

Strategies for Energy Efficiency Retrofitting: Analysis and Recommendations

A Compendium of Data and Data Sources
Provided by Sustainable Spaces

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Energy Smart Homes for America

Reducing Carbon, Creating Jobs, Saving Energy for the American Homeowner

The emerging home energy efficiency industry offers significant promise to achieve several national priorities. Home performance retrofitting creates energy smart homes and it offers the tremendous potential to generate rapid economic stimulus as well as make meaningful progress toward the goals of environmental sustainability and reduced energy consumption.

With a modest investment in the home energy industry, converting American housing stock into energy smart homes has the potential to reduce home energy consumption by at least 25%--equating to a 5% reduction in the US carbon footprint. Thus, a focus on converting America's houses into energy smart homes can spur major advancements in our national energy goals while creating U.S. green-collar jobs and improving the lives and budgets of American homeowners.

- **CLIMATE:** Over 20% of US carbon emissions come from our homes. Fortunately, there is tremendous potential to significantly reduce carbon emissions through cost-effective solutions that are ready for immediate deployment. Achieving a 25% reduction in home energy consumption is a feasible and cost-effective objective for most homes.
- **GREEN-COLLAR JOBS:** Promotion of energy efficiency retrofitting will create hundreds of thousands of green-collar jobs that cannot be outsourced.
- **HOMEOWNER SAVINGS:** Home energy costs are a major growing expenditure in family budgets. These regressive costs pressure low and middle income homeowners, in particular, because they are already struggling with mortgages. A modest one-time home retrofit can save families at least 25% on their energy bills, which, for the average American family, equates to an annual stimulus of \$500 into our local communities.
- **CLEAN GRID:** The rapid return on investment (ROI) from very cost-effective energy efficiency measures affords us the ability to invest in the more costly renewable energy technologies that are necessary to build a clean grid. Large-scale deployment of renewable energy will be made economically sustainable by a combination of high ROI energy efficiency with more costly clean generation. The blending of these will achieve a rate that is cost competitive with grid energy and requires far fewer subsidies.
- **HEALTH:** Improving home performance has the added benefit of simultaneously improving indoor air quality. This improved indoor air quality significantly impacts inhabitants' health and productivity--improved health means reduced health care costs.

Currently, there are substantial subsidies for residential renewable energy generation and some weatherization subsidies for low-income families. However, meaningful incentives for home energy efficiency do not exist for the vast majority of homeowners, namely middle income families. To achieve large scale impact and leverage the public's investment, weatherization and retrofitting efforts should include both low income and middle income homeowners.

In addition, parity must be achieved between incentives for renewable energy generation and energy efficiency. By encouraging integrated projects that combine cost-effective energy efficiency measures to reduce loads with smaller, less expensive renewable energy systems, we will be able to achieve greater improvements in energy use for significantly less investment.

The home performance industry has the fundamental infrastructure in place to play a key role in reducing energy consumption and helping to ensure environmental sustainability. Its cadre of retrofiters, raters, standards, and building technologies is tested and ready. In order to scale quickly, the following four steps are necessary:

1. **INCENTIVES:** Extend up to a 30% tax credit to home energy efficiency retrofitting, similar to the tax incentive available for solar investments for homeowners. Equal incentives will create a level playing field by promoting energy efficiency and renewable energy sources equally. To solve our climate crisis in the built environment, there needs to be a focus on incentives that equally promote renewable generation and energy efficiency based on results not products, providing a balance that is economically sustainable at scale and extending the impact of the public investment by allowing homeowners to choose the most cost-effective measures for their home.

Key elements of an energy smart home incentive:

- 20% prescriptive credit phases out over 4 years, and is meant to spur rapid workforce development with a lower barrier to entry.
 - 30% performance based credit for homeowners who use either a 3rd party auditor or a certified contractor and achieve a 25% or greater savings.
 - Test-in and Test-out per Home Performance with Energy Star guidelines.
 - Credit applies to cost of installation as well as materials.
 - Credit also qualifies as an offset to the Alternative Minimum Tax (AMT).
2. **FINANCING:** Provide federal loan guarantees, interest deduction, and long-term, low-interest unsecured financing options to help homeowners invest in improving their home's performance. With proper financing homeowners can achieve cost effectiveness immediately by offsetting loan payments with energy savings.
 3. **STANDARDS:** Leverage the Home Performance with Energy Star program as a standard model, including third party verification. Mandate national contractor and auditor certification and accreditation through RESNET (Residential Energy Services Network), BPI (Building Performance Institute), or other qualified accreditation agencies who conduct independent, third-party quality assurance on the work performed.
 4. **“MPG” for the HOME:** Like buying a car, knowing a house's energy efficiency can be a valuable criterion for buying a home as energy costs represent a growing monthly expense for many Americans. Homes receiving tax incentives or homes placed on the market for sale could receive a rating by either the DOE Energy Smart Home Scale (e-

scale), or Home Energy Rating System (HERS). These systems provide a simple measure of a building's performance, and are equivalent to giving homes a "miles per gallon" (MPG).

This Energy Smart Homes program creates a win-win proposition of economic stimulus and a sustainable new green economy. It's time to focus on programs that can immediately have an impact on our economy and climate, while giving meaningful relief directly to the American middle class homeowner.

Home Performance Industry Landscape

Energy Efficiency Workforce

- Home Performance Contractors / "Vertically Integrated Contractors"
- Specialty Contractors – HVAC, Insulation, Plumbing, Solar
- Home Energy Raters
- Training Providers
- Weatherization Contractors

Certification, Standards and Programs

- Home Performance with Energy Star – HPwES ([website](#))
- Building Performance institute – BPI ([website](#))
- Residential Energy Network - RESNET ([website](#))
- ASHRAE
- ACCA
- NATE

Advocacy

- Natural Resource Defense Council - NRDC ([website](#))
- ACEEE ([website](#))
- ASE ([website](#))
- NASEO ([website](#))
- COWS ([website](#))
- ACI ([website](#))

Industry Stakeholders

- ACEEE – **American Council for an Energy-Efficient Economy** is a non-profit organization dedicated to advancing energy efficiency as a means of promoting economic prosperity, energy security and environmental protection. ACEEE fulfills its mission by conducting in-depth technical and policy assessments, advising policymakers and program managers, working collaboratively with business and public interest groups, and educating consumers and business.

- **ACI – Affordable Comfort Institute** is a non-profit organization founded in 1986 to define the best ways to make homes energy efficient. The organization’s focus on building science, testing, and diagnostics evolved into home building performance. ACI organizes national and regional conferences and training programs for industry professionals to understand how buildings work.
- **Apollo Alliance** is a coalition of business, labor, environmental, and community leaders working to catalyze a clean energy revolution in America. Apollo Alliance promotes policies and initiatives to speed investment in clean energy technology and energy efficiency, put millions of Americans to work in a new generation of well-paid, green collar jobs, and make America a global leader in clean energy products and services. Apollo coalitions have been established in ten states and four cities to promote policy change consistent with the organization’s Ten-Point Plan.
- **ASE – Alliance to Save Energy** promotes energy efficiency worldwide to achieve a healthier economy, a cleaner environment and greater energy security. To achieve this, ASE leads energy efficiency initiatives in research, policy advocacy, education, technology deployment and communications, and initiates public-private partnerships and strategic alliances to optimize resources and expand its sphere of influence.
- **BPI – Building Performance Institute** is a recognized global leader supporting the development of a highly professional building performance industry through individual and organization credentialing and a rigorous quality assurance program. Since its founding in 1993, BPI has expanded to serve not only the weatherization industry, but also the growing residential and multi-family building performance contracting industry.
- **COWS – Center on Wisconsin Strategy** is a national policy center and field laboratory for economic development. COWS works with business, government, labor, and communities, to try out new ideas, test their effectiveness, and disseminate those with promise. Some areas of focus include economic and workforce development, sectoral strategies and career pathways, clean energy and energy efficiency, and strategies for improving low-wage work
- **The Energy Future Coalition** is a non-partisan public policy initiative that seeks to speed the transition to a new energy economy. Combining expertise and advocacy, the Coalition brings together business, labor, and environmental groups to identify new directions in energy policy with broad political support. The Energy Future Coalition works closely with the United Nations Foundation on energy and climate policy, especially energy efficiency and bio-energy issues. The UN Foundation provides financial and in-kind support to the Coalition.
- **EIA – The Energy Information Administration**, created by Congress in 1977, is the statistical agency of the U.S. Department of Energy. EIA is the country’s premier source of unbiased energy data, analysis, and forecasting. EIA provides this information to promote sound policy making, efficient energy markets, and public understanding about energy and its interaction with the economy and the environment.

- **Home Performance with Energy Star** is a joint program of the U.S. Environmental Protection Agency and the U.S. Department of Energy focused on saving money and protecting the environment through its Energy Star rating for home energy efficiency. HPwES sets standards and provides accreditation to building professionals and has 23 state programs that engage third party auditors to ensure that its quality metrics are being met.
- **NAHB – National Association of Home Builders** is a trade association that helps promote policies that keep housing a national priority. NAHB is a federation of more than 800 state and local associations whose membership consists primarily of home builders and remodelers.
- **NYSERDA – New York State Energy Research and Development Authority** is a public benefit corporation created in 1975 to facilitate change through the widespread development and use of innovative technologies to improve the State’s energy, economic, and environmental well-being. R&D projects have focused on topics including environmental effects of energy consumption, development of renewable resources, and advancement of innovative technologies. NYSERDA, primarily funded by state rate payers, created New York Energy SmartSM, which helps to maintain momentum for the State’s efforts to develop competitive markets for energy efficiency; demand management; outreach and education services; research, development, and demonstration; low-income services; and to provide direct economic and environmental benefits to New Yorkers.
- **RESNET – Residential Energy Services Network** is an industry association that has developed national standards for building energy efficiency rating systems that are recognized by the mortgage and financial industries and the federal government for verification of energy performance for various programs, including EPA Energy Star. The rating system uses a relative energy use index called the HERS Index, which rates on a scale of 0 (Zero Energy building) to 100 (the American Standard Building)
- **SAHF – Stewards of Affordable Housing for the Future** is a network of eight social enterprise nonprofits that provide high quality, affordable rental homes. SAHF's members came together in 2004 to promote their shared ownership objective, which embraces the notion that stable, affordable housing is critically important in the lives of our citizens, including low income seniors and Americans with disabilities, to enjoy a high level of independence.

Business Models

Within the Energy Efficiency industry three business models emerge for the long-term viability across the income spectrums. The three models can work concurrently. The key differences encompass both the income brackets served and the methodology by which the energy efficiency measures are carried out.

Weatherization Assistance Programs

The Low Income Weatherization Assistance Program (WAP) provides eligible households with full-scale home energy conservation services.

The program is administered by a network of local agencies, in many areas the same agency that administers the Low Income Home Energy Assistance Program (LIHEAP or Fuel Assistance) program.

Households that are eligible for the Low Income Home Energy Assistance Program (LIHEAP or Fuel Assistance) are eligible for weatherization services. Eligibility is based on household income no more than 200% of the Federal Poverty Level. See the “Income Guidelines” link for additional information. Priority of service is given to those households with elderly, disabled, children (6 and under), LIHEAP high-energy users, and Native Americans. Homeowners and tenants with their landlord permission are eligible.

Homes also receive a thorough evaluation of the heating system as well as health and safety testing of all combustion appliances. Local licensed and insured weatherization contractors complete the work at no cost to the residents. The local agency inspects all completed work to be certain that the authorized work was completed in a satisfactory manner.

Historically speaking, the WAP tends to provide primarily single-measure energy efficiency retrofitting bundled with utility subsidies. The current structure of the WAP does not lend itself to long-term economic sustainability for large-scale efforts to institute energy efficiency measures in all income brackets.

Home Performance Contractors: “Vertically Integrated” and Specialty Contractors

Home Performance contractors are private sector contractors that utilize building science and diagnostics to create custom, comprehensive performance-based solutions for homes.

A “Vertically Integrated Contractor” holds either a general contracting license and/or multiple specialty contracting certifications and provides comprehensive services within a single business entity. Unlike a specialty contractor, a VIC has the capacity to perform home energy audits and provide solutions to residential homeowners. VICs must be held to the highest standard of Home Performance Contracting through governing bodies offering quality assurance and performance tiered third-party oversight.

Specialty Contractors are contractors that specialize in specific aspects Home Performance, such as HVAC, insulation, plumbing, or solar. These Specialty Contractors are also held to the highest standard of Home Performance Contracting, but will more often be sub-contracted by the aforementioned certified VIC or aggregated by a homeowner in response to recommendations by a third party Certified Energy Rater.

Harvard's Joint Center for Housing Studies estimates that General remodeling contracting firms earning over a million dollars in 2002 generated over 40 percent of employment and captured nearly 60 percent of revenue among all general contractors; indicating that larger firms are beginning to play a more dominant role in the remodeling industry. Additionally, the total number of general and special trade remodeling contractors increased 32 percent between 1997 and 2002 to just over 530,000 with most of the growth occurring among self-employed contractors.¹ With this in mind, the home performance industry has a workforce in place that can be trained and mobilized quickly, while effectively serving high percentages of United States.

Home Energy Raters

Provide energy-efficiency strategies and tests for existing and new residential and commercial construction. Raters offer two major types of services: 1) assistance in reviewing current construction practices and recommended improvements that will result in ENERGY STAR compliance; and 2) conducting Home Energy Rating System (HERS) ratings.

Currently derive most business from rating new construction as part of the Build American and Energy Star Homes Programs. Recent attempts to move towards existing home rating and even diagnostics.

¹ Harvard, The Changing Structure of the Home Remodeling Industry (2005), Joint Center for Housing Studies

Benefits of Retrofitting American Homes

How many buildings or families could benefit from a retrofit?

According to the RECS, in 1997 there were over 101 million U.S. housing units, with total energy use of 10.25 quadrillion Btus (quads) as measured at the building site (the figures cited here all exclude energy consumed in the generation and transmission processes). Average site energy use per housing unit was 101 million Btu in 1997. More than half of these dwelling units were constructed before modern energy codes existed, and over 75% of them require “significant energy upgrades.”² Sixty percent of residential households report having winter drafts and 62% complain of uneven heating and cooling.³

In California, 70% of the GHG emissions related to single-family envelope energy consumption can be attributed to homes built before California had an energy code (1983). Spending \$10,000 to retrofit a 1960s home— adding a new furnace, air conditioner, tight duct system and R-30 ceiling insulation, for example—could save 8.5 tons of carbon, at a cost of \$588 to \$1,176 per ton depending on tax credits and incentives. Increasing the energy efficiency of a new home by 35% from the 2005 Title-24 building energy code standards would cost about \$5,000 and would reduce emissions by 1.1 tons at a cost of \$4,545 per ton. Retrofitting existing homes with energy-efficient features is four to eight times more carbon and cost-effective than further improving new housing, according to a recent ConSol study.⁴

Retrofitting existing homes to achieve energy savings of 25%-35% is highly achievable, as has been shown many times in many locations. For example, a recent evaluation of an existing home retrofit program in Austin, Texas, found average electricity savings were in the range of 25%-35% annually, with yearly energy cost savings of \$188 per household. The total savings generated by this program were 3.8 megawatts, preventing emissions of 4,000 lbs of carbon. These savings were the achievement of a local affiliate of the Home Performance with ENERGY STAR (HPwES) program, a jointly managed program of the U.S. Department of Energy (DOE) and the U.S. Environmental Protection Agency (EPA). This program includes rebates and financing for home performance retrofits of existing homes. The HPwES Rebate program offers a rebate of up to 20% of the cost of the energy conservation measures (up to \$1,400). The average loan in this program for a new air-conditioning (A/C) system and typical air-sealing and insulation improvements was \$5,000.

The home remodeling industry is estimated to be over \$280 billion per year. That’s the current level of spending on new cabinets, kitchen counters, bath renovations and other home improvements. Over \$140 billion is provided by contractors at an average cost of over \$40k per remodel.⁵ There are over 100 million single-family homes in the USA, of which more than half

² [Harvard, The Changing Structure of the Home Remodeling Industry \(2005\), Joint Center for Housing Studies](#)

³ Energy Information Administration, 2001, RECS

⁴ http://www.fypower.org/pdf/ConSol_MeetingAB32.pdf

⁵ Harvard, The Changing Structure of the Home Remodeling Industry (2005), Joint Center for Housing Studies

were constructed before modern energy codes existed, and over 75% of them require “significant energy upgrades.”⁶ Sixty percent of residential households report having winter drafts and 62% complain of uneven heating and cooling.⁷ Residential energy unit costs are often twice the cost of industrial and large commercial customers, making residential energy efficiency improvements the most cost effective of all other sectors. Surveys and focus groups of homeowners time after time indicate their increased awareness of the costs of energy use and its subsequent environmental and security implications. They also express a willingness to do their part, and have shown they will alter their purchase behavior, evidenced most obviously in the geometric increases in ENERGY STAR products sales.

How much energy and dollars related to energy bills could be saved annually?

Assuming savings of 25% on 1 Million Homes. The average home spends: \$1,817 per year or 950 Therms.⁸

If we save 25% on 1 million homes:

$$950 \text{ Therms} \times 1,000,000 \text{ homes} \times 25\% \text{ savings} = 237,500,000 \text{ Therms of savings}$$

$$1 \text{ Therm} = 100,000 \text{ BTU}$$

$$1 \text{ Therm} = 29.29 \text{ kWh}$$

$$1 \text{ Therm} = .00002929 \text{ GWh}$$

$$237,500,000 \text{ Therms} = 6,959 \text{ GWh}$$

Thus, with a 25% reduction of energy usage in 1,000,000 US homes:

$$6,959 \text{ GWh of energy are saved and } \$454,250,000$$

The average coal power plant produces 5846 GWh per year. By retrofitting 1,000,000 of the roughly 124 million residential homes in the US, energy efficiency upgrades can effectively close 1.2 coal power plants.

⁶ Energy Information Administration, 2001, RECS

⁷ Patterns & Trends, NYSERDA 2007, New York and US average rates by sector and by year. pg. 5.

⁸ http://www.eia.doe.gov/emeu/recs/recs2005/hc2005_tables/c&e/detailed_tables2005c&e.html

What is the investment required and payback?

- 25% energy reduction per 1,000,000 homes
- Net Investment: \$6B
- Incentive Investment: \$2B
- Savings per year = \$454 per house or \$454M⁹ dollars per year.
- Return on Investment (assuming no energy escalation) = 13.2 simple year payback

How many jobs will be created per 1M homes retrofitted per year?

Home Performance Testing

Homes Tested Per week Per Auditor:	5
Homes per year (80% utilization):	200
Conversion to Retrofit:	70

Home Performance Retrofitting

To achieve:	1000000	homes per year
Testers in the field:	28571	
Average job (days):	4	
Crew size:	3	
number of homes fixed per crew per year:	55	
number of crews necessary:	18182	
Number of crew jobs:	54546	
Project manager (manage 4 crews each):	4546	

Direct Jobs Created

Testers:	28571
Retrofitters:	54546
Project Support:	4546
Overhead Jobs (25%):	21916

Workforce Required for every 1 million Homes Retrofitted per Year: **109,579 Jobs**

⁹ Assumes that average per kWh in US = \$0.11

Workforce Opportunity & Requirements

Approximately half of every dollar spent on building construction goes to local wages and benefits. Because building is a local activity that cannot be outsourced, money invested in this sector cycles through local economies several times, bolstering the entire US economy. The breadth and depth of the Building Sector provides the best opportunity for both immediate and long-term positive impacts on the US economy.¹⁰ ([2030 Stimulus Proposal](#))

What are the occupations and skills involved in building retrofits?

“Green Collar Jobs” (as defined by the [Apollo Alliance](#)): well-paid career track jobs that contribute directly to preserving or enhancing environmental quality. The jobs range from entry-level positions to high-skill, higher-paid, jobs with a career access pathway to job skill and wage advancement.

HVAC, Carpentry, Insulation, General Construction, Remodeling

BPI Certifications:

- Building Analyst
- Shell or Envelope Specialist
- Heating
- Air Condition / Heat Pump
- Manufactured Housing
- Multifamily Building Analyst
- Large Boiler Plant Specialist
- Hydronic Heating System Designer
- Multifamily Advanced Heating Plant Technician

What is the status of the existing workforce?

The National Renewable Energy Lab identified the shortage of skills and training as a leading workforce barrier to renewable energy and energy efficiency growth.¹¹

Harvard’s Joint Center for Housing Studies estimates that over 500,000 firms are engaged in some form of residential home improvement work. Most of these companies provide specific services for homeowners, including replacing air conditioning or heating systems, replacing windows, or adding insulation to attics. However, very few contractors are taking a systematic approach to home performance improvement.¹²

10 Architecture 2030 Stimulus Proposal

11 “Nontechnical Barriers to Solar Energy Use: Review of Recent Literature,” NREL.

12 Harvard, The Changing Structure of the Home Remodeling Industry (2005), Joint Center for Housing Studies

The total number of general and special trade remodeling contractors increased 32 percent between 1997 and 2002 to just over 530,000 with most of the growth occurring among self-employed contractors.¹³

Employment in construction fell to 7.2 million in July 2008, down from 7.7 million in July 2006. As a result, there are a large number of unemployed construction workers who could be quickly re-employed in an ambitious program promoting building retrofits, just as there are large numbers of job-seekers who are looking to enter construction careers.

A number of studies show that every \$1 million invested in retrofits creates approximately 12 direct jobs. By this estimate, investing on the order of \$10 billion a year in retrofits, as proposed here, can be expected to directly create close to 120,000 direct jobs a year and 600,000 over five years, with a large share of these jobs in relatively high-paying occupations.¹⁴

Actual job creation when considering externalities in manufacturing, service, and other support industries are generally considered to be on the order of 7x the amount of direct job creation.

What are the projected workforce demands (quantitative and qualitative) for a large-scale retrofit program?

Currently about .01% of the nation's homes are receiving systematic "home performance" improvements each year. At this rate it would take about 10,000 years to complete what many policy makers describe as the "low hanging fruit" of improving the energy and environmental performance of our nation's existing housing stock. Even at a 1% penetration rate, over a century would be required. How do we ramp up to serve an even more ambitious goal of 10% penetration per year or more?¹⁵

While tens of thousands of firms provide professional home improvement services in the residential sector, each trade specializes in one category of product and does not focus on improving the overall performance of the house as a system. Without a systematic, whole house approach, highly efficient solutions cannot be obtained. For example, the U.S. Department of Energy estimates that 40 percent of heat loss in a building is caused by air infiltration, not to mention the added losses that result from leaking ducts for heating and cooling systems. Replacing a furnace or the windows in a house without air sealing the house compromises the efficiency of the intended improvements. Coupling air sealing and duct sealing with added insulation and highly efficient heating and cooling systems, as well as highly efficient appliances and lighting, optimizes home performance, and dramatically lowers energy costs and climate change emissions.¹⁶

To achieve 10% penetration per year, the large scale ramp-up of home performance contracting will require a nationwide pool of over 25,000 contracting firms each performing on average 400

13 Harvard, The Changing Structure of the Home Remodeling Industry (2005), Joint Center for Housing Studies

14 "The Direct Impact of Home Building and Remodeling on the U.S. Economy", National Association of Home Builders.

15 "Developing a 'Green Collar' Work Force to Upgrade the Performance of the Nation's Housing Stock", Larry Zarker.

16 Id.

jobs per year or eight per week. A workforce of a minimum of 100,000 professional and technical staff would be required. There would need to be a minimum of 350 training organizations each handling on average 300 students per year across all of the disciplines listed above.¹⁷

In the New Deal, the Civilian Conservation Corps employed over three million individuals in what has been recognized as the single greatest conservation program in America and it served as a catalyst to develop the very tenets of modern conservation. It may be time to reinvigorate the CCC and provide tens of thousands of men and women with the skills to diagnose and weatherize America's residential buildings. The benefits to national energy security, to climate change, and to energy affordability would be enormous.¹⁸

The following papers have a number of case studies about workforce development and the investment required to create this workforce:

What training programs already exist?

Home Performance with Energy Star
BPI
ACI
State and Utility Programs
NYSERDA / CBPCA and other State HPwES Providers

What new training resources will be required?

There would need to be a minimum of 350 training organizations each handling on average 300 students per year across all of the disciplines listed above. Existing entities most qualified to administer the training are Home Performance with Energy Star and BPI.

What are the mechanisms to bring marginalized or at-risk populations into the green workforce?

- “Green Collar Jobs” / Clean Jobs Green Jobs – Van Jones
- Blue-Green Alliance
- Roots for Social Service
- Green For All

An approximately 3-6 month training program that utilizes both training in the classroom and on-the-job training to provide clients with the following direct services: (1) initial assessment; (2) basic literacy skills (math, English, writing, computer, oral presentation, basic communication skills, etc.); (3) life skills and soft skills training; (4) financial management skills; (5) OSHA Safety Training Certification; (6) an environmental educational component; (7) basic vocational skills relevant to green collar work force opportunities.¹⁹

17 [SAHF – Stewards of Affordable Housing of the Future](#)

18 [Developing a ‘Green Collar’ Workforce to Upgrade the Performance of Nation’s Housing Stock](#)

19 “Green Collar Jobs,” Raquel Pinderhughes, PHD, 2007

Financing Alternatives

Despite the potential for reducing energy consumption in the building sector, energy efficiency programs have often met with disappointing results. There are several barriers to improving the energy efficiency of homes. In fact, over the last 30 years there has been a contentious debate over why consumers and businesses forego “cost-effective” energy efficient products and practices, and what role public policy and enabling programs (such as financing programs) should play in influencing these decisions. Barriers to improving the efficiency of homes include: ²⁰

- **Transaction costs** – The time and effort required to get enough information to make a decision, apply for financing, and arrange for the work to be done may simply not be perceived as worth the return in energy savings.
- **Lack of information** – Many customers do not know how to implement energy efficiency measures or understand and have confidence in the benefits of a project.
- **Uncertainty of energy savings** – On *average*, a set of measures might produce a predictable level of savings, but savings can never be perfectly predicted for an individual home.
- **Split incentives** – Split incentives occur when the decision-maker does not receive many of the benefits of a measure. An example is the case of rental property owners who lack incentives to invest in building efficiency upgrades because it is the tenant who pays the utility bill.
- **Initial capital investment** – The first cost of a project may deter investment, either because the resident does not have access to capital or they choose to make higher-priority investments.

For a historical assessment of investments into energy efficiency, please see [**“ENABLING INVESTMENTS IN ENERGY EFFICIENCY,”**](#) in appendix.

- **Grant**
- **Tax Credit**
- **Loan**

²⁰ “Enabling Investments in Energy Efficiency”, Merrian Fuller Energy & Resources Group UC Berkeley

Financing Alternatives: Case Studies

Berkeley, California

Goal: lower citywide emissions 33% from 2000 by 2020

Laws:

- Mello-Roos Act - special tax district (charter cities only)
- California AB811 – uses assessment districts (e.g. Palm Desert / Berkeley).
 - Finance Energy Efficiency and Renewables on tax bill. Use a low interest long term municipal bond. Payments made on tax bill and follow the house if sold.

Funds:

- Use taxable municipal bonds, with a warehouse line of credit (Renewable Funding)
- Rates: US 10-year Treasury plus 4.25% fixed interested over 20 years (it's now at 8.25%)

Projects:

- Pilot: solar only; \$1.5MM which will max out with 40 projects
- Looking at energy efficiency for next year

Palm Desert, CA

Goal: reduce GHG emissions to 7% below 1990 levels by 2012 (more stringent goal than AB32)

Amended code to public improvements (e.g. infrastructure and roads) to provide loans for energy upgrades

- Secured with property lien (i.e. regardless of personal credit)
- 3 tracks: efficiency, solar, and custom
- Interest rate: 7% fixed up to 20 years; paid back through property tax (doesn't appear on credit check)
- Requires energy audits before any improvements are made

Additional Examples

- Boulder, CO
- State of Pennsylvania (Keystone HELP, PA Home Energy)
- New York State, NYSERDA
- State of Oregon