Follow the Money to Create Durable Demand for Home Energy Upgrades: Case Studies in State & Local Government Actions

Madeline Salzman, Earth Advantage

Abstract

Transforming the home upgrade market to substantially support residential decarbonization requires programs and policies to build meaningful value for homeowners, buyers, renters, and investors. Without building value, it will remain a significant challenge for residential efficiency and electrification projects to gain market share, which requires that other market actors invest their own funds and resources into these projects.

Luckily, there are cities and states that have been working to address these issues of building and retaining value for home energy upgrades through home energy labeling policies and data aggregation systems. This paper will illuminate various state and local government programs that have helped build real market value for improved energy performance, thus unlocking financing and funding opportunities for home upgrades. This paper will focus on the government actions that have made this possible, including passing ordinances, creating public-private partnerships, adopting national standards, and more.

This paper will also provide foundational context about the current state of the residential remodeling market, identify existing value streams that remain relatively untapped to support home energy upgrades, and new methods for pulling in these funds. The paper will include analysis of residential remodeling market information as well as new frameworks for understanding the market segments that can be redirected from business-as-usual projects to investments that lead to housing decarbonization.

Introduction

While popularized to examine political corruption, "following the money" is not only useful for rooting out bad behavior. Following the money in the marketplace - in terms of funding sources, spending, and wages - helps researchers contextualize market adoption and valuation for any product or service of interest. The first step to transforming the market is to understand how the market currently exists, and then identifying which funding sources may be available to support new investments that are not currently being supported. After setting this research foundation, this paper showcases how governments are following the money through the residential building market to bring more funding to the table for home energy upgrades.

Pulling in more funding to support home energy upgrades is vital to defeating the climate crisis: rough estimates of the costs of decarbonizing US housing are around $4-5 trillion (Walker et. al. 2023,Webster et. al. 2024). While the Inflation Reduction Act (IRA) and Infrastructure Investment and Jobs Act (IIJA) make important strides into funding the total, they represent only about one percent of the total cost of this work. Following the money shows us there are various large, untapped funding sources that governments can help direct toward home energy upgrades that support better quality of life, lower energy costs, and a more stable climate.

Market transformation describes activities and actions that result in a product or service growing in terms of overall market share. For the purposes of this paper, we focus on "home energy upgrades" [1] as the product or service of interest. Understanding which activities or actions are needed requires an understanding of what factors drive a product or service to attain greater market share. In general, there are two major ways a product or service may gain greater market share: either (1) market choice is limited within the market, or (2) purchasers perceive the

[1] Defined as building envelope efficiency and mechanical system upgrades that lead to US housing decarbonization.

product or service as having a better cost-to-benefit ratio to other available products or services. Therefore, strategic market transformation activities will focus on either (1) limiting market choice, (2) reducing costs (monetary or otherwise) to the product or service, or (3) creating greater recognition and acceptance of benefits or value.

Market transformation can be tracked by measuring the share of homeowners making home energy upgrades over time and deemed successful when the proportion of spending on these projects increases when compared to overall spending on home renovation and remodeling. To meet the moment of the climate crisis, market transformation efforts should also result in absolute (non-relative) growth in overall spending on home energy upgrades aligned with decarbonization priorities. Such growth not only requires more spending within the sector, but also more generalized economic growth characterized by broad household access to discretionary funds and affordable interest rates.

Market transformation activities fit into larger strategic efforts to support targeted industry growth, commonly called "industrial policy". The United Nations (UN) characterizes industrial policy as, "government actions to alter the structure of an economy, encouraging resources to move into particular sectors that are perceived as desirable for future development" with the goal of mitigating systemic market failures (Altenburg & Assmann 2017). Historically, industrial policy has focused on strategies that develop and grow the manufacturing sector; however, the phrase has been more recently used to describe more broad market interventionist policy actions. Many industries require significant front-end investment in critical materials mining, manufacturing facilities, workforce development, industry standards, and generalized infrastructure that enable affordable, quality products in the marketplace. An example of generalized infrastructure investments can be seen in the impact of the New Deal on electricity production across the U.S., including in rural areas where cost-effective electricity delivery was not possible, which successfully subsidized the cost of doing business in rural communities and thus supported rural economic development.

In the last decade, *green* industrial policy has emerged as a strategic framework for augmenting low-carbon industries and transitioning toward a decarbonized economy (UN Environment Programme n.d.). Industrial policy is typically focused on national or regional economic competitiveness, whereas green industrial policy focuses specifically on environmental impacts of the climate crisis as threats to national security, economic development, and overall well-being. Examples of green industrial policies include subsidies (e.g., rebates, tax credits), research and development, product standards and minimum codes, public procurement, and feed-in tariffs. The UN notes that this term is now used to cover issues and actions across the entire economy and not just actions focused on manufacturing (Altenburg & Assmann 2017).

Market transformative green industrial policies focus on addressing market failures that prevent necessary green industries from full market participation. Common market failures that have stymied economy-wide decarbonization include externalities, public goods, information failure, and market control (Gillingham & Sweeney 2010). All these market failures show up in the context of home energy upgrade market growth, such as: environmental pollution caused by and within homes that impact human health, and the lack of systemic inclusion of environmental factors in home appraisal and valuation. Similarly, the ways that home features affect public goods - clean air, water, and a stable climate - are not accounted for in real estate processes to assure these impacts are priced. Home buyers, sellers, owners, and renters are often all experiencing information failures that prevent home energy information - including estimated energy costs - from being included in real estate transactions (Myers, Puller, & West 2022).

Finally, locationally specific mismatches between housing supply and demand contribute to consolidated market control, particularly of homeowners and investment landlords in urban markets. The remainder of this paper focuses on Green Industrial Policies being adopted around the country that transform the market to account for these failures and increase home energy upgrade adoption.

Background of Existing Market Conditions

Transforming the market requires a comprehensive understanding of where the market is today, as well as identification of market indicators that would suggest market transformation is occurring. To inform market transformation strategies and indicators to monitor, this paper summarizes background information about clean energy employment, home remodeling, and home energy upgrades throughout the country.

Residential Building Construction Sector. Given the general lack of data collection regarding specific investments in home energy upgrades today, market characterization can be understood based on available data regarding the residential building construction sector, and at times, data regarding building equipment contractors and home remodeling and repair. The following subsections organize data based on sectoral spending, occupations, and employment, and details most relevant to home energy upgrade spending, occupations, and employment are provided where available.

Spending. According to the Associated General Contractors of America (AGC) in 2022 spending on new and renovation construction in the U.S. is roughly equal between nonresidential and residential construction, at $921 billion and $927 billion respectively[2] (AGC 2023). Within residential construction, in 2021 the residential remodeling industry market was valued at roughly $495 billion, with 47% of homeowner spending going to interior, exterior, and/or equipment or system repair and replacement each year (Joint Center for Housing Studies [JCHS] 2023). About $406 billion of this total amount was spent by homeowner-occupants, while an estimated $89 billion was spent on rental/vacant home by landlords. Breaking this down by household, in 2021, 50% percent of U.S. homeowners spent $4,000 or less on home improvements or maintenance, while the top 20% of income-earners spent on average $9,000 on home improvement or repair. Most home upgrade projects are funded through cash from homeowner savings (JCHS 2023). For projects over $10,000 in cost, home equity and homeowner's insurance also represent significant funding sources.

Home Mortgage Disclosure Act (HDMA) data suggests that in 2022 nearly 1.5 million homes in the U.S. were issued mortgage loans for home improvement purposes, totaling over $184 billion (HDMA 2024). From 2022-2018, each year on average over 1.1 million homes were issued home improvement mortgage loans, totaling over $132 billion. Data also suggests home improvement mortgage loans account for roughly 37% of home owner-occupant improvement spending in the U.S. each year, and disproportionately cover a portion of higher cost home improvement projects (JCHS 2023).

Little data is available regarding exact spending by home insurance agencies on home improvement (personal communication with JCHS and National Association of Insurance Commissioners [NAIC], 2024). Survey data from the Department of Housing and Urban Development suggests that in 2021 homeowners report that home insurance paid for about $35

[2] This figure includes spending across single-family, multifamily, public, and improvement construction spending within the residential sector.

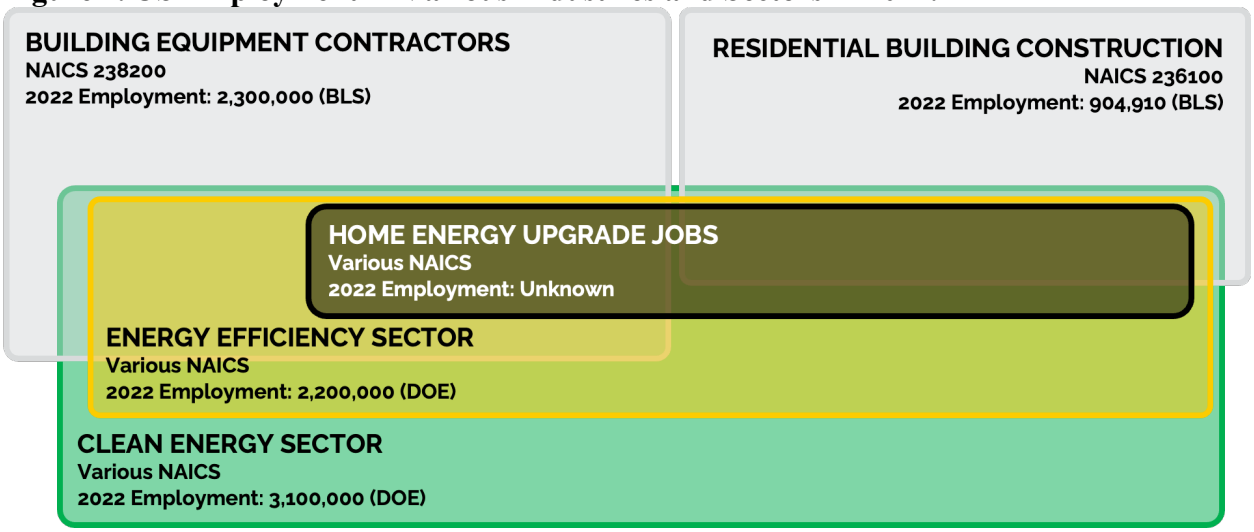
billion in home repair projects, however such an estimate is not available for rental property landlords or from home insurance providers themselves (JCHS 2023).

As a subset of overall residential construction, the residential renovation and repair sector is particularly sensitive to economic changes – including but not limited to the COVID-19 pandemic – because market share typically depends on discretionary spending at the individual household level. Economic swings that impact interest rates, rates of construction, and/or household discretionary spending have a pronounced impact on the residential sector overall, including home energy upgrades. A goal of market transformation efforts is to introduce safeguards that will drive more stable and sustainable growth in this sector to support year-round employment and profitable businesses. Many businesses also report slow seasons in the winter that can require some employees to pursue unemployment.

Employment. The size and scope of the existing sector can also be understood in terms of employment rates. The U.S. Department of Labor Bureau of Statistics (BLS) provides data about two major industries relevant to residential building construction and remodeling: Residential Building Construction and Building Equipment Contractors. These are identified in BLS data as North American Industry Classification System (NAICS) codes 236100 and 238200, respectively. The most common occupations employed by Residential Building Construction are carpenters and construction laborers, while the most common occupations employed by Building Equipment Contractors are electricians and plumbers, steamfitters, and pipefitters (BLS 2024). BLS data shows that as of May 2022, approximately 938,000 people are employed within the Residential Building Construction industry and approximately 2.3 million workers are employed within the Building Equipment Contractor industry. Within the Building Equipment Contractor industry, data is not available describing what percent of these workers and/or working hours are spent on work in residential buildings.

Similarly, the U.S. Department of Energy (DOE) publishes the U.S. Energy Employment Report (USEER) annually, which quantifies employment specific to energy industries. The most recent report found that in 2022 there were 3.1 million clean energy workers in the US, 2.3 million of which work on energy efficiency (US DOE 2023). However, the USEER report does not distinguish what proportion of these workers focus fully or partially on residential building clean energy or energy efficiency projects.

Figure 1. US Employment in Various Industries and Sectors in 2022.



Overall, synthesizing data characterizing employment and business opportunities directly related to home energy upgrades remains a challenge. Different analyses separate jobs by industry sector (e.g., construction, manufacturing), business sector (e.g., residential, commercial), energy type (efficiency, renewables), and/or other schematic (e.g., clean energy job, green job). As a result, determining the number of individuals employed in home energy upgrade work, and/or the number of businesses incorporated to accomplish this work, and/or the number of people in existing occupations skilled to do this work (even if they are not primarily employed to do so today) is not feasible using existing data sources. Figure 1 shows an illustrative schematic of these overlapping data and shows estimated employment figures from various sources.

Occupations. A wide variety of occupations are represented within residential building construction and remodeling businesses, particularly occupations classified within construction trades or business services. Even if many of the workers in these occupations are not currently employed to conduct home energy upgrades, many of them are capable of completing this work, or nearly capable with some basic skills training. For many of these workers, a key factor limiting their current work on home energy upgrades is lack of financial incentive in terms of available contract work offering competitive wages. Even when certification training represents an additional barrier, sufficient financial incentives can help overcome this barrier as workers see an opportunity to increase their wages and career development. **Table 1** includes a selection of occupations key to deployment of home energy upgrades, with information about relevant industry employment as of May 2022 and mean wages.

Table 1. Buildings Employment and Residential Wages for Key Occupations (BLS, 2023).

SOC CODE	OCCUPATION	BUILDING INDUSTRIES EMPLOYMENT	RESIDENTIAL SECTOR MEAN HOURLY WAGE
47-2031	Carpenters	542,930	$26.51
47-2111	Electricians	502,930	$26.25
47-2152	Plumbers, Pipefitters, Steamfitters	311,030	$27.39
47-1011	Construction Trade First-Line Supervisors	284,950	$33.92
49-9021	HVAC Mechanics & Installers	278,800	$26.52
47-2061	Construction Laborers	251,810	$20.65
11-9021	Construction Managers	183,090	$47.23
47-2181	Roofers	131,980	$23.32
47-4011	Construction and Building Inspectors	128,950	$33.07
47-2211	Sheet Metal Workers	56,420	$23.75
47-2131	Insulation Workers (Floor, Ceiling, Wall)	33,130	$22.06

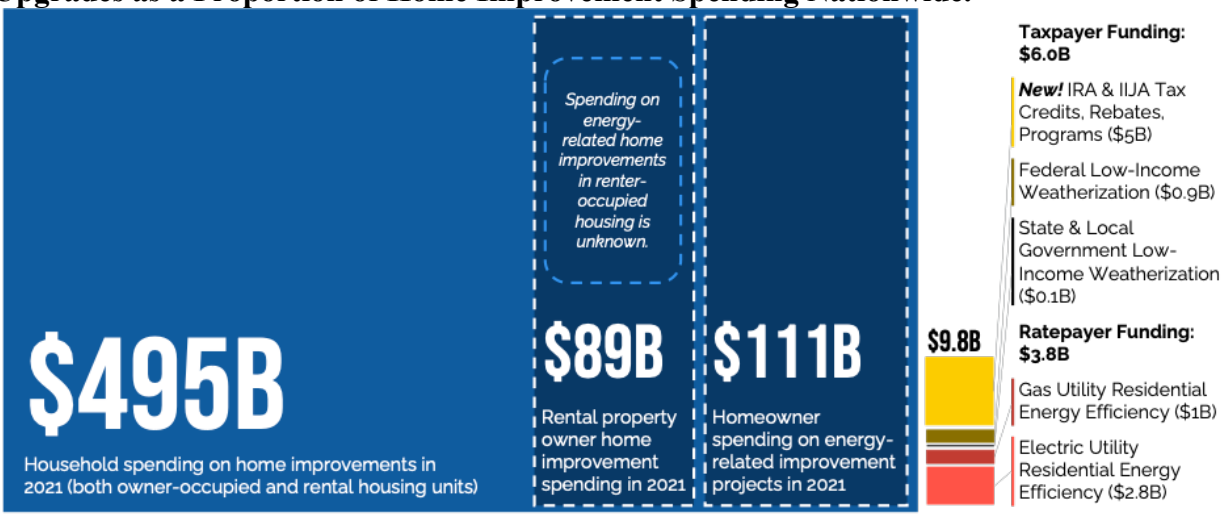
For each of these occupations, an unknown percent of these workers and their time is spent on projects in residential buildings. Workers in these key occupations of interest employed outside the residential building construction sector enjoy median and mean wages approximately 10% higher than workers employed in residential building construction. This wage disparity between workers in the same occupation but across industry sectors contributes to residential building construction employer hiring and retention challenges.

Contextualizing the Home Energy Upgrades Market. As a subset of the overall residential construction and sector focused on specific elements of residential renovation and

repair, the exact size of the home energy upgrade market is unknown. A portion of this market is relatively easy to monitor, as it is funded through governments and utility regulators through weatherization assistance programs and ratepayer residential efficiency programs. Data collected by the Energy Information Administration (EIA) shows that in 2022 electric utilities spent nearly $2.8 billion on residential energy efficiency programs (EIA 2023). The American Gas Association (AGA) reports that in 2020, gas utilities spent around $959 million on residential efficiency programs (Vondra & Hoy 2023). Recent average appropriations for low-income home weatherization services - administered both by the DOE and the Department of Health and Human Services - result in about $900 million annually. In addition, some states and local governments also provide their own taxpayer funding resources to support home energy upgrades. The American Council for an Energy Efficient Economy (ACEEE) estimates this amounted to about $114 million in funding for low-income weatherization in 2021 across 13 states (ACEEE 2022). In addition, the IRA and IIJA make available an estimated $50 billion for home energy upgrades between tax credits, rebates, and weatherization resulting in an influx of funds to the market averaging about $5 billion annually (Congressional Budget Office 2022). Altogether, recent years provided about $9.8 billion annually on home energy upgrades via ratepayer and taxpayer sources across the country.

Household cash and credit-based spending on home energy upgrades projects is much harder to identify and track over time. On a national scale, there is no coordinated tracking of businesses and workers capable of home energy upgrade projects or the installation of home energy upgrade features. Owner-occupied households spent an estimated $111 billion on energy-related home improvement projects in 2021, however data is not available to provide a similar estimate for renter-occupied households (JCHS 2023). Owner-occupied household spending on energy-related improvements represents 34% of spending by these households on home improvements and 22% of the home improvement market overall.

Figure 2. Graphic Representation of Estimated Annual Spending on Home Energy Upgrades as a Proportion of Home Improvement Spending Nationwide.



Understanding spending on home energy upgrades in the mass market has some data limitations. First, as mentioned above, there is limited data estimating the amount renter-occupied households spend on energy-related improvements annually. Even if renter-occupied households represent a smaller percentage of the overall market, upgrades that take place to replace broken equipment certainly represents some part of the market. Second, there is little to no data

collection on pre- or post-upgrade home energy conditions, including identification of technologies being replaced or installed. Because of this data limitation, there is a lack of clarity about which projects may represent a low-efficiency or fossil fuel-based installation versus an upgrade aligned with overall U.S. housing decarbonization goals.

Systematized data collection processes could help policymakers understand what energy-related installations are already occurring in the market and what market gaps exist to support decarbonization-aligned installations. Such data could also support generating consensus around which energy installations and services may constitute an upgrade to be aligned with climate and housing stock improvement goals. Finally, this data could also support homeowners, buyers, sellers, and investors to better understand home energy features and their benefits, which can drive valuation of these improvements in the real estate market. The same information failures that prevent effective monitoring of market adoption also hinder overall market function, as both home buyers and sellers lack necessary information tools to effectively invest in home energy upgrades.

The goal of market transformation is to increase the percent of household spending on home energy upgrades as a proportion of total home upgrade spending: align as much of the spending in the blue box in Figure 2 as possible with a decarbonized future. When estimating the total cost of US housing decarbonization at $4 trillion (Walker et. al. 2023,Webster et. al. 2024), if we rely solely on the current rate of ratepayer and taxpayer funding of home energy upgrade projects (about $10 billion per year), it will take 400 years to complete decarbonization home energy upgrades across the existing U.S. housing stock. If existing homeowner spending on energy-related improvement projects (about $111 billion per year) were aligned with decarbonization priorities, the estimated timeline for US housing decarbonization drops to just around 35 years. If the current rate of spending on energy-related improvements were to increase as a proportion of total home upgrade spending from 22% to 40% (and be aligned with housing decarbonization priorities), the timeline drops to just under 20 years. To mitigate the climate crisis, market transformation becomes an imperative. The remainder of this paper explores the Green Industrial Policies that state and local governments are taking on that provide the necessary scaffolding for this market transformation to occur.

Theory of Change

Following the money in the home upgrade and replacement market suggests there are a few major funders and financiers of this work: homeowners (including owner-occupied households as well as landlords), home mortgage lenders, home insurance providers, ratepayer funded programs, and taxpayer funded programs. To lure these funders and financiers toward supporting decarbonization-aligned home energy upgrades, they must believe such investment will deliver them real value that is worth the cost. States and local governments can take action to influence market valuation of these improvements, which can then improve the perceived cost-benefit ratio of investment in this work across funder and financier stakeholders. In doing so, state and local governments are catalyzing additional flows of capital to support skilled worker employment, new innovative businesses, and future programs that improve housing and the environment.

Ultimately, to reliably pull in more funding and financing for this market, this work must appeal to those who have (a) a logical stake in benefiting from these improvements, and (b) access to funding and financial resources. The culminating outcome of market transformation activities must appeal to the interests and needs of market actors to justify their investment of

time, money, and political capital. **Table 2** identifies the key funder and financier stakeholders for home improvement funding and poses the logical stake and conditions for investment they must have to shift financial streams toward home energy upgrades. **Table 2** also identifies limitations related to focusing on each funding or financing stakeholder. Given that each group has its own limitations in terms of impact, adopting an "all of the above" strategy to market transformation will bring the lowest risk of failure to deliver access to home energy upgrades across the market.

Table 2. Theory of Change for Funders, Financiers to Support Home Energy Upgrades.

FUNDING OR FINANCING PROVIDER	MARKET TRANSFORMATION GOAL	LOGICAL STAKE: INCENTIVE FOR INVESTMENT	BELIEFS & RESOURCES: CONDITIONS FOR INVESTMENT	LIMITATIONS
Homeowners (owner-occupants, landlords, property investors)	Homeowners believe that home energy upgrades deliver value such that they sustain market demand for these upgrades.	• Owner-occupied: value improved living experience • All: improved prospect of rental/resale	• Must believe that the value of home energy upgrades justifies cost • Must have access to capital	Even if the value proposition is accepted, many homeowners do not have access to capital.
Lenders (mortgage financiers, underwriters)	Financiers and underwriters believe homebuyers value home energy upgrades such that they provide low-cost and low-risk capital to borrowers.	• Higher value green mortgage-backed securities • Reduced risk of mortgage default • Better reputation from climate impact reporting	• Must believe home energy upgrades improve home value • Must have mortgage products that can be effectively communicated and easily used	Resources may not be accessible for borrowers near their debt-to-income (DTI) ratio limit or with poor credit.
Home Insurance Providers	Insurance providers believe supporting home energy upgrades will improve business.	• Better services will retain customer base • Reduce future insurance claims	• Must believe funding home energy upgrades brings a business benefit	Restrictions may prevent rebuilding higher quality homes.
Governmental and regulatory bodies (state, local, utility regulators)	Demonstrate value of continued taxpayer and ratepayer funding for home energy upgrades in low-income, poor credit, and/or disadvantaged households.	• Constituents value and demand support for these programs • Prioritization supports constituent engagement	• Must believe the value of funded programs outweighs cost • Must have an available funding mechanism	Not always a reliable funding source to support business and workforce stability.

In general, the theory of change for pulling home funders and financiers toward supporting home energy upgrades rests on these stakeholders understanding and believing the value that these projects will deliver to their interests. Generally, homeowners benefit from the prospect of their home's improved value in terms of rental and resale. When homeowners are also owner-occupants, they personally benefit from the home's improved living experience in terms of reduced energy bills, increased comfort, better indoor air quality, and greater resilience. Mortgage lenders benefit from being able to sell "green" mortgage-backed securities (MBS) on the secondary market, from improvements that help homes retain value, and from a strong reputation that supports customer selection. Governmental and regulatory bodies benefit from supporting programs that they believe their constituents value. Despite the verifiable benefits, these stakeholders are often not aware of these benefits, or of the harms caused by home poor energy performance.

Although home insurance providers are included in the list above as major funders of home improvements, this may not be a straightforward resource to leverage to in support of home energy upgrade funds directly. Typically, insurance funding for home upgrades after losses does not cover improvements to the home's energy performance or resilience condition. While economy-wide decarbonization supports better resilience outcomes, the impacts of energy pollution are global, which minimizes the incentive for any one home insurance provider to fund efficiency upgrades. Therefore, there may be less potential to increase this funding stream to

support home energy upgrades aligned with decarbonization priorities. In some cases, home insurance premium calculations could be used as a tool to indicate to homeowners that resilience upgrades (e.g., roof and attic improvements) will reduce premium costs (Mure et al. 2023).

Federal, state, and local governments can all play roles in supporting greater recognition of home energy upgrade value by systematizing access to standard information about these projects. By providing key information designed to be useful to these stakeholders in key decision-making moments, governments can correct market failures that have so far resulted in systemic devaluation of home energy upgrades. Examples of such policies are discussed in the following sections.

Market Transformative Green Industrial Policy Case Studies

The following case studies have been chosen primarily based on the theory of change grounding policy designs and based on access to data or other results attributable to these efforts. In general, verifiable results of market transformation activities are slow to accumulate, as market shifts of "business as usual" practices often take time to occur. There is no one "market decider" that makes all the changes necessary for a market to transform; rather, as various actors make slight changes to their workflows, energy efficiency can proliferate. As a result, the case studies explore policies that have taken place over the last decade and present the latest evidence that these policies are driving market-level impacts. Additional state and local governments can benefit from the foundations that have been built already to catalyze market growth of home energy upgrades in their own communities.

Single-Family Market Policies: Oregon. In 2007, the Oregon legislature enacted a goal for greenhouse gas reductions statewide, causing the Governor to establish an Energy Efficiency Working Group in 2008. At the recommendation of this working group the Oregon legislature passed Senate Bill (SB) 79 in 2009, which created, "a Task Force to investigate voluntary and mandatory building energy scores" (ODOE n.d.). As a result of this bill, the Governor appointed a committee of 13 representatives who provided recommendations for a statewide voluntary home energy scoring policy (ODOE n.d.). In 2013, the recommendations from the Task Force were formally adopted by the legislature through House Bill (HB) 2801. These laws set the foundation for Division 63, Chapter 330 of the Oregon Administrative Rules, and set basic standards for businesses seeking to provide building energy labeling services (Oregon Secretary of State 2024). These standards include but are not limited to requiring use of DOE's Home Energy Score, establishing minimum training requirements, and subjecting businesses to licensure by the state's Construction Contractors Board. These requirements serve to build legitimacy of the businesses and services being delivered in Oregon, helping to contribute to overall service valuation. These actions reduce the likelihood of illegitimate businesses scamming customers in this market, thus reducing risk of market participation for the consumer. For well-meaning businesses, this prevents illegitimate businesses from undercutting the market by capturing customers with services that do not meet minimum state standards.

Although these actions by the State of Oregon are more than a decade old, they set necessary scaffolding for a real market to be established. These actions treat building energy scoring as a legitimate industry sector and service, subject to standards and oversight like any other sector operating within the state. When done correctly, these types of standards help industries make investments in their own growth as risk of market confusion and product

devaluation goes down. These policies also serve as a foundation for local government policies that have been able to promulgate that go further than the state to transform the market.

In 2016, City of Portland unanimously passed a local ordinance requiring a state of Oregon-compliant home energy label be included in all real estate listings and home advertisements in the jurisdiction (City of Portland 2024a). In 2018, the Home Energy Score policy launched, followed by enforcement to assure compliance. Policymakers were driven to support consumer protection through energy cost transparency, as well as help the market identify cost-effective opportunities to reduce carbon pollution. By requiring the label to be included in real estate listings, the city hoped to support homebuyers in making informed investment decisions, and to support the real estate industry in attributing appraisal value to home energy features. Since policy launch, more than 40,000 Home Energy Scores have been delivered to homes in Portland, representing about 25% of all of Portland's single-family housing (Green Building Registry 2024).

As home energy labels have become a standard component of doing business in Portland, market actors have taken notice: businesses promote their Home Energy Scoring services online, and score data is pulled from the city's Green Building Registry to the local multiple real estate listing service and to consumer-facing real estate websites including Redfin and Zillow. Real estate agents work to supply home sellers and buyers with information about how to understand a home's Score and how to improve home sustainability (Portland Metropolitan Association of Realtors 2024). Systematic access to standard data and educational resources matter: at ACEEE's Summer Study in 2022, a paper was published showing that in the Portland market – as well as other markets with similar policies – for every one-point increase in a home's Home Energy Score and $100 decrease in estimated annual energy bills, there is an associated 0.5% increase in sales premium (Pigman et. al. 2022).

These impacts on resale value can in turn influence homeowner investment decisions. Recent analysis from the City of Portland has found that homes with Home Energy Scores in Portland are 10 times more likely to receive an energy efficiency measure incentive than homes without a Home Energy Score in Portland (City of Portland 2024c). The study only reviewed data from January through June 2023, so any homes that waited longer than six months after receiving their Home Energy Score were not included in the sample. Still, 8.8% of Home Energy Score recipient households pursued at least one energy efficiency upgrade offered by the Energy Trust of Oregon as compared to 0.8% of homes without a Home Energy Score in a three-year period (City of Portland 2024c). Conversations with Oregon-based contractors suggest that while Home Energy Score is only minorly referenced in requests for work, they do report that recent homebuyers drive the bulk of current market demand for home energy upgrades.

Since 2017, additional cities to Portland have also enacted policies requiring Oregon Home Energy Label disclosure, resulting in nearly 1 million Oregonians living in jurisdictions with systemic home energy data access. Now, the Oregon Department of Energy is exploring opportunities to support mandated Home Energy Label disclosure in the rental housing market.

In Oregon and elsewhere, Home Energy Score data transparency requirements have been identified as a key element of market transformative green industrial policies. For the homeowner, Home Energy Score provides home-specific data, including actionable recommendations for energy-saving improvements that payback over time. For the regulator, Home Energy Score can also be used to gain insight into the nature of energy burdens across the state, prioritize communities based on need, and quantify the gaps in housing today to minimize energy burden, electrify, or decarbonize. For the lender, the Home Energy Score can translate

into real home value, which can extend equity for homeowners to borrow against to complete home energy upgrades with home improvement mortgages. If there is no ability to attribute value to these upgrades, then using home improvement mortgages for energy improvements remains mostly untenable. Home Energy Score documentation of higher home performance can also be a trusted source for underwriters to sell mortgages on the secondary market for a green premium (S&P Global 2023).

More work is needed to assure this stream of low-interest financing becomes available to homeowners. Recognizing that public funds only represent a small amount of their current work scopes, contractors suggest that programs supporting low-interest financing could be a useful tool to foster market growth. Next, we explore how the secondary mortgage market has already been supported for green financing in multifamily buildings.

Multifamily Market Policies: California. The market for green mortgage backed securities (MBS) in the multifamily market is well established, with over $100 billion in multifamily green bonds issuance from Fannie Mae since 2017 (Fannie Mae 2024a). A combination of factors, including state and local government leadership, have made this possible. To determine if multifamily properties may qualify as "green" for the purpose of resale on the secondary market, Fannie Mae often relies on buildings reporting their ENERGY STAR Score. Created by the U.S. Environmental Protection Agency (EPA) in 2014, the ENERGY STAR Score for Multifamily Buildings produces a 1-to-100 score based on how the building's annual energy usage compares to other similar buildings (EPA 2024). Where applicable, Fannie Mae also uses industry-recognized green building certifications to identify green multifamily buildings in their portfolio (Cluett et. al. 2020). The existence of these government standards and industry-recognized programs reduce Fannie Mae's risk in participating in an otherwise new marketplace. By referring to these standards, Fannie Mae can leverage environmental program expertise in their own green financing product designs.

Without state and local government leadership, Fannie Mae's access to the necessary data to justify these investments would be severely stymied. The City of Berkeley, California, was the first local government in the country to enact a building energy benchmarking ordinance using EPA's ENERGY STAR Portfolio Manager for multifamily buildings. In 2015, Berkeley passed the Building Emission Savings Ordinance (BESO), which included Home Energy Scoring requirements for single-family homes and ENERGY STAR Scoring requirements for commercial building properties (City of Berkeley 2023). The city uses federally funded tools, including ENERGY STAR Portfolio Manager and DOE's Standard Energy Efficiency Database (SEED) Platform, to aggregate and manage this data, which also unlocks access for mortgage financing stakeholders, including Fannie Mae (personal communication with City of Berkeley 2024). Since enactment, the policy has allowed for multifamily buildings with an ENERGY STAR Score of 80 or higher to defer the requirement of a physical building assessment up to five years. In addition, multifamily buildings that have industry-recognized green certifications may be found exempt from the physical building assessment requirement but are still required to annually report their ENERGY STAR Score. Analysis of Berkeley's ENERGY STAR Score data from 2019-2022 shows that among reporting multifamily buildings, the average score rose from 87 in 2019 to 91 in 2022 (City of Berkeley 2024).

Since Berkeley enacted the BESO ordinance, more than 40 jurisdictions – including the states of California, Colorado, and New Jersey, as well as Washington, DC – have adopted similar policies (Fannie Mae 2024b). These state and local policies have fostered the creation of

data which then supports financial products offering benefits for green loans, including lower interest rates, higher net cash flow determinations, and up to 5% more loan proceeds (Fannie Mae 2024c). For building owners that may not otherwise consider green home upgrades, these incentives make the prospect of green investments more attractive. Starting in 2023, properties with Fannie Mae loans in these jurisdictions are required to submit their annual Energy Performance Metrics to Fannie Mae through their Green Verification and Measurement Service (Fannie Mae 2024b). These jurisdictional energy benchmarking policies have acted as necessary scaffolding for Fannie Mae to deploy usable financial products.

According to their Green Bond Impact Methodology, projected energy savings of Green MBS are calculated in accordance with EPA ENERGY STAR Portfolio Manager after establishment of a baseline of 12-month energy consumption, in conjunction with an ASHRAE Level-2 energy audit (Fannie Mae 2022). Fannie Mae uses these resources to estimate the environmental impact of their green loan products, including an estimated 11.8 billion kBTU of source energy and 759,000 $MTCO_2e$ saved (Fannie Mae 2024d). Since Fannie Mae's Green MBS exploded onto the market in 2017, program data analysis and program evaluation have spurred updates. In 2022, Fannie Mae conducted an analysis of Green Mortgage Loan property data to inform development of a Multifamily Electrification and Decarbonization Roadmap (Fannie Mae 2023).This analysis supported conclusions of keeping "energy efficiency at the forefront of decarbonization" based on analyzed carbon emission and cost savings. Fannie Mae is now in a process of reviewing their existing financial product offerings to align with these priorities. Finally, Fannie Mae and EPA recently collaborated on a new ENERGY STAR Score for multifamily buildings based on water consumption (EPA 2024).

Discussion

It is not by accident that these case studies showcase work that has been building for the past decade. In many ways, market transformation policies reject the strict paradigm of energy savings attribution and the government's role in directly paying for energy-saving projects. These policies recognize that the market transactions that have caused the climate crisis are the same ones that need to be transformed to mitigate it. By establishing standard incentives for these upgrades across the market, it is possible to achieve scale at a much faster rate than government-funded programs alone.

Importantly, policy efforts such as those in California and Oregon do not supersede the need for government-funded programs, particularly for low-income households. Unfortunately, there is enough need across low-income households in disadvantaged communities to justify continued and increased funding for low- or no-cost home energy upgrade programs. Market transformative policies pair well with these programs, as it can reduce pressure on state and local governments to meet the home energy upgrade needs of even higher income households. The more households that can afford home energy upgrades without direct government support, the more government funding can be directed toward households that may otherwise be left out. In addition, sustaining market demand for home energy upgrade businesses and workers outside of government-funded programs can help achieve economies of scale that reduce risk for everyone involved.

In these two cases in particular, funding for low-income household energy upgrades has not been left behind. In November 2018, Portland, Oregon voters passed an initiative that launched the Portland Clean Energy Community Benefits Fund (PCEF) (City of Portland 2024b). This initiative established a 1% surcharge on retail sales in Portland among retailers with

total annual retail revenue over $1 billion and over $500,000 in local revenue (City of Portland 2019). Through this new fund, the City of Portland estimates they will award $750 million in climate justice investments between 2023 and 2028 – on average, $150 million each year. As a city of about 650,000 residents, this comes out to a funding rate of about $230 per person per year – potentially the highest rate of public clean energy funding anywhere in the US. More work is needed to assure these funds are spent efficiently and effectively so they turn into real, recognizable benefits for recipient households.

In California, the state legislature passed Assembly Bill (AB) 209, which established the Equitable Building Decarbonization (EBD) Program. This program establishes statewide efforts to fund decarbonization projects in low-income households, and has been allocated a budget of up to $922 million over six years - an average of about $150 million per year (California Energy Commission 2024). Through this program, California has launched what may be the largest state-run program for low-income home energy upgrades. California is also looking to expand its use of home energy labeling statewide, as the California Public Utilities Commission (CPUC) has approved a statewide Home Energy Score pilot program (BayREN 2024). As more households gain access to standard home energy information, more homeowners will seek to improve their homes, more financiers will participate in the market, and more people advocate for funded programs.

Conclusion

Given the coming influx of federal funds for home energy upgrades – estimated in Figure 2 above at about $5 billion per year between grants, rebates, and tax credits – states and local governments have a tremendous opportunity to serve households with much needed home energy upgrades. At the same time, state and local governments should recognize the relatively small impact these funds may have when compared to the overall market for home improvements, including “business as usual” home energy upgrade projects. Instead of hoping state and local climate and housing goals will be solved only through taxpayer and ratepayer funded programs, policymakers and advocates can accelerate growth of the clean energy economy by supporting market transformation. Specifically, state and local governments can support green industrial policies that reduce real and perceived risk for investors and build market demand for home energy upgrades. Catalyzing funding flows into this market from homeowners, lenders, and regulators can enable overall market growth and stability that encourage business innovation and attractive employment opportunities for workers in the clean energy economy. Turning on the tap for these funding and financing flows is only possible through building publicly recognized value of home energy upgrades such that new funders and financiers understand the benefits of putting continued funding resources to these projects. Moving forward, the market will benefit from more localities following similar models to California and Oregon that set industry standards, support market transparency, and demonstrate the value of this work.

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