

CITY AND COUNTY OF DENVER'S



Home Energy Score Pilot

Evaluation Report

December 2019



DENVER
CLIMATE ACTION,
SUSTAINABILITY &
RESILIENCY



lotus
engineering & sustainability

U.S. DEPARTMENT OF ENERGY
Home Energy Score



Partner



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ACKNOWLEDGMENTS



The City and County of Denver would like to thank the following partners and collaborating organizations and individuals for their contributions, support and guidance with preliminary research, program development and participation in the Home Energy Score pilot program efforts:

- *American Council for an Energy-Efficient Economy*—Stefen Samarripas
- *Allegheny Science & Technology*—Patty Kappaz
- *Boston Government Services*—Glenn Dickey
- *Center for Energy and Environment on behalf of the City of Minneapolis*—Isaac Smith
- *City of Berkeley*—Catherine Campbell-Orrick, Billi Romain
- *City of Columbia, Missouri*—Brandon Renaud
- *City and County of Denver*—Support from multiple individuals and departments
- *City of Fort Collins*—Kim DeVoe, Kirk Longstein
- *Denver Residents*
- *E3 Power*—Jeremy Bryan, Jessica Kurela, Andy Wildenberg
- *Earth Advantage*—Anthony Roy, David Heslam, Erik Cathcart
- *Elevate Energy*—Deb Philbrick, Pamela Brookstein
- *I.D. Energy*—Brent Loya
- *Home Inspection Companies who provided scores in the pilot*: 4 Seasons Inspection Services, Axium Inspections, Blackstone Inspections, Blue Spruce Home Inspections, Call 2 Inspect, Vango Inspections
- *National Association of State Energy Officials*—Ed Carley and the Home Energy Labeling Working Group
- *Rocky Mountain Institute*—Jacob Corvidae, Michael Gartman, Greg Hopkins
- *The Building People*—Ken Slattery
- *U.S. Department of Energy*—Madeline Salzman
- *Visual Data Consulting*—Salesforce support



Report prepared by Lotus Engineering and Sustainability, LLC.



Layout design by Adrian Newman, Creative Professional



INTRODUCTION

In the spring of 2018, the City and County of Denver's (Denver) Department of Public Health and the Environment (DDPHE) launched a home energy label pilot program using the U.S. Department of Energy's Home Energy Score™ to generate the label. The pilot program sought to understand whether receiving an energy label during the transaction of a home could increase energy efficiency in single-family residential buildings in Denver. DDPHE was also interested in understanding whether an energy label would be helpful in meeting some of the residential sector goals laid out in [Denver's 80x50 Climate Action Plan](#), specifically:

- Reduce energy use in single-family homes by 10 percent by 2025.
- Reduce energy use in single-family homes by 20 percent by 2035.
- Establish a home energy rating for all single-family buildings so that owners, renters, and potential buyers can make informed decisions about a home's efficiency and operating costs.

The pilot program will continue to run through the end of 2019 and the intent of this analysis, which was conducted in late fall 2019, is to understand the impacts of the pilot and identify if and how Denver can use a home energy label to support greater residential energy efficiency. Specifically, this analysis seeks to answer the following questions:

- A. Does sharing an energy label around the transaction motivate efficiency investments sooner with sellers, buyers and/or new owners?
- B. Does sharing the Score with sellers, buyers, or new owners result in energy savings?
- C. What are the opportunities and challenges related to using the Score as a tool to encourage energy efficiency?
- D. Is the Score the right tool for Denver to encourage residential energy efficiency?
- E. What are the next steps for Denver regarding energy labels?

BACKGROUND

Analysis Approach

DDPHE hired Lotus Engineering & Sustainability, LLC. (Lotus), to complete this analysis. Lotus reviewed documents related to the pilot program, including survey responses and data collected in the program's Salesforce database. This analysis was based on data that was collected through the end of September 2019 and on responses to an initial survey sent after a Score was received and closing survey sent out by DDPHE staff through early October 2019.

INTRODUCTION TO HOME ENERGY LABELS

DDPHE's pilot program specifically focuses on the ability to highlight a home's energy efficiency features using the Home Energy Score™ (the Score) tool, developed by the U.S. Department of Energy (DOE) in collaboration with the national laboratories. The Score is a specific type of asset-based home energy label aimed at providing home owners, sellers, buyers, and renters with comparable information about a home's energy use by rating a home on a 1-to-10 scale based on a standard assessment that can be compared across the housing market.¹

Home energy labels are similar to a miles-per-gallon rating for a car. While actual energy used in a home is not factored into many asset-based home energy labels (including the Score), the fixed assets of the home (such as the square footage, building materials, insulation levels, and major fixed equipment like furnaces and water heaters) are modeled through building energy software to estimate home energy performance. Although it still plays a part of overall energy use in a home, occupant behavior is not factored into an asset score. Oftentimes energy usage data cannot be utilized in real estate transactions because the data is private. The Score employs a building energy model that is designed to be a best-fit tool for real estate transactions. See Figure 1 for further details on what is included in the Score.

Home energy label programs were developed to address a lack of homeowner and renter awareness and provide information on the energy performance of a home that is being bought or sold in a real estate

¹ For more information see <https://www.energy.gov/eere/buildings/downloads/home-energy-score>.



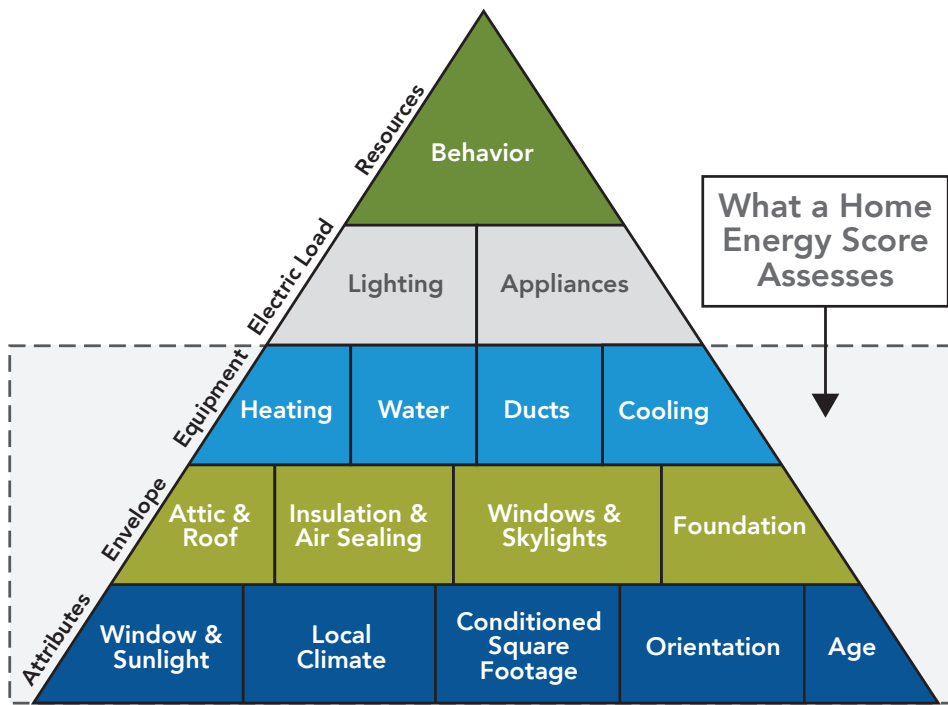


Figure 1: Components included in the Score and similar asset-based energy labels.

transaction. This may enhance awareness of utility costs and prioritization of energy efficiency when making a home purchase and retrofit decisions. By using energy disclosure to increase the visibility of home energy efficiency and standardize the way that a home's efficiency features are assessed and communicated, a home energy label has the potential to leverage market forces to drive efficiency improvements.

Several states and cities have developed voluntary or mandatory home energy labeling policies; refer to Table 1 for a partial list of programs and policies happening around the country. Under a mandatory requirement energy disclosure is required at

the Time of List (i.e., when a home is listed publicly for sale) or Time of Sale (i.e., before the home is purchased, typically at closing). Mandatory disclosure could also apply for rentals at Time of Lease. There are a variety of approaches to supporting the disclosure of energy efficiency; the commonality is the intent to inform homeowners and renters about the energy features of a home, provide insight into potential future energy costs, and to encourage investments in energy efficiency, as well as behavior change, that may reduce energy use.

By using energy disclosure to increase the visibility of home energy efficiency and standardize the way that a home's efficiency features are assessed and communicated, a home energy label has the potential to leverage market forces to drive efficiency improvements.

CITY/STATE	DISCLOSURE POLICY?	ENERGY LABEL USED	NOTES
Fort Collins, CO (electric utility) ²	Voluntary	Epic Certificate	Customer is provided with energy audit through Fort Collins utility program. Utilizes the Score tool as the modeling engine.
State of Connecticut ³	Voluntary	Home Energy Score	
State of Massachusetts ⁴	Voluntary	Home MPG	Coming soon. Homeowner will be provided with energy audit through Mass Save. Will utilize the Score tool as the modeling engine.

Table 1: Energy disclosure policies by location.

² For more information see <https://www.fcgov.com/utilities/epiccertificate>.

³ For more information see <https://www.ennergizect.com/events-resources/energy-articles/home-energy-score>.

⁴ For more information see <https://www.mass.gov/service-details/home-mpg-energy-performance-scores>.



CITY/STATE	DISCLOSURE POLICY?	ENERGY LABEL USED	NOTES
State of Missouri ⁵	Voluntary	Home Energy Certification	Homeowner can receive gold and silver certificates for homes with good energy performance as measured by the Score or HERS rating.
Columbia, MO (electric utility) ⁶	Voluntary	Efficiency Score	Customer is provided with energy audit through Columbia Power & Light. Utilizes the Score tool as the modeling engine.
State of Oregon ⁷	Voluntary	Home Energy Score	Program has a custom report similar to the City of Portland.
Association of Bay Area Governments (through BAYREN) ⁸	Voluntary	Home Energy Score	Program is offered across 9 counties in the Bay Area.
Berkeley, CA ⁹	Mandatory, Time of Sale	Home Energy Score	Program has a custom report.
Portland, OR ¹⁰	Mandatory, Time of List	Home Energy Score	Program has a custom report.
Minneapolis, MN ¹¹	Mandatory, Time of List	Energy Disclosure Report	Program will go into effect January 2020.
Austin, TX ¹²	Mandatory, Time of List	Energy Audit	Program is offered through Austin Energy utility.
Chicago, IL ¹³	Mandatory, Time of Sale	Utility Bills	Program is available to homeowners and renters.
Montgomery County, MD ¹⁴	Mandatory, Time of Sale	Utility Bills	
State of Kansas ¹⁵	Mandatory, Time of Sale	Energy Checklist	Program is only for new construction.
State of South Dakota ¹⁶	Mandatory, Time of Sale	Energy Checklist	Program is only for new construction.

Table 1: Energy disclosure policies by location.

5 For more information see <https://energy.mo.gov/mhec>.

6 For more information see https://www.energystar.gov/about/content/columbia_water_and_light.

7 For more information see <https://www.oregon.gov/energy/save-energy/Pages/HEPS.aspx>.

8 For more information see <https://www.bayrenresidential.org/>.

9 For more information see <https://www.cityofberkeley.info/BESOsale/>.

10 For more information see <https://www.pdxhes.com/>.

11 For more information see <http://www.minneapolismn.gov/www/groups/public/@citycoordinator/documents/webcontent/wcmsp-217174.pdf>.

12 For more information see <https://austinenenergy.com/ae/energy-efficiency/ecad-ordinance/energy-conservation-audit-and-disclosure-ordinance>.

13 For more information see https://www.chicago.gov/city/en/depts/bacp/supp_info/energy_disclosureapplication.html.

14 For more information see https://www.montgomerycountymd.gov/OCPR/Files/disclosure_sellers.pdf.

15 For more information see http://www.mwalliance.org/sites/default/files/meea-research/energy-disclosure-fact_sheet.pdf.

16 For more information see https://dlr.sd.gov/realestate/forms/builders_energy_efficiency_disclosure_faq.pdf.



DENVER'S PILOT PROGRAM

After exploring different options related to home energy labels, DDPHE selected the Score tool for use in this pilot program. The DOE's scoring tool allowed the City to essentially plug-and-play because a label was already established, including requirements for trained Assessors and quality assurance.

Eligibility

The City and County of Denver has a history of running voluntary energy programs available to all residents within the City. While resources for residents are essential, it can be challenging for the City to know which homes need improvements and, more importantly, which homes are ready (and financially able) to tackle projects like adding insulation or upgrading heating/cooling equipment. Therefore, the pilot used a strategic approach to target individuals who may be more likely to make energy improvements if a label was shared around the transaction – either when preparing to sell a home or when purchasing. An example of a mandatory program that was in place at the time of the design of Denver's pilot program was in the City of Berkeley, which gives residents up to 12 months to complete a Score by using a deferral fee that allows residents to either complete a Score or implement energy improvements within the first year of being in the home.¹⁷ Berkeley's program has seen people take advantage of this one-year window to complete a Score or improvements, and with this information in mind, Denver chose to include those who recently purchased a home (called "New Owners" in the pilot) to test whether energy improvements would be more likely to happen within the first year of ownership as well.

Score Assessments

Individuals who hold specific credentials and have completed the required training and mentoring established by the DOE can provide a Score and are known as Home Energy Score Certified Assessors™ (Assessor). Denver contracted with E3 Power, a Denver based energy audit firm, to perform Score assessments offered in the pilot. In February of 2019 Denver facilitated trainings to add home inspection companies including 4 Seasons Inspection Services, Axiom Inspections, Blackstone Inspections, Blue Spruce Home Inspections, Call 2 Inspect, and Vango Inspections into the pilot to provide the opportunity for buyers and sellers to obtain a Score during an inspection. Per the DOE's partner requirements, five percent of all homes scored must receive quality assurance (QA), and I.D. Energy was hired to perform remote QA for the pilot and ultimately took on the task of recruiting and training home inspectors who joined the pilot.

At the time that Denver's pilot program launched the Score tool was only applicable for single-family detached and attached homes, meaning that stacked multifamily units could not be scored because they have a shared roof or foundation that did not work with the scoring tool's underlying modeling software. Denver's eligibility requirements to receive a Score included that the home was recently purchased (within the last 12 months), for sale, or under contract. This allowed sellers, buyers or new owners the opportunity to obtain a Score at no cost. In October 2019 DOE confirmed that stacked multifamily units are now able to be scored. This improvement of the scoring tool can benefit future multifamily work in Denver if the Score continues to be utilized.

¹⁷ For more information see <https://www.cityofberkeley.info/BESOsale/>.



The Score Report

The Score rates homes on a 1-to-10 scale regarding energy efficiency assets and potential to save energy. The scoring tool accounts for the home's efficiency features to estimate its annual energy usage. This amount is then translated into a 1-to-10 score. This translation normalizes for local weather conditions but does not normalize for home age or size. The person requesting the Score receives a report showing the home's current Score and estimated annual energy use and costs. The report also includes recommendations for improving the home's efficiency and a calculation of what the home would score, and what the estimated annual energy savings would be, if the recommended measures were implemented. An example of a Score report for a home that received a relatively low initial score ('2') and had several recommendations that could increase the score significantly (to a '7') is shown in Figure 2.

The Score report generates automatic recommendations if there is an estimated payback of 10 years or less to implement recommendations. This payback period is calculated in the scoring tool by utilizing state average utility rates and projected installation costs for projects like insulation and ENERGY STAR rated equipment. The cost and payback calculations do not factor in available utility or City rebates. The report details which recommendations should be addressed in the near term and which recommendations should be addressed in the future when it is time to replace or upgrade equipment at the end of its life. See Figure 3 for an example of recommendations for the home that could go from a score of '2' to a '7' if all recommendations were implemented.

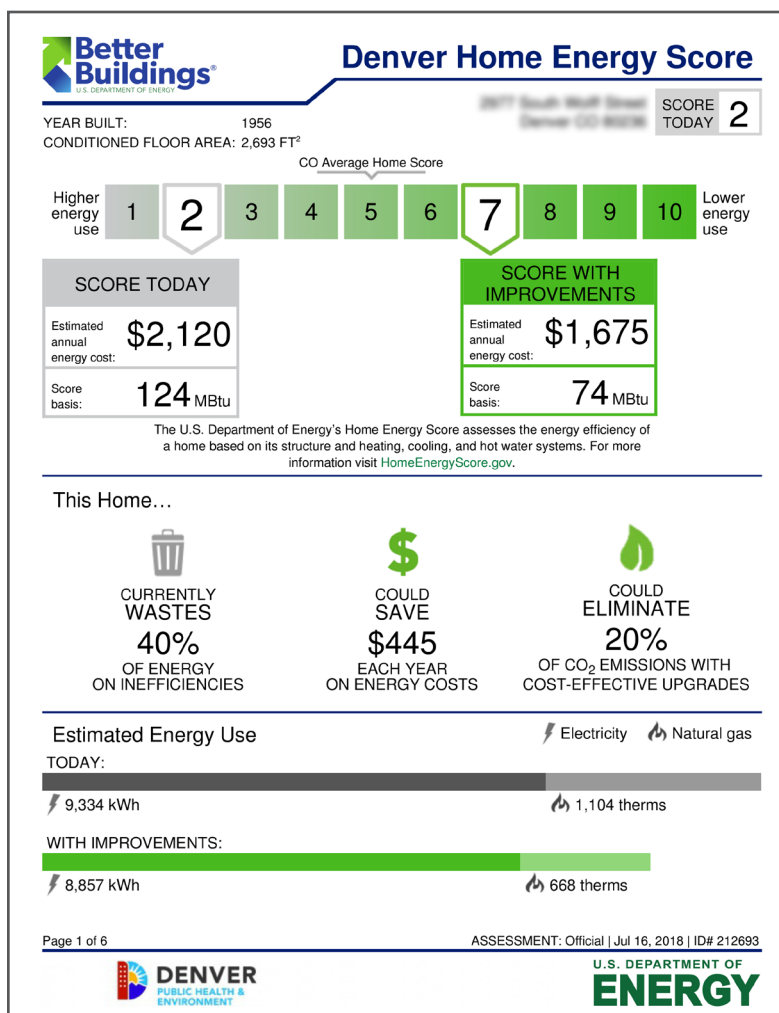


Figure 2: Score report for a home scoring a '2'.

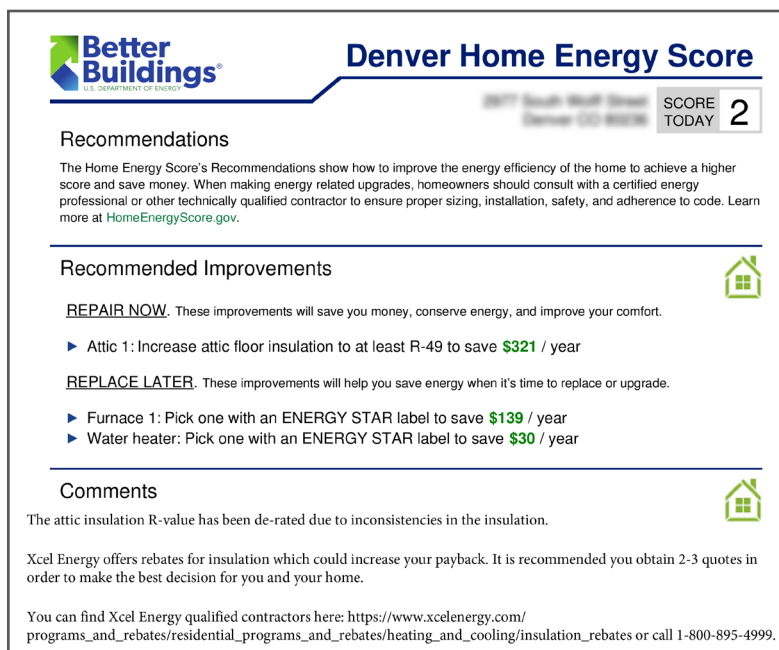


Figure 3: Score recommendations to take a home from a '2' score to a '7' score.



Data Tracking

Participation in Denver's pilot was tracked using a customized Salesforce database which allowed for automation when sending leads to Assessors and notifying residents about their appointments or opportunities to receive gifts if they completed surveys. The database includes information on the property such as year built, size of the home, address, neighborhood, council district, and list/sale price. Homes that ultimately received Scores have additional information about the home's Score, including details from the report (such as recommendations for future upgrades), and results from an initial survey (if completed) that was sent to participating households a week after they received their Score. Additionally, DDPHE collected responses from a closing survey from willing participants several months after they received their Score. Additional data on Score recommendations and potential cost savings were provided by the DOE, and additional data on construction permits pulled in Denver were provided by Denver's permitting office. The intent with accessing permitting data was to match addresses for homes scored with permits to see if any energy improvements were made either before or after a home was Scored. Ultimately, permitting data was not used in the analysis due to difficulties with the way permits are tracked compared to the specific energy projects tracked in the pilot. An initial attempt to merge the data utilizing Power BI (a Microsoft product used to connect disparate data sets) provided minimal confidence in the results. However, access to permit data in coordination with Denver's Community Planning and Development Office shows potential for improving Denver's ability to match permit data with energy upgrade data to verify projects. Data from different sources were merged into one spreadsheet and has been provided to Denver.

Approximately 50 percent of pilot participants responded to the initial survey that was sent a week after receipt of a Score. To encourage participation in the initial survey, participants were rewarded with a gift set that included items such as LED lightbulbs, smart power strips, and solar powered outdoor lights. DDPHE's Environmental Quality Division, responsible for running this pilot program, also collaborated with the Public Health Inspections division within DDPHE to include short-term radon test kits as part of the participation gifts. By including the radon test kits, the department was able to further raise awareness about radon, how to test for it, and the health impacts it can have on people exposed to the gas. Denver doesn't have a way to track the number of homes that receive a radon test as part of a home inspection (radon testing is voluntary and therefore an added cost over the standard home inspection); therefore, this presented an additional opportunity to educate on radon, radon mitigation systems, and the need to re-test for radon every few years.¹⁸ This inter-departmental collaboration helped in linking the ideas of an energy efficient home and a healthy home, and highlighted Denver's work on both of these fronts.

An additional closing survey, which obtained feedback from 25 percent of all pilot participants analyzed in this report, was conducted in September of 2019. In order to encourage participation in the closing survey, participants were rewarded with gift cards to Home Depot.

Lotus completed a data analysis using the combined dataset based on data current through September 26, 2019, as well as the results of the closing survey conducted in late September.

¹⁸ For more information see <https://www.denvergov.org/content/denvergov/en/environmental-health/public-health-inspections/radon.html>.



Outreach and Attrition

DDPHE conducted extensive outreach to home buyers, sellers, and new owners to inform them of the pilot program and eligibility to participate. It is worth noting that the primary target audience of the Score is focused more on sellers and buyers rather than new owners to better inform the transaction process and opportunities to highlight a home's energy efficient features.

To reach buyers and sellers, Denver initially attempted to engage the local community of real estate agents and lenders to encourage them to provide information about the Score to buyers and sellers. Likely due to the fact that Denver is still seen as a "seller's market," very little response came from this engagement. Recognizing that Denver staff would have little knowledge of who was preparing to sell or under contract through available public information, Denver staff attempted another approach to engage buyers and sellers through the home inspection process. To generate more Scores for buyers and sellers and reduce outreach time and budget spent finding buyers and sellers, Denver brought home inspectors into the pilot, thereby making it possible for inspections already scheduled to simply add a Score while the inspector was in the home.

This strategy with home inspectors encountered a few barriers that made achieving the initial goal of scoring 1,000 homes through home inspectors during the pilot difficult. In Denver, many inspectors serve both the City and surrounding suburbs, which made it difficult to ensure that inspectors trained in Denver's pilot could consistently score homes only in the City and County of Denver boundaries. Additionally, many inspection companies stated that they were unable to allocate additional time to add a new service that was only applicable in Denver due to the priority of keeping up with the demand of the current market for standard inspections. At the time of this analysis, the home inspector strategy obtained 124 scores through this pathway, compared to an initial goal to score 1,000 homes by the end of December 2019. Denver has sent requests to inspectors in the pilot to better understand

what other barriers may have existed for scoring more homes in Denver, but responses are still being collected and therefore not included in the report.

New owners (i.e., those who recently purchased a home in the last 12 months) were targeted utilizing data from the multiple listing service (MLS). DDPHE sent direct letters to new owners and used social media posts on outlets like NextDoor, Facebook, and Twitter to inform the community about the opportunity to participate in the pilot. Additionally, content was included in neighborhood newsletters when possible.

Marketing materials described how the Score could be used as a tool to understand how much energy a home is expected to use based off its fixed assets, and how the score may identify cost-effective recommendations to reduce energy use; see Figure 4 for an example of a flier for new owners. By highlighting the fact that homes

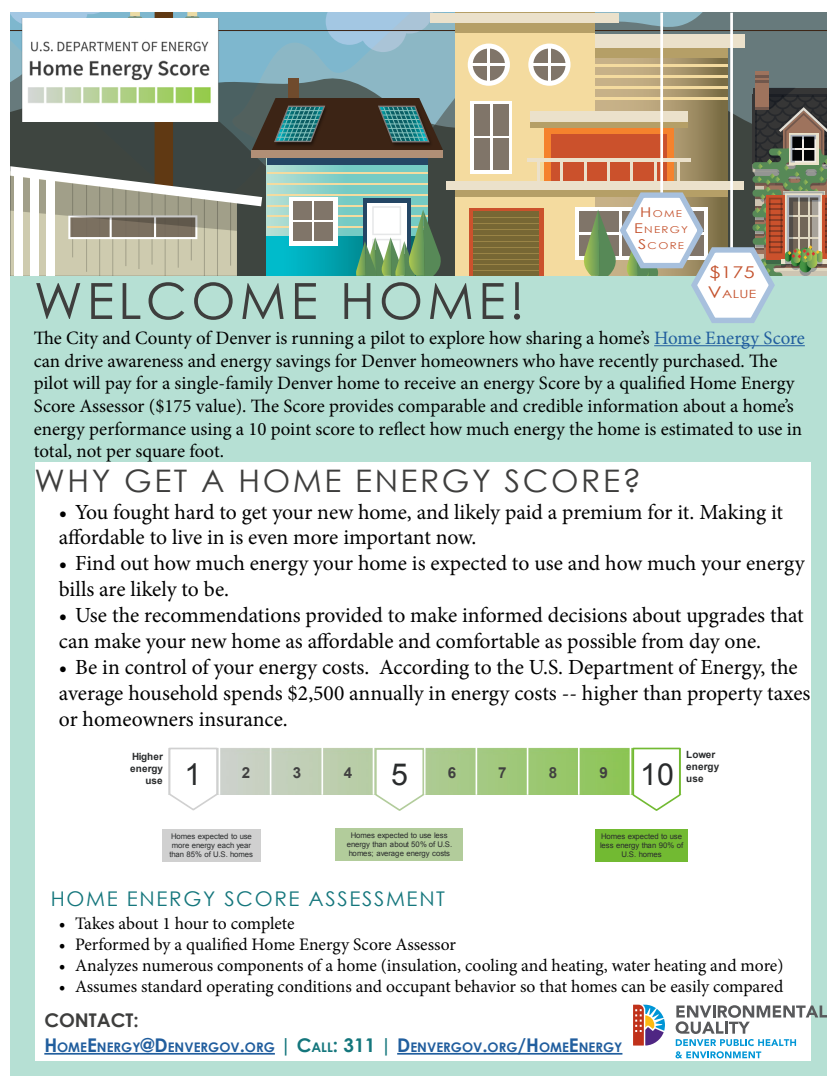


Figure 4: Fliers created for new homeowners.

Approximately five percent of new homeowners who received direct mailers signed up for a Score.

in Denver's strong residential real estate market tend to sell at a premium, and DOE's assumed average household energy expenditure is between \$1,800–\$2,200, the materials suggested that home improvements informed by a Score could enhance a home's affordability and comfort.

DDPHE tracked the effectiveness of direct letters and social media efforts. Approximately five percent of new owners who received letters ended up requesting a Score (i.e., out of 10,902 letters mailed there were 497 requests) and approximately 226 requests came from social media. Based on the number of letters mailed and new owner participants in the pilot, it can be assumed that most leads came from new owners as a result of the letter.

ANALYSIS OF WHAT CAUSES A PARTICULAR SCORE

Size

Based on the data from the pilot, several factors play into the calculation of a home's initial Score and can provide some insight into trends. One might expect that larger homes would receive a lower Score due to

the fact that the Score does not normalize on the basis of home size, and indeed, the average size of a home that scored a '1' is significantly larger than the average size of a home that scored a '10' (2,698 square feet for a home scoring '1' compared to 2,024 square feet for a home scoring a '10'). However, the data on all homes scored in the pilot did not indicate a specific correlation between a home's Score and the home's size. In other words, while the average home scoring a '1' was roughly 25 percent larger than a home scoring a '10', there was no linear regression for home size versus Score, and homes scoring an '8' or a '9' were, on average, larger than homes scoring a '3' or a '4'. If outliers¹⁹ are removed from the dataset, a home that scored a '1' was shown to be, on average, 17 percent larger than a home scoring a '10', indicating that a small number of very large homes in the dataset were not skewing the comparison of score to home size in a significant way. When removing outliers, the average size of a home scoring a '1', a '2', or a '3' decreased by nine percent, three percent, and four percent, respectively. See Table 2 for details on the average size of all homes in the pilot by score, as well as average size by score once outliers are removed.

SCORE	NUMBER OF HOMES RECEIVING THIS SCORE	AVERAGE HOME SIZE (SQ. FT.)	AVERAGE HOME SIZE WITH OUTLIERS REMOVED (SQ. FT.)
1	121	2,698	2,444
2	48	2,261	2,195
3	82	2,137	2,044
4	92	2,195	2,117
5	68	2,113	2,066
6	62	1,953	1,953
7	45	2,124	2,162
8	39	2,219	2,137
9	24	2,469	2,468
10	18	2,024	2,024

Table 2: Average home size by Score.

¹⁹ 'Outliers' were defined as homes whose given square footage was less than 500 square feet or more than 5,000 square feet.



Year Built & Structure

While a direct correlation between home size and Score could not be drawn, the year a home was built appeared to be correlated with the initial Score. In general, the older a home is, the more likely it is to receive a lower Score due to older energy-related features. The average year built for a home in the pilot that scored a '1', a '2', or a '3' was in the early- to mid-1930s; of the 251 homes receiving one of these lower Scores, the oldest home was built in 1893 and only 12 homes in this grouping were built after the year 2000. With only two exceptions, those homes that were built in more recent years and still received a Score of '3' or lower are larger than the average size of all homes that received Scores through the pilot program (2,219 square feet on average), and in several cases were nearly double or triple the size of the average home.

Starting with homes that scored a '4', the trend is for the average home receiving each Score to be built roughly a decade later. In other words, the average home scoring a '4' was built in the 1940s, the average home scoring a '5' was built in the 1950s, etc. This trend may be a coincidence or may come as a result of building practices and/or the evolution of local codes and policies. Of homes that received a score of '10', only 2 homes were built before the year 2000 (one in 1999 and one in 1922); of homes that received a score of '9', six were built before 2000. Table 3 details the oldest, newest, and average year built for each Score. Upon further analysis, there were many outliers that indicated that, while year

built can be correlated with the Score, there is not a direct causal relationship between the two. In fact, it is important to note that in addition to the year built, there are underlying variables such as wall structure or common building practices at the time of building that also contribute to a home's Score. Of approximately 250 houses in the pilot scoring less than a '4', 210 of them had structural brick or concrete block walls with no insulation, which DOE has indicated are drivers of a lower Score due to a lack of wall insulation. Based on the general correlation between a home's Score and the year the home was built, year built might be a useful variable to use when determining which homes could be targeted for a Score in future programs in Denver.

Heating Fuel Type and Utility Rates

Of all homes analyzed in this report, 99 percent heat with natural gas and 96 percent use natural gas for water heating. The scoring tool factors in average statewide utility rates when determining which recommendations to include; in Colorado these natural gas rates are identified as the 4th lowest in the country. Denver customers served by Xcel Energy have rates that are even lower than the state average. Due to Denver's low natural gas costs, the scoring tool did not calculate significant annual estimated energy cost savings in reports where a new furnace or water heater was recommended for replacement at the end of its life. While these recommendations were included in many reports, the savings were minimal and therefore did

SCORE	NUMBER OF HOMES RECEIVING THIS SCORE	AVERAGE YEAR BUILT	OLDEST HOMES	NEWEST HOMES
1	121	1932	1885	2011
2	48	1936	1879	1999
3	82	1933	1886	2018
4	92	1945	1891	2019
5	68	1952	1886	2015
6	62	1962	1901	2019
7	45	1978	1900	2018
8	39	1990	1908	2019
9	24	1999	1927	2019
10	18	2009	1922	2019

Table 3: Average, oldest, and newest year built of home by Score



not appear to give a strong incentive to make the recommended efficiency improvements. While there is not enough data to be statistically relevant to support a direct causal relationship between a home's heating fuel type and initial Score (due to the fact that the vast majority of homes were heated with natural gas), there is evidence to suggest that obtaining a higher Score with improvements for homes heated with natural gas may come with longer payback periods in order to achieve higher Scores based on the lower natural gas costs in Denver. It is also important to note that the default scoring tool cannot recommend switching fuel types and will not recommend an upgrade that would increase a home's energy use. For example, homes with window air conditioning units as opposed to a ducted cooling system would not receive automatic recommendations for a high efficiency air conditioner or air source heat pump if the presence of cooling was strictly through a window unit. Assessors have the ability to generate an Alternate Score using the tool to model different scenarios. This could support informing upgrades a homeowner may already be planning, such as adding a ducted system, or electrification strategies the City may wish to promote in the future.

PROGRAM RESULTS

Participation: Who Received Scores?

As of September 26, 2019 (when data for this analysis was pulled), a total of 599 homes had received a Score. By the time data for this analysis was pulled nearly 26 percent of original requests for a Score had not been completed; this was due to the fact that the homes were either not eligible to receive a Score because the homes were not Denver's target audience for the pilot, the property was a stacked multifamily unit, the

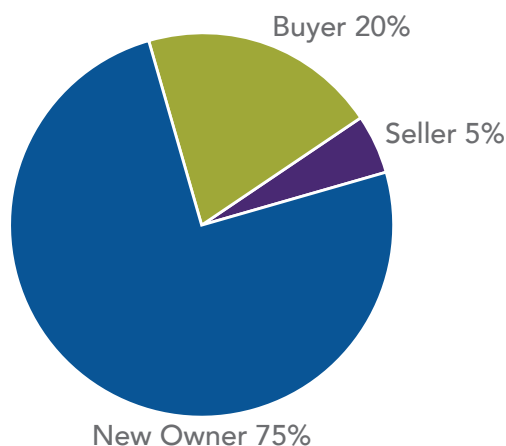


Figure 5: Share of stakeholder types receiving the Score.

requester was no longer interested or unresponsive when contacted about scheduling an assessment, or the assessment simply hadn't occurred yet. Of the homes that received a Score, 20 percent of those were buyers, five percent were sellers, and 75 percent were new owners (see Figure 5). While the greatest interest for a Score came from New Owners, it is important to note that due to Denver's access to MLS data through the Denver Assessor's Office, New Owners were also the most straightforward audience to target due to the ability to send direct letters on a monthly basis to homes that were recently purchased. This was the primary outreach strategy, followed by no-cost posts to Next Door, Facebook and Twitter, and finally the home inspector pathway.

Scores: How Did We Do?

The average home Score in Denver was a '4', while the most common Score for all pilot program participants was a '1', with 20 percent of participating homes receiving this Score. The next most common Scores were a '4' and a '3', with 15 and 14 percent of homes receiving these Scores, respectively. The least common Score in the pilot was a '10', with only three percent of homes scored receiving this designation. Figure 6 shows the spread across all of the initial Scores for homes participating in Denver's pilot.

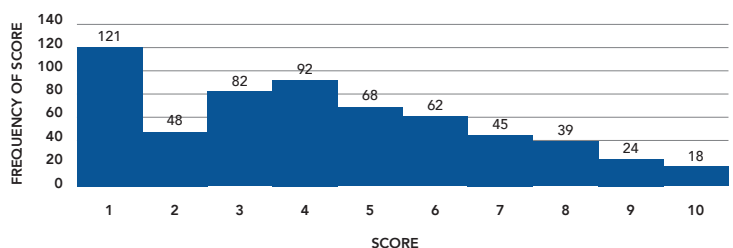


Figure 6: Initial Scores for Denver homes in the pilot.

If all homes in the pilot were to implement all recommended upgrades and be rescored, the average home Score would be a '6' and the most common Score would be a '7'; see Figure 7. On average, homes that initially scored a '7' or below could improve their Scores between one and two points if all recommendations were implemented. The shift in the Score distribution between Figure 6 and Figure 7 illustrates the potential for increasing Scores, which can be seen as a proxy for home efficiency, in Denver if all recommendations were implemented.



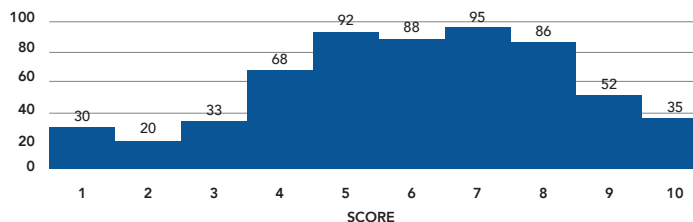


Figure 7: Score after all recommendations are implemented.

Upgrades: Were Upgrades Completed because of the Score?

A total of 304 participants responded to an initial survey after receiving their Score report. Of those participants, 267 responded to a survey question regarding whether they plan to implement upgrades based on the recommendations in the report. This does not mean they will implement all upgrades identified in the report, but one or more. Of those who responded to the survey, nearly 77 percent indicated that at some point they plan on implementing one or more of the recommendations, and an additional 10, percent indicated that they have already implemented one or more upgrades; see Figure 8, where the bolded responses are included in this 77 percent. Thirteen percent of respondents indicated that they do not plan on taking any action. Across all these survey respondents, the average Score was a '4', with nearly half of these homes initially scoring a '3' or below.

A large majority of sellers that responded to the initial survey indicated that they already have or plan to implement upgrades in the next six months to a year. However, it should be noted that there were only 28 homes scored on behalf of the seller, and only 19 of those responded to the initial survey. While responses to the initial survey may appear to indicate that sellers are highly motivated to make improvements, during phone interviews with sellers for the closing survey, these individuals noted the exact opposite. Sellers interviewed noted that Denver is a seller's market and that due to this they were not motivated to make improvements, though if it were to become a buyer's market the motivation to make improvements from sellers would likely increase.

Across all homes in the pilot the average number of recommended upgrades was just over two. The most common recommended upgrade was a water heater replacement, which constituted 30 percent of all upgrades (when combining recommendations for both an ENERGYSTAR water heater and a heat pump water heater), followed by a furnace replacement, which constituted 24 percent of all upgrades (when combining recommendations for both an ENERGYSTAR furnace and a heat pump). See Figure 9 for details; note that in this graph the five least common recommendations (window replacement, wall insulation, duct insulation, roof insulation, or floor/crawl insulation) were grouped

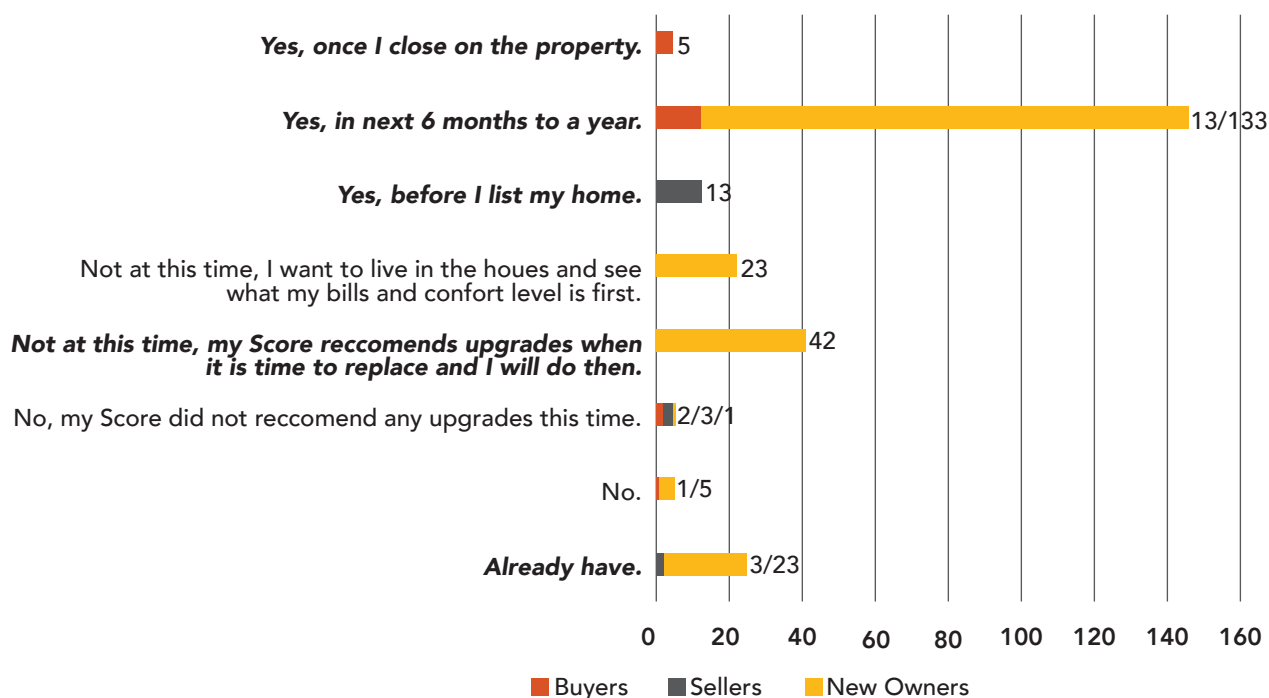


Figure 8: Survey responses regarding planned upgrades.



together under 'Other'. Note that the data on recommendations available for this analysis did not include details on which recommendations were suggested to be acted on in the near term versus in the future (such as when equipment requires replacement). If possible, tracking the suggested timeline for implementing upgrades in a future program may provide useful insights into how Denver can encourage and support greater investment in efficiency in the future.

Homes receiving a Score of a '1' had, on average, nearly five recommendations included in the report, while homes scoring a '9' or a '10' had, on average, zero recommendations included in their reports. As one may expect, the average number of recommendations decreases with each increase in the Score. The greatest number of recommendations that any home received was a total of 10 recommendations; two homes received this many, and both had an initial Score of '1' with the opportunity to increase their Scores to a '7' or an '8' if all recommendations were implemented. A total of 54 homeowners, or nine percent of all pilot participants that received a Score, were not provided with any recommendations that met DOE's 10-year payback, meaning that the default Score did not provide them with any actionable information or motivation to pursue efficiency upgrades.

The Score also provides estimated cost savings based on the recommendations included in the report. DOE provided an additional data set that included total estimated cost savings for various upgrades; this data was analyzed alongside the pilot data. Based on this analysis, the average cost savings per household if all recommendations were to be implemented was \$191.80 per year. The highest estimated annual cost savings provided by the DOE for a household that implemented recommendations was \$2,160 for a

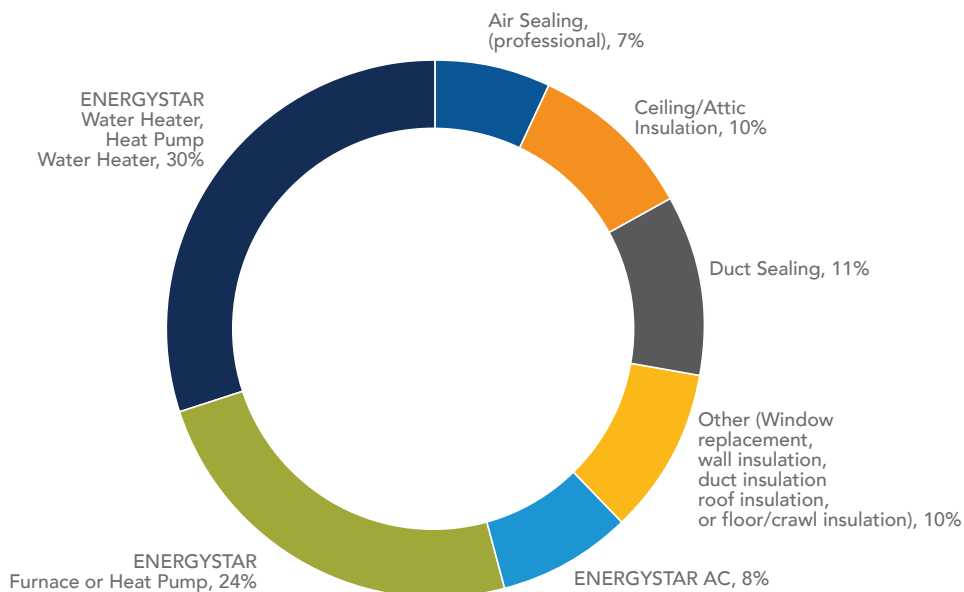


Figure 9: Most commonly recommended upgrades in Score report.

home with six recommendations, including air sealing, attic floor and crawlspace insulation, and upgrading to an ENERGYSTAR-rated water heater and heat pump. The lowest amount of estimated savings from recommendations was \$0; these were likely cool roof recommendations that advised households to install a roof designed to reflect sunlight and absorb less heat. Six homes received recommendations that, per DOE, are not estimated to result in any savings. It is worth noting that the scoring tool has since updated its software and any recommendation that saves less than \$10 per year is no longer included. Homes that scored a '1' had the highest average estimated cost savings from implementing upgrades at \$555 annually, and homes that scored a '9' had the lowest average estimated cost savings from implementing upgrades at \$29 per year. Of those households that received a recommendation to replace their water heaters (the most common recommendation in the reports), 87 percent were told that the annual savings from this investment would be \$35 per year or less; this represents minimal annual savings for an upgrade that has a significant price tag associated with it. Of those households that received a recommendation to replace their furnace (the second most common recommendation in the reports), 65 percent were told that the annual savings from this investment would be \$156 a year or less. The minimal annual savings from some of the recommendations helped to highlight and raise awareness regarding Colorado's (and Denver specifically) lower natural gas costs compared to other partners across the country;

'I'm very appreciative of this service. I am also excited about the Xcel rebate program and the information I received on that, which I was unaware of.'

-Pilot program participant



these lower energy costs can make a cost-saving argument for upgrades like water heaters or gas furnaces less compelling to a homeowner.

Across all homes in the pilot the most common planned upgrade was ceiling and attic insulation (which represents 36 percent of all planned upgrades) followed by DIY weatherstripping or pipe insulation (representing 14 percent of all planned upgrades) and floor/crawlspace insulation (representing 12 percent of all planned upgrades). See Figure 10 for details on which upgrades participants indicated they plan to implement; note that this list includes items that participants reported that they plan to do that were not included in the recommendations provided in the Score, such as weatherstripping and replacing lightbulbs with LEDs. This indicates that either the Assessors provided some participants with additional information about cost-effective energy-saving measures, or that at least some

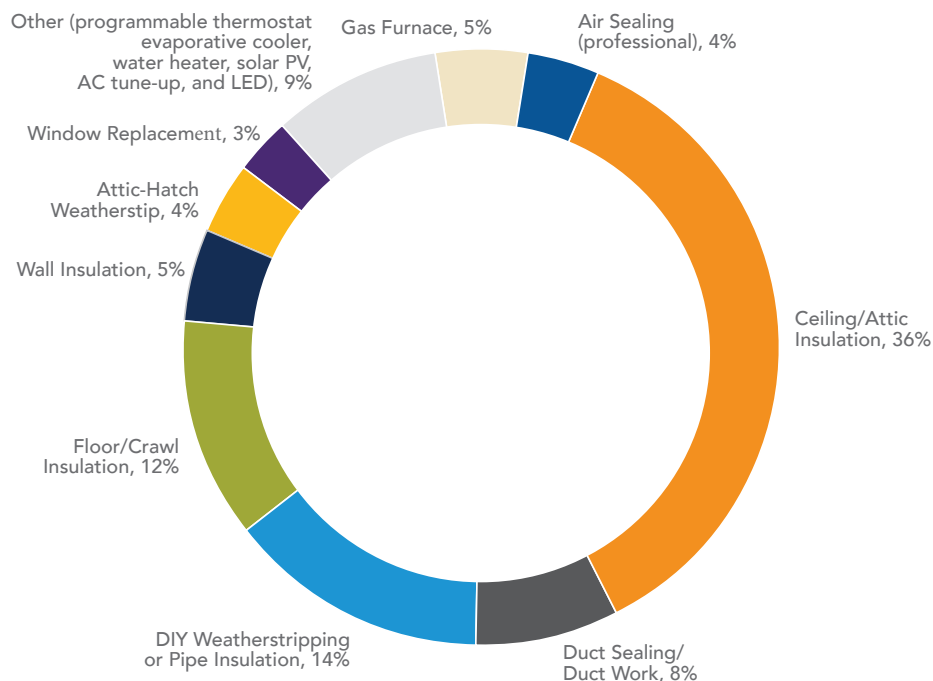


Figure 10: Planned upgrades reported by program participants.

'I enjoyed the experience and was happy to have the opportunity to talk to the professional and have a prioritized list of measures to consider.'
-Pilot program participant

pilot participants were individuals that may already have some level of knowledge about energy efficiency and a motivation to address energy efficiency in their homes.

Based on the data from the DOE, the average annual cost savings for homes that implement ceiling/attic insulation ranges between \$65 to \$299 per year depending upon the level of insulation recommended in the Score report and the home's current insulation level (i.e., R-19, R-30, etc., up to R-60). The lowest potential annual savings for a single household from ceiling/attic insulation was \$12 per year, and the highest annual savings for a single household was \$613. The average savings for crawlspace insulation, based on DOE estimates, was between \$24 to \$382 per year, again depending upon current and recommended levels of insulation in the home. Xcel

Energy provides some rebates and incentives for home insulation projects; however, these reduced costs are not included in DOE's default payback calculations and, therefore did not factor into which recommendations populates a report. DOE did not provide estimates on cost savings from DIY weatherstripping, as this is not included on the list of potential recommendations that appear in the Score.

This variability in cost savings for the most frequently recommended upgrades, such as a water heater, compared to the frequently planned upgrades, may act as a de-motivator for some homeowners that may otherwise be interested in improving the efficiency of their home. Across many Scores, a frequently cited recommendation is to replace the water heater with a more efficient version when the current unit needs replacing, yet the annual cost savings of this improvement in the Score report is relatively low, usually coming in between \$11 to \$24 in savings annually, and two-thirds of homes in the pilot could have annual cost savings from implementing upgrades somewhere between \$0 to \$299. This low savings potential on a home improvement investment that is relatively high provides little financial motivation for individuals to move forward with implementing improvements in the home. If presented in a clearer way through a custom report this could combat demotivation from a report that automatically generates minimal cost savings.



'The upfront cost of making the upgrades is not justified for the estimated annual savings, but I will make upgrades as necessary given the condition/useful lives of certain items.'
-Pilot program participant

Survey Responses

Method for Collecting Input

Feedback for Denver's pilot program was collected through an initial survey emailed to participants within a week of receiving their Score, as well as through a closing survey completed in late September and early October 2019. Approximately 50 percent of pilot program participants (304 households) responded to initial surveys at the time of this analysis and 25 percent of pilot program participants (151 households) participated in the closing survey.

Of those who participated in the initial survey, feedback was overall generally positive regarding support the program provided. Based on initial survey responses, 82 percent of households felt that the Score would help them save energy and 65 percent felt that the Score would help them save money. Only eight percent of respondents said that the Score was not helpful, see Figure 11.

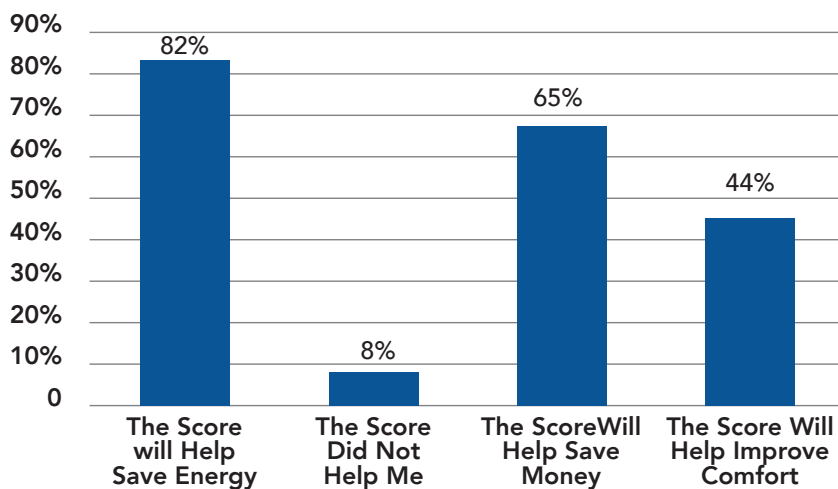


Figure 11: Participant response in the initial survey regarding the impacts of the Score.

Desire for Information

Of those that said that the Score was not helpful, 80 percent received Scores below a '5', and three received a report with no recommendations listed. The written comments from individuals that indicated that the Score was not valuable reflect frustration around the amount of actionable solutions included in the final Score report, and in some cases, participants expressed frustration around the fact that in the report the potential cost of recommendations are very high in comparison with the annual return on investment. Although the average Score for the respondents that said that Score did not help them was lower than the overall average Score in the pilot, the written comments and feedback indicate that it was more a frustration with the scoring tool and the lack of actionable information provided than overall frustration over the Score one received that drove this feedback. Anecdotally, some qualitative responses in the closing survey indicated that residents view energy improvements as something that can be fixed, whereas your neighborhood or school district isn't something one can change. According to a 2019 article in the Denver Post, a recent study concluded that Metro Denver homeowners move on average every 6.63 years, which could also factor into whether energy investments will ever be made in a home, especially higher cost upgrades.²⁰ This could indicate that while more information about a home is always welcome, providing information alone will not necessarily lead to immediate action if they do not intend to stay in the home long term. It's also worth noting that because of several factors, including that participation in the pilot program was voluntary, the cost to receive a Score was free, and there was not much familiarity with the Score, the City wonders if many participants had low expectations of what they would get and therefore any information about the home was welcomed. If the Score was not free, the City wonders if participation numbers would be lower and expectations for the report may in fact be higher given that it came with a cost.

²⁰ For more information see <https://www.denverpost.com/2019/02/15/denver-residents-house-hop/>.



'The conclusions from the assessment were rather weak. I was hoping I would glean some actionable information, but this was not really the case. Minor little things here and there that don't really add up to much.'

-Pilot program participant

Denver also obtained feedback from E3 Power about their work in the pilot; E3 Power performs audits to help answer customer's questions about their home, but does not complete upgrades and is therefore a true third party providing audit reports that uncover issues and recommend solutions. The E3 Power auditors noted that more times than not they are addressing more in their home assessments than just energy usage. Additionally, the Score is meant to be coupled with invested and knowledgeable Assessors (like E3 Power) who can tailor information to a specific homeowner through the Alternate Score option or the Comments section, where applicable. While Assessors were not required to utilize the Alternate Score or Comments section in the pilot, some Assessors used these features regularly. This level of detail can provide beneficial information to owners, and if consistency is desired amongst the Score reports, cities or utilities administering labeling efforts may wish to consider requirements for Assessors that includes using the Comments or Alternate Score functions of the scoring tool from the onset of a program.

Motivation Levels

Based on information in the closing survey DDPHE conducted near the end of the pilot, the Score has the impact of increasing the level of motivation that a household feels to implement energy efficiency improvements only slightly. On a scale of 1 to 10, the average reported level of motivation for addressing home energy efficiency before receiving a Score was 6.7, whereas the average level of motivation after receiving their report was 7.2. Nearly 20 percent of responding participants reported that they were actually less motivated to invest in efficiency after getting the results of their Score, often again citing lack of actionable recommendations as a main source of frustration. However, overall 72 percent of respondents to the closing survey agreed that sharing a Score could be enough to encourage people to invest in energy efficiency, and nearly 95 percent of respondents indicated that they would be motivated by additional

rebates tied to their Score recommendations. This data provides insight into ways the City may be able to increase motivation by offering additional rebates.

Data reflects that the Score with recommendations can be a motivator for some people, but generally does not increase level of interest in and motivation to act on projects significantly, and in fact in some cases can act as a de-motivator for people who may have initially been interested in making improvements if the annual cost savings are marginal and/or the home's Score may not change much (if at all) after implementation. Sellers responding to the closing survey indicated that in a market that is not as strong as Denver's they may be more motivated to make improvements before listing the home, but that it wasn't necessary in today's market to ensure a quick and profitable sale.

51% of the closing survey responses said an energy label should be shared publicly during the home sale process through online portals like the MLS (Redfin, Zillow) or Assessor records.

Sharing Preference

When asked what the most valuable way would be to share information about a home's energy efficiency attributes, 83 percent of closing survey respondents said that this information would be best shared through disclosure about past energy bills and a list of the home's efficient and inefficient equipment. While this was the most common response, it is worth noting that simply disclosing bills or energy features may not provide homeowners with enough information to effectively compare homes across the housing market in the way that the Score aims to do. An additional 44 percent of respondents said that a 'miles per gallon' type of tool, like the Score, is the best way to share this information (please note, respondents could select multiple options; therefore, totals will add up to more than 100 percent). 91% of those who responded to the

Nearly 95 percent of closing survey responses indicated that they would be motivated by additional rebates tied to their Score recommendations, and many indicated that they believe that listing a home's efficiency features and sharing prior energy use would be good to include as part of the home buying process.



initial survey believe it is good to raise awareness about a home's Score during the transaction and approximately 51% of the closing survey responses said an energy label should be shared publicly during the home sale process through online portals like the MLS (Redfin, Zillow) or Assessor records.

Due to a limited number of sellers participating in the pilot, and the discovery that only one home in the entire pilot publicly shared their home's Score (which was a 10), we are unable to determine whether disclosing at time of list would have affected purchase decisions on properties in question. However, it is important to note that more information is often welcomed when purchasing a home and therefore it could be assumed that a Score would be viewed as a valuable piece of information in the transaction process. Recognizing that upgrades may not happen right away, the Score aims to help owners find value in energy improvements and communicate that value when selling a home. It is important to note however that participation to obtain a Score was voluntary and free of charge. If Denver were to require the disclosure of this information by every home sold and require the seller or buyer to pay for it, the City wonders if responses to how information should be accessed might change and whether expectations of what is provided might differ.

Opportunities and Challenges Related to Using the Score as a Tool to Encourage Energy Efficiency

OPPORTUNITY: *Providing a home energy label is an opportunity to start dialogue around energy efficiency and develop a trusting relationship between Denver and participating homes.*

Based on qualitative responses in the closing survey, Assessors that performed the Score assessments were, in general, knowledgeable and friendly, and, in many cases, able to answer questions that residents had regarding the home's efficiency and potential for improvements. A Score assessment can be used to initiate a conversation about energy efficiency and has the potential to begin establishing a trusting relationship

'We asked her (Assessor) several questions about the report and what her personal suggestions were for low-cost improvements. She was very knowledgeable'

-Madeline, pilot participant

between Denver and its residents. This may facilitate greater levels of consumer protection and awareness about features and issues of a home the average homeowner may be unaware of without a building science

background. While early adopters may be quick to implement energy efficiency upgrades with little or no outside motivation, others may need more guidance on which projects to invest in, or may need to live in the home for at least a year (or more) to know how it feels and what it costs to operate. Homes are complicated and there is not a one-sized solution for making every home in Denver energy efficient, but the City can leverage this continued dialogue to support efforts that turn lukewarm motivation into action.

'[My assessor] was very friendly and very helpful. He showed me some of the features that he noticed that made the house less energy efficient (such as gaps in the lighting in the kitchen) and also explained a lot of information to me.'

-Megan, pilot participant

OPPORTUNITY: *On average, the scoring tool estimates a five percent electricity savings and 21 percent natural gas savings per home if all recommendations are implemented.*

Denver's nearest residential single-family climate goal calls for a 10 percent reduction in energy use by 2025. If a customized Score were created and Denver could offer additional rebates in coordination with Xcel Energy to increase investments in energy efficiency, achieving this goal with the support of a disclosure policy could help Denver achieve its climate goals. A recent report studying the effects of mandatory efficiency disclosure policies in Austin, Texas found that disclosure increases investments made by sellers and buyers, and government intervention has helped to address a market failure of incomplete information in housing transactions about the energy performance of homes.²¹

²¹ For more information see <http://e2e.haas.berkeley.edu/pdf/workingpapers/WP044.pdf>.



Recognizing that some upgrades won't happen until end of life, it would have been even more informative to break out estimated savings for recommended improvements that can be done now versus later. This was not conducted in the analysis due to the available data, but in the future this data could provide more insight into realistic energy savings based on when upgrades are more likely to happen.

OPPORTUNITY: Customizing the default Score would allow for the inclusion of local incentives, and rebates.

Since available rebates and incentives are not factored into the DOE's estimated cost savings, some cost-effective energy efficiency improvements were often excluded from the Score report (e.g., insulation, air sealing, etc.). In addition, only upgrades that provide a 10-year payback (exclusive of utility rebates or incentives) are included in the Score report, several homes that received a Score were told that there were no cost-effective upgrades, the suggested upgrades would not actually result in significant cost savings, and/or their home's Score would not improve even after implementation. Figure 12 and Figure 13 show an example of a home that scored a '1', but where the scoring tool did not find any improvements that could be included in the list of recommendations with a 10-year payback, and therefore, the default report had no recommendations.

The City of Portland (through Earth Advantage) is using a customized Score report that includes recommendations independent of what the scoring tool automatically generates and could be of consideration for Denver should they wish to offer an energy label in the future. By offering a customized Score report, Denver may be able to provide more relevant and actionable information to homeowners that is more effective at motivating action.

As seen in Figure 13, while the scoring tool did not highlight any recommendations for improvements in this home, the Assessor took an extra step to add detail to the report regarding recommendations on insulation

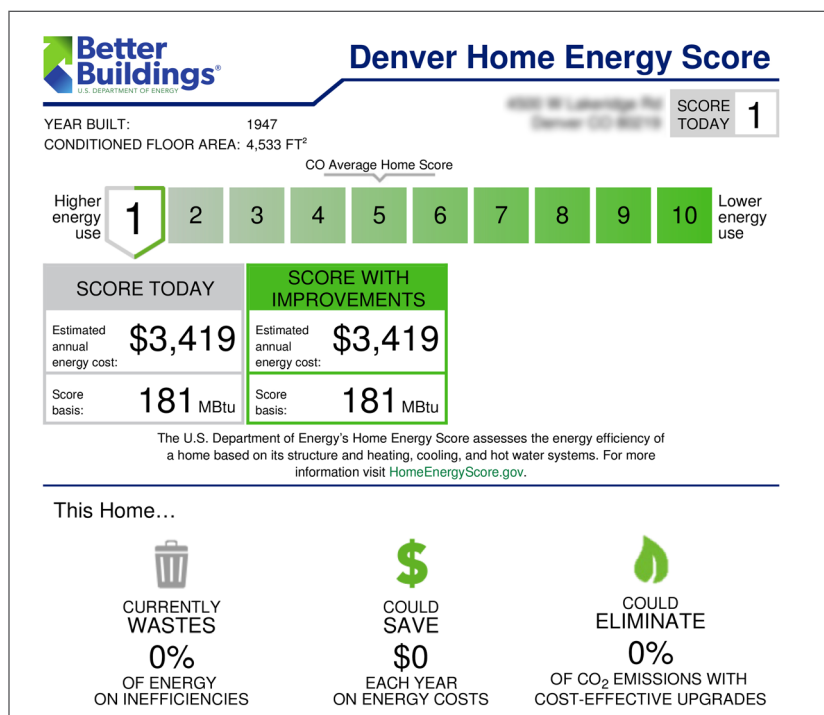


Figure 12: Score report for a home scoring a '1'.

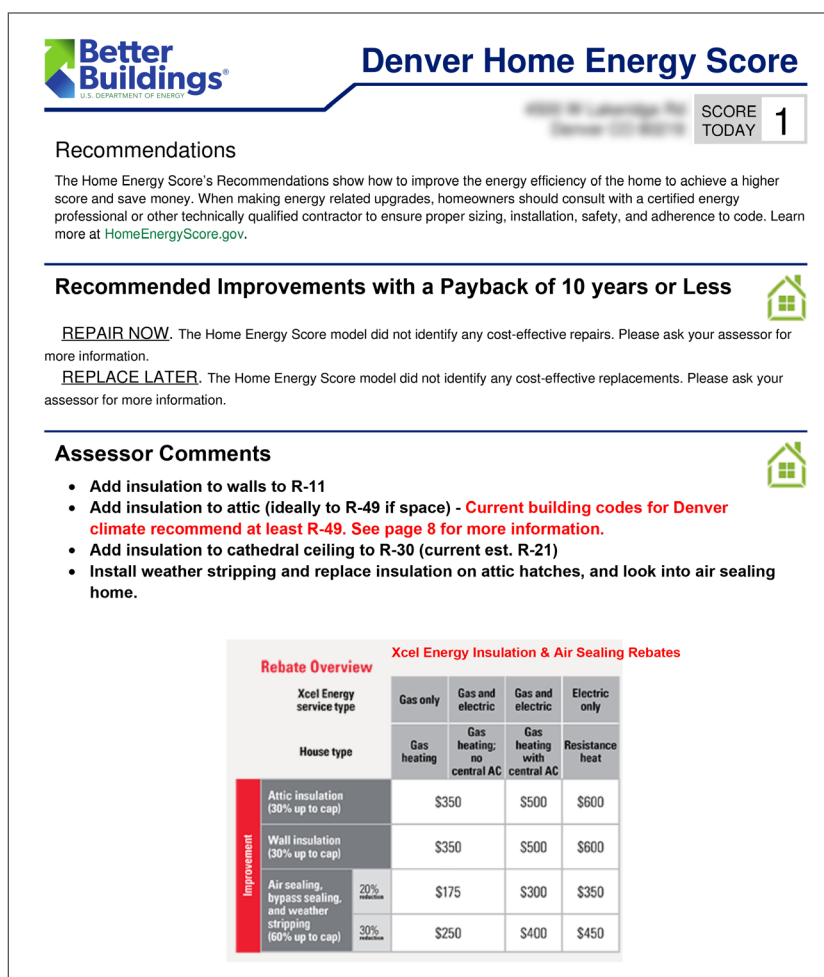


Figure 13: Score recommendations for a home scoring a '1'.



improvements that could be made to the home, as well as rebates available from Xcel Energy. Adding additional comments into reports was common practice for some Assessors and began to show real value in the visual inspection necessary to generate a Score. In cases where a home scored low and the tool did not identify cost-effective recommendations, the Assessor was able to point out areas of improvement regardless of the 10 year payback.

There are several examples of a Score report detailing potential recommendations that a homeowner can implement in the future, such as replacement of an existing furnace or water heater when the current equipment reaches its end-of-life. Often these recommendations have a significant cost associated with them; at the same time, the annual cost savings to the homeowner from the improvement may be minimal. Paying a high capital cost for a measure that yields little cost savings does not incentivize a homeowner to make upgrades prior to when they are forced to (i.e., when the existing equipment reaches the end of its functional life), and the minimal annual savings for a more efficient piece of equipment may not be enough to motivate homeowners to purchase the more efficient equipment even when the time comes to replace if the only argument for a high efficiency replacement is low annual savings in the Score report. Denver could develop additional incentive programs to help subsidize the cost of such expensive measures to improve their adoption. While a full analysis of building permit records was not conducted for this report, preliminary investigation showed that some homes that received a Score had permits pulled for equipment replacement (e.g., furnace or water heater) in the year prior to receiving their Score. Many of these homes also had replacement of this equipment with a more efficient version included in the list of recommendations in their Score report. This indicates that many of these homes may have received a 'like for like' replacement on equipment rather than investing in more energy efficient models of the equipment. This highlights an opportunity for the City to offer incentives to homeowners, builders, and contractors towards the purchase of higher efficiency equipment for single family homes; this may be especially effective at ensuring equipment is replaced with more efficient models if the home is being flipped and then sold to the long-term occupants.

'The energy Score is a somewhat useful starting point but it misses a lot of details. If the Score is to become part of the disclosure docs of a house sale in the future it will have to be a lot more detailed and not miss issues.'

-Pilot program participant

The DOE provides partners with three versions of a Score report for use in programs, although content about local rebates or where to find contractors is not automatically included. Denver created customized content about local rebates and where to find contractors and added it to the default report making the final product 10 pages long. To further streamline what was shared with residents, Denver worked with Earth Advantage to create a customized two-page report (see Figure 14 and Figure 15) that allowed for some alignment with recommendations and current building codes, local utility rates and carbon emissions factors to produce a more useful report. The report also maintained a similar design as reports provided by the City of Fort Collins to ensure consistency about energy labels across the Front Range. If the pilot were

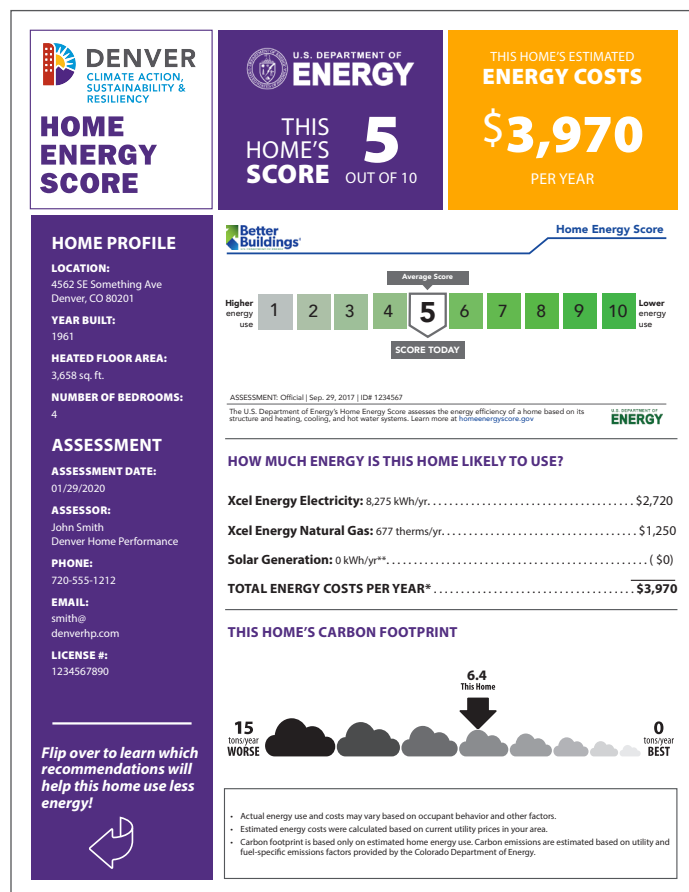


Figure 14: Sample customized Score report for Denver.



to become a permanent program or requirement it is recommended that Denver fully implement a customized report that can also factor in local rebates to further motivate action.

While the Score is intended to provide a higher-level overview of a home's efficiency features and is not intended to replace or provide the same information as one would receive in a detailed home energy audit, a custom Score would also allow for the inclusion of non-fixed assets if it were a priority for Denver. Some of the simplest measures for residents to implement with energy cost savings potential are to improve lighting, implement temperature setbacks, and install new appliances. This was communicated to all pilot program participants, but based on feedback comments received, some participants still had an expectation that they would receive a more detailed report on their home than the information that is typically is included in a Score. Clear and consistent communication with participants prior to the Assessor entering their home, perhaps including an example of what the final report will look like, may help to mitigate this issue in the future.

CHALLENGE: *There is significant variation in the Score mobility of a home, and many would not improve their default Score even if recommended improvements were made.*

There is significant variation in the likelihood of increasing Scores across the homes rated in the pilot. For example, 25 percent of homes that initially scored a '1' would also score a '1' if all recommended upgrades were implemented; 23 percent of homes initially scoring a '1' could move up to a '4' if all recommended improvements were made. Homes that initially scored a '2' were most likely to be able to attain a Score of '4' if all recommended improvements were made. Homes that scored an '8' on their initial score are most likely to remain an '8'

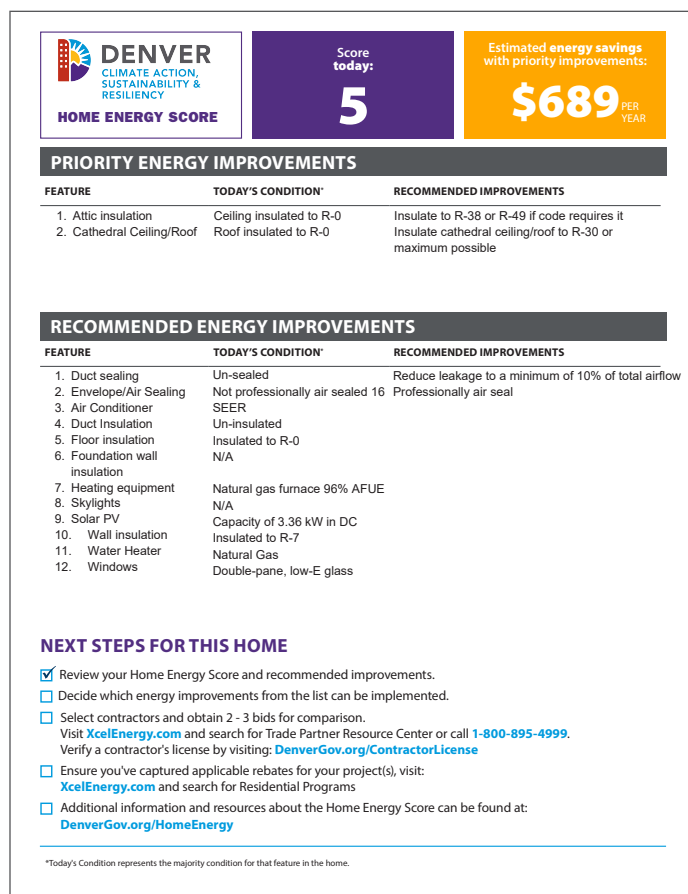


Figure 15: Sample customized Score report for Denver.

INITIAL SCORE	MOST COMMON SCORE ONCE RECOMMENDATIONS ARE IMPLEMENTED	FREQUENCY OF MOST COMMON SCORE ONCE RECOMMENDATIONS ARE IMPLEMENTED
1	1	25%
2	4	42%
3	5	38%
4	5	32%
5	7	29%
6	7, 8	35% each
7	8	40%
8	8	51%
9	9	71%

Table 4: Initial and potential Scores for Denver homes participating in the pilot.

even when making all recommended improvements. Table 4 shows information on the initial and most likely potential Score for each bucket of initial Scores across the pilot program.



By only utilizing the default report, 20 percent of all Scores in the pilot (121 homes) could not improve their Score even if all recommendations were implemented. It should be noted that if the Assessor provides Comments or generates an Alternate Score to demonstrate additional recommendations outside of a 10-year payback, all homes could still improve their scores. Comments or Alternate Score information would need to be established as part of any voluntary or mandatory program's requirements to mitigate the perceived barrier to improve a Score based on the default recommendations.

Fifty-four homeowners (9 percent of all pilot participants) were provided with no recommendations for improving efficiency in their homes through the automatically generated report; of those that did receive recommendations for efficiency improvements that included annual cost savings, the average annual savings was \$266. As seen in Figure 16, the majority of homes receiving recommendations with cost savings were told they could save between \$0-\$260 per year, with only two homes receiving recommendations that could save them upwards of \$1,040 a year. This further illustrates

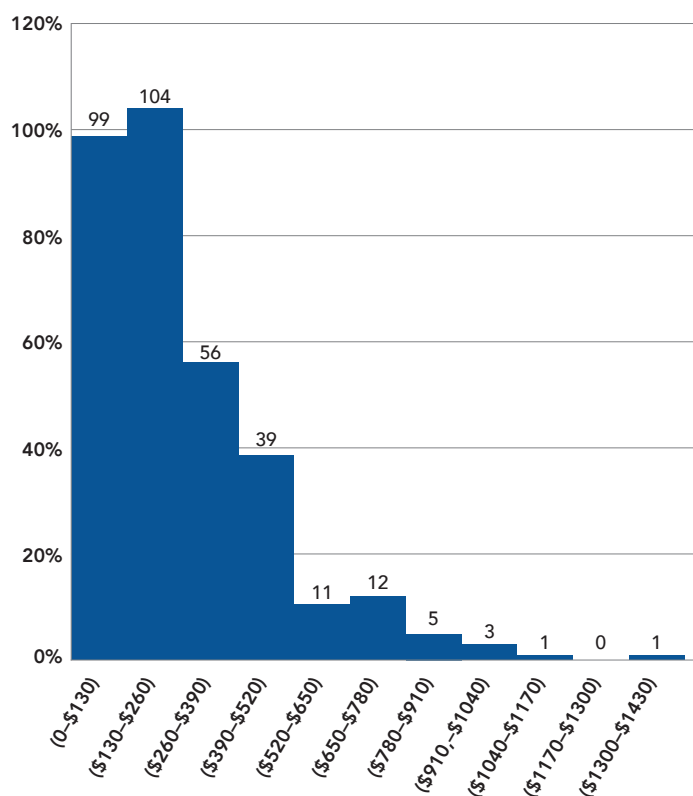


Figure 16: Number of Scores showing the range of annual cost savings per DOE calculations.

the challenge of the default scoring tool as a motivator for individuals to implement recommended upgrades, as a minimal annual savings with no chance to improve a home's Score may not justify extensive investments in efficiency upgrades.

CHALLENGE: *Denver has low natural gas rates, making it difficult for natural gas saving measures to yield significant cost savings.*

Based on Denver pilot data from DOE, Colorado has natural gas rates that are lower than the national average, with Denver specific rates through Xcel Energy falling lower than the statewide rates used in the scoring tool. Recommendations to reduce natural gas use should be abundant since the majority of Denver homes are heated with natural gas (99 percent of homes in the pilot for space heating and 96 percent of homes for water heating). However, due to Colorado's lower natural gas rates, and hence, less opportunity to save on natural gas costs, coupled with the fact that utility rebates and incentives are not factored into the payback calculations, homes in Denver have received slightly fewer recommendations than the national average. On average, Denver homes received just two recommendations, while the average number of recommendations nationally was just over three.²²

Due to Colorado's lower natural gas rates, and hence, less opportunity to save on natural gas costs, coupled with the fact that utility rebates and incentives are not factored into the payback calculations, homes in Denver have received slightly fewer recommendations than the national average.

OPPORTUNITY: *Lower than national average scores in Denver highlight importance of bringing energy efficiency to residents.*

Compared to homes that have been scored nationally, the homes scored in Denver have received slightly lower Scores. Based on data provided by the DOE, overall homes scored in Denver have an average initial Score of 4.3 and an average potential Score of 6.0; this compares to an average initial Score of 4.7 and potential Score of 7.1 in the national dataset. It should be noted that neither Denver nor national Scores are at random due to the fact that in Denver homeowners currently have to opt-in to the program and nationally the requirements

²² Based on data provided by DOE's Home Energy Score partner portal.



of local municipalities and jurisdictions dictates who receives a Score to some degree.²³ Compared to Denver, homes receiving a Score nationally tend to have a more ‘mobile’ Score, meaning that there is a greater likelihood of the Score increasing if recommendations are implemented. For example, homes scoring a ‘1’ for their initial Score in Denver have a 25 percent chance of remaining a ‘1’, whereas nationally these homes only have a 9 percent chance of remaining a ‘1’.²⁴ See Figure 17 for more information.

This variation between Denver’s data and national averages may be due to several factors, including that the average home scored in Denver is slightly bigger and slightly older than the homes scored nationally (2,281 square feet and built in 1954 in Denver, versus 2,018 square feet and built in 1963 nationally). Additionally, a higher proportion of homes scored in Denver have air conditioning than those scored nationally, and homes scored in Denver are also more likely to have a gas water heater versus a heat pump water heater, or a gas furnace over an air source heat pump than homes scored nationally. As air conditioners and water heaters are part of the fixed assets in a home that contribute to a Score, and heat pump (i.e., electric) water heaters and furnaces are a significant energy savings measure, the prevalence of these types of equipment in Denver may contribute to the lower overall Scores while exposing opportunities to upgrade homes in alignment with Denver’s evolving climate goals particularly around electrification.

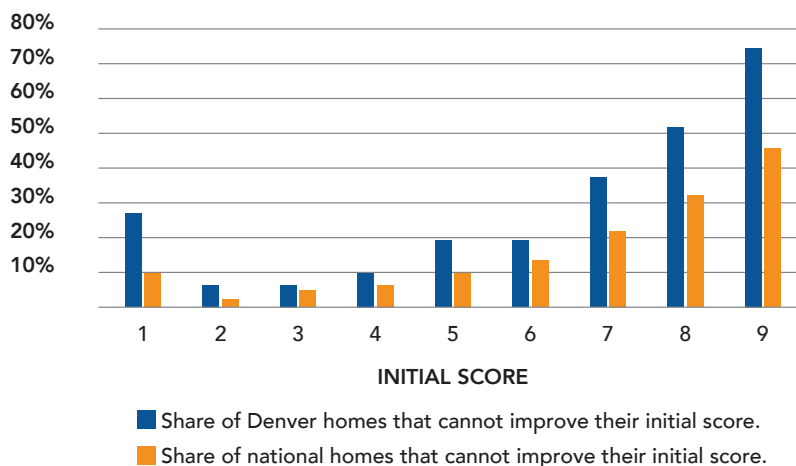


Figure 17: Share of homes in Denver and nationally that cannot improve their Scores.

OPPORTUNITY: Mandatory disclosure would increase housing data & job creation.

If Denver were to require a mandatory Score, or other energy label, prior to transferring ownership, the number of homes assessed would increase by nearly twenty times. A total of 599 homes had received a Score at the time the data for this analysis was pulled. Based on data received by the Denver Assessors office and sourced from the MLS, during the 16-month period from the beginning of May, 2018, to the end of September, 2019, an estimated total of 13,844 single-family residential homes (including townhomes) were sold, meaning that homes participating in the pilot represented just over four percent of all of the homes that would have otherwise been required to participate if a mandatory disclosure policy were in place.

²³ For more information see <https://betterbuildingssolutioncenter.energy.gov/beat-blog/100000-home-energy-scores-so-far-and-counting>.

²⁴ Based on data provided by the DOE’s Home Energy Score partner portal. Note: DOE’s data for Denver is based off all homes in Denver that have received a Score, not just those included in the pilot program analysis.



This is important to highlight for a few reasons:

- 1) Denver homes scored lower than other programs nationally, indicating that homes are less efficient and could benefit from energy efficiency, and scoring more homes increases the City's knowledge of its housing stock.
- 2) Mandatory programs can provide a predictable, consistent, and critical mass of information for the market to trust and eventually come to expect. While short term successes such as a Score leading to an upgrade are necessary, Denver could consider playing a role to support the engagement of real estate agents and appraisers who can, over time, learn to assign value to energy efficient home features as the basis for considering the disclosure requirement of a label to hit the City's residential climate goals.
- 3) An increase in the number of home's assessed through a disclosure could provide Denver the opportunity to examine neighborhoods where energy burden²⁵ is the highest in Denver and consider connecting existing energy programs for income qualified residents to assist residents with the most need (see Figure 18). This would help to reduce energy use in these neighborhoods and enhance equity across the community, as often households with higher energy burden are also households that are most vulnerable within the community.

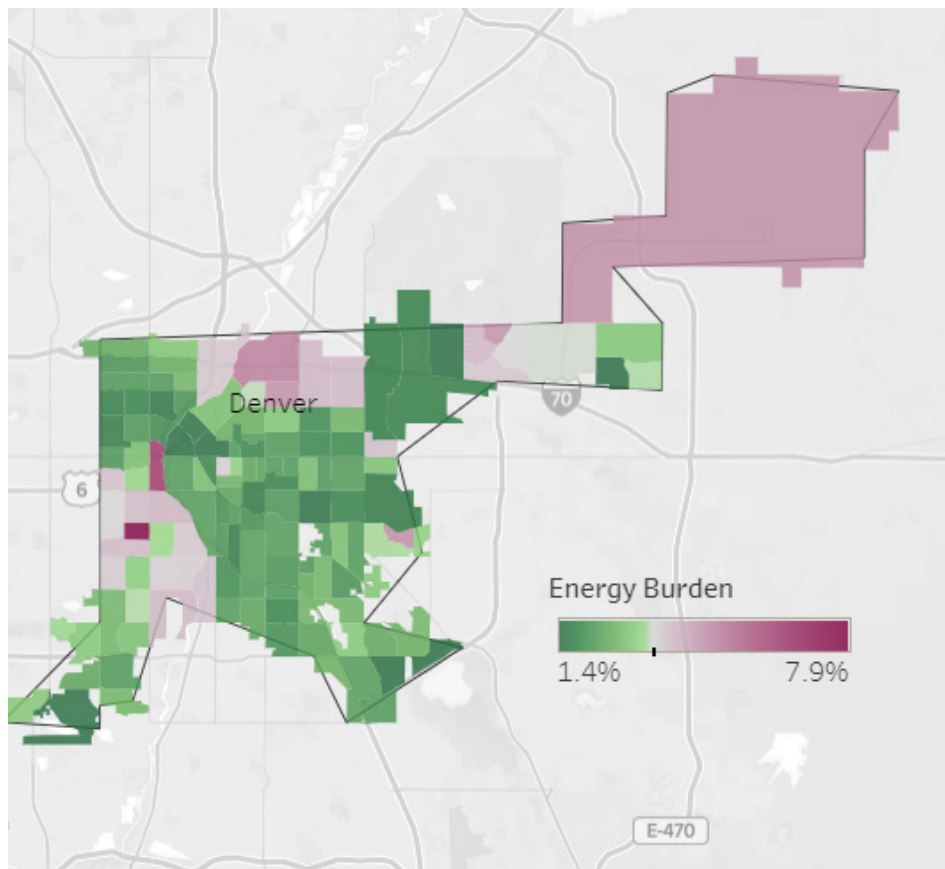


Figure 18: Energy burden in Denver.

- 4) Denver estimates that at least 32 Assessors would be needed to fulfill the demand for Scores under a mandatory requirement.²⁶ A total of 18 trained Assessors were brought on to support Denver's pilot program with 11 ultimately staying active and scoring homes. While currently there is not an available supply of active Assessors to meet this demand, training Assessors in the pilot proved to be easy. This highlights the opportunity for a mandatory requirement to lead to an increase in the number of skilled and trained energy assessors in the area, as well as an increase in energy efficiency installation work if even a small percentage of homeowners implemented recommendations from their Score report.

²⁵ 'Energy burden' is the percent of annual income that a household pays towards utility bills; households are generally considered heavily burdened if their energy bills exceed 10 percent of annual income. For more information on energy burden see <https://aceee.org/blog/2019/04/efficiency-reduces-energy-burdens-low>. Energy burden map provided by The Greenlink Group: <https://public.tableau.com/profile/the.greenlink.group#!/vizhome/shared/WZXBXP7NH>.

²⁶ Based on information utilized in the Home Energy Labeling Cohort provided by the Rocky Mountain Institute (Policy Blueprint & Impact Calculator).
 "Policy Blueprint": "[https://urldefense.com/v3/_https://rockmtains.sharepoint.com/:w/s/BLD-ResidentialEnergy/CityPolicy/EZpuaaJ3WmNGjkHvrN5tSeABBeH3ZGy49KIufSOi8GJlyQ?e=6YkXzO_!!M87Ej6RJKlw!H_1hwYU7BFNRmY0VYiIWpg-lpfJOmp87ily7dAJI22g3MJ2BhxSKfUgWhFsGwfDdq3Z6Rt4\\$](https://urldefense.com/v3/_https://rockmtains.sharepoint.com/:w/s/BLD-ResidentialEnergy/CityPolicy/EZpuaaJ3WmNGjkHvrN5tSeABBeH3ZGy49KIufSOi8GJlyQ?e=6YkXzO_!!M87Ej6RJKlw!H_1hwYU7BFNRmY0VYiIWpg-lpfJOmp87ily7dAJI22g3MJ2BhxSKfUgWhFsGwfDdq3Z6Rt4$)" HELP Blueprint Template.docx
 "Impact Calculator": "[https://urldefense.com/v3/_https://rockmtains.sharepoint.com/:x/s/BLD-ResidentialEnergy/CityPolicy/ESV-iHwdlSxGqJ0pAgsUB_ABY1PZEaO6jTQj6Zfi6E0YMA?e=twfywS_!!M87Ej6RJKlw!H_1hwYU7BFNRmY0VYiIWpg-lpfJOmp87ily7dAJI22g3MJ2BhxSKfUgWhFsGwfDdp5Xu5wY\\$](https://urldefense.com/v3/_https://rockmtains.sharepoint.com/:x/s/BLD-ResidentialEnergy/CityPolicy/ESV-iHwdlSxGqJ0pAgsUB_ABY1PZEaO6jTQj6Zfi6E0YMA?e=twfywS_!!M87Ej6RJKlw!H_1hwYU7BFNRmY0VYiIWpg-lpfJOmp87ily7dAJI22g3MJ2BhxSKfUgWhFsGwfDdp5Xu5wY$)" HELP Impact Calculator.xlsx



Next Steps

Overall, a Score or other home energy label effort may be a useful part of the puzzle for raising awareness about energy efficiency but should not be taken as a stand-alone approach to ensuring Denver meets its residential energy goals. While this tool could be included in a toolbox of options that support Denver's goals, a more effective approach may be to utilize the DOE energy calculation methodology, while producing a custom label that has a greater focus on local considerations, such as incentives and building codes.

Building off the lessons learned and insights from this pilot, some elements to consider integrating into the City's single-family residential efforts:

- Continue to **monitor cities with disclosure policies** (specifically Portland, Berkeley and Minneapolis) to understand housing market impacts and energy savings as a result of the disclosure over time.
- Explore ways that a **third-party software** could customize not only the layout of a Denver energy label, but what it would cost to integrate local rebates, local utility costs and options for solar or fuel switching into the estimated energy savings.
- Include information about **efficiency opportunities outside of those tied to a home's fixed assets** (e.g., switching our lightbulbs for LEDs, DIY weatherstripping, etc.) in a Score report. This may result in a report that is more motivating to Denver homeowners in regard to implementing upgrades.
- **Establish annual messaging to residents** on the topic of energy efficiency to initiate an energy efficiency dialogue and build trusting relationships between Denver and its constituents. Examples could include seasonal messaging about annual tune-ups or rebates the City offers so residents know where to go for resources.
- Consider **combined messaging with water usage** to streamline communication rather than separate water from energy use. This could be particularly worthwhile for rental properties if average utility costs can be shared at the time of renting where the costs may be more important to know ahead of time (this would be similar to Minneapolis' program).
- **Develop incentive programs** that specifically target the improvements that residents reported they would complete, like insulation, and for especially costly measures such as a new water heater. Additionally, incentive programs that address future efforts aimed at strategic electrification in homes may be effective.
- **Market rebates to contractors and builders** renovating or building new homes to incent the installation of higher efficiency equipment and measures like insulation to combat the prevalence of inexpensive equipment that may not be as efficient.
- **Market efficiency programs in neighborhoods with high energy burden**; this may help to reduce energy costs for vulnerable populations and enhance community equity.
- Seek to better understand how wrapping home energy labels into the home buying process prior to closing can **make mortgage products more accessible** for interested home buyers.
- Advocate for efforts tied to **data access between the City and utility** to inform energy burden and high energy users for better targeting to homes that could benefit from energy improvements and energy cost savings.
- **Improve data sharing on building permits** specifically tied to residential energy improvements.
- **Engage more with real estate agents, appraisers and lenders** to understand how best to assign value to energy efficient home features as the basis for considering a disclosure requirement of a home energy label to hit the city's residential climate goals.
- Investigate how a long-term policy will help to **highlight utility costs if the economy changes** (such as in a recession), demonstrating how homes are more affordable due to lower operating costs through energy efficient features.



CONCLUSION



Overall, the Score pilot program seemed to increase awareness about home energy efficiency for many participants; however, receiving a Score report alone didn't necessarily ensure that homeowners would take immediate action resulting in significant energy savings. In addition to arming homeowners with information that may help them better understand opportunities to reduce energy use in their homes, the Score also gave the City a way to assess homes through consistent data collection, which has the potential to inform future strategies to help reduce residential energy use across the City in new ways.

As 91 percent of initial survey respondents (50 percent of all pilot participants) believe that energy information should be highlighted during the home transaction process, this illustrates that there is a need for Denver to support consistency with how home energy efficiency features are described and highlighted to ensure that the language used is standard across the housing market. In the future this common language and labeling may reveal a clearer path for requiring the disclosure of energy information during the transaction process. Based on this analysis, Denver may be able to utilize a customized version of the Score in combination with other strategies to increase residential energy efficiency in the future.



In November of 2019, during this evaluation, the City and County of Denver formed a new Office of Climate Action, Sustainability and Resiliency. While the work for this pilot was completed under the Department of Public Health and Environment, future efforts will now fall within the newly formed office.

