

How One State Pursued Improvements in its Weatherization Program

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ABSTRACT

As a part of continuing efforts at research and program improvement, Wisconsin's low-income weatherization program launched several initiatives in recent years to improve program cost-effectiveness and to achieve greater energy savings. These new initiatives will be described and results presented. Some of these results may also be widely transferable to other residential energy efficiency programs.

As an example, weatherization policy makers altered rules to favor higher efficiency measures. The program established ENERGY STAR as the required performance level for most appliances and equipment installed, including furnaces. For other measures, the program established a policy of specifying higher efficiency, higher cost measures only after determining sufficient cost effectiveness by using a test on each case. Measures discussed here include refrigerators and freezers, boilers, and lighting. The weatherization program adopted simplified methods to identify refrigerators and freezers for replacement and new practices to encourage removal of secondary units. When high efficiency condensing boilers became available, a cost effectiveness test was required to choose between standard and condensing types for installation. Also, the program adopted a policy of complete replacement of all incandescent lighting. The need for and reasoning behind these program modifications will be presented.

Efforts to improve the program continue. In this paper, remaining potential to impact refrigerator and freezer savings are discussed, using appliance shipment data as support. Dropping the cost effectiveness test for boilers and defaulting to all condensing boilers is discussed. For the lighting measures, data is presented to suggest that the high number of measures installed per home is producing substantial electric savings impacts. Data on per-home savings impacts for all weatherization measures is presented.

Additional specific policy changes to increase the energy impacts of the program are identified. One example recommendation is for agencies to use a rapid feedback energy impact calculator to help identify under-performing homes for follow-up and problem correction.

Development of Low Income Weatherization in Wisconsin

Low income weatherization has been carried out in Wisconsin since the early 1970s. As Wisconsin's program evolved, it included new measures and process changes aimed at improving program cost effectiveness and achieving greater energy savings. Examples of significant changes before 2000 include adoption of high efficiency condensing furnaces, audit protocols such as NEAT, blower doors, infrared cameras, and new training regimes for field crews. This paper will describe newer initiatives in Wisconsin's weatherization policy.

Following earlier efforts to integrate ENERGY STAR into weatherization, Wisconsin program managers took a major step toward ENERGY STAR when they launched a formal procurement effort for the state's 25 local weatherization agencies in 2002 (Mapp & Smith 2006). By 2006, ENERGY STAR was the default requirement for most products the program covered, including health and safety measures such as dehumidifiers and ventilation fans (WDOA 2009a). Most notably, the program adopted ENERGY STAR requirements for furnaces, refrigerators and freezers, and light bulbs. Shown

in Table 1 below is the number of several key measures installed in FY08, out of 9,784 weatherization jobs.

Table 1. Key Measures Installed by the Wisconsin Weatherization Program in FY08

Measure	Quantity	Weatherized Residences Reached with this Measure
Heating System Replacements	3,651	37%
Refrigerators	4,750	49%
Freezers	943	10%
CFLs, torchieres, and Exit Signs	193,800	98%

About 80% of heating system replacements installed were ENERGY STAR qualified natural gas furnaces. Other heating systems installed were wall furnaces, space heaters, and boilers using oil, LP, or natural gas, and a few wood systems. The mix of measures installed depended on the building types reached through the weatherization program each year. In FY08, homes weatherized in Wisconsin included 44% single family homes, 9% mobile homes, 19% two to four unit buildings, and 28% buildings with five units or more.

Boilers

The program installed about 380 gas boilers in FY08. Program policy is to install condensing type boilers when it is the most cost effective choice. Program guidelines mandate replacement of natural gas furnaces or boilers if the SSE is less than or equal to 75% and the unit has less than a five year life expectancy. Once the decision is made to replace the boiler, auditors must run the NEAT audit in order to determine whether the Savings-to-Investment Ratio (SIR) of 1.0 is met to install the standard or high efficiency boiler. In cases where both boiler measures have SIR >1.0, the measure with the highest SIR is installed. Program data indicates that at least 45% of natural gas boilers installed were high efficiency condensing type in FY08.

A simpler blanket replacement guideline could be justified without sacrificing SIR in most cases. Currently, a NEAT audit is needed to justify installation of a condensing boiler. Data and practices on condensing boilers merits additional scrutiny and tracking. If the cost of condensing boilers drop, this measure could pass the cost effectiveness test more often. Switching to all condensing boilers could also introduce further program efficiencies by reducing the need for full NEAT audits.

Several agencies indicate already that their current practice is to install only condensing boilers as replacements. In their territory, the incremental cost of condensing boilers is so small and the incremental savings so large that the condensing boiler always beats the standard boiler. Why does the incremental cost of condensing boilers have a persistently higher cost in some territories? Possible explanations include reluctance on the part of some contractors to install a new technology and concerns

about liability. If the weatherization program (or some other entity, perhaps the state public benefits program Focus on Energy) can provide training in that market, we anticipate that condensing boilers will become more widely available at competitive price. A guideline could be based on some additional checklist-type requirements to qualify homes, reducing the need to run the NEAT audit to only jobs that failed the checklist. If the weatherization program can help develop the market for more energy efficiency boilers, this would benefit the whole general residential and small commercial market.

Refrigerators and Freezers

Several new program approaches increased savings from refrigerator and freezer measures in weatherized homes. First, program rules were structured to limit the types of refrigerators installed, and to add freezers as an allowable weatherization measure. Second, program managers adopted simplified selection criteria for determining which units to replace. Finally, rules on refrigerator and freezer removal were eased, allowing more measures to be installed.

While some other states' weatherization programs allow agencies wide latitude in choosing refrigerator models to install, Wisconsin has chosen to limit types installed. The disadvantage is that weatherization customers have less choice in the model they receive. Advantages include lower procurement and administrative costs by bulk buying of a few "no frills" models, and increased predictability of energy savings. Wisconsin rules require ENERGY STAR, top freezer, automatic defrost, two door refrigerators without through-the-door ice or water, and only in fixed sizes of 15, 18 or 21 cubic feet, depending on household size. Corresponding savings from the measure is estimated at standard deemed values, according to the size. One advantage of incorporating ENERGY STAR into equipment specifications is better estimating the final energy savings from each installation. Program exceptions allow refrigerators with bottom freezers for less able customers who request them.

In the last few years, the program expanded to include freezers as a measure. Replacement freezers are required to be ENERGY STAR, manual defrost, and the same size or smaller than the freezer replaced. Initially only chest freezers were allowed as a replacement. However, many customers did not have a large enough floor area (footprint) in their home available for the replacement of an upright unit with a chest unit with a larger footprint. A review of the available upright freezers indicated that manual defrost upright freezer units had energy use similar to chest units and price tags that met program SIR criteria. Now the program allows freezers to be replaced with either chest or upright manual defrost units.

Simplified Selection Criteria for Refrigerators and Freezers

One difficulty in refrigerator and freezer replacement is the time and expense of deciding which refrigerators and freezers to replace. Over time, Wisconsin program guidance has evolved to specify replacement for refrigerators manufactured prior to the 1993 federal standard, or units with R12 refrigerant listed on the nameplate. Also, when a building requires a NEAT audit, the refrigerator is replaced if the measure meets a minimum 1.0 SIR. Freezers are replaced if they are manufactured prior to the 1993 federal standard, or have R12 refrigerant listed on the nameplate.

Refrigerator. Previously, refrigerator selection criteria was more cumbersome. The agencies were relying on either age estimation through model number taken from the nameplate, or measuring refrigerator energy use in the field over some predetermined minimum period. Problems came from difficulty using the nameplates, as well as the time, effort, and risk of moving units for measurement. Moving refrigerators caused floor scratching or damage, breakage or damage to materials stored on top of the unit or damage to the unit itself.

For the nameplate method, auditors needed a database with the full range of brands, types, sizes and model number along with federal usage or with assumed degradation levels. They also needed guidance on use of nameplate type, including location of identifying characteristics such as R12 or R 134a refrigerant or Freon. In order to facilitate estimating energy usage and age through use of the model number, a database with this information was needed, but existing databases were out of date. A searchable electronic data base was developed to provide estimated usage under the federal test procedure (Cavallo 2009). Assumed current usage was based on the NEAT audit degradation protocol and the years during which the identified model was produced. Later versions of the database also included information on how to use the serial number to identify the actual year of manufacture. This database is available on line and can be down loaded so that it can be used in the field on a Personal Digital Assistant. In many cases, this nameplate method eliminated the need for field energy use measurements.

After a review of the estimated annual consumption data, it was determined that units manufactured before the 1990 federal maximum usage standard went into effect should be removed and would meet the cost effectiveness test. After a few years, the criteria for replacement or removal was modified to identify any unit manufactured prior to the 1993 revision to the federal maximum usage standard for removal and replacement.

Freezers. Continuing comments from the field indicated that it was often difficult to locate the name plate on freezers or to locate and read the model number when it was on the back of the freezer unit. There was also a request for a single reading that could reliably identify older units. After reviewing the data from about 100 units, two parameters were identified that were closely associated with annual energy usage or age of unit: wattage when running and Power Factor (PF).

The wattage along with the typical duty cycle determines the annual usage. However, when a refrigerator or freezer first kicks on, the wattage is high and then drifts down over a four or five minute period to an asymptotic level that can be used to establish criteria for replacement or removal. The review of data suggested that if the wattage when running at a steady state asymptotic level is greater than 240 watts (a 24 hour day times 10), then the unit should be replaced. However, the asymptotic level is reached after a five minute period and this was deemed too long for what was desired in the field, so the wattage when running was deemed an infeasible selection criteria.

The second parameter investigated was the Power Factor (PF). The power factor (between 0 and 1) is the relative phase shift between the voltage and current 60 cycle wave forms. Review of the available data indicated that older units had a PF close to 0.50. Slowly over time manufacturers installed capacitive power factor compensators to bring the PF closer to 1.0. A review of the data indicated that if the PF was less than 0.72, the unit was manufactured before 1990. The selection criteria for freezer replacement or removal was modified to determine the power factor measured by a wattmeter. If the PF was less than 0.72, the unit was eligible to be replaced or removed. This selection criteria worked well and had the added advantage that the PF determined was reliable, steady and reached an asymptotic value within 15 seconds. This was a quick, reliable, reproducible, easy-to-implement procedure for use in the field.

Metering Versus Nameplates. Metering refrigerators and freezers did require access to the plug. This was not always easy. There was also some question as to how reliably the data was being entered in the field for documentation of the selection for removal and estimation of energy savings. Informal discussions with field personnel indicated that what was desired was to be able to open the refrigerator or freezer door and through visual inspection identify units for removal. After review of many hundreds of nameplates and discussions with EPA and AHAM, it became apparent that the refrigerant or Freon used had changed in response to federal mandates at about the same time that the federal standard

changed in 1993. The refrigerant changed from R 12 to R 134a just when the federal standard for maximum usage changed.

In Wisconsin, the selection criteria for removal or replacement was changed so that any unit with refrigerant R 134a is to be retained and any unit with refrigerant R 12 or any other refrigerant or where the name plate can not be located, is eligible to be removed or replaced. This selection criteria is particularly easy to apply because the name plate for all models since about 1990 is a plasticized Mylar sticky name plate located about shoulder height on the left side of the fresh food compartment. If the name plate is metal and screwed on a riveted to tack welded on near the bottom of the unit, it is an older unit. This adage also becomes useful: “Avocado, Brown, or Harvest Gold, if it’s colored, it’s really old.”

Removal of Secondary Refrigerators and Freezers

While refrigerator and freezer replacements are limited to one of each type per household, the Wisconsin program allows removal of additional functioning units from the home for additional energy savings. Removals boosted refrigerator/freezer measures in the weatherization program by several percentage points in FY08, over just replacements alone. Up to two removals each of refrigerators and freezers are allowed per household. The customer incentive was recently increased from \$50 and made uniform at \$100 per removal. Another recent modification was lifting the restriction on units in unconditioned space. In Wisconsin, it was argued, a unit on the porch or in the garage was out in the cold so it did not consume much energy. Sample monitoring and comments from the field indicated that just as expected, during the summer, the hot exposed units compensated for the low consumption during the winter with increased consumption during the summer. Now program policy allows all units anywhere in or on the residence to be removed or replaced, whether in conditioned or unconditioned space. These modified policies may boost the removal rate for FY09 and later years.

The long term goal is the complete removal of all units using refrigerant R 12. Complete removal not only saves energy but reduces harmful freon release. The Global Warming Potential (GWP) of R 12 greatly exceeds the GWP of R 134a so the reduction of future global warming is greatly reduced by early removal of these units and proper disposal of the freon.

Lighting

The Wisconsin Weatherization program incorporated energy efficient lighting as a simple-to-implement measure to reduce clients’ electric bills. Following national initiatives, an early guideline was to replace the five most often used incandescent light bulbs. There was some difficulty in determining which sockets were the five most highly used. As the cost of CFLs continued to drop, there was a policy decision to simplify the program to include replacement of every incandescent light bulb with an appropriate ENERGY STAR bulb, Exit sign or CFL torchiere. This guideline also covered replacement of 3-way bulbs, and outdoor security lighting with ENERGY STAR bulbs.

Figure 1 shows the number of CFLs installed per house, based on data from 2,020 single family building weatherization jobs completed in the earlier part of FY09.

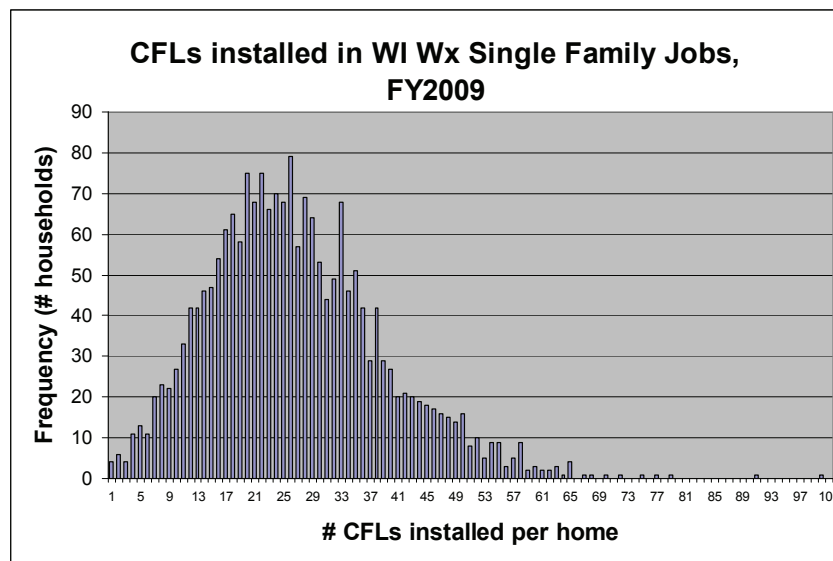


Figure 1. Lighting measures installed per single family weatherization job for early 2009.

The most frequent number of CFLs installed per home was 26. This CFL measure can be used as a proxy for all lighting measures: it accounted for 94% of the total lighting measures installed in weatherized single family homes in FY08. The other 6% were outdoor, 3-way, and torchiere lighting measures, which were counted separately. Even at 26 CFLs per home, the current weatherization lighting protocol is apparently not tapping the full energy saving potential in the homes served. Duplexes, mobile homes, and apartments served had similar untapped lighting energy saving potential.

National data suggests that typical homes have around 40 light bulb sockets. It would be desirable to develop a field estimate of the lighting potential for Wisconsin homes. The typical house in Wisconsin is about 1600 square feet. We estimate that socket intensity is lower than national numbers, about 50 square feet of conditioned space per socket, rather than 40. More data is needed to develop a more reliable rule of thumb estimate of potential for use in the field.

A brief survey indicated that many of the agencies perceived barriers to the complete replacement of lighting in homes they weatherize. Agencies did not carry a broad range of bulbs because of a lack of storage space, and limitations tracking more than five or six types of bulbs. Some agencies believed that only twist-style CFLs were available and ENERGY STAR qualified. This precluded use of higher color temperature bulbs, outdoor and wet-rated CFLs, and encapsulated CFLs such as globe, torpedo or A-line. Procuring smaller bulbs, bulbs with narrow bases, and higher wattage 200w replacements was a problem. Agencies also did not recognize harp extenders as a solution for large base CFLs, such as 3-ways.

In order to better understand the current installation practices, state weatherization staff initiated information displays at the periodic gatherings of the local weatherization agencies. The displays included the broad range of CFL bulb types available and information on how to obtain the bulbs. As a consequence, many agencies requested a presentation at their local office for the benefit of local weatherization agency staff. Several of these presentations elicited concerns related to lack of knowledge of availability, reliability, brightness and cold weather operation. Sample CFLs were provided to the sites and assistance provided in modifying their procurement procedures. Innovative storage and inventory procedures were established for newer types of CFLs and CFLs with limited applications such as small CFLs for overhead fans. Additional informal onsite conversations brought out concerns about the availability of dimmable lamps, and slow starting in cold environments. Current

opportunities for additional bulbs include brighter outdoor security lamps such as all weather 4100K Par 38 or 65 watt outdoor rated CFLs.

To encourage more use of energy efficient lighting, state weatherization staff offer waivers in response to agency requests for using energy efficient lighting that is not ENERGY STAR qualified. This has facilitated use of LEDs, cold cathode CFLs, candelabra base CFLs, and other types of energy efficient lighting that is appropriate to an application but not ENERGY STAR qualified.

Figure 2 below shows how the rate of installation of lighting measures has grown. Since apartments and mobile homes have fewer sockets on average than single family homes and duplexes, installation rate can also be affected by the mix of housing types reached by weatherization in a given year. FY09 data is for the first part of the year only.

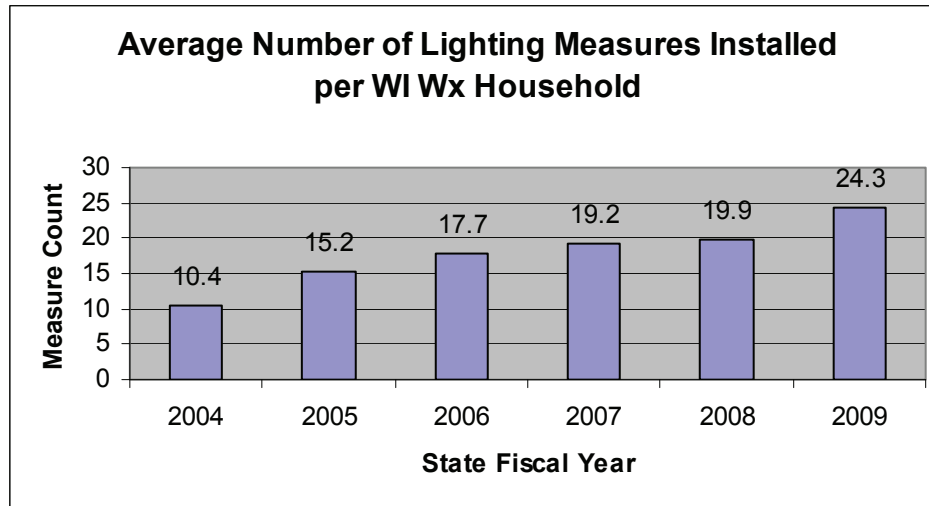


Figure 2. Average Number of Lighting Measures Installed per Weatherized Home in Wisconsin

Energy Saving Impacts

Results of the last major evaluation of the Wisconsin weatherization program are shown in Table 2 (Lee, Rathbun & Schauer 2004).

Table 2. Savings Estimates from Wisconsin Weatherization Impact Analysis 2004

Housing Type	Average Annual kWh Savings per Unit	Average Annual Therms Savings per Unit
Single family / shelter	924	169
Trailer/mobile home	1,167	59
2-4 unit building	783	185
Multifamily (5+ units)	46	94

The number and type of measures installed per weatherized home have continued to evolve since then. Wisconsin program managers estimate that a home weatherized in FY08 saved 915 kWh and 164 therms of natural gas per year on average (WDOA 2009b). The building mix reached that year included 44% single family jobs, 9% mobile homes, 19% two to four unit buildings, and 28% apartment buildings with 5 or more units.

Recent billing analysis further confirms this general level of savings and illuminates how some measures are contributing the total program savings. Table 3 shows the energy savings from billing analysis of two groups of homes weatherized in a FY 2006 pilot project in southeast Wisconsin (Goldberg & Agnew 2007). About half the homes were single family and half were 2-4 unit buildings.

Table 3. Energy Savings Per Home from Two Groups of Homes Weatherized in FY06

	Pilot High Energy Use Group	Comparison Group
Number of Households	1,243	238
Average # of CFLs Installed	18.2	15.6
Electric savings contribution primarily from lighting (kWh)	680	446
Electric savings from refrigerator / freezer (kWh)	308	261
Electric savings from Electric-to-Gas Conversion (kWh)	135	67
Total Electric Savings (kWh)	1,123	775
Total Natural Gas Savings (Therms)	333	93

(Goldberg & Agnew 2007, 5-3; 5-4)

Analysis from a small program similar to low income weatherization in Wisconsin shows similar overall savings results (Ward, Lee & Duerst 2009). The Targeted Home Performance Program (THP) reaches households just above the income limits for low income weatherization -- from 150% to 200% of poverty. Savings for THP were estimated at 1,636 kWh and 269 therms per home in FY08. One difference with the weatherization program is THP's inclusion of central air conditioning and ECMs in furnaces, measures the low income weatherization program rarely installs. The THP energy saving impact per home is higher than the low income weatherization energy impact probably because of the expanded HVAC measures allowed, and possibly due to a greater focus on single family buildings or differences in the data set, including low participation and sample size for THP. THP reaches only a few hundred homes per year.

Refrigerators and Freezers

A review of American Home Appliance Manufacturers (AHAM) appliance shipment data suggests that Wisconsin's weatherization program is tapping most of the potential for refrigerator and freezer savings. What fraction of refrigerators in use in Wisconsin today would be eligible for replacement, if age was the selection criteria? Assuming a lifetime of 30 years, the refrigerator shipment data for the period 1978 to 1993 indicates that 42.7% of refrigerators would be eligible for replacement, and 48.4% of freezers. The Wisconsin weatherization program is replacing or removing one refrigerator in 50.5% of homes on average. For freezers the number is 10.5%. This suggests that weatherization is capturing the potential for refrigerators. Since refrigerator removals are only 3% of replacements, the program may be missing some secondary refrigerators. The increased customer incentive may assist in reaching this potential in the future. It may be reasonable to assume the low income sector has a similar appliance saturation as the general housing sector. While the evidence is not clear, it is possible that more older refrigerators are present in low income households.

The ratio of freezers to refrigerators shipped may suggest the potential for replacing freezers. For 1978 to 1993, the ratio of chest freezers to refrigerators shipped to Wisconsin was 16.4%. The ratio of freezer to refrigerator measures in the weatherization program is 20.9%, suggesting the program is reaching the potential. If upright freezers are included, the freezer to refrigerator potential is estimated from AHAM shipment data at 28%. There is additional potential for installing freezers now that uprights are allowed.

Lighting

The weatherization pilot results in Table 3 suggest that the relatively high rate of CFL installation is yielding substantial electric savings. Furthermore, recent analysis from the THP program bolsters evidence of increased savings resulting from installing even larger numbers of CFL per home. Similar to the low income weatherization program, THP had increased its CFL installation rate from 13.6 bulbs in FY05 to 24.8 in FY08. A recent analysis on THP concluded that CFLs as a measure contributed an estimated 546 kWh annual savings in FY05, which rose to 996 kWh annual savings in FY08 (Ward, Lee & Duerst 2009). THP's 996 kWh per-home lighting energy savings achieved with 24.8 bulbs is significantly higher than the 447-661 kWh achieved in the weatherization pilot with only 15.6-18.2 bulbs. This suggests that substantial lighting negawatts are being left on the table even by programs already installing a dozen CFLs per home or more on average. This tends to support the Wisconsin low income weatherization program's decision to lift the cap on the number of CFLs the program installs per home.

Rapid Savings Feedback for Program Improvement

Weatherization programs need more immediate feedback on the effectiveness of installed measures. While programs and policy changes are implemented regularly, evaluations of programs are typically based on work several years old, limiting evaluation findings' value to program implementers when they are determining whether to tweak their practices. A self administered tool for agencies to use on their weatherization jobs would provide a more immediate indication of the energy savings achieved, reinforce the need for quality work, and identify potential problems before they become embedded in the program. Unlike a large sample program evaluation, this analysis would not be a reliable indicator of total program savings. Nor would it provide a definitive model of energy savings in an individual home, which could be affected by many unrelated factors such as moving in and out of residents. However, a quick-and-dirty per-home energy analysis still could be useful for the purpose of agencies identifying

their poor performing jobs and practices in the field that need to be improved. More rapid feedback on energy savings would assist agencies in flagging outlier jobs that need additional attention to meet program standards. Furthermore, this rapid feedback could be a component of a more comprehensive program for enhanced oversight for new public funding for weatherization.

Typical impact evaluation efforts have examined the impact one or two years after the measures have been installed. A new rapid feedback tool for agencies would take inputs of pre-weatherization energy consumption, weatherization measures installed, residents, and perhaps square feet or other building size data. Utility consumption data is available from the intake agency and can be used for a pre-installation test or rating such as the EPA ENERGY STAR Yardstick. This may become more feasible as Wisconsin begins a pilot using continual updating of the consumption data and change in previous year's consumption data. The rapid feedback tool should examine changes in the therms per heating degree day (HDD) during winter months. This ratio is relatively constant from month to month during the winter heating season.

Rules of thumb may be incorporated into the tool to identify problem jobs. For example, the installation of an ENERGY STAR furnace, replacing an older 70 per cent efficient furnace, should result in a savings of about 20%. Installation of a significant amount of insulation should also result in significant savings during the winter months. Improved air sealing should result in significant reductions in the ratio of therms per HDD from one year to another for the same months and from month to month during the same year over the months the measures were installed. Electric usage should decrease for the non-weather-sensitive months of April and May and September and October. Replacement of refrigerators, freezers, or their removal, and replacement of incandescent light bulbs with CFLs should reduce electric utility consumption. Electric usage should decrease by about 100 kWh each month for refrigerator and freezer removal and lighting replacement, 50 kWh per month for refrigerator or freezer replacement alone, and 400 kWh per month for electric water heater replacement with natural gas. Each of these measures should provide sufficient change in utility electric billing consumption that the individual agencies should be able to detect the change and verify the effectiveness of their measures.

Weatherization agencies' Board of Directors have been asking for evidence of the reduced utility burden on the low income clients they serve. In addition, Wisconsin anticipates a need to document in detail the savings from the new weatherization funds made available from the federal ARRA stimulus package. With a stated goal to double the number of houses weatherized, some immediate feedback on savings, and not just number of measure installed, will likely be required. This rapid analysis tool could provide a component of a comprehensive enhanced oversight protocols desired by public funding agencies.

Future Improvements

Below are several areas for the Wisconsin weatherization program to consider when adopting new policies to continue to improve the energy saving impacts of their program:

- Adopt a goal of complete removal of all refrigerators and freezers using any refrigerant other than R 134a.
- Replace the current air infiltration protocol with a numeric goal such as 1 CFM at 50 Pascal per square foot of conditioned space.
- Implement a self-guided impact evaluation protocol for field weatherization crews, based on monthly utility billing data. This could provide quick turnaround, continuous feedback for quality improvement and help agencies flag poor performing jobs that need more attention.

- Continuing to adopt new ENERGY STAR criteria as they become effective and as new types of equipment are covered by ENERGY STAR, such as condensing gas water heaters.
- Raise the required efficiency levels beyond ENERGY STAR to one of the CEE higher efficiency tiers, depending on the saturation of ENERGY STAR in the Wisconsin market for a particular appliance or type of equipment.
- Add new measures such as replacing electric clothes dryers with gas, replacing rechargers and small electronic devices or entertainment products with ENERGY STAR versions, or installing other baseload electric measures such as smart power strips or occupancy controls to reduce phantom load.
- Specify only condensing boilers for boiler replacements. If SIR test is retained, drop requirement to go with higher SIR boiler, and specify condensing boiler whenever SIR is greater than one.
- Investigate new ECM drop-in replacement electric motors for condensing furnaces, for energy savings during the heating and air conditioning seasons.

Conclusions

Many of the initiatives undertaken by the Wisconsin Division of Energy Services could also be adopted by other states. Implementation depends on available funding, flexibility of federal rules, and the ability to overcome internal constraints. The Wisconsin weatherization Program has made some progress into incorporating ENERGY STAR into all aspects of its program. Virtually every CFL, refrigerator, freezer, and gas furnace installed in the program is ENERGY STAR qualified. Using ENERGY STAR as the standard for most equipment simplifies the equipment selection process, guarantees selection of the upper tier of energy efficient equipment, eliminates the need for periodic reviews of program equipment efficiency specifications, and allows for the reduction in equipment costs through bulk purchasing.

Wisconsin currently encourages local weatherization agencies to replace every incandescent light bulb in a client's residence. Suitable replacements have been identified for common, decorative and specialty incandescents. The recently enacted federal legislation phasing out or requiring increasingly higher efficiency standards for incandescent lighting provides an additional reason for weatherization programs to put more emphasis on CFLs. Weatherization agencies can serve as a model for what all other building owners, occupants, and facility managers can accomplish immediately in terms of lighting energy savings, in industrial, commercial, and residential sectors.

Wisconsin's simplified protocol for identifying refrigerators and freezers for replacement or removal can be applied by an agency or householder. The use of refrigerant R12 as the criteria for change simplifies selection criteria, reduces the time involved, removes ambiguities and also provides for early removal of refrigerants with the greatest Green House Gas Potential.

The weatherization program has been instrumental in the promotion of 90% AFUE condensing furnaces in Wisconsin, a state with one of the highest saturation of condensing furnaces in the nation. In the future, the program could play a similar role in promoting the installation of high efficiency condensing gas boilers.

The Wisconsin program has also developed an extensive program of field staff to assure consistent quality monitoring and inspection with assistance for the improvement of quality installation practices and completeness of all measure implementation.

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