Minnesota Energy Efficiency Potential Study: 2020–2029

Appendix F: Low-Income Sector Market Study

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Introduction

The full report that this appendix supports, *Minnesota Energy Efficiency Potential Study: 2020-2029*, is available for download on the project website.

Minnesota has a thirty-plus year history of leadership in energy efficiency policy and achievements. In order to continue to maximize the benefits of cost-effective energy efficiency resource acquisition by utilities, the project team, consisting of Center for Energy and Environment (CEE), Optimal Energy (Optimal) and Seventhwave, was commissioned to:

- Estimate statewide electric and natural gas energy efficiency and carbon-saving potential for 2020-2029;
- Produce data-driven and stakeholder-informed resources defining market segments, end uses, measures, and programs that could be targeted in the decade ahead to realize the state's cost-effective energy efficiency potential; and
- Engage stakeholders in order to help advance robust energy policies and energy efficiency programs in the state, and to inform future efficiency portfolio goals.

This appendix dives more deeply into the potential for energy efficiency improvements in low-income households in Minnesota. For the purposes of the study, the project team defined "low-income" as households with income at or below 200 percent of the Federal Poverty Guideline (FPG).[1] By this definition, there are roughly half a million low-income households in Minnesota, representing almost one in four households in the state. Note that while this definition is used by the federal Weatherization Assistance Program and a number of utility CIP programs, other metrics—such as percent of area median income—are also used, particularly for determining eligibility of multifamily properties.

[1] The 2018 Federal Poverty Guideline is $12,140 in annual income for the first household member, plus $4,320 for each additional member. The analysis is based on Census survey data for 2011 through 2015, and uses the FPG for each survey year.

Characteristics of Low-Income Households in Minnesota

The housing type mix of low-income households is fundamentally different from that of the non-low-income population in the state. While nearly nine out of ten non-low-income households resides in a single-family home, about a third of low-income households live in a multifamily building (Table 1). In other words, only about one in five residents of a single-family home is low-income, but roughly half of apartment dwellers can be classified as such. This makes multifamily energy efficiency improvements an important consideration for programs targeting this population. This basic demographic fact is noted in a recent set of evaluation reports examining utility low-income CIPs prepared by APPRISE, Inc., and the issue is examined in more detail later in this appendix.[2]

Table 1. Housing mix for low-income and non-low-income households in Minnesota.

Type of home	Low-Income	Non-Low-Income
Single-family	57%	85%
Multifamily (2-4 units)	8%	3%
Multifamily (5+ units)	35%	12%
	100%	100%

Source: Census American Community Survey (2011-2015).

Low-income households are also more likely to heat their home with more expensive fuels such as electricity and propane. This is partly a reflection of the fact that these households are more likely to be apartment dwellers, where electric heat is more common, but the difference between low-income and non-low-income households persists to some extent even within housing type (Table 2).

Moreover, low-income households are more likely to reside in older homes than are non-low-income households. A useful dividing line is 1980, because most homes built prior to the 1980s were not subject to energy codes and are thus more likely to be under insulated or leaky.[3] More low-income households reside in pre-1980s housing stock than do non-low-income households (Table 3).

[2] See "Low Income CIP Evaluation Study: Summary Report," prepared by APPRISE, Inc. for the Minnesota Department of Commerce, Division of Energy Resources, December 31, 2017. Available at: http://mn.gov/commerce-stat/pdfs/card-low-income-cip-evaluation.pdf. Four additional detailed reports can be found via the CARD Research Project Search engine.

[3] The first energy conservation code in Minnesota came into effect in 1976.

Table 2. Heating fuel by housing type and household low-income status.

Heating fuel	Overall		Single-family		Multifamily	
	Low-Income	Non-Low-Income	Low-Income	Non-Low-Income	Low-Income	Non-Low-Income
Natural gas	55%	70%	61%	72%	48%	58%
Electricity	26%	14%	13%	10%	43%	34%
Other	19%	16%	26%	18%	9%	8%
Total	100%	100%	100%	100%	100%	100%

Source: Census American Community Survey (2011-2015).

Table 3. Age of home by housing type and household low-income status.

Year built	Overall		Single-family		Multifamily	
	Low-Income	Non-Low-Income	Low-Income	Non-Low-Income	Low-Income	Non-Low-Income
<1940	20%	16%	22%	16%	16%	15%
1940s	5%	4%	7%	5%	3%	2%
1950s	10%	11%	13%	11%	6%	6%
1960s	11%	9%	10%	9%	13%	11%
1970s	18%	15%	15%	14%	23%	20%
1980s	13%	13%	11%	12%	16%	17%
1990s	11%	15%	11%	16%	11%	11%
2000+	12%	17%	11%	17%	12%	18%
	100%	100%	100%	100%	100%	100%
Built prior to 1980	64%	55%	67%	55%	61%	54%

Source: Census American Community Survey (2011-2015).

Because of this—and no doubt because low-income households have less disposable income for energy-efficiency upgrades—there are some aspects of the population of low-income households and housing stock where there are more remaining opportunities for energy-efficiency improvements than the general population. For example, the single-family survey conducted for the study revealed that the saturation of programmable thermostats in low-income households lags behind that of non-low-income households by about 14 percentage points (56% vs. 70%). Similarly, data from the State's low-income weatherization program suggests that even after controlling for home age, low-income households have more opportunities for shell measures such as insulation and air sealing. These differences are incorporated into the modeling.

Low-Income Achievable Potential

The study's modeling estimates suggest that programs targeting low-income households have the potential to achieve cost-effective first-year savings of 1.4 percent of annual electric utility sales for low-income households (Table 4) and 1.3 percent of natural gas sales (Table 5). This represents 24 percent of the total electricity savings potential in the residential sector and 21 percent of the total residential potential for natural gas.

Table 4. Statewide electric energy efficiency potential by low-income housing type, 2020-2029.

Low-income customer segment	Projected average annual sales, 2020-2029 (GWh)	Incremental energy-efficiency potential*	
		(GWh)	% of sales
Single-family	4,735	68	1.4%
Small multifamily (2-4 units)	556	7	1.2%
Large multifamily (5+ units)	1,788	23	1.3%
Total	7,080	98	1.4%

*Mean of first-year savings potential for 2020-2029 under the Program Scenario.

Table 5. Statewide natural gas energy efficiency potential by low-income housing type, 2020-2029.

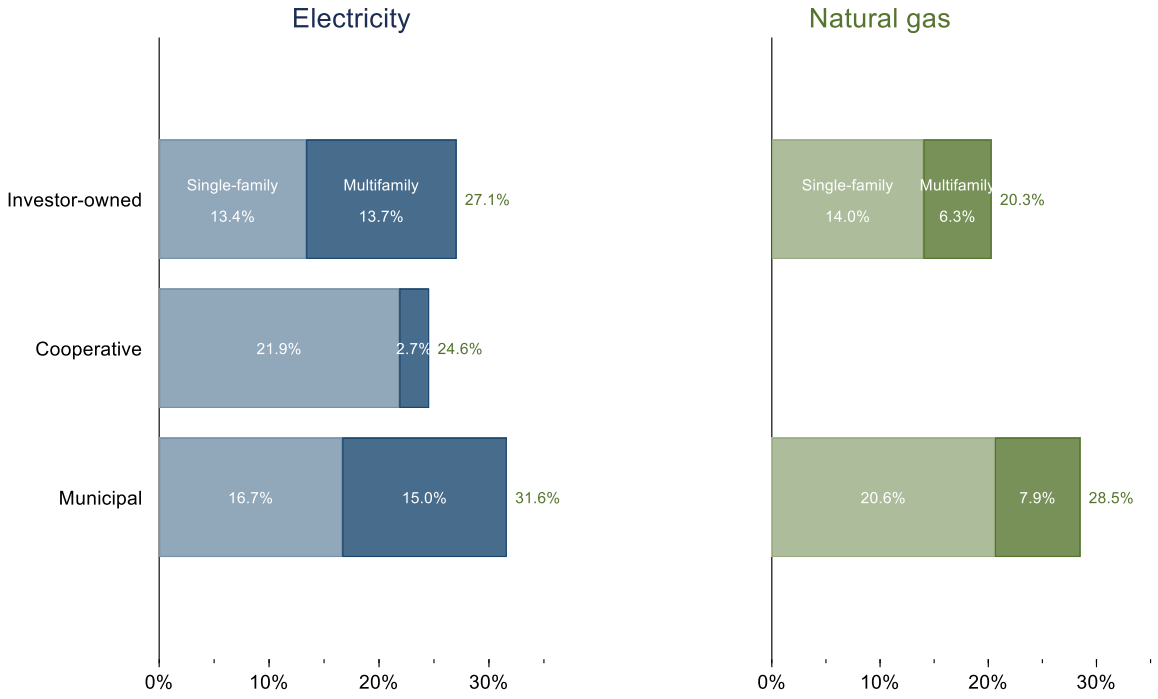
Low-income customer segment	Projected average annual sales, 2020-2029 (Dth, thousands)	Incremental energy-efficiency potential*	
		(Dth, thousands)	% of sales
Single-family	21,454	287	1.3%
Small multifamily (2-4 units)	2,638	39	1.5%
Large multifamily (5+ units)	6,410	81	1.3%
Total	30,502	407	1.3%

*Mean of first-year savings potential for 2020-2029 under the Program scenario.

Municipal utilities have a somewhat higher share of residential achievable potential that is attributable to low-income households than do investor-owned or cooperative utilities (Figure 1). This is largely a reflection of the fact that Census data suggests that a somewhat higher proportion of low-income households among municipal utility customers.

Notably, about half of the achievable electric potential for low-income customers of municipal utilities—and a third of the natural gas potential—is the multifamily segment. The APPRISE study noted that while Minnesota's investor-owned utilities have made efforts to address the low-income multifamily segment, municipal utilities largely have not done so. The analysis here suggests that there is untapped savings potential among low-income multifamily properties in municipal-utility service territories. Unsurprisingly, the models show little low-income potential in the multifamily segment for cooperative electric utilities, which tend to be dominated by single-family housing.

Figure 1. Total achievable low-income energy-efficiency potential in 2029 as a percent of total residential-sector potential, by fuel and utility type.



Space heating measures dominate the low-income savings potential for both electricity and natural gas (Figure 2). This is not surprising for natural gas, where most consumption is in fact for this end use. For electricity, it reflects the significant savings that can be achieved from offsetting or eliminating resistance electric heat with heat pumps, particularly opportunities for using ductless heat pumps to offset baseboard resistance electric heat in multifamily buildings.

Figure 2. End-use distribution of total achievable energy efficiency potential for low-income households in 2029, by fuel and housing type.

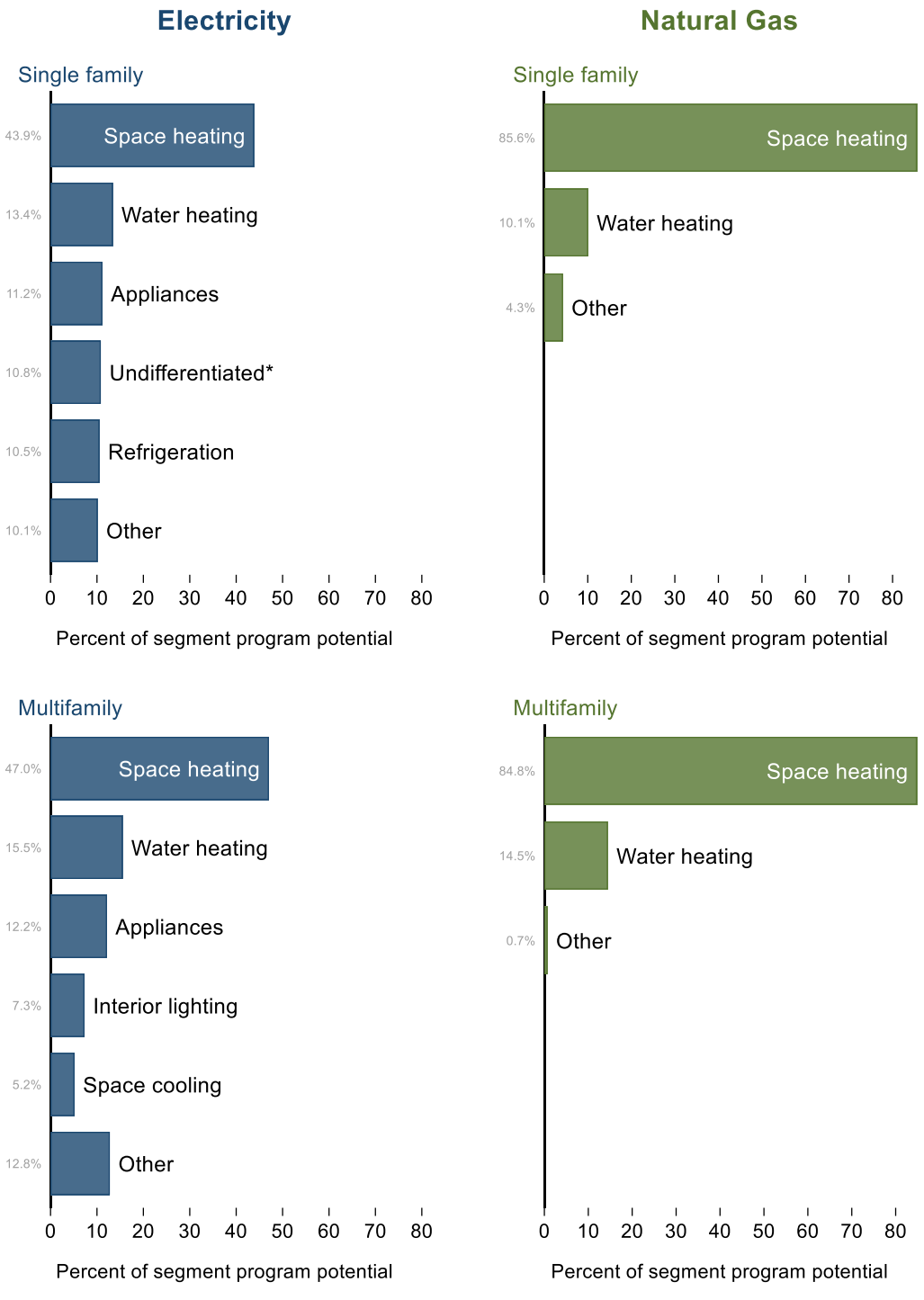
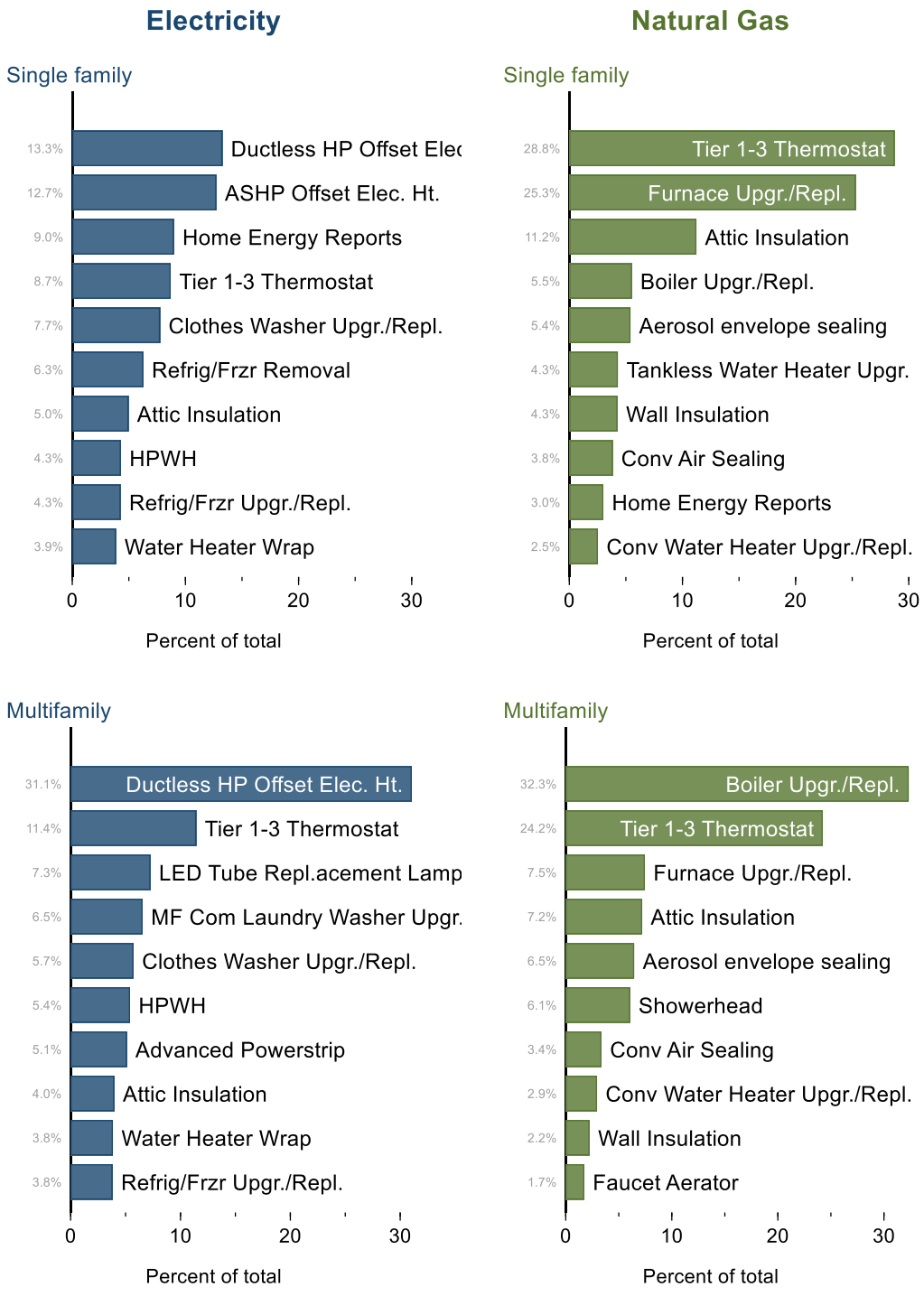


Figure 3. Top measures for low-income households in terms of total achievable potential in 2029, by fuel and housing type.



Low-Income Spending Requirements and Implications for Achievable Potential

The CIP legislation sets minimum spending requirements for utility low-income programs. The requirement for all electric utilities as well as for customer-owned natural gas utilities is 0.2 percent of residential gross operating revenue (GOR). For investor-owned natural gas utilities, it is 0.4 percent of GOR.

The project team analyzed projected program budgets for the modeled achievable energy efficiency potential under the Program Scenario to assess whether these budgets—which are based on measures that pass cost effectiveness screening—would exceed the minimum low-income spending requirements. This check is necessary to ensure that the estimates adequately represent full achievable potential. If modeled spending on low-income programs were to fall short of required spending, then utilities could presumably invest in additional measures non-cost-effective and achieve additional savings.

The analysis combines modeled estimates of projected electricity and natural gas sales over the 2020-2029 analysis period with 2016 utility rates to estimate average GOR and low-income program spending requirements over the 10-year analysis period. These were compared to average projected low-income program budgets from the achievable potential models.

The results indicate that low-income program spending at the estimated achievable energy efficiency potential levels would significantly exceed the statutory minimum spending requirement for low-income (Table 6). Depending on the fuel and utility or utility grouping, program budgets for modeled achievable potential would be expected to exceed low-income spending requirements by a factor of roughly 2 to 13. The highest ratios of potential to mandatory spend requirement are among utilities where residential customers make up a significant fraction of total sales, and that are subject to the lower 0.2% spend requirement, as is the case for municipal gas utilities. These findings hold true at the level of individual customer-owned utilities as well.

A limitation of the analysis is that GOR is estimated from 2016 electricity and natural gas rates. If future rates depart significantly from 2016 values, GOR and spending requirements would be affected.

Table 6. Modeled average annual low-income program budget for achievable energy efficiency potential and projected average annual low-income spending requirement, 2020-2029, by fuel and utility or utility group.

Utility or utility group		Achievable low-income program budget ($000s)	Projected low-income spending requirement ($000s)	Ratio
Electricity				
Investor-owned	Xcel Energy	6,688	3,025	2.21
	Minnesota Power	1,228	293	4.20
	Otter Tail Power Company	754	186	4.04
Cooperative	Great River Energy	5,779	2,521	2.29
	Minnkota Power Cooperative	972	302	3.22
	Dairyland Power Cooperative	561	210	2.68
	East River Electric Cooperative	92	27	3.37
	Other Cooperatives	134	36	3.75
Municipal	Southern Minnesota Municipal Power Agency	876	320	2.73
	Missouri River Energy Services	808	185	4.37
	Minnesota Municipal Power Agency	267	148	1.80
	Central Minnesota Municipal	286	88	3.25
	Northern Municipal Power Agency	142	38	3.76
	Heartland Consumers Power District	116	24	4.90
	Other Municipals	879	243	3.62
Natural Gas				
Investor-owned	Xcel	6,094	1,214	5.02
	CenterPoint Energy	10,328	2,401	4.30
	Minnesota Energy Resources	4,058	685	5.92
	Great Plains Natural Gas	426	48	8.92
	Greater Minnesota Gas	84	24	3.43
Municipal	All municipal utilities	1,367	103	13.23

Identifying Eligible Low-Income Households

Another aspect of assessing achievable energy efficiency potential among low-income households is that of identifying qualifying households for targeting program efforts.

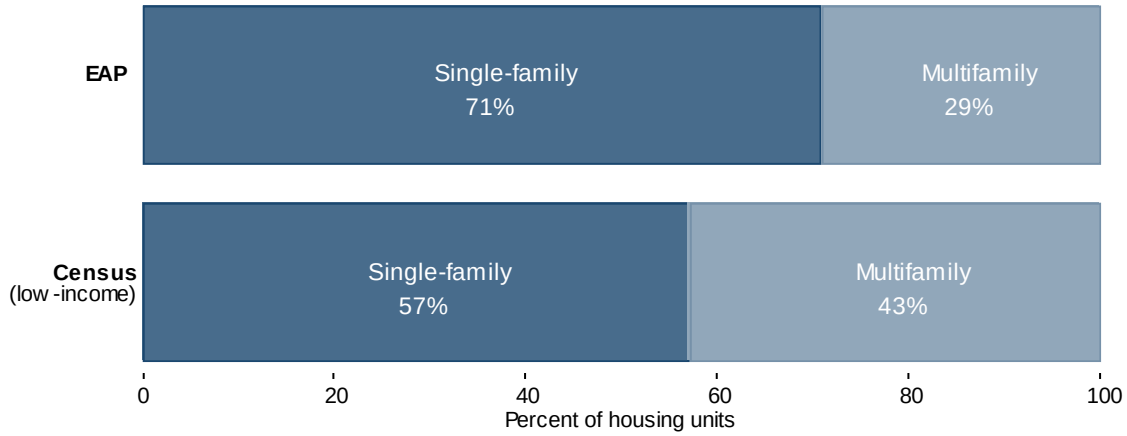
For single-family households, a key vehicle for identifying eligible households is the federal Energy Assistance Program (EAP), which provides financial assistance to qualifying households to help pay energy costs.[4] Households that receive EAP benefits form the bulk of those treated by the federal Weatherization Assistance Program (WAP), with which several Minnesota utilities coordinate their low-income CIP efforts. In addition, because EAP payments are directly credited to utility accounts, these households are known to the utilities.

As part of the analysis, the project team obtained anonymized EAP data for 2014 through 2016. The data for this period show an average of about 145,000 Minnesota households receiving EAP benefits annually, or about a quarter of what Census data would indicate to be the total eligible population in the state. It should be noted that many households do receive EAP benefits in multiple years: about 211,000 unique households participated in the program across the three-year period that were analyzed.

The EAP data indicate that the population of EAP recipients is skewed toward single-family households and away from households in multifamily properties relative to Census population estimates (Figure 4). This likely has to do with the fact that EAP participation is more popular among households that pay a heating bill, and many apartment dwellers have heat included in their rent. This makes EAP a somewhat better vehicle for identifying low-income single-family households than multifamily residents.

[4]Income eligibility for EAP is set at 50 percent of state median income. This is different from, but close to, income thresholds as the FPG-based definition used here. For example, in 2018 the EAP annual income threshold for a family of four is $48,077, while 200 percent of the FPG is an annual income of $50,200.

Figure 4. Minnesota housing-type split for Energy Assistance Program (EAP) recipients and low-income population (Census).



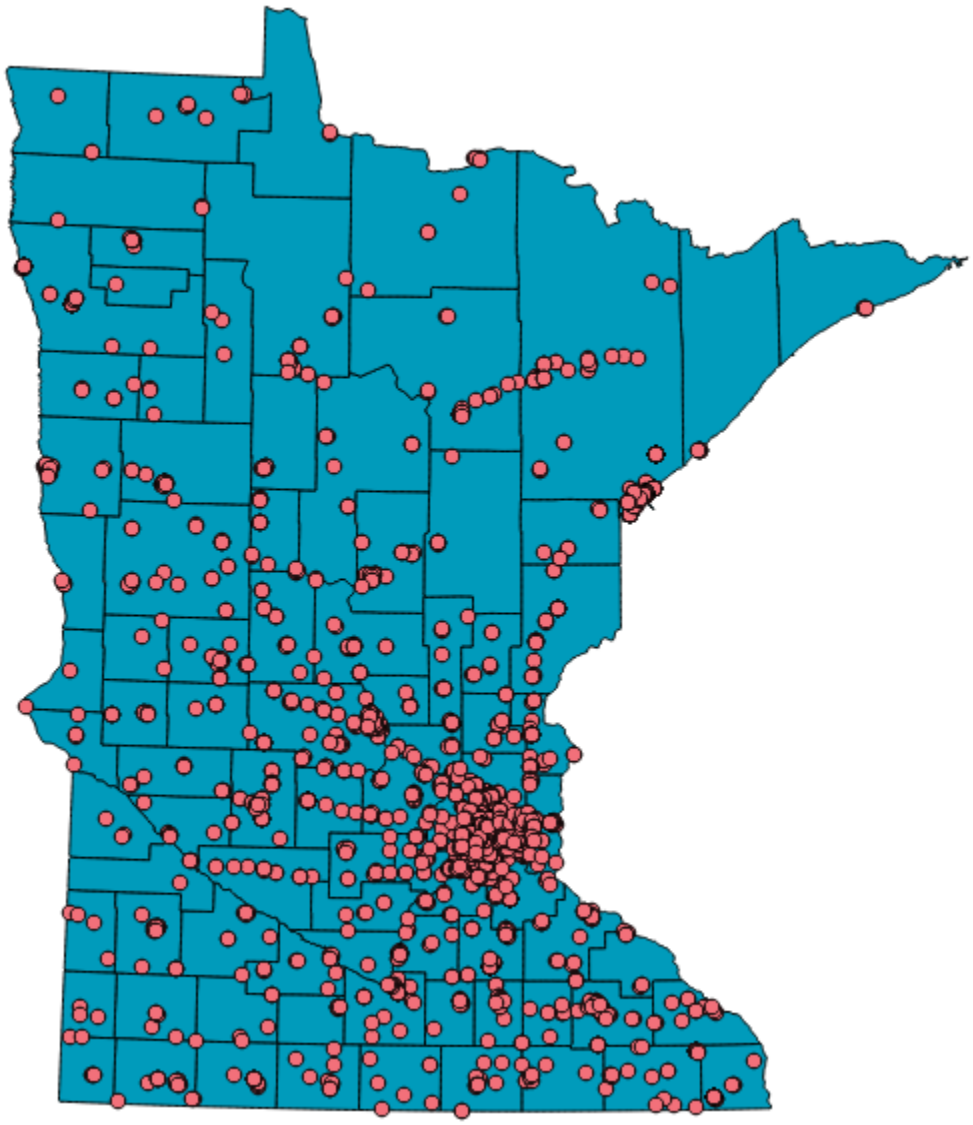
Sources: EAP program data for 2014-2016; Census American Community Survey (2011-2015)

For multifamily, a key issue is that energy efficiency treatments are often applied at the building level, which raises questions about how to income-qualify buildings that are occupied by a mix of low-income and non-low-income tenants. The Department of Commerce has issued guidance on this issue, which allows utilities to consider the entire property as low-income if at least 66 percent of the units are occupied by low-income households—or if a property appears on one of several lists the pre-qualify the property to be treated as entirely low-income.[5]

Chief among the latter is the list of properties certified under the State's low-income rental classification statute, which provides tax incentives for qualifying rental properties. There are about 2,800 LIRC apartment properties scattered throughout the state (Figure 5). Combined, these properties represent 156,600 housing units, or about 80 percent of the roughly 186,000 low-income apartment units that the achievable potential estimates are based on. Among electric utilities, 78 percent of the LIRC properties are located in investor-owned utility service territories, 15 percent are in municipal utility service areas, and 7 percent are in cooperative utility service territories.

[5] See http://mn.gov/commerce-stat/pdfs/conserve-prog-low-income-guide.pdf.

Figure 5. Low-Income Rental Classification (LIRC) properties.



Modeling Limitations Related to Estimates of Low-Income Achievable Potential

There are certain limitations of the modeling process as it relates to the low-income population that bear mentioning. These include:

- **Program budgets** – For estimating program budgets under the achievable potential scenario, the models incorporate a global assumption that incentive levels are 50 percent of incremental measure costs. However, low-income weatherization efforts often install measures for free. Thus, the estimated low-income program budgets are likely on the low side.
- **Upgrade measures** – a portion of the estimated potential derives from incentivizing households to upgrade to higher-efficiency equipment when they are replacing equipment such as a furnace or an air conditioner. Assumptions about annual uptake for these upgrade opportunities are set in the models at the measure level, not by customer segment, so uptake among low-income customers is set at the same value as the non-low-income households in the models. In reality, low-income households arguably: (a) replace equipment somewhat less frequently than the general population; and, (b) are less likely to upgrade to higher efficiency when they do need to replace equipment. Upgrade measures account for 15 to 30 percent of the estimated achievable potential among low-income households, depending on the housing type and fuel in question.
- **Retrofit measures** – As with upgrade measures, assumptions about annual uptake for retrofit measures such as wall insulation are set at the measure level, with low-income segments assigned the same values as the general residential population. Uptake among low-income households is strongly determined by the ability for low-income programs to identify, enroll and treat these households. Depending on the scale and nature of these efforts, uptake among low-income households could be higher or lower than the models suggest. Retrofit measures account for between 35 and 70 percent of the estimated achievable potential.
- **New construction** – The models included growth factors that scale up residential load over time to account for new construction and opportunities for new-construction programs. These do not differentiate between market-rate and affordable housing. If the pace of affordable housing construction lags that of market-rate housing, then the models will overestimate energy efficiency opportunities in this segment. New construction opportunities account for roughly 10 to 30 percent of the modeled achievable low-income potential.
- **Multifamily housing** – The estimates of low-income energy-efficiency potential are built at the housing-unit level. But as noted above, multifamily properties are often qualified for low-income CIPs at the *building* level, and thus may contain a mix of low-income and non-low-income households. The may create some differences in the estimated scale of the multifamily low-income market between the models and actual programs. However, this issue cuts both ways, and both the LIRC database and a prior Minnesota multifamily characterization study suggest that the housing-unit-based estimates provide a reasonable estimate of the scale of the market.