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A MULTI-STATE ANALYSIS OF EQUITY IN UTILITY-SPONSORED ENERGY EFFICIENCY INVESTMENTS FOR RESIDENTIAL ELECTRIC CUSTOMERS

RESEARCH REPORT
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OVERVIEW

State Energy Efficiency Resource Standards (EERS) have emerged across the United States, becoming prevalent in the early 2000's. EERS policies are state laws that require utilities to pursue energy efficiency as a cost-effective energy resource. As a result, billions of dollars have been invested in improving residential energy efficiency. The expressed goals of EERS policies include providing consumers direct economic savings by reducing wasted energy, and indirectly through avoided costs of constructing additional power plants. In 2016 alone, twenty-nine EERS states invested $2.5 billion in energy efficiency programs. While utilities regularly surpass annual energy savings goals required by EERS laws, the distribution of program benefits across subpopulations remains a concern for many stakeholders and energy justice advocates. This study takes a novel approach to examining EERS investments through an energy justice lens, taking the first step to assess distributional justice of residential program investments across socioeconomic groups: low-income (or income-qualified) and non-low-income residents. To accomplish this, we develop a comparison metric, known as the Energy Efficiency Equity baseline (E3b), which estimates equitable utility investment proportionate to the low-income population in the service territory and as a percentage of the total residential energy efficiency investment portfolio. This study captures $5.6 billion of spending by eleven Investor-Owned-Utilities (IOUs) from 2012-2021, located in six EERS states: Connecticut, Colorado, Illinois, Massachusetts, Michigan, and Minnesota. The study reveals various distributional disparities in low-income investments and investment trends among utilities, with most underperforming relative to the E3b. However, recent trends suggest improvement by large utilities. Policy revisions, stakeholder intervention, and utility decision-making is beginning to shift this trend.

KEY FINDINGS

FINDING 1

Each state approaches low-income program requirements differently. The two main factors include:

- Low-income program qualifier: State policy approaches define the population that qualifies for low-income programs, setting the equity bar for the Energy Efficiency Equity Baseline.
- Minimum spending requirements: States also define (or do not define) the minimum level to be allocated towards low-income programs.

FINDING 2

Socioeconomic characteristics (the percent of population qualified for low-income programs) vary greatly across utility territories. The proportion of population eligible for low-income programs varied greatly between 2012-2018 and between utilities, from 23% to 45%. In 2018, the range was 17% to 45%.

FINDING 3

The Energy Efficiency Equity baseline (E3b) was developed as a normative baseline metric for utility spending on low-income customers. It effectively accounts for differences in policy approaches, differences in socioeconomic characteristics of each utility territory, and how these factors change overtime. Estimated E3b investments in 2018 ranged from $700,000 to nearly $61 million.

FINDING 4

The E3b was used for several performance indicators:

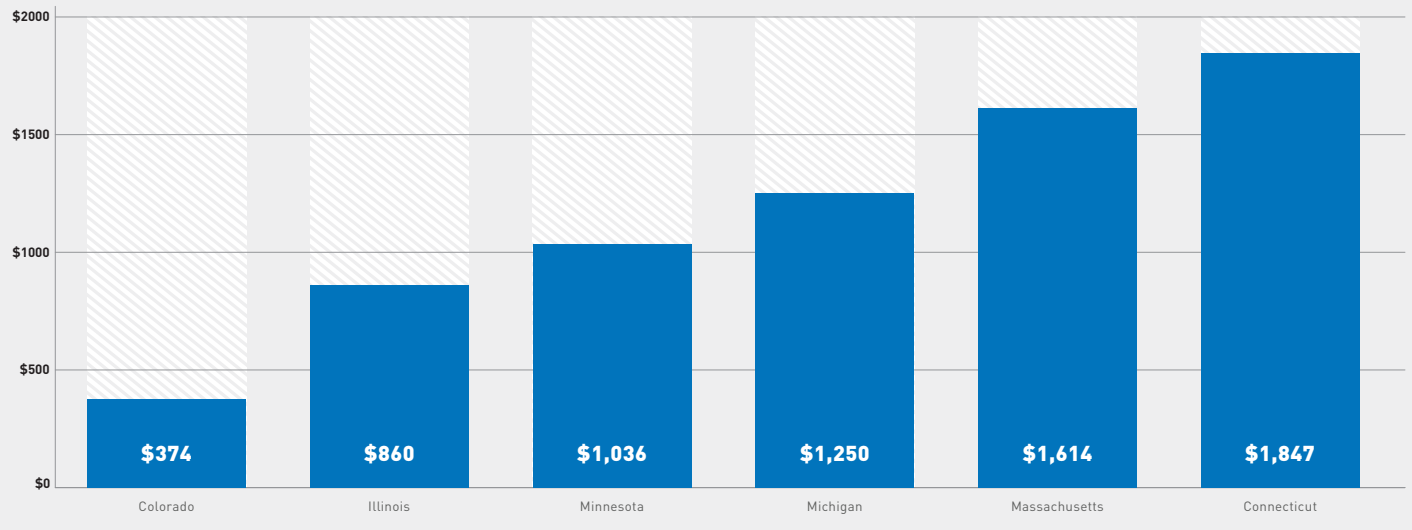
a. *Annual E3b deficit by year*: The largest annual deficit was in 2017 with a shortfall of $91 million. In 2021, the planned spending levels result in a smaller E3b deficit of $27 million, despite increases in total residential portfolio spending (low-income plus non-low-income). This reflects substantial shifts in portfolios, emphasizing low-income programs. This also reflects an overall trend across study states towards more equitable allocations of residential energy efficiency program spending.

b. *Cumulative E3b deficit*: The cumulative E3b deficit for the eleven IOU's in this study reached $585 million (2012-2021), with the largest cumulative deficit for a single IOU at $123 million.

c. *Rankings*: Normalized for portfolio size, E3b performance rankings on an annual basis and lifetime basis can be found in Table 3.

d. *E3b performance is likely due to a combination of factors including*: state policy parameters (income qualifiers and spending requirements), as well as utility decision-making. Two notable performances improvements, while associated with regulatory changes, exceeded low-income spending requirements, moving one utility from #11 to #1, in terms of annual E3b performance (2015 to 2018).

FIGURE 1: AVERAGE HOME ENERGY AFFORDABILITY GAP (2016) FOR LOW-INCOME HOUSEHOLDS BY STATE



Note: Low-income is defined as <200% FPL in that study.

Source: Fisher, Sheehan & Colton, 2016.

INTRODUCTION

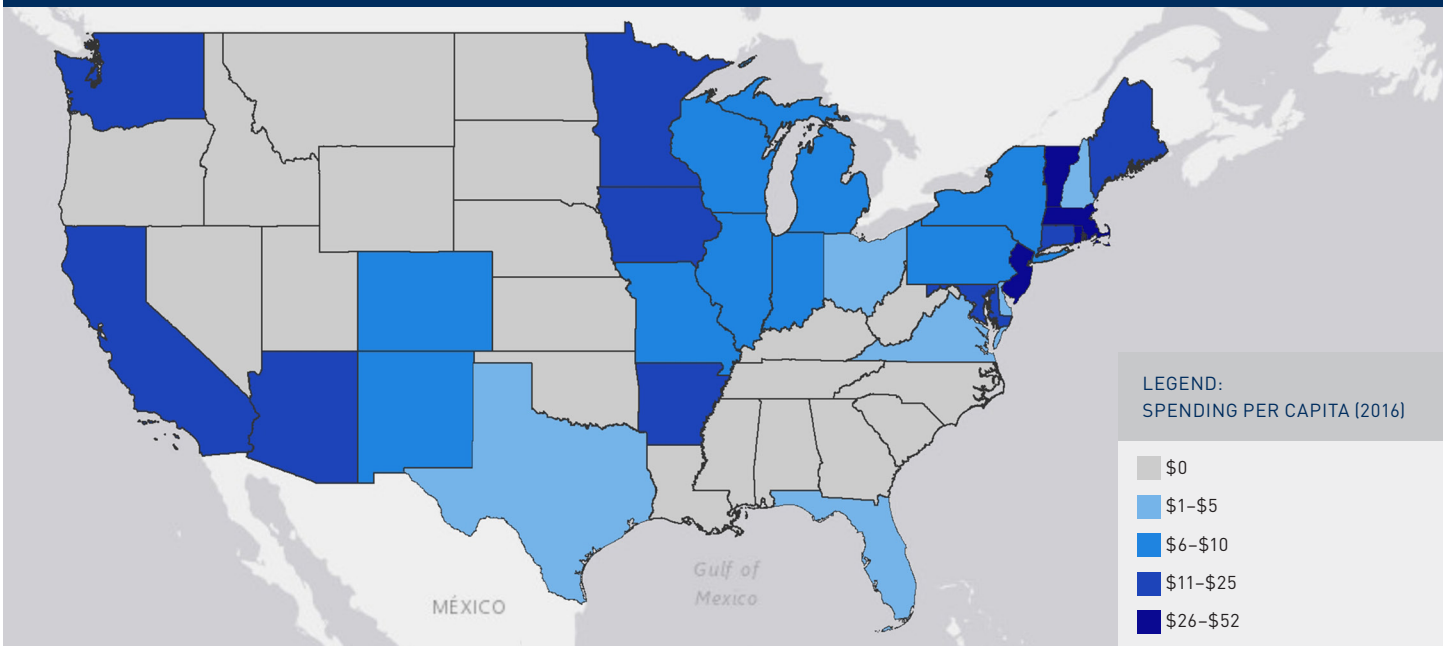
According to the U.S. Energy Information Administration one in three households experience energy insecurity, or struggle to afford energy, and one in five households are forced to forego other necessities such as food or medicine to pay energy bills.[1] In 2016, a study of major U.S. cities found a median annual energy burden (the percent of income a household spends on energy costs) of 3.5%. However, for low-income households the median energy burden was more than twice as high at 7.2%.[2] Energy unaffordability varies across the country. One measure that captures the annual dollar gap between affordable energy costs and actual energy costs is the Home Energy Affordability Gap (HEAG). The HEAG, developed by law and economics consulting firm Fisher, Sheehan & Colton, is a function of several factors including: energy prices, housing unit and household size, tenure (owner/renter), heating fuel mix, and local temperature dynamics.[3] Figure 1 illustrates the variability of the HEAG for low-income households in six states of interest in this study. The average annual statewide HEAG ranged from $374 in Colorado to $1,847 in Connecticut for households earning at or below 200% of the federal poverty level.

Increasing residential energy efficiency is viewed as a strategic energy affordability intervention. This is particularly important for low-income households, as they tend to reside in older, less energy-efficient homes and are less likely to adopt or afford even basic energy-efficient technology, like LED bulbs.[4] Moreover, low-income households have an energy use intensity (EUI) that is 27% higher, on average, when compared to higher-income households.[5] The EUI is a proxy for energy efficiency, normalizing the energy use per square area of a home, thus a relatively higher EUI represents less efficient energy consumption. Therefore, low-income households should be prime targets for utility-sponsored energy efficiency investments.

State Energy Efficiency Resource Standards (EERS) provide an opportunity to reduce EUIs and alleviate energy-related financial burdens for low-income households. Energy efficiency programs can result in direct financial savings as well as non-energy impacts (NEIs) such as improving health and well-being, and provide employment and financial stability. Currently, 29 states have established EERS that require investor-owned utilities (IOU) to make energy efficiency programs available to all residential consumers, many with similar goals and objectives. Figure 2 illustrates the states where these policies have been implemented. In 2016, EERS states invested a total of $2.49 billion in residential electric efficiency programs. Of the 238 million residents living in these states, roughly one-third live at or below 200% of the federal poverty level, a common qualifier for participation in low-income programs.[6]

EERS policies require utilities to reach legislated annual energy savings targets based upon the companies' retail sales the

FIGURE 2: ENERGY EFFICIENCY RESOURCE STANDARD STATES GROUPED BY ENERGY EFFICIENCY PROGRAM SPENDING PER CAPITA (2016)



Source: US Energy Information Administration

TABLE 1: STATE POLICY APPROACHES TOWARDS LOW-INCOME ENERGY EFFICIENCY PROGRAMS INCLUDING SPECIFICATIONS FOR INCOME QUALIFICATIONS, AND PROGRAM INVESTMENT REQUIREMENTS

STATE	UTILITY	YEARS	LOW-INCOME QUALIFIER	REQUIRED LOW-INCOME INVESTMENT
CO	Xcel	2012-2021	150% Federal Poverty Level or 60% State Median Income	No requirement
	Black Hills			
MI	DTE	2012-2021	200% Federal Poverty Level	No requirement
	Consumers			
MA	Eversource	2012-2021	60% State Median Income	10% of total portfolio including C&I
	National Grid			
IL	Ameren	2012-2016	80% Area Median Income	$8.4 million (after 2017)
		2017-2021	300% Federal Poverty Level	
	ComEd	2012-2021	80% Area Median Income	$25 million (after 2017)
CT	Eversource	2012-2021	60% State Median Income	No requirement
	United			
MN	Xcel	2012-2016	200% Federal Poverty Level or 80% AMI, whichever is greater	0.2% of residential retail revenues
		2017-2021	110% Federal Poverty Level or 50% SMI, whichever is greater	

previous year. Utilities accomplish this by delivering a range of energy efficiency measures targeting various consumer markets within their energy portfolio. Each measure has an associated first year energy savings, lifetime savings, and peak demand savings. Residential programs, a subcomponent within the utility portfolio, typically target specific consumer markets: single- or multi-family, owner- or renter-occupied, and low-income or non-low-income households. While many states require low-income specific programs, also known as income-qualified programs, states vary greatly in their requirements for utilities to offer energy efficiency programs targeting low-income households. The requirements represent different legislative approaches that dictate investment levels.

Despite well-documented inequalities in low-income household energy efficiency and affordability, utility energy efficiency investments are not necessarily distributed equitably across socioeconomic groups.[7] Moreover, although most utility-sponsored energy efficiency programs are ratepayer funded, with ratepayers contributing proportionately based on their consumption, some stakeholders have expressed concerns about whether low-income consumers receive a fair proportion of annual investments.[8]

Several studies have sought to measure the performance of state and utility-sponsored energy efficiency portfolios targeting low-income consumers using metrics such as per capita investments, number of participants (as percent of customers), whether savings per property are maximized, and energy savings per participant.[9] While these are important indicators of performance, utility efficacy in reaching low-income populations lacks a measure to understand the distributional equity of investments across socioeconomic groups. Distributional justice, one of the pillars of energy justice, requires equity in the distribution of benefits. Thus, the objective of this study was to develop a measure that allows for comparing the equitable distribution of energy efficiency investments between low-income and non-low-income households across states and utilities.

To accomplish this objective, we explored the distribution of $5.6 billion between socioeconomic groups (low-income and non-low-income) in utility-sponsored electric residential

energy efficiency investments across six states and eleven utilities.[10] This study focuses on investment decisions controlled by each state's EERS policy and utility decision-making. Investment levels among programs targeting low-income and non-low-income populations are compared against a baseline estimate, known as the Energy Efficiency Equity baseline (E3b), which integrates key factors of income qualifications and the socioeconomic composition of utility service territories.

There were four core research questions. First, how have state EERS policies approached two key factors that impact distributional equity in utility-sponsored programs: the qualification for low-income program eligibility and the mandated low-income program spending requirement? Second, what are the variations in socioeconomic subpopulations across utilities? Third, can a metric be developed to compare distributional equity in energy efficiency investments among states and utilities? Fourth, are utility-sponsored energy efficiency program investments being distributed equitably between low-income and non-low-income segments of the population and what trends are observed in equitable energy efficiency investment performance over time and among utilities?

FINDING 1: VARIATIONS IN STATE LOW-INCOME RESIDENTIAL ENERGY EFFICIENCY POLICY

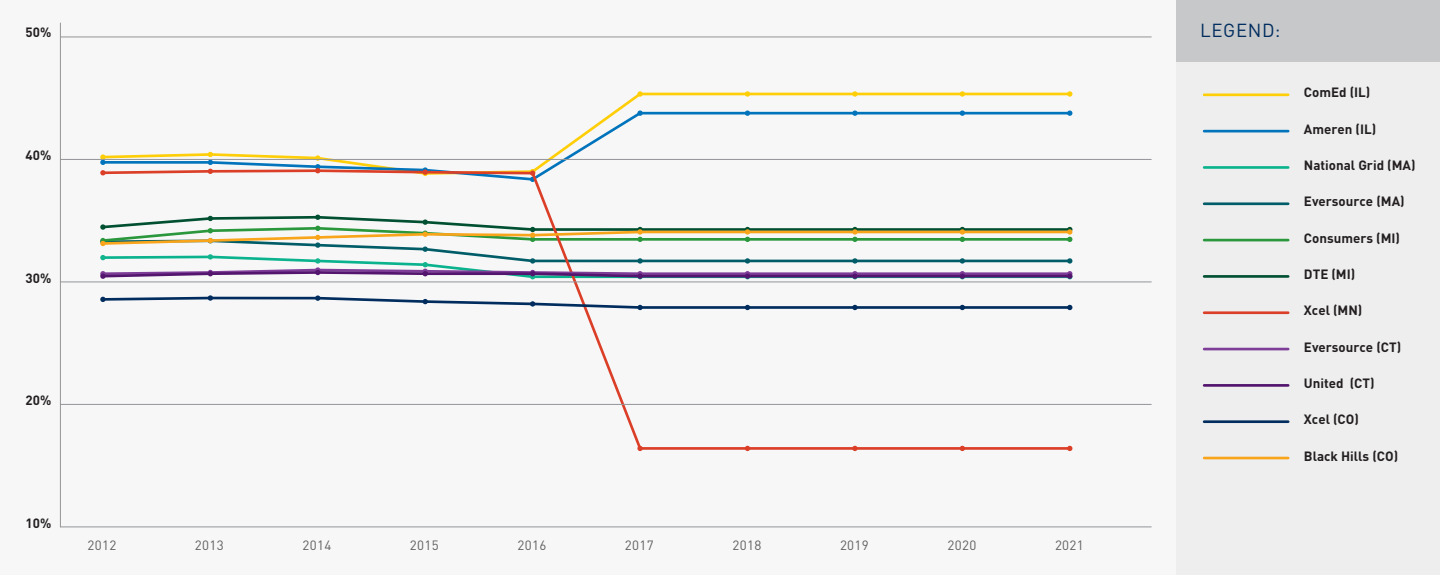
There are two significant ways in which states shape equity in low-income EERS investments: the low-income qualifier and required investment level for low-income programs. A household's qualification for low-income energy efficiency program participation is determined by their annual gross income. States qualify households as low-income with annual incomes at or below either a designated percent of the federal poverty level (FPL) or state or area median income (SMI or AMI). As shown in Table 1, some states qualify households based upon the greater of the two designations. Some states or utilities have changed their low-income qualifier during the period of analysis.

States also vary in their required investment levels for low-income programs. Some states require a low-income investment level based on percentage of total portfolio (Massachusetts), a specified dollar amount (Illinois), or percent of retail revenue (Minnesota). Other states do not require a certain level of investment in low-income energy efficiency programs (Colorado, Michigan, and Connecticut)

FINDING 2: VARIABILITY IN ELECTRIC UTILITY SERVICE TERRITORY LOW-INCOME QUALIFIED POPULATIONS

The proportion of the population qualified and targeted by low-income programs varied among utility territories and states, reflecting differences in qualifiers and socioeconomic characteristics. The smallest segment targeted by any qualifier was Xcel-MN after 2016, where qualified residents composed the lowest 17% of income earners. The largest segment, qualified low-income programs, was found in ComEd-IL territory, composing 45% of the population, after a 2016 qual-

FIGURE 3: THE PERCENT OF THE POPULATION QUALIFIED FOR LOW-INCOME PROGRAMS RESIDING WITHIN EACH UTILITY TERRITORY. MAJOR SHIFTS REFLECT CHANGES IN THE QUALIFIER, WHILE MINOR SHIFTS REFLECT CHANGING ECONOMIC CONDITIONS



ifier change, as shown in Figure 3. In the figure below, minor shifts reflect economic changes, while sharp changes reflect a change in the low-income program qualifier.

FINDING 3: THE ENERGY EFFICIENCY EQUITY BASELINE (E3B)

As a way to compare equity in energy efficiency investments across states and utilities we needed to develop a normative baseline metric for utility spending on low-income customers. This metric, known as the *Energy Efficiency Equity baseline* (E3b), accounts for the proportion of the population defined as low-income in a utility's service territory and the total annual residential energy efficiency investment dollars (Figure 4). The E3b accounts for differences in policy approaches as well as socioeconomic characteristics per utility territory and each year.

FIGURE 4: EQUATIONS TO DETERMINE THE ENERGY EFFICIENCY EQUITY BASELINE INVESTMENT (E3B)

E3B INVESTMENT

=

LOW-INCOME POPULATION (%)

×

TOTAL RESIDENTIAL ENERGY EFFICIENCY INVESTMENT ($)

For each utility territory, the proportion of the population qualified as low-income was determined in accordance with each state's definition. Several steps were taken to determine the income-qualified (or low-income) population within each utility territory:

1. Electric retail service territories were defined using a spatial dataset from Homeland Infrastructure Foundation-Level Data (HIFLD);
2. US Census data were used to determine the economic status of households;
3. Households were counted and defined as low-income and non-low-income based upon the state definition;
   - Several states hold two qualification options, setting the household income threshold as percentage of either federal poverty level (FPL), or area median income/state median income (AMI/SMI) (see Table 1). For these states, both FPL and SMI were tested. In all relevant states, it was found that more residents qualified through the SMI option. Hence, SMI was used for those states.

TABLE 2: ESTIMATED E3B INVESTMENT FOR 2018, BASED UPON TOTAL RESIDENTIAL EERS SPENDING AND PERCENT OF POPULATION QUALIFIED FOR LOW-INCOME PROGRAMS

STATE	UTILITY	TOTAL RESIDENTIAL EE INVESTMENT ($, MILLIONS)	LOW-INCOME POPULATION (%)	ESTIMATED E3B INVESTMENT ($, MILLIONS)	ACTUAL INVESTMENT ($, MILLIONS)
CO	Black Hills	$2.0	34%	$0.7	$0.66
	Xcel	$26.1	28%	$7.3	$3.8
CT	Eversource	$37.0	31%	$11.4	$13.2
	United	$6.4	31%	$1.9	$2.2
IL	Ameren	$29.1	44%	$12.7	$16.1
	ComEd	$132.4	45%	$60.0	$48.2
MA	Eversource	$144.6	32%	$45.9	$29.3
	National Grid	$167.8	31%	$51.1	$33.0
MI	DTE	$52.1	34%	$17.9	$12.5
	Consumers	$32.0	34%	$10.7	$5.4
MN	Xcel	$28.2	17%	$4.6	$2.4

4. Percent population qualified for low-income programs was calculated for each utility territory (income-qualified households / total households), for each year (2012-2021);
5. Values from 2017 were carried forward as constant for future year estimates.

The E3b estimates an equitable spending level for low-income programs, based upon the qualified population and total annual investment dollars in residential programs (both low-income and non-low-income programs) from 2012-2021. Spending categorized outside of these programs, such as pilot programs, was not included. Program investment data for actual spending in past years were extracted from annual utility energy efficiency reports as filed with the state regulatory authority. For future years, planned program spending was taken from utility plans filed with the state regulators. For utilities that had not filed plans through the year 2021, program spending values were carried forward as constant from the previous year. Table 2 presents E3b estimates for 2018, illustrating the baseline investment utilities should have made in their low-income programs that year based upon the total residential portfolio investment and the percent of population qualified for low-income programs.

FINDING 4: ANNUAL E3B PERFORMANCE

Next, we explored the trends in E3b performance over time and among utilities using two metrics: the E3b deficit, in dollars; and the percent E3b achieved.

FIGURE 5A: EQUATION TO DETERMINE THE E3B DEFICIT

E3B DEFICIT ($)

=

E3B INVESTMENT ($)

-

ACTUAL LOW-INCOME RESIDENTIAL ENERGY EFFICIENCY INVESTMENT ($)

FIGURE 5B: EQUATION TO DETERMINE THE E3B ACHIEVED

E3B ACHIEVED (%)

=

ACTUAL LOW-INCOME RESIDENTIAL ENERGY EFFICIENCY INVESTMENT ($)

÷

E3B INVESTMENT ($)

FIGURE 6: YEAR-TO-YEAR E3B DEFICIT TRENDS FOR ELEVEN IOUS. FIGURES ABOVE $0 REFLECT LOW-INCOME PROGRAM INVESTMENT LEVELS ABOVE THE E3B, WHEREAS FIGURES BELOW $0 REFLECT LOW-INCOME PROGRAM INVESTMENTS BELOW THE E3B

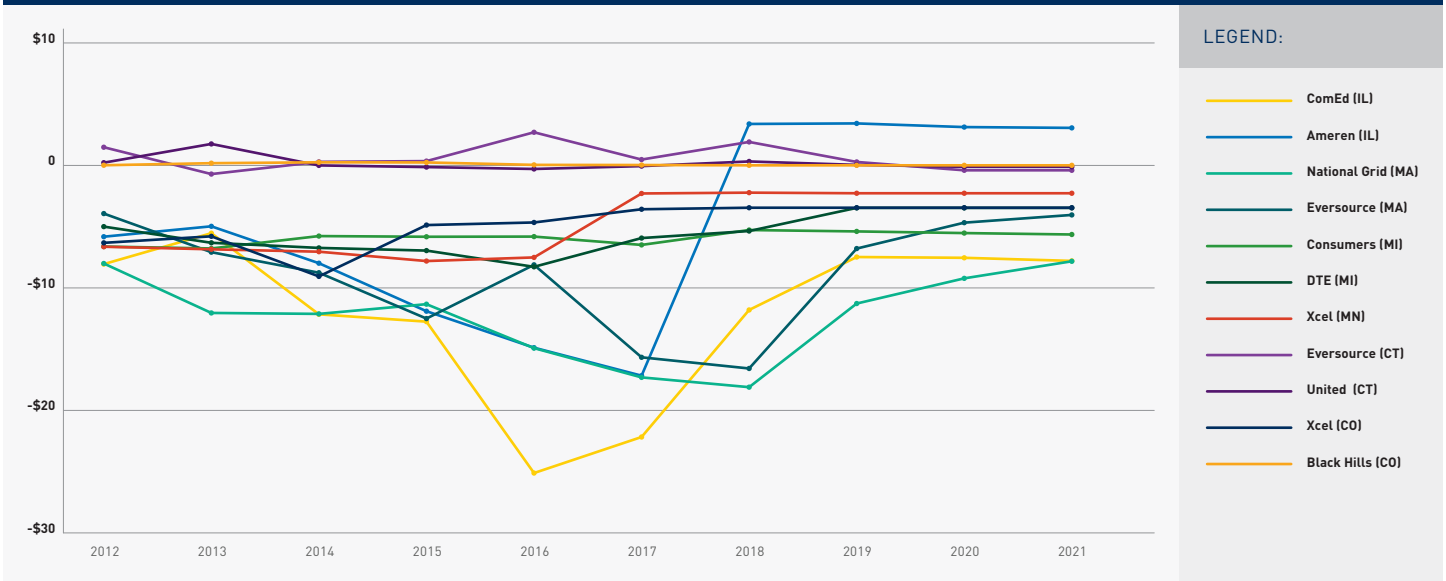
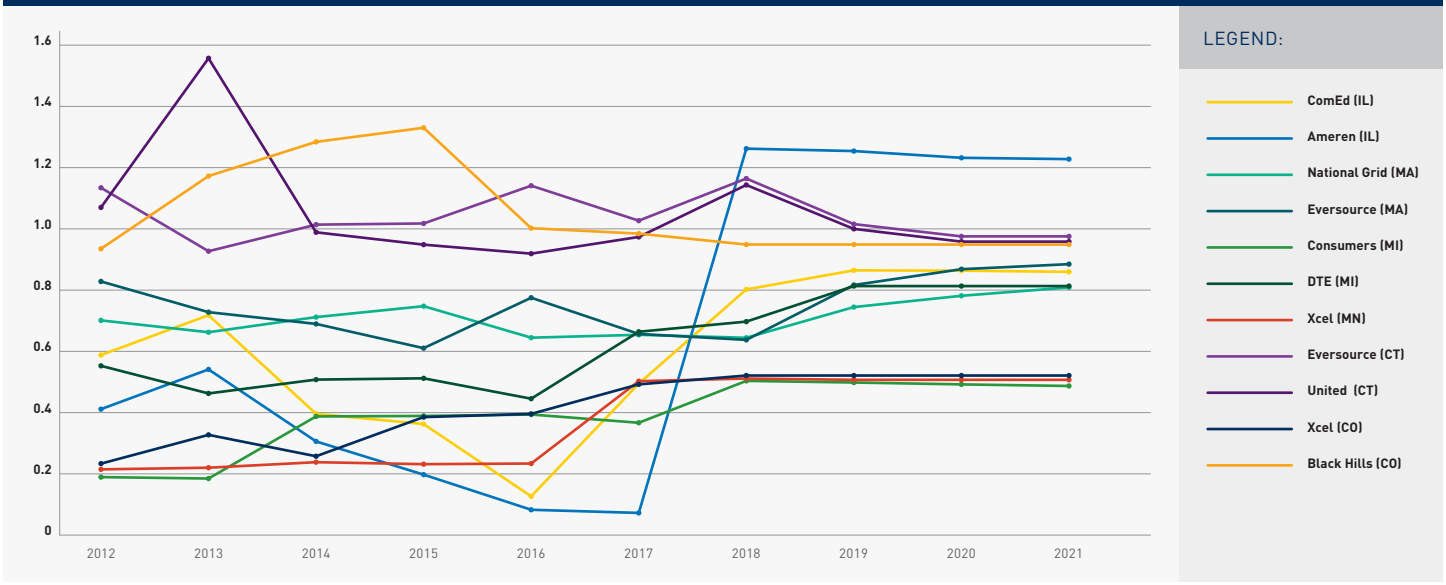


FIGURE 7: YEAR-TO-YEAR % E3B ACHIEVED FOR ELEVEN UTILITIES' RESIDENTIAL EERS PORTFOLIOS



The E3b deficit measures the difference between actual investments in low-income programs and the investment levels estimated by E3b (Figure 5a). The annual E3b deficit (Figure 6) is useful for comparing the deficit or surplus in absolute terms (dollars) among utilities in any given year. It is also useful for examining a single utility's performance over time as its portfolio size changes. The largest total deficit, across all utilities, was observed in 2017 totaling $91 million, but by 2021 investments in low-income programs across the board are expected to increase, thereby decreasing the annual deficit to $32 million, a 65% reduction. This reflects a general trend of energy efficiency investment planning that emphasizes increased low-income program investments in the future.

To normalize for variations in residential energy efficiency portfolio size (total dollars spent), utilities were compared using the metric percent E3b achieved (Figure 5b). This represents how close a utility came to spending at the estimated E3b level relative to its residential portfolio size. This metric is useful for comparing annual performance among utilities of varying sizes, as well as within utilities over time as portfolio sizes grow or shrink (Figure 7).

The cumulative effect of the E3b deficit (absolute dollars) overtime is shown in Figure 8. A flat trend line, reflects low-income program investment levels are maintained at the E3b. An upward trend reflects low-income program investment levels exceeding the E3b level. A downward trend reflects investment levels at an E3b deficit year-to-year.

The total cumulative E3b deficit across the eleven utilities is estimated to reach $598 million by 2021. The largest estimated cumulative E3b *deficits* by utility are:

#1 National Grid-MA ($123 million)

#2 ComEd-IL ($121 million)

#3 Eversource-MA ($89 million)

Portfolio sizes (all residential programs, excluding commercial and industrial (C&I) investments), ranged from $1.4 to $167 million per year. It is important to note that the three aforementioned utilities also have the largest portfolios, and are not normalized to account for this difference. The rankings shown in Table 3, illustrate yearly and cumulative percent E3b achieved performance, normalized by portfolio size. In this case, Eversource ranks fourth, National Grid ranks fifth, and ComEd ranks sixth in lifetime percent E3b achieved performance. Policy changes, for instance, in Illinois' Future Energy Jobs Act (2016) and the resulting shift in program allocations towards low-income programs, can be observed in rankings between 2015 and 2018, where ComEd (#11) and Ameren (#10), shift to #1 and #5 respectively.

The average E3b achieved across the eleven utilities was 64% in 2012 and 79% in 2021. The top performer in 2012 achieved 113% (Eversource), while the bottom performer achieved 19% (Consumers). The top performer in 2021 is set to achieve 106% (Black Hills), while the bottom performer is set to achieve 49% (Consumers).

To examine the impacts of portfolio size on E3b performance, the cumulative portfolio size was compared to the cumulative

FIGURE 8: CUMULATIVE LOW-INCOME PROGRAM INVESTMENT TRENDS, INCLUDING E3B DEFICIT ($), FOR EACH UTILITY RESIDENTIAL PORTFOLIO

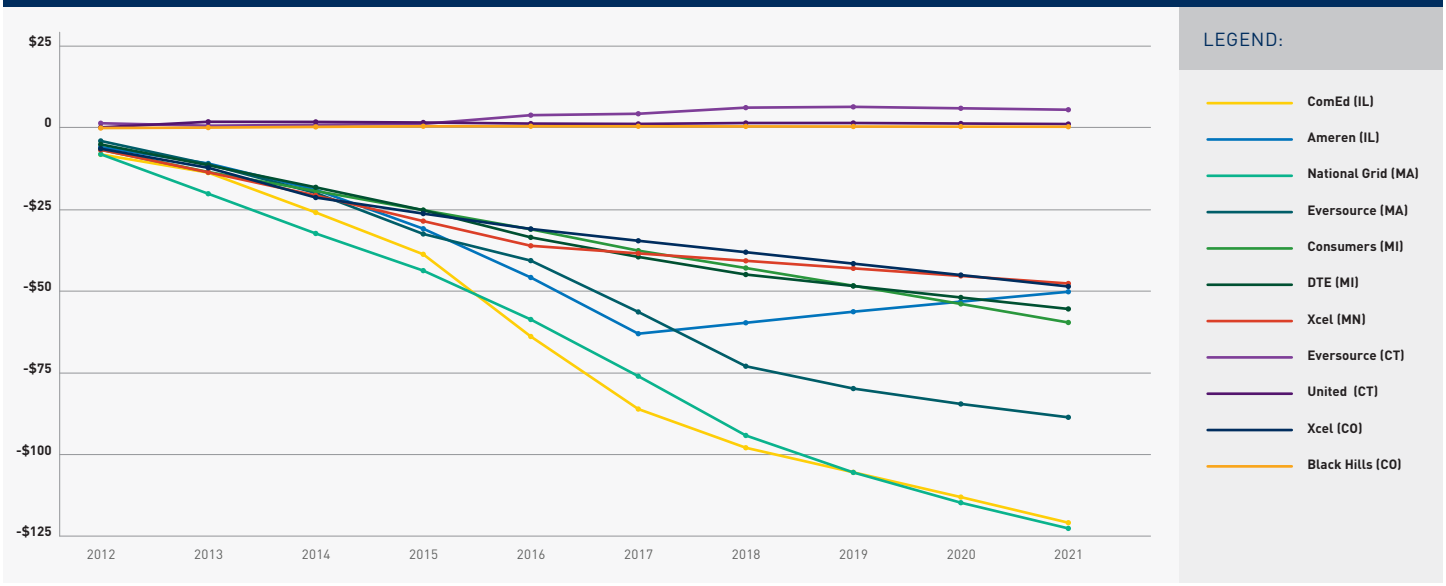
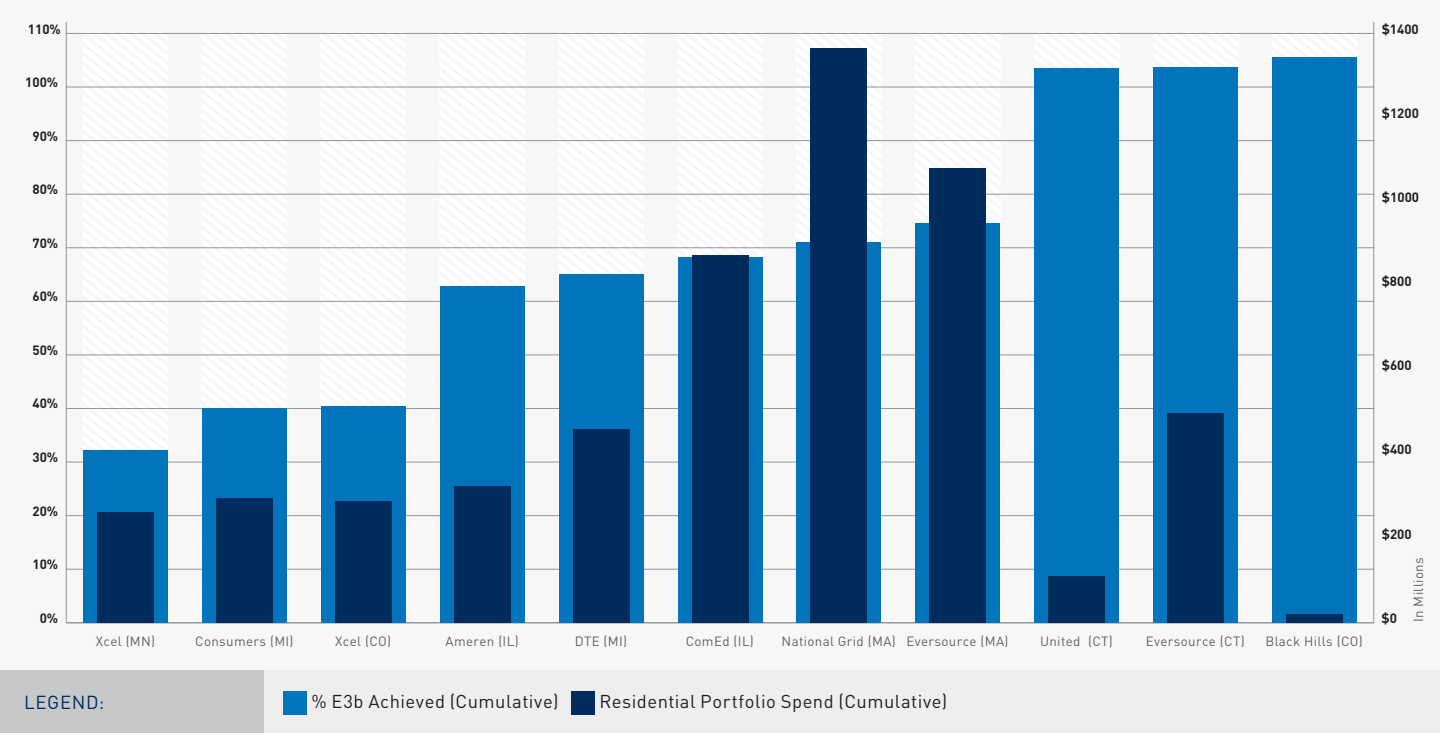


TABLE 3: UTILITY RANKINGS OF ANNUAL E3B INVESTMENT PERFORMANCE (% E3B ACHIEVED) AT THREE-YEAR INTERVALS AND CUMULATIVELY (2012-2021)

RANK	2012	2015	2018	2021	CUMULATIVE INVESTMENT (2012-2021)
#1	Eversource (CT) 113%	Black Hills (CO) 133%	Ameren (IL) 126%	Ameren (IL) 123%	Black Hills (CO) 106%
#2	United (CT) 107%	Eversource (CT) 102%	Eversource (CT) 116%	Eversource (CT) 98%	Eversource (CT) 104%
#3	Black Hills (CO) 94%	United (CT) 95%	United (CT) 114%	United (CT) 96%	United (CT) 104%
#4	Eversource (MA) 83%	National Grid (MA) 75%	Black Hills (CO) 95%	Black Hills (CO) 95%	Eversource (MA) 75%
#5	National Grid (MA) 70%	Eversource (MA) 61%	ComEd (IL) 80%	Eversource (MA) 89%	National Grid (MA) 71%
#6	ComEd (IL) 59%	DTE (MI) 51%	DTE (MI) 70%	ComEd (IL) 86%	ComEd (IL) 68%
#7	DTE (MI) 55%	Xcel (CO) 39%	National Grid (MA) 65%	DTE (MI) 81%	DTE (MI) 65%
#8	Ameren (IL) 41%	Consumers (MI) 39%	Eversource (MA) 64%	National Grid (MA) 81%	Ameren (IL) 63%
#9	Xcel (CO) 23%	ComEd (IL) 36%	Xcel (CO) 52%	Xcel (CO) 52%	Xcel (CO) 40%
#10	Xcel (MN) 22%	Xcel (MN) 23%	Xcel (MN) 51%	Xcel (MN) 51%	Consumers (MI) 40%
#11	Consumers (MI) 19%	Ameren (IL) 20%	Consumers (MI) 50%	Consumers (MI) 49%	Xcel (MN) 32%

FIGURE 9: CUMULATIVE LOW-INCOME PROGRAM INVESTMENT TRENDS, INCLUDING % E3B ACHIEVED, AND TOTAL PORTFOLIO SPENDING 2012-2021. THE BEST E3B PERFORMERS HAVE THE TALLEST LIGHT BLUE BAR



% E3b achieved (Figure 9). Annual energy efficiency portfolios, from 2012-2021, range in size from $19.8 million to $1.36 billion. The three largest utility portfolios ranked #4 (Eversource), #5 (National Grid), and #6 (ComEd), while the three smallest utility portfolios ranked #1 (Black Hills), #3 (United), and #11 (Xcel-MN). Thus, no clear correlation between portfolio size and E3b performance was identified.

POLICY IMPLICATIONS AND CONCLUSION

1. The E3b is a useful metric for evaluating utility performance from an equity perspective. It can be used to compare among utilities and within states, among utilities with small to large portfolios, and utility performance over time. E3b provides flexibility for existing and future variations in state policy approaches, while accounting for the socioeconomic characteristics within utility service territories.
2. Results suggest that while most utilities are underperforming relative to the E3b, positive investment trends are estimated into 2021. This is likely the result of a combination of factors: utility decision-making, stakeholder interventions, and state policy adjustments.
3. EERS policies aimed at achieving equity in energy efficiency should integrate factors including: socioeconomic characteristics of each utility territory, low-income program qualifiers, proportion of the population qualified to participate in these programs, and the total size of the residential portfolio investment.
4. Investment inequities in low-income energy efficiency program investments between 2012-2021 may indicate inequities in direct energy savings benefits for this segment of customers. Although not the focus of this study, this is a topic that should be further studied.
5. A comprehensive study across EERS states, capturing both the electric and gas programs, as well as the energy savings achieved, will provide useful insights to policy makers, advocates, and utility companies aiming to achieve greater equity in energy.

ENDNOTES

1 U.S. Energy Information Administration. "One in three U.S. households faces a challenge in meeting energy needs." https://www.eia.gov/todayinenergy/detail.php?id=37072&src=%E2%80%B9%20Consumption%20%20%20%20%20%20Residential%20Energy%20Consumption%20Survey%20(RECS)-b2#

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10 This study does not capture the distribution of energy savings (kWh) as a result of these programs.

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