



ENERGY FIT HOMES

A tool to transform the market for energy efficiency in existing homes

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CENTER FOR ENERGY AND ENVIRONMENT
NEIGHBORHOOD ENERGY CONNECTION

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The Minneapolis Area Association of REALTORS® was critical in helping us understand potential concerns, as well as opportunities, in Realtors' use of certificate programs. They were also gracious in helping organize and hosting a focus group composed of their members to formally get feedback on the concept.

Bill Shadid facilitated and synthesized insights from three focus groups on the Energy Fit Homes concept, which helped us to refine the program concept.

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Finally, we wish to thank the thousands of **homeowners** who have participated in our residential programs. They have been the real inspiration for the Energy Fit Homes program.

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1 INTRODUCTION

Incorporating the value of energy-efficiency improvements at the time of sale for existing homes is critical for the scaling up of residential energy efficiency. Recently there have been national discussions of the best method to accomplish this objective. We propose here a state-level energy-efficiency certificate approach for homes that achieve a basic standard of energy efficiency.

Key features that we feel are critical for the success and scalability of the certificate program are that it:

- [be designed **specifically for existing homes**, not merely an adapted new-home tool;
- [**focus on energy-efficiency**;
- [be **achievable** for the average homeowner through cost-effective upgrades;
- [have **flexibility** in achieving requirements, as long as energy performance targets are met;

- [have certification requirements that **tie in to utility-funded energy-efficiency programs**;
- [have **credible standards** and **reliable third-party verification** that standards are met; and
- [have a **simple and clear program process**.

The Center for Energy and Environment (CEE), in partnership with the Neighborhood Energy Connection (NEC), has developed such a certificate program specifically for Minnesota's existing homes, called "Energy Fit Homes," will be introduced later in 2014. This paper describes the rationale for this program as well as the proposed standards and program process.



Incorporating the value of energy-efficiency improvements at the time of sale for existing homes is critical for the scaling up of residential energy efficiency.

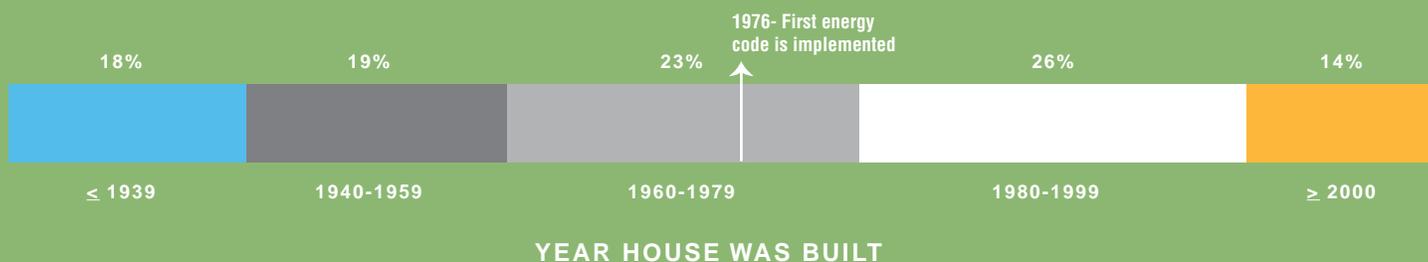
THE MARKET'S FAILURE TO INCORPORATE ENERGY EFFICIENCY

Utility programs to promote and provide incentives for energy efficiency have existed in Minnesota for more than 30 years, yet the vast majority of homes in the state (as in the nation) have not implemented simple, cost-effective energy-efficiency opportunities such as installing attic insulation. Furnaces labor every winter to heat these leaky homes, some of which may have only a thin bat of 100-year old horsehair insulation. Although the 1976 state

energy code required that new homes include basic energy-efficiency features, this code applies to only about half of Minnesota's housing stock (see Figure 1).

Ironically, while most home performance certification focuses on new homes, the potential for savings in this market is actually quite small. Minnesota has a stringent energy code

[FIGURE 1] AGE OF EXISTING HOUSING STOCK IN MINNESOTA¹



for new homes, which is in the process of being strengthened even more. The incremental savings of going beyond code requirements is small compared to the potential savings for the vast number of relative energy hogs in the existing homes market.

...over 400,000 homes, or at least one-quarter of all Minnesota homes, lack wall insulation, adequate attic insulation, or both.³

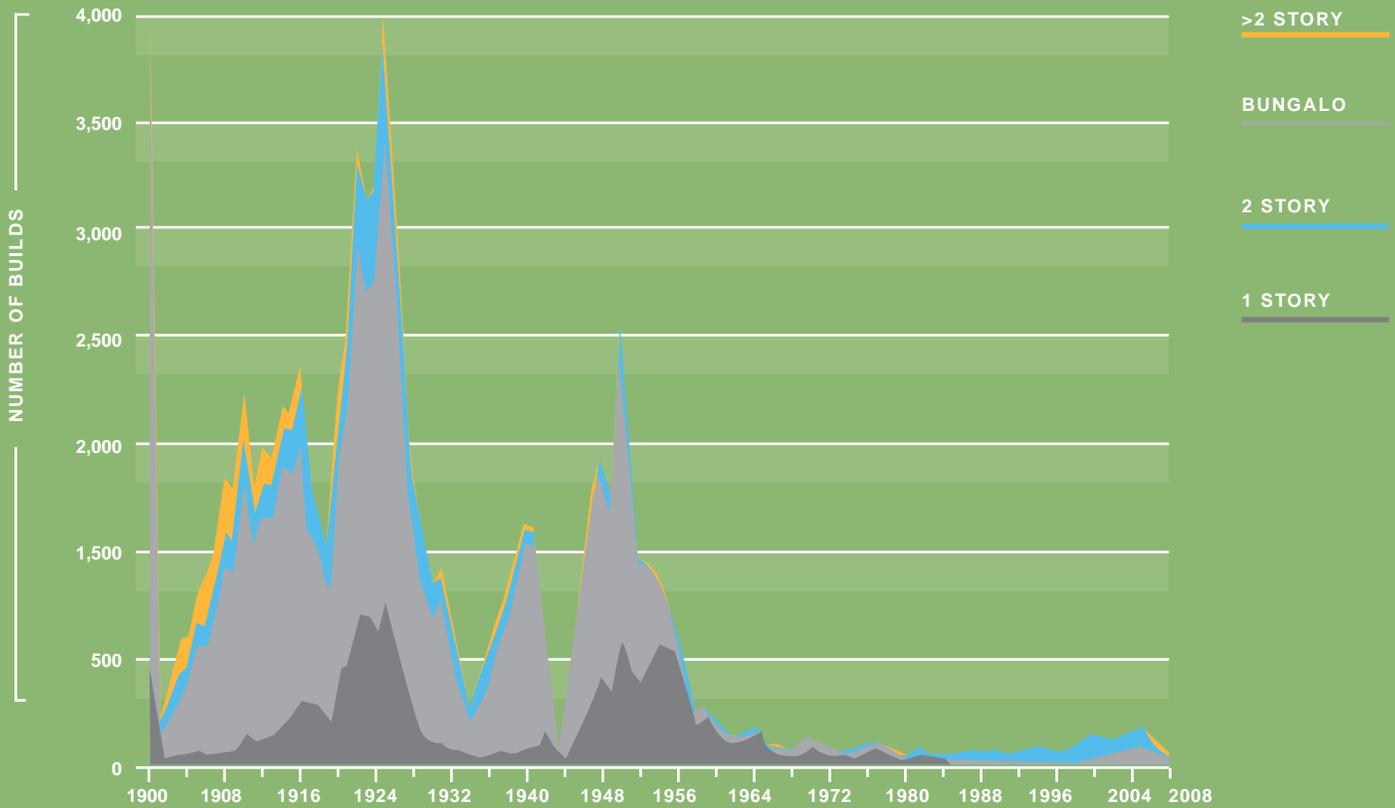
Basic, inexpensive efficiency measures include installing adequate attic and wall insulation and sealing air leaks, which can increase a home's heating efficiency by as much as 30% to 50%.

CEE estimates that more than 300,000 homes in Minnesota have inadequate attic insulation (less than R-20), and more than 139,000 homes have no wall insulation (Figure 2).² Thus over 400,000 homes, or at least one-quarter of all Minnesota homes, lack wall insulation, adequate attic insulation, or both.³ In total, these homeowners are paying \$55 million in wasted energy costs every year, yet only an estimated 8,000 homeowners per year complete insulation upgrades.⁴ At this rate, it would take more than 50 years to insulate all of these homes, at a cumulative loss of more than \$1 billion in wasted energy expenditures.⁵ Moreover, these figures underestimate the total amount of wasted energy, as they do not include additional weatherization needs outside of basic insulation upgrades.⁶

[FIGURE 2] ESTIMATED NUMBER OF SINGLE-FAMILY HOMES IN MINNESOTA THAT LACK INSULATION, BY AGE OF HOME⁷

AGE OF HOME	≤1939	1940-1959	1960-1979	1980-1999	≥ 2000	TOTALS
TOTAL NUMBER OF HOMES	297,131	285,329	361,989	411,296	219,670	1,575,415
HOMES WITH INADEQUATE ATTIC INSULATION	48%	39%	15%	2%	-	20%
HOMES LACKING WALL INSULATION	37%	4%	5%	-	-	9%

[FIGURE 3] MINNEAPOLIS' SINGLE-FAMILY HOUSING STOCK BY YEAR BUILT AND STYLE



Source: Minneapolis Assessor's Office

This underperforming housing stock is often concentrated in the region's older cities and towns. For example, in the city of Minneapolis, over 80% of the homes were built before World War II. Despite the wide

availability of home energy programs in the city, CEE estimates that nearly 40% of those homes, or one-third of the housing stock, have never upgraded their wall insulation.

However, despite the economic benefits of efficiency, there are several established reasons why homeowners do not invest in retrofits:

- [**Competing priorities for investing in home remodeling projects.** Unlike some home improvement projects, insulation (for example) is not visible and does not have the emotional appeal of other, more visible projects such as room additions or kitchen remodels.
- [**Lack of consistent and credible information about the home's current level of efficiency.** Most homeowners did not confirm that their home had wall insulation, for example, when they bought it. Many erroneously assume that it did. Likewise, most home buyers do not investigate the efficiency of the heating system.
- [**Lack of clear and simple action steps.** Although many homeowners may want to “go green” with their home, without a clear indication of what to prioritize, and how to effect improvements, they typically take no action.
- [**Efficiency measures don't add value when it comes time to sell the home.** A homeowner's investment in most efficiency improvements is recouped fairly quickly; however, homeowners often intend to move before they recoup their investment, and because there is no current, widely used, or accepted market mechanism to capture the value of energy-efficiency improvements, they are unsure whether the investment will increase the sale price. . This uncertainty can be a significant factor in a decision not to upgrade.

A certificate program's key contribution is to make the hidden value of energy efficiency conspicuous and enticing for both homeowners and homebuyers.

These market failures can be addressed through a well-designed energy-efficiency certificate program, along with supporting utility energy-efficiency programs.⁸ A certificate program's key contribution is to make the hidden value of energy efficiency conspicuous and enticing for both homeowners and homebuyers. It should not simply close an information gap, but promise easy, desirable achievement — for broad adoption beyond just the environmentally motivated. It must provide a tangible symbol that a home meets an accepted standard for energy efficiency. A certificate should ensure peace of mind to a homeowner that she is maintaining her home and making a wise financial decision, whether or not she remains in her home long enough to recoup her investment through energy savings. And for the environmentally conscious homeowner, it should have value as an emblem of their commitment to sustainability, analogous to the highly visible symbol of a solar panel.

INCORPORATING THE VALUE OF ENERGY

In the new home market, there is mounting evidence that homes with “green” or Energy Star certificates enjoy a price premium. In the largest such study to date in the United States, energy efficiency as a green feature was dis-aggregated as a key determinant of the price premium.⁹ Although the market for older homes plays by different rules, and there are not a lot of data on any equivalent certificates for existing homes,

...the price premium for new homes suggests the potential for a similar price premium for existing energy-efficient homes.

the price premium for new homes suggests the potential for a similar price premium for existing energy-efficient homes. Should Energy Fit Homes gain market acceptance, it will add tangible value at the time of sale to the owner of a certified home. While home purchasing decisions are based on location, an emotional connection, and other factors, and perhaps only a small segment of home buyers would actually conduct searches based

on Energy Fit Homes certification, the presence of a certificate may confirm a potential buyer’s choice or tilt her decision between two homes under consideration. Therefore, Energy Fit Homes certification may result in shorter times on the market for certified homes and quicker sales. Just as importantly, the presence of an Energy Fit Homes certificate can equip homebuyers with information that they can use as part of a negotiation and can help them make choices about which investments to make in their new home.

Some of the features of a certified home — such as insulated walls and high-efficiency furnaces or boilers — can already factor into the appraisal process, potentially increasing the appraised value of a home by perhaps \$2,000 to \$5,000.¹⁰ In order to further encourage appraisers to value these features, the Appraisal Institute has published a worksheet that can be used when valuating green and energy-efficiency features.¹¹ This creates a common comparison or reference point of features. The Energy Fit Homes certification process will conform to the information in these standardized data fields. In addition, Energy Fit Homes provides a level of assurance that upgrades have been done correctly. It includes ventilation

and combustion safety verification that real estate agents, homebuyers and sellers alike will recognize as financially advantageous for the duration of a buyer's occupancy of the home.

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In the long term, Energy Fit Homes' ability to achieve a price premium for a certified home will require:

- [A critical mass of issued certificates, demonstrating that Energy Fit Homes is market-proven.
- [Acceptance by appraisers of the value of homes with Energy Fit Homes certification. Data-driven appraisers need high-quality data to support a price premium in order to have credence with the appraisal community.
- [Acceptance by real estate agents and their willingness and ability to communicate the value of Energy Fit Homes to home buyers.

THE LANDSCAPE OF EXISTING CERTIFICATES FOR “GREEN” HOMES

A range of “green” and energy-related certificates are available for homes, led by the success of the U.S. Green Building Council’s LEED (Leadership in Energy and Environment Design) designations, including one for new residential housing.

Most certificates in the marketplace encompass sustainability efforts extending beyond energy efficiency, and most are designed to be used for new construction or major renovations.

In Minnesota, five “green” building certifications are available, all of which must be certified by a third party. In addition to the national programs, LEED for Homes and Energy Star Certified New Homes, there are three regional programs also operating in Minnesota: Minnesota GreenStar, Green Communities, and Minnesota Green Path.¹²

The regional programs do have pathways for existing homes; however, efficiency is only one of several pathways. The programs were generally designed for certification to be awarded as part of a broader remodeling effort rather than as a stand-alone energy-efficiency upgrade, and cost-effectiveness is often not a criterion for the energy-efficiency upgrades. None of these programs has a significant volume of certified older homes, a gap

that Energy Fit Homes would be able to fill by providing a simple, inexpensive mechanism for identifying cost-effective efficiency measures that will bring an existing home up to a basic standard of energy efficiency.

Interest in and activity around the efficiency of existing homes is growing, at national as well as state levels. Here, states are leading the

Here, states are leading the way, and there are more than a dozen state-level programs, or proposed certification programs, focusing on energy efficiency in existing homes.

way, and there are more than a dozen state-level programs, or proposed certification programs, focusing on energy efficiency in existing homes. Some of these programs grant a certification for completing individual upgrades (for example, attic insulation), while others, like Energy Fit Homes, are based on achieving a level of whole-home

performance. The U.S. Department of Energy (DOE) has discussed introducing a national certificate for its Home Performance with Energy Star program (HPwES), a nationally branded program implemented with local partners and sponsors that conducts energy upgrades on existing housing stock.¹³ CEE has reviewed an early draft of this concept and it could offer promise, although it appears that it may require some upgrades that are not cost-effective and may be administratively complex. And it

could be many years before this certification enters the marketplace, if at all. In any case, a state-level certification is arguably a superior approach to a one-size-fits-all national approach. Regional differences in climate, heating fuels and construction methods mean that a state-level tailored approach can more easily focus on the most appropriate measures for that state. Minnesota in particular would do well to have its own program, tailored to reflect its severe climate and large number of older homes.

[FIGURE 4] EXAMPLE OF LEED FOR HOMES CERTIFICATION



SHORTCOMINGS OF CURRENT ENERGY RATING SYSTEMS

Most new-home certificates use the Home Energy Rating System (HERS), or a similar energy model, to demonstrate a home's achievement of a pre-set performance target. This target is often expressed with reference to building code (e.g., 15% more efficient than current code). A third-party-trained HERS rater collects and processes more than 100 data points to calculate a HERS rating for each certified property.

In these scoring systems, both new and existing homes are scored on the same absolute scale. This means that, all other things being equal, an existing home with the same score as a new home will have the same energy usage per square foot, creating a consistent metric for all homes. The HERS system uses metrics that encompass a mix of efficiency measures, many of which are not physically possible or practical for homes designed and built long ago. In new construction energy performance can be improved by adjusting hundreds of construction variables (such as location of windows and orientation of the building itself); in existing homes many variables cannot — from a practical standpoint — be changed. Not many homeowners, for example, will change window placement and building orientation in order to improve the

efficiency of their pre-war bungalows. Similarly, most of Minnesota's existing housing stock has 2x4 wall cavities which can accommodate considerably less insulation than the 2x6 cavities required in new construction. While it may be possible to add some additional wall insulation to these 2x4 walls (such as by exterior insulation and re-siding the house), it is neither practical nor cost-effective.

An additional drawback of HERS is that it is time-intensive and costly. While this expenditure of time and money can be very worthwhile for new construction, for existing homes it is excessive, as HERS requires the measurement and documentation of many variables that cannot be easily changed in existing homes such

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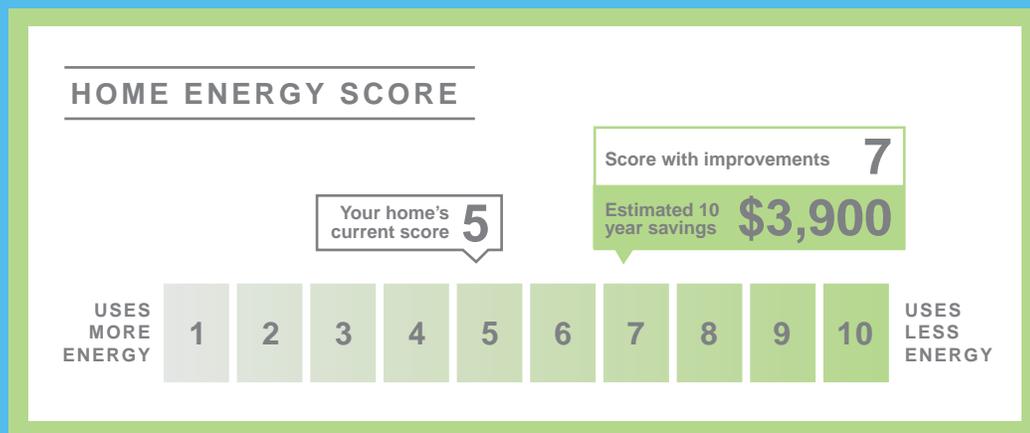
A HERS assessment of an existing home can cost from \$500 to \$1000, a significant portion of the cost of a typical energy-efficiency upgrade. The extra cost and expense of a HERS assessment does not result in significantly improved accuracy in modeling, when comparing modeled energy usage to actual energy bills.¹⁴

The DOE has introduced a new energy scoring system, the Home Energy Score, which is designed for existing homes. It rates a home based on total modeled energy usage, and also computes a potential rating after suggested energy-efficiency improvements are completed. It takes less time to collect inputs, and is more suited to older homes than HERS. However, like HERS, the Home

Energy Score still scores homes on an absolute scale.¹⁵ Thus, an existing home can do every cost-effective retrofit for that home, and still may achieve a low score.

CEE scored 154 homes in the Twin Cities as one of nine cities in a national Home Energy Score pilot in 2011.¹⁶ Figure 6 indicates the distribution of the homes' current scores, as well as the homes' computed scores after completing recommended upgrades (the "potential score"). Few of the homes were capable of achieving a "perfect" score of 10 for their potential score; this "zone of unattainability" is the difference between the homes' potential score, and a perfect score of 10. Although the Department of Energy has since modified the score in a way that will reduce the zone of unattainability, it is still a structural feature of the scoring method.

[FIGURE 5] DEPARTMENT OF ENERGY'S HOME ENERGY SCORE RATING



Thus, absolute-scale home scoring systems demonstrate a zone of unattainability for the majority of older homes, which will never be able to match the scores of newer homes despite completing valuable, cost-effective upgrades. The widespread use of these scoring systems can create frustration among owners of older homes and discourage them from conducting energy upgrades that would still (after the upgrades) earn them a relatively low score.

The goal of a scoring system or certification for existing homes should be to motivate homeowners to invest in energy upgrades, and improve the energy efficiency of existing housing. Therefore, to score existing homes on an absolute scale, while perhaps intellectually appealing (comparing “apples to apples”), is counterproductive, because it does not help motivate homeowners to complete upgrades. The importance of having a scoring system specifically for existing homes is

underscored by an unintended consequence of a one-size-fits-all approach: If a common rating system is effective and homeowners’ preferences shift toward homes with the best scores, individuals who care about energy efficiency may favor newer homes that can achieve the best scores, and those for whom energy efficiency is not a priority may choose older homes and be less likely to improve their efficiency. Thus, a broader perspective is needed, one that compares homes to their own potential.

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— [FIGURE 6] THE “ZONE OF UNATTAINABILITY” OF THE HOME ENERGY SCORE —



ENERGY FIT HOMES:

REWARDING AND MOTIVATING HOMEOWNERS TO BRING THEIR HOMES UP TO A BASIC STANDARD OF EFFICIENCY

The goal of the Energy Fit Homes is to create value for energy-efficiency improvements, and eventually achieve a massive scale-up of energy-efficiency investments in existing Minnesota homes by bringing a these homes up to a basic standard of energy efficiency. We have identified several features that are critical to facilitating such a massive scale-up, and which were designed into the Energy Fit Homes certification.

DESIGNED SPECIFICALLY FOR EXISTING HOMES. We designed Energy Fit Homes specifically for Minnesota’s existing homes, because existing homes are fundamentally different, and have different opportunities, from new homes. Just as new homes are evaluated on measures falling within designers’ and builders’

control, existing homes need to be assessed according to measures within homeowners’ control. Existing housing stock needs its own reference point, specifically customized to building type and to climate and the associated energy consumption patterns.

For example, the most prevalent type of single-family home in the City of Minneapolis is the story-and-a-half, or bungalow-style house. For the basic Energy Fit Homes certification, the reference is a home that meets basic performance thresholds for equipment and building envelope for that home type. In insulating the attics of these homes, typically four separate areas must be considered: an attic peak, attic slant walls, knee walls, and side attics



THE IMPORTANCE OF INCREMENTAL COSTS FOR NEW HOMES VERSUS RETROFIT COSTS FOR EXISTING HOMES

The reason that energy-efficiency opportunities are different for new homes compared to existing homes is that new homes have a basic cost for any home feature, and the cost of efficiency is the incremental cost to upgrade to the efficient model. For new homes, only this incremental cost of an energy upgrade, over the alternative, needs to be considered. However, once a home is built, choosing an alternative means making a second investment on top of the first, and it is not as cost-effective to upgrade to the efficient model. For example, a more efficient window may cost \$400, compared to \$350 for a standard window. The more efficient window saves the homeowner \$100 in energy costs over 10 years. If the incremental cost of investing in the more expensive window in a new home is \$50 and will save \$100 over 10 years, it is a positive return on investment for the homeowner within a fairly short period of time. However, if an existing home already has the standard windows, the cost to replace a window with the more efficient variety is not the incremental cost of \$50, but \$400, the entire cost of the new window, and to this must be added installation costs. The replacement of a standard window with a more efficient window would pay back in 40 years — beyond most homeowners' definitions of “cost-effective.” Instead, adding attic insulation to a home with only minimal existing insulation can pay back the cost of the installation in 5-10 years.

FOCUSING ON COST-EFFECTIVE ENERGY-EFFICIENCY OPPORTUNITIES.

Energy Fit Homes focuses on practical energy-efficiency measures that offer a return on investment for the homeowner, dramatically increasing the potential scale of the market. This emphasis on cost-effectiveness allows homeowners to recoup their investments and essentially invest in the social good at very little cost. All of the major investments considered in Energy Fit Homes have an expected lifetime of at least 18 years, and “cost-effective” is defined as having a simple payback of 10 years or less. Homeowners who sell their homes within 10 years will both provide benefits to the next homeowner and potentially recoup some or all of their investment at the time of sale, while homeowners who live in their homes for longer

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than 10 years will see a larger, ongoing payback through avoided energy costs year after year.¹⁷ Note that cost-effective energy upgrade opportunities are different, and much narrower, for existing homes than for new homes (see sidebar).

ACHIEVABLE FOR THE AVERAGE

HOMEOWNER. The focus on cost-effective upgrades means that the certificate will be achievable for the average homeowner. The built-in economic argument – an Energy Fit Home is a smart economic investment – will help convince average homeowners to achieve certification. This is important, as to achieve large-scale success, Energy Fit Homes must appeal to more than the committed environmentalist.

ENERGY PERFORMANCE MODEL PROVIDES FLEXIBILITY IN ACHIEVING CERTIFICATION.

Related to the cost-effectiveness issue, some homes may be very close to achieving certification, but have slightly less insulation than prescriptive requirements. For this, an energy performance model customized for existing homes is used to provide flexibility in meeting certification requirements, while still ensuring that all homes meet a minimum level of energy performance.

Energy Fit Homes uses an energy model designed for existing homes that determines whether a home substantially complies, within a certain tolerance, with the program standards and therefore can be certified. Energy Fit Homes uses the Home Energy Fitness (HEF) model, which was developed specifically for Minnesota’s existing housing stock.¹⁸ It is simple to use, collects only the inputs that are important for

older homes, and can be performed quickly and inexpensively, keeping the certification program’s administrative costs low.

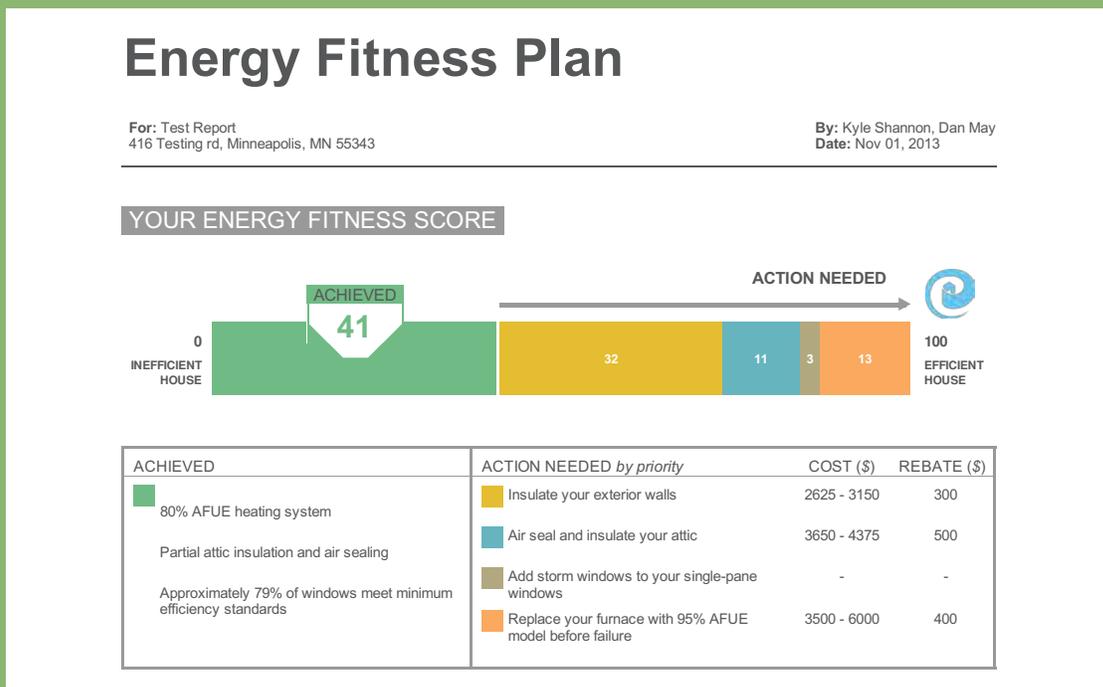
The four building blocks of the HEF model are added to determine a home’s total score: attic insulation and air sealing, wall insulation, heating system, and windows.

The HEF score compares an energy-efficient reference home to the home being assessed, using a reference home of the same building type as the home being scored (e.g., a 1.5-story bungalow house with knee walls). There are currently nine basic house types that are used for the HEF model. The score of a specific home represents the energy performance level (in terms of annual energy usage¹⁹) that the home has achieved compared to an efficient reference home — an Energy Fit Homes-certified home. A home with a

score of 100 is as efficient as the reference home; a home with a score of 0 is the lowest efficiency for that type of home. A home can be certified by achieving a HEF score greater than 95, and meeting all the other requirements.

The advantage of using the HEF energy performance model for determining compliance is that there can be greater flexibility in achieving certification, while still ensuring that all homes meet a basic level of energy performance. If the certificate simply required an attic insulation level of R-49, many efficient homes would not qualify. For example, a home that had R-40 insulation instead of the prescriptive requirement of R-49 insulation would typically use 9 more therms/year (about \$6) than the reference house with R-49 insulation. But because it would cost hundreds of dollars to have an insulator bring up the level of insulation to R-49, it

[FIGURE 8] THE HOME ENERGY FITNESS MODEL AS A TOOL TO ACHIEVE



...there can be greater flexibility in achieving certification, while still ensuring that all homes meet a basic level of energy performance.

would not be cost-effective for the home to add insulation simply to achieve certification. Thus, although there are required elements to achieve certification, Energy Fit Homes is a performance-based program.

Of course, if a home met all the minimum standards and no flexibility was required to meet these standards, a home could achieve Energy Fit Homes certification without needing to run an energy model. The model simply provides more flexibility in achieving certification.

CERTIFICATION REQUIREMENTS

TIE IN TO UTILITY-FUNDED ENERGY-EFFICIENCY PROGRAMS.

In Minnesota, electric and natural gas utilities are required to implement energy-saving programs, with the goal of helping their customers to decrease their energy use by 1.5% every year. By state law, utilities must take into consideration the cost-effectiveness of their expenditures on energy-saving programs, and they are generally allowed to spend money only on programs that have a positive cost-benefit ratio.²⁰ Most utilities already have robust programs in place to help their customers save energy, programs that support the implementation of most of the measures assessed

by Energy Fit Homes. The programs include rebates and other incentives for customers who insulate their homes or purchase high-efficiency heating systems. They also fund home energy audits and similar programs, such as the Home Energy Squad Enhanced program, as well as contractor quality-assurance programs. These utility programs can help reduce the costs incurred by homeowners in achieving the certificate, both administrative costs (such as the cost of the energy assessment) and costs of the energy upgrades themselves (through rebate programs). Currently, most utilities offer rebates for the implementation of every energy upgrade requirement of Energy Fit Homes, with the exception of window upgrades.

CREDIBLE STANDARDS AND RELIABLE THIRD-PARTY VERIFICATION. It is crucial that Energy Fit Homes standards be credible, and have a reliable method for verifying that the standards have been achieved. The proposed standards, and process for verifying the standards, are discussed below. The standards were developed by CEE and NEC, both non-profit organizations with deep experience in residential energy efficiency.

SIMPLE, CLEAR AND LOW-COST

PROGRAM PROCESS. Because energy efficiency is not a top priority for most people, it is essential that the program be as easy to access as possible, including a very simple and clear program process. This includes having a low administrative cost and time burden for the participating homeowners.

CERTIFICATION STANDARDS

Based on CEE and NEC's review of thousands of home energy audits conducted in Minnesota, the highest-value cost-effective energy upgrade opportunities for homeowners in Minnesota are:

1. Wall insulation
2. Attic insulation and air sealing
3. Heating systems (furnaces or boilers)
4. Windows
5. Lighting

Energy Fit Homes' basic certification requires attic insulation to be raised to R-49 where physically possible, attic bypasses to be sealed, walls to be insulated to capacity, windows to be at least single-pane windows plus storm windows, and the furnace or boiler to be at least 90% efficient.

Energy Fit Homes also includes lighting upgrades that are easy, cost-effective ways to reduce energy bills. At least 50% of the existing permanent lighting fixtures must be high-efficiency (either CFL or LED). Although this requirement is somewhat different from the other requirements in that it relates less to the structure of the home, lighting upgrades pay back very quickly and

provide ongoing reductions in energy bills.²¹ Other devices, such as low-flow showerheads and aerators, were also considered for Energy Fit Homes because combined, these direct-install items can provide short paybacks and energy reductions.²² However, focus group research showed that adding too many device-oriented requirements caused customer confusion and could decrease the willingness to participate. Therefore, only lighting was included.

This list of key efficiency measures is specific to Minnesota's climate and housing stock and does not include some upgrades that might be cost-effective in other climates. For example, in hotter climates, replacing an existing air conditioner with a more efficient model can be a very cost-effective efficiency upgrade, but it is generally not

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cost-effective in Minnesota because our cooling season is so short. Similarly, Minnesota housing stock does not typically have ductwork outside of the conditioned space. Therefore, although duct sealing can be highly cost-effective in other parts of the country, in Minnesota it does not lower energy bills sufficiently to justify the costs for the purposes of Energy Fit Homes.²³

Energy Fit Homes, like all home certificates, must generalize in order to be broadly applicable. Cost-effectiveness is determined at the level of the house type; therefore, while it will be cost-effective for the majority of homes to achieve the certification requirements, in some instances measures will be required that may be less cost-effective for an individual home (i.e., the cost of meeting the certification requirements would have more than a 10-year payback).

The most salient example is heating systems. Determining the exact cost-effectiveness of replacing a less-efficient furnace with a more efficient model will depend on the efficiency of the existing and new models, how old the furnace is, and other variables specific to a particular home. For homes in which the furnace is near the end of its useful life, replacement with a more efficient

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model is likely to be cost-effective, while for other homes it may be ultimately more cost-effective to wait until the furnace has lost more efficiency. Energy Fit Homes requires all homes to have furnaces or boilers with a minimum annual fuel utilization efficiency (AFUE) of 90% in order to achieve certification. Although this requirement may not be cost-effective for all homes, in general it is cost-effective, and it maintains the consistency and credibility of the certificate. However, heating systems is one area where replacement may be costly to homeowners (particularly for boiler systems), and for some, the benefits of certification will not be justified by the cost of replacing their heating systems.

A home will be certified once program administrators verify that it meets the requirements in the areas discussed above and summarized in Figure 9.

— [FIGURE 9] SUMMARY OF PROPOSED CERTIFICATION REQUIREMENTS (V 1.0) —

CATEGORY	REQUIREMENT
ATTIC INSULATION AND AIR SEALING	Attic insulation is R-49 when possible, given existing space restrictions Attic bypasses are sealed, as measured by visual inspection or blower door testing Some flexibility allowed, as long as Home Energy Fitness score is greater than 95
WALL INSULATION	Walls are insulated to capacity (without expanding the wall cavity) Some flexibility allowed, as long as Home Energy Fitness score is greater than 95
HEATING EQUIPMENT	Furnace/boiler at least 90% efficient. Programmable thermostat is installed
WINDOWS	Windows are single-pane windows plus storm, or better
LIGHTING	At least 50% of lighting in permanent fixtures is efficient (CFLs or LEDs)
VENTILATION	Meet Minnesota code requirements for air infiltration, or have appropriate ventilation installed
COMBUSTION SAFETY	Furnace/boiler and hot water heater meet combustion safety requirements, or are closed combustion appliances

ADDITIONAL STANDARDS CAN BE USED IN FUTURE FOR HIGHER LEVELS OF CERTIFICATION

Initially, the Energy Fit Homes program will only provide one level of certification. However, some homeowners will desire to go above and beyond the basic level and achieve a higher-performing home. Energy Fit Homes can encourage these homeowners by developing, in the future, one or more additional

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levels of the Energy Fit Homes that recognize these achievements, for example, basic, gold, and platinum certification.

Energy-efficiency features that may be added in additional levels include:

- [**Appliances.** Energy Star appliances, or even the top tier within those categories, could be given credit.²⁴
- [**Lighting.** Homes with higher levels of efficient lighting could be given credit.

- [**Air conditioning.** For homes with central or a split-system air-conditioning installed, credit could be given for achieving high SEER ratings.

- [**Additional air sealing.** In addition to the most common air sealing (attic bypasses), whole-house air sealing to a specific standard could be credited, necessitating the sealing of windows, rim joists, and other key locations.

- [**Additional windows.** Credit could be awarded for having low-e or other high-performing window systems.

- [**Super-insulation.** Exterior insulation installed as part of the installation of new siding dramatically increases the walls' R-value from what can be achieved by insulating only the wall cavity, and this improvement could be given credit.

- [**Water heating.** A high-efficiency water heater, such as a condensing tank hot water heater, could be credited.

- [**Renewable energy systems.** A solar electric, solar hot water, or solar air system could be given credit.

Requirements for additional levels may be based either on a checklist-type approach in which each action would earn the homeowner a certain number of points, or a performance-based approach in which a certain energy reduction goal — such as 20% above basic certification — would need to be achieved and verified by modeling.

CERTIFICATION PROCESS & QUALITY ASSURANCE

KEY FEATURES OF THE ENERGY FIT HOMES CERTIFICATION PROCESS, SIMILAR TO THOSE OF OTHER CERTIFICATION PROGRAMS, ARE:

- [A set of standards that define what it means to achieve certification
- [Third-party verification that a home meets the standards and qualifies for a certificate
- [A built-in quality-assurance process to ensure consistency in the application of the standards

Together, these features are the foundation of the certificate's effectiveness and its credibility and will form the basis of market confidence in the certificate, which is crucial to achieving scale.

THE CERTIFICATION PROCESS INVOLVES THE FOLLOWING FOUR MAIN STEPS.

1. Home assessment identifies upgrades.

We anticipate that the majority of homeowners will enter the program through a home assessment. Generally, home assessments can be offered to homeowners at a greatly discounted cost because of the support of existing utility programs.²⁵ The home assessment will evaluate the five main

measures of Energy Fit Homes and identify a work scope (if necessary) that the homeowner will need to complete in order to obtain the certificate.

2. Homeowner completes any required upgrades.

Homeowners will be encouraged to use insulation contractors appropriately certified through the Building Performance Institute (BPI) and participating in a utility-sponsored quality-assurance program, if such contractors are available.²⁶ These contractors have agreed to do work according to established standards and to have a portion of their work inspected; they must consistently pass inspections in order to remain a part of the program. The advantage to a homeowner of using such a contractor is that she would not have to pay for an additional inspection, as the quality assurance, including inspections, is already provided by the program.

3. Program administrator verifies that the work was completed.

CEE will act as the program administrator for Energy Fit Homes, in conjunction with the NEC. If no work is required, the verification can be done at the

home assessment (Step 1). If a homeowner has not used a certified contractor, an inspection will be necessary to verify that the home meets Energy Fit Homes' standards. Conversely, if the home is part of a utility program, an inspection may not be necessary. If the work is done by a participating contractor, completion of the work can be verified by the contractor or homeowner providing the program administrator with a paid invoice. The program administrator will inspect a portion of the jobs in order to ensure compliance with program standards.

4. The homeowner receives Energy Fit

Homes certificate. The program administrator will issue the certificate to the homeowner, upon completing the verification process. In addition to a paper certificate with detailed information about the home, the homeowner could receive a plaque for display above her outside door, or some other visible symbol of their achievement. The homeowner may also choose to have his address displayed on a web-based map of certified homes. When the homeowner is ready to sell his home, Energy Fit Homes will be used by the selling agent as a feature of the home, and could be listed as a feature on the multiple listing service (MLS). The homeowner will authorize the program administrator (CEE) to confirm to the selling agent that a certificate was issued to the proper address. The program administrator will maintain a database of all homes that have received

certification, and all pertinent information about the certification.

CEE and NEC intend that certification would expire after 7 years, and require re-certification. This is because new certification requirements may be adopted by that time because of new technologies that can increase cost-effective savings. Also, certifications that are valid indefinitely do not have as much credibility in the marketplace. It is expected that there could be expedited methods to re-certify, rather than having to repeat the entire process.

...it is expected that additional channels of achieving the certificate would be developed in order to further achieve scale.

Once Energy Fit Homes gains market acceptance, it is expected that additional channels of achieving the certificate would be developed in order to further achieve scale. Home inspectors, for example, may be able to include in their reports an assessment of whether a home would meet existing Energy Fit Home certification requirements, and remodeling contractors may be able to do likewise.

ENERGY FIT HOMES LINKAGE WITH OTHER INITIATIVES

A POTENTIAL MECHANISM FOR USE IN OTHER “GREEN” HOME CERTIFICATION PROGRAMS.

Energy Fit Homes is designed to be a stand-alone certification system signaling a basic level of energy efficiency for existing homes. In addition, it is a potential mechanism for incorporation into other certification schemes that look beyond energy efficiency. The energy-efficiency requirements of these broader programs could be met through certification by Energy Fit Homes in cases in which an efficiency goal is desired to be added, strengthened, or in some way made more amenable for use with existing homes.

CONSISTENT WITH THE PROPOSED BUILDING PERFORMANCE INSTITUTE (BPI) STANDARDS AND WITH OTHER LOCAL CERTIFICATION PROGRAMS.

Energy Fit Homes certification is one of many local certifications associated with home performance programs being developed around the country. In September 2013 the BPI released standards for issuing a certificate of completion for residential efficiency upgrades.²⁷ Energy Fit Homes would be compatible with these standards. It is designed to be compatible with both the

“Certificate of Efficiency Improvements” and the “Certificate of Performance” as described in the BPI standard.²⁸

CONSISTENT WITH EMERGING NATIONAL STANDARDS FOR DOCUMENTING THE ENERGY EFFICIENCY OF HOMES FOR SALE.

National discussion continues around how best to document the value of energy-efficient homes within the real estate industry, including the development of standard fields for this documentation within the multiple listing service (MLS). CNT Energy and the Home Performance Council have developed a “Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market.”²⁹ The Energy Fit

...our approach is consistent with, and will help advance, the goal of incorporating data on energy performance into real estate transactions.

Homes program shares this orientation, and our approach is consistent with, and will help advance, the goal of incorporating data on energy performance into real estate transactions. In addition to collecting data on individual upgrades in a consistent manner (as suggested in the blueprint), the achievement of an Energy Fit Homes certification will be a data point that could be incorporated into the MLS, and over time, become a trusted information source for real estate professionals about a home's energy performance.

EASILY INTEGRATED INTO UTILITIES' ENERGY-EFFICIENCY PROGRAMS.

A key advantage of using cost-effectiveness as a criterion in defining the requirements for Energy Fit Homes certification is that it facilitates the certificate's integration into existing utility programs. Utilities may consider providing a "bonus rebate" for homes that achieve Energy Fit Homes certification, thus encouraging homeowners to complete several efficiency projects at once and increasing utilities' credit earned for efficiency from a source that's relatively easy to get — people who have already

GREENING THE MLS

In 2013, the NorthStar MLS, a listing service for homes in Minnesota and western Wisconsin, incorporated searchable fields that allow sellers to list six different green building certifications with the service, as well as a home's Home Energy Rating System (HERS) score. All of the green certificates must be certified by a third party, and include: LEED for Homes, Energy Star, Minnesota GreenStar, Green Communities, Minnesota Green Path, and Wisconsin Green Built Home.

BENEFITS OF ENERGY FIT HOMES IMPLEMENTATION FOR A BROAD RANGE OF STAKEHOLDERS

Achieving success with Energy Fit Homes is a major social change endeavor. The success of Energy Fit Homes requires the cooperation and support of a broad range of stakeholders in order to take hold among a significant segment of Minnesota homeowners. Because the focus of Energy Fit Homes is on achieving an energy outcome that is both easily measurable and achievable,³⁰ it is well suited to be a focal point for cooperative efforts by professionals working in a

...it is well suited to be a focal point for cooperative efforts by professionals working in a variety of sectors and capacities.

variety of sectors and capacities. For example, local governments can help achieve their environmental objectives by adopting a goal to get a certain percentage of their housing stock certified, which is an easily measured outcome. Figure 10 presents some of the key stakeholders in this effort and the potential role they can play, and benefits they can receive, in the Energy Fit Homes certification program. The benefits to the diverse groups are mutually reinforcing.

The implementation of Energy Fit Homes will also rely upon the contributions of the banking/mortgage industry, which could help to finance the necessary improvements to achieve certification. Banks could also originate “energy-efficient” loans that would allow a higher loan amount based on the increased cash flow stemming from lower energy bills.

[FIGURE 10] KEY STAKEHOLDERS FOR IMPLEMENTATION OF ENERGY FIT HOMES

UTILITIES

Utilities stand to benefit significantly from the potential of Energy Fit Homes to motivate homeowners to follow up on energy audits. Energy Fit Homes will strengthen the connections between utilities and their customers most motivated to perform efficiency upgrades, helping utilities to glean more efficiency from each point of contact. Utilities also have an important role to play in the success of Energy Fit Homes, including helping to fund energy assessments and contractor quality-assurance programs, and to provide rebates for key cost-effective efficiency measures required by the certification.

STATE OF MINNESOTA

State agencies, such as the Pollution Control Agency and the Department of Commerce, Division of Energy Resources, will value the ability of Energy Fit Homes certification to move them closer to the energy-efficiency and carbon-reduction goals established by the state legislature. The State of Minnesota has a key role to play in promoting the Energy Fit Homes certification program and, as the regulator of public utilities' conservation improvement programs, in facilitating utility involvement in Energy Fit Homes.

LOCAL GOVERNMENTS

Local governments will benefit from the scale at which Energy Fit Homes can work within cities' and towns' existing housing stock. Local governments will help to promote Energy Fit Homes to residents in a variety of ways, including by providing incentives, using related programs to raise awareness among homeowners and contractors, and requiring or promoting Energy Fit Homes where appropriate within their regulatory authority. For example, requiring publicly funded projects to achieve Energy Fit Homes basic certification would benefit local governments as well as increase the reach of Energy Fit Homes.

INSULATION AND HVAC CONTRACTORS

The expansion of the Energy Fit Homes program means increasing demand by homeowners for HVAC upgrades and the addition of attic and wall insulation. Insulation and HVAC contractors can be actively involved as well by promoting the program and assisting their customers in achieving certification. Remodelers can play a similar role by actively promoting the program and assisting their customers in integrating efficiency upgrades into major remodeling projects.

REAL ESTATE AGENTS AND APPRAISERS

Through the Energy Fit Homes certification, Realtors will have an additional measure with which to differentiate homes on the market, specifically, the large market of existing homes. Realtors will be in an excellent position to educate home buyers and sellers on the meaning and benefits of Energy Fit Homes, and interested Realtors can play a role in assisting their clients' achievement of the certification. In addition, many Realtors are reluctant to make statements about a home's "greenness" or energy efficiency due to liability concerns, lack of education on the topic, or both. A certificate issued by a third party helps to alleviate these concerns and encourage broader usage. Appraisers will benefit from having up-to-date data which allows for accurate comparisons in order to draw out the contributory value of homes having the Energy Fit Homes certification in order to accurately integrate the efficiency of the home into the home's market value.

OTHER "GREEN" BUILDING PROGRAMS

Most "green" building certification programs, generally serving the new homes and remodeling markets, have not had high market penetration in the existing home market. Home certification programs in Minnesota have often worked cooperatively to promote "green" building overall, and Energy Fit Homes is designed to work cooperatively with this coalition as well, meeting an important need. For programs for which energy efficiency is not a major component, Energy Fit Homes offers a simple, inexpensive mechanism for adding or expanding this element of the certification. And for programs currently relying for their energy assessments on HERS ratings, Energy Fit Homes offers an energy model that, in addition to offering lower administrative costs, is much better suited to the assessment of existing homes.

ENVIRONMENTAL AND HOUSING NON-PROFITS

Environmental and housing nonprofits will find Energy Fit Homes a valuable tool for supporting their constituencies' efforts to create homes and lifestyles that are more environmentally sustainable and more resilient in the face of uncertain energy supplies and prices in the future.

CONCLUSION

This paper has described plans for a new energy-efficiency certification program for existing homes called Energy Fit Homes. This certification program is designed to increase the overall efficiency of Minnesota's existing housing stock by providing recognition and value to homeowners who conduct energy-efficient upgrades. Energy Fit Homes focuses on practical, cost-effective energy-efficiency measures that allow a homeowner to recoup his investment in efficiency upgrades, even if he sells the home before seeing a complete return on investment via lower energy bills. An Energy Fit Homes certification will make the hidden value of energy efficiency conspicuous and enticing for both homeowners and home buyers, adding tangible value at the time of sale to the owner of a certified home and dramatically increasing the potential scale of the market. Energy Fit Homes is designed to offer easy,

desirable achievement, attainable for virtually any homeowner — for broad adoption beyond just the environmentally motivated.

CEE and NEC plan to implement the Energy Fit Homes program, as described in this paper, later in 2014. Implementation of the certificate will require the active involvement of a broad range of stakeholders working together to help achieve participation by a large segment of Minnesota homeowners. Importantly, utility programs can help provide an easy pathway and help pay for some of the cost of the Energy Fit Homes' required upgrades. With these other pieces in place, we believe that Energy Fit Homes can play an important role in the transformation of Minnesota's existing housing stock, saving homeowners millions of dollars and dramatically reducing energy usage throughout the state.



This certification program is designed to increase the overall efficiency of Minnesota's existing housing stock by providing recognition and value to homeowners who conduct energy-efficient upgrades.

END NOTES

¹Source: U.S. Census.

²These numbers are based on an investigation of insulation levels in over 3,600 homes in the Twin Cities area, extrapolating this information by housing year built. This estimate should be considered an order of magnitude estimate.

³CEE estimates that 23% of the homes that lack wall insulation also have insufficient attic insulation; accounting for this overlap, the number of homes estimated to have both insufficient attic insulation and no wall insulation in Minnesota is 421,708.

⁴Xcel Energy, CenterPoint Energy, and Minnesota Energy Resources (which collectively serve 93% of the residential natural gas customers in Minnesota) estimate that a total of 4,024 customers will install wall or attic insulation each year from 2013 to 2015, based on historical averages (source: 2013-2015 Triennial Conservation Improvement Plans by Xcel, CenterPoint, and MERC). Because utilities generally give out separate rebates for wall insulation and attic insulation, the total number of homes may be less than 4,024. Approximately 68% of all households in Minnesota are served by natural gas (source: 2008 Minnesota Utility Data Book and U.S. Census). Assuming that 4,025 represents about half of all insulation jobs in the state (not all customers are served by natural gas, and not all insulation jobs receive rebates), this is approximately 8,000 insulation jobs per year.

⁵Assuming that 8,000 insulation retrofits per year is a rate of about 2% of the homes needing insulation per year (keeping in mind that the number of retrofits declines each year if it is assumed to be a percentage of total needed upgrades that are done each year).

⁶For example, homes that have greater than R-20 attic insulation, but are leaky and can save energy through air sealing, or homes with greater than R-20 attic insulation, but less than the current code requirement of R-49. Also, the estimate does not include heating system upgrades that can dramatically cut energy bills.

⁷CEE extrapolated statewide numbers from a database of 3,600 Twin Cities metro-area homes where existing attic and wall insulation levels were documented. These were segregated into the U.S. Census categories for home age, and the percentage of homes in each age cohort was multiplied by the U.S. Census data for total Minnesota homes to arrive at the estimates. The number of homes built in 2000 or later with inadequate wall or attic insulation (as well as the 1980-1999 cohort for wall insulation) were too small to be extrapolated and were assumed to be zero (even though several homes in the CEE database from these age cohorts did have inadequate insulation, despite its being required by code).

⁸Note that a voluntary certificate program is one of several, non-mutually exclusive options for potentially incorporating energy efficiency into the market; mandatory energy bill disclosure and asset rating at time-of-sale are two additional options that have been implemented in several markets in the United States. See: Rachel Cluett et al., "Residential Energy Use Disclosure: A Review of Existing Policies," American Council for an Energy-Efficient Economy, 2013. www.aceee.org/research-report/a131

⁹According to the study of over 1 million homes, "Energy efficiency is an important underlying determinant of the increased values for 'green' certified dwellings." Nils Kok, M. Kahn, "The Value of Green Labels in the California Housing Market: An Economic Analysis of the Impact of Green Labeling on the Sales Price of a Home," July 2012. This study found, on average, a 9% price premium from green labels and a 14% premium for Energy Star homes. 70% of the homes in this study were sold as new-construction homes, and more than two-thirds of the labeled homes in the study were Energy Star.

¹⁰This is according to the opinion of a professional appraiser in the Twin Cities market that CEE talked to as part of research for the development of the Energy Fit Homes.

¹¹The Appraisal Institute, "Form 820.04: Residential Green and Energy Efficient Addendum," January 2013. www.appraisalinstitute.org/education/green_energy_addendum.aspx.

¹²A sixth program, the Wisconsin Green Built Home program, is listed on the multiple listing service for the Twin Cities Metropolitan Area, which includes two counties in Wisconsin.

¹³Note that some of the local HPwES programs have introduced their own state-level certifications (Illinois, for example). These state-level certifications, although affiliated with a HPwES program, are different from the DOE's proposed national HPwES certification program.

¹⁴See: J. Edwards, D. Bohac, C. Nelson, and I. Smith, "Field Assessment of Energy Audit Tools for Retrofit Programs," U.S. Department of Energy, NorthernSTAR Building America Partnership, July 2013. www.nrel.gov/docs/fy13osti/56762.pdf

¹⁵One notable difference is that the Home Energy Score scale is based on total baseload energy usage and not energy usage per square foot, like HERS. Thus, larger homes (which will have greater total energy usage, all other things being equal) will score relatively worse in the Home Energy Score scale compared to HERS.

¹⁶The results of this pilot are documented in the following report: J. Edwards, D. Bohac, C. Nelson, and I. Smith, “Field Assessment of Energy Audit Tools for Retrofit Programs,” U.S. Department of Energy, NorthernSTAR Building America Partnership, July 2013. www.nrel.gov/docs/fy13osti/56762.pdf

¹⁷This does not include any financing costs.

¹⁸Formerly called the “Home Energy Improvement Index,” this model is discussed at greater length in a forthcoming report from the Center for Energy and Environment.

¹⁹Note that although the HEF model has the capability to model electric usage, it currently models only natural gas energy usage (for gas-heated homes), based on the parameters that are included in the model (heating system and building envelope).

²⁰Utilities are required to submit and obtain approval for plans for their conservation programs to the Minnesota Department of Commerce, Division of Energy Resources, which considers the programs’ cost-benefit ratios in its decision whether or not to approve; a ratio above one indicates that the benefits are lower than the costs. An exception is granted for programs for low-income residents; utilities are not required to have ratios below one for low-income energy-efficiency programs in consideration of the social benefits provided.

²¹Even with new federal lighting standards, there will be opportunities for saving energy through lighting for many years to come, as not all compliant lighting uses as little energy as CFLs or LEDs.

²²For example, in the Home Energy Squad program jointly run by Xcel Energy and CenterPoint Energy, the average savings from so-called “direct install” measures is around 10 Dth of gas and 450 kWh of electric savings annually (or roughly \$100 of savings).

²³In cases where there is ductwork in unconditioned areas in Minnesota housing it is typically found in attic spaces. Duct sealing therefore would often be addressed through the attic air sealing work required for the Energy Fit Homes certificate.

²⁴The Consortium for Energy Efficiency ranks some types of appliances according to even more stringent levels of efficiency than the Energy Star label (www.cceel.org).

²⁵For example, the Home Energy Squad Enhanced program in participating cities in CenterPoint Energy territory, the Home Performance with Energy Star program in Xcel Energy territory, or Minnesota Energy Resources’ audit program.

²⁶Such as offered in CenterPoint Energy territory through the Home Energy Squad Enhanced program, in Xcel Energy territory through the Home Performance with Energy Star program, or in Minnesota Energy Resources territory through the Qualified Insulation Contractor program.

²⁷“Standard Requirements for a Certificate of Completion for Residential Energy Efficiency Upgrades.” See: www.bpi.org/Web%20Download/BPI%20Standards/BPI-2101-S-2013%20Standard%20Requirements%20for%20a%20Certificate%20of%20Completion%20for%20Residential%20Energy%20Upgrades%202013-09-03.pdf

²⁸Note that while the Energy Fit Homes certificate would be compatible with the BPI standards, there is, by design, quite a bit of flexibility in these standards, and many other certifications that vary significantly from the approach described here would also be compatible with the BPI standards. That is, while the BPI standards are a starting point for developing a certificate, different certificates that both comply with the BPI standards may not be equivalent to each other. For example, a HERS rating could be considered compatible with the “Certificate of Performance” in the BPI standards, although we have argued extensively here that this approach is not suitable for widespread use in existing homes.

²⁹See: “Unlocking the Value of an Energy Efficient Home: A Blueprint to Make Energy Efficiency Improvements Visible in the Real Estate Market”, August 2013, CNT Energy and National Home Performance Council www.cntenergy.org/media/Unlocking_Value_2013.pdf

³⁰The outcomes-based orientation of Energy Fit Homes can be contrasted with the action of getting an energy audit, which is frequently promoted as a common action for homeowners to take. However, audits do not by themselves lead homeowners to complete energy upgrades to their homes, and in fact typically have very low or incomplete follow-through rates. Substituting the Energy Fit Homes program for a simple audit can result in improved follow-through and more energy saved. Achieving the Energy Fit Homes certification may involve the homeowner getting an audit, but the audit is not the focus; the outcome is.



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