Advancing Equity in Energy Efficiency Funding and Financing: Scenarios and Roadmap

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ABSTRACT

Since the American Recovery and Reinvestment Act of 2009, Pub. L. 111-5, billions of dollars have been capitalized to fund residential energy efficiency financing programs. States and local governments are increasingly using a diverse range of funding and financing programs to advance energy efficiency in this sector. Funding sources and programs have distinct goals and requirements, and utilize different funding mechanisms, such as the grant-based Weatherization Assistance Program for low-income households. This analysis explores overlaps and gaps between federal funding for residential energy efficiency and how states and local governments can strategically deploy programs to address market gaps, reduce energy burden, and advance energy equity.

First, it reviews five existing and new federally funded programs supporting residential energy efficiency by funding source, mechanism, and audience. Then, it analyzes opportunities at the intersection of energy burden and household income to complementarily deploy funding and financing for energy efficiency, including two case study scenarios with the U.S. Department of Energy's Energy Efficiency Revolving Loan Fund (RLF) Capitalization Grant Program and Weatherization Assistance Program (WAP). Using the Low-Income Energy Affordability Data (LEAD) Tool, the scenarios identify 4,927,968 households in funding hotspots and 1,042,641 households in financing hotspots. Finally, it provides a roadmap states and local governments can use to conduct their own analysis of market gaps and barriers in energy efficiency funding and financing, and develop approaches to address these gaps, using methods demonstrated in this study, to reduce energy burden, support energy equity, and advance market transformation.

Introduction

Investments in energy efficiency have increased in recent years. Between 2015 and 2022, annual energy efficiency investments in North America grew from $46 billion to $53 billion for a total of $365 billion across these eight years (IEA 2022) and energy efficiency financing lending across several major program types increased 40% between 2014 and 2019, providing nearly $7 billion annually by 2019 (ACEEE 2020a). With both private and public investments driving energy efficiency improvements across sectors (IEA 2020), states and local governments have been key actors in residential energy efficiency investments. Newly injected federal funds reinforce their position. A strategic approach by states and local governments to deploying energy efficiency funding and financing in the residential sector can support equitable distribution of the benefits of these upgrades to households that need them most.

In 2009, with the passage of the American Recovery and Reinvestment Act, states capitalized $566 billion in revolving loan funds to support energy financing (DOE 2023c). Today, through the Bipartisan Infrastructure Law (BIL), Pub. L. 117-58, Inflation Reduction Act (IRA), Pub. L. 117-169, and annual appropriations, states and local governments are receiving

another $16 billion in federal energy program investments, including energy efficiency funding and financing programs (DOE 2023b). As program managers that can catalyze further private investment, states and local governments influence investments and investment practices in residential energy efficiency (DOE 2023c). Through policies, partnerships, and program design models, these programs can inform lending practices and fill funding and financing market gaps.

With both existing programs funding energy efficiency and new BIL and IRA funded programs, states and local governments are increasingly overseeing a diverse range of financing structures and grant programs to advance residential energy efficiency. These programs have both overlapping and distinct goals and requirements and utilize differing funding mechanisms. Developing knowledge of the existing energy efficiency funding and financing market; designing programs according to funding source requirements, market gaps, and household needs; and strategically engaging in the market can enable states and local governments to deliver effective programs that advance energy equity.

Residential energy efficiency funding and financing market

States and local governments have access to a variety of federal funding sources with varying requirements and capabilities to support residential energy efficiency funding and financing programs. Table 1 summarizes five key programs in this space by funding source, mechanism, and audience eligible for program funding. These programs represent federal opportunities for residential energy efficiency funding and financing that are currently available to states and local governments and they allow program administrators to target low-income populations. Some of these funding opportunities, including U.S. Department of Energy's (DOE) Energy Efficiency Revolving Loan Fund (RLF) Capitalization Grant and Home Energy Rebates programs, are new initiatives funded through BIL and IRA, which also provided additional funding to existing programs. Additionally, some focus funds on low-income households (e.g., the DOE's Weatherization Assistance Program (WAP) and the U.S. Department of Health & Human Services' Low-Income Home Energy Assistance Program (LIHEAP)) while others make funds available to all households but include provisions for low-income households such as grants or larger sums of funding specifically for low-income households (e.g., RLF, DOE's Energy Efficiency Community Block Grants (EECBG), and Home Energy Rebates). Furthermore, some programs, such as LIHEAP and EECBG, provide flexibility for program managers to set their own eligibility limits allowing them to further prioritize specific households to receive assistance (ACF 2022; DOE 2023d).

With this flexibility and access to multiple funding sources to reach households, states and local governments can stack funding to deliver further benefits to a recipient beyond what a single program could on its own.[1] Additionally, states and local governments can strategically deploy funds to fill market gaps, such as those left by the eligibility criteria of other programs, or those in which private lending options have been limited (SEE Action Network 2017). This analysis explores additive (stacking) as well as complementary (gap-oriented) strategies to advance energy equity in the scenarios analysis.[2]

[1] See the Roadmap for discussion on stacking.

[2] In January 2021, Executive Order 14008 announced the Justice40 Initiative (J40), which calls for certain federal investments to direct 40 percent of their overall benefits to disadvantaged communities (The White House 2021). Four of the five funding sources included in Table 1—all except Home Energy Rebates—are J40-covered programs

Table 1. Selection of current federal funding sources for funding and financing programs supporting residential energy efficiency

Program	Source	Mechanism	Audience
WAP	U.S. Department of Energy	Grants	Low-income households *Income limit: the greater of 200% federal poverty guidelines (FPG), 80% area median income (AMI), or 60% state median income (SMI)*
LIHEAP	U.S. Department of Health and Human Services	Grants	Low-income households *Income limit: set by grantee (upper limit cannot exceed the greater of 150% FPG or 60% SMI; upper limit cannot be lower than 110% FPG)*
RLF	U.S. Department of Energy	Loans and Grants	Loans – Homeowners *Income limit: none* Grants – Low-income homeowners *Income limit: the greater of 100% federal poverty line (FPL) or 70% Lower Living Standard Income Level (LLSIL)*
EECBG	U.S. Department of Energy	Grants and Vouchers	Households *Income limit: none*
Home Energy Rebates	U.S. Department of Energy	Rebates	Low-income households (eligible for larger rebates) *Income limit: less than 80% AMI*

Existing and new federally funded programs supporting residential energy efficiency are available to states and local governments including the WAP, LIHEAP, RLF Program, EECBG, and Home Energy Rebates (not an exhaustive list, e.g., does not include tax credits). Note: "households" refers to both renters and homeowners. *Sources*: DOE 2021; ACF 2022; DOE 2022b; DOE 2023d; DOE n.d.

Analysis: Equity-based funding and financing hotspots

The landscape of federally funded programs supporting residential energy efficiency (Table 1) reveals opportunities for states and local governments to deploy programs that complement each other and equitably address needs and market gaps. Programs that fund grants in low-income households can be stacked, as allowed through the applicable program's requirements, for deeper energy retrofits; programs without income limits can provide financing to market segments not served by existing funding or financing options. The geographic areas with a high concentration of these complementary opportunities are referred to here as funding and financing hotspots. These hotspots can be defined by various characteristics, such as consumer demand for loan products, aging building stock, or limited existing funding or financing programs. Identifying areas with high concentrations of certain characteristics enables states and local governments to better target program outreach, a significant barrier to deploying cost-effective energy efficiency financing programs (SEE Action Network 2017). Emphasizing outreach in hotspots aligned with program goals and requirements increases the chance of

(The White House 2022). Implementing J40 at the state and local level is not the focus of this analysis. However, this analysis can help states and local governments deploy programs with an equity orientation, and similar methods can be applied to identify and prioritize J40 communities using the Climate and Economic Justice Screening Tool.

participation, lowering program costs relative to savings. This analysis examines funding and financing hotspots at the intersection of energy burden and household income as an opportunity for states and local governments to implement programs that further equity in energy efficiency.

Energy burden. The percentage of gross household income spent on energy costs is referred to as energy burden. In the United States, the median household spends 3.1% of their income on energy bills with 25% of households facing high energy burdens (more than 6% of income spent on energy) and 13% facing severe energy burden (more than 10% of income spent on energy) (ACEEE 2020b). Energy burden is a salient household characteristic to inform energy efficiency funding and financing programs that support equity because this burden is not proportionally distributed across the country. Low-income, Black, Hispanic, Native American, and older adult households experience "disproportionally high energy burdens nationally, regionally, and in metro areas" (Drehobl, Ross, and Ayala 2020). High and severe energy burden can be caused by factors such as an outdated or inefficient heating system and can be reduced by energy upgrades (DOE 2018). Energy efficiency funding and financing programs that prioritize communities with high energy burden can lower energy costs and support energy equity.

Household income. Income is another key household characteristic that can be used to identify equity-informed funding and financing hotspots. Lower-income households that lack resources to finance energy efficiency upgrades present an opportunity for delivering energy retrofits that improve health, safety, and energy cost outcomes (NREL 2023; Reeg and Smedick 2023). Identifying overlaps in eligibility criteria of multiple funding programs can support deeper retrofits without debt-burdening low-income households. Moderate-income households that fall outside of income eligibility criteria of funding programs for low-income households, but often "lack the financial resources to fund energy upgrades on their own" (ACEEE 2023, 14), are also good candidates for targeted financing programs.

The intersection of these two household characteristics—energy burden and income—represents an opportunity to strategically deploy energy efficiency funding and financing programs that advance equity. Lower-income households tend to live in older housing (AAC 2023), which is typically less energy efficient, resulting in these households "spending more per square foot on energy services than higher income households" (SEE Action Network 2017). More comprehensive retrofits, which can be accomplished through stacking multiple funding sources, can address these inefficiencies to reduce energy costs.[3] Moderate-income households that fall outside of income eligibility criteria are also more likely to face high energy burden than high-income households (DOE LEAD n.d.). Because many moderate-income households are outside federal grant income eligibility limits, they need ready access to financing programs. States and local governments can offer these households loans with more flexible underwriting criteria, longer loan terms, and lower interest rates, through direct lending programs or in partnership with private lenders. Additionally, program managers can extend financing program reach by leveraging private capital through co-lending or credit enhancement models.

[3] States and local governments may be interested in stacking grants and financing for deeper energy upgrades in low-income households. Rationale and parameters for deploying financing in low-to-moderate income households have been presented (Leventis et al. 2016; SEE Action Network 2017). However, there is a commonly held policy position (not universally accepted) that low-income homeowners should not be the target of financing (DOE 2024). This paper follows this policy position by not considering financing scenarios for low-income households.

Scenarios Analysis: Advancing Equity in Energy Efficiency Funding and Financing

This analysis considers how federal funding and financing and federally-capitalized programs supporting residential energy efficiency with different requirements can be strategically deployed to households with high energy burden and low-to-moderate income. The Weatherization Assistance Program (WAP) and the Energy Efficiency Revolving Loan Fund (RLF) Capitalization Grant Program are used to illustrate how an established and newer program, as well as grant and loan programs can be strategically deployed in this space. The WAP, established in 1976, provides grants to low-income households for weatherization, which may include energy efficiency upgrades. States receive approximately $300 million annually from DOE for WAP programs (DOE 2023a), and through the BIL, WAP provides states another $3.5 billion in funding (DOE 2022a); states can distribute WAP grants to local governments and organizations as subgrantees. WAP funds are available to both renters and homeowners with income eligibility thresholds set as the higher of 200% FPG, 60% SMI, or 80% AMI (DOE 2021), and the program allows for funding of approved measures up to approximately $8,500 per home (known as the average cost per dwelling unit), adjusted annually (DOE 2023c).

The RLF Program allocates $250 million to states to establish or capitalize existing revolving loan funds for energy efficiency audits, upgrades, and retrofits across residential, commercial, and public sectors. States can use up to 25% of RLF Program funds to provide grants to low-income homeowners and small businesses with income eligibility limits for homeowners set at the higher of 100% FPL or 70% of the LLSIL (DOE n.d.). Loans provided through the RLF Program to homeowners are not income restricted.

States can utilize both WAP and RLF Program grants to fund energy efficiency projects in low-income homes, and through the RLF Program, states can provide energy efficiency financing to homeowners, including those that fall outside income eligibility thresholds for RLF Program grants. Using the Low-income Energy Affordability Data (LEAD) Tool, This analysis will examine how the WAP and RLF Program can be strategically deployed to prioritize funding and financing hotspots of high energy burdened, low-to-moderate income (LMI) households through two scenarios: 1) funding (grants) for energy efficiency projects in low-income, owner-occupied households (Scenario 1), and 2) financing (loans) for energy efficiency projects in moderate-income, owner-occupied households (Scenario 2) (Table 2).

The LEAD Tool, maintained by DOE, provides data on household income and energy characteristics through an online, interactive platform (DOE 2020). LEAD shows geographic concentrations of households that fall within specified characteristics of interest, including areas of high energy burden and low-to-moderate income, at the state, county, census tract, and city levels.[4] Other tools are available to support states and local governments in strategically designing and deploying energy funding and financing programs;[5] this analysis focuses on the LEAD Tool because it intersects energy burden thresholds and household income thresholds.

[4] The LEAD Tool includes data for the 50 states, Puerto Rico, and the District of Columbia. It does not include data on other U.S. territories, which are eligible for WAP and RLF Program funds. The LEAD Tool averages energy costs across five years; 2022 is the latest year of data integrated into the tool (Ma et al. 2019; DOE LEAD n.d.). This analysis refers to LEAD Tool data and features as of July 11, 2024.

[5] Examples of other available mapping tools to support designing and implementing equity-oriented funding and financing programs include the Climate and Economic Justic Screening Tool (CEJST), the State and Local Planning for Energy (SLOPE) Platform, and Building Stock tools (ComStock and ResStock).

Table 2. Scenarios summary

	Scenario 1: Funding hotspot	Scenario 2: Financing hotspot
Rationale	Complete more comprehensive energy upgrades & retrofits for low-income households facing high energy burden by deploying funding from multiple programs.	Fill market gaps by providing financing to moderate-income, high energy burdened households that are not eligible for grants.
Household Criteria[6]	• Low-income (<100% FPL) • Energy burdened (6+%) • Owner-occupied	• Moderate-income (80-150% AMI) • Energy burdened (6+%) • Owner-occupied

Scenarios 1 and 2 illustrate opportunities to strategically deploy funding and financing programs (e.g., the WAP and RLF Program) that supplement and complement each other, reduce energy burden, and advance equity.

Because the LEAD Tool shows household and energy data geographically, this analysis considers three states with low, medium, and high population densities (Wyoming, Wisconsin, and New Jersey) as samples to demonstrate potential households that may be reached under these scenarios (Table 3). Applying owner-occupied filter to the LEAD Tool (per RLF Program eligibility), the total number of households in these sample states range from 168,055 (Wyoming) to more than two million (New Jersey) and have average energy burdens near the national average, between 2% and 3%. Through BIL, these states are receiving between $12 million and $97 million in WAP and RLF Program awards (Table 3).

Table 3. Sample state summary

State	Population density (population per square mile)	Households (total)	Energy burden (average)	WAP and RLF awards (one-time BIL allocation)*
Wyoming	6	168,055	3%	$12,351,563
Wisconsin	109	1,641,142	2%	$96,922,215
New Jersey	1,263	2,195,522	2%	$89,595,758
National	93.8	82,185,430	3.1%	$3,750,000,000

Three sample states with low, medium, and high population densities illustrate the LEAD Tool across geographies. Households and average energy burden are shown for owner-occupied, non-boat/RV/van households only. *States receive annual WAP allocations in addition to BIL awards. *Sources*: U.S. Census Bureau 2021; DOE LEAD n.d.; ACEEE 2020b.

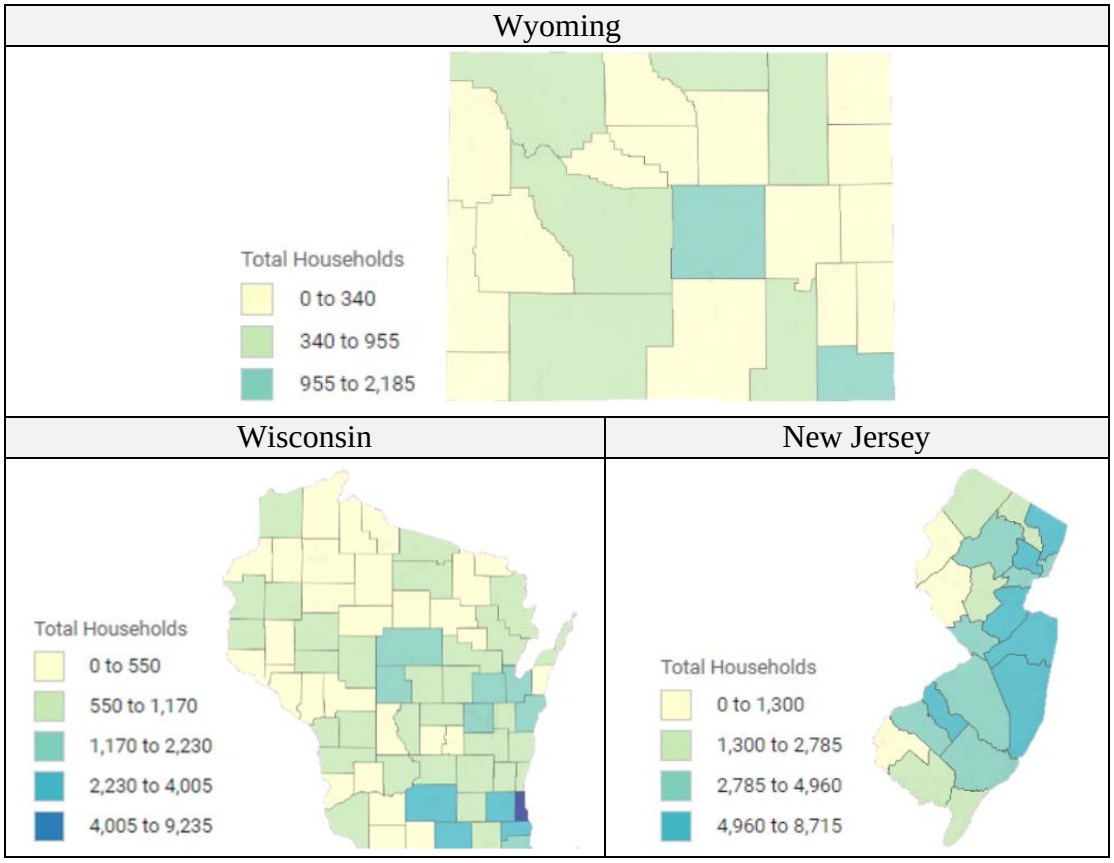
Scenario 1 funding hotspot: low-income households with high energy burden. The WAP and RLF Program both allocate funds to states to provide grants for energy efficiency projects in low-income households; by navigating the requirements of each program, states may be able to support deeper energy retrofits that can lead to a greater reduction in energy costs and lower energy burden. Because the WAP limits the average cost per dwelling unit of measures that can be funded in a dwelling unit and the RLF Program does not limit recipient funding per unit, RLF Program funding may be stacked, or used in addition to WAP funding, to deliver deeper energy retrofits in a home. Where the RLF Program is more limited than WAP, however, is in recipient eligibility: grants are only available to homeowners and under income thresholds lower than the

[6] This analysis excludes the LEAD Tool building type "Boat/RV/Van."

WAP. By identifying areas with a high concentration of households eligible for both the WAP and RLF Program that have high energy burden, states can support an equitable deployment of funding that delivers deeper energy retrofits and lowers energy burden.

To identify funding hotspots of high energy burdened, low-income households eligible for WAP and RLF Program, LEAD Tool filters are set to owner-occupied residences under and at 100% FPL,[7] and have an energy burden at or above 6%. Figure 1 shows where there are high concentrations—funding hotspots—of households that meet Scenario 1 criteria. In Wyoming, central and southeastern counties have a higher concentration of low-income, high-energy burdened households; in Wisconsin, these populations are concentrated in the southeastern counties of the state; and in New Jersey, central eastern and northeastern counties have a higher concentration of these households (Figure 1).

Figure 1. Counties in sample states with Scenario 1 funding hotspots



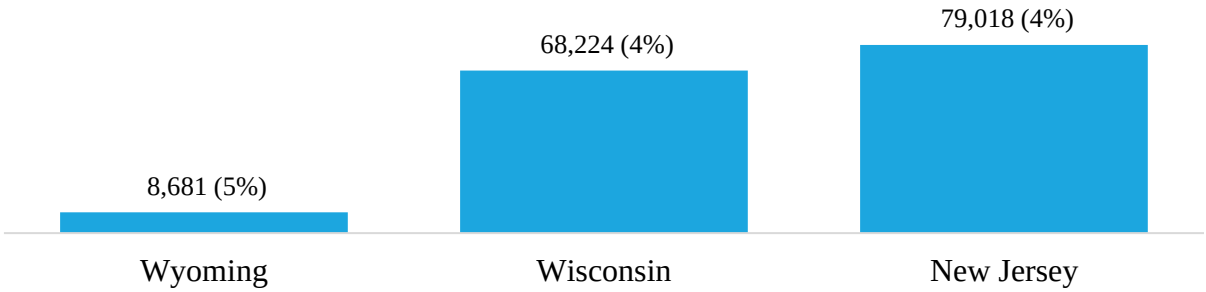
The LEAD Tool identifies counties[8] by the number of households eligible under Scenario 1—owner-occupied, low-income (0-100% FPL), non-boat/RV/van households with high energy burden (6+%)—across three sample states: Wyoming, Wisconsin, and New Jersey. *Source*: DOE LEAD n.d.

[7] Although RLF Program income eligibility for grants is the higher of 100% FPL or 70% LLSIL, and LLSIL is sometimes higher than 100% FPL and therefore would identify a greater number of household eligible, because the LEAD Tool does not currently integrate LLSIL data, this analysis uses the 100% FPL threshold, demonstrating the minimum number of households meeting income eligibility across programs. An advanced analysis that incorporates LLSIL thresholds may identify more households eligible for WAP-RLF stacking.

[8] Users can also identify other geographic areas (i.e., census tracts, cities) in the LEAD Tool.

Under Scenario 1, 97% of households within low-income thresholds under both the WAP and RLF Program also face high energy burden (Figure 2) with 8,681 homes in Wyoming, 68,224 in Wisconsin, and 79,018 in New Jersey. Nationally, 4,927,968 households meet Scenario 1 criteria (DOE LEAD n.d.).

Figure 2. Scenario 1 households in sample states (number of Scenario 1 households and number of Scenario 1 households as a percent of all owner-occupied households)



Scenario 1 households—owner-occupied, low-income (0-100% FPL), non-boat/RV/van households with high energy burden (6+%)—demonstrate an opportunity to advance equity. Nationally, 97% of low-income households under this scenario face high energy burdens with an average energy burden of 27.5%. *Source*: DOE LEAD n.d.

Scenario 2 financing hotspot: moderate-income households with high energy burden. Under Scenario 2, RLF Programs are strategically deployed to households with high energy burden that fall outside of WAP income eligibility thresholds. Because WAP recognizes 200% FPG, 80% AMI, and 60% SMI income thresholds, identifying which of these thresholds includes the greatest number of households will inform a more strategic deployment of financing programs (Table 4).[9] Households eligible for energy efficiency upgrades through WAP can access these resources, while those that fall outside these thresholds can access financing supported by state and local government programs. Using LEAD Tool data (DOE LEAD n.d.), this analysis shows that the 80% AMI threshold includes the largest number of households, both within each sample state and nationally, with more than 24 million households under this threshold across all states (Table 4). Thus, the 80% AMI threshold is used as the lower limit for identifying moderate-income financing hotspots for Scenario 2.

Table 4. Low-income thresholds (in thousands)

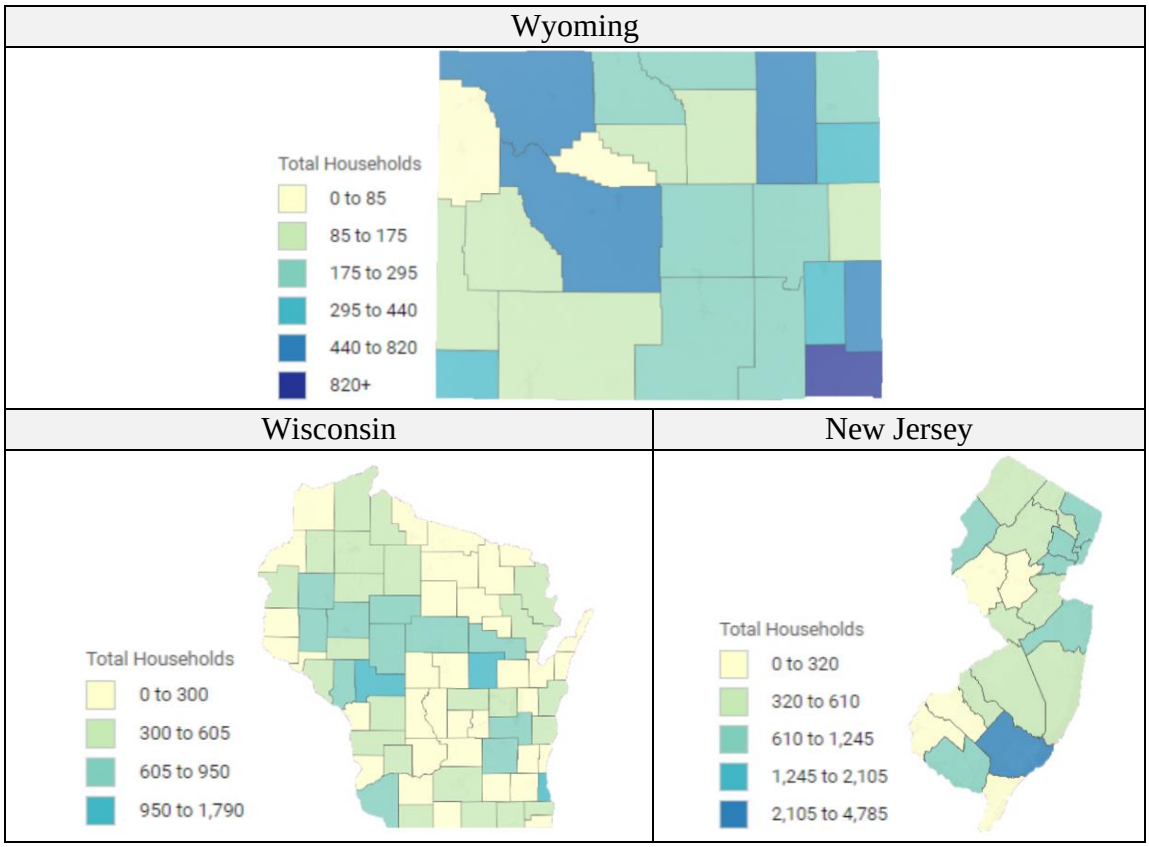
State	Households (total)	Households 0-200% FPL (total)	Households 0-60% SMI (total)	Households 0-80% AMI (total)
Wyoming	168	26	31	53
Wisconsin	1,641	226	290	466
New Jersey	2,196	232	420	568
National	82,185	14,260	15,331	24,514

[9] The LEAD Tool incorporates income thresholds based on the federal poverty line (FPL) as opposed to the federal poverty guidelines (FPG). Although FPG is based on FPL, there are some key differences. For states looking to deploy and/or stack programs with FPG income thresholds, the LEAD Tool FPL data can still be valuable as a general planning tool. For the purposes of this analysis, FPL data is used to approximate FPG reach.

The number of owner-occupied, non-boat/RV/van households varies across three income eligibility thresholds recognized by WAP—FPG, SMI, and AMI—with AMI yielding the largest number of households across all states and the District of Columbia. See footnote 10 for a discussion of FPG versus FPL; national figures include 50 states, Puerto Rico and the District of Columbia. *Source*: DOE LEAD n.d.

The LEAD Tool includes three brackets above the 80% low-income threshold for AMI (80-100%, 100-150%, and 150%+ AMI). For the purposes of this analysis, the 80-100 and 100-150% AMI brackets were used to identify Scenario 2 households. Figure 3 shows where there are high concentrations—financing hotspots—of households under Scenario 2. In Wyoming, the northwestern, northeastern, and southeastern counties have higher concentrations of these homes; in Wisconsin, these populations are primarily concentrated in central counties; and in New Jersey, eastern counties demonstrate potential financing hotspots.

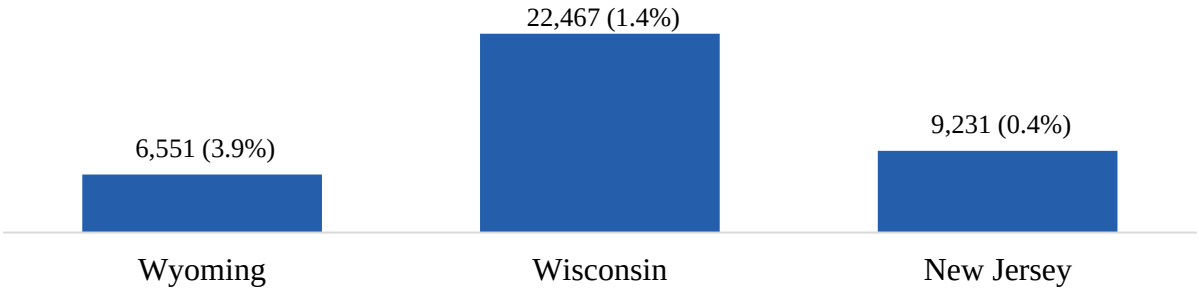
Figure 3. Counties in sample states with Scenario 2 financing hotspots



The LEAD Tool identifies counties by the number of households eligible under Scenario 2— owner-occupied, moderate-income (80-150% AMI), non-boat/RV/van households that are not eligible for WAP but are eligible for RLF facing high energy burden (6+%)—across three sample states: Wyoming, Wisconsin, and New Jersey.

Figure 4 shows the number of households under Scenario 2 criteria (owner-occupied, moderate-income households with high energy burden) in each sample state range from 6,551 in New Jersey to 22,467 in Wisconsin. Nationally, 1,042,641 owner-occupied, moderate-income households face high energy burden (DOE LEAD n.d.).

Figure 4. Scenario 2 households in sample states (number of Scenario 2 households and number of Scenario 2 households as a percent of all owner-occupied households)



Scenario 2 households—owner-occupied, moderate-income (80-150% AMI), non-boat/RV/van households that are not eligible for WAP but are eligible for the RLF Program that face high energy burden (6+%)—present a potential opportunity to advance equity in energy efficiency financing. *Source*: DOE LEAD n.d.

This analysis finds a limited number of households eligible under Scenario 2. As shown in Figure 4, 6,551 households in Wyoming, or approximately 4% of the state's 168,055 owner-occupied households, meet Scenario 2 criteria; however, this percentage drops for Wisconsin (1.4%) and New Jersey (0.4%). The fewer households identified under Scenario 2 (with moderate-income households) than Scenario 1 (with lower-income households) may be due to the inverse relationship between household income and energy burden: as household income increases, energy burden tends to decrease. However, as more than one million moderate-income households nationally face high energy burden, Scenario 2 illustrates an opportunity to spur market transformation and advance energy equity for homes in need. States that wish to reach more moderate-income, energy burdened households may consider conducting additional analysis with broader moderate-income brackets, e.g., 80-200% AMI, or adjust energy burden thresholds depending on their area average. Additionally, if existing grant programs in an area use other income thresholds, such as 0-200% of the FPL or 0-60% of the SMI, these thresholds could be used as the lower limit for a financing hotspot analysis, enabled by the LEAD Tool with 200-400% FPL and 60-100% SMI brackets.

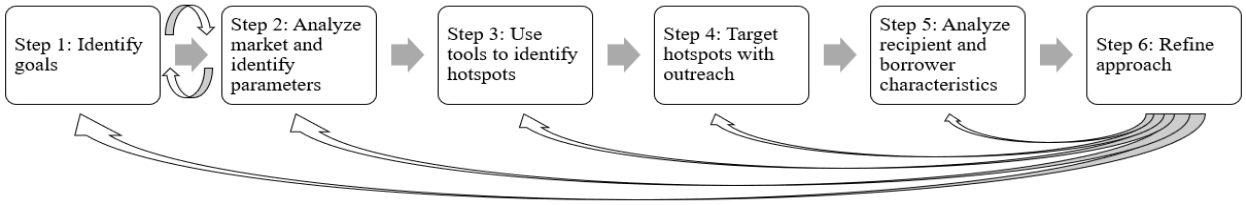
While these scenarios illustrate how states and local governments can strategically deploy multiple energy efficiency programs to reduce energy burden and advance equity, they do not provide a comprehensive review. For example, these scenarios do not explore how funding programs could be strategically deployed to low-income, high energy burdened households above 100% FPL and below 80% AMI. Deploying funding for energy upgrades in these households may be accomplished through the WAP, other low-income, residential programs supporting energy efficiency (e.g., Table 1), or stacking multiple funding sources. Exploring this and other similar scenarios of interest, can be similarly done in the LEAD Tool using techniques described in this analysis. In strategically deploying funding and financing programs to support energy efficiency, states and local governments can transform the market by emphasizing programs for homes in need, facing higher energy burden in their communities.

Roadmap

States and local governments can conduct their own analysis to identify energy efficiency funding and financing hotspots, using methods developed in this study, and deploy programs that

address these hotspots, reduce energy burden, and advance energy equity. This roadmap can inform implementation of this approach (Figure 5).

Figure 5. Roadmap to identify hotspots and strategically deploy funding and financing



This roadmap represents a fluid process. Program managers can move through the steps and revisit steps as needed to support designing and deploying effective funding or financing programs.

Step 1: Identify goals. The first step to strategically designing and deploying residential energy efficiency funding and financing programs at the state or local level is to identify program goals. This may mean identifying and aligning with existing goals in their mission and vision, strategic plans, or other organizational goals. Program administrators may also determine program-specific goals to align with the needs of their jurisdiction, such as lowering energy burden for high energy burdened LMI households, as explored in this analysis, or improving energy efficiency in the oldest, least efficient buildings.[10] Identifying program goals helps decision-makers direct funding and financing resources toward specific desired outcomes.

Step 2: Analyze market for gaps and identify parameters for strategic deployment. After identifying initial energy efficiency goals, states and local governments can conduct an analysis of the current market for financing and funding programs in their jurisdictions to determine needs and gaps to fill to reach these goals. This analysis may call for states to revisit and refine goals identified in Step 1. The landscape analysis of federal funding available to support residential energy efficiency (Table 1) illustrates an inventory of current offerings that states and local governments can perform to identify eligibility for programs, overlaps for complementary deployment, and gaps in funding and financing offerings. For example, program managers can determine which income levels are not eligible for grant funding, but are also not ideal recipients for lending, identifying an energy efficiency financing market gap to be tapped.

With an understanding of the opportunities and gaps in energy efficiency funding and financing, aligned with their goals, states and local governments can set parameters for their programs. These parameters can include household characteristics such as income levels, energy burden, or occupancy type. To hone parameters, program managers may consider questions such as: Which parameters address market gaps and needs? Which create a larger pool of eligible households? If we aim to deploy a program most equitably, which household characteristics can help achieve this? States and local governments looking to stack programs will want to consider program requirements as they set parameters.[11]

[10] Numerous resources are available to inform program goal setting, such as the DOE Energy Efficiency and Renewable Energy Handbook on Residential Program Design & Customer Experience. Program administrators may also utilize third parties to assess market needs and develop program goals.

[11] There are numerous considerations when stacking funding and financing programs. Program managers must identify program requirements, such as energy audit requirements and eligible measures and income levels, which

Step 3: Use data-driven tools to identify geographic concentrations of populations that meet your goals. The next step in developing a strategic program approach is to utilize tools, such as the LEAD Tool, to identify areas with financing or funding hotspots.[12] States and local governments can take the parameters identified in Step 2 that support their goals and set tool filters to show geographic concentrations of populations that meet these parameters. Within the LEAD Tool, users can do this by applying filters, such as income levels, energy burden levels, or renter versus owner occupancy, to show geographic concentration of populations that meet eligibility of multiple federal funding programs at the census tract, city, and county level (e.g., Scenario 1). Additionally, users can apply filters to locate populations that may stand just outside of certain thresholds to identify where there may be gaps to fill in program reach (e.g., Scenario 2). With these tools, users can visualize and calculate anticipated reach through mapping and data outputs and inform program outreach. If program managers are planning to partner with private financial institutions, cross walking these hotspots with financial institutions serving the area (e.g., CDFIs, credit unions, and other financial institutions with missions focused on serving that community) can help them identify potential lending and outreach partners.

Step 4: Target hotspots with outreach. By utilizing tools to generate maps and datasets of funding and financing hotspots aligned with program goals and participant requirements, states and local governments can overcome a significant barrier in deploying cost-effective energy efficiency financing programs: targeted outreach (SEE Action Network 2017). Targeted outreach can promote programs to the appropriate audiences, increasing the chance of participation and lowering the program costs relative to energy savings.

When conducting outreach in identified areas, states and local governments can further support program uptake by emphasizing benefits aligned with household needs. For example, outreach that emphasizes health and safety benefits of energy efficiency can be important to low-income households disproportionately impacted by respiratory issues (SEE Action Network 2017). Additionally, administrators can improve outreach by partnering with local organizations who may be more familiar with household needs and priorities in the area and have community trust.[13] Programs may also consider direct outreach in hotspots to assess community interest for their programs and help residents overcome a barrier to financing: lack of awareness of available incentives (Reeg and Smedick 2023). It is especially important to communicate eligibility, available incentives, and the potential for deeper upgrades and retrofits when conducting outreach for stacked programs (see footnote 13). When communities understand that they can use multiple funding streams to complete more comprehensive upgrades with lower project costs, they may be more likely to utilize stacked funding and reap deeper benefits. Finally, in designing outreach, states and local governments may consider setting uptake goals for the number or percentage of households reached as a benchmark to assess the effectiveness of outreach.

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may differ across programs, and review program guidance to support compliance. Additionally, they may consider strategies to help recipients overcome barriers to receiving funding from multiple sources.

[12] Other tools include the Climate & Economic Justice Screening Tool, which identifies disadvantaged communities; Building Stock tools (ComStock and ResStock), which identify buildings with high energy upgrade needs; and the State and Local Planning for Energy (SLOPE) Platform.

[13] Kentucky is one such example of effective partnering with local organizations. Their work with the Housing Development Alliance has helped prioritize assistance and meet local needs using LEAD Tool data.

Step 5: Analyze grants and loans relative to program goals. Once a program has begun making loans or grants, states and local governments can collect and analyze borrower or recipient characteristic data to determine if the households that utilized funding or financing align with program goals (Step 1). For example, what percentage of borrowers or recipients were in the program hotspots, either in terms of audience or geography (e.g., high energy burden, LMI households, underserved communities)? How has marketing and outreach influenced who is participating in programs? When borrower or recipient data has been captured and analyzed, states and local governments can assess how successful the program was in reaching priority groups, filling identified market gaps, or achieving target uptake volume, and thus if the goals of the program were met.[14]

Step 6: Refine approach. With an assessment of program reach (Step 5), states and local governments can refine their program goals, design, and implementation. This may involve adjusting the parameters in tools to better hone population hotspots, or engaging in different or more intensive marketing and outreach in areas where desired uptake has not been achieved. By revisiting and refining program rationale and design, such as the market analysis, parameters of priority populations, their geographic distribution, and how the resulting program design connects to program goals, states and local governments can more effectively deploy programs that support equitable outcomes. This may involve retracing several steps in this roadmap (Figure 5) to continually revisit and develop an approach that addresses market gaps and supports market transformation.

Conclusion

States and local governments can strategically deploy residential funding and financing programs to support energy efficiency, reduce energy burden, and advance energy equity. By identifying funding and financing hotspots, or geographic areas with high concentration of certain populations, such as low-to-moderate income households with high energy burden, states, local governments, and other capital-providing entities (e.g., utilities, financial institutions) can implement equity-oriented energy efficiency programs. This analysis and roadmap describe how program managers and administrators can utilize existing, data-based tools, such as the LEAD Tool, to complementarily deploy programs to targeted market segments and support deeper energy retrofits that reduce energy burden and fill market gaps.

This strategic deployment of funding and financing supports transformation in the residential energy efficiency market. By stacking grants for low-income, high energy burdened homes (Scenario 1), more comprehensive energy upgrades can be funded to markedly reduce energy burdens. Prioritizing moderate-income, high energy burdened homes for financing programs (Scenario 2) helps overcome market barriers these households face in accessing energy efficiency financing; as these households may fall outside of income-based grant program eligibility, but still have need for energy efficiency upgrades to reduce their energy burden, this approach can provide access to capital with the flexible underwriting criteria, lower interest rates, and longer loan terms that state and local government-backed programs can provide.

This paper provides a foundational analysis of key federally funded programs supporting residential energy efficiency funding and financing available to states and local governments,

[14] Publishing loan program data (e.g., New York's Green Jobs Green New York dashboard) can promote accountability and demonstrate alignment with program goals such as reach in funding and financing hotspots.

and opportunities to strategically deploy this funding in hotspots that advance energy equity. Additional research can further support an analysis of energy efficiency funding and financing market transformation opportunities by considering: How can federal residential energy efficiency funding be complemented by state and local government funding and private funding to support energy equity? What additional market transformations can be achieved through strategic funding and financing program deployment, e.g., workforce development in high need communities through a demand outlet? How can this roadmap be adapted to support energy equity in other markets, e.g., public housing and commercial sector, and what tools are available to support strategic deployment of energy efficiency funding and financing programs?

Acknowledgements

This research was supported in part by an appointment with the Science, Technology and Policy Program sponsored by the U.S. Department of Energy (DOE). This program is administered by the Oak Ridge Institute for Science and Education (ORISE) for the DOE. ORISE is managed by ORAU under DOE contract number DE-SC0014664. The views expressed in this paper do not necessarily reflect the views of DOE, ORAU, or ORISE.

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