Minnesota Energy Efficiency Potential Study: 2020–2029

Appendix G: Rural Utility and Agricultural 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.

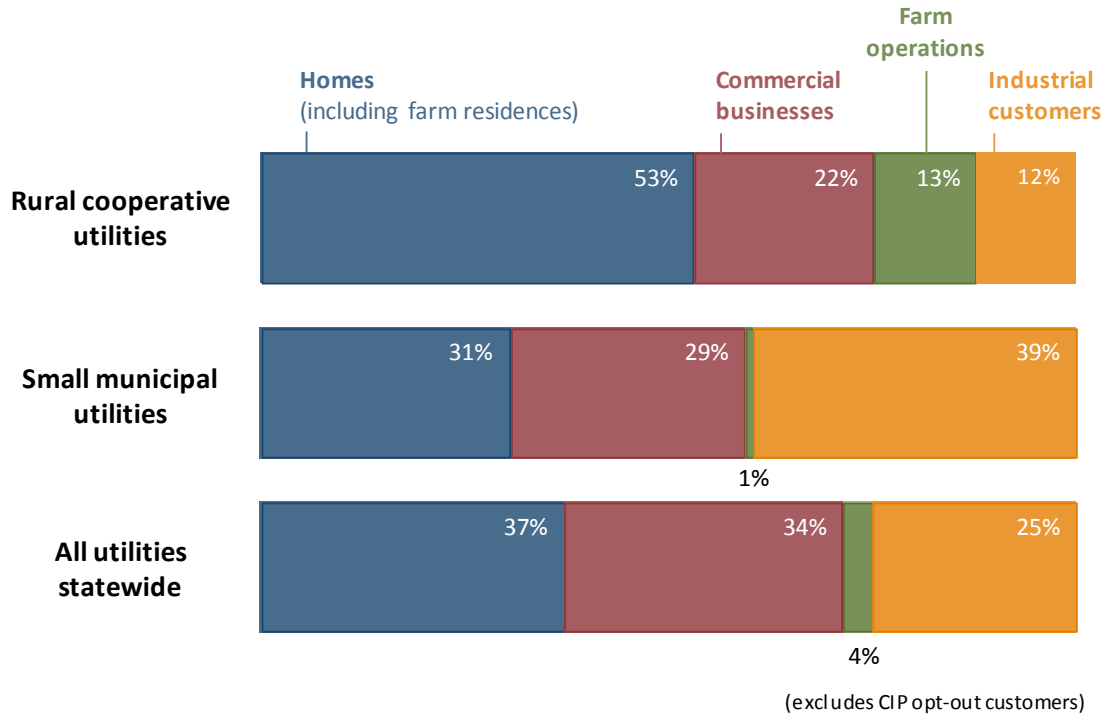
Small customer-owned utilities face unique opportunities—and challenges—in achieving energy-efficiency goals. These are examined in more detail in this appendix, focusing on electric cooperatives with fewer than 50 customers per square mile and municipal electric utilities with fewer than 10,000 customers. This includes all but three of Minnesota's 47 electric cooperatives, and 119 of 124 municipal electric utilities in the state.[1] Combined, these utilities account for about a quarter of statewide electricity sales. Legislation enacted in 2017 exempts 18 smaller cooperatives and 51 municipal electric utilities from CIP requirements[2]. These are included (and noted) in a few results reported here but are omitted from most of the analysis results.

As discussed in more detail below, rural cooperatives and small municipal utilities differ in their customer composition in some significant ways that affect the types of opportunities for energy efficiency improvements (Figure 1). These differences, along with the small size of these utilities, also create unique challenges for implementing CIPs.

[1] Excluded electric cooperatives are: Dakota Electric, Connexus Energy and Wright-Hennepin Electric Cooperative. Excluded municipal electric utilities are Rochester, Moorhead, Shakopee, Austin and Owatonna.

[2] See 2017 Minnesota Statutes, Section 216B.241 (https://www.revisor.mn.gov/statutes/2017/cite/216B.241/subd/216B.241.1b#stat.216B.241.1b)

Figure 1. Distribution of electricity sales (MWh) by customer class for rural cooperatives and small municipal utilities compared to statewide proportions.



Rural electric cooperatives

Minnesota's 44 rural electric cooperatives serve an astonishing 87 percent of Minnesota's land area, yet account for only 16 percent of electricity sales. While "rural cooperative" may bring to mind farms, most of the electricity sold by rural cooperatives is actually for homes (including farm residences) and businesses.

Nearly all homes in rural cooperative service areas are single-family structures, including about half of Minnesota's 80,000 manufactured homes. Notably, almost 30 percent of homes served by rural cooperatives in the northern half of the state are seasonal properties that are not typically occupied year-round. Because rural residences served by cooperatives are typically outside natural-gas service areas, residential customers of rural cooperatives are about twice as likely as the state as a whole to have electric heat or an electric water heater (Figure 2 and Figure 3). Similarly, these homes also have a much higher prevalence of deliverable heating fuels such as propane. And, as might be expected, the saturation of air conditioning is lower among northern cooperatives (Figure 4).

Figure 2. Heating fuel proportions for single-family homes, for rural electric cooperatives and statewide.

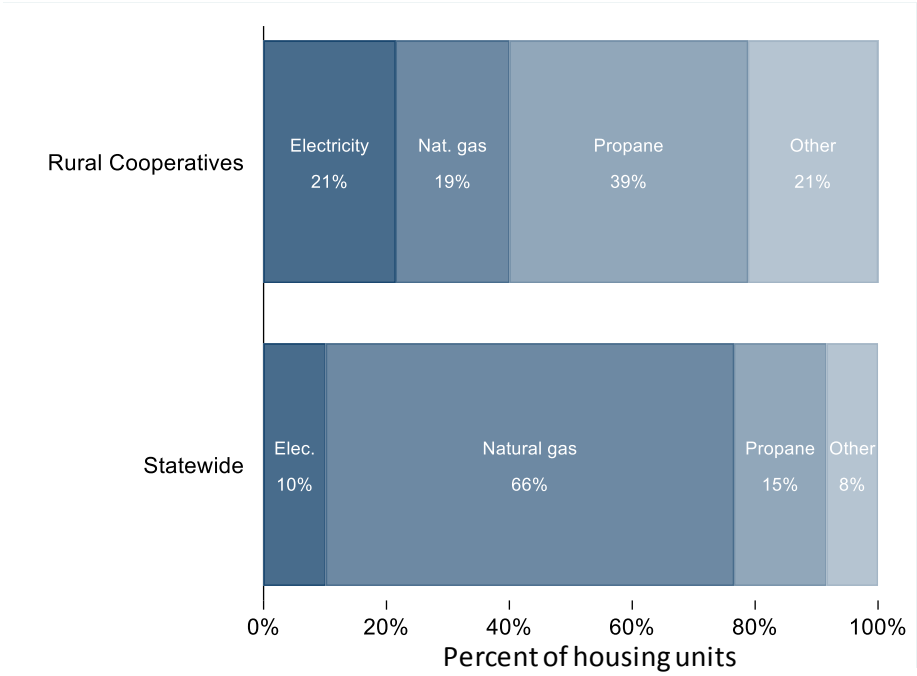


Figure 3. Water heater fuel proportions for single-family homes, for rural electric cooperatives and statewide.

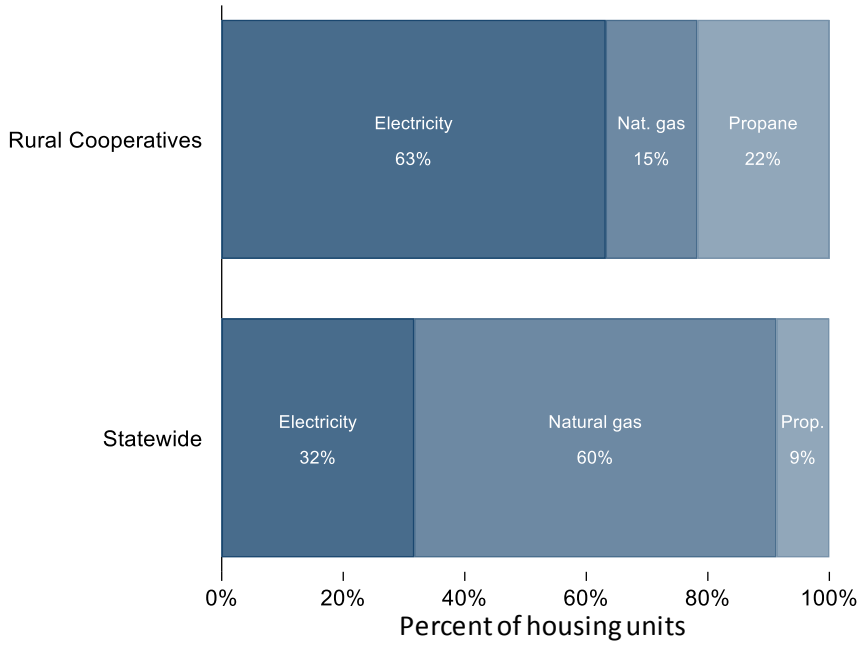
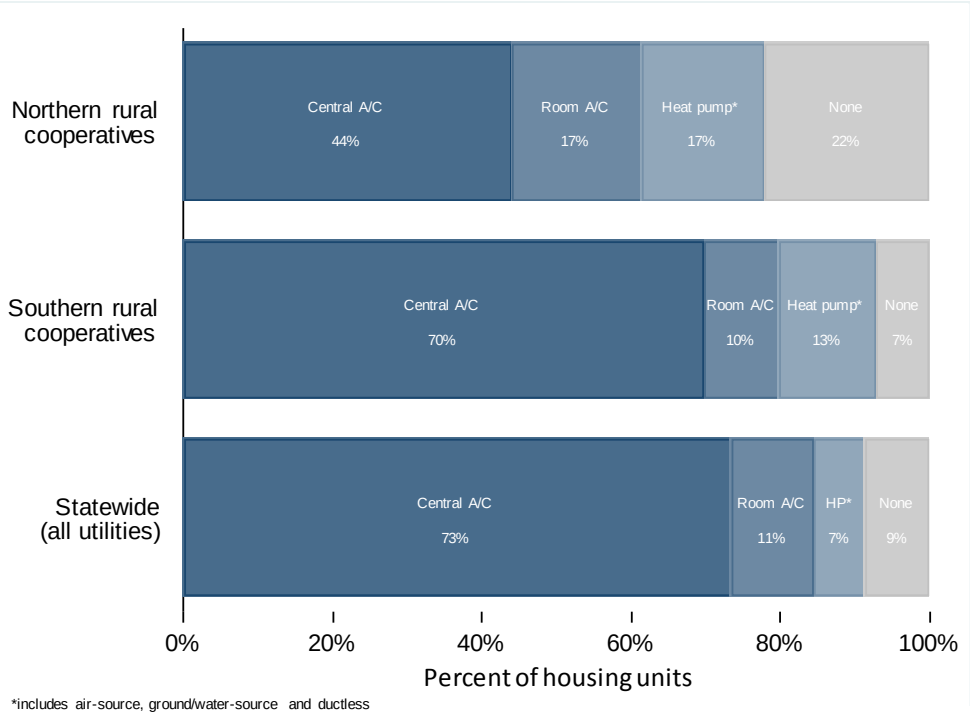


Figure 4. Space cooling equipment proportions for single-family homes, rural electric cooperatives and statewide.



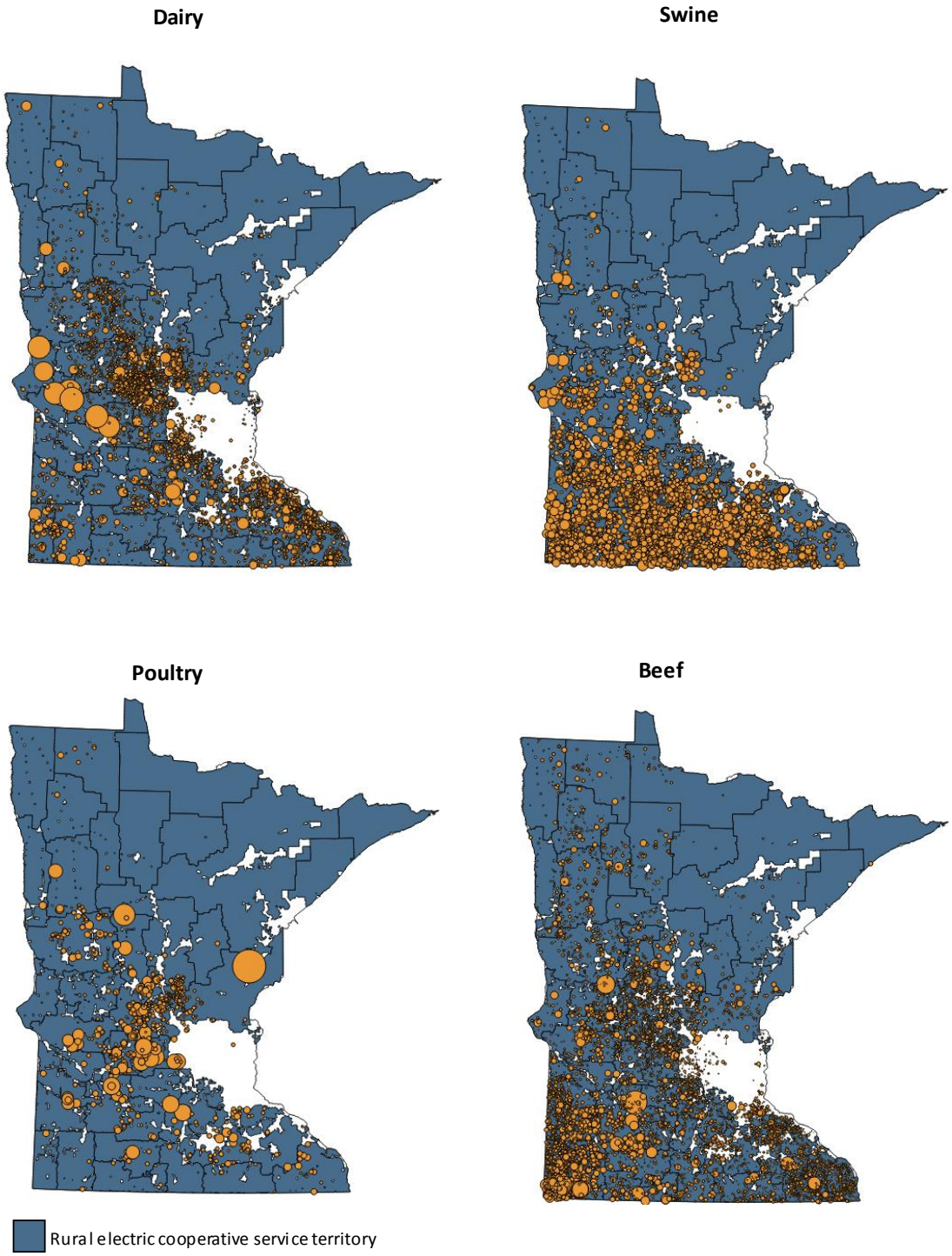
Rural cooperatives have significantly fewer industrial customers and somewhat less commercial load than other utilities (see Figure 1 earlier in this appendix). On the other hand, more than 80 percent of the electricity used for farm operations in the state is sold through rural electric cooperatives—though these sales are estimated to still account for only about 13 percent of rural cooperative sales on average.[3]

Farm electricity consumption can be divided into various livestock operations, crop production and irrigation. These are not uniformly distributed among rural cooperatives; rather, some cooperatives are much heavier in some types of farms than others (Figure 5). For example, dairy farms account for as little as zero and as much as 60 percent of total farm-operation load among Minnesota's 44 rural cooperatives. The energy efficiency models take these regional differences into account.

(One caveat: in contrast to the residential and commercial sectors, the project team found limited data on energy consumption for farming operations. Some academic studies are available that provide data on electricity consumption per head for various types of livestock operations, but these were not all specific to Minnesota's climate. And only able one dated reference for electricity used in crop farming was found. This introduces additional uncertainty regarding the magnitude and composition of farm energy consumption and subsequent potential estimates. A better characterization of electricity consumption on Minnesota farms would be useful.)

[3] "Farm" sales reported by utilities are considerably higher, because these generally include farm residences, which are accounted for separately here.

Figure 5. Distribution of selected livestock farms in Minnesota.



Source: Minnesota Pollution Control Agency feedlot database

The 44 rural electric cooperatives account for 17 percent of the achievable statewide electric program potential. Only 16 percent of this potential is attributable to the 18 CIP-exempt rural cooperatives, while 84% is in the service areas of the 26 rural cooperatives with CIP requirements. The remainder of the discussion is confined to rural cooperatives with CIP requirements, but relative results are substantially the same if CIP-exempt utilities are also included.

The models project an average annual achievable energy efficiency potential of 1.6 percent of electricity sales among these cooperatives (Table 1). At the end of the 10-year analysis period (2029), the models estimate 14 percent savings from achievable program activity over the period, with 41 percent of this attributable to the Residential sector, 49 percent to the Commercial sector and 10 percent to the Industrial sector.

Table 1. Energy efficiency for rural electric cooperatives with CIP requirement, by sector.

Sector	Projected average annual sales, 2020-2029 (GWh)	Incremental energy-efficiency potential*	
		(GWh)	% of sales
Residential	7,026	100.7	1.4%
Commercial	4,114	90.3	2.0%
Industrial	1,250	17.7	1.4%
Total	12,691	208.8	1.6%

*Mean of first-year savings potential for 2020-2029 under the 50% Incentive Scenario.

While nearly all agricultural potential is in the form of retrofits to existing equipment, more than a third of the estimated potential for non-farm commercial customers—and a fifth of the residential-sector potential—is estimated to be associated with new construction and/or renovation activities (Figure 6). Since most rural areas are not seeing significant growth, this potential is most associated with renovation of existing homes and businesses.

Residential customers of rural cooperatives overwhelmingly live in single-family homes, so it is no surprise that 95 percent of the achievable potential in this sector lies within this housing type. Offsetting electric resistance heat with central and ductless heat pump dominates the measures in the residential sector, accounting for fully a third of the estimated achievable potential in 2029 (Figure 7).

In the commercial sector, achievable potential is more evenly distributed among businesses, though unsurprisingly, there is little potential for savings in large offices and retail establishments (Figure 8). As noted above renovation measures lead the list of measures in this segment.

Farm opportunities are led by variable-speed drives, lighting measures, and measures associated with dairy farms (Figure 7).

Figure 6. Composition of total achievable potential in 2029 for rural cooperatives with CIP requirements, by program type within sector.

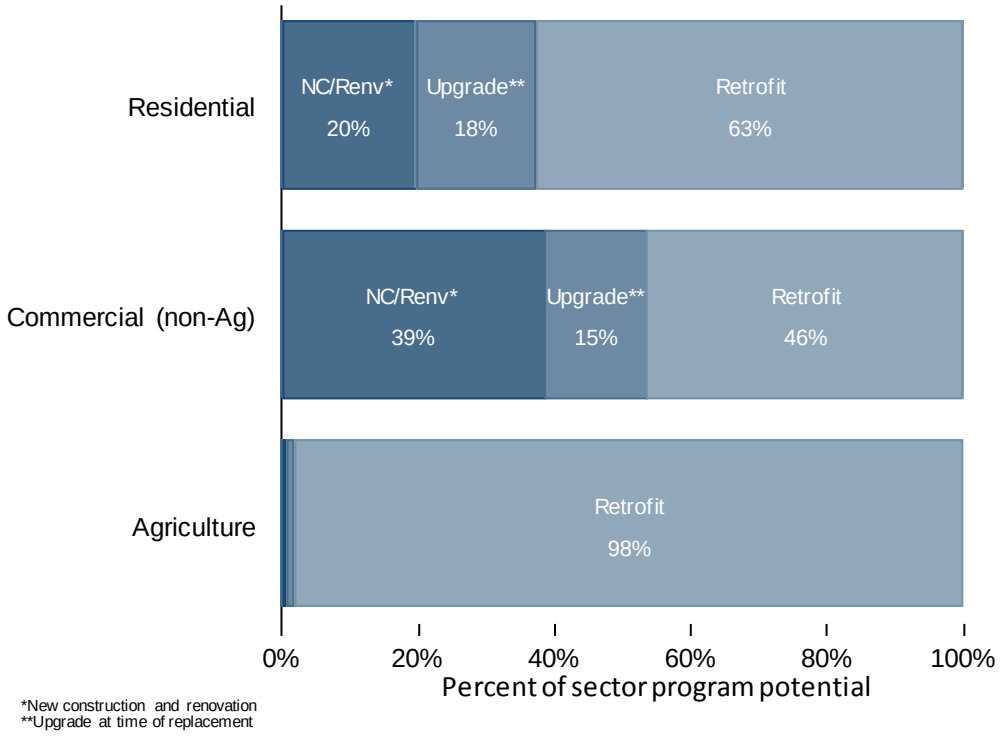
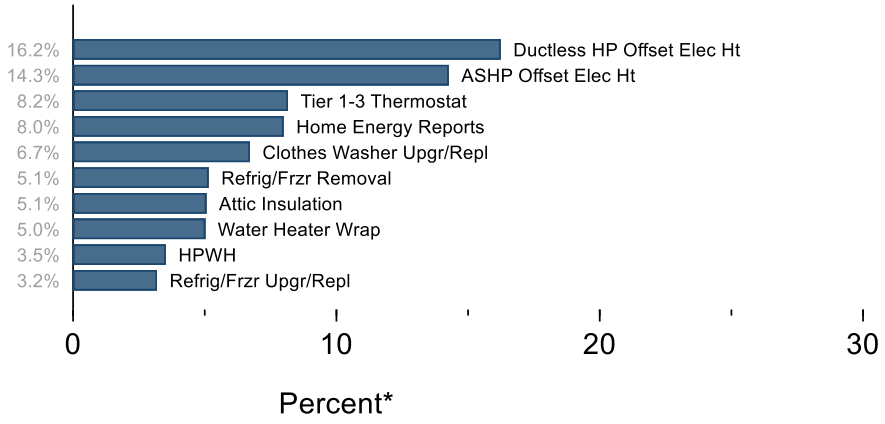
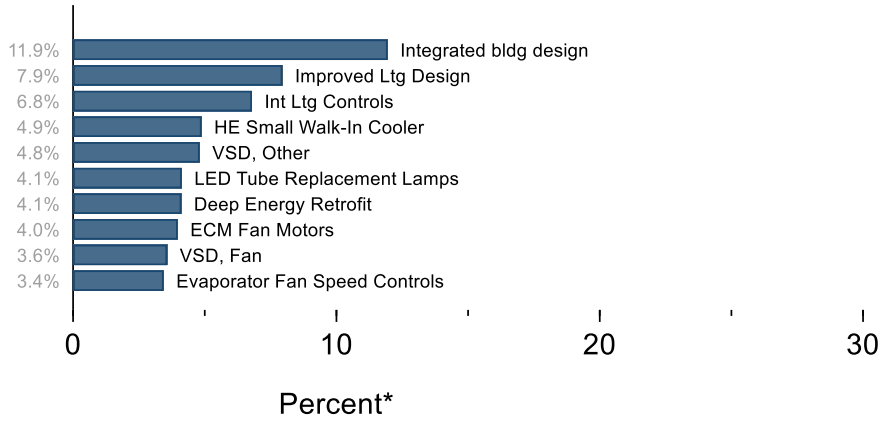


Figure 7. Top measures for rural electric cooperatives with CIP requirements, by sector.

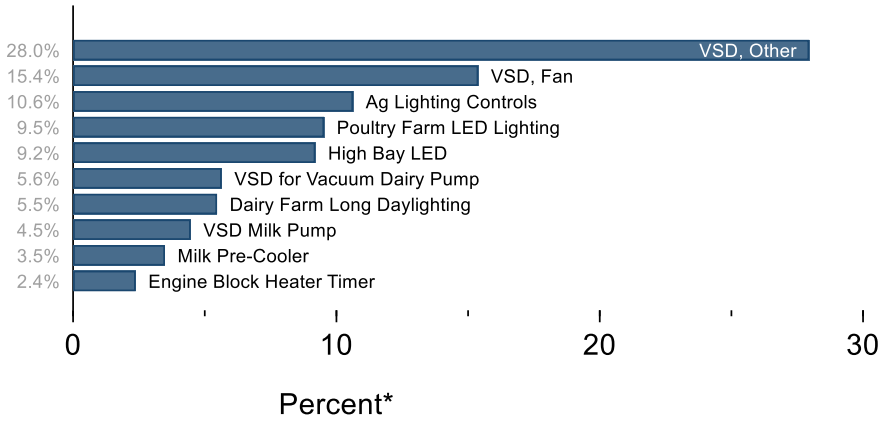
Residential



Commercial (non-Ag)

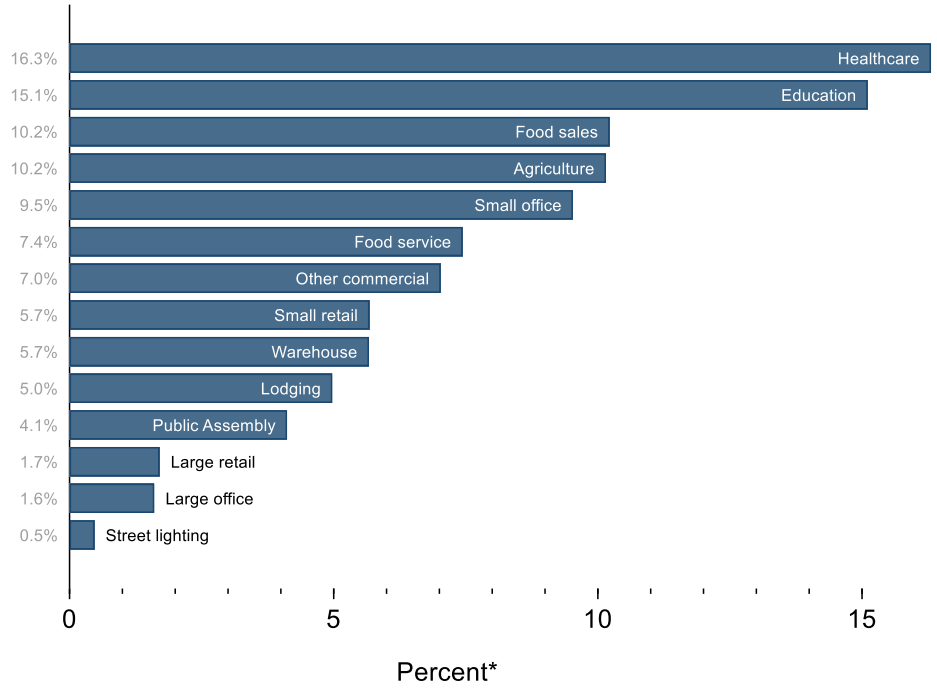


Agriculture



*Percent of sector total achievable program potential in 2029

Figure 8. Segment contributions to total commercial-sector achievable potential in 2029 for rural cooperatives with CIP requirement.



*Percent of total achievable program potential in 2029

Small Municipal Utilities

The most notable aspect of small municipal utilities is that they tend to have a proportionately higher industrial load (see Figure 1, page 5). On average, almost 40 percent of electricity sales by small municipal utilities goes to industrial customers, though a third have no industrial load at all, while a few sell nearly 80 percent of their electricity to industrial customers. The median small municipal utility with industrial load has only 10 industrial customers, though a few have more than 200.

Homes served by small municipal utilities tend to mirror the statewide composition of Minnesota housing, with a mix of single-family and multifamily dwellings. Similarly, the distribution of commercial businesses served by these utilities resembles that of the state as a whole, with the exception of fewer large commercial properties found in larger urban areas.

The 119 small municipal utilities in the state account for 11 percent of the achievable statewide electric program potential. Only 10 percent of this potential is attributable to the 51 CIP-exempt municipal utilities, while 90% is in the service areas of the 73 small municipal utilities with CIP requirements. The remainder of the discussion omits CIP-exempt municipal utilities.

The models suggest that small municipal utilities have average annual achievable energy efficiency potential of 1.3 percent of electricity sales, with the industrial sector showing the lowest relative potential and the commercial sector showing the highest (Table 2). At the end of the 10-year analysis period (2029), the models estimate 15 percent savings from achievable program activity over the period, with 17 percent of this attributable to the Residential sector, 50 percent to the Commercial sector and 33 percent to the Industrial sector.

Table 2. Energy efficiency for small municipal utilities with CIP requirements, by sector.

Sector	Projected average annual sales, 2020-2029 (GWh)	Incremental energy-efficiency potential*	
		(GWh)	% of sales
Residential	2,789	36.1	1.3%
Commercial	2,760	73.0	2.6%
Industrial	3,607	46.8	1.3%
Total	9,156	155.9	1.7%

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

Challenges Faced by Rural Cooperatives and Small Municipal Utilities

The primary challenge for rural cooperatives and small municipal utilities to make energy efficiency inroads is one of scale. The average rural cooperative has electricity sales that are less than 10 percent that of Otter Tail Power, which is the smallest investor-owned utility that implements CIP activities in the state. Small municipal utilities have even fewer sales, averaging only two percent of Otter Tail Power's load. For the most part, these smaller utilities lack adequate staffing and other resources for implementing CIPs, and any fixed costs associated with operating CIPs are must be spread across a much smaller base.

The scale issue is addressed somewhat through joint programs through power marketing membership organizations. Minnesota has four cooperative-utility membership organizations and six municipal power pools, collectively involving 41 of 48 rural cooperatives and 70 of 118 small municipal electric utilities (in additional to three cooperatives in the Twin Cities area and three larger municipal utilities that have been excluded here). Most of these organizations coordinate umbrella efficiency programs for their members. This pooling of resources can help smaller utilities achieve CIP energy efficiency goals, though these efforts are sometimes complicated by the fact that some of the organizations have membership that spans across multiple states. Two of these organizations, Great River Energy and the Southern Minnesota Municipal Power Agency have achievable potential that meets or exceeds that of the investor-owned utilities (Table 3). However, even pooled power marketer, the scale of the remaining cooperative and municipal utilities falls short of that of the smallest investor-owned utility in the state (Otter Tail Power). Moreover, 19 municipal utilities with CIP requirements are not members of any power-pool association.

Table 3. Total achievable potential in 2029, by utility group.

Utility or Utility Group		Number of utilities: CIP	Number of utilities: CIP-exempt	Total achievable potential in 2029*: (GWh)	Total achievable potential in 2029*: Relative to Otter Tail Power
Investor-owned**	Xcel Energy	1	0	6,161	16.19
	Minnesota Power	1	0	661	1.74
	Otter Tail Power Company	1	0	381	1.00
Cooperative	Great River Energy	22	6	2,342	6.15
	Minnkota Power Cooperative	4	4	181	0.48
	Dairyland Power Cooperative	3	1	253	0.67
	East River Electric Cooperative	0	4	0	0.00
	Other Cooperatives	0	3	0	0.00
Municipal	Southern MN Mun. Power Agency	16	2	676	1.78
	Missouri River Energy Services	14	7	332	0.87
	Minnesota Municipal Power Agency	7	2	259	0.68
	Central Minnesota Municipal	13	3	149	0.39
	Northern Municipal Power Agency	3	7	51	0.13
	Heartland Consumers Power District	1	1	63	0.17
	Other Municipals	19	29	505	1.33

*For member utilities with CIP requirements. Program scenario.
**Excludes NW Wisconsin Electric, which has fewer than 100 customers in Minnesota.

Another scale challenge is that rural cooperatives and small municipals face is marshaling the expertise needed to address energy efficiency opportunities for a small number of large customers with unique characteristics. Fur rural cooperatives, this issue largely manifests itself in the form of larger livestock operations. For example, about 90 percent of the electricity used for raising turkeys in Minnesota is associated with a few hundred farms scattered across about a dozen rural cooperatives in the state, few of which have more than 15 farms. It is hard to envision serious efforts to incentivize turkey farm energy savings under such circumstances in the absence of some sort of collaborative cross-utility effort. Similar issues arise with industrial customers of small municipal utilities.