Retrofit Standardization

Phase 2 Study

RAMPING UP ENERGY EFFICIENCY IN
NYC'S SMALL HOMES

NOVEMBER 2015

PRATT CENTER FOR COMMUNITY DEVELOPMENT | 50 YEARS

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PRATT CENTER FOR COMMUNITY DEVELOPMENT

536 Myrtle Avenue,
Brooklyn, NY 11205

(718) 636 3486
www.prattcenter.net

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1. Overview

In 2012, the Pratt Center for Community Development launched the Retrofit Standardization Study to test a simplified, scalable approach to implementing energy efficiency upgrades in small residential buildings throughout New York City. Although these buildings are not New York City's most egregious energy wasters, they comprise two-thirds of the city's building stock and account for 17% of the city's carbon emissions.

We estimated that retrofitting half of the city's 650,000 small homes would save homeowners at least $255 million annually, create over 2,500 jobs, improve indoor health and safety, and preserve the building stock.

The Pratt Center strategy sought to capitlize on the redundancy of the building stock by developing a standard package of energy retrofit measures based on building typology. Below we summarize our findings from Phase 2 of the study, which concluded in September 2015.

Ramping up energy retrofits in NYC homes by streamlining the retrofit process

Pratt Center for Community Development launched the Retrofit Standardization Study to test a simplified, scalable approach to implementing energy efficiency upgrades in New York City's 1-4 family buildings. The study was predicated on the hypothesis that energy audits of similar buildings built around the same time (e.g. the typical brownstone row house) would yield the same recommended energy saving measures, and if so, the need for the timely and confusing energy audit would be negated.

The first phase of the study sought to prove that hypothesis by conducting energy audits on 22 two-family, attached, gas-heated, masonry homes.

The audits revealed a common package of energy efficiency measures that were cost-effective in all 22 homes. **The Starter Package**, comprised of measures that included air sealing and weather stripping the residence and basement, insulating the roof hatch, insulating basement pipes, replacing incandescent light bulbs

with LEDs, installing low-flow water fixtures, adjusting the hot water temperature, installing carbon monoxide and smoke detectors, and ensuring adequate fresh air access for the boiler's combustion process, **was estimated to save homeowners on average 13% in energy use.** Variations of this package, which added basement and/or roof insulation, were estimated to increase the potential savings to 21%.

Making it easier for homeowners

Completed in September 2015, the second phase of the study continued the testing begun in the first phase by examining the process, especially the interactions with homeowners, required to scale a standardized approach to energy retrofits. We offered a pre-determined set package of energy retrofit measures customized to a particular building type.

2. Methodology

Based on the 22 energy audits conducted during Phase 1 of the study, Pratt Center selected 8 homes (16 units) to participate in the second phase of the research. Participating homeowners received one of the four package variations (see Figure 2) at a cost of $1; the balance of the project cost was paid by Pratt Center. In an effort to gather data on boiler set temperatures and run times, 5 of the 8 homes received an Ecobee "smart" thermostat, which enables homeowners to more easily manage the temperature in their homes.[1] Pratt Center contracted with BrightHome Energy Solutions to perform the installations and Bright Power as a technical advisor and evaluator. Pratt Center conducted follow up interviews with homeowners one year after the retrofit; Bright Power conducted weather-normalized utility bill analysis one year after the retrofits.

Photo by Steve Pisano, CC BY 2.0

1. Only homes that had updated electric wiring received the Ecobee.

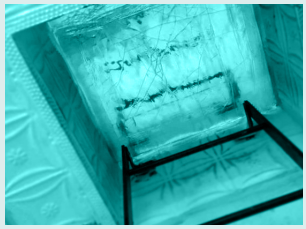
3. Energy Saving Measures

All the homes selected for phase 2 reftofits were receipients of the Starter Package, which involved air sealing the residence and cellar, insulating exposed hot water and heating pipes, installing low flow aerators and showerheads, replacing incandescent lamps with LEDs, reducing the hot water temperature to 115 degrees, installing carbon monoxide detectors and sealing and insulating the roof hatch. Figure 1 documents examples from phase 2 homes of how the baseline measures were commonly applied.

In some cases, additional measures beyond the Starter Package were implemented to test variations of the package when applicable. These additional measures included roof insulation, basement joist insulation[2] or both (see Figure 2).

FIGURE 1
Baseline Measures included in the Starter Package


Air sealing and weatherstripping


Insulating roof hatch


Insulating basement pipes


LED lights

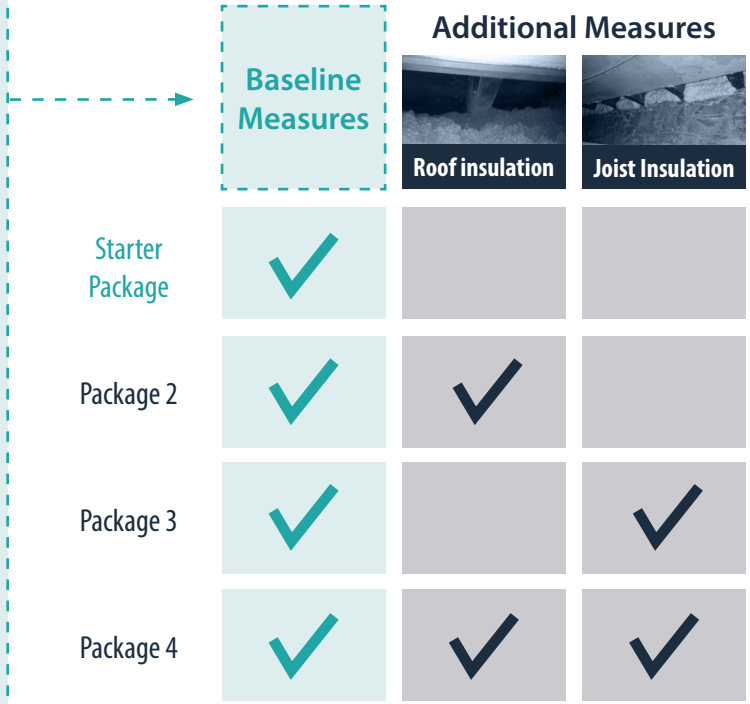

Low-flow water fixtures

Reducing hot water temperature


CO/Smoke detectors


Ensure fresh air access

FIGURE 2
Variations of the Starter Package



More details on the packages can be found in Pratt Center's *Retrofit Standardization Study Interim Report* at **www.prattcenter.net**

2. As indicated in the Interim Report, one of the original four variations was the Starter Package plus Basement Roof Insulation. However, further assessment revealed the significant variability in basement ceiling materials that negated the ease of a standardized improvement. As a result, the basement ceiling insulation measure was replaced with basement rim joist insulation during Phase 2.

4. Key Findings

Old homes need some TLC

All of the homes in the Retrofit Standardization Study were built in the late 1800s and not surprisingly, all needed some basic carpentry to facilitate effective air sealing. For example, in many homes, door sweeps that would have prevented air flow from the basement into the main residence were not able to be installed properly as basement doors did not close and seal due to warped door frames and/or floors. Historic parlor front doors were also difficult to air seal and in many cases were not addressed due to cost constraints. Basic carpentry solutions were applied where possible, but this extra cost was not factored into the price of the original package.

If you can make it here, you can make it anywhere

Home performance contractors working in New York City have to face a number of challenges such as traffic, parking, and - in the case of working in the winter months as we were for the study - snow. These and other logistical hurdles impacted the timeline of many of the retrofits. These "costs of doing business" were not explicitly included in the package price but are likely costs for any project in the five boroughs.

Everyone loves light dimmers

Incandescent lights controlled by dimmer switches were prevalent in the 8 Phase 2 homes, particularly in high-use areas such as kitchens and front hallways. While the Starter Package included replacing incandescent lights with LEDs, LEDs have been known to flicker (or not work at all) when installed with old dimmer switches. The cost for a licensed electrician to update the old dimmer

for an LED-compatible switch was not included in the study scope of work, and as such no lights on dimmers were changed, comprising a significant missed opportunity for electric savings. However, LED technology is improving at a rapid pace, and this compatibility issue is not as common. While individual bulbs will still have to be tested, it is anticipated that in the future the need for a licensed electrician to replace the dimmer switch will be greatly reduced.

Upping the ownership

All of the homeowners were excited to participate in the study and appreciated the opportunity to learn more about energy use in their home. In particular, homeowners were happy to have core health and safety issues addressed such as the installation of carbon monoxide and smoke detectors and the identification of asbestos and gas leaks. On the other hand, many homeowners were resistant to caulking trim around their windows if it impacted the home's aesthetics, replacing lights if the original color could not be matched and installing low-flow showerheads where custom rain showerheads existed. Despite recognizing that these changes would save homeowners energy and money, they reluctantly agreed to the changes.

The Starter Package scope called for blower door guided air sealing to assist BrightHome in prioritizing areas for sealing and weather stripping. However, homeowners did not always adequately prepare their home for this effort; furniture pushed against walls and dust build-up prevented comprehensive air sealing in some cases. Similarly, many homeowners strongly resisted the use of the blower door throughout the day that was blocking egress for their tenants as well as letting cold air into the house on the day of the retrofit, preventing the benefit of the guided blower door air sealing. While homeowners recognized the valuable home improvement they were receiving, the one dollar participation cost was likely not sufficient to have them fully vested in achieving all of the study's outcomes.

Smart thermostats can help reduce energy…but only sometimes

The Ecobee smart thermostat, which enables a homeowner to easily program a thermostat based on the time of day, season and other factors, was installed in five of the eight homes for data purposes only. Some homeowners reported never changing their set temperature. However, several others reported regularly using the Ecobee to monitor and manage their heat use and had greater utility savings than anticipated. While this study cannot isolate the impact of the Ecobee alone, the inclusion of the smart thermostat appears to have significant benefits to energy savings, as well as to increasing homeowner awareness of energy use.

5. Homeowner Feedback

In follow up questionnaires collected one year after the retrofit installations, homeowners gave their general impressions of the impacts of the energy retrofit, provided updates on any changes made to their homes subsequent to the retrofit, including tenant occupancy, and shared about how the retrofits might affect their willingness to invest in future energy saving upgrades. The comments received indicate an overall positive experience both in terms of benefits gained from reftrofit installations and in terms of newfound awareness and appreciation of energy use in the home.

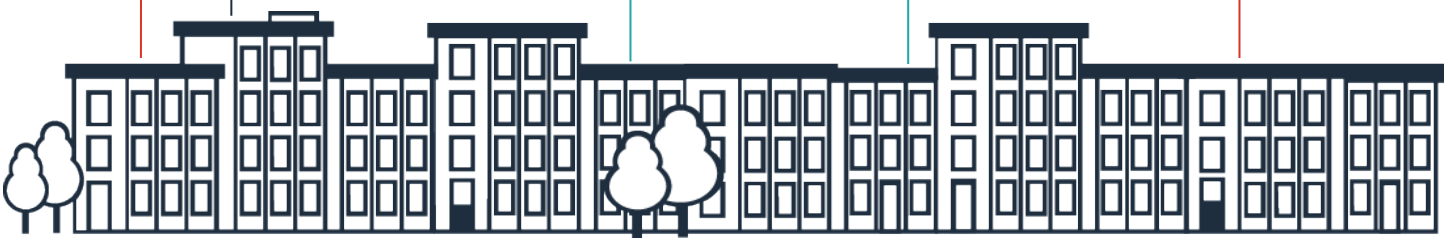
"If we had another home, we would definitely do more. Definitley a light bulb moment."

"The house has always been super cold, and this winter it seemed much warmer."

"Are you kidding me? It was great! I have already recommended it to friends."

"It is a great starting point for a conversation with my kids. It's been a great way to reflect on the impacts of our daily decisions... how we live and consume."

"It would have been a hard sell before, but knowing what I know now... Now I'm not dreading cold, cold days."



6. Next Steps

Starting in 2016, Pratt Center will be taking the next step by embarking on the Small Homes Initiative, a pilot generously supported by the New York City Council, to test the starter package on a larger sample to measure the consistency of energy savings in similar buildings receiving the same energy efficiency measures. The Small Homes Initiative builds on the key findings from the Retrofit Standardization Study and lays the groundwork for a citywide program aimed at scaling energy upgrades in New York City's 1-4 family market.

The Small Homes Initiative will set out to identify, recruit homeowners, and retrofit at least 30 attached, 1-3 family homes throughout the city. If proven feasible, the results of this Initiative will help inform the development of new energy efficiency program offerings in New York City and other urban areas with similar building stock. This will be useful to New York City as it develops new strategies to shape its energy future.