriately.”



To address the contractor education piece, Phius offers online training, which is incredibly important to jurisdictions as they start to standardize passive house.

I honestly am crazy excited about the opportunities that retrofitting our existing homes offer for changing the country's entire energy dynamics and look forward to sharing more case studies as these projects are completed.

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