Delivering Energy Efficiency to Middle Income Single Family Households[1]

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ABSTRACT

Middle-income households account for one-third of total U.S. residential energy use and figure prominently in meeting energy savings targets that now exist in most states, as well as reducing air pollution emissions and managing demands on the grid. Energy upgrades have the potential to provide significant benefits to middle income households—by lowering bills, increasing the integrity of their homes, improving their health and comfort, and reducing their exposure to rising energy prices.

This study describes innovative program designs, financing tools, and outreach strategies that show promise in increasing the attractiveness and accessibility of energy efficiency for these households group. The strategies described in this report need robust and supportive policies, to capture the entire energy savings opportunity.

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Introduction

Many middle income households – defined here as the middle third of U.S. households by income – are under significant financial strain, and rising energy bills are a contributor to this stress. Energy improvements can provide significant benefits to middle income households – by lowering bills, increasing the integrity of their homes, improving their health and comfort, and reducing their exposure to volatile, and rising, energy prices. Middle income households are also responsible for a third of U.S. residential energy use, suggesting that increasing the energy efficiency of their homes is important to deliver public benefits such as reducing power system costs, easing congestion on the grid, and reducing environmental impacts.

To achieve deeper savings goals, utilities and governments are beginning to look beyond typical residential energy efficiency programs that discount compact fluorescent light bulbs (CFLs) or provide rebates for high-efficiency appliances and equipment. Increasingly, they are turning to programs that improve the energy efficiency of the entire house – by sealing up leaks, adding insulation, repairing ducts, and replacing inefficient heating and cooling systems. These more comprehensive programs typically offer the same incentives for

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all non-low income households and usually require customers to pay a significant portion of the costs. These comprehensive home energy improvements often cost $5,000 to $15,000 per home.[2] Higher income households are better positioned financially to take advantage of programs that promote comprehensive home energy upgrades and require substantial household investment.[3]

This leaves millions of middle income homes wasting energy and exposed to rising energy costs. These homes are often older and less efficient than those of their higher income peers,[4] suggesting large untapped energy savings potential exists. Delivering comprehensive energy efficiency improvements to just one-third of the 32 million single family middle income households could save roughly as much energy each year as is used by every home in Houston, Phoenix and San Francisco.[5] At a minimum, adding insulation, sealing air leaks, and repairing ducts – would require an investment of roughly $30 billion to $100 billion for just this third of the market.[6] By comparison, total estimated program funding for multi-measure home energy efficiency upgrades targeted at all non-low income households is about $7.7 billion over the next decade.[7] And while there is some private sector energy efficiency services activity occurring, the costs of delivering multi-measure energy upgrades to the middle income market far exceed both expected public resources and naturally-occurring market activity. A more aggressive effort to target middle income households will also require significant customer contributions to the cost of the energy saving measures and an interlocking framework of program design and supportive policies and public monies.

Middle income households represent a diverse market – encompassing fixed-income elderly households in the suburbs, economically disadvantaged urban residents, dual-income families working for relatively low wages, recent college graduates, and others. While there is no 'silver bullet' to help these households overcome the range of barriers they face, this paper describes outreach strategies, innovative program designs, and financing tools that show promise in increasing the attractiveness and accessibility of energy efficiency for this group. These strategies must be paired with enabling and complementary policies to reach their full potential.

Research Scope & Methodology

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[2] This is a rough estimate of the range of project costs currently reported by administrators of comprehensive home energy upgrade programs targeting savings of at least 20 percent per home (Zimring et al. 2011).

[3] While most non-Weatherization Assistance Program (WAP) energy efficiency programs do not formally track income of their participants, discussion with program administrators and other experts from around the country reveal that early participants in home energy upgrade programs are more likely to be higher income households.

[4] Compared to higher income households, middle income households have a larger share of homes that pre-date modern energy codes for residential buildings and are associated with higher energy use and operating costs per square foot (EIA, 2005).

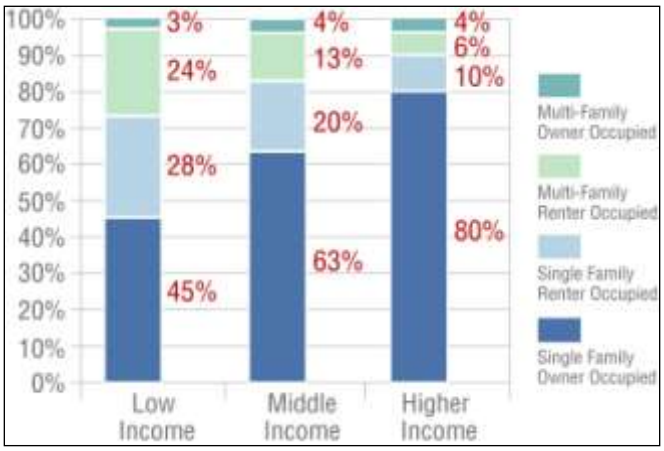
[5] This estimate is derived using the assumption that households save 17% on multi-measure home energy improvements (the weighted average used by the SEEAction Residential Retrofit Working Group), saving a total of 3.44 X 10^11 BTUs annually.

[6] Assumptions behind this estimate include: 1) A low-end cost for basic insulation and air sealing of $3,000 per home; 2) A higher-end cost of $10,000 per home for a full home energy assessment followed by some combination of measures that include HVAC replacement, air sealing, duct sealing, additional wall, floor, and attic insulation (where appropriate). The resulting aggregate cost estimate is derived as follows: $3,000 to $10,000 * 38.5 million middle income households * 83 percent single family households * 33 percent of eligible market = $32 billion to $105 billion.

[7] Estimate is drawn from an analysis of taxpayer and utility customer funding for home energy upgrades done for the SEE Action Residential Retrofit Working Group (SEE Action 2010).

The large majority (83 percent) of middle income households lives in single family homes, and 67 percent of these own their home (see Figure 1) (Census 2010). The highest concentrations of middle income households live in metropolitan areas; chiefly in the smaller cities and suburbs outside of the largest cities. This report focuses on that 83 percent of middle income households who live in single family homes and either rent or own them – a total of 32 million U.S. households.[8]

Figure 1. Comparison of Housing Type and Ownership Status Across Income Groups



Source: Census 2010

The question posed in this report is: How can programs motivate these middle income single family households to seek out more comprehensive energy upgrades, and empower them to do so? Research methods included interviews with more than 35 program administrators, policy makers, researchers, and other experts; case studies of programs, based on interviews with staff and a review of program materials and data; and analysis of relevant data sources[9] and existing research on demographics, the financial status of Americans, and the characteristics of middle income American households.

Driving Demand for Energy Improvements

Middle income households face many of the same barriers to investing in energy upgrades as their higher income peers (Fuller et al 2010).[10] These households also face additional challenges to adopting comprehensive energy efficiency. In the wake of the recession, many lack access to capital or are reserving these funds for emergencies. They are not interested

[8] The single family classification includes one to four unit and manufactured homes.

[9] Data sources include the Current Population Survey of the U.S. Census Bureau (Annual Social and Economic Supplement, March 2011), the 2005 Residential Energy Consumption Survey of the U.S. Energy Information Administration, the 2009 Consumer Finance Survey of the Federal Reserve Bank and other materials.

[10] Key lessons from this report can be accessed at: http://drivingdemand.lbl.gov/reports/lbnl-3960e-keylsns.pdf

in making non-emergency investments in energy efficiency.[11] Though they cannot solve all the challenges faced by middle income households, the following outreach strategies show some promise in overcoming the barriers specific to this market segment.

Reduce Participant Costs & Risk

Middle income households are sensitive to the risk that upgrades will not yield the savings estimated. It may also not be realistic, especially in today's policy and economic environment, to expect middle income households to spend $5,000 to $15,000 in proactive energy efficiency investments, even if they do pay back. This report identifies a range of strategies for reducing total cost and risk for participants:

- **Start With the Basics.** Encourage homeowners to do the basics today at a cost of $2,000 to $5,000– for example, air sealing and climate-appropriate insulation. In the future every time they remodel living spaces, or replace equipment (e.g., furnace, water heater, air conditioner, windows), encourage or require the most efficient measures. The Arizona Public Service (APS)/Salt River Project (SRP) coordinated Home Performance with ENERGY STAR© completed approximately 4,000 upgrades in 2011 that saved 10 percent on average and cost $3,000 per home. Contractors gave the customer a comprehensive energy upgrade plan up front, and most contractors anticipate maintaining the customer relationship over time as households need and can afford additional work.
- **Targeted rebates.** It is clear that rebates help to drive demand (Fuller et al. 2010). It may be appropriate to tier these incentives by income to enable access for those who can least afford upgrades. For example, the New York State Energy Research and Development Authority (NYSERDA) offers a 50 percent rebate to households earning 60 to 80 percent of Area Median Income (AMI), double its standard 25 percent rebate. With limited public funding, one outstanding challenge is finding the "sweet spot" where incentives reduce a household's financial contribution *just enough* to motivate action, but avoid paying more than needed or discouraging households to invest in improvements beyond the basics.
- **Leverage existing public programs.** Several programs are making existing public investments go further, For example, in California, the cities of Richmond and Berkeley are using publicly-funded workforce training programs to deliver free or deeply incented energy improvements to middle income households (Zimring et al 2011).
- **Pre-packaged Improvements.** Many energy efficiency programs rely on energy assessments that can cost $100 to $600 to identify the energy saving improvements for each participating household. A less costly option is to forego an onsite home assessment, and use prescriptive approaches – offering a standard set of measures that are widely expected to save energy across a range of properties or within a specific type of targeted housing. Health and safety testing would still be required after upgrades are completed.
- **Do-It-Yourself (DIY) Improvements.** About one third of all middle income home improvements including energy related home improvements were "do-it-yourself" projects in

[11] Proactive investments are discretionary non-necessary investments as opposed to reactive investments that must be made to solve an immediate problem such as a broken furnace.

2008-2009 (Census 2009). In a 2010 six month pilot run by the Central Vermont Community Action Council (CVCAC), the program provided participants with training, professional guidance, and financial incentives. The 24 participants who made improvements themselves were satisfied with the program and able to get energy upgrades at a reduced cost (Zimring et al. 2011).

- **Flexible Loan Terms.** Loan terms can be modified based on project performance—the term might be set at five years based on expected savings to ensure that monthly energy bill savings exceed improvement financing costs, but if the savings are less than estimated, program managers could have the flexibility to reduce monthly payments by extending the loan repayment period to ensure that savings are greater than loan payments.[12]
- **Performance Guarantees.** In theory, the residential energy efficiency market is a potential market for insurance products – such as performance guarantees that ensure households save money on energy improvement investments. Today, however, performance guarantees are generally considered too expensive to offer to individual homes. Even in large buildings, the process of monitoring and responding to claims is costly, and there is plenty of room for debate about the causes of failure to meet predicted savings. Despite these challenges, programs should consider piloting guarantees to assess the cost of offering them, their value in driving demand for energy efficiency and their impacts on household behavior.

Use Trusted Messengers

Tapping trusted sources of information—such as local leaders, local organizations, and peers—can get attention and overcome uncertainty by building upon existing relationships and networks. These trusted parties may differ across income groups and even within middle income households in a region. Peer-to-peer information sharing seems particularly important in middle income communities and some programs have had early success leveraging existing social service providers and community development financial institutions (CDFIs) to market energy improvements.

Solve a Problem that Households Recognize

It is also important to sell energy upgrades in ways that most appeal to middle income households. Below we include some messages that may resonate with the middle income market:

- **"Maintain the Value of Your Home"** – Middle income households have historically made significant home improvement investments[13] – many of which have no short term positive impact on household cash flow, but maintain or increase the value of the home or improve quality of life. These investments are seen as part of the ongoing cost of owning and maintaining one's home. Framing energy improvements as investments in maintaining the value of their largest asset may be an important motivator.

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[12] When a loan term is extended, the overall loan amount is not changed, but monthly payments are reduced. While a longer term may ensure that a customer's monthly energy savings exceed monthly loan payments, extending the loan term also means that the borrower pays interest for a longer period of time, thus incrementally increasing the cost of the investment.

[13] From 2008-2009, middle income homeowners spent approximately $42.5 billion on home improvements (Census 2009).Home improvement spending by renters is not available.

- **"Replace Aging/Broken Equipment"** – Many middle income households have aging or broken equipment that they know needs to be replaced – and enabling them to invest in more efficient equipment can be attractive. Allowing participants to make weatherization investments in conjunction with these equipment replacements may increase program participation.
- **"Solve Health & Safety Issues"** – Specific health-related triggers can open significant markets for energy improvements among low and middle income families. For example, consider focusing on households with asthmatic children where unhealthy home air quality is a trigger for asthma attacks which can be ameliorated by upgrades that focus on airflow, adequate ventilation, and using building materials that do not aggravate or cause health problems.[14]
- **"Save Money by Reducing Energy Bills" –** While high energy bills are not a priority issue for some, many middle income households face significant housing affordability challenges, and reducing their energy bills can increase their financial stability. Reducing the cost of heating or cooling may also allow households to afford greater comfort in their homes.

Make It Easy (But Not Too Easy)

Offering simple, seamless, streamlined services is particularly important for middle income households. Packaging incentives, minimizing paperwork, and pre-approving contractors gives people fewer reasons to decide against or delay energy upgrades. However, while an easy process is vital, making program elements free (such as the initial energy assessment) may attract "tire kickers" who do the first step, but never make improvements.

Access to Capital

The upfront cost of home energy improvements is a significant barrier to investment. Middle income households have historically invested in home improvements, and many (65 percent) have not needed financing to do so (Guerrero 2003). But the recession has depleted household savings, suggesting that many middle income households need financing to overcome this barrier.

Challenges to Accessing Capital

Housing wealth is the primary asset against which middle income households have historically borrowed, and that foundation has eroded. Nationally, housing prices have declined by almost a third (32 percent), but middle income households have been disproportionately impacted, as they had more of their wealth invested in their primary residences heading into the

[14] There are options to simultaneously improve indoor air quality (IAQ) and improve energy efficiency. However, it is important that energy improvements include adequate ventilation to mitigate any potential air quality risks caused by reducing air leakage from homes.

recession and their primary residences have lost a greater percentage of property value as compared to the homes of their wealthier peers (see Figure 2).[15]

Figure 2. Case-Shiller 20-City Composite Home Price Index
January 2007 to June 2011 in three major U.S. cities, tiered by initial property value

Source: S&P 2011

At the same time that home equity has declined, lenders have responded to increasing consumer risk by restricting access to other types of loan products. Today, many of the largest energy efficiency loan programs have application rejection rates in the 30-50 percent range – and these rejection rates are higher among middle income households than upper income households (Fuller et al. 2011).

Opportunities for Increasing Access to Capital

A number of energy efficiency programs are deploying credit enhancements, novel underwriting criteria, and innovative financing tools to reduce risks for both financiers and borrowers in an effort to increase the availability of energy efficiency financing for middle income households.[16] Many of these initiatives are new, and it is important that their impacts on middle income participation in home energy improvement programs be evaluated as programs mature.

Credit Enhancements. By reducing lender risk, publicly-supported credit enhancements can leverage limited public monies and attract additional private capital for residential loans.[17]

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[15] The median middle income home value in 2007 was $150,000 (Bucks et al. 2009). Assuming a value decline of approximately a third, this median value is likely to be approximately $100,000 today. This value falls into the "low tier" of the three-tiered Case-Shiller 20-City Composite Home Price Index across all of the index's 20 major metropolitan statistical areas (MSAs) except for Phoenix (where properties under $95,901 are in the "low tier") (S&P 2011).

[16] Underwriting criteria exist to ensure that those who get access to financing are willing and able to repay it. Care needs to be taken with who is given access to credit and what claims are being made about the financial benefits of energy improvements.

[17] LLRs reduce lender risk by providing first loss protection in the event of loan defaults. For example, a 5 percent LLR allows a private lender to recover up to 5 percent of its portfolio of loans from the LLR. A $20 million fund of private capital would need a $1 million public LLR (5 percent coverage), leveraging each public dollar 20 to 1. On any single loan default, the LLR typically pays only a percent of the loss (often 80 percent) to ensure the lender is incentivized to originate loans responsibly.

Credit enhancements – in the form of loan loss reserves (LLRs), subordinated debt, and guarantees – can reduce a lender's risk by sharing in the cost of losses in the event that a borrower defaults. Several programs are using credit enhancements to incentivize their financial partners to offer energy improvement loans to households who would otherwise not have access to capital. Some are simply using larger than average LLRs to compensate lenders for the additional risk associated with more lenient underwriting standards, while other programs are providing lenders with tailored enhancements for each loan issued to a less qualified borrower.

Alternative Underwriting Criteria. Rather than using credit enhancements to expand financing to "riskier" borrowers, a number of energy efficiency financing programs are deploying alternative underwriting criteria to identify creditworthy borrowers who do not meet traditional lending standards. These programs take a number of approaches, but most rely on strong utility bill repayment histories to replace or reduce the importance of credit scores and/or debt-to-income (DTI) ratios.

Innovative Financing Tools. New financial products may be more effective at serving middle income households—particularly those that do not qualify for existing tools. The three financing tools highlighted below have the potential to enhance repayment trends and, in so doing, may catalyze underwriting practices that provide more middle income households with access to capital:

1. *On-bill financing (OBF).* Many households have long histories of paying their utility bills regularly, and some financial experts believe that on-bill repayment will reduce loan delinquency and increase household willingness to finance energy improvements. In some cases, programs attach the repayment obligation to a household's utility meter (instead of the individual customer). Subject to existing regulatory practices, nonpayment could also trigger utility shut-off, a powerful customer incentive to make payments.[18]
2. *Paycheck-deducted loans.* Paycheck-deducted financing involves repaying a loan through regular, automatic deductions from an employee's paycheck. Under one model developed by the Clinton Climate Initiative, a credit union provides the loan capital, and loan repayment is deducted through payroll and automatically transferred to the credit union. The security of the payroll deduction allows credit unions to do more lenient underwriting and offer a lower interest rate than they would otherwise offer for standard unsecured loans.
3. *Property Assessed Clean Energy (PACE).* For those middle income households who have equity in their homes, PACE may be a promising financing tool if it gets past the current regulatory hurdles.[19] PACE programs place tax assessments in the amount of the improvement on participating properties, and property owners pay back this assessment on their property tax bills. Like other property taxes, these assessments are treated as senior liens; which makes them very secure. PACE is debt of the property, which suggests that underwriting need not be based on a borrower's personal creditworthiness (and that the financing can be transferred with the property). PACE currently faces significant regulatory

[18] The same consumer protections that guard against utility service cancellation in the event of utility bill nonpayment also protect on-bill financing borrowers from meter shutoff in the event of loan nonpayment.
[19] These regulatory obstacles are outlined in a 2010 LBNL policy brief: http://eetd.lbl.gov/EA/EMp/reports/ee-policybrief081110.pdf

hurdles, which have largely eliminated its use around the country for the residential market, pending court rulings or federal legislation.

Middle income households clearly need new ways of accessing affordable credit if they are to make home energy upgrades. However, it is important to acknowledge that there can be negative consequences to promoting loans and other products to particularly vulnerable segments of the population. Underwriting criteria exist for a reason – to ensure that those that get access to financing are willing and able to make required monthly payments. Care needs to taken with regard to who is given access to credit and what claims are being made about the benefits of energy improvements.

Building Structure Issues

A significant number of middle income houses have building structure and maintenance issues that reduce their value and can adversely affect the health and safety of their occupants. Households are often aware that these problems need to be addressed, but in an uncertain economy, households are reluctant or unable to invest scarce resources in making fixes before those problems turn into emergencies. Frequently, these problems must be addressed before – or in conjunction with – the installation of energy improvements. While more expensive in the short run, addressing non-energy issues as part of energy efficiency program delivery can attract more participants and address important health and safety hazards. The following program elements may make addressing these issues easier for programs and households alike:

- **Leverage Weatherization Contractors.** The existing network of more than 1,000 organizations that deliver the services of the federal Weatherization Assistance Program may have the skills and experience needed to serve middle income households with both energy and non-energy housing issues. In addition, many face the likelihood of significant layoffs without additional income streams as American Recovery and Reinvestment Act funding winds down. While WAP delivery agents are experienced in home performance, many may lack the complementary skills necessary to sell energy improvements.
- **Allow Non-Energy Measures in Energy Efficiency Financing.** Nationally, about 10 to 15 percent of low income households are rejected from the Weatherization Assistance Program (WAP) due to the presence of health, safety, or maintenance issues (Wilson 2011). It is reasonable to expect that some of the same patterns of maintenance, health and safety problems are also present in middle income homes – particularly those households on the lower end of this income range. Allowing households to use a portion of their energy efficiency loan for non-energy measures may be an attractive way to address these issues. Clean Energy Works Oregon (CEWO) permits households to use up to 20 percent of the energy improvement loan as a "contingency allowance" for non-energy improvements such as water damage repair, ventilation improvements, dealing with old knob and tubing wiring, etc.
- **Coordinate Public Funding from Multiple Sources.** Streamlining existing funds and services can reduce intervention costs and enhance benefits for households by presenting the homeowner with multiple complementary services in a single, coordinated package. For example, the Green & Healthy Homes Initiative is bundling weatherization services with home health services (such as lead hazard reduction and indoor allergen reduction) to

implement a comprehensive assessment, intervention, and education program that improves health, economic and social outcomes of low and middle income families.

The Role of Policy

While important for reaching middle income households, the program design, outreach and financing strategies outlined in this report are probably not sufficient to deliver energy improvements to this market at scale. A range of policy options are discussed below – and several are likely to enhance energy efficiency across all markets, including to middle income households.

Energy Savings Targets

More than half of the states have established energy savings targets of some sort through an Energy Efficiency Resource Standard (EERS), a statutory requirement for utilities to acquire all cost-effective energy efficiency, or energy efficiency goals that are described in utility resource plans. These states and the federal government are expected to spend $7.7 billion on non-low income multi-measure home energy efficiency programs over the next 10 years (SEE Action 2011). The design features of these policies influence the degree to which energy efficiency program administrators are motivated to provide more comprehensive home energy services. EERS's with comprehensive, long-term savings goals and "all cost-effective" policy guidelines that consider a societal perspective (e.g. including social impacts, environmental externalities) are more likely to encourage comprehensive residential energy efficiency programs.

Cost Effectiveness Considerations

More than two thirds of the 43 states with energy efficiency programs funded by utility customers place primary weight on the total resource cost (TRC) test to select those programs. The TRC typically includes a limited set of non-energy benefits that residential energy upgrades deliver in calculating total benefits. Approaches that may enhance and broaden opportunities for home energy upgrade programs targeted at middle income households include the following:

- **Measuring Cost Effectiveness on a Portfolio Basis.** Screening energy efficiency efforts at the portfolio level allows administrators to pursue efficiency across multiple sectors, including hard-to-reach markets such as low and middle income households, small business, and others.
- **Balancing Program Screening Decisions Across Multiple Cost Effectiveness Tests.** Program administrators and regulators can weigh the merits of programs and portfolios across multiple tests that bring a broader array of values into consideration. Regulators can also specify that program administrators use specific inputs to cost-effectiveness screening (e.g., a social discount rate, methods to quantify non-energy benefits).
- **Valuing Non-Energy Benefits.** Public health, safety, equity, and economic development could be considered as explicit policy goals in developing a portfolio of energy efficiency programs.

- **Exempting Project Components and Programs from Resource Testing.** Necessary, non-energy project costs such as mold remediation and roof repair could be exempted from cost effectiveness testing screening methods for programs that target these households. For example, in some states, low-income energy efficiency programs are treated as "non-resource" programs that help meet equity objectives and are not required to pass a TRC test as a condition for being offered. A similar approach could be extended to efficiency services for some middle income households – particularly those that have been hard hit by the recession.

Building From Voluntary Programs to Regulatory Solutions

Additional policy options include codes, standards, labeling, and upgrade regulations:

- **Codes, Standards and Work Specifications.** Building energy codes and appliance, lighting, and equipment standards can contribute substantially to efficiency among middle income households. "Reach" codes and financial incentives for even higher efficiency buildings and equipment can encourage market innovation.[20]
- **Labeling, Disclosure and Upgrade Regulations.** Building labeling and energy use disclosures can build a more efficient marketplace by making the full costs of operating a home more transparent to renters and homebuyers. These tools make energy efficiency more visible—and valuable—in the home real estate market. These disclosures can also be transitioned into minimum energy performance standards (for example, Boulder, Colorado's SmartRegs ordinances).[21] Augmenting voluntary programs with regulations like those in Boulder may allow policymakers and energy efficiency program administrators to target limited public funds toward increased support for the most financially vulnerable low and middle income households.

Conclusion

It is important to recognize that progress is being made on delivering home energy efficiency upgrades to the residential sector. Many residential energy efficiency program administrators are increasing their emphasis on comprehensive home energy upgrade program offerings. Contractors are adding to their skill sets and adjusting their business models. Despite this progress, improving the home energy efficiency of middle income households is a challenging prospect. Beyond the significant barriers to driving demand that exist in the general population, middle income households face greater financial insecurity that can make proactive investment in energy improvements prohibitive. Those middle income households who are motivated to act are often unable to access financing or must address costly structural and maintenance issues in their homes before investing in energy efficiency. This report describes a number of financing tools, program delivery models, and outreach strategies that show promise

[20] Reach codes provide incentives for buildings that achieve better energy savings than baseline building energy codes.
[21] A case study on Boulder's SmartRegs ordinances is available here: http://eetd.lbl.gov/EA/EMP/reports/mi-policybrief-3-16-2012.pdf

in overcoming these barriers. However, it is clear that while these approaches may prove effective on the margin, they are not enough to be effective at the requisite scale for addressing broad public policy goals. Instead, these approaches should be seen as potential bridges or complements to robust public policies that provide access to energy efficiency for all market segments.

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