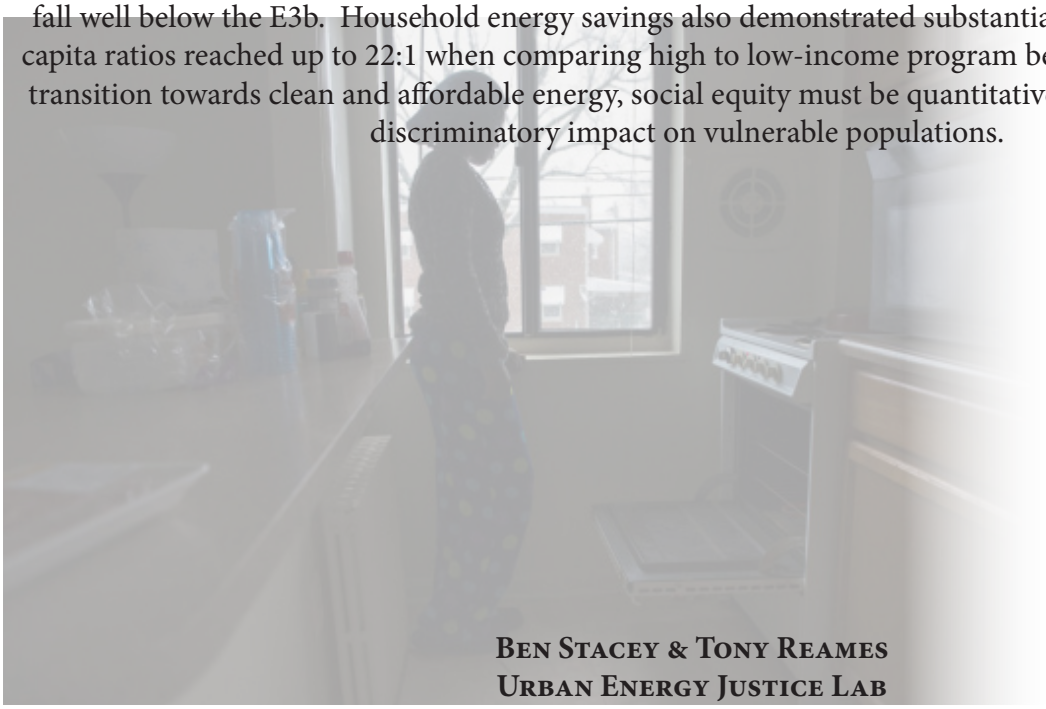
University of Michigan
December 01, 2017

Social Equity in State Energy Policy: Indicators for Michigan's Energy Efficiency Programs

Summary

State policies providing residential energy efficiency programs have emerged over the past decade with the goal of producing widespread economic and environmental benefits. While these policies have largely achieved and surpassed legislated objectives, the degree to which program benefits are distributed amongst population subgroups, particularly low-income residents, remains unclear. On average in the United States, low-income households are less energy efficient contributing towards 1 in 3 of these homes struggle to afford energy, and 1 in 5 facing decisions between energy use and other necessities such as food or medicine. Energy efficiency programs however, may offer a critical avenue in alleviating energy poverty. This study focuses on measuring the social equity achieved through Michigan's "Energy Waste Reduction" programs for the state's two major investor-owned utilities (IOUs). The study establishes a novel, quantitatively sensitive measure, called the Energy Efficiency Equitable baseline (E3b). This measure is used to identify disparities that occur in policy decision-making and outcomes. Particularly, the study quantifies disparities in program investments and household energy savings on a per capita basis between low and high-income residential groups. E3b reveals trends in policy outcomes from a social perspective, illustrating high variability in social equity between energy type and providers. Broad patterns showed that gas program investments approached equitable levels, however, electric Low-Income program investments fall well below the E3b. Household energy savings also demonstrated substantial disparities, where per capita ratios reached up to 22:1 when comparing high to low-income program benefits. As states aim to transition towards clean and affordable energy, social equity must be quantitatively evaluated to prevent discriminatory impact on vulnerable populations.



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KEY FINDINGS

- 35% of Michigan residents qualify for Low-Income Energy Waste Reduction (EWR) programs; this ranges widely (30-40%), depending upon utility territory.
- One key policy consideration for MI low-income consumers: In approving utility EWR Plans, the Michigan Public Service Commission, must consider, "the extent to which the plan provides programs that are *available*, *affordable*, and *useful* to all customers." -P.A. 342
- There is a $73.4 million gap in utility investment levels between equitable (E3B) and actual low-income program investments. This gap is only $1.0 million *gas* LI programs (2010-2016).
- On average, utilities invested 3 times less on Low-Income (electric) programs per capita, and near equitable levels for Low-Income gas programs .
- Low-income consumers overall recieved 10 times less home energy savings (electric) and 3.4 times less home energy savings (gas) when compared to high-income consumers. The greatest difference found, by utility, was 22 times higher.

I. BACKGROUND

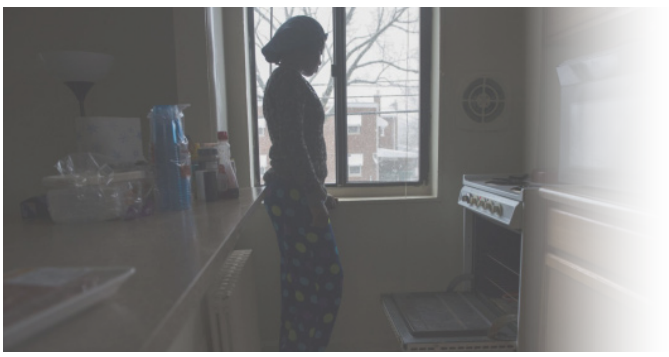
Energy Poverty

The relationship between residents and energy use varies between sociodemographic groups and the homes in which they live. This study focuses on income, as distinguished by state policy, however, the social perspective applied in this study can also be applied to groups by race, age, ability, and tenure.

Low-income consumers, defined as households earning below 200% of the federal poverty level (FPL), oftentimes occupy older homes which are energy inefficient. This contributes to a high energy-use-intensity (EUI), a proxy for energy waste, when compared to higher-income households. Nearly one-third of US homes struggle to afford adequat energy, and one in five homes trade-off energy use with other necessies such as food or medicine.[1] When a household's energy burden, or the percentage of income allocated towards energy bills, surpasses10%, the home is considered to suffer energy poverty.[2] Above 6%, the burden is considered unaffordable. In Michigan studies show that in 2016, 999,442 households experienced an energy burden greater than 10% while earning less than 150% of the FPL.[3] For low-income households, the average home energy affordability gap (HEAG) is $1,250 per year, totalling $1.7 billion in 2016 for Michigan.[4] Energy poverty has been shown to lead to negative mental and physical health impacts, recurring debt, and homelessness.[5] In severe cases, as described in the NAACP report, Lights Out in the Cold (2017), the struggle to afford heating bills in Michigan winters, has resulted in hypothermia and death.[6] Similarly, populations unable to afford cooling their homes, are vulnerable to the health impacts of urban heat islands.[7]

Policy & Social Problems of Energy

State and federal policies to address the social concerns surrounding energy affordability include energy shut-off protections, bill-payment assistance programs, home weatherization and energy efficiency programs.[8] Major federal policies include Low Income Home Energy Assistance Program (LIHEAP), and the Weatherization Assistance Program (WAP). While many states such as Michigan have legislated bill-payment assistance programs, policy targeting the reduction of energy waste at the household level presents an alternative approach that empowers households facing energy poverty and reduces the home energy affordability gap. For many low-income energy advocates, these state energy efficiency programs offer hope for a sustainable path towards eliminating energy poverty. Yet, while reports claim widespread social and economic benefits, concerns have been raised in regards to utility investment levels in programs targeting low-income residents and the impact on achieving an equitable energy future.



Source: Amanda Voisard, Washington Post (2016)

MI Energy Efficiency Policy: Goals & Accomplishments

The social, economic and environmental benefits of energy efficiency have driven policy changes in efficiency standards in residential building, appliance and vehicles over the past several decades. These policies have led to substantial social benefits including reductions in atmospheric emissions, consumer economic gains, and national security through reduced dependency on foreign energy. However, to understand the relative impact of energy efficiency policies from a social perspective, the distribution of costs and benefits between population subgroups must be clearly understood to avoid unintended social consequenses.

Energy efficiency legislation was first signed into Michigan law in 2008 as the Clean, Renewable and Efficient Energy Act, and amended in 2016 as the Clean and Renewable Energy and Energy Waste Reduction Act. This establishes standards for utility companies to achieve energy savings equivalent to 0.75% and 1% of retail sale volumes from the previous year for natural gas and electricity respectively. Regulatory agency reports show that the energy savings resultant of this policy (Subpart C. Energy Waste Reduction), has saved billions of dollars in energy costs to commercial, industrial, and residential consumers through these state regulated, utility managed, energy efficiency programs. As in many other state energy efficiency policies, energy providers are required to achieve these annual energy savings targets through EWR Plans, which outline the utility's portfolio composed of various Residential and Commercial & Industrial (C&I) programs.

Policy Goals:

"Help customers reduce energy waste" &
"To reduce the future costs of provider service to customers" -P.A. 342

Utility companies accomplish this through their range of programs targeting various consumer markets and employing a variety of energy savings interventions. For residential energy consumers, these programs are tailored towards two socioeconomic groups: low-income and non-low-income (higher-income).

In 2016, the Michigan Licensing and Regulatory Affairs (LARA) reported that EWR programs across the state resulted in consumer electricity savings of 1.1 million MWh and natural gas savings of 4.58 million Mcf. Utility companies spent $262 million of rate-payer funds on these programs, and captured a life cycle savings of $1.1 billion for consumers, demonstrating an aggregate return of $4.35 for every $1 invested across the state as a whole.

To incentivize energy savings beyond legislated standards, utilities exceeding these goals are granted financial incentives up to the lesser amount of:

Utility Financial Incentives:

20% of the annual EWR program expenditures OR
30% of the net-present-value of life-cycle cost reductions -P.A. 342

Program Revenue & Spending

To fund these programs, energy providers, whose rates are regulated by the state, are allowed to recover program costs from two distinct customer classes: Residential (including low-income residents), and Commercial and Industrial (C&I). Base revenue, is generated through an on-bill surcharge to consumers. The residential consumer class is charged volumetrically, dependent upon energy use (kWh, ccf), while C&I consumers are charged on a per-meter basis. The allocation of base revenue funds are restricted on a customer class basis. In other words, funds generated in the residential class were not allocated towards C&I programs. Both customer classes contribute to low-income programs. Similarly, utilities recover performance-based financial incentives through an on-bill surcharge.

Policy: Low-Income Consumer Outcomes

The Residential customer class in Michigan is composed of 9.7 million residents, 3.4 million (35%) of which qualify as low-income, face gaps in unaffordability and are likely to experience energy poverty. While not officially recognized within state legislation, regulatory agencies, energy providers, and low-income advocacy groups frequently cite the benefits of energy efficiency policy in reducing the impacts of energy poverty. However, the broad impact on energy poverty remains unclear.

MI EWR Act requires that utility companies offer programs for low-income residents, calling for "an established spending level" on Low-Income programs. While this study was unable to identify a standardized spending level, this requirement appears to be met through the EWR plan filing process, which requires Michigan Public Service Commission (MPSC) approval. EWR stipulates that in order to approve an EWR plan:

> **Michigan Public Service Commission** must consider: "The extent to which the energy waste reduction plan provides programs that are *available*, *affordable*, and *useful* to all customers" (PA 342)

Metrics for *availability, affordability* and *usefulness* were unable to be identified in this study, and are addressed in the Policy Recommendation section. Once approved, Low-Income program investment levels are subject to change. Commission Order U-15806 allows energy providers to reallocate up to 30% of any program's designated funds elsewhere.

Because residential programs employ tailored approaches for incentivizing participation, funding low-income specific programs is crucial to reach these households. While Low-Income programs are often free, non-low-income progams provide subsidized rates for incentives to participate. Commonly, identical or similar programs are offered separately as Low-Income or "Residential" (referred to henceforth as "High-Income" programs).

Policy also requires that collectively, program spending must prove to be cost-effective. However, this excludes Low-Income programs. The cost-benefit is measured as the Utility-Resource-Cost-Test (URCT), however, this cost-benefit metric does not account for the non-energy impacts (NEI's), and reduced demand for bill payment assistance that result from Low-Income programs.

In this study, the social disparities in distribution (between Low and High-Income programs) of rate-payer revenue (utility investments) and program benefits (household energy savings) are quantified. The results show wide variation in equity achieved by energy type (electric/gas) and provider (Utility A/Utility B), raising social and economic concerns for policy efficacy for providing household energy savings benefits to one-third of the state's population. This study demonstrates the necessity for developing metrics for EWR plan approval on the basis of *acessibility, affordability and usefulness*, and suggests the need for a Low Income oriented cost-benefit analysis tool.

From an energy justice perspective, energy efficiency policies have the significant potential to reduce energy poverty and the home energy affordability gap, but is shown here, that these policies are susceptible to furthering social inequities. As energy efficiency forms an integral role in planning for state energy demands, it is essential that policy makers, regulatory agencies and utility companies examine the impact from a social perspective in order to reach a more just energy future.

II. STUDY SCOPE & METHODS

This study establishes a metric tool, the Equitable Energy Efficiency baseline (E3b), to quantify the gap between equitable and actual levels in utility program investments and houehold energy savings. Trends from Michigan's two main investor-owned utility (IOU) providers, refered to as Utility A and Utility B, are compared spanning the policy implementation period from 2010-2016.

Data on utility investments and energy savings were extracted from annual regulatory reports detailing electric and gas EWR programs for each utility. 2009 data was excluded as a partial (first) year with incompatible data reports for the purposes of this study. Slight variation between utility reporting required minor data revisions, specifically the removal of Utility B pilot program data which did not differentiate Residential and C&I pilot programs comparably to Utility A).

Each utility territory, or coverage area, is unique in terms of population characteristics (figures 1 and 2). To assess equitable distribution program spending and energy savings between utility providers, these variables were normalized by the proporton of low-income residents in each utility territory. Spatial data describing energy provider coverage area at the subtownship level was provided by the Michigan Agency for Energy and paired with US Census Bureau 5-year ACS data (2015) to accurately differentiate variation in low-income

population levels. Populations in subtownships which had multiple, or overlapping energy providers, were attributed to both utility populations as consumer choices were indiscernible in these areas. Actual data for utilities' customer population socioeconomic composition were unavailable. To quantify disparities in utility investments in Low-Income programs, the E3b was established for each utility by energy type (Utility A electric, Utility A gas, Utility B electric, Utility B gas). This was done for each provider, by multiplying the annual sum of residential program investments (Low and High-Income) with the proportion of low-income residents in the respective territory. Investment deficit/surplus was calculated as the difference between actual spending and the E3b.

To compare disparities in per capita investments and energy savings by energy provider, utility reported data were compared to the territory population. Given the imprecision in determining actual utility customer populations, these values should be used for relative comparison only.

The focus of this study is limited to quantifying disparities in investments and energy savings between programs targeting low- and high-income residents. While it is plausible that "Residential (non-low-income programs) may spill-over to low-income consumers, this study distinguishes these programs with the assumption that this impact is minimal. Further studies are necessary to better assess the accessibility and impact of non-low-income residential programs on low-income customers. As previously noted, several non-low-income residential programs, have similar or identical counterparts offered as Low Income programs. Hence this study distinguishes the two as High Income and Low Income programs based upon their targeted markets.

III.RESULTS

Variation in Low-Income Population by Utility Territory

There are 3,390,700 Michigan residents who qualify for Low-Income EWR programs, however, they are not evenly distributed across geographic space (eg. utility coverage area). Spatial variation in income levels are illustrated in Figures 1 and 2 for electric provider territories. Depending on the service and provider, the percentage of low-income consumers ranges between 30.0-39.9% and 14.5-29.7% for minority populations (table 1).

Table 1. Percent population low-income by utility territory. (*Source*: Michigan Agency for Energy, US Census ACS 5-year 2015)

Population	State of Michigan	Utility A Electric	Utility B Electric	Utility A Gas	Utility B Gas
Total Population	9,677,170	4,348,955	4,675,213	4,785,515	3,577,48
Low-Income Population	3,390,700 **(35.04%)**	1,584,048 **(36.42%)**	1,549,477 **(33.14%)**	1,435,612 **(30.00%)**	1,428,0 **(39.92%**
Minority Population	2,076,696 (20.98%)	651,989 (14.5%)	1,361,406 (28.73%)	825,571 (17.13%)	1,087,96 (29.71%

Low-income populations for electric coverage area varies between 36.4% (Utility A) and 33.1% (Utility B) and racial composition varies by minority populations composing 14.5% (Utility A) and 28.7% (Utility B). Utility B territory encompasses 1.4 million non-white Michigan residents, including the largest black population in the state located in Detroit.

Population socioeconomc characteristics vary more greatly for gas service providers. Utility A Gas territory includes 4.8 million residents of which, 30.0% qualify for Low-Income programs, while Utility B gas, with 3.6 million residents, encompasses 39.9% low-income. Utility B gas also has 12.6% higher proportion of minority residents.

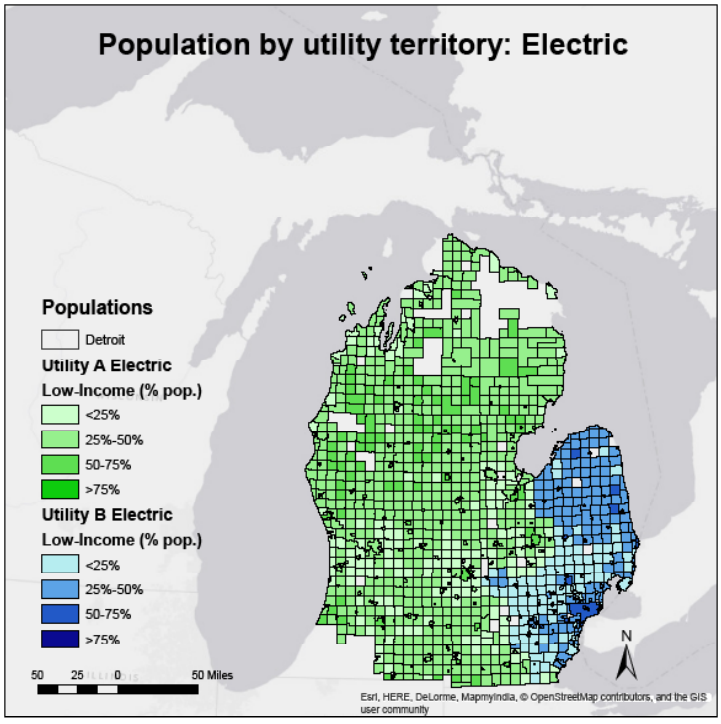


Figure 1. Low-income population distribution for Utility A and Utility B territories. (*Source*: US Census, Michigan Agency for Energy)

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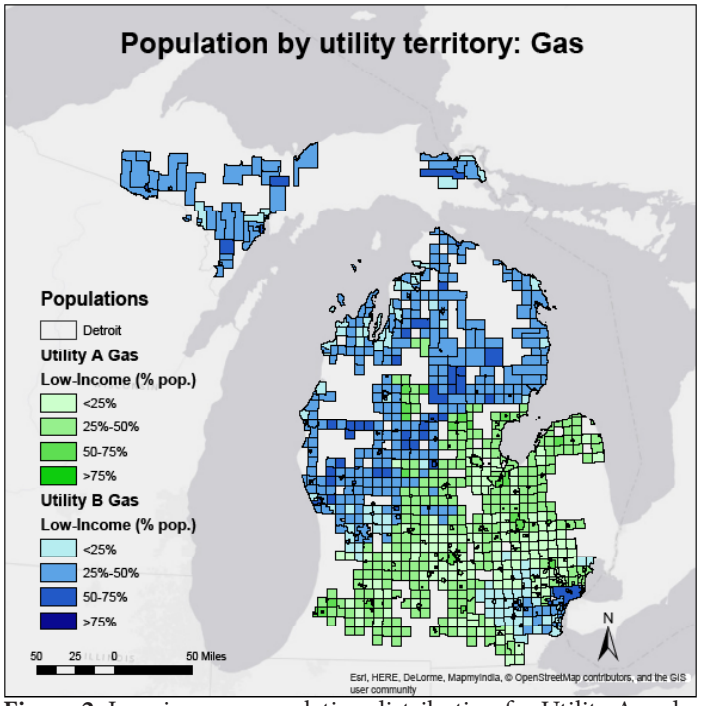

Figure 2. Low-income population distribution for Utility A and Utility B Gas territories. (*Source*: US Census, Michigan Agency for Energy)

Disparities in Equitable Utility Investments and Consumer Benefits

Summatively, Utility A and Utility B spent $596 million on EWR Residential programs between 2010-2016. For electric programs, Utility A invested $160 million total, ($18.7 million Low-Income). Utility B invested $237 million total ($40 million Low-Income). For gas programs, Utility A invested $187 million, ($62 million Low-Income) and Utility B $112 million total ($38 million Low-Income). Comparing the actual investment levels in Low-Income programs to the territory tailored E3b, a deficit for Low-Income program investments of $74.3 million (electric) and $1.0 million (gas) was identified (Table 2). Figure 7 demonstrates that there is a high degree of variability in proximity to E3b investments by energy type and provider. On average, gas programs were funded closer to E3b (1% below) than electric programs (56% below).

Investments in Energy Efficiency Electric Programs

Investment trends for both the Utility A and Utility B electric programs demonstrate a substantial deficit between actual and E3b levels from 2010-2016. Yearly, deficits ranged from $1.5 million to $7.4 million (Utility A) or 40%-82% under the E3b, and for Utility B: $3.5 to $6.9 million, or 39%-61% under the E3b (figures 3-7). Recently (2016), the equitable investment deficit for electric programs totalled $13.6 million for Utility A ($6.7 million or 64% under E3b) and Utility B ($6.9 million or 51% under E3b). The total spending deficit for electric Low-Income programs from 2010-2016 was $73.4 million, approximately 55.5% under the equitable baseline (table 2).

Investments in Energy Efficiency

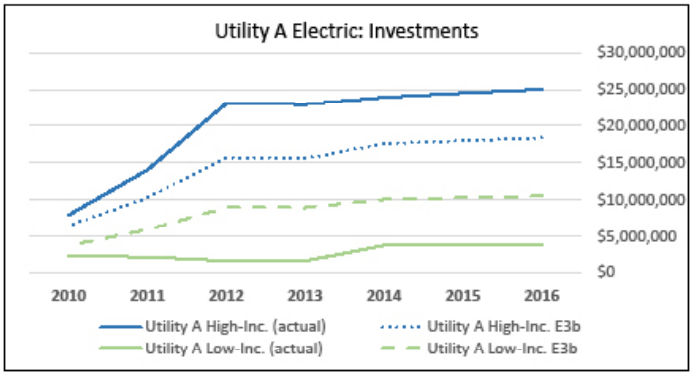

Figure 3. Actual vs. Equitable (E3b) spending for Utility A electric EWR programs between 2010-2016. *Source*: EWR Annual Reconciliation Reports (Utility A, 2010-2016), US Census Bureau 5-year ACS 2015, Michigan Agency for Energy.

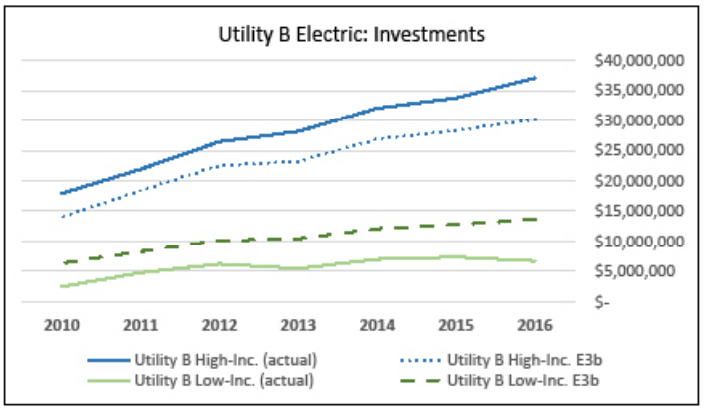

Figure 4. Actual vs. Equitable (E3b) spending for Utility B electric EWR programs between 2010-2016. *Source*: EWR Annual Reconciliation Reports (Utility B, 2010-2016), US Census Bureau 5-year ACS 2015, Michigan Agency for Energy.

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Gas Programs

Investment trends for gas programs show a much different pattern than electric programs, with actual investment levels near or surpassing the E3b. The cumulative spending deficit for EWR gas Low-Income programs from 2010-2016 is $1.0 million, reflecting an under investment of only 1%. This was composed of Utility A surpassing the E3b by $5.9 million and Utility B investing $6.9 million under the baseline, relatively 10.5% over and 15.4% under respectively (Table 2). Low-Income program spending ranged yearly, from $1.7 million under to $4.7 million over the E3b. In 2016, Low-Income investments by Utility A gas was $0.4 million, or 5% above, and $1.2 million or 18% below for Utility B (Figure 5-7).

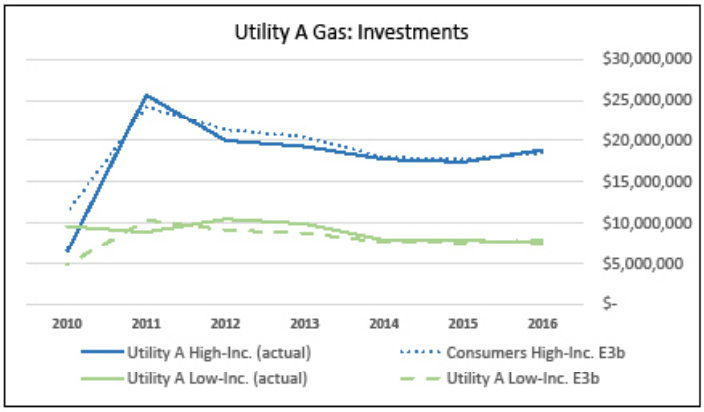

Figure 7. Actual vs. Equitable (E3b) spending for Utility A gas EWR programs between 2010-2016. *Source*: EWR Annual Reconciliation Reports (Utility A Energy, 2010-2016), US Census Bureau 5-year ACS 2015, Michigan Agency for Energy.

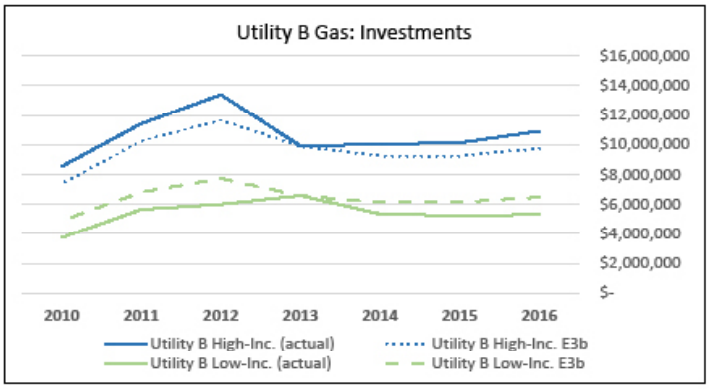

Figure 6. Actual vs. Equitable (E3b) spending for Utility B gas EWR programs between 2010-2016. *Source*: EWR Annual Reconciliation Reports (Utility B Energy, 2010-2016), US Census Bureau 5-year ACS 2015, Michigan Agency for Energy.

Table 2. Summary of EWR program investments, Actual vs. Equitable (E3b), 2010-2016.

Low-Income Program	Actual Investment	Equitable Investment	Investment Deficit	Proportion Deficit
Utility-A Electric	$18,670,697	$58,268,333	-$39,597,636	-68.0%
Utility-B Electric	$40,070,000	$73,828,290	-$33,758,290	-45.7%
Total Electric	$58,740,697	$132,096,623	-$73,355,926	-55.5%
Utility-A Gas	$62,151,372	$56,223,498	+$5,927,874	+10.5%
Utility-B Gas	$37,811,000	$44,711,541	-$6,900,541	-15.4%
Total Gas	$99,962,372	$100,935,039	-$972,667	-1.0%
Total	$158,703,069	$233,031,662	-$74,328,593	-31.9%

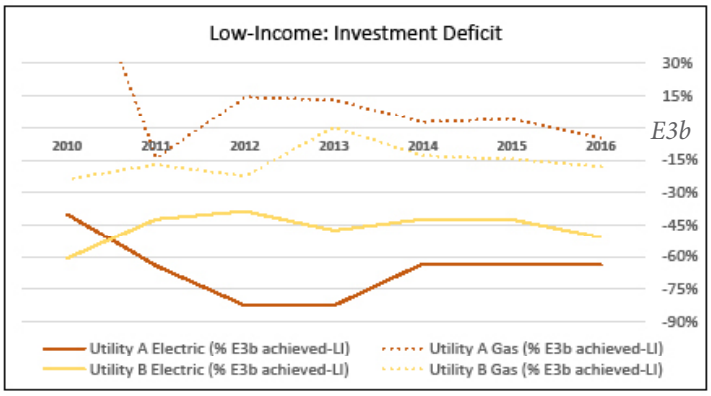

Figure 7. Summary comparison of EWR program investments (Actual vs. Equitable) between 2010-2016. *Source*: EWR Annual Reconciliation Reports (Utility A & Utility B, 2010-2016), US Census Bureau 5-year ACS 2015, Michigan Agency for Energy

MPSC Approved Plan vs. Actual

The difference between MPSC approved EWR Plan investment and actual investments varied between energy type and provider. In electric programs, the greatest yearly decreases were found in Utility B Low-Income programs, where reductions in three of seven years ranged from 25-31% (figures 8 & 9). No other program exceeded a 10% increase or decrease any year. Utility A electric Low and High-Income programs showed an average spending change of less than 1%. Utility B electric programs showed an average increase of 1% in High-Income and an average decrease of 14% in Low-Income programs. Variance in gas program spending included increases in Low-Income programs for Utility A (2010) and Utility B (2013), with a decrease in High-Income programs Utility B (2013). Average variance for Low-Income gas programs was 2% (Utility A and

Utility B), while High-Income programs increased by 1% and decreased by 4% respectively.

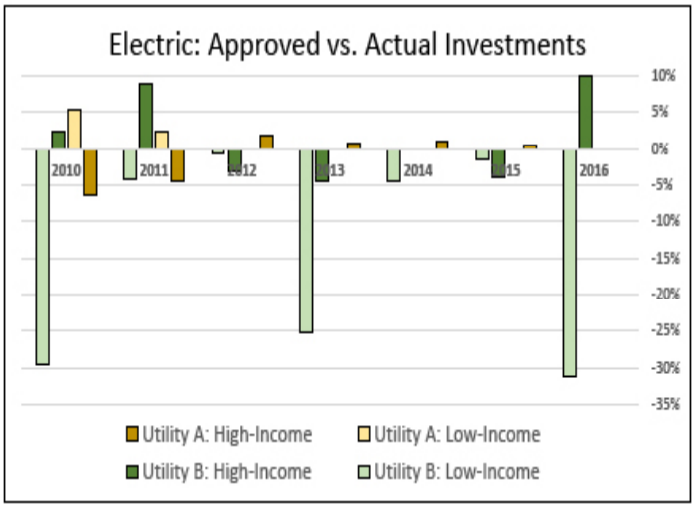

Figure 8. Variance in Electric Program spending (%) between EWR Plan approved and Actual spending for Utility A and Utility B (2010-2016).

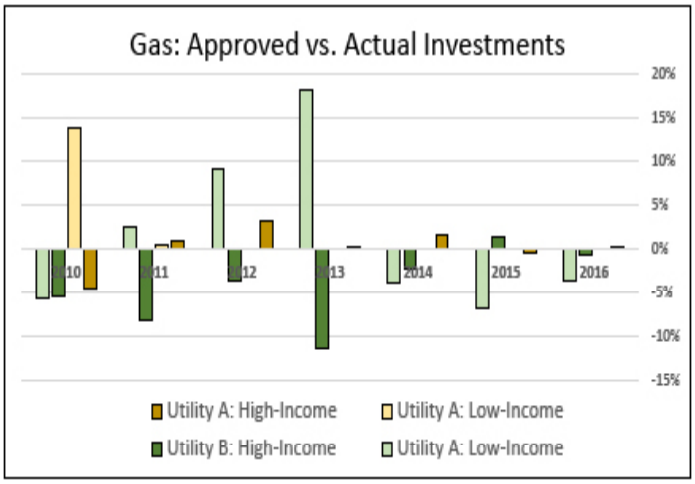

Figure 9. Variance in Gas Program spending (%) between EWR Plan approved and Actual spending for Utility A and Utility B (2010-2016).

Table 3. Summary of variance between Actual energy savings and Equitable (E3b) energy savings achieved (2010-2016).

EWR Program	Actual Energy Savings	Equitable Energy Savings	Energy Savings Deficit	Proportiona Deficit
Utility-A Electric (Mwh)	26,352	374,615	-348,263	-93.0%
Utility-B Electric (Mwh)	130,851	618,160	-487,309	-78.8%
Total Electric (Mwh)	157,203	992,775	-835,572	-84.2%
Utility-A Gas (Mcf)	670,513	2,023,135	-1,352,622	-66.9%
Utility-B Gas (Mcf)	842,927	1,858,773	-1,015,846	-54.7%
Total Gas (Mcf)	973,778	2,476,933	-1,503,155	-60.7%

Policy Benefits: Household Energy Savings benefits:

While the allocation of energy savings are not as direct as utility investment allocations in the decision-making process, the energy savings outcomes for both electric and gas EWR programs show severe disparities when comparing Low- and High-Income program results. Total energy savings deficits, representing disparities in outcomes, show outcomes 84.2% (total electric), and 60.7% (total gas) below E3b (Table 3). Again, patterns vary substantially by energy type and utility (figure 10). On an annual basis, electric programs ranged from 88-97% (Utility A) and 71-89% (Utility B) under E3b for Low-Income programs, with weighted averages at 93% (Utility A) and 79% (Utility B). For gas programs, annual disparities in energy savings ranged from 39-81% (Utility A) and 45-62% (Utility B), with weighted averages of 67% and 55% respectively.

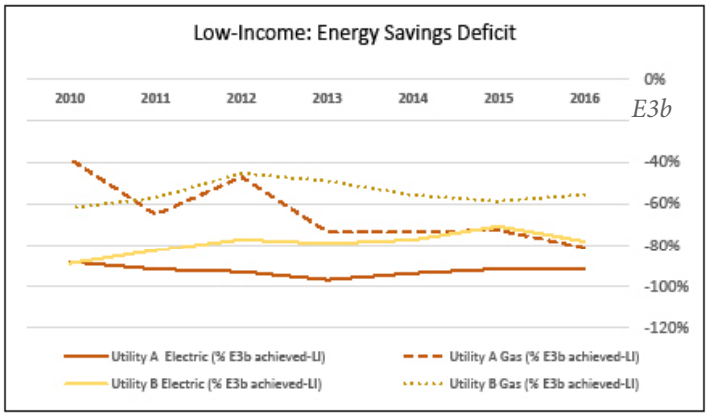

Figure 10. Summary comparison of EWR program energy savings (Actual vs. Equitable) between 2010-2016. *Source*: EWR Annual Reconciliation Reports (Utility A & Utility B, 2010-2016), US Census Bureau 5-year ACS 2015, Michigan Agency for Energy.

Per Capita Comparison: Utility Investments & Consumer Benefits

Results show that for EWR Residential *electricity* programs overall, utilities are investing 3.1 times as much per capita on High-Income programs. This varied between energy providers, where Utility A invested 4.3 and Utility B invested 2.4 times greater in High-Income programs (Table 4). For EWR Residential gas programs overall, utilities invested

Table 4. Summary comparison of per capita investments and energy savings between Low- (LI) and High- (HI) income populations.

	LI Investment ($ per capita)	HI Investment ($ per capita)	Investment ratio (LI:HI)	LI Energy Saved (per capita)	HI Energy Saved (per capita)
Utility A Electric	$11.79	$51.14	4.34	16.6	362.7
Utility B Electric	$25.86	$63.13	2.44	84.4	594.0
Total Electric	$18.75	$57.50	3.07	50.1	485.5
Utility A Gas	$43.29	$37.39	0.86	467.1	1,813.0
Utility B Gas	$26.48	$34.54	1.30	590.3	1,775.2
Total Gas	$34.91	$36.28	1.04	528.5	1,798.2

only 1.04 times greater in High-Income programs. This also varied between gas providers, with Utility A and Utility B investing 0.86 and 1.30 times as much in High-Income programs.

In terms of per capita energy savings, high-income electric consumers received on average, 9.7 times greater household savings than low-income consumers. For natural gas, high-income received 3.4 times greater savings. Particularly high, was Utility A's ratio of 22:1 (High/Low-Income) electric savings while Utility B programs produced electric savings at a 7:1 ratio. For gas programs, Utility A produced a savings ratio of 4:1, while Utility B performed at a 3:1 ratio.

IV. DISCUSSION

Impacts Across Residential Socioeconomic Groups

The results of this study demonstrate the occurance of severe disparities in Michigan's state energy efficiency policy between 2010-2016. The degree of social equity highly depended upon energy type and the utility provider. The disparities in program outcomes can partially be attributed to sustantialy lower investments in Low Income programs and repeated reallocation of Low-Income funds from MPSC plan approved spending levels. However, one utility's investments in EWR Low Income gas programs exceeded equitable investment levels. Yet, low-income consumer savings produced were four times less per capita. This demonstrates that while equitable investments are important, it will not lead to equitable policy outcomes.

While some states have addressed social concerns through the establishment Low-Income program investment standards, whether as a percentage of total program spending (ie. MA) or dependent upon utility size (ie. IL), this study demonstrates the need for further alignment in policy, regulatory processes and the underlying mechanisms for measuring costs and capturing bnefits in order to achieve socially equitable outcomes. Further studies on alternative policy measures are necessary to guide policy makers, regulatory agencies and utility decision-makers towards a more just energy future.

V. RECOMENDATIONS

To achieve greater social equity in energy efficiency and consumption in the household across socio-economic groups, this study concludes with the following policy and regulatory recommendations:

- Establish investment standards for Low-Income programs that reflect the E3b tailored spatial and socioeconomic approach for each utility.
- Set a ceiling for inequiable policy outcomes (e.g. a max ratio of household energy savings benefits per capita, resulting from High and Low-Income programs.
- Develop further metrics for current state policy requiring the Commission to approve or reject proposed EWR plans based upon: availability, affordability, usefulness.
- Create Low-Income specific cost-benefit measures that capture the full social benefits of reducing severe home energy burdens. This includes non-energy imacpts (NEIs) such as health, employment, education, safety.

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Acknowledgements:

A special thanks to the **Edna Bailey Sussman** Grant for providing the opportunity to conduct research at the intersection of environment and society and to our community partner, **Ecoworks Detroit**, for their invaluable insights to the Low-Income Energy Waste Reduction programs in Michigan.