Weatherization and Energy Efficiency as a Resource

Questions and Answers

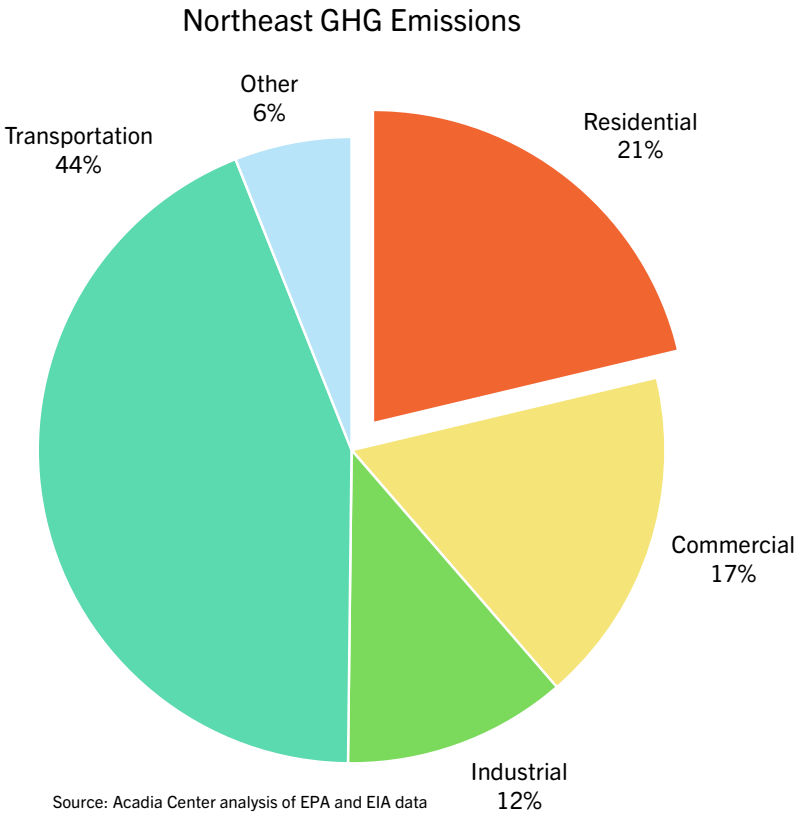
June 2015

Acadia Center

Advancing the Clean Energy Future

Q: Are residential buildings a significant potential source of energy and emissions reductions?

A: Yes. Emissions from fossil fuel and electric consumption in residential buildings in the Northeast are the source of over a fifth of greenhouse gas pollution in the region. Energy efficiency programs have been very successful at capturing large quantities of cost-effective energy savings, particularly in this region, but the majority of energy savings in existing buildings has come from the installation of high efficiency lighting and equipment. As programs have evolved from focusing only on electric savings to including natural gas and in some cases deliverable fuels, they have had some success achieving cost-effective heating and air conditioning energy savings through improvements to the building "shell" (the walls, windows, foundations, and roofs), but getting to the point of full weatherization of the bulk of the Northeast's older building stock is a more challenging task.



Source: Acadia Center analysis of EPA and EIA data

Q: How does weatherization compare to energy efficiency resource acquisition? Is it the same thing?

A: Some weatherization falls within the traditional resource acquisition model – energy savings that are less expensive than traditional supply. However, there is a body of weatherization that would not fall under this model as it is currently implemented in most jurisdictions. Energy efficiency is often the least cost energy resource. States that adopt a "least cost procurement" strategy can reduce their energy costs by purchasing as much efficiency as possible, compared to the more expensive traditional fuel and electric supply from fossil fuel generators. Some residential weatherization projects – particularly those in older homes – often don't fit within this framework because they can be significantly more expensive, often more expensive than any energy savings the upgrade might generate. These projects are less attractive or extremely difficult for both efficiency program administrators and customers to undertake based on current cost-effectiveness criteria.

acadiacenter.org • admin@acadiacenter.org • 617.742.0054 ext. 001

Boston, MA • Hartford, CT • New York, NY • Providence, RI • Rockport, ME • Ottawa, ON, Canada

It is also important to note that in the Northeast, weatherization primarily saves energy for building heating (primarily natural gas, heating oil, and propane), with a smaller benefit from summer cooling savings (electricity). While some efficiency programs now take an all fuels approach, many do not, and are focused primarily on electric savings. Justifying weatherization solely based on electric savings shrinks the pool of those that are cost effective even further.

Q: Why are energy efficiency programs even needed? If weatherization will save customers money, won't they make the investment?

A: Cost-effective energy efficiency, by definition, delivers savings that exceed its costs. Those unfamiliar with the intricacies of the efficiency market often wonder why businesses and residents need any help or financial support to do what is ultimately in their economic best interest. In an idealized market, the efficiency would all get done, but real-world markets are much more complicated, particularly so in the case of energy efficiency.

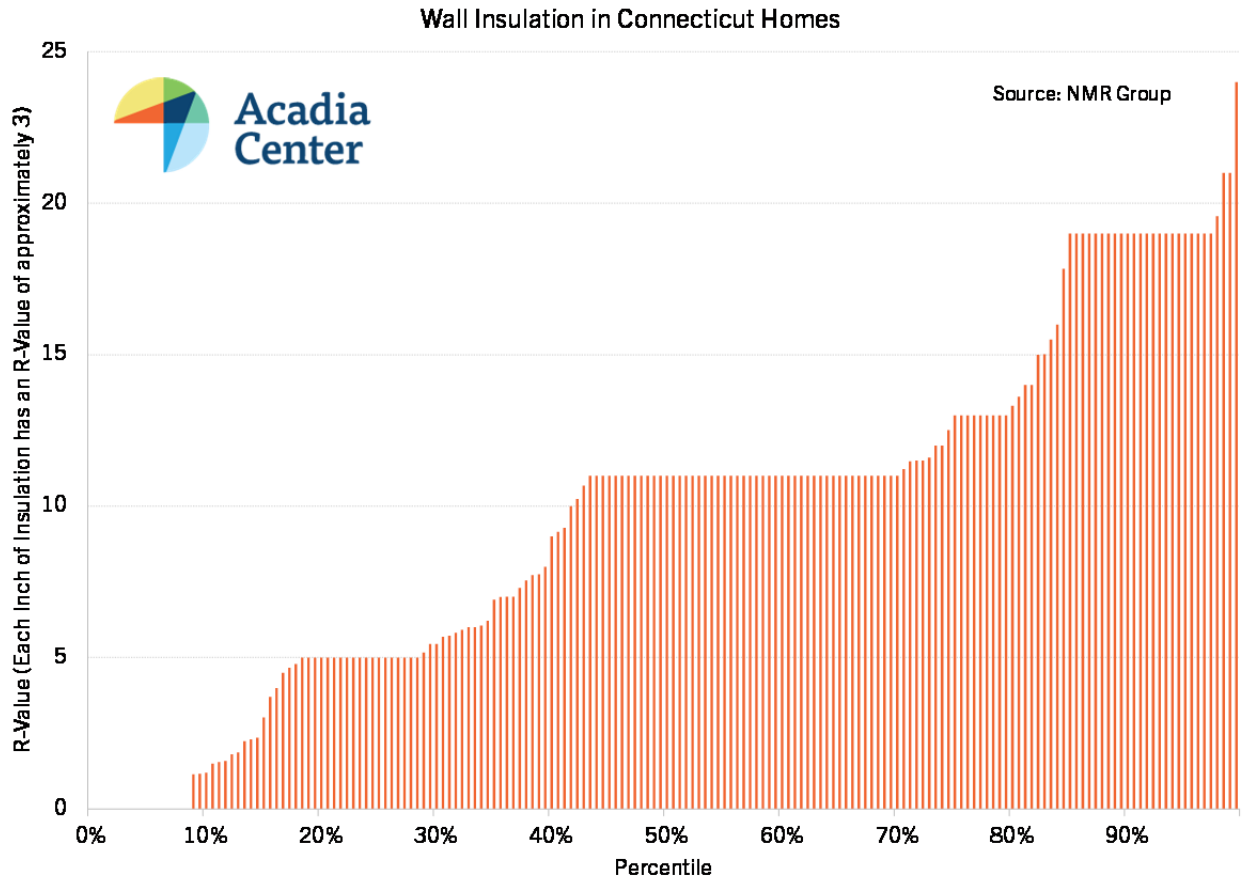
Energy efficiency is complex and there are a variety of barriers that need to be overcome to ensure success. Energy efficiency programs that address these barriers create a robust functioning market where one did not exist. Energy efficiency in buildings can involve technical challenges involving appliances, heating/cooling equipment and thermostats, the building shell, building air flow and insulation, water heating and plumbing, and building energy management hardware and software. To complicate matters, human behavior regarding home improvement and financing decisions and attitudes toward new technology have an added impact on how people use energy. Consumers often lack the time and knowledge to take advantage of best energy efficiency options on their own. These complications have been identified in terms of economic and behavioral theory; they are called "market failures" and contribute to the difficulties of the efficiency market. A list of some of the more common market failures is detailed in the table below. By carefully and methodically addressing each of them, however, market-based efficiency programs achieve dramatic success in unlocking energy and cost saving potential.

Common Market Barriers Inhibiting Adoption of Cost-Effective Efficiency	
Split Incentives	Building owners often do not pay energy bills so are less likely to invest in EE as it benefits the renter.
Lack of individual cost information	Energy bills are generally a single figure and do not contain info on how much energy an individual appliance or building feature (e.g., windows) contributes to bill. Weatherization measures save on both heating and cooling, exacerbating this.
Uncertainty of savings	A residential consumer will not know with certainty future energy prices or the exact energy savings of an upgrade, making it difficult to compare costs and benefits.
Inadequate info about Efficient Options	Consumers often do not know which product or service choices are the more efficient ones.
Bounded Rationality / Complexity	The complexity of many decisions on weatherization projects are beyond the ability of a residential consumer to make an economically optimal choice.
Elevated Discount Rates	There is significant research that indicates that consumers have inconsistent and often very high internal discount rates when making economic decisions. This can

	lead to decisions not to implement weatherization projects that are cost effective.
Liquidity Constraints	Consumers often have inadequate (or inconvenient) access to capital to pay the up-front costs of weatherization projects.
Transaction Costs	Like high discount rates, many consumers have high internal values on their time. The time and effort required to research an efficient upgrade, fill out a loan application, find a contractor and get quotes, or have workers in their home can outweigh the expected value of returns in energy savings.

Q: Energy efficiency is generally much less expensive than buying energy. Isn't this the case for weatherization?

There is often a misconception that buildings are either old and inefficient or new (or retrofitted) and efficient. The reality is much more nuanced. The figure below[1] depicts the average wall insulation in a representative sample of existing single family homes in Connecticut. The figure shows a wide range of insulation in homes, with nearly 10% of homes having no wall insulation and about 25% having more than about 4 inches (R-13) of insulation.



[1]Single-Family Weatherization Baseline Assessment, NMR Group, Inc., *http://www.energizect.com/sites/default/files/R5-Connecticut%20Weatherization%20Baseline%20Assessment-FINAL%2006-04-14.pdf*

This is illustrative of the overall condition of existing homes. At one end of the spectrum there are homes that are very leaky, have single pane windows and have no insulation. These are generally quite cost-effective to retrofit. At the other end of the spectrum, homes that are already very efficient will not gain much from a retrofit.

It is the large swath of homes in the middle, those with some (but not enough) insulation, that are the most problematic because the energy savings are nowhere near as great, but due to the labor-intensive nature of insulation the retrofit costs are nearly the same. Every additional inch of insulation provides less energy savings than the one before it. The first inch of insulation generates the most value, but if it is already in place, the retrofit can't capture that value. According to the study author, fewer than 30% of the homes represented by the figure above would have a positive payback from wall insulation upgrades under standard cost effectiveness testing,[2] even though all of them would experience additional energy savings.

Q: What are some of the things that make weatherizing some buildings so expensive?

A: Many older homes have improvements that must be completed before weatherization work can be done, which significantly increases the cost of achieving energy savings. The most common of these "pre-weatherization" issues are lead paint, asbestos, mold, and knob and tube wiring. Most of these also have an effect on the health and safety of building occupants. Despite this, given the prevalence of these issues in the existing building stock, particularly in the Northeast, it is clear that many homeowners are reluctant to address them, with or without energy savings.

There is also a subset of the building stock that has very high upgrade costs for a variety of other reasons, mostly related to extra costs for insulating or air sealing. For example, interior wood paneling with air gaps is difficult to fully weatherize without a complete replacement, something that would be far more expensive than normal insulation and air sealing. From the individual's perspective, it often doesn't make sense to invest in a weatherization upgrade that will take 20 or 30 years to pay off.

Brick and masonry buildings present a special challenge to insulate, particularly in colder climates. Interior walls generally need to be completely removed in order to properly insulate and seal these types of walls. Because insulating the walls will make them colder, special care must be taken to manage moisture so that bricks stay dry enough to freeze without being damaged. This requires special attention to materials and sealing, and may also require exterior upgrades such as waterproof coatings or extending overhangs and window sills to better manage rain. All of these factors lead to upgrade costs that far exceed those of typical wood framed buildings.

Q: Why would we want to encourage customers to undertake weatherization projects that cost more than they will save?

A: While traditional efficiency programs generally are not able to address these types of upgrades because they do not meet today's cost-effectiveness criteria, tackling this market and capturing these energy savings can have important benefits to consumers and society. Reducing energy usage helps customers by lowering bills and decreasing the impact of sudden rises in energy prices. Reducing carbon emissions and other air pollutants has value to society, particularly if there are mandatory reduction targets for them. It is unlikely that 2050 emissions reductions of 80% can be achieved without extensive weatherization efforts for existing buildings. Updating cost

[2]Page 39, Single-Family Potential Study (Review Draft), NMR Group, Inc, *http://www.energizect.com/sites/default/files/R15_Single-Family%20Potential%20Study_Review%20Draft_9-05-14.docx*

effectiveness tests (and funding sources) to reflect these values will allow these projects to become feasible within efficiency programs and for customers.

Q: If we need to dramatically increase weatherization retrofits in the region, how can we address all of these hurdles?

A: To achieve the important social and environmental benefits of improving the existing building stock, policymakers must take steps to better address this market. Given the complexities of making this market function when upgrades would be cost-effective for consumers, it is highly unlikely that a hands-off approach will work any better than it has worked to date. Customers are generally not going to invest their money in upgrades that have extremely long payback periods or do not fully pay back in energy savings, increased property values, or some other value.

A major first step would be to change cost effectiveness criteria to account for the value of GHG reductions. This would allow increases in the amount of financial incentives available to customers with marginally or non-cost-effective upgrades. Funding for these incremental costs would need to come from other sources, such as GHG mitigation funds or proceeds from carbon tax or cap-and-trade programs. Benefits for improved public health could similarly be utilized to support funding for health and safety work to address pre-weatherization issues.

Uptake could also be increased through improvements to program design: better customer engagement, targeted marketing and communications, better integration with other building trades to minimize lost opportunities when equipment fails or is replaced, access to convenient financing, training for contractors, among others. There is a growing body of publications highlighting what the emerging best practices are in this evolving field. One recent summary can be found here: http://www.raponline.org/featured-work/tapping-efficiency-in-homes

Complementary public policies can also help increase weatherization efforts as well as improve the effectiveness of efficiency programs. Ensuring that some of the value of an upgrade can be recouped if a homeowner moves can dramatically change the customer's incentive to engage in an upgrade. Mandatory time of sale/lease building labeling can help with the issue of energy efficiency upgrades with long payback periods and reduce the perceived risk for homeowners to undertake them. Labeling would help the improved energy performance of a home be reflected in the sale price and thus increase the incentive for homeowners to undertake upgrades.

While there is no silver bullet for addressing this large segment of the existing building stock, a combination of these strategies can put the region on the right path to the emissions reductions that will be needed in the future.

For more information:

Jamie Howland, Director, Energy Efficiency and Demand-Side Initiative, jhowland@acadiacenter.org, 860-246-7121 ext.201

Abigail Anthony, Director, Grid Modernization Initiative, aanthony@acadiacenter.org, 401-276-0600