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Abstract

This paper describes an energy efficient housing stimulus strategy that can: (1) quickly provide large-scale job creation; (2) reduce home energy bills by 30% to 50% with associated reductions in emissions and energy assistance spending; (3) stabilize home values and reduce foreclosure inventory; (4) help to eliminate childhood lead poisoning; and (5) implement regulatory reforms that highlight market incentives for cost effective energy efficiency and alternative home energy investments. These benefits, far in excess of costs, can be achieved by combining "lead-safe window replacement" with other weatherization activities and simple regulatory and market reforms. This strategy can help to coordinate American Recovery and Reinvestment Act funding for energy efficiency, the $75 billion Making Home Affordable plan to reduce foreclosures, and the recently announced partnership between the Departments of Energy (DOE) and Housing and Urban Development (HUD) to streamline weatherization efforts and spur job creation.

Key Words: Energy Efficiency, Cost Benefit Analysis, Housing, Lead Poisoning

Energy Efficient Housing Stimulus that Pays for Itself

President Obama has charged his economic team with finding "areas where we can get a twofer, where we're getting both a short-term stimulus and we're also laying the groundwork for long-term economic growth." (CQ Transcriptswire, 2008) This paper presents a strategy that can yield a fiver: (1) provide large-scale job creation; (2) reduce home energy bills by 30% to 50% with associated reductions in emissions and federal spending for energy assistance; (3) stabilize home values and reduce the foreclosure inventory; (4) help to eliminate childhood lead poisoning; and (5) implement regulatory reforms that highlight market incentives for cost effective energy efficiency and alternative energy investments. These benefits, far in excess of costs, can be achieved by combining "lead-safe window replacement" with other weatherization activities and simple regulatory and market reforms. This strategy can provide a critical connection between American Recovery and Reinvestment Act funding for energy efficiency, the $75 billion Making Home Affordable plan to reduce foreclosures, and the recently announced partnership between the Departments of Energy (DOE) and Housing and Urban Development (HUD) to streamline weatherization efforts and spur job creation.

Large-Scale Job Creation

Window replacement is a labor intensive activity that can quickly create millions of jobs with window manufacturers and their suppliers and, importantly, for housing renovation workers, especially hard hit by the housing market decline. Secondary, economic multiplier effects would include increased demand for light trucks from workers employed by this initiative. The 2008 spike in gas prices has (belatedly) discouraged the use of light trucks in rush hour commutes, but

the light truck market has also been hard hit by the decline in housing construction and renovation work, where trucks are essential tools of the trade. Housing workers who are able to replace aging pickups due to new work generated by a national window replacement initiative would also find that trucks available today can be much more fuel efficient than the old models they replace.

Reduce energy bills, emissions, and federal energy assistance

Replacing old single-pane windows with Energy Star windows would provide ongoing economic stimulus for decades to come by reducing utility bills by hundreds of dollars every year for every family residing in homes targeted by this strategy. Low-e windows that reduce solar gain to save on air conditioning (AC) also yield the greatest savings in afternoon hours when peak demand strains electric generating capacity. Targeting households eligible for the Low Income Home Energy Assistance Program (LIHEAP) would yield ongoing federal savings by replacing annual energy assistance with permanent energy bill savings. This strategy would complement Weatherization Assistance Program activities, which often include adding insulation and reducing excess air infiltration, but rarely include window replacement.

Stabilize home values and reduce foreclosure inventory

This strategy can help to halt the decline in home prices by putting equity into homes in the form of energy efficiency. While many factors determine home prices, home value increases by about $20 for every one dollar reduction in annual utility bills, after controlling for other home characteristics. (Nevin & Watson, 1998) Academic research and realtor surveys also specifically document higher home value associated with window replacement. (Nevin et al, 1999; Alfano,

2002-2009) Providing federal funding for window replacement and other weatherization work in any home purchased from the inventory of foreclosed homes would target this equity-enhancing investment directly to neighborhoods hard hit by foreclosures.

Help eliminate childhood lead poisoning

Childhood lead poisoning is the most pernicious and pervasive child environmental health problem in the USA. Extensive research shows that preschool lead exposure profoundly affects the risk of later educational failure and criminal behavior. Lead paint hazards in older homes, including deteriorated lead paint and lead contaminated dust, are by far the most common cause of early childhood lead exposure today. Severe lead poisoning is often caused by lead paint chip ingestion, but the much more common exposure pathway is lead-contaminated dust, ingested by young children via normal hand-to-mouth activity as they crawl and play on floors. Ingested lead travels through the bloodstream to the child's brain, where elevated blood lead causes many types of neurobehavioral damage. (Lidsky and Schneider, 2003) Impoverished, minority children are disproportionately harmed by lead paint hazards but all children in older housing are at risk.

Lead paint hazard reduction can be achieved through interim controls that remove lead dust and stabilize deteriorated lead paint and/or permanent abatement of these hazards. Hazard reduction actions in any specific home can be determined by home-specific risk assessments that include testing the lead content of deteriorated paint and paint on friction surfaces (e.g., windows) and wipe testing for lead in dust. Lead safe window replacement avoids these up front evaluation costs, yields substantial energy savings, and can permanently remove lead paint hazards via the following four-step upgrade in homes with single-pane windows (Nevin and Jacobs, 2006; Jacobs and Nevin, 2006; Nevin, et al., 2008):

- Replace all single-pane windows with Energy Star windows;
- Stabilize any significantly deteriorated paint;
- Perform specialized cleaning to remove any lead-contaminated dust; and
- Perform clearance (dust wipe) testing to confirm absence of lead hazards after cleanup.

Windows have the highest levels of lead in paint and dust of any building component, and friction surfaces on windows create lead dust hazards even in homes without any deteriorated paint. Lead paint was banned after 1978, and is especially common in homes built before 1960. Double-pane windows became widely used in colder climates in the 1980s, and low-e windows became common in the 1990s. As a result, research shows single-pane windows in older housing are reliable indicators of both lead paint hazards and inefficient energy use.

Regulation reform and market transformation

Despite the research linking home value to energy costs, standard mortgage underwriting ignores energy use. Income ratios that determine whether you qualify for a mortgage compare income to PITI - Principal, Interest, Taxes, and Insurance. There is no "E" for energy in income ratios and no utility bill analysis in standard appraisals, even though energy costs in many homes exceed taxes and insurance combined. Lenders do offer Energy Efficient Mortgages (EEMs) that stretch the income ratios for efficient homes, but EEM use is limited because EEMs do not affect appraised value, and lenders can stretch income ratios for other reasons (without additional paperwork needed for an EEM). In fact, the recent surge in mortgage defaults and foreclosures reveals how reckless lenders became in qualifying people for mortgage payments they could not afford. The bursting of the housing market bubble and subsequent decline in home prices should

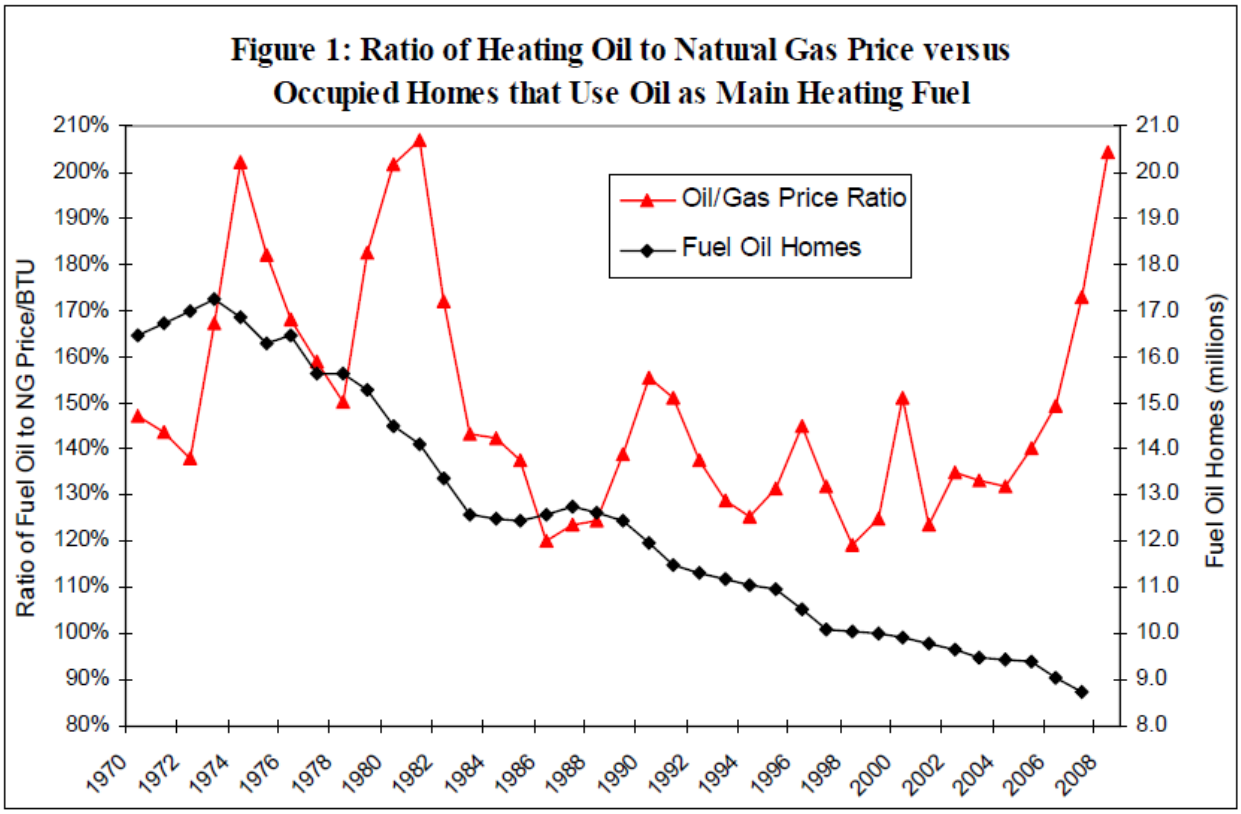
end any debate about the fact that sustainable home value is inexorably linked to what people can afford to pay to live in those homes. Energy costs are a major component of housing costs, and should be explicitly incorporated in standard underwriting and appraisals for all mortgages.

How energy bills affect the housing market and home values

One early academic study linking energy costs to home value found that the 1974 spike in heating oil prices changed the resale price of gas-heat versus oil-heat homes. (Halvorsen and Pollakowski, 1981) There was no difference in home value related to heating fuel in 1970-1973, but there was a $4,597 premium for gas-heat homes in the first half of 1975.

Figure 1 shows how 1970-2008 trends in the ratio of heating oil to natural gas prices have affected the total number of oil-heat homes due to new construction preference for gas heat, demolition of old oil-heat homes, and fuel switching in existing homes.1 In 1973, 17.2 million homes used oil heat, but by 1977 there were just 15.6 million oil-heat homes.[1] After the 1979 spike in heating oil prices, there were just 12.6 million oil-heat homes by 1983. The 1980s oil price crash halted the decline in oil-heat homes until the 1990 invasion of Kuwait caused another spike in the price of heating oil, and by 1999 there were 10 million oil-heat homes. In 2007 (the most recent data) there were just 8.7 million oil-heat homes. The percentage of new construction homes with oil heat fell from 10% in the early-1970s to 2.7% in 1985, rose to 4.4% by 1989 (as oil prices fell), then fell to 1.7% by 2007.[2] The extreme spike in heat oil prices relative to natural gas from 2003 to 2008 could prove to be the final death knell of the U.S. “heating oil season”.

[1] Price ratio based on residential gas and oil price per BTU (Energy Information Administration, 2008 and 2009)
[2] Built within the last four years (U.S. Bureau of the Census, 1974-1984 & 1986-2008)



Source: U.S. Bureau of Census 1986-2008; Energy Information Administration, 2008 and 2009
(Price Ratio based on Heating Oil and Natural Gas Prices per BTU)

Home energy efficiency impact on home value

Other research in the 1970s and 1980s found that home energy-efficiency increased home value regardless of heating fuel, with some evidence that the premium for energy-efficient homes reflected a rational trade-off between utility bill savings and after-tax mortgage interest costs. (Corgel et al., 1982; Johnson and Kaserman, 1983; Laquatra, 1986; Longstreth, 1986; Dinan & Miranowski, 1989; Horowitz & Haeri, 1990) This hypothesis was later tested against very large American Housing Survey (AHS) datasets, including separate analysis of 1991, 1993, and 1995 national AHS data and merged 1992-1996 AHS metropolitan statistical area (MSA) data. (Nevin & Watson, 1998) This analysis found that home value increased by about $20 per $1 reduction in annual utility bills, after controlling for living space and other home characteristics (Table 1).

Sub-sample analyses showed the same result for attached and detached homes, regardless of heating fuel used. Mortgage rates were near 7% from 1991-1996, and the mortgage interest deduction resulted in after-tax mortgage rates near 5%, so the efficient home value premium of $20 per $1 in annual energy savings reflected a rational trade-off between annual energy bill savings and after-tax mortgage interest expense

Table 1: Increase in Home Value per Dollar Decrease in Annual Utility Bill

AHS Sample	Sample Size	Time Period	Increase in Home Value per One Dollar Decrease in Annual Utility Bill
National Sample: Detached Homes	16,000	1991	$23
		1993	$20
		1995	*$21*
Merged MSA Sample: Detached Homes	46,000	1992-96	$18
Merged MSA Sample: Attached Homes	3,000	1992-96	*$23*

Source: Nevin & Watson, 1998

Homebuyers do not calculate the present value of energy savings, but many buyers do ask to see utility bills before they make an offer (Long & Foster, 2009), to evaluate their ability to pay their total housing costs. The AHS analysis indicates this budgeting by informed buyers determines the marginal price of energy efficient homes, reflecting a rational trade-off between mortgage interest and energy costs. Moreover, this impact of energy efficiency on home value was evident through the mid-1990s, when energy prices were relatively benign.

Window replacement impact on home value

A subsequent study found more evidence of how energy-efficiency affects home value, based on a Remodeling Magazine (RM) "Cost vs. Value" survey comparing home upgrade costs with realtor estimates of how upgrades affect home value. This study found that 1993 RM value estimates for window replacement were consistent with $20 in added value per $1 of annual energy savings from replacing single-pane windows (and storm windows in cold climates) with standard double-pane windows. (Nevin et al. 1999) This analysis estimated 50% greater savings with Energy Star windows, but reasoned that the 1993 realtor value estimates reflected standard double-pane window savings because high efficiency windows (that now qualify as Energy Star) accounted for just a fraction of replacement windows before 1993. Therefore, this study anticipated RM window replacement value estimates would increase with greater awareness of additional energy savings with Energy Star windows. The 1993 RM value estimate was 74% of window replacement cost, but RM survey value estimates increased to 85% of cost in 2003 and 2004 and 90% in 2005. (Alfano, 2002-2009)

RM window value estimates vary by MSA, with higher cost recovery in colder climates, consistent with higher heating costs, but value estimates have increased in warm climates with greater awareness of AC savings with low-e windows. After large surcharges were added to California electricity rates in 2001, RM cost recovery estimates for window replacement in San Francisco, San Diego, Sacramento and Los Angeles rose from an average of 61% in 1999, to 91% in 2001, and over 112% in 2002 through 2005.

RM survey trend data suggest that realtor value estimates for all upgrades (e.g., room additions and remodeling) have been somewhat inflated by the housing bubble and deflated by the recent fall in home prices. The average value estimate for all RM upgrades peaked at 87% of

cost in 2005 and fell to 67% of cost by year-end 2008, but window replacement value estimates declined less than for other upgrades, from 90% of cost in 2005 to about 78% at the end of 2008.

Net Benefits of Lead Safe Window Replacement

USA child (and adult) blood lead fell substantially from the 1976-1980 Second National Health and Nutrition Examination Survey (NHANES II) through the 1988-199 1 NHANES III due to regulations that removed lead from gasoline, can solder, and new paint. The NHANES III report on blood lead through 1991 noted that lead paint hazards in older homes posed the greatest ongoing childhood lead exposure risk, and warned: "Without efforts to reduce these exposures, population blood lead levels are unlikely to continue to decline." (Pirkle et al, 1994)

Subsequent NHANES data revealed an unexpected 1990s decline in childhood blood lead levels, and housing surveys revealed a concomitant decline in lead paint hazards. (US Centers for Disease Control and Prevention, 1997 and 2000; Jacobs et. al., 2002) Research has now shown that most of the 1990s decline in lead paint hazards and childhood blood lead was due to the replacement of single-pane windows with lead paint on friction surfaces. (Nevin and Jacobs, 2006; Jacobs and Nevin, 2006) Renovation work that disturbs lead paint without proper cleanup can create severe lead dust hazards in the short run, and this likely happened in some homes with unsafe window replacement work over the 1 990s, but the long-term effect was to reduce lead hazards as window replacement removed a key source of dust contamination. The lead safe window replacement strategy was designed to realize the long-term energy savings and lead hazard reduction benefits of window replacement, and protect against immediate lead exposure risks (at modest incremental cost) by conducting paint stabilization, as needed, plus cleanup and

clearance testing for lead dust. Table 2 shows per unit costs, benefits, and energy savings of lead safe window replacement. (Nevin et. al., 2008)

Table 2: Lead-Safe Window Replacement Costs, Benefits, and Energy Savings per Unit

	800 ft^2 Attached 7 Windows	1200 ft^2 Detached, 10 Windows	1800 ft^2 Detached, 16 Windows
Costs:			
Window Replacement	$6,118	$9,684	$15,494
Weighted Average Interior Paint Stabilization	$146	$146	$146
Weighted Average Exterior Paint Stabilization	$291	$291	$291
Specialized Cleanup	$386	$510	$510
Lead Dust Clearance Testing	$175	$219	$219
Average Cost	**$7,116**	**$10,850**	**$16,660**
Market Value Benefits:			
Windows	$5,485	$8,681	$13,890
Weighted Average Interior Paint Stabilization	$144	$144	$144
Weighted Average Exterior Paint Stabilization	$270	$270	$270
Average Market Value Benefit	**$5,899**	**$9,095**	**$14,304**
Average Lifetime Earning Benefit			
Weighted Average in Pre-1940 Housing	$6,847	$6,847	$6,847
Weighted Average in 1940-1959 Housing	$2,847	$2,847	$2,847
Weighted Average in 1960-1977 Housing	$632	$632	$632
Annual Energy Savings (15%-25%)	**$130-216 / yr**	**$194-324 / yr**	**$292-486 / yr**

Source: Nevin et al., 2008

Lead safe window replacement costs, annual energy savings, and related market value benefits vary by size of housing unit and number of windows replaced. Window replacement costs reflect contractor and supplier labor, material, overhead, and profit (the cost per window for a large volume purchase should be much lower than this retail cost). Window replacement market benefits are mainly due to a 15% to 25% reduction in fuel bills.[3] The weighted average cost and value for paint repair reflect the fraction of homes with deteriorated paint multiplied times the average cost and value of paint repair in those homes. The weighted average lifetime

[3] Plus an appearance value of roughly $100 per window (Nevin et al, 1999)

earnings benefits of avoided lead exposure reflect the fraction of homes with resident preschool children multiplied times the average benefit for those children. (Nevin et. al., 2008)

It is important to note that the costs shown in Table 2 reflect remodeling contractor and supplier data including labor, material, overhead, and profit. This retail window replacement cost should substantially overstate the cost per window the federal government should pay for a large volume purchase of windows during a severe housing industry contraction.

The documented benefits of avoided preschool lead exposure

The lifetime earnings benefits of lead safe window replacement builds on a long history of regulatory analysis and research quantifying the present value of higher earnings associated with avoided preschool lead exposure. (Schwartz, 1994; Salkever, 1995; U.S. Department of Housing and Urban Development, 1999; Grosse et. al., 2002) Preschool blood lead of 10 ug/dl (micrograms of lead per deciliter of blood) results in an average loss of 7.4 IQ points relative to children with blood lead of 1 ug/dl (Canfield et al, 2003), with associated losses in education attainment. (US Centers for Disease Control and Prevention, 1991; Lanphear et al., 2005; Miranda et al., 2007) USA preschool blood lead trends from 1936-1990 also explain 65% of the substantial 1948-2001 variation in mental retardation (MR) prevalence, 45% of the 1953-2003 variation in the average Scholastic Achievement Test (SAT) verbal score, and 65% of 1953-2003 variation in the average SAT math score. (Nevin, 2009) These temporal trends are characterized by best- fit time lags consistent with lead-induced cognitive damage in the first year of life: A 12-year lag for school-age MR prevalence and a 17-year lag for SAT scores.

Lead paint hazards, including lead-contaminated dust, are found in 68% of pre-1940 homes, 43% of 1940-1959 homes, and 8% of 1960-1977 homes. (Jacobs et. al., 2002) NHANES

data show children in pre-1940 housing account for 40% of all children with blood lead above 10 μg/dL. Another 30% of children above 10 μg/dL are in homes with year-built not reported, mainly in low-income rental units, which are disproportionately older housing units. Preschool blood lead prevalence above 5 μg/dL by year built clearly shows that housing is the key childhood lead exposure risk today: 20% of preschool children in pre-1940 homes have blood lead above 5 μg/dL, versus 14% in homes with year-built not reported, 10% in 1940-1949 homes, 6% in 1950-1959 homes, 4.4% in 1960-1977 homes, 2.8% in 1978-1989 homes, and just 1.2% in post-1989 homes. (Nevin et. al., 2008)

Lifetime earnings benefits in Table 2 vary with age of housing because lead paint hazards are more common in older housing, and lead safe window replacement avoids pre-intervention risk assessment costs by using single-pane windows as an indicator of lead paint hazards. About 65% of pre-1960 housing and 55% of 1960-1979 housing have mostly single-pane windows. Almost all pre-1940 homes with single-pane windows also have lead paint on interior window surfaces. Replacing those old windows almost always yields lead hazard reduction benefits for current and future resident children because lead paint on old window friction surfaces acts like a perpetual lead-contaminated dust generator. Approximately 40% of 1940-1959 homes and 10% of 1960-1979 homes with single-pane windows also have lead paint on interior window surfaces. This means 60% of 1940-1959 homes and 90% of 1960-1979 homes with single-pane windows are much less likely to have lead paint hazards, reducing the average lifetime earnings benefit of lead safe window replacement in these homes. Lead safe window replacement in these homes would still yield the same annual energy savings and market value benefits, including the market benefit of routine paint repair as needed.

The estimated benefits of avoided childhood lead exposure in Table 2 do not include any crime reduction benefits even though many controlled studies point to childhood lead exposure as major risk factor for later offending. (Wright et. al., 2008; Dietrich et al., 2001; Denno, 1990; Needleman et al., 1996; 2003) National preschool blood lead trends also explain most of the substantial variation in crime rates across decades in the USA, Canada, Britain, Australia, New Zealand, West Germany, France, Italy, and Finland. (Nevin, 2007) Crime rates track blood lead with very similar time lags within each nation: A 23-year lag for violent crime and an 18-year lag for property crime. Violent offending peaks around age 23 and property crime offending peaks around age 18. This relationship is consistent with lead-induced neurobehavioral damage in the first year of life, and peak offending ages linked to another critical period of brain growth from adolescence through the 20s. The rise and fall of average preschool blood lead over time is also consistent with subtle shifts in peak offending ages across decades.

Additional savings and market benefits from other weatherization work

Table 2 reflects only window replacement costs and benefits and not any costs, energy savings, or market benefits of other weatherization. The Weatherization Assistance Program (WAP) rarely replaces windows due to performance goals for energy savings per dollar spent and expenditure limits per house. The WAP often uses high density insulation methods that also reduce excess air infiltration, and duct sealing to reduce AC and heating costs. (Berry et al, 1997) Evaluation data show the WAP reduces average gas-heat bills by about 20%. (Schweitzer, 2005) Combining lead safe window replacement with high density insulation methods and duct sealing could double the energy savings and associated market benefits shown in Table 2. This strategy yields additional savings when heating and AC equipment are replaced, because improved

structural efficiency reduces the size and cost of AC and heating equipment needed (per square foot of living space)..

Housing affordability, foreclosure prevention, and economic stimulus

The Making Home Affordable Modification Program will spend $75 billion to reduce foreclosures by working with lenders to make mortgage payments more affordable for 3 to 4 million at-risk homeowners. (U.S. Department of the Treasury, 2009) The costs and benefits of this program provide a useful benchmark for comparison with lead safe window replacement.

If a lender reduces a borrower's principal, interest, taxes, and insurance (PITI) payment to no more than 38% of income, then the $75 billion Modification Program will match additional lender payment reductions to bring the borrower's PITI-to-income ratio down to 31%. In other words, the lender must reduce payments by another 3.5% below 38% of income in order for this program to provide a matching 3.5% to reduce the borrower's ratio to 31%. Borrowers also get up to $1,000 per year for five years, reducing their mortgage principal balance, as an incentive to stay current on the loan. Mortgage holders receive fees for modifications plus "pay for success" fees for three years if the borrower stays current on the loan. The program also makes payments of up to $10 billion to partially offset any investor losses due to ongoing home price declines. In summary, the program provides federal match funding to reduce borrower payments by 3.5% of income, and creates incentives for lender rate reductions, mortgage holder participation, and continued payments by 3 to 4 million borrowers, at a cost of $75 billion.

Alternative 1: A LIHEAP-eligible household strategy

Table 3 shows the net benefits of an alternative strategy, spending almost $75 billion for lead safe window replacement in pre-1960 housing with LIHEAP eligible residents. There are about 41 million pre-1960 housing units in the United States (divided almost equally between pre-1940 and 1940-1959 units) and 26.9 million of those pre-1960 units (65%) still have mostly single-pane windows. About one quarter of U.S. households have income below the level that makes them eligible for LIHEAP, which means about 6.7 million LIHEAP eligible families live in pre-1960 housing with mostly single-pane windows. The federal government could pay for lead safe window replacement in every one of those 6.7 million homes at a cost of $73 billion. This would help about twice as many households as the 3 to 4 million expected to benefit from the $75 billion Modification Program. This lead safe window replacement strategy would also provide market benefits of $61 billion, related energy savings of almost $2 billion per year, over $32 billion of earnings benefits, plus large-scale job creation and economic multiplier effects.

Table 3: Lead-Safe Window Replacement in LIHEAP Eligible Homes*

Year Built	**Pre-1960 Units**	**Pre-1980 Units**
Occupied Housing (units, thousands)	41,396	82,061
With Single-Pane Windows	26,907	49,273
LIHEAP Eligible: 25%	6,727	12,318
LIHEAP Eligible Lead Safe Window Replacement ($ millions)		
Costs	$72,986	$133,653
Market Value Benefits	$61,181	$112,035
Lifetime Earnings Benefits	$32,467	$36,001
Net Benefits	**$20,662**	**$14,382**
Annual Energy Savings	$1,742	$3,190

*Based on Table 2 costs, benefits, and energy savings for 1200 ft^2 detached home with 10 windows

In terms of housing affordability, the Modification Program focus on PITI as a percent income does not address the related concept of "energy burden", the percent of income used to pay residential energy costs. In 2003, the average household energy burden was 6% of income,

but average burden for LIHEAP eligible households was 13.6%. (Campaign for Home Energy Assistance, 2006) With energy bill savings of 20%, lead safe window replacement would have reduced the 2003 energy burden for LIHEAP eligible households by 2.7% of income (20% of 13.6%). Residential electricity and natural gas prices increased over 30% from 2003 to 2008, as heat oil prices rose 135%. (Energy Information Agency, 2009) Therefore, a 20% reduction in 2008 LIHEAP eligible household energy burden would have been about equal to the 3.5% reduction in "PITI burden" directly funded by the Modification Program, but lead safe window replacement would provide that affordability gain to twice as many households.

With respect to foreclosure prevention, the Modification Program only targets PITI as a percent of income, but the amount of equity borrowers have in their home is a more important factor in mortgage default and foreclosure risk. The $61 billion of market benefits from lead safe window replacement in 6.7 million housing units is equity put into those homes. The lower interest rates and incentives of the Modification Program do not create home equity because they are not transferable to any future buyer of that home, but ongoing annual energy savings are transferred to future buyers, along with other home characteristics that determine home value.

The administration expects the Modification Program to help stabilize home prices for other homeowners, based on estimates of how foreclosures affect other local home prices. This market effect would be greater with lead safe window replacement in LIHEAP eligible homes because this strategy would help twice as many households and actually add $61 billion of equity to upgraded pre-1960 homes. Table 3 shows this equity-enhancing market benefit increases to $112 billion if homes assisted include all LIHEAP eligible pre-1980 homes with single-pane windows. Adding other weatherization upgrades could double the annual energy savings and the equity-enhancing market benefits shown in Table 3.

Alternative 2: A foreclosure inventory sales incentive strategy

Robert Samuelson (2009) describes the administration's housing strategy as "only half a plan", focusing on foreclosure prevention when the "best way to limit foreclosures is to promote an economic recovery by stimulating home buying." Samuelson sees a deflationary psychology causing buyers to wait for home prices to fall further, even though housing affordability is now at a multi-decade high, based on an index that compares family income to mortgage interest rates and home prices. He suggests the simplest way to break this psychology is to "bribe prospective buyers not to wait", perhaps by offering a $15,000 tax credit for the purchase of a new home.

One problem with this proposal is that the focus on new homes does not recognize that older homes account for a larger share of the inventory problem. Pre-1980 housing accounts for 57% of all vacant homes for sale or rent; homes built after March 2000 account for 18%. (U. S. Bureau of the Census, 2009) Homes built after March 2000 are less likely to be financed under Fannie Mae and Freddie Mac mortgage limits, due to higher prices for new homes, so pre-1980 housing likely accounts for well over 60% of the Fannie Mae and Freddie Mac foreclosed home inventory. Reducing that foreclosure inventory, and the downward pressure it exerts on all home prices, is the key to restoring strength and stability in financial markets. Lead safe window replacement and other weatherization could be funded as a promotion to accelerate resale of foreclosed homes owned by Fannie Mae and Freddie Mac. Targeting foreclosed homes would also reduce costs because renovation work in empty homes is often less expensive, especially in older homes where some extra expense must be incurred to protect residents from lead dust hazards during renovation.

Many economic stimulus provisions could be coordinated for this effort, including: HUD lead paint abatement, Community Development Block Grant (CDBG), and HOME funds used to

rehabilitate affordable housing; Neighborhood Stabilization funds distributed through CDBG to buy, repair, and resell foreclosed homes; and DOE Energy Efficiency and Conservation Block Grant and WAP funds. The Making Home Affordable Program will also increase the Treasury funding commitment to Fannie Mae and Freddie Mac by $200 billion, which could be used to leverage stimulus funds to reduce their foreclosed home inventory. With the highest housing affordability in decades already sparking buyer interest, especially in foreclosed homes, offering lead safe window replacement and weatherization upgrades with the sale of foreclosed homes could further stimulate buyer demand, help clear the excess inventory of empty homes, and halt home price declines in areas hard hit by foreclosures by putting new equity into those homes.

This foreclosure sale incentive could be offered to anyone buying a home as a permanent residence, providing a double-incentive for first-time buyers now eligible for a tax credit of up to $8,000 for any home purchase. Samuelson states that these "are younger and poorer buyers - the weak credit risks of today's crisis. They won't rescue housing." Actually, first-time buyers are the only ones who can reduce the excess inventory of empty homes. Wealthier households have either decided they do not want to own a home, or they already own one. Some of those families want to sell their current homes and buy newer homes but cannot do that with the fierce price competition from so many foreclosed homes. Any strategy that does not attract first-time buyers will leave us playing musical housing chairs, with way too many chairs. Samuelson is right that first-time buyers are poorer, which means they should be especially interested in foreclosed home bargains and home energy savings. He is also right that first-time buyers are younger, and thus more likely to have young children vulnerable to lead paint hazards.

Implementation Options, Accountability, and Regulatory Reform

The specific proposals described above, targeting LIHEAP eligible households and/or foreclosed property sales, can be modified in many ways that would still realize the benefits per housing unit shown in Table 2. One way to maximize the impact on neighborhoods hard hit by foreclosures would be to combine both strategies. There are many neighborhoods with high concentrations of both LIHEAP eligible households and empty foreclosed homes. Renovation crews could provide lead safe window replacement and other weatherization upgrades for most homes in such neighborhoods, slashing energy burden for occupied units, attracting new buyers of empty units, and increasing home equity in all upgraded units. This neighborhood effort to stabilize home values should also include rental units, because older housing often shifts from "for rent" to "for sale": AHS data show 54% of all pre-1950 units were rented at some time from 1985 to 1997, but just 22% were rental units throughout this period. (President's Task Force on Environmental Health Risks and Safety Risks to Children. 2000)

Accountability and Evaluation

The American Recovery and Reinvestment Act and the Making Home Affordable plan could provide much of the funding needed for this housing stimulus strategy. The DOE and HUD partnership to streamline federal weatherization efforts and spur job creation could also help to implement a coordinated strategy and establish oversight measures to ensure performance and cost accountability and facilitate related regulatory reform. DOE and HUD, working with Fannie Mae and Freddie Mac, could track costs, energy savings, and net benefits of lead safe window replacement and other weatherization in upgraded homes. Simple reporting forms for grantees could record lead safe window replacement costs by housing unit size (square feet) and

number of windows replaced, costs incurred for other weatherization (duct sealing, adding insulation and reducing excess air infiltration), and other renovation work done (e.g., roof repair needed to sell a foreclosed home). Labor hours could be detailed to document renovation job creation. In coordination with electric and gas utilities, longitudinal data could be collected on energy bills for upgraded homes, for comparison with energy bills for similar homes (from utility and/or AHS data). Fannie Mae and Freddie Mac could also collect longitudinal data on resale prices, mortgage defaults, and foreclosures to confirm expected market benefits. This evaluation data would fulfill the administrations commitment to provide stimulus spending and performance data that give "detailed and timely information on how and where recovery dollars are spent". (Emanuel and Orszag, 2009)

Regulatory Reform and Market Transformation

The Interagency Agreement between HUD and DOE promises to "explore home energy disclosure and audit standards as well as new financing tools that will enable national scale investment in residential energy efficiency." (U.S. Department of Energy, 2009) The disclosure most needed is routine reporting of home energy costs, and the financing tool most needed is an explicit recognition of energy costs in mortgage underwriting and appraisals.

Research indicates that informed homebuyers, who ask to see utility bills, determine the marginal price of home energy efficiency across large AHS datasets. Still, many homeowners and homebuyers do not make informed decisions about energy use, and providing better energy cost information could leverage market forces to dramatically improve energy efficiency and housing market economic efficiency. Just as the Truth in Lending Act standardized how lenders disclose loan percentage rates, a "Truth in Energy Cost Act" should require gas and electric

utilities to report 12-month rolling average costs with every utility bill. Utilities could also report weather-adjusted costs using readily available data on average heating and cooling degree days by location. These adjusted annual energy costs should be reported in real estate listings and reflected in mortgage underwriting and appraisals. This systematic reporting of energy bills, and greater awareness of how they impact home value, would encourage homeowners to investigate and make energy saving investments that can earn attractive financial returns.

Incorporating energy costs in mortgage underwriting and appraisals would establish a market mechanism to value energy efficiency, residential solar power, geothermal heat pumps, and other technologies that entail trade-offs between annual savings and up-front investments financed by a mortgage. Energy costs might have been less relevant to mortgage underwriting in decades past, when most homes were similarly inefficient, but new energy technologies require a market mechanism for valuing those investments. Home inspections and appraisals should also better document efficient home features, including insulation levels, window efficiency ratings, and blower door tests that measure excess air infiltration, but the most important audit standard for homebuyers should be PITIE - Principal, Interest, Taxes, Insurance, and Energy.

A lead safe window replacement and weatherization initiative could help launch this market transformation by training independent home inspectors and appraisers to perform blower door tests. Home inspectors should also be trained to do wipe tests for dust lead.4 Performance data collected to evaluate this initiative could also support research by Fannie Mae and Freddie Mac to specify evolving standards for how mortgage underwriting and appraisals should reflect energy costs as they relate to specific energy efficiency and energy technology investments.

Opportunities for Public-Private Partnerships

Charitable donations and foundations could help to leverage the public funding for this initiative. Many utilities already sponsor fuel funds that make charitable appeals for low-income bill-paying assistance, leveraged by LIHEAP incentive funds. Lead-safe window replacement and weatherization could broaden the charitable appeal of utility-sponsored funds to encompass long-term fuel savings through energy efficiency, associated emission reductions, lead poisoning prevention, foreclosure prevention, and home price stabilization. Working with utilities would also complement existing utility programs to promote Energy Star products, including windows.

LIHEAP primarily helps low-income households pay their energy bills, but states can use up to 25% of LIHEAP funds for weatherization (generally administered with WAP funds). The federal government could further enhance the fund-raising potential of utility-sponsored funds by increasing the percent of LIHEAP funds states can use to match utility-sponsored fund donations for lead-safe window replacement and other weatherization. This partnership could also be facilitated by regulatory changes specifying that LIHEAP eligible households are eligible for any federal funds used for lead-safe window replacement and other weatherization (waiving lower income eligibility thresholds for some federal programs).

The participation of foundations could help bring the benefits of this initiative to those likely to become renters, despite the best efforts at foreclosure prevention, by providing a rental alternative to keep families facing foreclosure in their homes. Foundations could buy homes in the process of foreclosure, through short sales at prices below the mortgage amount owed, and rent the homes back to the current occupants. Lenders would have a clear incentive to work with foundations on this effort because lender losses on short sales are lower than on foreclosures. HUD and DOE could encourage this strategy by funding lead safe window replacement and

other weatherization in homes purchased for this purpose. If these transactions were financed with a 10% down-payment, then $100 million of foundation funding could keep $1 billion of housing from being added to the foreclosure inventory.

The MacArthur Foundation (2007) has already launched a $150 million, ten-year effort to preserve affordable rental homes, awarding grants and low-interest loans that leverage available government and other funds. By coincidence, this MacArthur Foundation effort is called their "Window of Opportunity" initiative.

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