Gauging the Impact of Various Definitions of Low- and Moderate-Income Communities on Possible Electricity Savings From Weatherization

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Overview

With rising interest in lowering energy costs for low- and moderate-income households, the U.S. Department of Energy (DOE) asked Lawrence Berkeley National Laboratory (LBNL) to assess the implications of pursuing energy efficiency neighborhood-by-neighborhood where those households are most prevalent. DOE provided certain scenarios for qualifying geographic areas as "low- and moderate-income communities," and LBNL used data on demographics, housing types and recent savings from low-income retrofits or weatherization to provide rough electricity savings estimates under those scenarios.

Introduction

A large number of entities nationwide – chiefly nonprofits and religious organizations, local and state governments, and utilities – work to save energy and reduce its costs for low-income households. These efforts typically focus on retrofits, or weatherization, of homes or replacement of inefficient appliances and lighting. Funding for these efforts comes from a variety of private and public sources, the largest being utility customer charges and the federal government.

Through its Weatherization Assistance Program and complementary efforts, the U.S. Department of Energy (DOE) has funded or otherwise supported energy efficiency improvements for low-income households, which also result in economic, environmental, and health benefits to individuals and communities. That support has driven energy efficiency improvements and minor associated repairs for more than 7 million low-income households since 1976 (Weatherization Assistance Program website 2017). For various reasons detailed in this brief, weatherizing low-income homes can be difficult, however, and the number of eligible households can outstrip resources and create backlogs in some locales. Recently, diverse stakeholders have demonstrated interest in expanding energy bill savings for low-income households and communities, and the federal government has responded with the DOE Better Buildings' Clean Energy for Low Income Communities Accelerator, among other initiatives.

Focusing deployment efforts on identified low- and moderate-income communities can have multiple benefits, including lowering energy costs for both households and businesses in the area while providing jobs installing energy-saving measures. These measures also can reduce health or safety risks, especially for low-income households, whose members often are elderly, disabled or chronically ill.

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Challenges and Opportunities

Efforts to save energy for low-income households have always faced challenges, including but not limited to:

1. Transaction costs for households and weatherization providers in establishing income eligibility
2. Heads of households that cannot afford, or are otherwise unable, to take time off work for income verification, retrofit and pre/post inspections
3. Distrust of programs and contractors offering "free" services or a reluctance to accept those services
4. Households that do not own housing or landlords that do not pay energy bills, reducing motivation for weatherization – or householder unwillingness to ask landlord for improvements
5. Poor condition of housing, including severe structural or health and safety issues (e.g., leaking roof, asbestos, antiquated wiring) that can preclude installation of energy-saving measures

This brief is aimed at the first issue – assessing eligibility at a high resolution and state and national scale. Providers of low-income energy efficiency services can reduce some screening time and costs by obtaining referrals from government or nonprofit entities that perform income verification for other purposes or by categorical qualification – automatically qualifying households deemed income eligible for utility rate reductions, the federal Supplemental Nutritional Assistance Program or the Women, Infants and Children program, for example. But screening for eligibility by building or neighborhood – as a proxy, we use census tracts[1] – also can reduce the administrative costs of determining the income of each individual household and also provide economies of scale when contractors weatherize homes.

With mounting interest in helping low- and moderate-income households save on energy costs, DOE's Office of Energy Policy and Systems Analysis asked LBNL to provide rough estimates of energy efficiency savings opportunities in low- and moderate-income communities, as defined by various levels of income eligibility and neighborhood density of eligible households. Bounding the scope and savings potential of energy efficiency under these various definitions can be useful to state and local governments considering ways to reduce energy bills for low- and moderate-income households.

Methodology

This brief summarizes a rough approximation of possible electricity savings in low- and moderate-income communities, assuming residences in those communities were to undergo energy efficiency improvements typical of those funded by the federal weatherization program. It provides estimates for the percentage of population deemed eligible using several federal eligibility guidelines and variants. Those

[1] Census blocks are the smallest geographic unit of data collection for the U.S. Census Bureau's flagship decennial census. Census block *groups* are the smallest area for census data publication and include 250 to 500 households. Block groups are defined in part by natural or constructed boundaries – rivers and freeways, for example. Census tracts contain a few census blocks and generally have a population size between 1,200 and 8,000 people, with an optimum size of 4,000 people. Census tracts were selected for this analysis because of time constraints and analytical tractability. Analyzing eligibility at the census block group level would offer higher precision and more confidence in targeting finite resources on households with low or moderate incomes.

estimates are multiplied by average household electricity savings estimates from retrofits conducted under the auspices of the federal Weatherization Assistance Program.

This approach, described in more detail below, should not be confused with a formal energy efficiency potential study. Such studies usually take a bottom-up approach that often involves defining a baseline efficiency and identifying efficiency measures that meet various screens for technical, economic and practical viability for implementation within the context of a program with certain levels of participation and capacity to deliver services. Such studies can form the basis for program budgeting, design and planning and setting savings targets. That kind of analysis is considerably beyond the scope of this work.

This analysis nonetheless offers some broad insight into the number of eligible households and energy savings for each state under various potential approaches[2] to identifying low- and moderate-income communities.[3]

The process has four steps:

1. Identifying the number of eligible households[4] and communities under various definitions of "low and moderate income"[5] by reviewing public U.S. Census Bureau data,[6] then aggregating these eligible households into communities in each state;

2. Characterizing the housing stock in each state, including the type of structures (single family, mobile home, multi-family),[7] heating fuel, and climate zone;

3. Estimating potential electricity savings per housing unit by structure type, heating fuel, and climate zone, based on median values supplied in recent evaluations of the U.S. Department of Energy's Weatherization Assistance Program;[8] and

4. Totaling the estimated electricity savings potential by state and nationally for each eligible household in each combination of structure type,[9] heating fuel and climate zone.

LBNL used this approach to estimate the eligible population and the *maximum* single-year energy savings that might result from applying traditional income eligibility guidelines for low-income weatherization. LBNL

[2] Details for each scenario may be found in Table 1, below Figure 1.

[3] Energy efficiency for "low- and moderate-income communities" could plausibly include non-residential structures, but analysis of the commercial and industrial market sectors is significantly more difficult, partly because of the diversity of structures and end uses and partly because the connection between commercial and industries activities and income levels and energy burden is less clear than for households.

[4] Where it was necessary to apply income guidelines specific to household size, LBNL rounded up the average household size for each census tract and treated as eligible all households with incomes at or below the qualifying threshold for that household size. This method does risk including some non-low-income households that technically can claim zero income because of losses, but these households are very few in number and unlikely to influence the savings estimates to any significant degree.

[5] Income eligibility for the Weatherization Assistance Program is based upon 200% of the federal poverty threshold for household sizes ranging from one to nine or more. There is no standard or consensus definition of moderate- or middle-income or "middle class." However, some utility efficiency programs aiming for those demographics have used 250% or 300% of the federal poverty level as an eligibility threshold. This brief presents the results of testing the impacts of using those thresholds.

[6] American Community Survey (ACS) five-year summary data from 2009-2014.

[7] Detailed summary data on the composition of housing stock for income-qualified households at the census tract level were not available. Analysis of American Community Survey microdata was deemed beyond the scope of this analysis.

[8] Oak Ridge National Laboratory and its subcontractors conducted these evaluations for weatherizations performed for various subsets of the years 2008 to 2011. The evaluations may be accessed at http://weatherization.ornl.gov/evaluation_nr.shtml

[9] Note that the savings estimates presented in this brief are for multi-family and single-family housing (including mobile homes but not boats or vehicles). Because multi-family structures that are master metered often are treated by utilities as commercial accounts, some of the savings estimated here are commercial in nature. The majority is residential, however.

screened households for eligibility using variants on those guidelines to include moderate-income households. DOE was interested in changes in the magnitude of energy savings across multiple definitions of low- and moderate-income communities. LBNL thus also screened census tracts, as a proxy for communities, by the density of income-eligible low- and moderate-income households, using a range of densities for income-eligible households in each census tract. For this brief, we chose to focus on the middle of that range, 65% and 75%. For example, if a "low-income community" were defined as having at least 65% of households meeting the typical income eligibility for weatherization (200% of the federal poverty level or less), then LBNL identified all census tracts meeting that criteria and summed the estimated energy savings for all housing units within those tracts. The 65% and 75% densities were deemed fairly high densities for low- and moderate-income households – neighborhoods where the presence of households that would not be individually income eligible was small. Communities with higher densities of low- and moderate-income households were relatively few and concentrated in certain urban areas, and they presented substantially fewer possible projects and thus lower total energy savings.

To assess possible electricity savings in neighborhoods fitting the various definitions of low- and moderate-income communities, it is critical to take into account the type of housing structure, heating fuel and climate zone. Each of these variables figures prominently in the quantity of energy saved by a weatherization. Weatherizing a detached single-family house with all-electric heating in the South will generally produce larger savings of electricity (median of 1,837 kWh/unit) than a similar house with natural gas heating in the colder, drier northern tier states of the Midwest (median of 511 kWh/unit). Median electricity savings in a single-family house can be nine times the per-unit savings in large apartment buildings with the same heating fuel (natural gas) and in the same climate zone (cold). Evaluations of the federal WAP program provided these values for most combinations of structure type, heating fuel and climate; we made some extrapolations in the few instances where data were not available (i.e., extending a median per-unit savings estimate from one climate zone to a similar climate zone, e.g., per-unit savings for a single-family home in a cold climate also used for savings in single-family homes in a very cold climate).

We offer significant caveats near the end of this brief for consideration in interpreting the results. But a separate note on methodology is warranted here. All of the definitions of low- and moderate-income households and communities depend on a combination of income level and household size. Summary census data were not available to provide household size distribution or type of housing structure at each cohort of household income.

Because of limitations on scope or data availability at finer geographic scales and income levels, we extrapolated the breakdown of structure types and heating fuels for each state to the neighborhoods (census tracts) that qualified as low or moderate income under each definition. That is, we assumed that each low- or moderate-income neighborhood had the same combination of housing type and heating fuels as the state at large. This assumption risks an ecological fallacy – that is, drawing conclusions about individuals or small samples based on observations of a group or a larger sample.[10] Here, we extend findings regarding the composition of housing stock statewide to the housing stock of individual census tracts (where we can screen households and neighborhoods for income eligibility). It is almost certainly the case that low- and moderate-income households in urban areas are more likely to live in multi-family dwellings than a given state's population as a whole. All other things being equal, applying the statewide housing mix at the neighborhood level may underestimate electricity savings in some states and overestimate savings in others.

The savings estimates for each definition of low- and moderate-income community should be regarded as a rough approximation of maximum possible savings in the first year of an energy efficiency initiative, assuming all

[10] The definition of ecological fallacy can be found in multiple sources, including for example the Research Methods Knowledge Database at Cornell University, accessible at http://www.socialresearchmethods.net/kb/fallacy.php.

households in the tract participated in weatherization of their homes, no homes had previously been retrofitted, and no homes were excluded because of health or safety issues. These estimates therefore should be viewed as outer bounds. .[11]

In parallel with our analysis, the DOE Office of Energy Policy and Systems Analysis (EPSA) performed geographic screening using income eligibility data from the U.S. Department of Treasury for New Markets Tax Credit (NMTC) and the U.S. Department of Housing and Urban Development for its Low-Income Housing Tax Credit for Qualified Census Tracts (LIHTC QCTs), both aimed at incenting economic development or low-income housing in low-income communities.[12] EPSA estimated energy savings for the eligible households using the LBNL methodology, based on structure and fuel type and per-unit savings estimates from the WAP evaluations. Because the two analyses are similar in methodology and focused on assessing savings from various definitions of low- and moderate-income communities, we have included the results of the EPSA analysis for comparison purposes.

Results

Figure 1 presents the results of the LBNL analyses and also incorporates results of the similar analyses performed by DOE-EPSA for comparison. The colors and shading indicate the various income-eligibility thresholds and definitions of low- and moderate-income communities. Table 1 explains the abbreviations and definitions, and Appendix A provides more detail on the results.

This brief is not intended to evaluate or provide grounding for any specific policy. But a few general conclusions can be drawn from the analysis:

- Low-income households are widely distributed nationally. Testing income eligibility for individual households thus results in significantly higher number of eligible households and greater associated energy savings. Testing eligibility by geography, especially at finer resolution (on the level of census block groups or tracts versus the state or national level), inherently reduces the total number of qualifying households and the associated savings, in part because large concentrations of low-income households are relatively few in number.

- A trade-off exists, however, between reductions in the savings when assessing household income eligibility at finer geographic resolution and minimizing provision of low- or no-cost retrofits to households that otherwise would not be income eligible for those services. Using geographic qualifications therefore can introduce a tension between higher overall savings at larger geographic scales and minimizing the use of finite weatherization funds on retrofits for otherwise ineligible households.

[11] The savings estimates in this brief may be regarded as closer to economic than technical potential, however, because the median savings values used to calculate total savings are derived from actual weatherizations that typically must pass a benefit-cost test. Weatherization program implementers and contractors typically apply a benefit-cost test known as the savings-to-investment ratio (SIR). In general, projects are approved when they meet an SIR of at least 1.0; that is, the value of the energy and water saved equals or exceeds the cost of the measures that deliver the savings.

[12] NMTC analysis was performed using July 2015 eligibility estimates from the U.S. Department of Treasury Community Development Financial Institutions Fund (https://www.cdfifund.gov/Documents/Forms/GeographicReports.aspx) and a publicly available tool from Novogradac & Company (https://www.novoco.com/resource-centers/new-markets-tax-credits/data-tools/nmtc-mapping-tool). LIHTC QCT analysis was performed using data from HUD on 2016 Qualified Census Tracts (https://www.huduser.gov/portal/datasets/qct.html#2016).

- Examining the eligibility and savings implications of screening for income eligibility at both the individual and community levels would be a useful exercise. The flexibility of such an approach would enable savings for low- and moderate-income households living in neighborhoods with diverse incomes and also from neighborhoods with significant concentrations of low- and moderate-income households.

- While it is possible to obtain order of magnitude estimates with this method, confidence in those results would be significantly higher with data that more finely characterizes housing quality, tenure and energy use by income cohort.

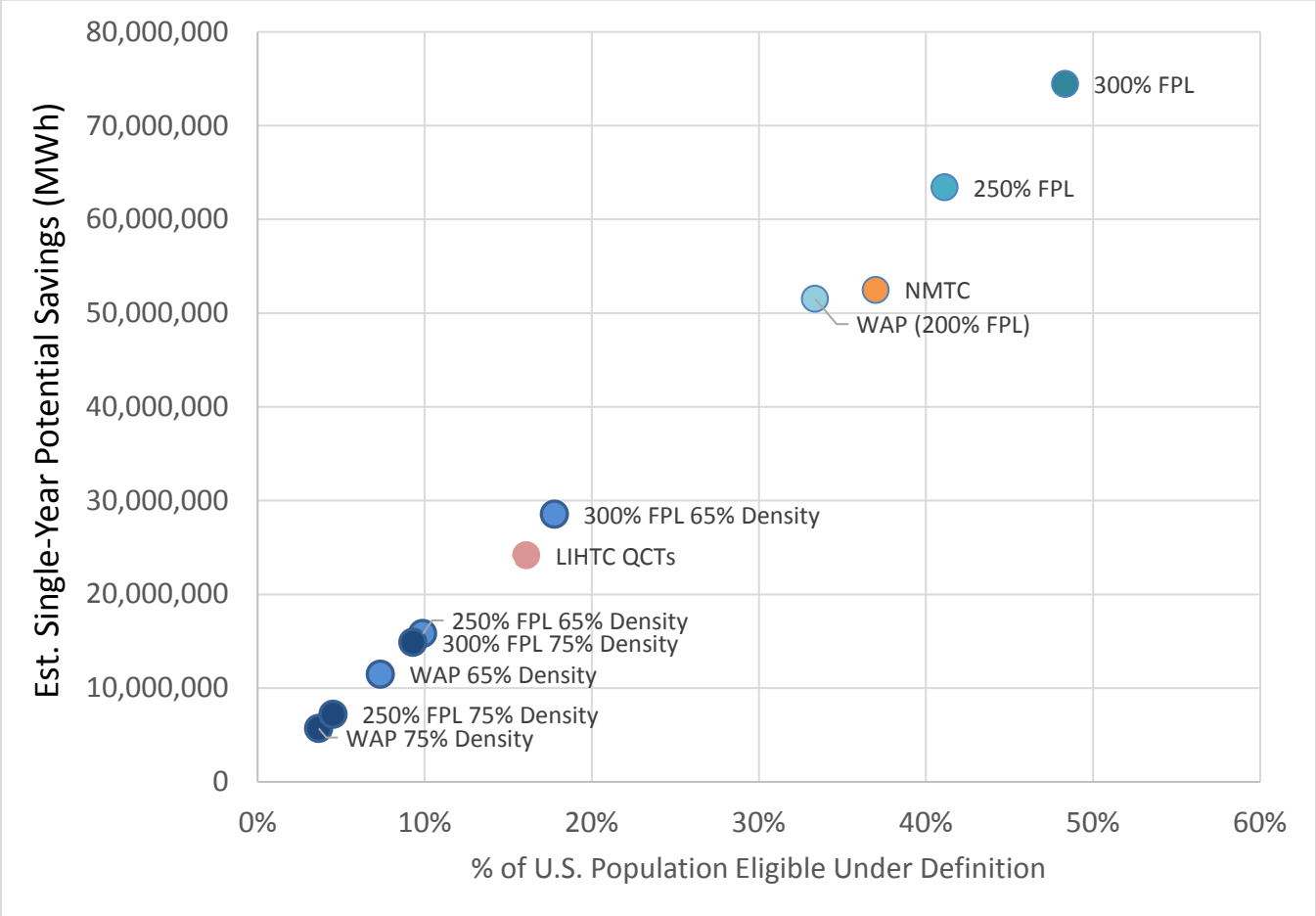

Figure 1. Comparison of maximum first-year electricity savings potential and market size for low-income energy efficiency improvements under various income eligibility thresholds and definitions of "low-income communities"

Table 1. Abbreviations and definitions of the scenarios charted in Figure 1

Abbreviation	Eligibility Definition Description
WAP	U.S. Department of Energy Weatherization Assistance Program eligibility guidelines: All households nationally with incomes equal to or less than 200% of the federal poverty levels for different household sizes
WAP 65% Density	All households in census tracts where at least 65% of households have incomes no greater than 200% of the federal poverty level

WAP 75% Density	All households in census tracts where at least 75% of households have incomes no greater than 200% of the federal poverty level
250% FPL	All households nationally with incomes equal to or less than 250% of the federal poverty levels for different household sizes
250% FPL 65% Density	All households in census tracts where at least 65% of households have incomes no greater than 250% of the federal poverty level
250% FPL 75% Density	All households in census tracts where at least 75% of households have incomes no greater than 250% of the federal poverty level
300% FPL	All households nationally with incomes equal to or less than 300% of the federal poverty levels for different household sizes
300% FPL 65% Density	All households in census tracts where at least 65% of households have incomes no greater than 300% of the federal poverty level
300% FPL 75% Density	All households in census tracts where at least 75% of households have incomes no greater than 300% of the federal poverty level
LIHTC QCTs	U.S. Department of Housing and Urban Development identified Qualified Census Tracts for Low Income Housing Tax Credits, with eligibility for tracts with at least 50% of households having incomes below 60% of area median income
NMTC	Federal New Markets Tax Credit, which can be awarded to investors in businesses and economic development projects in census tracts where the individual family poverty rate is at least 20% or median family income is 80% or less of area median

Essential context and limitations of these results:

- No adjustment has been made for participation; that is, all eligible households are assumed to agree to retrofits. For reasons noted above, many eligible households ultimately decide not to participate. Some analyses have found that only about half of income-eligible households that have not already had energy efficiency improvements are willing to allow weatherization of their homes.[13]

[13] See, e.g., "Needs Assessment for the Energy Savings Assistance and California Alternate Rates for Energy Programs" at http://liob.cpuc.ca.gov/Docs/2016%20LINA%20Final%20Report%20-%20Volume%201%20of%202.pdf

- For all of these estimates, the method does not "net out" estimated savings already acquired through weatherization to date; that is, the electricity saved from past weatherizations remains in the estimate of the maximum available savings. Further work would be needed to better quantify and remove those savings. It is likely, however, that at least 5% and perhaps as much as 20% of the residences of households deemed eligible here have undergone energy efficiency retrofits in the last decade and thus do not present meaningful savings opportunities.

- Typically, about one in five residences of income-qualified households cannot be weatherized without first addressing significant structural, health or safety issues, such as knob-and-tube wiring, asbestos insulation, mold and roof leaks.[14] Unless funds are available for rectifying those deficiencies and enabling installation of energy efficiency measures, the savings estimates provided in this brief may be further reduced by roughly 20%.

- All savings values reported in this brief have been rounded to the nearest 10,000 megawatt-hours (MWh) to reflect some of the uncertainty in the assumptions used in the analysis and to avoid misleading the reader about the level of precision in the estimates.

- Some states have zero qualifying households under some higher density definitions of "low-income communities" (i.e., 75% of households or more must meet relatively low income-eligibility thresholds).

Contact us:

Please direct any questions regarding this brief or related technical assistance to Ian Hoffman at LBNL (ihoffman@lbl.gov) or John Agan at DOE-EPSA (John.Agan@hq.doe.gov). More information regarding technical assistance to state, local and tribal governments may be found at http://energy.gov/ta/state-local-and-tribal-technical-assistance-gateway.

[14] DOE Office of Weatherization and Intergovernmental Partnerships, personal communication, December 2016.

Appendix A. Electricity Savings and Market Penetration Estimates

Table A-1. Estimated maximum single-year electricity savings (MWh) and percentage of total national savings from applying income guidelines based upon variants of the federal poverty level, at the national and regional level

Megawatt-hour savings for definitions of low- and moderate-income communities by income and the density of income-eligible households by census tract									
Census Region	All Households at 200% of the Federal Poverty Level (FPL)	All Households at 250% of the FPL	All Households at 300% of the FPL	At least 65% of Households in Census Tracts Eligible at 200% of FPL	At least 75% of Households in Census Tracts Eligible at 200% of FPL	At least 65% of Households in Census Tracts Eligible at 250% of FPL	At least 75% of Households in Census Tracts Eligible at 250% of FPL	At least 65% of Households in Census Tracts Eligible at 300% of FPL	At least 75% of Households in Census Tracts Eligible at 300% of FPL
US	51,500,000	63,400,000	74,400,000	9,100,000	3,000,000	20,100,000	8,500,000	35,900,000	17,300,000
Northeast	9%	9%	9%	8%	8%	7%	7%	6%	7%
South	54%	54%	53%	62%	61%	63%	61%	62%	61%
Midwest	16%	17%	17%	14%	15%	14%	14%	14%	14%
West	20%	20%	20%	16%	16%	16%	18%	17%	18%
Climate Zone									
Very Cold	6%	6%	6%	4%	5%	4%	4%	4%	4%
Cold	20%	20%	21%	17%	17%	16%	16%	16%	16%
Moderate	23%	23%	24%	16%	13%	19%	15%	22%	17%
Hot-Humid	38%	37%	37%	51%	52%	49%	50%	47%	49%
Hot-Dry	13%	13%	13%	13%	13%	12%	15%	12%	14%

Table A-2. Estimated eligible households as a percent of state households and estimated maximum electricity savings if low-income communities are defined as all households meeting a given income threshold based on the federal poverty level

State	Households at 200% of the Federal Poverty Level		Households at 250% of the Federal Poverty Level		Households at 300% of the Federal Poverty Level	
	Percent of State Households Qualifying	Single-year potential savings - MWh	Percent of State Households Qualifying	Single-year potential savings - MWh	Percent of State Households Qualifying	Single-year potential savings - MWh
Alabama	43%	1,310,000	52%	1,580,000	60%	1,820,000
Alaska	26%	40,000	34%	60,000	41%	70,000
Arizona	38%	1,420,000	48%	1,770,000	56%	2,070,000
Arkansas	45%	690,000	54%	840,000	63%	970,000
California	35%	4,780,000	43%	5,890,000	50%	6,880,000
Colorado	31%	590,000	39%	750,000	47%	910,000
Connecticut	27%	290,000	33%	360,000	40%	430,000
Delaware	31%	120,000	39%	160,000	47%	190,000
District of Columbia	29%	120,000	35%	150,000	41%	170,000
Florida	40%	6,180,000	50%	7,670,000	58%	8,950,000
Georgia	41%	2,380,000	50%	2,910,000	58%	3,380,000
Hawaii	29%	100,000	37%	130,000	45%	160,000
Idaho	41%	240,000	51%	300,000	61%	350,000

Illinois	34%	1,390,000	42%	1,730,000	49%	2,040,000
Indiana	37%	980,000	47%	1,240,000	56%	1,470,000
Iowa	32%	360,000	41%	470,000	49%	560,000
Kansas	34%	440,000	43%	550,000	52%	660,000
Kentucky	40%	940,000	48%	1,140,000	55%	1,310,000
Louisiana	40%	1,140,000	47%	1,360,000	53%	1,540,000
Maine	35%	90,000	43%	110,000	51%	130,000
Maryland	25%	730,000	32%	940,000	39%	1,140,000
Massachusetts	29%	580,000	35%	720,000	42%	850,000
Michigan	38%	970,000	47%	1,200,000	55%	1,410,000
Minnesota	29%	510,000	37%	660,000	45%	800,000
Mississippi	49%	820,000	58%	970,000	66%	1,100,000
Missouri	37%	1,070,000	47%	1,340,000	55%	1,590,000
Montana	37%	120,000	47%	150,000	55%	180,000
Nebraska	33%	250,000	42%	320,000	51%	390,000
Nevada	36%	450,000	45%	570,000	54%	680,000
New Hampshire	25%	80,000	33%	100,000	40%	130,000
New Jersey	28%	690,000	35%	860,000	41%	1,020,000
New Mexico	42%	300,000	51%	360,000	59%	420,000

New York	32%	1,540,000	37%	1,810,000	44%	2,120,000
North Carolina	36%	2,110,000	44%	2,570,000	52%	3,010,000
North Dakota	29%	110,000	35%	130,000	44%	160,000
Ohio	37%	1,620,000	46%	2,020,000	54%	2,380,000
Oklahoma	40%	760,000	50%	940,000	58%	1,100,000
Oregon	36%	830,000	45%	1,040,000	53%	1,220,000
Pennsylvania	34%	1,490,000	42%	1,860,000	50%	2,200,000
Rhode Island	32%	90,000	40%	110,000	47%	130,000
South Carolina	41%	1,270,000	51%	1,550,000	59%	1,800,000
South Dakota	34%	110,000	44%	140,000	52%	170,000
Tennessee	41%	1,600,000	50%	1,970,000	59%	2,290,000
Texas	38%	6,250,000	46%	7,550,000	53%	8,780,000
Utah	32%	220,000	38%	260,000	47%	320,000
Vermont	28%	30,000	34%	40,000	42%	50,000
Virginia	26%	1,160,000	32%	1,440,000	39%	1,740,000
Washington	27%	1,180,000	34%	1,460,000	41%	1,760,000
West Virginia	40%	360,000	48%	420,000	56%	500,000
Wisconsin	30%	550,000	37%	680,000	45%	840,000
Wyoming	27%	50,000	34%	70,000	42%	80,000

Table A-3. Estimated eligible households as a percent of state population and estimated maximum electricity savings if low-income communities are defined as census tracts with at least 65% of households meeting a given income threshold

State	All Households in Tracts with 65% of Households at 200% of the Federal Poverty Level		All Households in Tracts with 65% of Households at 250% of the Federal Poverty Level		All Households in Tracts with 65% of Households at 300% of the Federal Poverty Level	
	Percent of State Households Qualifying	Single-year potential savings - MWh	Percent of State Households Qualifying	Single-year potential savings - MWh	Percent of State Households Qualifying	Single-year potential savings - MWh
Alabama	6%	200,000	15%	470,000	31%	940,000
Alaska	0%	-	3%	10,000	6%	10,000
Arizona	8%	310,000	16%	580,000	26%	980,000
Arkansas	6%	90,000	17%	260,000	36%	550,000
California	5%	750,000	12%	1,690,000	20%	2,830,000
Colorado	2%	40,000	6%	120,000	13%	250,000
Connecticut	2%	20,000	6%	60,000	9%	90,000
Delaware	2%	10,000	4%	20,000	9%	30,000
District of Columbia	5%	20,000	10%	40,000	17%	70,000
Florida	9%	1,340,000	20%	3,120,000	36%	5,560,000
Georgia	8%	490,000	21%	1,240,000	38%	2,220,000
Hawaii	0%	-	4%	10,000	10%	40,000
Idaho	3%	20,000	15%	90,000	40%	240,000

Illinois	6%	240,000	12%	510,000	20%	830,000
Indiana	6%	150,000	14%	370,000	27%	720,000
Iowa	2%	30,000	6%	70,000	11%	130,000
Kansas	4%	60,000	11%	150,000	22%	290,000
Kentucky	5%	120,000	15%	350,000	30%	710,000
Louisiana	7%	200,000	14%	420,000	23%	670,000
Maine	2%	-	4%	10,000	12%	30,000
Maryland	2%	60,000	5%	140,000	9%	260,000
Massachusetts	3%	60,000	7%	150,000	11%	230,000
Michigan	8%	220,000	15%	390,000	26%	680,000
Minnesota	2%	40,000	4%	70,000	8%	150,000
Mississippi	15%	250,000	35%	590,000	55%	930,000
Missouri	4%	120,000	14%	400,000	30%	870,000
Montana	2%	10,000	8%	30,000	19%	60,000
Nebraska	4%	30,000	9%	70,000	17%	130,000
Nevada	8%	100,000	17%	210,000	30%	370,000
New Hampshire	1%	-	1%	-	4%	10,000
New Jersey	3%	80,000	8%	210,000	15%	360,000
New Mexico	12%	90,000	27%	190,000	38%	270,000

New York	6%	280,000	10%	470,000	15%	720,000
North Carolina	4%	220,000	11%	610,000	22%	1,290,000
North Dakota	2%	10,000	3%	10,000	6%	20,000
Ohio	6%	280,000	14%	610,000	25%	1,100,000
Oklahoma	7%	130,000	18%	340,000	36%	680,000
Oregon	2%	50,000	9%	220,000	24%	540,000
Pennsylvania	6%	260,000	11%	500,000	19%	810,000
Rhode Island	6%	20,000	13%	30,000	18%	50,000
South Carolina	8%	240,000	20%	620,000	39%	1,190,000
South Dakota	2%	10,000	7%	20,000	17%	60,000
Tennessee	8%	300,000	21%	820,000	39%	1,500,000
Texas	11%	1,880,000	20%	3,310,000	31%	5,140,000
Utah	2%	10,000	5%	30,000	14%	90,000
Vermont	0%	-	0%	-	4%	-
Virginia	2%	80,000	4%	170,000	9%	400,000
Washington	2%	60,000	3%	140,000	9%	380,000
West Virginia	3%	30,000	8%	70,000	21%	190,000
Wisconsin	3%	60,000	5%	100,000	9%	170,000
Wyoming	0%	-	0%	-	2%	-

Table A-4. Estimated eligible households as a percent of state population and estimated maximum electricity savings if low-income communities are defined as census tracts with at least 75% of households meeting a given income threshold

State	All Households in Tracts with 75% of Households at 200% of the Federal Poverty Level		All Households in Tracts with 75% of Households at 250% of the Federal Poverty Level		All Households in Tracts with 75% of Households at 300% of the Federal Poverty Level	
	Percent of State Households Qualifying	Single-year potential savings - MWh	Percent of State Households Qualifying	Single-year potential savings - MWh	Percent of State Households Qualifying	Single-year potential savings - MWh
Alabama	4%	70,000	11%	220,000	22%	430,000
Alaska	0%	-	2%	-	4%	10,000
Arizona	6%	140,000	12%	350,000	21%	570,000
Arkansas	3%	30,000	12%	90,000	25%	240,000
California	3%	230,000	9%	830,000	16%	1,690,000
Colorado	1%	10,000	4%	50,000	10%	130,000
Connecticut	1%	10,000	4%	20,000	7%	60,000
Delaware	2%	-	3%	10,000	6%	20,000
District of Columbia	3%	10,000	7%	20,000	11%	40,000
Florida	5%	490,000	14%	1,320,000	26%	2,810,000
Georgia	5%	160,000	13%	440,000	27%	1,000,000
Hawaii	0%	-	2%	-	7%	10,000
Idaho	2%	10,000	9%	20,000	22%	70,000

Illinois	4%	80,000	9%	230,000	15%	430,000
Indiana	4%	50,000	10%	150,000	18%	330,000
Iowa	1%	10,000	4%	30,000	7%	60,000
Kansas	2%	10,000	7%	60,000	15%	140,000
Kentucky	2%	20,000	8%	90,000	19%	240,000
Louisiana	4%	60,000	9%	160,000	16%	310,000
Maine	1%	-	2%	-	6%	10,000
Maryland	1%	20,000	3%	60,000	6%	100,000
Massachusetts	2%	20,000	5%	60,000	9%	120,000
Michigan	6%	90,000	11%	190,000	20%	350,000
Minnesota	1%	10,000	3%	30,000	5%	60,000
Mississippi	10%	90,000	22%	220,000	42%	460,000
Missouri	3%	40,000	8%	120,000	20%	340,000
Montana	1%	-	4%	10,000	14%	20,000
Nebraska	2%	10,000	7%	30,000	13%	70,000
Nevada	4%	40,000	11%	90,000	23%	200,000
New Hampshire	0%	-	1%	-	2%	-
New Jersey	2%	30,000	5%	60,000	11%	160,000
New Mexico	8%	20,000	18%	80,000	30%	160,000

New York	3%	80,000	6%	190,000	11%	350,000
North Carolina	2%	50,000	6%	170,000	13%	400,000
North Dakota	0%	-	1%	-	5%	10,000
Ohio	5%	110,000	10%	280,000	17%	530,000
Oklahoma	4%	30,000	10%	120,000	24%	280,000
Oregon	1%	20,000	4%	50,000	13%	150,000
Pennsylvania	4%	90,000	8%	230,000	13%	440,000
Rhode Island	3%	-	10%	20,000	14%	30,000
South Carolina	4%	50,000	12%	220,000	27%	510,000
South Dakota	2%	-	5%	10,000	13%	20,000
Tennessee	4%	90,000	13%	270,000	26%	660,000
Texas	7%	640,000	15%	1,640,000	24%	2,950,000
Utah	1%	10,000	2%	10,000	8%	30,000
Vermont	0%	-	0%	-	1%	-
Virginia	1%	30,000	2%	70,000	5%	120,000
Washington	1%	30,000	2%	50,000	5%	110,000
West Virginia	1%	10,000	4%	20,000	11%	50,000
Wisconsin	3%	30,000	4%	60,000	7%	90,000
Wyoming	0%	-	0%	-	1%	-

Table A-5 presents estimates developed by EPSA staff, based on LBNL's methodology and eligibility for federal tax credits.

Table A-5. Estimated savings and market size based upon eligibility of census tracts where household incomes meet the respective guidelines for two federal tax credits

State	Climate Zone	New Markets Tax Credit - eligible communities		HUD Low-Income Housing Tax Credit - "Qualified Census Tracts" (residential only)	
		Population qualifying	Single-year potential annual savings - MWh	Population qualifying	Single-year potential annual savings - MWh
Alabama	Hot-Humid	41%	1,220,000	19%	590,000
Alaska	Very Cold	27%	50,000	6%	10,000
Arizona	Hot-Dry	40%	1,440,000	19%	730,000
Arkansas	Moderate	42%	630,000	18%	290,000
California	Hot-Dry	41%	5,460,000	19%	2,580,000
Colorado	Cold	37%	680,000	15%	300,000
Connecticut	Cold	31%	330,000	16%	180,000
Delaware	Moderate	33%	130,000	8%	30,000
District of Columbia	Moderate	61%	240,000	40%	170,000
Florida	Hot-Humid	34%	5,060,000	16%	2,480,000
Georgia	Hot-Humid	42%	2,370,000	17%	1,010,000
Hawaii	Hot-Humid	26%	90,000	14%	50,000
Idaho	Very Cold	26%	150,000	10%	60,000
Illinois	Cold	35%	1,450,000	17%	700,000
Indiana	Cold	33%	870,000	16%	420,000
Iowa	Cold	25%	280,000	9%	110,000
Kansas	Moderate	33%	410,000	13%	160,000
Kentucky	Moderate	45%	1,050,000	17%	420,000
Louisiana	Hot-Humid	42%	1,170,000	19%	560,000
Maine	Very Cold	27%	70,000	8%	20,000

Maryland	Moderate	37%	1,070,000	14%	420,000
Massachusetts	Cold	32%	640,000	16%	340,000
Michigan	Very Cold	35%	900,000	18%	460,000
Minnesota	Very Cold	32%	560,000	10%	190,000
Mississippi	Hot-Humid	49%	810,000	18%	310,000
Missouri	Moderate	38%	1,070,000	16%	460,000
Montana	Very Cold	29%	90,000	13%	40,000
Nebraska	Cold	29%	210,000	12%	90,000
Nevada	Hot-Dry	31%	370,000	15%	190,000
New Hampshire	Very Cold	31%	100,000	6%	20,000
New Jersey	Cold	31%	750,000	11%	280,000
New Mexico	Moderate	47%	320,000	20%	140,000
New York	Cold - NY	40%	1,920,000	21%	1,040,000
North Carolina	Moderate	39%	2,170,000	17%	1,020,000
North Dakota	Very Cold	24%	90,000	9%	40,000
Ohio	Cold	33%	1,450,000	18%	830,000
Oklahoma	Moderate	38%	700,000	19%	370,000
Oregon	Moderate	34%	760,000	13%	310,000
Pennsylvania	Cold	34%	1,470,000	16%	740,000
Rhode Island	Cold	31%	80,000	19%	50,000
South Carolina	Hot-Humid	41%	1,200,000	17%	520,000
South Dakota	Very Cold	27%	90,000	15%	50,000
Tennessee	Moderate	39%	1,470,000	18%	730,000
Texas	Hot-Humid	43%	6,790,000	19%	3,220,000
Utah	Cold	26%	170,000	11%	70,000
Vermont	Very Cold	22%	30,000	8%	10,000
Virginia	Moderate	40%	1,770,000	10%	440,000

Washington	Moderate	34%	1,410,000	12%	520,000
West Virginia	Cold	39%	340,000	17%	160,000
Wisconsin	Very Cold	28%	510,000	11%	210,000
Wyoming	Very Cold	21%	40,000	5%	10,000
Totals		37%	52,460,000	16%	24,140,000

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