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2023 MISSOURI ENERGY BURDEN ASSESSMENT

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LIBERTY UTILITIES – 2023 MISSOURI ENERGY BURDEN ASSESSMENT

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INTRODUCTION

This brief report presents the methodology and findings from Liberty's 2023 Missouri energy burden assessment. The results of the assessment are contained in the web dashboard at https://liberty2023.empowerdataworks.com/

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1. METHODOLOGY

1.1 GENERAL APPROACH

This energy burden assessment relies on collecting customer-level data, modeling missing attributes, then aggregating key metrics by geographic, demographic or building variables for analysis. The customer data (including estimated household income) comes from various sources as described in the rest of Section 1. Some demographic attributes were modeled or inferred using statistical techniques due to lack of primary data in the Customer Information System (CIS) or other sources. American Community Survey data was mainly used to sanity check aggregate statistics of customer-level data at the census tract level.

Three types of metrics were calculated:

- Metrics related to energy burden based on demographic and geographic characteristics
- Participation and funding in Energy Assistance Programs
- Customer energy use characteristics

The final dataset and results were packaged in a web dashboard for utility staff.

1.2 DATA SOURCES

The data sources leveraged for the analysis are described in this section.

DATA PROVIDED BY LIBERTY

Customer Information System (**CIS**): This data included monthly electricity bills for 30 months in 2021-23, account numbers and service addresses. A separate data extract included the dates and customer accounts that received late payment and disconnection notices, allowing us to calculate the on-time payment rate for different customer segments.

Direct Assistance Program Data: We received a list of participating accounts in LIHEAP and ECIP in 2021-23, along with discount amounts and dates. This allowed us to calculate the total assistance funding at the household level.

DATA OBTAINED FROM OTHER SOURCES

Geocoding: All customer addresses were geocoded to a latitude/longitude pair to facilitate geographic analysis. In addition, we mapped the latitude/longitude pairs to census tracts, block groups and blocks in order to pull additional aggregate statistics.

American Community Survey (**ACS**): ACS data (2021 5 year estimates) was primarily used for QA to ensure that aggregate counts for various demographic attributes match the expected distributions from ACS.

1.3 FINAL ATTRIBUTES AND METRICS

The calculation methods for the metrics and attributes used in this report are described in this section. For all attributes, we also captured metadata related to the source of data and the confidence in the value (for example, data from primary sources has a high confidence, while modeled data has lower confidence). All of the data is robust for aggregate analysis, while high confidence data is better suited to customer-level marketing and program targeting.

Household Income: Income data could be matched to 51% of households in Liberty's Missouri service territory. To estimate the incomes for the remaining 49%, we used an interpolation procedure.

For households with missing income data, an estimated income was calculated as the average of the incomes of the three geographically closest households. Households that received LIHEAP were assigned an income under 60% of the State Median Income, as their income had been verified as falling under this limit.

Validation: The median income in the region closely matches the median household income estimates from the American Community Survey.

Poverty Status: The number of people living in a household cannot be easily obtained from any public data sources. This makes it difficult to identify a household's poverty status compared to the Federal Poverty Limit or the Area Median Income, both of which are defined by household size. The median household size in the five primary Liberty Missouri counties (Jasper, Newton, Christian, Greene, Taney) varies from 2.2 to 2.7. In general, we used the income limits for three person households in this analysis as they produced the most accurate estimates of poverty compared to census data.

Validation: According to the US Census Bureau, between 14-15% of households in the five main Missouri counties served by Liberty would fall under 100% of the Federal Poverty Limit. In this assessment, the poverty rate is 14%, which is within the census range.

Building type: Meters were classified into one of four building types: single family, mobile homes and multifamily apartments, commercial or master metered and unoccupied. Commercial meters were those tagged with a specific commercial use by the county assessor or that were on a commercial rate class. Additionally, we filtered out meters using in excess of 60,000 kWh per year as those are likely associated with commercial uses or are master metered. Meters that showed energy consumption less than 2400 kWh/year were flagged as potentially unoccupied.

Overall, the number of household meters excluding commercial, seasonal and unoccupied meters was approximately 114,000. Addresses with multiple units were flagged as apartments.

Validation: The aggregate housing type counts (~90% single family/duplex, 10% multifamily/mobile/ADU homes) show a higher rate of single family homes than the American Community Survey (~77%). Multifamily or mobile homes may be misclassified as single family homes if there is insufficient data in their address in the Customer Information System.

Homeownership Status: Homeownership status (rent vs. own) was determined using two methods. The demographic dataset included homeownership for approximately 51% of customers. For the other 49%, households in multifamily apartments were tagged as "Likely Renters", and households without any account changes during the two year analysis period were tagged as "Likely Homeowners". This approach can potentially undercount long-term renters and tag them as homeowners. However, the accuracy of the approach seems sufficient for the purposes of large-scale aggregate analysis as in this study.

Validation: The owner-occupied housing rate from the American Community Survey is approximately 68% in the five main Missouri counties (which represents 78% of Liberty's service area). The homeownership rate from this analysis is 67%, and the two estimates fall within each other's margin of error.

Load Disaggregation and Heating Type: A simple load disaggregation was applied for all households using their monthly energy bills. This involved taking the tenth percentile of monthly energy use (normalized by the number of days in a billing period) as the assumed base

load. Then, the energy use that exceeded the base load in the winter months (October through April) was designated as "heating-related energy use", while the energy use that exceeded the base load in the summer months (May through September) was designated as "cooling-related energy use".

Homes with a heating-related energy use that exceeded 15% were flagged as potentially utilizing electric heat (primary or secondary), while homes with under 15% heating-related energy use were flagged as non-electrically heated homes.

Validation: The approach has been previously tested by Empower Dataworks vs. a variable-base degree day regression and it yields similar results but at a much smaller computational cost.

Energy Burden and Energy Efficiency Potential thresholds: These thresholds were set as follows:

- Electrically heated:
  - High-burden threshold: Greater than 6%
  - High efficiency potential threshold: Greater than 14 kWh/sq.ft.
- Non-electrically heated:
  - High-burden threshold: Greater than 4%[1]
  - High efficiency potential threshold: Greater than 7 kWh/sq.ft.

Energy Burden: Energy burden for a household is calculated simply by dividing annual electricity expenses by gross household income.

$$Energy\ Burden\ [\%] = \frac{Annual\ Electricity\ Expenses\ [\$]}{Annual\ Household\ Income\ [\$]}$$

Excess Burden: Excess burden is the portion of a household's energy burden in excess of the 6%/3% threshold.

$$Excess\ Burden\ [\$]$$
$$= \max(0, Energy\ Burden\ [\%]$$
$$- High\ Burden\ Threshold[\%])$$
$$\times Annual\ Household\ Income[\$]$$

On-Time Payment Rate: This is the proportion of all energy bills that did not require a late payment or disconnect notice to be sent out.

Energy Assistance Funding: The dollar amount of funding flowing through energy assistance programs (including discount, donation and weatherization programs) through discounts or rebates.

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[1] The current accepted high energy burden threshold (6%) is a rule of thumb developed by Fisher, Sheehan and Colton based on total household energy expenses (gas + electricity + delivered fuels). There is currently no guidance on flagging high burden for non-electrically heated homes. We considered average gas bills in Missouri – which typically comprise a third of a home's energy bills and we consider non-electrically heated homes in this assessment, as "high-burden", if they spend more than 4% of their income on their electricity bill (two-thirds of 6%).

Customer Bill Reductions (**Avoided Burden**): The total bill impact (in dollars) from energy assistance programs. This is the same as the assistance funding for direct assistance programs and is based on measure savings for energy efficiency programs as described in Section 1.2.

Avoided Need: The total bill impact (in dollars) from energy assistance programs, specifically for program participants flagged as "high-burden". Bill impact is equal to the amount of assistance grants or discounts for direct assistance programs and is equal to measure savings (kWh/year) multiplied by the residential kWh rate ($/kWh) for energy efficiency programs.

Census Tract Statistics: Since each customer has been mapped to a census tract and block group, we are also able to match customers to census tract average statistics (e.g. highly impacted communities, presence of children, non-English speakers, education level, environmental pollution etc.).

Energy Assistance Need: This is the sum of excess burden across all customers.

1.4 SOURCES OF UNCERTAINTY

- **Household income** is a dynamic piece of data as residents move in and out of homes and income data can become outdated within a year or two.

- **Poverty status.** Since household size cannot be reliably captured through any available data source, household poverty status is subject to uncertainty. The Federal Poverty Limit and State Median Income both use household size as a scaling factor. In this analysis, we have used income thresholds for 3-person households for consistency and clarity, but they may under-estimate or over-estimate the actual income eligibility depending on the actual sizes of low-income households in this service area.

- **Individual vs. aggregate data usage.** The underlying dataset has customer-level flags for data quality – data from primary sources is considered high quality while modeled data is considered medium or low quality, depending on the availability of supporting sources of information (example, home values and location). Higher quality data can be used for individual program targeting, lower quality data can be used for program design and aggregate reporting.

- **Building types.** There is some uncertainty in the classification of building types as described in Section 1.3. This could results in misclassifying non-residential meters as occupied households or single family homes as auxiliary dwellings.

- **Achievable reductions in energy assistance need.** This analysis presents a *technical* energy assistance need based on energy burden. However, in our experience with energy assistance programs in general, many customers may not participate in programs, regardless of program design or available benefits due to a variety of barriers like access to information, application process difficulties, stigma and lack of trust. Understanding the *economically achievable* reduction in energy assistance need through utility programs would require a qualitative research of non-participants in a utility's service area.

2. LIBERTY'S ENERGY BURDEN BASELINE

2.1 LIBERTY MISSOURI RESIDENTIAL SECTOR PROFILE

Liberty's service territory in Missouri was composed of approximately **114,000 occupied households** (with a detectable energy use and not designated as shops, garages or commercial properties).

Ethnicity: According to the U.S. Census Bureau, approximately 85% of residents in Liberty's Missouri service area are non-Hispanic white. Hispanic residents comprise 7% of the population, mainly concentrated in Jasper County.

Household Income: The median household income for residents in Liberty's service area is approximately $55,000, well below the state average of $61,000. Approximately **14%** of households would fall under 100% of the federal poverty limit, and **39%** of residents would fall under 60% of the State Median Income. An additional 16% of households earn between 60-80% of the state median income. These "borderline" customers would be ineligible for almost all energy assistance programs, but still bear a relatively high level of energy burden. Designs for programs that are ratepayer-funded should take into

account the degree of additional burden that would be imposed on these customers.
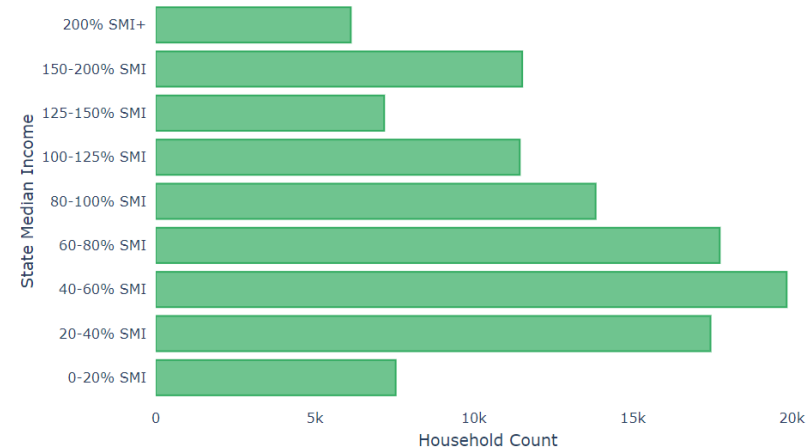
Figure 1. Household income as a percent of state median income for Liberty's Missouri residential customers

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Energy Bills: Liberty residential electricity rates are about average for the region. Annual energy bills average **approximately $2,100/year with an average annual consumption of 13,600 kWh**, with approximately 49% of customers using electricity as a primary or secondary heating fuel. Figure 2 shows the distribution of annual electricity bills.
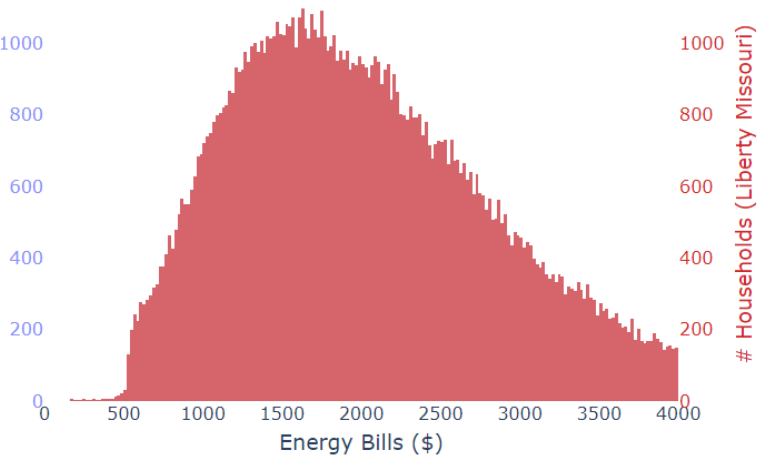
Figure 2. Household electricity bill distribution for Liberty's Missouri residential customers

2.2 ENERGY BURDEN

Liberty customers have an **average and median electricity energy burden of 5.3% and 3.4%**, respectively. Figure 3 compares Liberty's median energy burden to values published in other jurisdictions. The median burden is comparable to rural regions in the Midwest.

The average household paid $2,100/year in electricity bills in 2021-23. Of 114,000 identified households, **37,000 were deemed to have a high energy burden**, meaning that annual electricity bills exceeded 6% of their income for electrically-heated homes and exceeded 4% of their income for non-electrically heated homes. These high-burden customers paid an average of $2,500 in annual electricity bills; the higher bill average reflects their higher likelihood to live in less efficient or older homes. The **total annual energy assistance need for Liberty customers in Missouri in 2021-23 was approximately $38M/year**—the total reduction that would bring all customer electricity bills below the high burden threshold (6% of income for electric heat and 4% for non-electric heat). The energy assistance need specifically for low-income customers was approximately $33M/year.
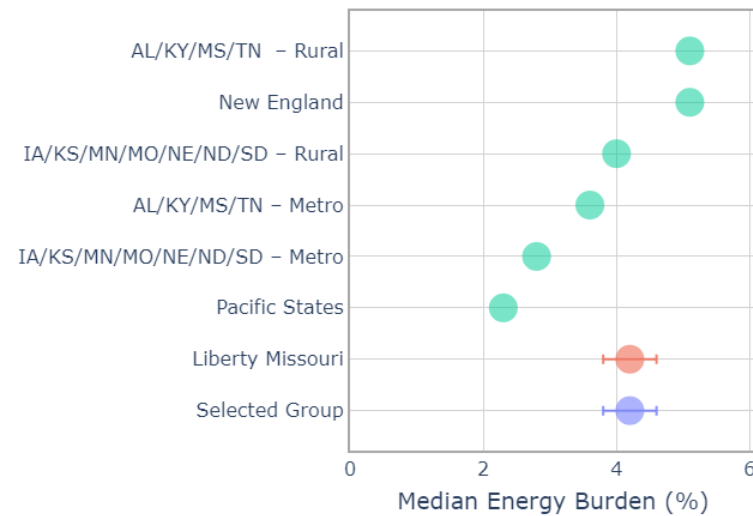
Figure 3. Energy burden benchmarking vs. other regions

Liberty's energy charge in its residential retail rate is between 12 and 14 cents/kWh, which is in line with other utilities in the region and below the national average of 16 cents/kWh. Therefore, low incomes and high energy use, rather than rates, appear to be the most significant drivers of high energy burden in the area.

Although averages and medians give a general indication of energy burden across a service territory, the reality is

that **energy burden is a customer-level metric** and its distribution is a better indicator of the burden that customers experience. The distribution of energy burden among Liberty customers is shown in Figure 4.

The goal of an effective energy assistance portfolio should be to prioritize the customers who most need the assistance, i.e. the customers to the right of the 6%/4% thresholds.

Approximately 52% of the energy assistance need for Liberty customers is among renters, indicating that conservation programs targeted at high-burden customers will need to grapple with the split incentive problem between landlords and tenants, but energy burden among homeowners is also a significant category. Other customer segments can be investigated in more detail in the data dashboard.

Number of Households **~114,000**	
Low Income Households <60% SMI: **~45k**	
Median Electricity Burden **~3.5%**	
High Burden Households **~37,000**	

Bottom line: Our prime target for energy assistance is approximately 37,000 "high-burden customers"
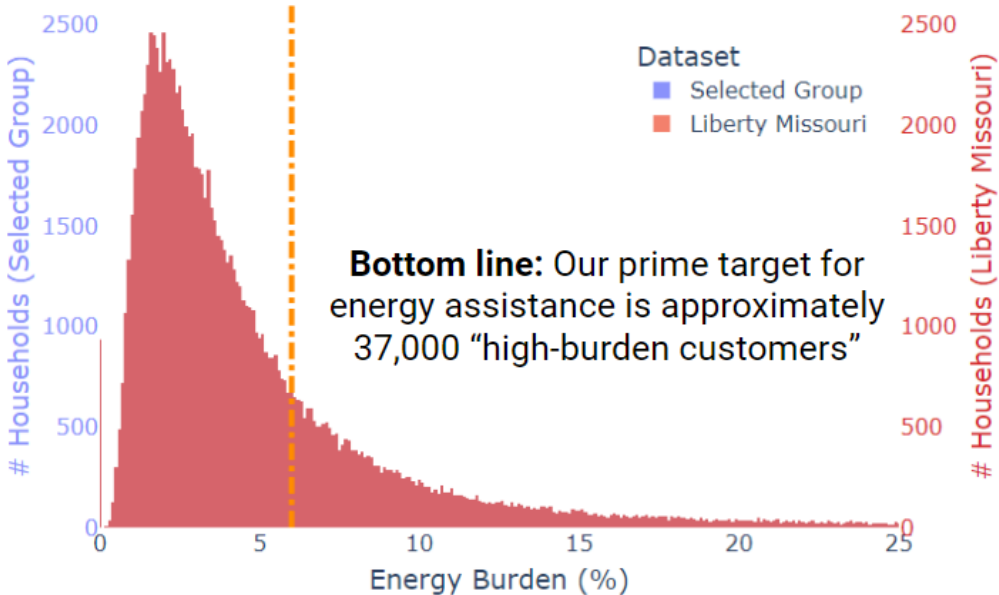
Note: Energy burden is based on total household energy use. In this assessment, we use separate thresholds for electric heat (6%) and non-electric heat households (4%) (based on average gas bills in the area), since we don't have gas or delivered fuel data.

Figure 4. Distribution of energy burden among Liberty Missouri customers.
Figure shows all homes but dashed line indicating 6% high energy burden threshold applies to electric heat households.

2.3 CONSERVATION VS DIRECT ASSISTANCE

Figure 4 shows the distribution of energy burden and energy efficiency potential (defined through Energy Use Intensity thresholds) across all low-income residential customers. In a perfect world, the energy assistance portfolio would match these customer segments. For example:

- Conservation and weatherization programs should primarily serve **high burden, high potential** households
- Direct assistance programs should primarily serve **high burden, low potential** households
- Crisis/emergency programs should primarily serve **low burden, low potential** households
- Traditional conservation programs with financing should serve **low burden, high potential** households

Aligning targeted customers with program strengths results are the most cost-effective pathway to energy burden reduction.
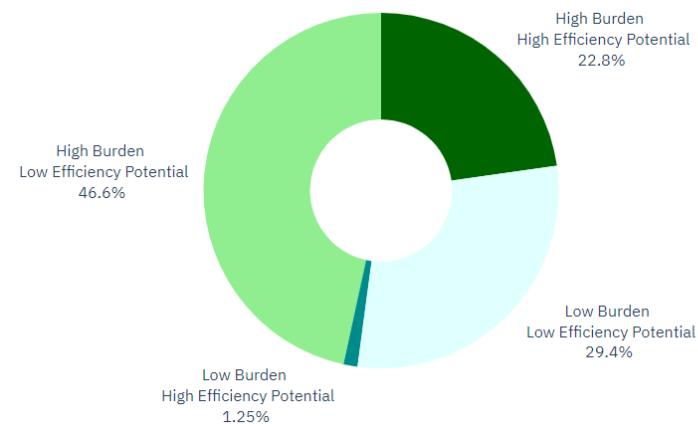
Figure 5. Liberty Missouri low-income customer segments by energy burden and energy efficiency potential.

Approximately 29% of Liberty's low-income customers are low-burden and low-efficiency potential. These customers' energy bills may not be a huge expense relative to housing, medical and education expenses, and

they should not be prioritized in the more intensive programs, such as weatherization.

33% of high burden customers also have a high efficiency potential indicating that the energy assistance program mix should equally prioritize sustained energy burden reductions through energy efficiency and weatherization. At the same time, we should recognize that scaling up low-income weatherization faces a host of barriers and these customers are in need of more immediate assistance options (through rates, grants or discounts).

3. ENERGY BURDEN REDUCTION OPPORTUNITIES

3.1 POTENTIAL ACTIONS

Rising energy costs and the challenges of energy affordability and customer disconnections reinforce the need to prioritize energy burden reduction in high-burden households. To meet these challenges, Liberty needs to pursue a holistic strategy that combines best practices in program marketing and delivery, combined with a full portfolio of interconnected program offerings.

To achieve this goal, we are presenting the following list of actions for Liberty's consideration – these were selected to fit (i) Liberty's current energy burden baseline, (ii) Liberty's current program mix and (iii) best practices gleaned from peer utilities.

The actions fall in three categories:

i. *Research/Planning*: Actions needed to monitor and report energy burden reductions, and set realistic targets

ii. *Programs*: Actions related to tweaking current programs, or piloting new programs.

iii. *Funding*: Actions related to funding allocations.

The following parameters are given for each action:

- *Readiness level*: Has this action been widely deployed/researched in other regions or by other utilities?

- *Budget*: Expected budget range (outside of staff time)

- *Staff time*: Time needed for project management or implementation

- *Energy burden impact:* The relative overall impact to customer energy burden. The actual impact will depend on the magnitude of investment in each action and its specific design.

POTENTIAL ACTION	READINESS LEVEL	BUDGET	LIBERTY STAFF TIME	ENERGY BURDEN IMPACT
Adopt energy burden reduction as a metric for all conservation programs	Intermediate	$	🕐🕐	Foundational Action (No direct impact)
Implement a targeted marketing and outreach strategy	Proven	$ $	🕐🕐	🧍🧍🧍
Community and small business energy efficiency in high-burden neighborhoods	Proven	$	🕐	🧍
Energy Ambassador program	Pilot	$ $	🕐🕐🕐	🧍🧍
Design new affordability program	Proven	$ $ $	🕐🕐	🧍🧍🧍

ADOPT ENERGY BURDEN REDUCTION AS A METRIC FOR ASSISTANCE AND CONSERVATION PROGRAMS

Type: Research/Planning

Readiness level: Intermediate

Main Goal: Measure program progress towards energy equity and affordability

Target Customer Segment: All program participants

Budget: Internal Staff Only

Required Staff time: *Moderate* (Staff time to make internal business case and set up internal tracking systems)

Description:

"*You cannot manage what you cannot measure*"

For Liberty's programs to make a meaningful impact on energy affordability, then they need to excel at reaching high-burden customers and identifying high-burden customers among program participants. This is not an insurmountable task, particularly for income-qualified programs, where incomes are already collected as part of the intake process.

As a first step, the Liberty team will need to get internal buy-in to adopt energy burden-related metrics (e.g., average energy burden reduction per participant and per dollar spent) as formal program metrics. This includes developing the internal business case and verifying the feasibility of doing this through data sharing with partner agencies, technical infrastructure and reporting tools. Once the metrics are being tracked, they can be used to direct program investments and design decisions.

IMPLEMENT A TARGETED MARKETING AND OUTREACH STRATEGY

Type: Programs - Operations

Readiness level: Proven

Main Goal: Improve participation of high-burden customers in current programs

Target Customer Segment: High-burden customers

Required Staff time: *Moderate* (Communications + Energy Assistance staff)

Energy Burden Impact: *High* (primarily improves the targeting effectiveness of programs, so more high burden customers participate)

Description:

Program targeting is a catch-all term and it could manifest as any of the following:

➢ Use a consistent, repeatable process for creating targeted marketing campaigns that are culturally and demographically relevant. One example is *Empower Dataworks Targeting Playbook*, but there are other frameworks that accomplish the same goal.

➢ Identify high-burden customers and neighborhoods using data from this Energy Burden Assessment and use these customer lists for targeted informational campaigns.

➢ Initiate a program of energy bill clinics in high-burden neighborhoods to raise awareness about energy efficiency and to provide an educational opportunity to customers about their bills.

➢ Build relationships with large property managers, trade allies and community organizations that serve high-burden neighborhoods.

➢ Test the *Whole Neighborhood Approach* to energy efficiency/weatherization, especially in concentrated pockets of energy burden in more rural areas. (https://www.osti.gov/biblio/1126788)

COMMUNITY AND SMALL BUSINESS ENERGY EFFICIENCY IN HIGH-BURDEN NEIGHBORHOODS

Type: Program - Operations

Readiness level: Proven

Main Goal: Build rapport with trusted businesses and institutions in high-burden communities

Target Customer Segment: Businesses and community buildings in high-burden neighborhoods

Budget: Moderate increase in commercial energy efficiency budget

Required Staff Time: *Minimal* (Expansion of current commercial energy efficiency program)

Energy Burden Impact: *Minimal* (Doesn't directly reduce energy burden but builds trust with potential participants)

Description:

Liberty is successfully running a Small Business Direct Install program that targets outreach at small businesses and provides free energy upgrades. This action would be a minor modification to the program to include community organizations (especially religious facilities and community centers) in high-burden neighborhoods. These organizations are great advocates for energy efficiency and can help Liberty bridge the trust barrier with customers. In addition, we suggest that Liberty expand outreach for its commercial and residential energy efficiency rebates to focus on high-burden areas.

ENERGY AMBASSADOR PROGRAM

Type: Program

Readiness level: Pilot

Main Goal: Train community members in energy audits and the LIHEAP/energy assistance program application process

Target Customer Segment: 30-40 Energy Ambassadors + their communities

Budget: *Moderate* (Energy ambassador training/stipends)

Required Staff Time: *High* (Staff to design and implement program)

Energy Burden Impact: *High* for Energy Ambassadors, *Moderate* for their community members who enroll in programs.

Description:

A primary barrier to energy assistance program participation by low-income customers is lack of trust. In many communities around Missouri, there are regular customers who assist others in their communities by explaining the benefits of the programs and even helping with the application process. The Energy Ambassador program would formalize this process by paying a stipend to the "Energy Ambassadors" (usually low-income high-burden customers themselves) based on how many applications they bring in to the assistance programs.

As an extension to the referral portion of the program, the Energy Ambassadors could be trained to perform quick walkthrough energy audits and submit a simple audit form to Liberty. These "citizen energy auditors" would be empowered through performance-based income while leveraging their trusted connections to encourage participation among their neighbors and families. The workforce development component would also serve Liberty in the long run by reducing friction and expense in the intake/audit stage of energy efficiency programs.

IMPLEMENT A NEW AFFORDABILITY PROGRAM FOR THE HIGHEST BURDEN CUSTOMERS

Type: Funding

Readiness level: Proven

Main Goal: Ensure that more funding is made available to reduce energy burden.

Target Customer Segment: Program participants

Budget: Internal Staff Only

Required Staff Time: *Low*

Energy Burden Impact: *Low*

Description:

This energy burden assessment has found that there is a need for more funding to address the energy assistance need in Missouri. The most straightforward approach is to design a new affordability-focused program, similar to other utility assistance programs in Missouri and around the country. The accompanying slide deck includes a few different potential designs along with the financial analysis. The program could also be modelled on assistance programs offered by peer utilities in Missouri (see Section 3.2).

3.2 PEER UTILITY PROGRAMS

The following peer utility programs can be used as templates for designing a new pilot assistance program by Liberty Utilities.

AMEREN - KEEPING CURRENT PROGRAM

The Keeping Current energy assistance program was introduced in 2010 and is available to households earning less than 150% of the Federal Poverty Level. It consists of two components:

Year-round assistance: Tiered monthly bill credit ($60-90/month for electric heat customers and $35-40/month for alternate heat customers depending on poverty level) and arrearage matching for customers who stay current on their monthly bill payments.

Summer assistance: Bill credits ($25/month) in June, July, and August to account for increased air conditioning usage.

SPIRE – PILOT AFFORDABILITY PROGRAM

Spire has been collaborating with a stakeholder group to redesign its Payment Partner Program in order to focus more on year-round bill affordability. The redesigned program will be available to customers earning less than 300% of the Federal Poverty Level. Three bill discount tiers, ranging from 25% to 50% discount, will be offered to customers, depending on their gas energy burden range. Higher burden customers will receive a higher discount on their monthly bill.

This program design allows for expanded eligibility of customers while still focusing the higher benefits on customers who have a greater need.

3.3 ADDITIONAL RESOURCES

POTENTIAL ACTION	RESOURCES
Adopt energy burden reduction as a metric for all conservation programs	Roger Colton, January 28, 2020. Presentation can be requested from WA Dept. of Commerce. Energy Trust of Oregon, Diversity, Equity and Inclusion Operations Plan. https://energytrust.org/about/explore-energy-trust/diversity-equity-and-inclusion/
Implement a targeted marketing and outreach strategy	Empower Dataworks (hello@empowerdataworks.com) can share a Targeting Playbook and request a utility presenter to share their experiences.
Energy Ambassador program	Can borrow some design elements from HVAC contractor training programs: https://www.aceee.org/files/proceedings/2012/data/papers/0193-000210.pdf

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