Baseline Assessment and Policy and Program Evaluation

An Assessment of Current Policies and Programs for Energy Efficiency and Renewable Energy for Agriculture and Rural Communities

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PSC

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Executive Summary

The Michigan Energy Office initiated the Agriculture and Rural Communities Energy Roadmap process to document the current status of energy-efficiency and renewable energy policies and programs for rural residents and businesses in Michigan, as well as to inform key decision makers about policies and programs that could promote greater access to these resources amongst the agriculture sector and in the state's rural communities. The impetus for this effort was the recognition that **despite the overall success of Michigan's energy-efficiency and renewable energy standards over the past ten years, current standards do not emphasize serving agricultural or rural customers, and because of this lack of focus, these groups have not realized the same benefits as others.**

Responding to a directive from the Michigan Energy Office, the project team undertook a multifaceted approach to develop a roadmap for advancing energy efficiency and renewable energy across targeted populations and supporting the state's goals for a cleaner, more-efficient energy system. The first component of the roadmap process was to develop a comprehensive inventory of the current state of Michigan's energy-efficiency and renewable energy policies and programs. Next, the project team evaluated these programs and policies to determine how well they are serving agricultural and rural customers and examined exemplary programs in other states to define practices that could be adopted in Michigan to improve the impact of energy efficiency and renewable energy. The project team drafted a comprehensive summary report of the information gathered, compiling the document with the objective of informing stakeholders of barriers and opportunities that can be addressed through policy and programmatic changes that will expand opportunities for agricultural and rural customers.

Background

Energy efficiency and renewable energy have been key components of Michigan's energy policy framework for more than a decade. These policies require energy providers to work with customers to reduce energy use through efficiency upgrades and behavioral changes and promote the development of renewable resources at the utility, customer, and community scales. While these policies are available to all businesses and residents in the state, to date, there has not been a concerted effort to connect these resources to the agriculture sector or rural populations, which have historically been harder to reach than the typical energy consumers.

Despite being one of the largest segments of Michigan's economy, the agriculture sector has struggled to tap into the full potential offered by energy efficiency and renewable energy. In some cases, utilities have found it difficult to know exactly which accounts belong to agricultural customers because this aspect of customer accounts is not identified in utilities' billing systems—an agricultural customer would look like any other commercial and industrial or residential customer in the system. The challenge of reaching agriculture customers is compounded by the fact

that Michigan's agricultural sector is diverse, and these customers have unique needs that can require a more time-intensive approach than other businesses. In addition, the seasonal nature of agriculture operations means it is essential for program administrators to get timing right for outreach and implementation. Since energy is an essential input for the agriculture sector, representing up to 50 percent of the business expenses for several types of commodities, energy efficiency can have a major impact on agricultural customers' bottom line. Michigan's rural population has faced similar challenges to accessing energy-efficiency and renewable energy programs due to limitations such as access to suitable Internet service, proximity to major retailers offering discounted energy-efficiency products, availability of participating trade allies, and exposure to traditional marketing and outreach efforts.

Overall, rural and agricultural customers exhibit strong support for energy efficiency and conservation as well as renewable energy, specifically solar, yet customer awareness of available program offerings remains low and these groups have not accessed a proportionate share of existing programming. To date, there has been no analysis of the potential for energy efficiency or renewable energy in the agriculture sector or rural communities; however, stakeholders and customers perceive that **there is a sizeable untapped market for energy efficiency and recognize that existing programs and policies do little to target investment in these segments**. Analysis of utility energy-efficiency program data reveals that while there has been significant penetration of energy programs in agricultural and rural communities, the total savings impact falls short of a proportional share when compared to the number of customers residing or operating in rural zip codes; the majority of investment through energy-efficiency programs has occurred in more populated areas and with residents and businesses that are easier to reach.

Policies that specifically target the agriculture sector or rural communities have been limited; however, targeted programs, like those offered through the U.S. Department of Agriculture and Rural Development, certain utility providers, and the Michigan Energy Office, have demonstrated how concerted outreach can benefit agricultural and rural customers. In spite of this fact, these programs have not made up a large proportion of the overall funding for energy-efficiency programming in the state, and **more needs to be done to align policies and programming with the needs of rural and agricultural customers**. This report identifies a number of key themes and objectives that policymakers should consider to advance energy efficiency and renewable energy for these important sectors in Michigan.

Key Takeaways

Energy-efficiency programs should be available that have a specific emphasis on serving the needs of agriculture and rural customers. The largest source of energy-efficiency funding flows through utility programs as a part of Michigan's energy-efficiency resource standard. In recent years, utilities have begun to take a more direct approach to reaching agricultural customers through their energy-efficiency programs, recognizing the potential in the underserved population. Consumers Energy was the first utility to establish a specific agricultural program in 2014, and since

that time, several other utilities have established their own agriculture-specific programs. The rise of sector-specific programs illustrates how utilities are responding to the unique needs of their agriculture customers. Customers will benefit from an increasingly targeted approach to program design and implementation efforts.

Cost-effective energy-efficiency programming should continue to be a statewide policy priority and be made available to all Michigan residents. Energy efficiency remains a cost-effective resource in utilities' energy supply portfolios. However, there is no requirement for municipal utilities and electric cooperatives to continue to offer energy-efficiency programming for customers after 2020. While these utilities might voluntarily pursue energy efficiency, the lack of a state policy requirement creates a significant risk that there will be a portion of Michigan's rural population that would no longer have access to energy efficiency through their utility service provider. This creates the possibility that energy-efficiency investment in these communities will slow as the communication and incentives provided by existing programs diminish.

Better communication of the potential benefits of energy efficiency to help customers feel confident in their decision to invest is key. Agriculture customers stand to benefit from energy efficiency and renewable energy; however, there are other priorities that often take precedence over investing in energy. This is especially true when the agriculture sector faces low commodity prices and broader economic uncertainty. Additionally, agriculture customers are wary of the administrative burden associated with programs and can be reluctant to take on additional requirements. While low commodity prices are a strain on some agriculture customers' ability to invest in energy efficiency, they also mean that agriculture customers have a strong incentive to reduce input costs wherever they can.

Despite the potential benefits, many customers are still reluctant to invest due to the upfront costs. To build confidence, customers need accurate, trustworthy information about how their investment will benefit them in the short and long terms. However, even with accurate information about the cost and benefits of efficiency or renewables, some customers still won't be able to overcome the capital requirements needed. Programs that offer financial incentives (e.g., rebates) that make energy-efficiency investment more attainable by reducing upfront costs and shortening the payback period, together with financing options that address the need for upfront capital , have the potential to help customers overcome these barriers and drive energy investments.

Increasing customer awareness requires education and outreach about the viability of onsite renewable energy generation to control and/or reduce energy costs. Declining costs for customer-owned renewables continue to make onsite renewables, especially solar, a strong alternative to traditional utility service. The changing policy landscape for customer-owned resources presents an obstacle for some customers as they seek to understand how new program designs will impact them, but there is more that can be done to educate customers about the potential value of onsite renewable energy production, increase customer awareness, and ultimately drive adoption.

As Michigan's renewable energy sector is primed for continued expansion, rural landowners need to have support to understand the impact of renewable energy siting on their business and how they can benefit. The growth in utility-scale renewable energy has led to new opportunities for farmers to lease portions of their land for wind and solar development, augmenting their farm incomes with additional revenues. By leasing their land for renewable energy development, agricultural and rural customers can see declining costs for renewable energy as well as improved options for offsetting their energy costs.

Deliverable fuel customers should have the same opportunities to access energy-efficiency services as customers served by natural gas utilities. Rural communities have much greater dependence on deliverable fuels, such as propane, which are typically more expensive than natural gas. Currently, there is no requirement or incentive for deliverable fuel providers to offer energy-efficiency services, so customers who already pay more for their home energy also lack access to energy-efficiency programs. Policymakers should consider options for addressing this challenge with the goal of expanding energy-efficiency programs to deliverable fuel customers.

Michigan's rural communities and agriculture sector need better collaboration and coordination to advance policies that reflect their needs and disseminate information about existing opportunities. There is a sizeable unrealized energy savings in targeted sectors, and current efforts have not gone far enough to make resources available and build the necessary capacity among customers to expand these programs. Information related to opportunities for energy efficiency and renewable energy is largely disaggregated and only available from the entity that administers a program. To improve the availability and accuracy of information, there needs to be a resource that compiles information in a central location and makes it available to the appropriate groups. Opportunities exist for commodity groups and associations to partner with local civic organizations, nonprofits, or community institutions to inform the design of utilities' energy-efficiency programs and to connect customers to programs that will help them achieve real savings. These efforts should focus on improving how program administrators, contractors, and other vendors communicate about energy efficiency to support customers' understanding of how they might benefit from program participation. In addition, education efforts could promote peer-to-peer learning opportunities where customers can share their experiences and demonstrate program success.

Farm energy audits need to be focused on demonstrating tangible benefits for customers in a way that drives implementation and supports customer action. One of the key ways agricultural customers learn about the potential benefits offered by energy efficiency is through farm energy audits. Michigan's farm energy audit program has been an important resource for promoting standards and outreach in the agriculture sector, but the program does not do enough to drive implementation because the audits do not adequately document savings opportunities, nor do they

substantiate any future savings claims for custom agricultural projects. As one of the primary means by which customers learn about areas in which they can improve their energy efficiency, farm energy audits must do a better job of communicating potential benefits to customers and helping them understand how efficiency upgrades can improve their operations.

Finally, more needs to be done to directly link farm energy audits to utility energy-efficiency programs that can provide financial incentives and other assistance to help enable energy-efficiency improvements. Upfront and maintenance costs are the primary barriers for agriculture customers choosing to invest in energy efficiency, and customers need to feel confident that there are opportunities for them to access program support and other incentives or rebates. This is especially important since farm energy audits represent an added cost for customers—if these audits are not providing useful information, it will be increasingly difficult to get customers to partake in them. Farm energy audits also present a challenge for the auditors themselves—the amount of money auditors receive does not reflect the true cost of completing an audit, as the cost has been established administratively and does not correspond to an auditor's actual time commitment. Given that audits do not reflect the true cost of an auditor's time and the fact that agriculture customers are already sensitive to audit costs, farm energy audits that reflect the actual cost could further inhibit the number of audits conducted.

The key takeaways identified through the Agriculture and Rural Communities Energy Roadmap process provide important context for the needs of agricultural and rural customers in the state and offer potential paths forward to improve access and adoption in these populations. Addressing the barriers and opportunities for energy efficiency and renewable energy will take collaborative efforts from stakeholders and policymakers to implement policies and improve programs. This report will inform this dialogue and serve as a foundation for efforts going forward.

Project Overview

Recognizing the importance of Michigan's agriculture sector and rural communities, the Michigan Energy Office, on behalf of the Michigan Department of Environment, Great Lakes and Energy (EGLE), engaged Public Sector Consultants and the American Council for an Energy-Efficient Economy (the project team) to develop a research-driven roadmap that will guide the state's effort to develop programs and policies advancing energy efficiency and renewable energy in these key communities.

This project is framed by the understanding that despite the overall success of Michigan's energy efficiency and renewable energy standards over the past ten years, the state's agriculture sector and rural communities have not realized the same benefits as other parts of the state and current standards do not place an emphasis on reaching these populations. In response to the state's desire to develop programs and policies to advance energy efficiency and renewable energy in these important sectors, the project team embarked on a multifaceted process to create the roadmap to help advance the state's goals and better serve all consumers.

Project Team

The project team for the Agriculture and Rural Communities Energy Roadmap is comprised of Public Sector Consultants (PSC) and the American Council for an Energy-Efficient Economy (ACEEE). This team brings together firms with strong backgrounds in energy efficiency and renewable energy policy in Michigan and at the national level.

PSC served as the project manager for the Agriculture and Rural Communities Energy Roadmap. PSC is an objective, nonpartisan research and consulting firm whose services have been used to advance innovative solutions to difficult public policy challenges in Michigan and beyond for nearly 40 years. Clients use PSC's research, management, analytical, and advisory capacities to develop and implement policies and strategic plans; improve internal management; identify stakeholder priorities; build consensus amongst individuals and organizations with diverse perspectives; and identify political, regulatory, and economic factors influencing corporate and agency decisions.

ACEEE is a nonprofit 501(c)(3) organization that acts as a catalyst to advance energy-efficiency technologies, policies, and programs as a means of promoting economic prosperity, energy security, and environmental protection. For nearly 40 years, the council has supported the development of energy-efficiency technologies, programs, and policies in the areas of buildings, appliances, and equipment, industry, transportation, utilities, policy and program analysis, economic analysis, and financing. ACEEE carries out its mission by conducting in-depth technical, program, and policy analyses; advising policymakers and program managers; and working collaboratively with businesses, government officials, public interest groups, and other organizations. For rural communities, ACEEE recently launched an initiative to assess the unique needs and opportunities these communities face in advancing energy efficiency.

Goals and Objectives

The overarching goal of the roadmapping effort is "to create an agriculture and rural communities' energy roadmap to inform policymakers of recommended policies and programs that encourage energy waste reduction and renewable energy" (MEO 2018). To accomplish this goal, the MEO and project team aligned on the following objectives:

- Identify and review existing energy efficiency and renewable energy programs and policies.
- Assess the impact of existing programs and policies on agriculture customers and rural communities.
- Identify any gaps or opportunities in the delivery of existing programs and policies.
- Establish a common understanding of the value energy efficiency and renewable energy resources provide to customers and how these resources can improve Michigan's energy future.
- Provide recommendations for programs and policies that increase the accessibility of renewable energy and energy efficiency for a broad range of customers in the agriculture sector and rural communities.
- Foster stakeholder engagement around energy issues facing Michigan's agriculture sector and rural communities.

Project Scope

The project team, in collaboration with the MEO, developed a project plan based on achieving the objectives for the Agriculture and Rural Communities Energy Roadmap. There are three phases for this project.

The first phase of the project was to develop an inventory of the current energy-efficiency and renewable energy policies and programs targeted at Michigan's agriculture customers and rural communities. This phase includes conducting a baseline assessment of existing programs and policies as well as accomplishments to date. As a part of this assessment, the team interviewed key stakeholders from across the state representing a variety of sectors, such as energy providers, agricultural commodity groups, state associations, community foundations, conservation districts, government agencies, and nonprofit entities.

The second phase of developing the roadmapping process was conducted to assess the effectiveness of Michigan's existing policies and current programs intended to provide energy-efficiency and renewable resources to agriculture and rural communities. This phase of the project included surveying agricultural and rural customers throughout the state, benchmarking Michigan's existing policies and programs, reviewing utilities' existing program evaluations, and analyzing participating utilities' data. The outcomes from these two phases were combined into a single report that includes a summary of the current state of Michigan's policies and programs that promote renewable energy and energy efficiency in the agriculture sector and rural communities, as well as preliminary recommendations for improving access to these resources for targeted communities.

The final phase of this project will be focused on the development of the roadmap for Michigan's agriculture sector and rural communities. Stakeholder outreach and engagement will be a fundamental aspect of this portion of the project. At various points throughout this effort, the project team has and will continue to engage with a wide variety of stakeholders from across Michigan. Stakeholder input is essential to ensuring that the project results in relevant, actionable recommendations that will improve future programs and policies. Stakeholders will be asked to participate in the development of recommendations

and an action plan for policies and programs to support energy efficiency and renewable energy development in the agriculture sector and rural communities based on the results of research, evaluation, and their input.

Methodologies

Baseline Assessment Methodology

The baseline assessment is designed to serve as a foundation for evaluating existing programs and policies supporting energy efficiency and renewable energy in Michigan's agriculture sector and rural communities. This assessment was developed through several different research modes, including secondary research, literature review, and stakeholder interviews. The primary objectives for the baseline assessment are to provide the following:

- An inventory of current policies and programs that promote energy efficiency and the deployment of renewable energy systems to the benefit of the agriculture sector and rural communities, including programs provided by Michigan utility companies, government entities, nonprofits, third-party service providers, and other entities
- Information related to the potential for energy efficiency and renewable energy in agriculture operations and rural communities in Michigan, including baseline energy consumption characteristics and applicable energy efficiency technologies
- A summary of factors, risks, and opportunities that could impact implementation of such policies and programs

PSC, as the project manager, led the report development process and coordinated research efforts with ACEEE to synthesize relevant data and analyze information from secondary sources, including two recent reports from Michigan State University Extension titled *Michigan Farm Energy Program: Gaps, Issues & Opportunities* and *Michigan Farm Energy Program: Sustainability Roadmap*.

For the baseline assessment, the project team worked to identify and prepare an inventory of existing state policies (and federal or local policies where appropriate) that are intended to support and enable rural and agricultural customers to access energy-efficiency or renewable energy resources in Michigan.

The project team also conducted key informant interviews as a part of the baseline assessment to glean information from stakeholders about their awareness and perceptions of current programs. Interviews with key entities provide insight into the both the current issues facing agriculture and rural communities and other factors impacting energy efficiency and renewable energy at large that might not otherwise be ascertained. PSC worked with the MEO to identify interview participants, including:

- Consumers Energy
- Cooperative Elevator Company
- DTE Energy
- Eastern Upper Peninsula Regional Planning and Development Commission
- Efficiency United
- Huron County Economic Development Corporation
- Indiana Michigan Power Company
- Michigan Agri-Business Association

- Michigan Allied Poultry Industries
- Michigan Association of Conservation Districts
- Michigan Community Action
- Michigan Department of Agriculture and Rural Development
- Michigan Economic Development Corporation
- Michigan Electric Cooperative Association
- Michigan Energy Efficiency Contractors Association
- Department of Environment, Great Lakes, and Energy—Michigan Energy Office
- Michigan Energy Options
- Michigan Environmental Council
- Michigan Farm Bureau
- Michigan Farm Energy Program
- Michigan Greenhouse Growers Council
- Michigan Milk Producers Association
- Michigan Municipal Electric Association
- Michigan Municipal League
- Michigan Public Service Commission Staff
- Michigan Saves
- Michigan State University Extension
- Michigan Townships Association
- Michigan Vegetable Council
- National Regulatory Research Institute
- Potato Growers of Michigan, Inc.
- SEMCO ENERGY Gas Company
- Small Business Association of Michigan
- Superior Watershed Partnership & Land Trust
- Thumb Electric Cooperative
- U.S. Department of Agriculture—Natural Resources Conservation Service
- U.S. Department of Agriculture—Rural Energy for America Program
- University of Michigan; Gerald R Ford School of Public Policy; Center for Local, State, and Urban Policy
- Western Upper Peninsula Planning and Development Region

Policy and Program Evaluation Methodology

The policy assessment and program evaluation portion of the project entailed three tasks, including: 1) a review of existing evaluations of programs targeted to agriculture entities or programs offered to predominately rural communities; 2) comparison of Michigan's policies and programs to those in other states that demonstrate innovation or effectiveness in reaching agriculture and rural communities; and 3) a survey of rural residents, owners/operators of farms or agribusiness, rural community business, and local government or community leaders. Each of these tasks is described in more detail below.

Existing Program Evaluation Review

The team collected data from evaluations that examined program delivery to the targeted populations. Priority was given to evaluations conducted by or for Michigan utilities with a specific emphasis on agricultural or rural populations; however, research also covered programs that had a more general audience but included measures applicable to these populations (e.g., other general residential, commercial, and industrial programs). Cross-cutting analysis of these evaluations focused on:

- Program reach and impact
- Techniques employed to effectively engage rural and agricultural communities
- Challenges encountered in program implementation and strategies utilized to address or resolve those challenges
- Program realization rates (i.e., the extent to which projected savings actually occur based on verified installation)

Comparison of Michigan's Policies and Programs Against Other States

In this task, the team assessed and benchmarked Michigan's existing policies and programs that provide energy-efficiency and renewable energy services to rural and agricultural customers against policies and programs across the country, comparing successes, struggles, and lessons learned in other states, especially for programs and regions targeting similar populations. The team assessed program design and implementation, as well as the policies that support and enable such programs. For selected programs, the team conducted more in-depth analysis focused on innovative program design elements and how these elements impact the performance, savings, and engagement of targeted customers of such programs. This comparative review provided insights for program improvements and opportunities for increased program savings. Steps in this analysis included:

- A search for effective policies from other states related to energy efficiency and renewable energy in the agriculture sector and rural communities (with a particular focus on the Midwest)
- An assessment of Michigan's policy framework, to both identify positive features as well as gaps or areas for potential improvement
- A best-practice assessment of programs available in other states that incentivize and encourage investment in energy efficiency and renewable energy in their agriculture sectors and rural communities
- An assessment of the effectiveness of existing energy efficiency and renewable energy programs in Michigan to both identify positive features as well as gaps or areas in need of improvement

To conduct this work, the team mined data currently available from ACEEE and supplemented as necessary with data from the Midwest Energy Efficiency Alliance, regulatory staff, utilities, and program implementers. A framework of key policy or program characteristics to be collected was created for the benchmarking to ensure systematic review of each initiative. This framework established the structure for a database, provided as a separate deliverable, that includes policy and program information from midwestern states and other jurisdictions with programs targeted to agricultural and rural communities.

Survey of Rural Residents and Agricultural Communities

As part of the assessment of existing policies and programs in Michigan, the team collected primary data from key customer groups, including residents or rural communities, owners/operators of farms or agribusiness, businesses, and local governmental and community leaders. An online survey was conducted to gather information about:

- Level and sources of program awareness
- Level of customer or stakeholder engagement
- Characteristics of energy consumption of rural and agricultural communities
- Barriers to investment in energy-efficiency or renewable energy technologies specific to rural and agricultural communities
- Effectiveness of current programs in addressing those barriers
- Potential nonenergy benefits of energy-efficiency or renewable energy technology implementation

The team worked with stakeholders (e.g., Michigan Agri-Business Association and/or Michigan Farm Bureau) to distribute the survey to the agriculture and rural communities through email, newsletters, and other membership communication. In addition, the survey was sent to a panel sample of potential respondents from rural areas of the state (determined by zip code). The survey was programmed to ask questions specific to the respondent's perspective, e.g., resident or business owner/operator, as well as a set of core questions about policies, programs, and statewide energy needs. A total of 205 responses were collected, of which 58 represented multiple perspectives.

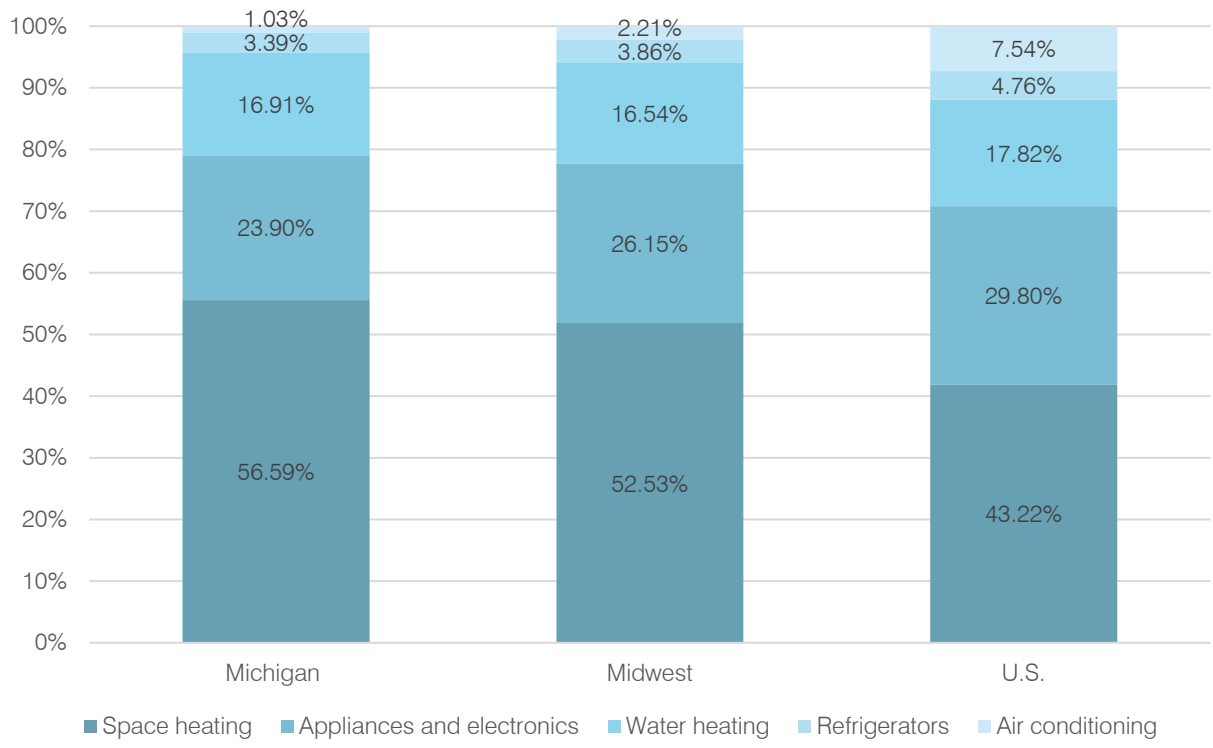
Baseline Program and Policy Assessment

As this project focused on energy issues in Michigan's agriculture sector and rural communities, the project team developed an overview of the state's agriculture sector and the rural population as well as a profile of Michigan's energy sector. This background information provides helpful information to stakeholders and to be used as a basis for future discussion.

Overview of Michigan's Energy Consumption and Providers

Energy is an essential component of everyday life for all Michiganders. Residents rely on energy service to heat their homes, power their commutes, run their businesses, and for a myriad other applications every hour of every day. On average, 55 percent of all energy consumed by Michigan households is for space heating purposes. The remaining household energy consumption is for lighting, appliances, electronics, and water heating. Air conditioning is a small part of the average household's total energy consumption. Michigan residents use a higher proportion of their energy for space heating than the regional and national average. This is because Michigan has more days where residents need to heat their homes. Similarly, Michigan households are less reliant on air conditioning than the national average. A full breakdown of household energy use for Michigan, the Midwest, and U.S. are provided in Exhibit 1 (PSC 2015).

EXHIBIT 1. Household Energy Consumption by End Use



Source: U.S. EIA 2013

Michigan residents meet their energy needs via a variety of sources. Electricity service in the state is supplied through 61 different electric utilities, including eight investor-owned utilities, 9 electric cooperatives, and 44 municipal electric utilities (MPSC July 2019). Although the two largest electric utilities (DTE Energy and Consumers Energy) serve over 87 percent of households in the state, a large proportion of rural customers are served by smaller utilities and electric cooperatives.

In addition to everyday household and business functions, over 9 percent of Michigan households rely on electricity for their home heating needs. The largest source of home energy consumption for home heating in Michigan is natural gas. Michigan frequently ranks as one of the top five states nationally for residential natural gas consumption (U.S. EIA May 2019). Michigan has ten natural gas utilities providing service to over 75 percent of state households (MPSC n.d.a). These providers delivered 848,731 million cubic feet of natural gas to 3,269,578 residential, 258,104 commercial, and 7,314 industrial customers in 2017 (U.S. EIA 2017). Propane is major source of energy for Michigan customers as well, supplying 8 percent of households. The average propane-supplied household consumes 1,189 gallons of propane per year, totaling over 380 million gallons—the most of any state in the nation for residential customers (MPSC July 1, 2019). Customers using propane typically receive the fuel by a truck directly delivering fuel to an onsite tank that the customer either owns or leases (MPSC July 2018). Other fuels, such as fuel oil, coal, coke, wood, and solar energy are used by a small portion of Michigan residents to meet their energy needs. The number of Michigan households using these various home heating fuels is presented in Exhibit 2.

EXHIBIT 2. Home Heating Fuel Use

	Michigan	Rural Communities
Utility natural gas	76.60%	53.10%
Propane	8.20%	22.90%
Electricity	9.30%	8.40%
Fuel oil, kerosene, etc.	1.20%	2.80%
Coal or coke	0.00%	0.10%
Wood	3.20%	10.10%
Other fuel	1.00%	2.00%
No fuel used	0.50%	0.50%

Source: U.S. Census Bureau 2018

There are certain differences between Michigan's rural population and the state as a whole when it comes to household energy consumption. Natural gas providers serve just over 50 percent of Michigan's rural population, which is 23 percentage points less than the statewide average. Rural customers are more heavily reliant on deliverable fuels, such as propane, due to lack of natural gas infrastructure. Nearly 23 percent of rural customers are supplied with propane. Wood is also a much more prevalent fuel source in rural populations, with 10 percent relying on this fuel source, whereas only 3 percent of the state's population as a whole uses wood. The use of fuel oil is also slightly more prevalent in rural communities, with nearly 3 percent of rural customers relying on it.

Price

Michigan residents spend 4.57 percent of their household income on electricity and natural gas, slightly higher than the national average of 4.52 percent (PSC 2015). This spending is influenced by several factors, including price and consumption. In 2017, average electric rates for residential, commercial, and industrial customers were 15.4, 11.0, and 7.19 cents per kWh respectively, making Michigan's average electricity prices higher than the national and regional averages (U.S. EIA March 2015; U.S. EIA November 2016; and U.S. EIA December 2018). Natural gas prices in the state in 2017 for residential, commercial, and industrial customers were $8.38, $7.02, and $5.97 per thousand cubic feet—lower than national average residential prices (U.S. EIA 2017; U.S. EIA June 28, 2019).

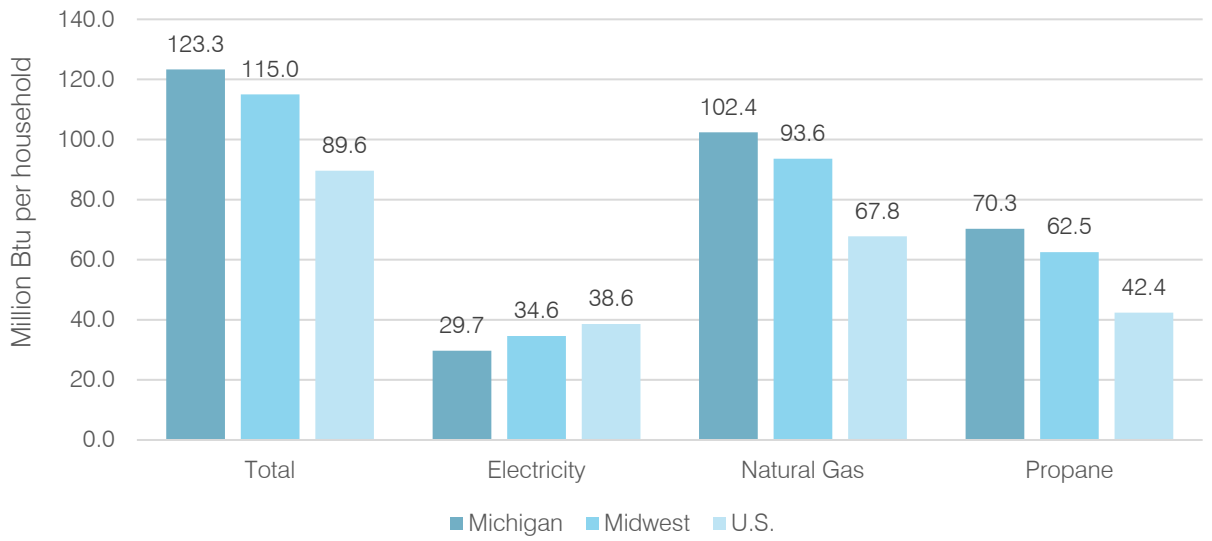
EXHIBIT 3. Michigan Average Annual Electric and Natural Gas Rates by Customer Class, 2017

Source: U.S. EIA March 29, 2019

Consumption and Expenditures

On average, Michigan households consume more energy than households in the Midwest and nationwide. This is due to high use of home heating fuels, such as natural gas and propane for seasonal heating needs. However, Michigan households consume less electricity, specifically. Average consumption by fuel type is provided in Exhibit 4 (U.S. EIA 2013).

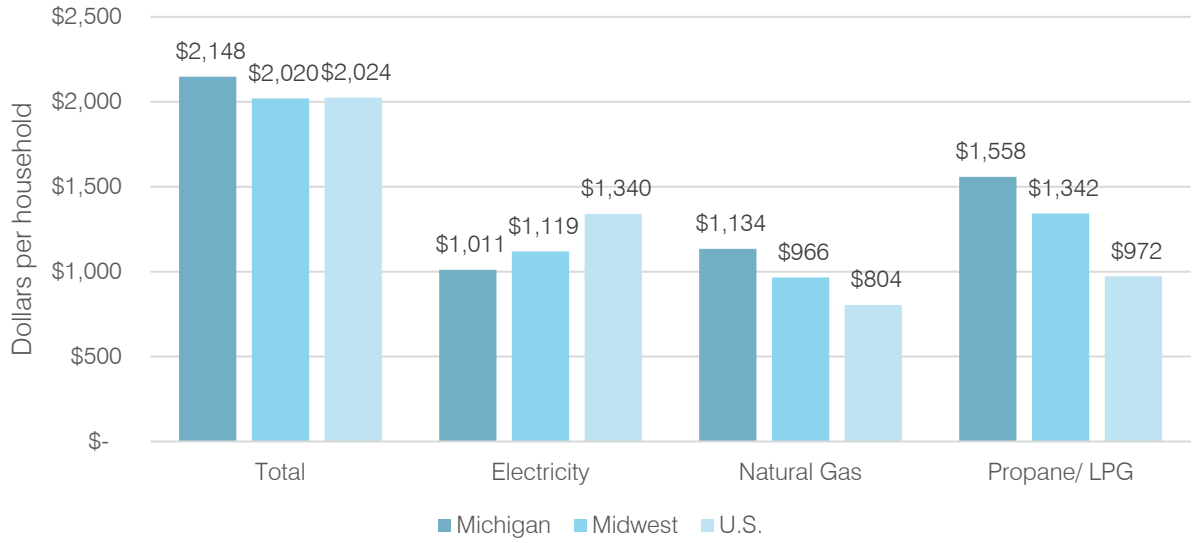
EXHIBIT 4. Average Household Energy Consumption



Source: U.S. EIA 2013

Michigan's average total household expenditure for energy is above both the Midwest and national average, with households spending, on average, $2,148 per year on their home energy expenses. Residents actually spend less than the national and Midwest average on electricity, owing in part to low seasonal cooling demands. A breakdown of total household energy consumption is available in Exhibit 5 (U.S. EIA 2013).

EXHIBIT 5. Average Household Energy Expenditures



Source: U.S. EIA 2013

Energy-efficiency and Renewable Energy Potential

Energy Efficiency

In 2017, the Michigan Public Service Commission (MPSC) worked collaboratively with DTE and Consumers to complete a study of energy-efficiency potential in the Lower Peninsula of Michigan. The study provided a foundational assessment for policymakers and identified the energy-efficiency measures having the greatest potential savings and the measures that are the most cost effective. The study—conducted by the consulting firm GDS Associates—estimates the potential for energy-efficiency measures under several scenarios, including technical potential, economic potential, and achievable potential.[1]

The study examined energy-efficiency measures across residential, commercial, and industrial sectors to determine that the achievable potential for cost-effective electricity savings is 16.9 percent of forecasted megawatt hour (MWh) sales for 2026 and 24.4 percent of forecasted MWh sales for 2036. The achievable potential for natural gas savings was not calculated in this report (GDS Associates August 11, 2017).

Another similar GDS Associates study was conducted for the Upper Peninsula (U.P.) of Michigan later in 2017. This study was also a collaboration between the MPSC and utility companies. GDS Associates combined results from a Consumers Energy efficiency potential study with U.P.-specific data to calculate results.

The study examined 568 energy-efficiency measures in the residential, commercial, and industrial sectors combined. Overall, the achievable potential for cost-effective electricity savings is 14.4 percent of forecasted MWh sales for 2026 and 20.4 percent of forecasted MWh sales for 2036. Like the potential study conducted for the Lower Peninsula, achievable potential for natural gas savings was not calculated in this report (GDS Associates August 9, 2017).

Renewable Energy

Renewable generation has increased at an average rate of 1 percent of total sales per year since Michigan's renewable portfolio standard (RPS) was implemented in 2008. The renewable energy report released as part of former Governor Rick Snyder's Readying Michigan to Make Good Energy Decisions process included an evaluation of the potential for expanding the state's RPS. The report found Michigan could achieve a 30 percent RPS by 2035 without exceeding current surcharge caps. The report also noted that other peer states in the Midwest—Wisconsin, Pennsylvania, Illinois, and Minnesota—have RPSs with annual increases of 0.8 to 1.3 percent of total sales per year (Quackenbush and Bakkal 2013).

In April 2015, the Vermont Energy Investment Corporation (VEIC) released their final report—*Michigan Renewable Resource Assessment*—which estimated the potential, as well as projections for, the cost and performance characteristics expected for renewable energy technologies, including utility-scale onshore wind, solar photovoltaics, and central station biomass power (VEIC 2015). This study estimated the amount of renewable generation that could feasibly be added through 2030 taking into consideration

[1] Technical potential is the theoretical maximum amount of energy that could be displaced by efficiency, disregarding all nonengineering constraints. Economic potential is a subset of technical potential that is cost-effective compared to conventional supply-side energy resources. Achievable potential is a subset of economic potential taking into account realistic market penetration scenarios, including the challenges of convincing end-users to implement energy-efficiency measures, administration and marketing costs, and the capabilities of administrators to increase implementation.

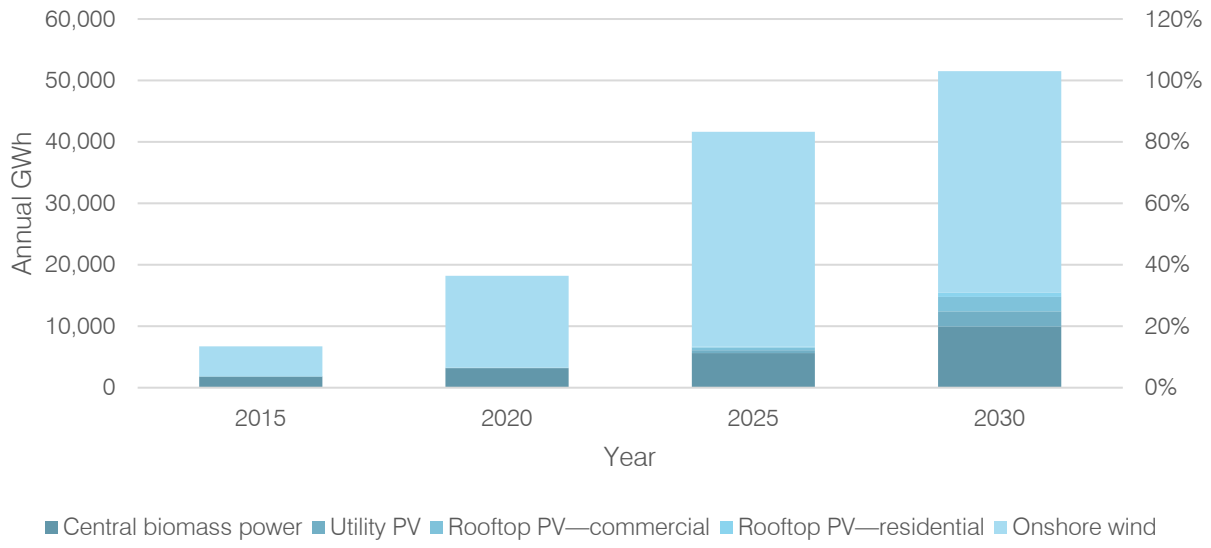
limitations on annual growth rates, existing energy resources, land use, and siting restrictions. Exhibit 6 shows the estimated potential generation for all renewable energy resources examined in the report. Exhibit 7 shows the amount of renewable energy required to achieve an expanded RPS that grows at 1 percent per year beginning at 10 percent in 2015.

EXHIBIT 6. Bounded Technical Potential Estimated Generation

Annual Generation, Gigawatt Hours (GWh)	2015	2020	2025	2030
Onshore wind	4,882	14,897	34,971	36,000
Rooftop Solar—residential	5	25	137	736
Rooftop Solar—commercial	15	81	435	2,339
Utility PV	16	87	466	2,509
Central biomass power	1,814	3,198	5,635	9,931
Total	**6,732**	**18,288**	**41,644**	**51,515**

Source: VEIC 2015

EXHIBIT 7. Onshore Wind, Biomass Power, and Solar Potential Contributions to Meeting Expanded RPS (GWh)

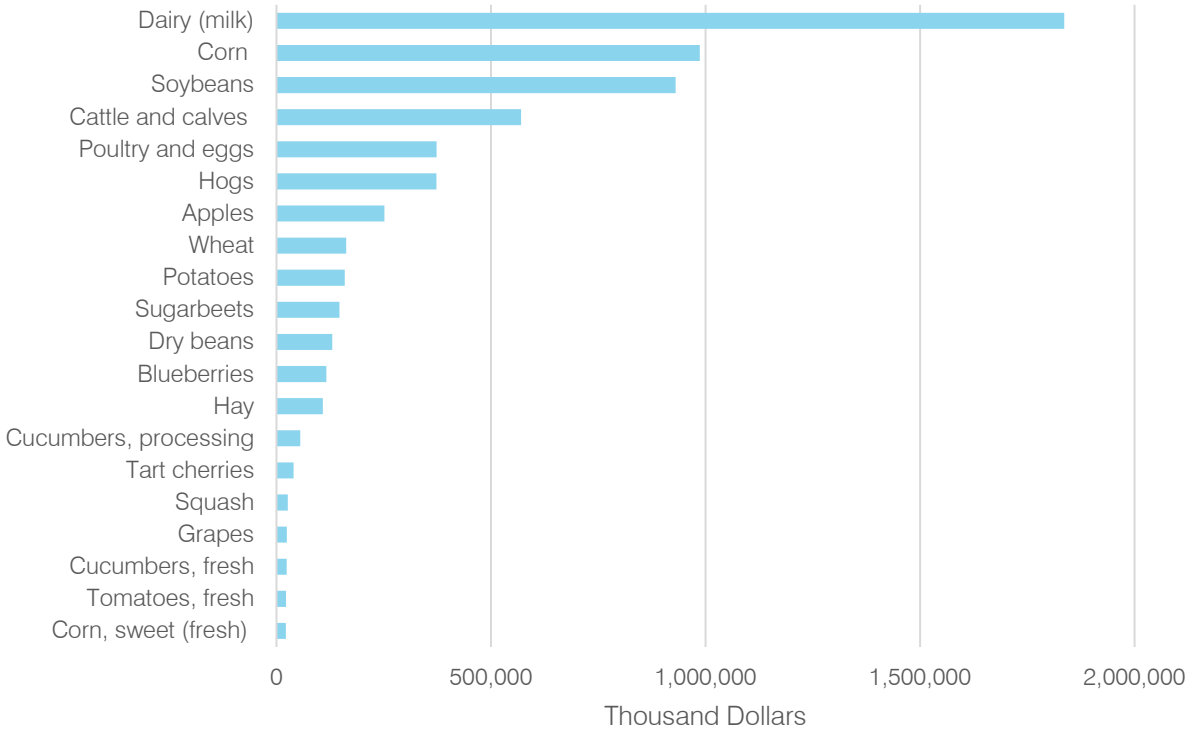


NOTE: Illustrates the bounded technical potential under expanded RPS. Standard starts at 10 percent in 2015 and increases 1 percent annually through 2030.
Source: VEIC 2015

Overview of Michigan's Agriculture Sector

Agriculture is a vital sector of Michigan's economy. There are over 50,000 farm operations across the state, producing over 300 different commodities, including field crops, livestock, fruits, nuts, vegetables, and more, using over 9 million acres of land, making Michigan the second most agriculturally diverse state in the nation. The total value of production from Michigan's agriculture sector in 2017 was $8.1 billion, and it is estimated that food and agriculture contribute $104.7 billion annually to Michigan's economy, representing roughly 20 percent of the state's gross domestic product. The food and agriculture sectors employ 923,000 people, around 22 percent of the state's total employment (MDARD n.d.b). The state's top 20 commodities by cash sales are displayed in Exhibit 8.

EXHIBIT 8. Michigan's Top 20 Commodities in Cash Receipts, 2017



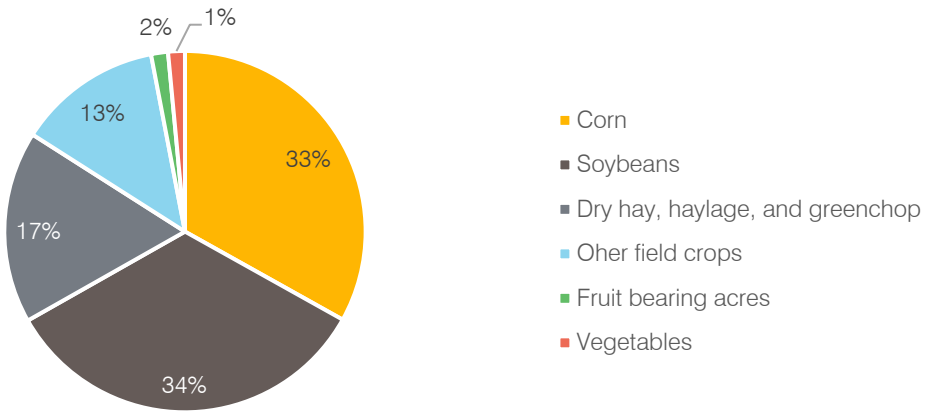
Source: NASDA 2018

In 2017, cash receipts from agricultural commodities in Michigan totaled more than $7.38 billion, with crop receipts representing the largest portion of this total, equaling out to more than $4.15 billion, followed by livestock and livestock product receipts, which equaled more than $3.22 billion. The total value of field crop production was more than $2.7 billion, while the total value of fruit production was more than $458 million, and the total value of vegetable production was $274 million (NASDA 2018). Interstate and international trade are also important components of Michigan agriculture, and in 2015, $2.8 billion of food and agricultural products were exported from the state (MDARD n.d.b).

The economic impacts of Michigan's agricultural sector extend far beyond the immediate producers and consumers of agricultural products. The State estimates that agricultural exports support over 22,600 additional Michigan jobs in food processing, storage, and transportation. Agricultural exports are estimated to produce $2.87 in economic activity for every $1 spent, meaning the State's $1.98 billion of exports has an additional local impact of $5.6 billion (MDARD n.d.b). Factoring in components such as transportation, storage, marketing, machine operation and repair, chemical treatments, and more, in 2017, net income from farming was calculated to be $604.9 million (NASDA 2018).

Agriculture is also responsible for a large amount of land use in the state. In 2017, farm operations used 9.95 million acres of land in Michigan, which equals roughly 16 percent of the state's total acreage. The average size of a farm in Michigan is approximately 195 acres. Harvested field crops comprised more than 6 million acres of this land, with fruit-bearing and planted vegetable land occupying 102,000 and 108,800 acres, respectively (NASDA 2018). A breakdown of land use by crop is provided in Exhibit 9.

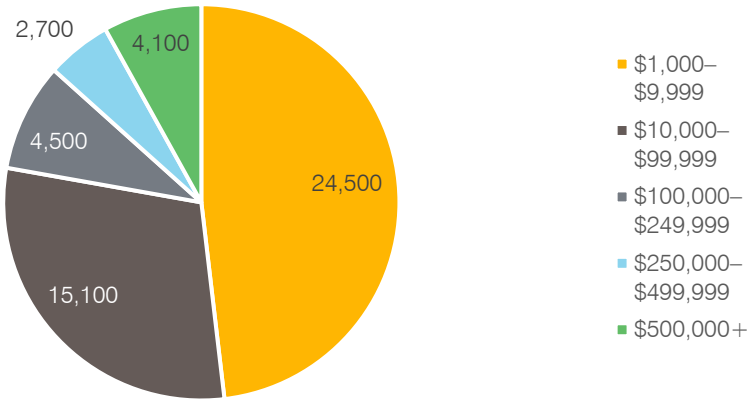
EXHIBIT 9. Acres of Michigan Farmland Harvested by Crop, 2017



Note: Total harvest acres equals 6.7 million acres. Other field crops include wheat, sugar beets, dry beans, potatoes, and oats.
Source: NASDA 2018

Michigan is home to more than 50,000 farms. Nearly half of these farms have between $1,000 and $10,000 in annual sales. Over three quarters of Michigan's farms have less than $100,000 in annual sales. A breakdown of the number of farms by annual sales is provided in Exhibit 10 below.

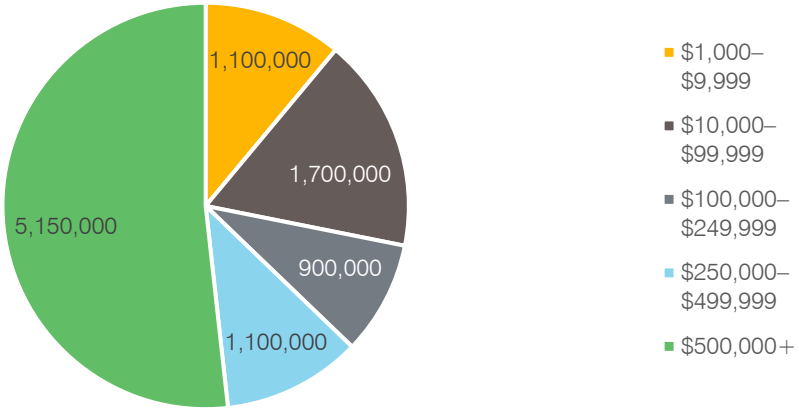
EXHIBIT 10. Number of Michigan Farms by Economic Sales Class, 2017



Source: NASDA 2018

Michigan's farms had 9.95 million acres of farmland under operation in 2017. While the majority of farms have annual sales of less than $100,000, the majority of land is owned and operated by larger farms. Despite only representing 22 percent of farming operations, farms with more than $100,000 in annual sales operate 72 percent of all Michigan farmland. The largest farming operations, those with annual sales exceeding $500,000, only comprise 8 percent of farms but operate 52 percent of farmland. In 2018, the average value of a farm per acre was $4,780, with cropland value per acre being $4,350 and pasture value per acre being $2,510 (NASDA 2018). In 2017, land use for farm operations was 81.2 percent cropland, 10.0 percent woodland, and 8.8 percent other (USDA NASS 2019).

EXHIBIT 11. Amount of Michigan Farmland by Economic Sales Class, 2017



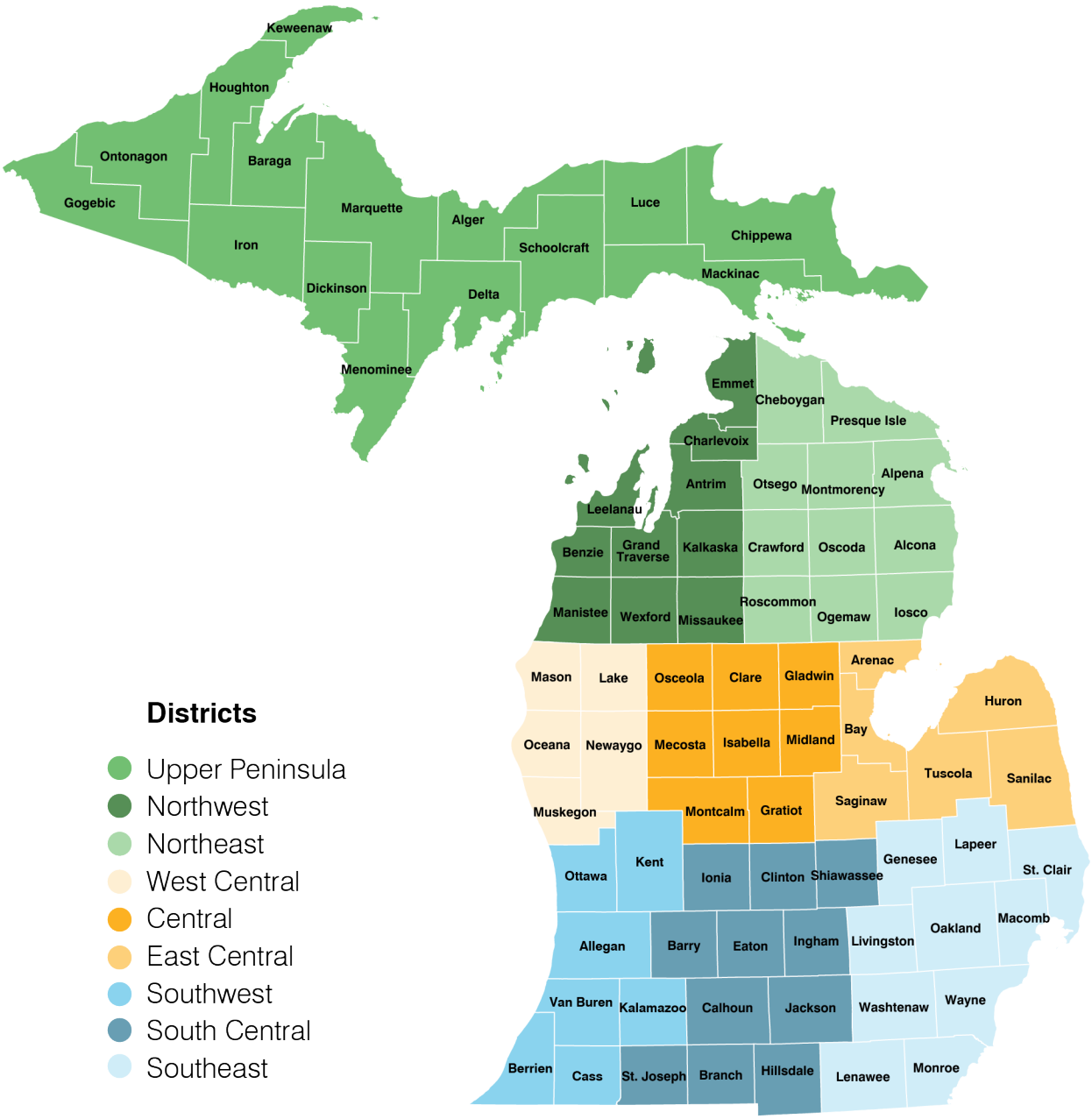
Source: NASDA 2018

Key Agricultural Commodities

As the second most agriculturally-diverse state in the country, Michigan is regularly a top producer of several agricultural commodities. In 2017, the state was the nation's leading producer of squash, Niagara grapes, asparagus, cucumbers, and multiple varieties of beans. As a top producer, Michigan produced

more than 72 percent of the United States' tart cherries and nearly 50 percent of the nation's dry black beans. That same year, the state ranked in the top ten states for production of 36 agricultural commodities, including apples, carrots, milk, pumpkins, oats, and potatoes (NASDA 2018).

EXHIBIT 12. Agricultural Statistic Districts



Note: The state is divided into nine Agricultural Statistics Districts to make data comparison easier. An Agricultural Statistic Distric is a contiguous group of counties having relatively similar agricultural characteristics. Each district has within it more homogenous agriculture than the state as a whole. They are numbered from north to south west to east.
Source: NASDA 2018

In 2017, Michigan produced more than 11.23 billion pounds of milk, making the state the sixth-largest milk-producing state in the nation. This was approximately 5.2 percent of the total United States' milk production. Of that milk, 35 million pounds was used where it was produced to feed calves or for milk, cream, and butter. The rest was marketed and earned over $1.83 billion in cash receipts in Michigan, the highest out of any single agricultural commodity. This milk, and other dairy products, came from 51 plants across the state of Michigan (NASDA 2018). The three principal counties in 2018 for milk cow heads in Michigan were Huron, Clinton, and Sanilac. That same year, the South Central district contained the most heads of milk cow of any district in the state.[2]

Corn—another principal agriculture product in Michigan—serves many purposes as an agricultural commodity. It is used for animal feed, as a grain, for human consumption, as a biofuel, and more. In 2017, Michigan was the ninth-, 12th-, and 13th-highest-producing state for corn for silage, sweet corn, and corn for grain, respectively. 99 percent of the crop land dedicated to corn production in Michigan was harvested for grain and silage, yielding over 306 million bushels. Corn (not including sweet corn) earned the second-highest cash receipts of any single agricultural commodity, at over $986 million; that same year, exports for corn were valued at almost $18.6 million (NASDA 2018). The three principal counties for grain corn production in Michigan were Lenawee, Sanilac, and Huron. That same year, the South Central district produced the most corn of any district in the state.

In 2017, Michigan produced over 96.4 million bushels of soybeans, equivalent to 2.2 percent of the nation's total production. This made Michigan the 15th largest producer of soybeans in the country. The crop was planted over 2.28 million acres, harvested from 2.27 million of those acres, and had a $897 million value of production. That year, soybeans earned over $930 million in cash receipts, the third highest of any single agricultural commodity in the state. In 2017, soybean exports were valued at over $147 million (NASDA 2018). The three principal counties for soybean production in Michigan in 2017 were (in order of highest to lowest): Lenawee, Sanilac, and Huron. That same, year, the South Central district produced the most soybeans of any district in the state.

Michigan's agriculture sector also has a large livestock component. At the start of 2018, there were 1.16 million head of cattle in Michigan. Combined with calves, cattle earned over $570 million in cash receipts, making them the fourth-highest-earning agricultural commodity in the state in 2017. That year, Michigan produced over 493 million pounds of cattle and calves (NASDA 2018). The three principal counties for heads of cattle in Michigan were Huron, Sanilac, and Clinton. That same year, the East Central district contained the most heads of cattle of any district in the state, with 258,800 heads, seconded closely by the South Central district with 256,300 heads. Outside of cattle, poultry and eggs earned over $373 million in cash receipts in 2017, making them the fifth-largest commodity by cash receipts in Michigan. That year, 4.225 billion eggs were produced in the state and on December 1, there were over 18 million chickens on hand (NASDA 2018).

Agribusiness

Beyond key agricultural commodities, there are a number of other products and services that are necessary for agricultural operations to be effective. These agribusiness products and services can range

[2] Data for some counties in regions was either not available or withheld to avoid disclosing data for individual operations.

from fertilizers and pesticides to livestock feed to grain handling. The economic impact of agribusiness is valuable as well, with food processing businesses alone generating nearly $25 billion for Michigan's economy (MEDC n.d.).

Service Providers

Grain Handlers

Food grains comprised nearly $4 billion in crop production value in the state of Michigan in 2017. As one of the largest and most valuable agricultural commodities, its storage and transportation is crucial for the longevity of agricultural markets in Michigan. In 2017, Michigan had 530 million barrels of on- and off-farm storage capacity, including the use of 191 off-farm facilities (NASDA 2018).

With 230 million barrels of off-farm capacity, numerous companies operate in the state to provide off-farm storage, marketing services, and assistance to Michigan agricultural operators. The largest of these grain handling and marketing companies in the state is Michigan Agricultural Commodities, with a storage capacity of slightly under 43 million bushels (or 12.9 million barrels), employing over 100 employees(MAC n.d.). As of 2019, there were nearly 300 licensed grain dealer facilities statewide (MDARD July 9, 2019).

Feed Suppliers

With feed crops accounting for nearly $1.1 billion of crop production value, more than $1.1 billion of purchased inputs, and more than $14 million in agricultural exports in Michigan in 2017, feed and fodder plays a central role in Michigan's agricultural operations. As such, the transportation and supply of feed also represents an important part of Michigan's agricultural networks (NASDA 2018). As of 2019, there were over 700 licensed commercial feed manufacturers and distributors in the state of Michigan (MDARD July 18, 2019).

Seed Companies

In 2017, Michigan agricultural operations required approximately $613.2 million in seed purchases, and Michigan exported approximately $57.6 million of seeds for planting in 2016 (NASDA 2018). Groups like the Michigan Crop Improvement Association help over 160 seed growers across the state by providing genetic, disease, productivity, and marketing information through seed production, field inspection, and lab testing, to facilitate the movement of seed or plant products in a variety markets (MCIP 2019).

Fertilizer (Manufacturing and Application)

In 2017, Michigan farmers spent $496.2 million on fertilizers and lime for their operations. In 2015, Michigan agricultural operations consumed over 1.3 million tons of various fertilizers (NASDA 2018). There are over 600 regulated fertilizer manufacturers and distributors in the state of Michigan, responsible for over 1.4 million tons of fertilizer. These fertilizers are sourced from across the country and even from some international markets, and include a wide variety of fertilizer types, as well as soil conditioners (MDARD n.d.a).

Food Processing

It is estimated that 47 percent of agriculture jobs in Michigan involve food processing (CANR 2018). In 2015, 2,166 licensed food processors generated nearly $25 billion in economic activity (MDARD and MEDC 2015). As of 2016, Michigan food processing and manufacturing directly employed 32,729 people and is responsible for an additional 62,423 jobs through indirect and induced employment and the

economic output of food processing and manufacturing was estimated to be around $30,581 million (Knudson 2018).[3] In 2017, processed fruit and vegetable exports totaled $86,914,000 and $41,542,000 respectively (NASDA 2018).

For processing purposes, Michigan produced 237,656 tons of cucumbers, 78,765 tons of snap beans, and 133,056 tons of tomatoes in 2017. That year, cucumbers for processing had a value of $55,849,000, with snap beans and tomatoes for processing having values of $15,753,000 and $13,705,000 respectively. In fruits, Michigan produced 394 million pounds of apples for processing through canning, as slices, and for juices and ciders; totaling $251,795,000 in value. The state also produced 47 million pounds of blueberries, 19,700 tons of sweet cherries, and 187.8 million pounds of tart cherries for values of $28 million, $13 million, and $39 million respectively. Grapes for wine and other processing totaled 63,500 tons at a value of $24 million (NASDA 2018).

Agritourism

Agritourism is also an important part of Michigan's agriculture sector. Tourists in Michigan can visit a wide variety of locations, including local farm markets, roadside stands, cider mills, you-pick farms, corn mazes, petting farms, ranches, educational farms, farm stays, wineries, and more. There are over 265 of these locations across the state (Michigan Agritourism 2019).

Energy Consumption in the Agriculture Sector

Agriculture is a significant sector of energy consumption across the country. In 2014, the agriculture sector consumed 1,714 trillion Btu nationwide, and this has number was been steadily rising since 2012. The entire food system is responsible for approximately 13 to 15 percent of total U.S. energy consumption. Energy in agriculture is consumed either directly or indirectly, with direct energy consumption as the on-farm use of fuels and electricity and indirect energy consumption as the production of fertilizers, pesticides, fungicides, and other off-farm processes. Of total agricultural energy consumption, 60 percent is from direct energy consumption. Both types of energy consumption can vary greatly based on the specific crop being produced and production practices. For instance, energy consumption for livestock production is almost entirely direct, while field crops consume a much higher amount of indirect energy owing to fertilizer and pesticide use (Hitaj and Suttles 2016).

Energy is also an important factor for farm operators' budgets and can vary widely based on commodity and production practices. For instance, energy inputs comprised 40 to 50 percent of business expenses for rice, peanuts, wheat, and cotton, but only 10 to 15 percent of business expense for livestock operations (Hitaj and Suttles 2016). Fluctuations in energy prices can also have significant downstream effects in agriculture. By one estimate, a doubling of fuel costs could lead to a 13 percent increase in commodity prices, and multiplying fossil fuel costs by four could create a 60 percent increase in commodity prices (Go 2013).

A growing relation between energy and agriculture is the production of energy on farm operations, rather than solely consumption. Programs such as the Renewable Fuel Standard (RFS) have led to the increased

[3] Indirect employment is the impact of business activity on employment in related industries, e.g., a farm helps to indirectly employ workers at food-processing plants because they need their product processed. Induced employment measures the impact resulting from general household spending that occurs as a result of business activity, e.g., the employees of the food-processing plant shop at a grocery store, which must hire employees to meet this need.

production of biofuel feedstocks like corn and soybean.[4] In 2012, 6,463 farms nationwide produced inputs for ethanol and biodiesel, and farms growing these crops have seen increased revenue since the implementation of the RFS (Hitaj and Suttles 2016).

Renewable energy production has also proven to be a valuable use of land for some farming operations. Farmers can install wind or solar energy technology on their land for their own use or they can lease their land to energy companies looking to build new renewable energy sources, both of which can augment revenue. In 2014, 5.4 percent of Michigan farms received income from energy royalties or leases, earning an average energy payment of $8,080 per farm (although this number widely varies). As of 2012, 10,181 farms across the country have leased their land for the use of wind energy generation.

Renewable energy production for on-farm use, rather than leasing, has been expanding in recent years as well. Nationally, from 2007 to 2012, the number of farms producing energy and/or electricity on farm more than doubled from 23,451 to 57,891 (approximately 2.7 percent of farms). The average installation for on-farm electric generation is 100 kW for wind energy and 4.4 kW for solar energy. Wind installations of 100 kW are usually enough to supply an entire farm's electricity demands (Hitaj and Suttles 2016).

Overview of Michigan's Rural Population

Definition of Rural Population

As part of developing the energy roadmap for rural and agricultural communities, it is necessary to define rural communities in Michigan. This presents a challenge, as federal agencies have over two dozen definitions for the term based on varying land-use, population density, and economic characteristics (Cromartie and Bucholtz 2008).

After reviewing the various definitions, the project team elected to use the definition provided by the Federal Office of Rural Health Policy (FORHP). The FORHP was created in 1987 to advise the U.S. Department of Health and Human Services on healthcare issues impacting rural communities, including accessibility, affordability, and the effect of the department's rules and regulations in less densely populated areas (FORHP May 2019). Interestingly, these healthcare issues are similar to those related to delivery of energy efficiency, renewable energy, and other advanced energy technology opportunities in agricultural and rural communities. Additionally, the FORHP provides a list of zip codes designated as rural areas, which are then used to map available service providers and facilities in these locations and to determine Medicaid and Medicare reimbursement rates (VGM Group DC Link 2015).

These zip codes represent nonmetro counties and rural census tracts that comprise rural areas as defined by the FORHP (FORHP November 2017). The resulting designation will allow the project team to work with major utilities in the state to determine the level of program participation as well as the savings and incentives delivered to customers.

The project team also explored several other definitions of rural communities, including those from the United States Department of Agriculture (USDA) and the Michigan Department of Agriculture and Rural Development (MDARD) (FORHP November 2017 and USDARD n.d.a). There is significant variation in

[4] The RFS program is a national policy to reduce greenhouse gas emissions, expand the nation's renewable fuels sector, and reduce reliance on nonrenewable imported oil. The program requires a certain volume of renewable fuel to replace or reduce the quantity of petroleum-based transportation fuel, heating oil, or jet fuel (United States Environmental Protection Agency 2017).

what constitutes rural, but most definitions focus on community size (e.g., fewer than 2,500 residents and up to 60,000 residents). While the USDA has a tool to determine if specific locations qualify for the Rural Energy for America Program (REAP), it does not have a comprehensive list of eligible locations.

Exhibit 13 shows rural zip codes in Michigan based on the FORHP definition of rural community and Exhibit 14 shows the list of rural counties (nonmetro) identified by FORHP (RHIH 2018 and HRSA 2018).

EXHIBIT 13. Map of Rural Zip Codes

Note: Map created by PSC using data from FORHP November 2017.

EXHIBIT 14. Designation of Michigan Counties as Rural

• Alcona	• Keweenaw
• Alger	• Lake
• Allegan	• Leelanau
• Alpena	• Lenawee
• Antrim	• Luce
• Arenac	• Mackinac
• Baraga	• Manistee
• Benzie	• Marquette
• Branch	• Mason
• Charlevoix	• Mecosta
• Cheboygan	• Menominee
• Chippewa	• Missaukee
• Clare	• Montmorency
• Crawford	• Newaygo
• Delta	• Oceana
• Dickinson	• Ogemaw
• Emmet	• Ontonagon
• Gladwin	• Osceola
• Gogebic	• Oscoda
• Grand Traverse	• Otsego
• Gratiot	• Presque Isle
• Hillsdale	• Roscommon
• Houghton	• St. Joseph
• Huron	• Sanilac
• Ionia	• Schoolcraft
• Iosco	• Shiawassee
• Iron	• Tuscola
• Isabella	• Wexford
• Kalkaska	

Note: Table created by PSC using data from FORHP November 2017.

PSC also mapped the counties designated rural by the FORHP to compare with the rural zip codes. Exhibit 15 below displays rural counties as defined by the FORHP.

EXHIBIT 15. Map of Rural Counties

Note: Map created by PSC using data from FORHP November 2017.

To compare the FORHP's rural zip code list to the list of rural counties, PSC overlaid the list rural counties and rural zip codes. As shown in Exhibit 16, these two definitions of rural are closely corelated. However, the FORHP's rural zip codes cover more territory.

EXHIBIT 16. Map of Rural Counties and Zip Codes

Note: Map Created by PSC using data from FORHP November 2017.

Demographics of Michigan's Rural Population

The project team conducted research to better understand the demographics of rural Michigan residents, selecting rural zip codes as defined by FORHP and analyzing data from the United States Census Bureau's 2017 American Community Survey (ACS) five-year estimates. Demographics of residents in rural Michigan zip codes were then compared with the demographics of the entire state.

This research allowed the team and MEO to gain a better understanding of the types of challenges residents of rural and agricultural communities might face, and how their challenges might differ from the challenges faced by residents of the state as a whole. This research also informed who would benefit from improved energy programs directed toward residents of rural and agricultural communities.

Methodology

The demographics information presented in this report is derived from the 2017 ACS estimates, which rely on 60 months of data (collected between January 1, 2013, and December 31, 2017) from every zip code in the nation. The ACS is comprised of data from 3.5 million households surveyed each year. This survey provides the most precise data for analyzing very small populations, such as zip codes in the state of Michigan.[5] Information pulled from other sources will be noted.

The demographic information provided in this report is organized into four categories: population characteristics, housing characteristics, educational attainment, and income and employment characteristics. The project team examined up to 15 different variables for all 554 rural zip codes in the state of Michigan and variables included in this report are listed below.

Population Characteristics

In 2017, Michigan's total population was 9,925,568. The number of residents living in rural zip codes was 2,049,623, which is equivalent to approximately 20.6 percent of the total population. Rural zip codes in Michigan are generally less racially diverse than the statewide average, with rural zip codes being 93.1 percent white compared to the statewide average of 78.7 percent. Residents in rural zip codes also tend to be older, with 23 percent of residents being 65 years of age and older, compared to the statewide average of 15.9 percent.

[5] The complete data set for the 2017 ACS five-year estimates is available online at factfinder.census.gov.

EXHIBIT 17. Ethnicity and Race—Michigan Total and Rural Areas

	Michigan		Rural	
Total	**9,927,414**	**Percentage**	**2,049,623**	**Percentage**
White	7,814,947	78.70%	1,908,000	93.10%
Black or African American	1,374,511	13.80%	42,137	2.10%
American Indian and Alaska Native	51,829	0.50%	25,179	1.20%
Asian	289,088	2.90%	12,546	0.60%
Native Hawaiian and Other Pacific Islander	2,808	0.00%	596	0.00%
Some other race	115,258	1.20%	13,301	0.60%
Two or more races:	278,973	2.90%	47,864	2.30%

Source: U.S. CB 2018

EXHIBIT 18. Gender—Michigan Total and Rural Areas

	Michigan	Rural
Total population—male	49.20%	50.50%
Total population—female	50.80%	49.50%

Source: U.S. CB 2018

EXHIBIT 19. Age—Michigan Total and Rural Areas

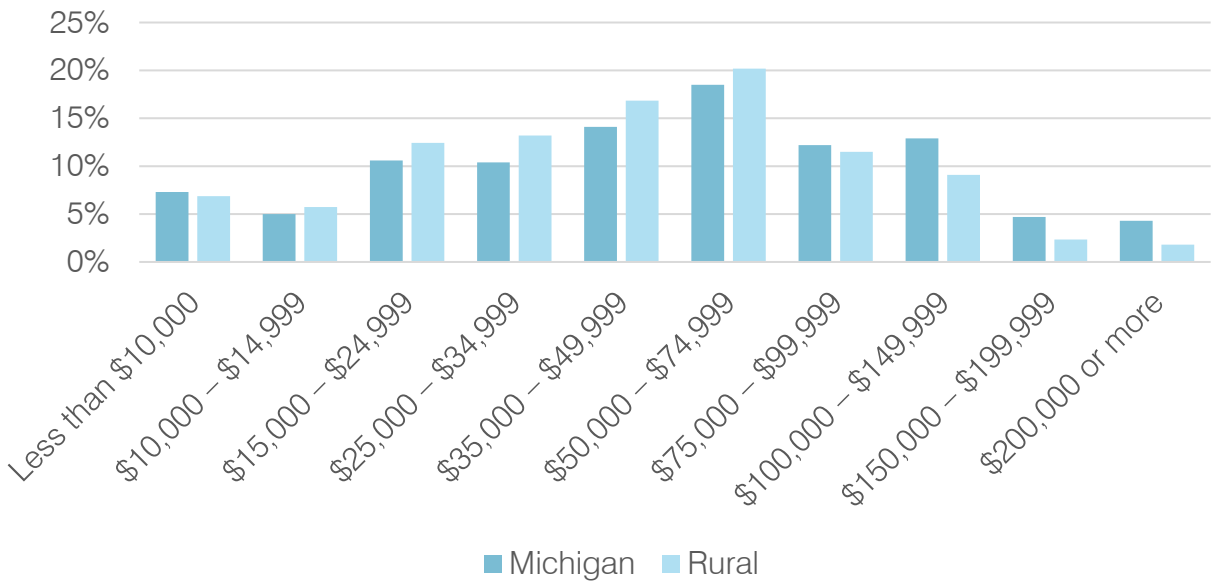
	Michigan	Rural
Under 5 years	5.80%	5.20%
Under 18 years	22.30%	19.40%
18 to 24 years	10%	7.50%
65 years and over	15.90%	23.00%

Source: U.S. CB 2018

Income and Employment Characteristics

Median household income for residents statewide was $52,668, with 15.6 percent of the population living in poverty. Looking solely in rural zip codes, median household income was $46,210—nearly 12 percent lower than the state median as a whole—with 15.7 percent of this rural population living in poverty. This poverty rate in rural zip codes is almost equal to the statewide poverty rate of 15.6 percent. As seen in Exhibit 21, rural Michigan has lower labor force participation and a slightly higher rate of unemployment than the state as a whole. However, the average rates of unemployment between the rural Michigan and statewide are relatively similar. The shape of income distribution also looks relatively similar between rural zip codes and statewide averages, with one difference being the higher percentage of earners in rural zip codes making $15,000–$74,999 and a lower percentage making $75,000 or above. Occupation, however, is more widely varied between rural zip codes and statewide averages, with 6.7 percent fewer residents in rural zip codes working in management, business, science, and art, and greater percentages working in service occupations, natural resources, construction, maintenance, production, transportation, and material moving.

EXHIBIT 20. Income Distribution—Michigan Total and Rural Areas



Source: U.S. CB 2018

EXHIBIT 21. Employment Characteristics, Population 16 and Over—Michigan Total and Rural Areas

	Michigan	Rural
Total Population 16 years and over	7,985,908	1,679,778
Labor force participation rate	61.20%	53.20%
Employment/population ratio	56.70%	49.10%
Unemployment rate	7.40%	7.80%

Source: U.S. CB 2018

EXHIBIT 22. Occupation, Population 16 Years and Over—Michigan Total and Rural Areas

	Michigan		Rural	
Civilian Employed Population	**4,524,874**	**Percentage**	**874,565**	**Percentage**
Management, business, science, and arts occupations	1,612,577	35.60%	252,504	28.90%
Service occupations	803,485	17.80%	168,238	19.20%
Sales and office occupations	1,039,958	23.00%	194,709	22.30%
Natural resources, construction, and maintenance	356,023	7.90%	97,042	11.10%
Production, transportation, and material moving	712,831	15.80%	162,072	18.50%

Source: U.S. CB 2018

Housing Characteristics

Michigan residents in rural zip codes have a 12 percent higher rate of homeownership than the statewide average, with relatively similar average household sizes.

EXHIBIT 23. Housing Characteristics—Michigan Total and Rural Areas

	Michigan	Rural
Total households	3,888,646	819,001
Average household size	2.49	2.39
Owner-occupied housing units	71%	83%
Renter-occupied housing units	29%	17%

Source: U.S. CB 2018

Educational Attainment

Education is a subject with some notable differences between those in rural zip codes and the statewide averages in Michigan. Residents of rural zip codes were 7.3 percent more likely than the statewide average to graduate high school as their highest level of education and were 4.2 percent less likely to obtain a bachelor's degree.

EXHIBIT 24. Educational Attainment, Population over 25—Michigan Total and Rural Areas

	Michigan		Rural	
Population 25 years and over	**6,719,972**	**Percentage**	**1,431,392**	**Percentage**
Less than 9th grade	204,526	3.00%	41,567	2.90%
9th to 12th grade, no diploma	452,157	6.70%	99,489	7.00%
High-school graduate (includes equivalency)	1,966,110	29.30%	523,548	36.60%
Some college, no degree	1,588,068	23.60%	341,955	23.90%
Associate's degree	622,070	9.30%	136,793	9.60%
Bachelor's degree	1,147,842	17.10%	184,393	12.90%
Graduate or professional degree	739,199	11.00%	103,647	7.20%

Source: U.S. CB 2018

Policy Overview

State and federal policies have played a central role in the growth of energy efficiency and renewable energy in Michigan over the years. An overview of the key energy-efficiency and renewable energy policies that have impacted the development of these resources is provided in the following section. By and large, these policies are not directed at the agriculture sector or rural communities. Instead state and federal policies have taken a broader approach to energy efficiency and renewable energy.

Energy Efficiency

Michigan Policies

Energy-efficiency Savings Targets

Energy efficiency has been a policy priority in Michigan for over a decade, starting with the passage of Public Act (PA) 295 in 2008, which established the state's first goals for reducing consumption of electricity and natural gas. These goals were designed to reduce future costs for customers while delaying the need for new electric generation capacity by reducing energy waste and promoting more efficient energy consumption. The law required electric and natural gas utilities to submit an energy efficiency plan with details about their program's design and estimated costs (State of Michigan October 2008). Utilities were given the option to self-administer their energy efficiency programs or to collaborate with other utilities in a joint program. To help control costs for the many smaller utilities, the state helped facilitate the creation of a state administrator that would operate energy efficiency programs for participating providers.

The savings targets established by PA 295 increased progressively each year from 2009 to 2012. Annual energy savings targets eventually leveled out at 1 percent for electricity and 0.75 percent for gas. PA 295's savings targets were to remain in place until the imposed spending cap is reached (State of Michigan 2008).

Michigan's commitment to energy-efficiency policies was reaffirmed in 2016 when the state adopted new energy policies. PA 342 of 2016 retained existing energy-efficiency targets for all energy providers through 2021. After 2021, these standards only apply to natural gas providers. For rate regulated electricity providers, energy efficiency targets will be set by the MPSC through biennial proceedings. Municipal electric utilities and electric cooperatives, which are not regulated by the MPSC, are exempt from energy-efficiency targets after 2021 (State of Michigan 2016).

State policies establishing a requirement for utilities to achieve energy efficiency for customers—like Michigan—have been shown to be the most effective policy for achieving energy efficiency (Molina and Kushler 2015). Like most states, Michigan's energy-efficiency resource standard does not provide specific direction for providers to ensure that the distribution of energy-efficiency investment is spread uniformly across the state, nor do these policies explicitly promote energy-efficiency investment for the state's rural communities or agriculture sector. However, Michigan has been one of a relatively few states that applied its utility energy savings requirements to municipal utilities and electric cooperatives, which has been an important policy mechanism for reaching more rural populations.

Residential Energy Improvement

PA 342 established a new option for utilities and customers to pursue energy-efficiency investment through on-bill financing options. Similar to legislation from 2014, which enabled municipal electric utilities to establish on-bill financing programs, PA 342 authorized regulated electric and natural gas providers to create their own programs. These programs will allow customers to pay for the costs of their investment directly on their energy bill, keeping their energy bill and loan repayment information in the same place (State of Michigan 2016). As with Michigan's energy resource standard, on-bill financing as a policy is open to participation from any resident, but actual program availability depends on whether a utility service provider decides to offer a program. To date, on-bill financing programs have only been adopted in a few jurisdictions.

Energy Savings Performance Contracting

Michigan allows state and local governments to participate in energy savings performance contracts to help reduce their energy costs through cost-saving conservation measures. This statute provides a framework for government facilities to undergo an investment-grade energy audit to determine potential savings and recommend cost-saving measures (State of Michigan 2013). Again, this policy—though promoting energy efficiency in the state at a broad level—is not targeted to any specific sector or geography.

Federal Policies

Appliance and Equipment Standards Program

The earliest consumer-facing federal energy-efficiency policies began with the Energy Policy and Conservation Act of 1975 (EPCA). This act established the Energy Conservation Program, which instructed the U.S. Department of Energy (DOE) to create energy testing, labeling, and targets for consumer appliances and equipment. The program is now known as the Appliance and Equipment Standards Program and is implemented by the DOE's Building Technologies Office. It requires that appliances and equipment meet mandatory energy-efficiency and conservation standards. These standards apply to approximately 60 categories of appliances and equipment, including space heating and cooling, refrigeration, cooking, clothes washing and drying, lighting, and plumbing. The DOE regularly updates these standards and testing procedures, and upon completion of these tests, a product's energy use, its comparison to similar products, and its annual operating costs are listed on a Federal Trade Commission EnergyGuide label (OEERE n.d.a; ENERGY STAR n.d.).

Products covered by the appliance and equipment standards program represent approximately 90 percent of home energy use, 60 percent of commercial building energy use, and 30 percent of industrial energy use. The DOE estimates that these national efficiency standards saved customers over $63 billion on their utility bills in 2015 and will save over $1 trillion cumulatively by 2020. The DOE asserts that benefits of the program extend far beyond customer savings, allowing manufacturers to invest in energy efficiency without losing competitiveness and helping reduce regulatory burden by the use of a consistent, national standard (OEERE 2017).

The federal appliance and equipment standards, which began with EPCA, have been amended and expanded numerous times through several legislative acts. In 1979, targets developed by the DOE in the original EPCA from 1975 were established as standards. The National Appliance Energy Conservation Act of 1987, the Energy Policy Act of 1992, the Energy Policy Act of 2005, and the Energy Independence and Security Act (EISA) of 2007 all either added new products to be standardized or added new standards for products that were already being tested (OEERE n.d.b).

Federal Building Standards

Federal energy-efficiency policy extends beyond appliances and equipment. The EISA required that new federal buildings be designed to exceed the American Society of Heating, Refrigerating, and Air-Conditioning Engineers standards or the International Energy Conservation Code. The act also required new and replacement buildings to be designed using sustainable design principles. Additionally, the U.S General Services Administration committed that all federal buildings will be designed to meet or exceed Leadership in Energy and Environmental Design gold certification requirements and ENERGY STAR standards (NC Clean Energy August 21, 2018b). This policy applies to rural communities only to the extent that federal buildings are located in these communities.

Renewable Energy

Michigan Policies

Renewable Energy Standard

In 2008, the Michigan Legislature passed Public Act 295, the state's first renewable energy policy, which contained the following objectives:

a. Diversify the resources used to reliably meet the energy needs of consumers in this state.
b. Provide greater energy security through the use of indigenous energy resources available within this state.
c. Encourage private investment in renewable energy and energy efficiency.
d. Provide improved air quality and other benefits to energy consumers and citizens of this state (State of Michigan 2008).

An essential provision of PA 295 was the creation of a renewable energy standard, which required electric providers to obtain 10 percent of their electric supply from renewable sources by 2015. In 2009, each provider was required to file an initial renewable energy plan, describing how they intended to meet the renewable standard requirements. The MPSC reviews these plans every two years. Electric providers whose rates are regulated by the MPSC are required to file annual renewable energy cost reconciliation cases.

Electricity providers successfully achieved the renewable energy targets defined by PA 295. Building off this success, policymakers expanded the state's renewable energy standard to 15 percent by 2021 with interim standard of 12.5 percent in 2019 and 2020. This standard does not apply after 2021, but rate-regulated utilities have to specify how much renewable energy will be included in their portfolio through integrated resource plans and provide an explanation if their renewable energy output falls below the requirement (State of Michigan 2016).

Commercial renewable energy development related to Michigan's renewable energy standard has occurred in many portions of the state, but the majority of new renewable energy capacity has come through the development of wind farms in rural areas . Of the 2,271 MWs of renewable energy capacity added pursuant to the renewable energy standard, wind energy accounts for 1,925 MWs or nearly 85 percent. This wind development has taken place almost exclusively on agricultural land in rural areas, including Huron, Sanilac, Tuscola, Gratiot, Isabella, Mason, Missaukee, Cheboygan, and Delta Counties (MPSC February 15, 2019a).

Customer-owned Distributed Generation

PA 295 also established Michigan's first statewide customer-owned distributed generation policy, referred to as net metering, which allowed customers to own and operate electric generation sources in parallel with the grid (State of Michigan 2008). In 2016, the Michigan Legislature updated the state's customer-owned distributed generation policy and required the MPSC to phase out the existing net metering program.

Under the existing program guidelines, distributed generation customers receive credits for the electricity they send to the grid to offset their energy consumption, depending on the size of their system and its category.

The initial net-metering installations were broken into the following categories.

- **Category one:** These customers are considered "true net-metering customers." Category one projects are limited to ≤20 kW inverter-based systems. A true net-metering customer is credited the full retail rate for each kWh they supply to the grid. These credits are applied to the customer's bill, and any excess credits will be carried over to subsequent months.
- **Category two:** The second category of net-metering customer is a modified net-metering customer. Projects in category two are limited to 20 kW and up to 150 kW. Modified net-metering customers receive a credit for each kWh of excess electricity produced reimbursed at a rate determined by the commission. Category two projects are not subject to standby charges.
- **Category three:** Net metering projects between 150 kW and 2 MW are also considered modified net-metering customers. These customers must pay standby charges equal to the retail distribution rate applied to their imputed energy usage. Excess generation is eligible for bill credits at a rate determined by the commission (MPSC October 2018).

Before replacing the net metering policy, the MPSC was required to conduct a study to determine the equitable cost of service for customers who participate in distributed generation programs. The MPSC's study resulted in a new recommendation for compensating distributed generation customers. Each utility can propose their own distributed generation tariff in their next rate case filing.[6] The final determination over new tariffs will be decided on a case by case basis for each utility by the MPSC. Customers who currently participate in net metering can keep their existing net metering arrangements for ten years; however, new installations will be subject to the revised program tariffs (MPSC April 2018).

[6] DTE and the Upper Peninsula Power Company are the only regulated utilities with approved new distributed generation tariffs.

Federal Policies

Public Utility Regulatory Policies Act

Though not exclusively a renewable energy policy, the Public Utility Regulatory Policies Act (PURPA) in recent years has played a significant role in the development of commercial renewable energy projects. PURPA was created in the late 1970's with the goal of diversifying the nation's electricity supply both in terms of fuel source and ownership. To accomplish this, PURPA established a new class of electric generation called qualifying facilities. Qualifying facilities can be either small (80 MW or less) independent power producers that use hydro, solar, wind, biomass, waste, or geothermal; or cogeneration plants that produce electricity and useful steam heat. Through PURPA, qualifying facilities can enter into power purchase contracts with local utilities to sell their generation as long as the qualifying facilities cost does not exceed what the utility would otherwise pay (MPSC November 2017).

PURPA has evolved, to some extent, over the years in recognition of changes in how the nation's electricity grid operates, however the law remains in place. As renewable energy costs have declined precipitously in recent years, PURPA has become a primary tool for renewable energy development, especially for solar. Despite being a federal statute, much of PURPA's implementation falls to state regulators. Michigan has been grappling with PURPA for the past two years to determine how standard-offer contracts should be structured and what types of projects should be eligible for these contracts. The MPSC has issued updated requirements for each regulated utility to implement PURPA, and these plans will be reviewed every two years.

Developers have hundreds of PURPA projects in utilities' interconnection queues. The potential development of these proposed projects will likely impact the agriculture sector and rural communities, as solar development requires a large amount of land.

Renewable Energy Tax Incentives

The Energy Policy Act of 2005 was the first legislation to implement federal tax credits for residential energy production. This act was amended by the Energy Improvement and Extension Act of 2008 and the American Recovery and Reinvestment Act of 2009. These amendments also allowed commercial entities to receive similar tax credits for renewable energy investments; these tax credits are known as Business Energy Investment Tax Credits (ITC) (NC Clean Energy March 1, 2018). Today, taxpayers may claim up to 30 percent of qualified expenses for energy systems that serve the taxpayers' residences or businesses, including solar-electric systems, solar water-heating systems, fuel cells, small wind energy systems, and geothermal heat pumps. Eligible expenses include labor costs, assembly, installation, and building materials. The tax credits are valued at 30 percent for all systems installed in 2019, except geothermal electric systems for businesses, which begin at 10 percent. The value of tax credits either decreases to a lower value or expires in years beyond 2022, as shown below in Exhibit 25 (NC Clean Energy March 23, 2018).

EXHIBIT 25. Business Energy Investment Tax Credit Phase-out Timeline

Technology	2016	2017	2018	2019	2020	2021	2022	Future Years
PV, solar water heating, solar space heating/cooling, solar process heat	30%	30%	30%	30%	26%	22%	10%	10%
Hybrid solar lighting, fuel cells, small wind	30%	30%	30%	30%	26%	22%	22%	N/A
Geothermal heat pumps, microturbines, combined heat and power systems	10%	10%	10%	10%	10%	10%	N/A	N/A
Geothermal electric	10%	10%	10%	10%	10%	10%	10%	10%
Large wind	30%	24%	18%	12%	N/A	N/A	N/A	N/A

Source: NC Clean Energy 2018

Another tax incentive for renewable energy use is a Modified Accelerated Cost Recovery System. With this, businesses can accelerate the depreciation of their investments, allowing them to reduce their overall tax obligations in the short term. Properties eligible include solar technology, fuel cells, microturbines, geothermal systems, small wind turbines, and combined heat and power systems. Recently, the Tax Cuts and Jobs Act of 2017 increased bonus depreciation to 100 percent for qualified property built between September 27, 2017, and January 1, 2023 (NC Clean Energy August 21, 2018c).

Program Inventory and Overview

Policies represent one component of the ecosystem for energy-efficiency and renewable energy deployment. In most cases, customers are not interacting directly with the policies; instead, customers interface with the programs that have been established to implement policies. The following section of this report provides an inventory and overview of key programs that support energy efficiency and renewable energy. Similar to the policies discussed in the previous section, many programs in Michigan do specifically focus on the agriculture sector or rural communities. Where applicable, this section will highlight programs that have this focus.

Energy Efficiency

Michigan Programs

Utility Programs

As a result of the policy established by PA 295 of 2008, all natural gas and electric utility customers in Michigan are able to participate in energy-efficiency programs offered by their electric and natural gas service providers. In general, utility programs are divided into two broad categories: residential and commercial/industrial. Residential programs consist of five major categories: lighting; heating, ventilating, and air conditioning (HVAC); weatherization; energy education; and pilot programs. Commercial/industrial offerings include prescriptive and custom programs. Prescriptive programs provide rebates for specific equipment replacement, such as lighting, boilers, pumps, and compressors. Custom programs generally provide a rebate per kWh of electricity savings or per thousand cubic feet of natural gas savings for a comprehensive system or industrial process improvement (MPSC February 15, 2019b).

In 2018, there were six natural gas investor-owned utilities, eight electric investor-owned utilities , ten electric cooperatives, and 40 municipal electric utilities with approved plans, for a total of 64 natural gas and electric energy-efficiency plans.[7] For the 2018 program year, 55 of the 64 utilities in Michigan formally coordinated the design and implementation of their energy-efficiency programs through a collaborative process in order to reduce costs, create consistency, and improve understanding of program offerings. The other nine utilities (generally the larger utilities in the state) independently administered their own programs (MPSC February 15, 2019b).

The project team reviewed annual energy-efficiency program reports and plans for the state's three largest investor-owned utilities and the two collaborative energy-efficiency providers and presents the following overview of these energy-efficiency programming. To the extent possible, the team has identified programs targeted to the agriculture sector and rural communities.

Agricultural Energy-efficiency Programs

Targeted energy-efficiency programs for Michigan's agriculture sector are not universal, but there are several examples of utility programs for this customer segment. The following section describes these programs.

[7] Energy efficiency has been given several different names in Michigan over the past decade. PA 295 originally referred to it as energy optimization and PA 342 refers to it as energy waste reduction. In this report, the project team has opted to use energy efficiency in place of energy optimization and energy waste reduction. For ease, all the references have been changed to reflect this decision.

Consumers Energy

Consumers Energy has the most mature example of an agricultural energy-efficiency program. The company launched their program as a pilot through their broader commercial and industrial energy-efficiency offerings in 2011. In 2014, the program grew into an independent agricultural energy-efficiency program, starting with just two measures, and has grown to over 40 prescriptive measures since that time. The measures that are in highest demand tend to be applications for grain dryers, greenhouses, irrigation, and dairy operations.

Consumers Energy provided agricultural customers with targeted energy-efficiency programs in 2017. One of the utility's main categories of programs was the Comprehensive Business Solution Program. This program offered included an agricultural component among ten other components (e.g. new construction, compressed air, etc.). The Comprehensive Business Solution Program generated energy savings for all business customers through the promotion of high-efficiency electric and natural gas equipment (42 specific agricultural measures were eligible in 2017). Consumers Energy also provided technical assistance and incentives for participating agricultural customers through prescriptive and custom rebates. Program staff worked directly with agricultural customers to assist them in finding opportunities for energy improvement as well as associated incentives for project completion. In addition, the program collaborates with Michigan State University's Farm Energy Program to offer rebates for customers who have completed an energy audit on their facility.

Since 2014, the Comprehensive Business Solution Program has provided over $4,245,000 in incentives to commercial agricultural customers, completed more than 750 applications with commercial customers, and provided rebates for 74 USDA tier-two farm audits. In 2017, two commercial audits were conducted and 223 qualifying commercial farm incentive applications were processed. The program delivered $1,000 for energy audits, and $1,697,598 in project incentives were provided. Total investment in the Consumers Energy electric and natural gas energy-efficiency programs in 2017 was $166,348,052. In 2017, the project incentives for the agricultural component of the Comprehensive Business Solution Program represented 1 percent of this total.

The second agricultural program Consumers Energy provided in 2017 was the Residential Agriculture Program. The program was designed to offer residential agriculture customers incentives for energy-saving measures in retrofit and major renovation projects.[8] It provides participating customers the same level of rebates as the prescriptive and custom incentives from the Comprehensive Business Solutions Program. This program collaborated with Michigan State University's Farm Energy Program to offer incentives to customers who had an audit completed at their operation.

Since 2014, the program has provided more than $391,000 in incentives to residential agriculture customers, completed more than 215 projects with these customers, and provided rebates for more than 75 USDA tier-two farm audits. In 2017, three residential agricultural energy audits were conducted, 34 qualifying residential farm applications were processed, and $1,361 in audit

[8] Note that on Consumers Energy's system, farms are sometimes classified as a commercial customer account and sometimes as a residential customer account (and sometimes have meters on the property that are associated with each category). Consumers Energy provides EWR programs to customers in either category.

incentives and $73,734 in project incentives were provided. Total electric and natural gas investment in this program in 2017 was $408,148. This represents 0.2 percent of Consumers Energy's 2017 electric and natural gas energy efficiency program total investment.

Consumers Energy's two agriculture programs are fairly comprehensive, serve both commercial and residential customers, and cover electric and natural gas measures.[9]

Consumers Energy's 2018–2021 energy-efficiency plan includes the same agricultural programs it offered in 2017—an agricultural component in the Comprehensive Business Solution Program and the Residential Agriculture Program. The company does not provide specific budgets for each component of the Comprehensive Business Solutions Program so it is not possible to calculate the percentage of the total budget that is being spent on the agricultural component. The total cost of the energy efficiency plan is approximately $172.9 million in 2018, $170.0 million in 2019, $171.7 million in 2020, and $173.6 million in 2021. Annually, the Residential Agriculture Program is planning to spend 0.1 percent of the total plan budget, representing a decrease in program spending compared to the 2017 program year.

DTE

DTE's 2016 energy-efficiency report included two agriculture programs. The objective of the Commercial and Industrial (C&I) Prescriptive Program is to provide predetermined measures and incentives to C&I customers for the installation of energy-efficient equipment. These incentives were designed to encourage commercial and industrial business customers to install energy-efficient measures in existing facilities in an effort to reduce overall energy consumption and save money on their energy bills. The C&I Prescriptive Program included an agriculture-focused application that assisted facilities with becoming more efficient with both electric and natural gas. DTE does not provide data on specific expenditures for each application of the C&I Prescriptive Program, so it is not possible to calculate the percentage of the total energy-efficiency expenditures devoted specifically to the agricultural component.

The second agriculture program offered by DTE is the agriculture pilot. This program was included in DTE's settlement in their electric rate case number U-17762. In this settlement, DTE agreed to adopt the prescriptive agricultural efficiency measures submitted by the Michigan Agri-Business Association. Working cooperatively with MABA, the pilot project is testing additional agribusiness-focused energy optimization measures, and new agribusiness applications for an existing energy-efficiency measures. Two entities—Co-op Elevator and the Michigan Dairy Association—were chosen for the pilot, which has four components: energy benchmarking, energy inventory and mapping, energy assessment, and the development of a strategic energy plan. The Co-Op Elevator and the Michigan Dairy Association pilots were completed in 2017. DTE does not provide specific expenditures broken down by pilot program, so it is not possible to calculate a percentage of total investment devoted to the agriculture pilot. Without data on program expenditures, it is difficult to determine the program's reach and level of impact.

[9] Electric and/or gas measures are covered in areas where Consumers Energy provides electric and/or natural gas service.

DTE's 2018–2019 energy efficiency plan continues the C&I Prescriptive Program and the agriculture pilot. This plan does not provide data on specific budgets for each application of the C&I Prescriptive Program or for the agriculture pilot program, so it is not possible to calculate the percentage of the total investment that is planned for the agricultural sector.

Michigan Electric Cooperative Association

The Michigan Electric Cooperative Association (MECA) Collaborative administers energy-efficiency programming for 12 electric cooperative and municipal utility members. The collaborative's members are Alger Delta Cooperative Electric Association, Cloverland Electric Cooperative, Great Lakes Energy Cooperative, HomeWorks Tri-County Electric Cooperative, Midwest Energy and Communications, Ontonagon County Rural Electrification Association, Presque Isle Electric and Gas Co-op, Daggett Electric, City of Escanaba Electric Department, Marquette Board of Light and Power, Village of Newberry Water and Light, South Haven Department of Public Works, and the City of Stephenson.

The MECA Collaborative 2017 energy-efficiency report included one agricultural program. The Residential Farm Services Program provides prescriptive incentives to residential farm members/customers for the installation of energy-efficient equipment for numerous agricultural applications, including, lighting, motors and drives, controls, heating, refrigeration equipment, and custom incentives for energy-efficient equipment and controls. Having a custom incentive allows efficiency measures and systems to be installed for situations specific to that member's/customer's application or process. The MECA Collaborative invested $100,699 in the Residential Farm Services Program. Total energy-efficiency program investment for the same year was $9,050,888. This means approximately 1 percent of the total investment was spent on the cooperative's Residential Farm Service Program.

The MECA Collaborative 2018–2019 energy-efficiency plan included the same Residential Farm Services Program from 2017. The program's budget for electric cooperative members in the 2018–2019 plan is $131,886 in 2018 and $131,886 in 2019. The total budget for the electric cooperatives' portfolio was $10,128,173 in 2018 and $10,176,467 in 2019. As a result, approximately 1 percent of the 2018 budget and 1 percent of the 2019 budget was set aside for the Residential Farm Services Program. The MECA Collaborative's municipal utility members' 2018–2019 budget for the Residential Farm Services Program is $2,315 in 2018 and $2,315 in 2019. The total budget for the municipal utilities' portfolio was $1,077,287 in 2018 and $1,080,862 in 2019. Thus, approximately 0.2 percent of the 2018 budget and 0.2 percent of the 2019 budget was reserved for the Residential Farm Services Program.

Indiana and Michigan Power Company

Indiana Michigan Power Company (I&M) offers agricultural energy-efficiency measures within its commercial and industrial portfolio through the Financial Incentive Qualitative Performance Component. I&M targets the small-business segment of agriculture sector, including food processing, dairy production, crop/fruit growing, wine production, etc. The company has three goals for this program: program outreach, customer energy-efficiency education, and enhanced small-business customer experience. Through the program, the company had an opportunity to teach this sector about energy efficiency and introduce them to I&M's energy-efficiency incentives and rebates. This customer segment is a relatively small portion of I&M's customer base.

I&M's outreach efforts during the 2017 program year included conducting nearly 100 customer/business visits and mailing more than 500 postcards. The company's 2017 report does not provide specific spending information for this program.

I&M's 2018–2019 energy-efficiency plan does not include mention of any programs specifically targeting agriculture customers.

Efficiency United

Efficiency United (EU) is comprised of 16 natural gas and electric utilities. The members are Alpena Power Company, Baraga Electric Utility, Bayfield Electric Cooperative, the City of Crystal Falls, the City of Dowagiac, Gladstone Department of Power and Light, Harbor Springs Electric Department, Hillsdale Board of Public Utilities, L'Anse Electric Utility, Michigan Gas Utilities, Negaunee Electric Department, Norway Department of Power and Light, SEMCO Energy Gas Company, Upper Peninsula Power Company (UPPCO), and Upper Michigan Energy Resources. EU's annual report does not specifically mention any agriculture programs during the 2017 program year.

Rural Energy Efficiency Programs

As presented in the rural demographics portion of this report, 20.6 percent of Michigan's population lives in rural communities. Yet, there has been little effort to specifically target energy-efficiency programs to this population or to determine the distribution of program benefits to the rural population. The project team reviewed utilities' energy-efficiency reports from 2017 and their 2018–2019 program plans to determine whether and how rural customers are being engaged by program administrators. An overview of these utility programs is provided below. The project team has worked with several utilities to gather information about their program offerings and the delivery of their programs to customers in rural communities.

Consumers Energy

Consumers Energy's 2017 energy-efficiency report does not indicate that any of the Consumers Energy programs specifically target the rural sector. While, most of the company's program offerings (e.g., ENERGY STAR Appliance, Income Qualified, Business Efficiency Report) are applicable to all customers, including rural customers, the program does not specify how the company will reach these customers. Consumers Energy's plan for 2018–2019 also does not indicate any specific efforts to target the rural population.

DTE

DTE's 2017 energy-efficiency report indicates that the company does not specifically target rural customers with its programs. Their 2018–2019 energy-efficiency plans also do not indicate that DTE will provide programs that specifically target the rural sector, but most of the company's proposed programs are generally applicable to all customers, including rural customers (e.g., Multifamily Program, Low-Income Program, C&I Prescriptive Program).

Michigan Electric Cooperative Association

The MECA Collaborative's member cooperatives and municipal utilities serve predominately rural populations. While this population is not considered separately in collaborative's annual energy-efficiency report, it is expected that the majority of the energy-efficiency programs provided by the MECA Collaborative serve rural customers. Additionally, future energy-efficiency planning efforts consider serving rural customers due to the nature of partners' service territories.

Indiana and Michigan Power Company

I&M's energy-efficiency program shares similar characteristics with Consumers Energy and DTE, as the utility serves a mix of rural and urban areas. I&M's annual energy-efficiency report does not indicate that the company emphasizes serving rural customers. In addition, the company's future energy-efficiency plans do not contain an emphasis for rural customers.

Efficiency United

Many of EU's member utilities have largely rural service territories, which likely contributes to a high percentage of their energy-efficiency programs being provided to rural customers. However, their annual energy-efficiency report does not specify the proportion of their program that serves rural customers. EU's energy-efficiency plan similarly does not differentiate between rural customers.

Michigan Farm Energy Program

Energy is an essential input in agriculture operations and presents an opportunity to reduce costs through improving efficiency. In 2012, Michigan State University researchers found that every $1 spent on efficiency programs results in savings of $3 in energy costs. As such, energy-efficiency improvements can result in significant savings on farms, in some cases as much as a 30 percent reduction in total energy cost, equivalent to statewide savings of over $500 million. Yet, Michigan State University estimates that, at most, only 0.5 percent of Michigan farms have had energy-efficiency audits to help identify areas for potential savings.

The Michigan Farm Energy Program (MFEP) was created in 2007, but the program was formally established in 2009 with the purpose of assisting farms and rural small businesses in reducing their energy use while maintaining or improving overall productivity, profitability, safety, and operator comfort as well as maintaining the technical excellence and acceptance of its energy audits and expertise (Gould and Proctor February 2019a). The MFEP provides several different functions in pursuit of its mission, including training for new auditors, continuing education opportunities for existing auditors, audit certification, technical support for outreach and extension services, hosting demonstrations, and research and development.

Since 2010, the MFEP has certified 32 energy auditors. These auditors completed 340 energy audits and 154 renewable energy assessments through 2017. These audits are accepted by all state, federal, and utility energy-efficiency programs, and several Michigan utilities offer a rebate to customers who complete a MFEP audit.

Michigan Saves

Michigan Saves is a nonprofit organization whose mission is to stimulate and support investment in renewable energy and energy efficiency for homes, businesses, and public buildings. Established in 2009 through a grant from the MPSC, Michigan Saves helps customers connect to a statewide network of authorized contractors. The organization operates as a green bank, making affordable financing and incentives available through partnerships with private lenders and energy providers (Michigan Saves n.d.a).

Through 2017, Michigan Saves has financed more than 996 commercial and 15,959 residential projects throughout the state, totaling $143,857,355 in investment in energy efficiency and renewable energy and an estimated $11,364,884 in utility bill savings for customers (Michigan Saves n.d.b). While Michigan Saves has statewide reach, the organization does not report on the extent of participation from rural communities or the agriculture sector.

Michigan Energy Office Programs

The Michigan Energy Office (MEO) offers a number of programs for Michigan customers to help them make investment in energy efficiency and renewable energy. These programs are administered through a combination of incentives, grants, and loans, and are targeted at different customer groups. Most of the MEO's programs are available statewide, but there are several programs that are targeted to specific sectors or populations. An overview of current programs that would be eligible to agriculture and/or rural communities is provided below (MEO n.d.).

Building Operator Certification Incentive

- Incentive payments are available to eligible public and non-profit building operators attending the Building Operator Certification training. This training is a useful tool for facilities personnel to help manage their building's connected systems and better control energy consumption. This program is available statewide.

Agriculture and Rural Communities Energy Incentive Program

- Financial incentives are offered to farms, agribusinesses, public entities, and rural small businesses for energy-related implementation projects recommended from energy audits and assessments. This program is designed to help customers overcome some of the financial barriers to implementing recommendations from an energy audit. This program is specifically targeted for the agriculture sector and rural communities.

Community Energy Management Program

- The Community Energy Management Program provides incentives to eligible municipalities and public schools in economically distressed communities to accelerate the use of energy efficiency and renewable energy. Projects must benefit public sectors. This program specifically targets low-income communities, communities impacted by coal plant retirements, Project Rising Tide communities, and communities in the Upper Peninsula.

Combined Heat and Power Technical Assistance Program

- In 2018, the MEO completed a combined heat and power (CHP) roadmap and created a technical assistance program to incentivize CHP implementation and adoption in response to recommendations from the roadmapping process.

Small Manufacturers Energy Waste Reduction Incentive Pilot

- This program offers rebates to small manufacturers with fewer than 50 employees to implement energy efficiency completed by July 31, 2019. Rebates are available and participating manufacturers are required to match funding at a 1:1 ratio. Eligible activities include energy audits, trainings, energy monitoring systems, HVAC system repair, diagnostic equipment, and other efficiency measures. This program is available statewide.

ENERGY STAR Certification for Public Educational Facilities

- The MEO offers an incentive for public education facilities to become ENERGY STAR certified. This incentive program funds a licensed professional to examine facilities and complete the ENERGY STAR application. This program is available statewide.

Michigan Match Assistance Pilot Program

- This program provides matching funds to eligible Michigan businesses to partially cover the cost-share requirement for a federal clean energy technology development grant. Businesses can receive up to $25,000 annually for up to three years and are required to match funding from the MEO at a 4:1 ratio. This program is available statewide.

Energy-efficiency and Renewable Energy Loans for Michigan Businesses

- The MEO offers small businesses in Michigan loans for energy-efficiency upgrades and renewable energy project implementation. This effort is directed at businesses seeking to upgrade and/or install clean energy technologies. Loans totaling $1.5 million are available, and loan requests should be between $50,000–$350,000 and limited to supplies, materials, and equipment costs only (MEO n.d.). This program is available statewide.

Property Assessed Clean Energy Financing

The Property Assessed Clean Energy (PACE) loan is a financing tool that enables Michigan property owners to pay for energy-efficiency, water-efficiency, and renewable energy upgrades. PACE allows property owners to receive funding up front for energy-saving upgrades on their facilities and pay the PACE loan back through a special assessment on their property taxes. PACE is available to commercial and industrial property owners, and, to date, 25 counties and 15 townships and cities have adopted policies enabling PACE projects in their communities. Several rural counties have adopted PACE as well, though it is not specifically targeted at rural communities (Lean and Green Michigan 2019).

Small Business Association of Michigan Energy Solutions

The Small Business Association of Michigan (SBAM) created their Energy Solutions program in partnership with DTE and Consumers Energy to help get more business owners to invest in energy-saving measures. The Energy Solutions program has a dedicated energy advocate who conducts outreach and works directly with small businesses to access available energy-efficiency services. This program is currently only available to select customers (SBAM n.d.)

Michigan Energy Assistance Program

The Michigan Energy Assistance Program (MEAP) was created in 2013 to help eligible low-income customers with their energy needs. This program leverages state and federal energy assistance funding to help customers pay their home energy bills and access additional services designed to promote self-sufficiency (MPSC n.d.b). One aspect of the self-sufficiency services provided to low-income customers

through MEAP has been home energy kits containing low-cost energy-efficiency measures, such as weather-stripping, LED lightbulbs, and window film. In the 2017 program years, more than 70,000 Michigan households received services designed to reduce their home energy use (MAE and MPSC n.d.)

Federal Programs

Rural Energy for America Program

The USDA offers support for energy-efficiency and renewable energy investment through the Office of Rural Development's Rural Energy for American Program. This program provides guaranteed loans and grants for energy-efficiency and renewable energy investment for small businesses in rural areas or agricultural producers. The purpose of this program is to increase national energy independence and decrease overall energy costs. Funds may be used for purchasing, installing, and constructing energy-efficiency improvements, including HVAC systems, insulation, lighting, cooling and refrigeration, and more. Funding types include loan guarantees for loans up to 75 percent of project costs, grants up to 25 percent of project costs, and combined grants and loans up to 75 percent of project costs. Loans range from $5,000 to $25 million while energy-efficiency grants range from $1,500 to $250,000. To receive any of these options for energy-efficiency project funding, an energy audit or assessment must be completed (USDARD n.d.a). During fiscal year 2018, Michigan pulled in $1,039,929 in REAP funding, the tenth most of any state, split between the 35 loans given to Michigan businesses and residents, with an average loan amount of just under $30,000 (USDARD n.d.b).

Weatherization Assistance Program

The USDA is not the only federal department providing assistance to agricultural and rural communities. The DOE's Office of Energy Efficiency and Renewable Energy (OEERE) operates the Weatherization Assistance Program (WAP), which assists low-income households by increasing the energy efficiency of their homes. The DOE distributes WAP funding across the country, where states and territories then contract with over 700 local agencies to provide household weatherization services and products to eligible households. The WAP spurs economic growth, producing new jobs and technologies, while also reducing environmental impact and creating better health outcomes for recipients. WAP funds can be used for weather-stripping doors and windows and also for upgrading building envelopes, heating and cooling systems, electrical systems, and electric baseload appliances (OEERE n.d.c).

Low Income Home Energy Assistance Program

The U.S. Department of Health and Human Services (DHHS) also has a program assisting families with energy-efficiency costs. The Low Income Home Energy Assistance Program (LIHEAP) is a program in the DHHS Office of Community Services (OCS) that provides families with funding to cover home energy bills, energy crises, and weatherization- and energy-related minor home repairs. . Eligible homes must make between 110 and 150 percent of the federal poverty guidelines, and the OCS is directed to prioritize households with greater home energy needs relative to household size and expenses, as well as households with elderly, disabled, and/or young members (OCS 2018).

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) is a program provided by the Natural Resources Conservation Service (NRCS) of the USDA. The program provides agricultural producers with financial and technical assistance to address natural resource concerns. This assistance can help improve water and air quality, conserve water, reduce soil erosion and sedimentation, and improve or create wildlife habitat.

The program is voluntary and producers receive one-on-one assistance with the development and implementation of their projects, otherwise known as conservation practices. The NRCS offers approximately 200 practices to producers on farms, ranches, and forests (NRCS n.d.a).

One of the services offered through EQIP is the On-farm Energy Initiative. This initiative helps agricultural producers make energy-efficiency improvements on their operations. Participants in the initiative develop an agricultural energy management plan with an NRCS-certified technical service provider then submit assistance requests for energy-efficiency improvements, such as lighting, grain dryers, irrigation pumps, heating and refrigeration units, and more (NRCS n.d.b).

Conservation Stewardship Program

Another energy-efficiency program offered through the USDA's NRCS is the Conservation Stewardship Program (CSP), which provides agricultural producers with conservation assistance. Conservation efforts can include grazing management, extending filter strips, and strategic planting of grass and crops, all directed at improving the efficiency and sustainability of agricultural operations and responsible land stewardship. Participants meet and consult with an NRCS planner to evaluate the participant's current conservation efforts. The NRCS planner then provides the participant with steps the participant can take to improve or introduce conservation efforts (NRCS n.d.c). One type of service offered in the CSP is an energy enhancement, which can include reducing fuel use, using different types of fertilizers, improving energy feedstock production, and upgrading farming equipment (NRCS n.d.d).

Renewable Energy

Michigan Programs

Customer-owned Distributed Generation

Michigan customers can participate in programs to build and own their own renewable energy generation sources through Michigan's customer-owned distributed generation policy. Customer-owned generation programs for regulated utilities are administered by the MPSC and implemented by individual electric service providers. To enroll in a distributed generation program, a customer must submit an application to their utility, and if it is approved customers can proceed with installing their renewable energy system, subject to the MPSC's generator interconnection rules.

Program participation is limited to 1 percent of an electric utilities' average in-state peak load for the preceding five years, though a utility can voluntarily exceed this limit with the MPSC's approval. Customers across the state can access distributed generation programs through their electric service provider until their provider has reached the program participation limit, though currently, the only utility to reach their participation cap has been the UPPCO.[10] The average cap space remaining for the remaining six rate-regulated electric providers in the state is 77 percent (MPSC October 2018).

[10] The MPSC recently approved a settlement agreement with the UPPCO to expand its distributed generation program from 1 percent to 2 percent.

Community Solar

Another program that enables customers to choose renewable energy is the community solar model. This program, in essence, blends commercial-scale renewable energy with customer-owned generation is the community solar model. Community solar—or shared solar—allows customers who otherwise may not have the opportunity to invest in renewable energy to purchase a portion of the output from a larger solar installation and receive a credit for the electricity generated (GLREA 2014). Community solar programs have recently begun to gain traction in Michigan, with more customers looking for opportunities to purchase renewable energy. As more customers take advantage of these programs, utilities are recognizing that these programs can serve several priorities, such as satisfying customer demand, diversifying energy supplies, and supporting a cleaner environment. Community solar projects have been developed by large investor-owned utilities, electric cooperatives, and municipal utilities, and to date, five community solar programs are in operation in Michigan. Customers' ability to participate in community solar programs is determined by their electric service provider and whether community solar arrays are fully subscribed.

Clean Energy for Low-income Communities

The MEO hosts the Clean Energy for Low-income Communities pilot program, which pairs energy efficiency with solar access to help low-income households reduce utility bills while putting them on a path toward energy self-sufficiency. The pilot has partnered with the Cherryland Electric Cooperative and the Village of L'Anse, with a future goal of partnering with an investor-owned utility. With the positive reception of the program, the MEO is considering expanding beyond the pilot.

Michigan Saves

Michigan Saves' program offerings for residential and commercial customers described in the energy-efficiency section above are also available to customers who want to invest in renewable energy.

Property Assessed Clean Energy

PACE programs in Michigan can also be used for customers to invest in renewable energy as well as energy efficiency. As with its efficiency projects, PACE programs offer funding for renewables that can be paid back through a special assessment on their property taxes.

Michigan Energy Assistance Program

In addition to providing energy assistance through education and low-cost energy efficiency, the MEAP has recently initiated a pilot program to help low-income customers choose renewable energy. This program is operated by the Superior Watershed Partnership through grant funding from MEAP. The goal of the pilot is to build up to 15 solar projects for low-income customers in the Upper Peninsula that will reduce the amount of energy these individuals have to purchase on their own and have a big impact on their ability to afford their energy bills (MPSC n.d.c*)*.

Federal Programs

Rural Energy for America Program

The USDA's REAP also provides guaranteed loans and grants for renewable energy systems for small businesses in rural areas or agricultural producers. Funds may be used for purchasing, installing, and constructing renewable energy systems, including biomass, geothermal, small hydropower, hydrogen,

tidal, wind, and solar energy systems. The relative funding and loan guarantee restrictions are the same as those for energy-efficiency funding. Renewable energy loans range from $5,000 to $25 million, while grants range from $2,500 to $500,000 (USDARD n.d.a).

Program Evaluations

The project team reviewed available evaluations of programs targeted to agricultural and rural customers to understand program performance to date. In addition, these evaluations could include lessons or recommendations that have informed subsequent implementation efforts.

Although the existing policy framework provides a comprehensive structure that includes rural areas of the state, the project team located very few evaluation reports that specifically addressed rural or agricultural programs. The prevalent approach for utilities has been to focus on overall implementation and evaluation of residential and commercial energy-efficiency programs, and with few exceptions, the utilities rarely specifically focus on rural or agricultural customers. Overall, evaluations have found programs to be cost-effective, but the results do not indicate specific data for rural or agricultural customers.

The few program evaluations relating to rural or agricultural customers were conducted for Consumers Energy, Efficiency United, the MECA Collaborative, and SEMCO ENERGY Gas Company. Highlights of evaluation findings and recommendations are included in this section.

Consumers Energy

Agriculture Energy Efficiency Pilot: Evaluation Report (2012)

The Agriculture Energy Efficiency Pilot evaluation report, prepared by EMI Consulting, contains the results of the program's process evaluation. The pilot program, implemented from 2010 to 2013, sought to encourage energy-efficiency improvements in the agricultural sector by incentivizing energy-efficiency measures for agricultural customers. The pilot covered all varieties of agricultural activities, including, but not limited to, dairy farming, agricultural greenhouses, small and large commercial farms, and grain drying systems. Seeking to tap the agricultural market's potential for energy savings, incentives for the installation of energy-efficiency measures and financial assistance for energy audits were offered. The evaluation informed Consumers Energy's decision to transition from a pilot to a full-scale program in 2014.

The evaluation's specific objectives were to:

- Determine the best practices in agriculture energy-efficiency programs with respect to incentive structure, program delivery, marketing, and outreach by comparing the pilot with other agriculture energy-efficiency programs
- Characterize the agricultural energy-efficiency market in respect to the potential for the program as it applies to specific agricultural applications
- Assess the effectiveness of program design, resource allocation, and delivery
- Describe participant awareness of and experience with the pilot, and identify drivers and barriers of participation
- Review energy savings calculations, assumptions, and supporting program documentation
- Develop recommendations for improvements and adjustments to program processes as needed

Toward these objectives, the evaluation team conducted a series of in-depth interviews with program and implementation staff, three interviews with experts on the Michigan agriculture industry, and 29 online surveys. Additionally, the evaluation conducted a review of agricultural energy-efficiency best practices.

Key findings included:

- The potential for energy efficiency in Michigan's agricultural sector is great. Consumers Energy services most of the Michigan's agricultural industry, including four of the state's top-producing agricultural counties. Moreover, current research on agricultural energy-efficiency potential coupled with analysis of farm energy audits and farmer survey results points to a large portion of unrealized, achievable agricultural energy savings.
- The audit component of the pilot (performed by certified auditors from the MFEP) lacked specific documentation of savings opportunities and were inadequate to substantiate any future savings claims for custom agricultural projects. While the audits are a primary means by which agricultural customers can be introduced to energy efficiency, the audits did not support determination of custom incentive eligibility through the Business Solutions Program.
- Cost constraints are viewed as the main barrier to participation for agricultural customers. As seen in other customer segments, agricultural customers either do not have funds to invest in energy-efficient equipment or are hesitant to borrow money for anything that is not directly associated with improved operations or increasing productivity.

Based on the pilot results, Consumers Energy transitioned the pilot to a targeted program for agricultural customers in its regular portfolio of energy-efficiency programs.

Agriculture Energy Efficiency Program: Trade Ally Interviews (2014)

Subsequent to full-scale implementation of the Agriculture Energy Efficiency Program, Consumers Energy commissioned EMI Consulting to conduct research with participating trade allies. To help Consumers Energy optimize the Business Solutions Agriculture specialty program, EMI Consulting completed in-depth interviews with 11 contractors who work with agricultural customers.

The contractor interviews yielded the following findings:

- For those who had difficulty with the program, barriers to participation are rooted in skepticism of Consumers Energy and receiving rebates as well as in difficulty reaching the right person to address questions about rebates.
- Contractors expressed a desire for Consumers Energy to align outreach with the seasonal nature of most agricultural work.
- Contractors felt most rebates were well-aligned with customers' needs.
- Some agriculture customers do not have access to three-phase power, and they feel this limits their ability to install energy-efficiency measures.

Agriculture Energy Efficiency Program: Participant Interviews (2015)

EMI Consulting conducted in-depth interviews with 11 program participants as described in Exhibit 26.

EXHIBIT 26. Consumers Energy Agriculture Energy-efficiency Program Participants

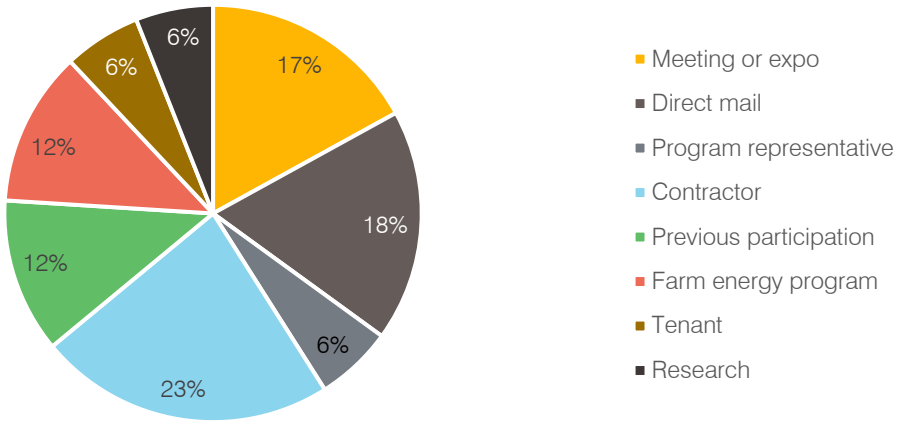
Farm Type	Measures Installed	Number of Respondents
Field crops/irrigation	• MSU Audit • VFDs on irrigation • Grain dryers	5
Dairy	• Refrigeration tune-up • LED lighting	3
Greenhouse	• Heat curtains	1
Livestock/boarding	• VSDs • LED lighting	2

Source: EMI Consulting 2014

Overall, the evaluation found that agriculture participants are highly satisfied with the program, rating the program from 7.9 for savings achieved to 9.2 for equipment performance (on a scale of one to ten). Of the 12 program participants interviewed, three participants reported issues timing their projects with the program's end-of-year schedule and the requirement to complete the installation by a specified deadline. Those participants that received an audit reported that the MSU auditor was informative and helpful with understanding Consumers Energy rebates.

Exhibit 27 shows the wide variety of channels though which participants learned about and engaged with the program

EXHIBIT 27. Channels of Program Awareness and Participation



Source: EMI Consulting 2014

Half of the agriculture customers interviewed stated that energy efficiency is a high priority for their operations driven by cost considerations. Participants are interested in reliable estimates of expected energy and cost savings, particularly those informed by real-life examples. The most frequent request for additional information or services included information on project paybacks or related case studies.

Efficiency United and the MECA Collaborative

Process Evaluation of Electric and Natural Gas Energy-efficiency Programs (2011)

KEMA, Inc. (now DNV GL) conducted a process evaluation of the 2011 Efficiency United and energy optimization (EO) portfolios of energy-efficiency programs operated by EU and the MECA Collaborative, respectively.[11] This evaluation is pertinent to the focus of this project because nearly all of the territory served by Michigan Community Action (MCA), EU, and MECA Collaborative programs is in areas considered rural in the state. Programs covered by this evaluation include:

- Residential and Small Business ENERGY STAR Products (ESP) Program
- Residential Appliance Recycling (RAR) Program
- Residential HVAC Program
- Residential Low-income (RLI) Program
- Residential Audit and Weatherization (A&W) program
- Multifamily Program
- Think! Energy Education Program
- Commercial and Industrial Program
- Multiple residential and C&I pilot programs

To guide the evaluation process, KEMA used data collected from 73 in-depth interviews with individuals involved in implementing the EU and EO program portfolios. In addition, surveys were conducted with selected participants from each program as well as with the general population of residential customers (nonparticipants) in the MECA Collaborative and MCA service territories.

The evaluation did identify several challenges reaching rural customers with energy-efficiency programs, including:

- Lack of suitable Internet access
- Long driving distance for customers to reach participating retail chains and retailers that stock high-efficiency equipment
- Customer resistance to newer products (e.g., adoption of energy-efficient lighting technologies)
- Capital spending decisions are often made at far away corporate offices (for the commercial customers, especially chain stores)
- Lack of specific offerings for farming and the forest products industry in the C&I program

The evaluation yielded several recommendations focused on expanded marketing investments and increased education of customers and market actors, including retailers and contractors, about energy-efficient technologies and incentives. Expanded quality control procedures and general improvements were recommended for several programs in the portfolio.

[11] Reference Evaluation Report

Efficiency United and SEMCO ENERGY Gas Company

Phase One: Process Evaluation of Electric and Natural Gas Energy-efficiency Programs (2015–2016)

A process evaluation report for the EU (under contract to MCA) and SEMCO ENERGY Gas Company portfolio of energy-efficiency programs was conducted by DNV GL (formerly KEMA) for the program years 2015 and 2016 (DNV GL 2016). Programs covered by this evaluation include:

- Residential Home Performance (HP) Program
- Residential ENERGY STAR Products (ESP) Program
- Residential Income Qualified Program
- Commercial and Industrial Program

The evaluation also addressed cross-cutting program marketing and delivery issues. DNV GL conducted in-depth interviews with the utilities whose customers are served by the programs and surveyed program participants (residential and C&I) and nonparticipants (C&I).

As an example of the results from this evaluation, findings for the HP Program are highlighted.

The evaluation found that satisfaction with the HP program amongst customers had increased significantly from 2013 to 2016. Customers reported that contractors were the primary source of information about the program, which is consistent with the program design, as the program relies on contractors to connect with customers and share information about the available rebates.

Phase Two: Process Evaluation of Electric and Natural Gas Energy-efficiency Programs (2015–2016)

A second phase of process evaluation of the Efficiency United and SEMCO ENERGY Gas Company portfolio of energy-efficiency programs was conducted for the 2015 and 2016 program years (DNV GL 2017). The second phase of the evaluation addressed these program elements:

- Residential and Small-business ENERGY STAR Products Program
- Residential Home Performance Program's window contractors
- Residential Home Performance program's "drop-out" HVAC contractors
- Community action agency (CAA) managers and/or administrators
- Residential Income-qualified Program Food Pantry Lighting Program

DNV GL completed in-depth interviews with program managers and stakeholders (contractors, retailers, CAA representatives, etc.) during the fourth quarter of 2016 and the first quarter of 2017 to inform the evaluation.

Findings for the Residential and Small-business ENERGY STAR Products Program showed that sales of LED lighting increased dramatically at participating stores from approximately 29 percent in 2015 to 80 percent in 2016, indicative of rapid market transformation. The evaluation did not determine how much of this change was attributable to the program itself or other factors, but the high volume of discounted products indicates some effect. Lighting retailers were satisfied with the level of rebates and felt that current incentive amounts for compact fluorescent bulbs and LEDs were adequate to encourage their customers to purchase those bulbs. However, the evaluation identified that retailers were having difficulty

maintaining adequate stock of discounted products. Observations made while conducting interviews with retail managers found several items with EU signage that were unavailable. Program field staff also reflected the view that the time required to restock rebated products was too lengthy. While this may be a sign that program-discounted products are experiencing healthy sales, it can also result in lost savings opportunities and customer frustration when other, nondiscounted (and potentially less-efficient) products are purchased instead.

Another issue raised in this evaluation is the prevalence of propane customers. It was noted that the high use of propane in rural areas, and in the Upper Peninsula service territory particular, precluded provision of heating-related measures to many customers. Michigan currently has no policy framework for energy efficiency relating to propane providers.

Impact Evaluation of Electric and Natural Gas Energy-efficiency Programs (2016)

DNV GL conducted an impact evaluation of the EU and SEMCO ENERGY Gas Company energy-efficiency programs.[12] The impact evaluation was conducted by from May to October 2016. While not specifically focusing on rural or agricultural programs, this evaluation is pertinent to this project because much of EU and SEMCO's service territories encompass rural areas in Michigan.

The goals of the impact evaluation were to:

- Provide independent expert evaluation to verify gross energy savings from each program as required by Public Act 295
- Document the lifetime energy savings achievements and report those findings to the MPSC
- Validate the deemed savings and average life of energy-efficiency measures for eligible energy-efficiency measures included in the Michigan Energy Measures Database

The evaluation verified measure installation, calculation method for energy savings, and documented operating characteristics of measures rebated through the programs. The evaluation measures savings using a method called gross savings adjustment (GSA) factors that measure the difference between evaluation-verified and program-reported energy savings. GSA factors ranged from 83.7 percent for the ENERGY STAR products program to 103.3 percent for the C&I program. For programs with GSA factors less than 100 percent, recommendations include improved documentation and customer education to ensure that measures are accurately accounted for and properly installed. The high GSA factor indicates a history of successful projects, and this evidence of savings could be influential for farmers or other managers assessing potential projects.

Lawrence Berkley Laboratory Evaluation of Programs Implemented by Publicly Owned Utilities

The evaluation team received a draft report from Lawrence Berkeley National Laboratory that examined the cost of saving electricity by publicly owned utilities (i.e., public power districts, municipal utilities, etc.) around the nation, many of which serve rural areas. Their analysis found that energy-efficiency

[12] EVALUATION OF ELECTRIC AND NATURAL GAS ENERGY OPTIMIZATION PROGRAMS Final Gross Savings Adjustment Factors Michigan Community Action, SEMCO ENERGY Gas Company, January 10, 2017

programs being delivered by these entities were very cost-effective, with an overall average cost of saved electricity of 2.5 cents/kWh. While the laboratory did not provide specific data by program type, the report noted that agricultural projects tended to be low cost (Hoffman et al. June 2018).

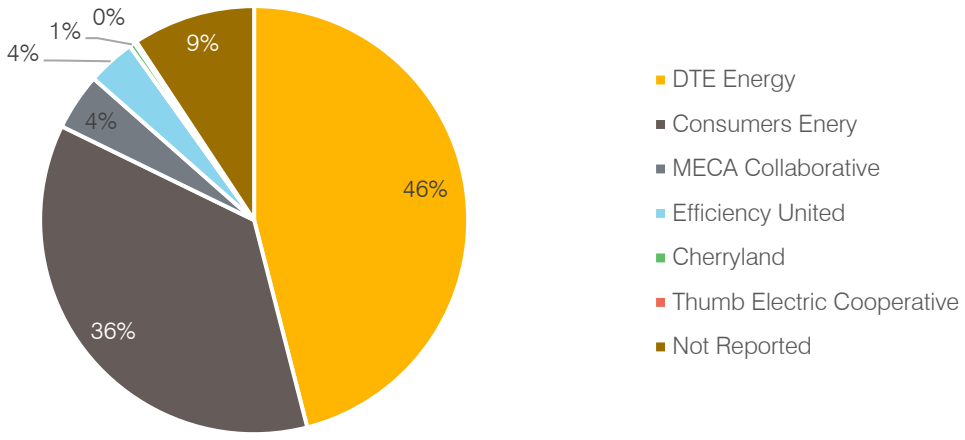
Program Delivery to Rural Communities—Utility and Program Administrator Data Request

As policies for energy efficiency do not require utilities to track participation in programs based on the categorization of customers as rural, there has been little reporting on how well programs reach these customers. To further assess the delivery of programs to rural communities, the project team coordinated with the MPSC to request data from utilities and program administrators. Using the definition of rural communities developed for this project, the project team requested the following information:

- Number of customers by sector in rural areas
- Number of program participants in rural areas
- Level of savings achieved by customers in rural areas
- Incentives received by customers in rural areas

This information allows for comparison of program delivery in rural areas to the state as a whole to determine if participation, savings, and incentives in rural areas are proportional to the number of customers they represent. Consumers Energy, DTE Energy, Thumb Electric Cooperative, Cherryland Electric Cooperative, MECA Collaborative, and EU responded to the data request. Together, the respondents represented over 90 percent of the electric sales in the state based on 2017 data from the U.S. Energy Information Administration, as shown in Exhibit 28 (U.S. EIA January 15, 2019).

EXHIBIT 28. Percentage of Statewide Utility Sales by Reporting Entity



Source: PSC analysis of program data

Exhibit 29 shows the estimated number of customers served by each reporting utility located in rural zip codes. The entirety of the Cherryland Electric Cooperative and Thumb Electric Cooperative service areas fit within the definition of rural. Overall, approximately 10 percent of DTE Energy customers are located in rural areas, while just over 20 percent of Consumers Energy residential customers are rural. Because the MECA Collaborative and Efficiency United provide energy-efficiency programs to the customers of multiple utilities, they were not able to provide a precise percentage of customers in rural areas. The MECA Collaborative, however, estimates 86 percent of residential customers and 95 percent of commercial and industrial customers are located in rural areas.

EXHIBIT 29. Percentage of Customers in Rural Areas

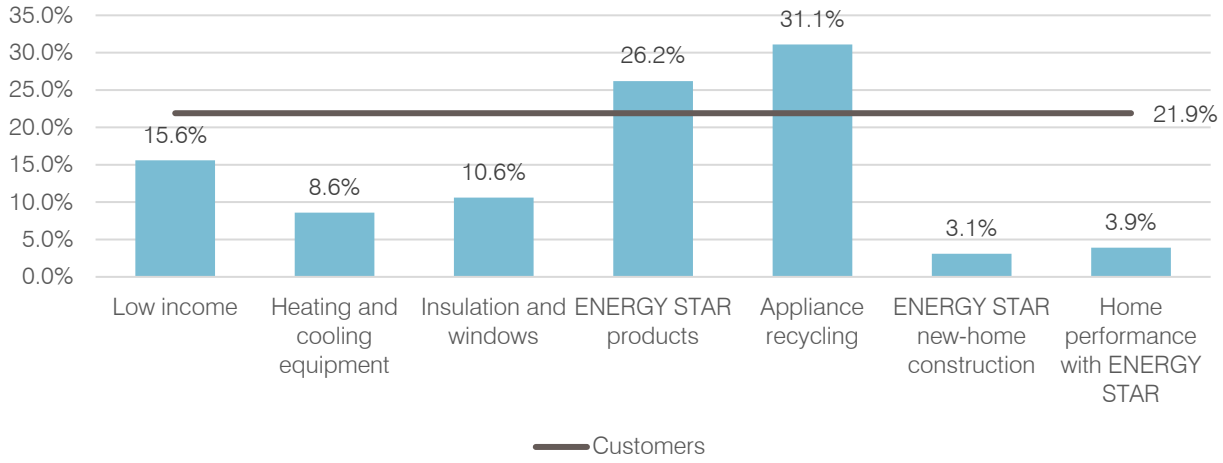
Utility or Program Administrator	Residential	Commercial	Industrial
DTE Energy	9.40%		9.30%
Consumers Energy	21.90%	29.80%	13.80%
Cherryland Electric Cooperative	100%	100%	100%
Thumb Electric Cooperative	~100%	100%	100%

Source: PSC analysis of utility data

In the overview of existing programs, it was noted that while there are few programs targeted specifically to agriculture and rural customers, those customers are generally eligible to participate in most, if not all, programs offered. There are some barriers that may make participation more challenging for agriculture and rural customers, such as fewer participating trade allies or retailers and less exposure to marketing and outreach. However, comparing the proportion of rural customers (i.e., all residents and businesses located in the identified rural areas) to the proportion of rural program participants (i.e., those customers that participate in one or more of the utility energy-efficiency programs) shows some success of existing outreach efforts.

Exhibit 30 shows the percentage of rural participants in selected Consumers Energy residential programs in 2017 compared to the percentage of customers. For some programs, such as ENERGY STAR products and appliance recycling, rural customers are overrepresented. The ENERGY STAR new construction program is underrepresented, but that may be a function of the locations in which new homes are being built. Customer characteristic data may help to explain other areas of underrepresentation, e.g., lower saturation of air conditioning and higher use of propane may result in lower participation in programs like the heating and cooling equipment program or HP Program.

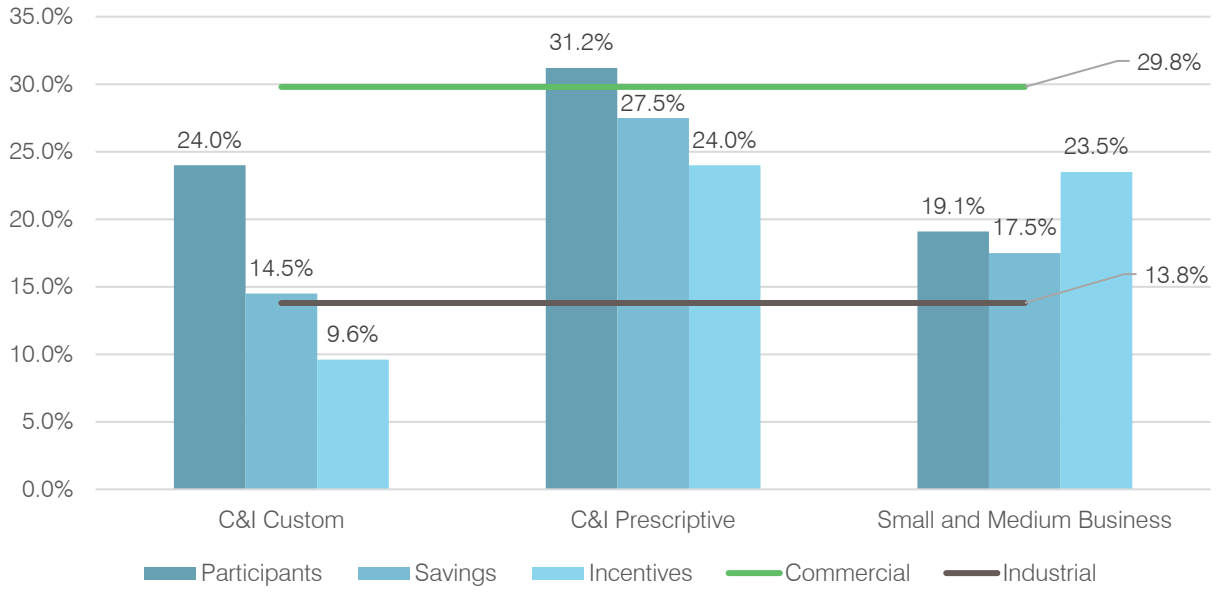
EXHIBIT 30. Consumers Energy Residential Rural Customers and Program Participants



Source: PSC analysis of utility data

Exhibit 31 makes a similar comparison for C&I programs. Of Consumers Energy commercial customers, 29.8 percent are located in rural areas while 13.8 percent of industrial customers are as well. In the chart, the proportion of customers in rural areas is compared to the percentage of program participation, savings achieved, and incentives distributed in rural areas for the program year 2017. Of the commercial programs, rural customers achieve the highest proportion of participation, savings, and incentives through the prescriptive rebate program.

EXHIBIT 31. Consumers Energy Commercial and Industrial Rural Customers and Program Participants, Savings and Incentives

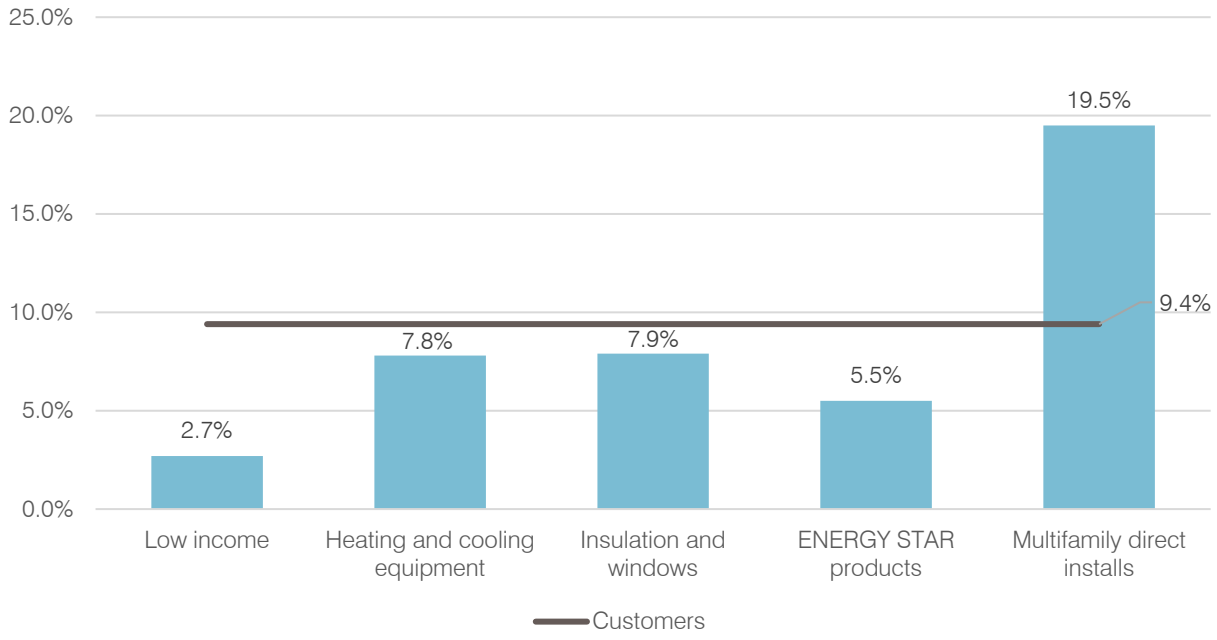


Source: PSC analysis of utility data

Consumers Energy offers two agricultural energy-efficiency programs that make use of several agricultural measures that are included in the Michigan Energy Measures Database. Rural participants accounted for over 70 percent of the participation and savings and 80 percent of incentives in the residential agriculture program in 2017. Overall, customers in rural zip codes contributed 24.5 percent of the portfolio electric savings and 8.8 percent of the gas savings.

Similar comparisons can be made based on DTE Energy's 2017 programs. Exhibit 32 compares residential program participation by rural customers to the percentage of rural customers overall. While the number of multifamily program direct installs in rural areas is almost double the proportion of total customers living in rural areas, most other programs see rural customers underrepresented.[13]

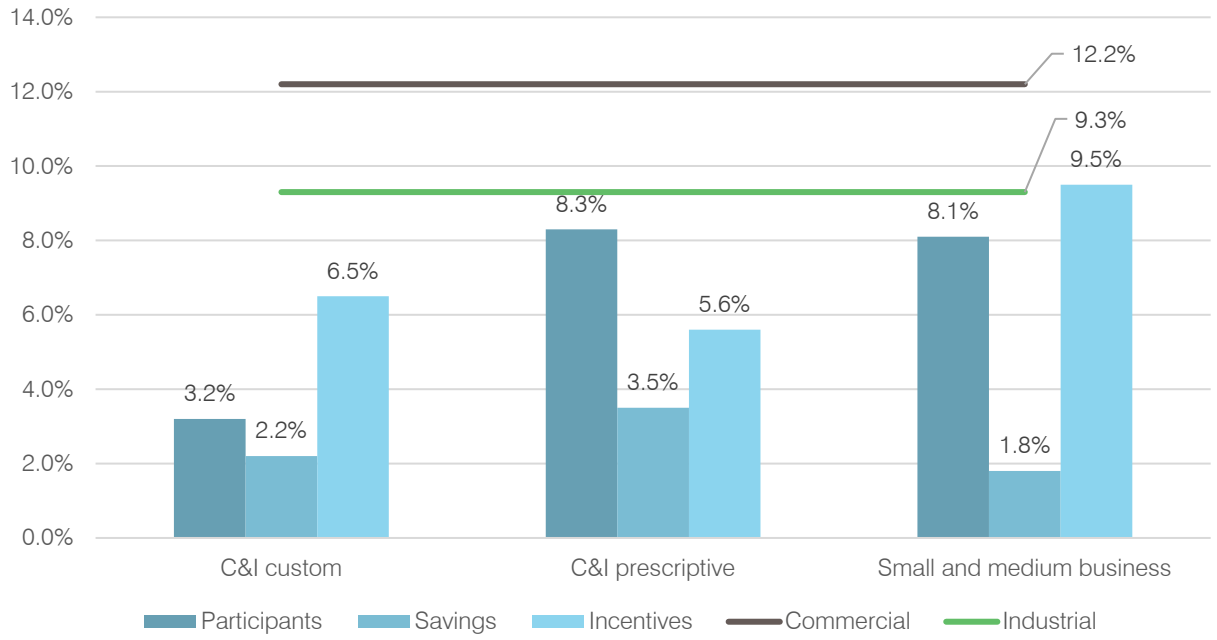
EXHIBIT 32. DTE Energy Residential Rural Customers and Program Participants



Source: PSC analysis of utility data

[13] Participation in direct-install programs is heavily influenced by the program implementer's outreach. Historically, DTE Energy has achieved high market penetration with its multifamily direct install program, especially in more populated areas. Recent program outreach has been focused on areas outside the urban areas of its service territory and is reflected in the proportion of participation in designated rural areas.

EXHIBIT 33. DTE Energy Commercial and Industrial Rural Customers and Program Participants, Savings and Incentives



Source: PSC analysis of utility data

In DTE Energy's service area, rural customers accounted for 55.8 percent of the natural gas savings for C&I custom projects, 11.7 percent of the prescriptive project savings, and 17.4 percent of small-business gas savings.

The project team examined just one year of agriculture and rural customer data in energy-efficiency programs implemented in conjunction with Michigan's energy legislation. Stakeholder interviews suggest that, as program options and outreach have increased for this segment, the depth and breadth of agriculture and rural energy-efficiency projects is increasing as well. While DTE Energy and Consumers Energy are showing significant participation, savings, and incentives in rural communities, for some programs, participation by rural customers falls short of the proportion of customers living in the rural areas. Closing this gap would require expanded efforts to ensure that rural customers are aware of programs as well as to make program participation more convenient.

Exemplary Policies and Programs

In addition to reviewing the programs available in Michigan, the project team reviewed programs in the Midwest and nationally that provide examples of innovation or best practices for serving agriculture and rural customers.

Methodology

To collect rural energy-efficiency policy and program data, the project team conducted interviews with industry experts involved in these types of programs around the nation, including but not limited to utilities (investor-owned, municipal, and cooperative), utility associations, state energy offices, statewide program implementers, and third-party program implementers. The team also leveraged recent ACEEE research that identifies leading rural and agricultural energy-efficiency programs (Shoemaker, Gilleo, and Ferguson 2018; Nowak, Kushler, and Witte 2019).

In collecting these rural program examples from across the country, the project team highlighted programs from a variety of different types of implementers. While there are many common challenges to serving rural communities across program implementer types, some are distinct to specific types of implementers (e.g., a lack of staff capacity for rural electric co-ops). With this in mind, the project team profiled programs from a municipal joint action agency, an investor-owned utility, a state energy office, a statewide program administrator, and a local energy district. Programs serving all rural customer segments, including agriculture, residential, commercial, and industrial sectors, were also sought out. While the project team identified a number of rural efficiency program examples, specific individual profiles were developed on a subset believed to have the most useful implications for Michigan. Similarly, in an effort to offer policy strategies relevant across Michigan's branches of government, the team profiled several rural energy-efficiency policies enacted in other states through legislative, regulatory, and/or executive actions.

Summary of Programs

This report highlights five energy-efficiency programs serving rural areas across the country, including a summary of offerings, available performance metrics, and lessons learned. For example, the Southern Minnesota Municipal Power Agency offers its member utilities energy-efficiency program design, development, and marketing services. Entergy Arkansas, with delivery by ICF (a global consulting services company), helps farmers and other agribusinesses make their property more energy-efficient by offering farm audits, incentives, and other technical assistance. The Florida Office of Energy has offered several energy-efficiency and renewable energy programs for agricultural producers across the state. Wisconsin's Focus on Energy, with delivery by APTIM, is working to increase rural customers' participation in existing residential and commercial efficiency programs and is offering several new rural-focused programs. The Winneshiek Energy District works outside of the utility framework to help farmers access state, federal, and private funds for energy-efficiency and renewable energy projects. Each of these five examples are profiled in more detail in Appendix A.

This report also highlights governmental policies working to drive investments in rural efficiency programs. For example, the Minnesota Conservation Improvement Plan requires many municipal and cooperative utilities, alongside investor-owned utilities, to meet an energy-efficiency target. Through the

California Rural Hard to Reach Local Government Partnerships' Working Group, investor-owned utilities, efficiency program administrators, and others collaboratively trouble-shoot technical and programmatic challenges they face trying to serve a particular rural customer. These examples are described in more detail in Appendix B.

Takeaways for Michigan

The project team compared current policies and programs in Michigan to rural policies and programs in other states to identify opportunities for improvement, particularly related to program design (see Exhibit 34). Complete discussion of the various programs reviewed is presented in Appendix A. Opportunities for program enhancements identified from this comparison are as follows:

- Offer a comprehensive suite of programs serving all rural customer segments (residential, C&I, and agricultural)
- Leverage federal financing (e.g., from the USDA) to combine with state, ratepayer, and/or member dollars
- Preserve the current state energy-efficiency requirements in Michigan for municipal and cooperative utilities, as they will be important for reaching rural and agricultural customers
- Clarify how EU and the MECA Collaborative can work together on program administration and reporting to the MPSC on municipal and cooperative utilities' energy-efficiency performance

EXHIBIT 34. Michigan Rural Policy and Program Comparisons

Michigan Program or Policy	Outside of Michigan: Program or Policy	Type
Consumers Energy, Agriculture Energy Efficiency	Entergy Arkansas, Agricultural Energy Solutions	IOU agriculture programs
Efficiency United, Program Portfolio	Focus on Energy	Statewide energy-efficiency program administrator
Michigan Energy Office, Agriculture and Rural Communities Energy Incentive	Florida Office of Energy	State energy office
Michigan Electric Cooperative Associate	Southern Minnesota Municipal Power Agency	Cooperative and municipal utilities
Michigan Clean, Renewable, and Efficient Energy Act Inclusion of Municipals and Cooperative Utilities	Minnesota Conservation Improvement Program	Energy-efficiency resource standard

Source: ACEEE analysis

More specific observations regarding current Michigan energy-efficiency programs serving rural and agricultural customers are discussed below.

Consumers Energy Agriculture Energy Efficiency

Notable Program Elements

- Targets rural and agricultural customers
- Serves agriculture facilities that are classified as residential or commercial and industrial customers
- Offers both electric and natural gas efficiency measures
- Offers both prescriptive and custom projects
- Holds in-person meetings with customers
- Assists customers in completing rebate application paperwork (via trade allies) (Nowak, Kushler, and Witte 2019)

Opportunities for Improvement

- Ramp up engagement with a diverse set of trade allies, as some farmers prefer to learn about energy efficiency from trade allies and industry experts. Trade allies should come from different agricultural subsectors (e.g., dairy, corn, poultry, greenhouses, etc.) and come prepared with a variety of case studies.
- Leverage multiple mediums for marketing to the agricultural sector, such as print, radio, and digital advertising.
- Work to stimulate word of mouth among farmers (e.g., provide materials to share with colleagues or even provide incentives for referrals)
- Leverage the USDA's REAP to secure low-interest loans, then work with trade allies to incorporate innovative financial solutions.
- Target crop farmers outside of their harvest time and during their off season so they have more time to implement efficiency projects.

Efficiency United

Notable Program Elements

- Delivers both residential and commercial energy-efficiency programs
- Participating utilities include municipal, cooperative, or investor-owned utilities (important for standardizing and scaling programs across utility service territories)
- Includes a "Find a Contractor" tool (Efficiency United n.d.a)
- Includes a free home energy assessment and a variety of measures in residential programs (e.g., space heating and cooling, water heating, air sealing and insulation, ENERGY STAR products, windows, appliance recycling, pool pumps) (Efficiency United n.d.b)
- Runs a trade ally program that includes marketing materials and other tools (key for building trust with customers, particularly in the agricultural sector)

Opportunities for Improvement

- Increase coordination between EU and the MECA Collaborative to ensure consistency of program offerings and to streamline processes for customers.

Michigan Energy Office Agriculture and Rural Communities Energy Incentive

Notable Program Elements

- Offers eligibility requirements that include agricultural businesses, communities, public entities, nonprofits, and small businesses

Opportunities for Improvement

- Bundle energy-efficiency and renewable energy measures but prioritize efficiency improvements.
- Offer a variety of energy-efficiency measures with a range of payback timelines.
- Understand farmers' crop cycles and build the program delivery schedule around it.
- Leverage federal financing and align program eligibility and application requirements with those of the financing source to streamline program participants' experiences.

Michigan Electric Cooperative Association

Notable Program Elements

- Includes trade ally program for contractors delivering residential, commercial, and industrial programs (Energy Optimization n.d.a)
- Offers variety of residential energy-efficiency programs (e.g., income-qualified, high-efficiency products, appliance recycling, HVAC, audits, manufactured homes, education, pilots, solar, and farm) (Energy Optimization n.d.b)
- Includes prescriptive and custom rebates, education, pilots, solar, and farm in commercial incentives (Energy Optimization n.d.c)
- Offers midstream residential HVAC pilot program (Energy Optimization n.d.d)
- Uses geotargeting to identify farms, builds relationships with trusted organizations, and works with trade allies to implement projects (Pucelik 2018)
- Offers commercial financing that combines incentives from EO with those from Michigan Saves (Energy Optimization n.d.e)

Opportunities for Improvement

- Extend financing to residential customers or promote clean energy financing options
- Offer specifically targeted agricultural energy-efficiency programs

Michigan Clean, Renewable, and Efficient Energy Act Inclusion of Municipal and Cooperative Utilities

Notable Policy Elements

- Includes municipal and cooperative utilities in energy-efficiency requirements
- Allows aggregate energy-efficiency program administration and reporting responsibilities via EU

Opportunities for Improvement

- Energy efficiency requirements for nearly all municipal and cooperative utilities in Michigan, which was established in 2008 by PA 295, will expire in 2021 due to PA 342 of 2016. Ensuring that these utilities do not lose the momentum built to date is important to ensure that agriculture and rural customers are served by these programs. In the absence of requirements, municipal and cooperative utilities can continue existing efficiency programs on a voluntary basis with support from other Michigan agencies, including the new Office of Climate and Energy.[14]
- Clarify how EU and the MECA Collaborative work together on program administration and reporting to MPSC on energy-efficiency performance.

[14] It should be noted that ACEEE's national research indicates that voluntary approaches have produced fewer energy-efficiency achievements (Molina and Kushler 2015).

Survey of Agriculture and Rural Communities

Public Sector Consultants conducted a survey of agriculture and rural communities in order to gain understanding of program awareness, participation experiences, and policy and program priorities and preferences. The survey was conducted online and was distributed through various associations and organizations that serve agriculture and rural communities. In addition, the survey was distributed to a random sample of Michigan households in the identified rural zip codes. Overall, 205 survey responses were collected. Respondents included residents of rural communities; owner/operators of farms, agribusiness, or other businesses in a rural community; local government or community leaders; and more, as shown in Exhibit 35. The survey was programmed to ask questions specific to the respondents' perspectives or roles.

EXHIBIT 35. Agriculture and Rural Communities Survey Respondents

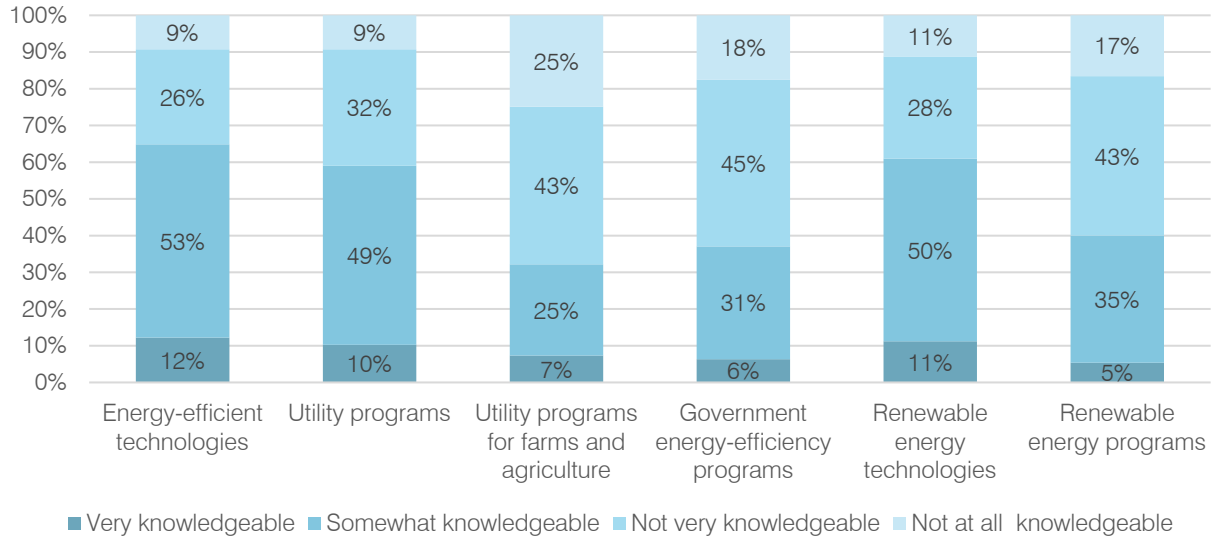
Respondent Type	Number of Responses
Resident of a rural community	175
Owner/operator of a farm	43
Owner/operator of an agribusiness	15
Owner/operator of a business in a rural community	15
Local government or community leader	38
Provider of services, equipment, or supplies to farms or rural facilities	10
Provider of energy-efficiency or renewable technologies or services	6

Note: Some respondents indicated that they belong to one or more category.
Source: PSC analysis of survey of agriculture and rural communities.

Awareness of Energy-efficiency and Renewable Energy Technologies and Programs

A primary objective of the survey was to assess the overall awareness of energy-efficiency and renewable technologies and programs. Overall, survey respondents indicated the highest degree of awareness of energy-efficient and renewable energy technologies (65 percent and 61 percent very or somewhat knowledgeable, respectively). Nearly 60 percent of respondents also indicated they were very or somewhat aware of utility energy-efficiency programs. Awareness of government energy-efficiency programs, renewable energy programs, and utility programs for farms and agriculture was somewhat lower, with 40 percent or fewer respondents stating that they were very or somewhat aware.

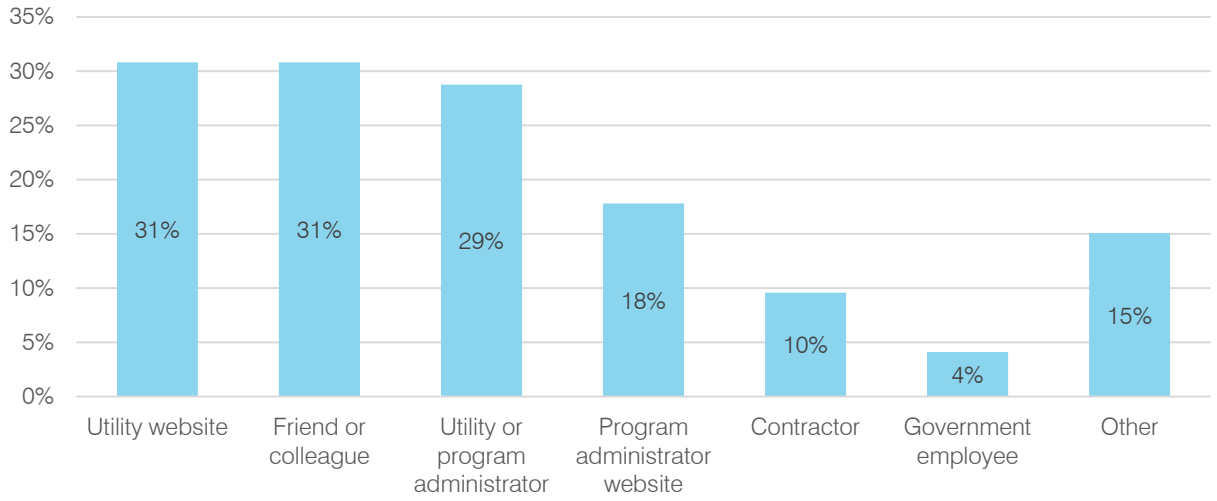
EXHIBIT 36. Awareness of Energy-efficiency and Renewable Energy Technologies or Programs



Source: PSC analysis of survey of agriculture and rural communities—all respondents. (n=205)

For those respondents that were somewhat or very knowledgeable about technologies or programs, utility websites and friend or colleague were the most common sources of awareness, followed by outreach from a program or utility administrator. Other sources of knowledge included events, industry newsletters, and direct mail.

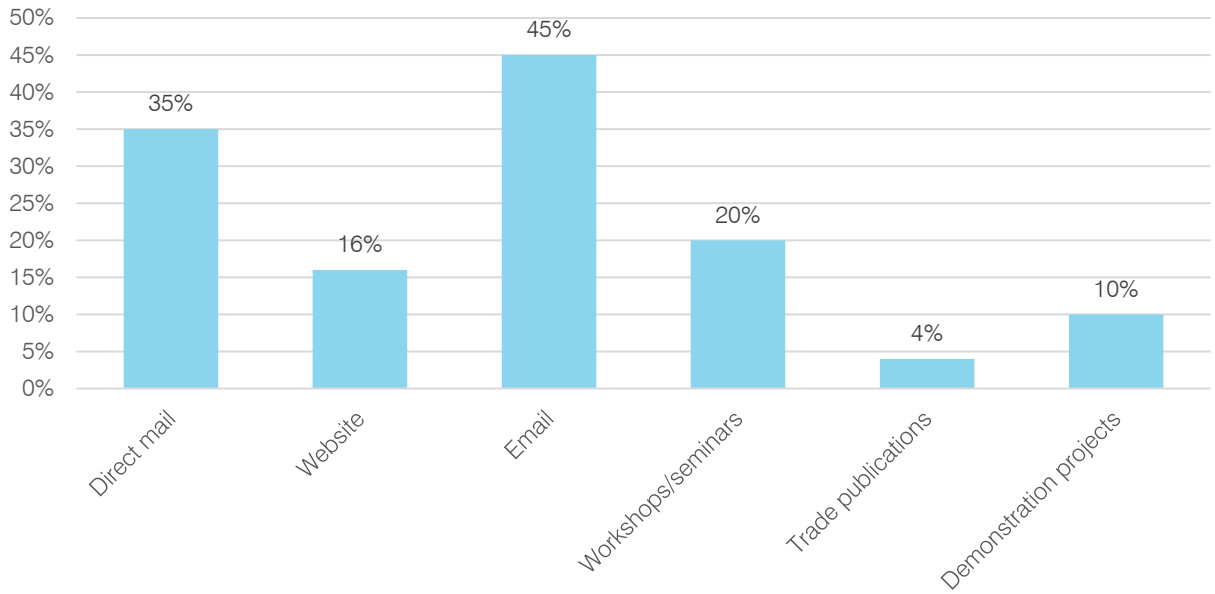
EXHIBIT 37. Sources of Technology or Program Awareness



Source: PSC analysis of survey of agriculture and rural communities. Multiple responses allowed. (n=146)

When asked how best to share information about available programs and resources, respondents identified email and direct mail as the most preferred methods. Respondents also indicated interest in workshops or seminars, with recommendations that MSU Extension services could host such events.

EXHIBIT 38. Recommended Communication and Outreach



Source: PSC survey analysis. Multiple responses allowed. (n=50)

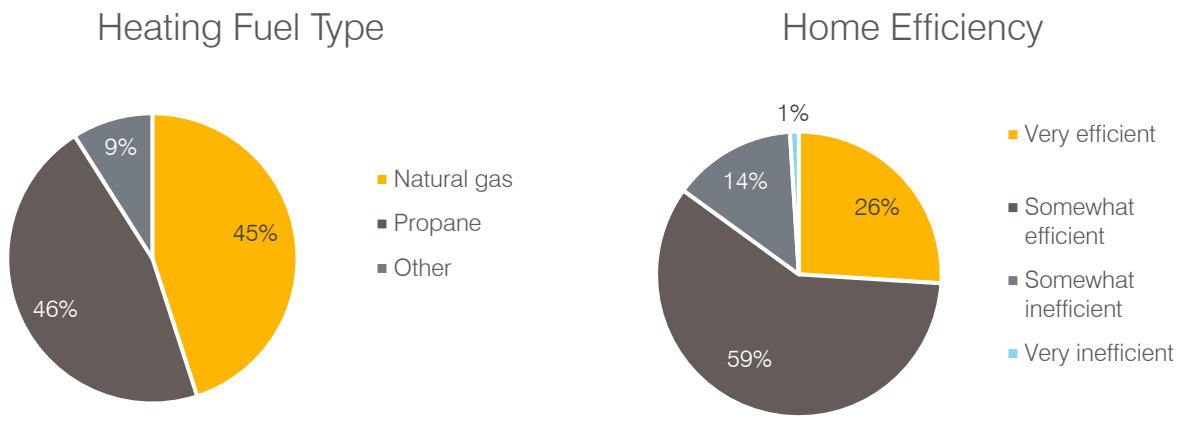
Perspectives of Agriculture and Rural Segments

Survey respondents were asked a series of questions specific to their perspective, e.g., residents of rural communities were asked about characteristics of energy use in their home. Areas of inquiry specific to the identified groups are discussed in the following sections.

Residents of Rural Communities

As noted, use of propane is higher in rural communities than it is in other parts of the state. Among survey respondents, 46 percent use propane and 45 percent use natural gas for home heating. Fuel types included in the category of other were wood, geothermal, fuel oil, and solar. Respondents were asked to assess the efficiency of their homes—just over one-quarter said their homes were very efficient, nearly 60 percent said somewhat efficient, and 15 percent rated their homes as somewhat or very inefficient.

EXHIBIT 39. Home Heating Fuel and Perceived Efficiency—Residents of Rural Communities

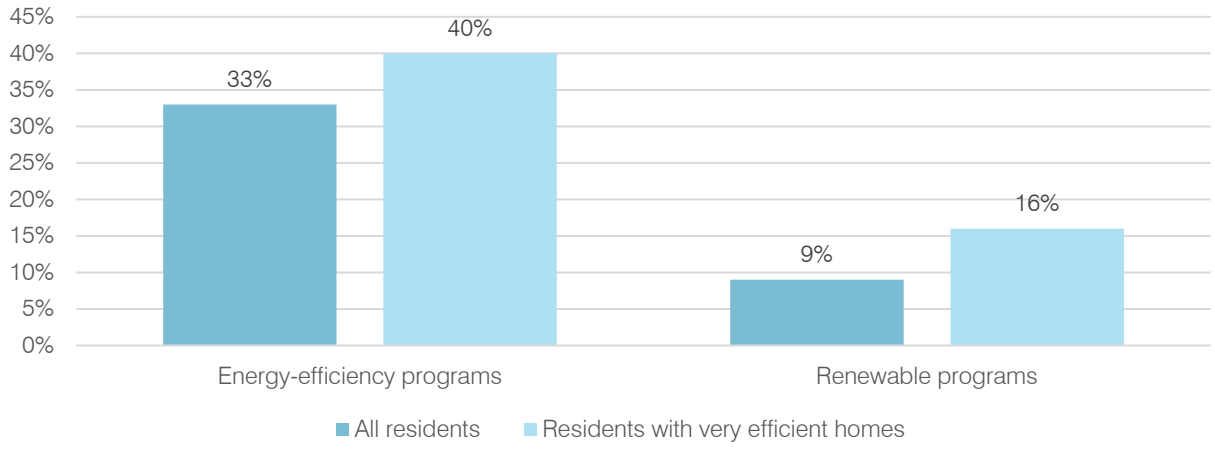


Source: PSC analysis of survey of agriculture and rural communities. (n=175)

One-third of all resident respondents said that they had participated in a program to increase energy-efficiency of their homes, while less than 9 percent had participated in renewable energy program.

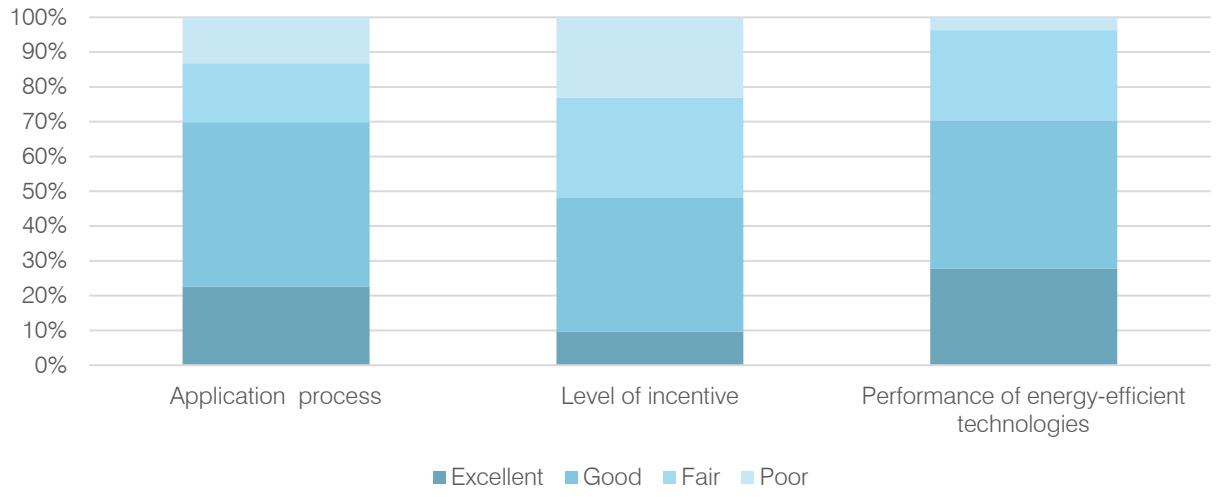
Respondents reported participating in a variety of energy-efficiency programs ranging from purchasing lighting at a local retailer to installation of a geothermal system. Satisfaction with the program application process and the performance of energy-efficient technologies was high.

EXHIBIT 40. Program Participation—Residents of Rural Communities



Source: PSC analysis of survey of agriculture and rural communities. (n=175)

EXHIBIT 41. Satisfaction with Program Elements—Residents of Rural Communities

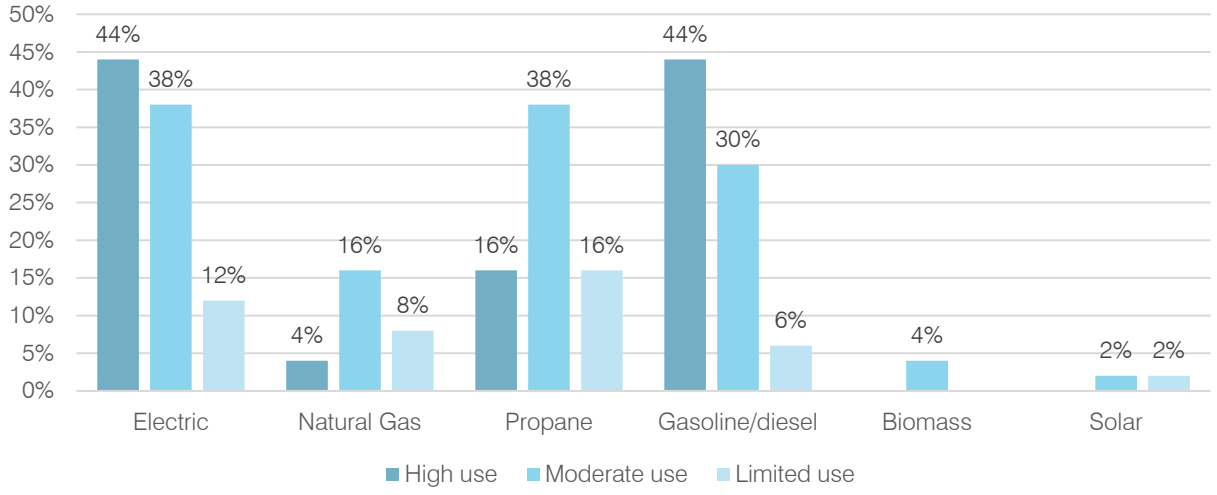


Source: PSC analysis of survey of agriculture and rural communities—residents participating in energy-efficiency or renewable energy programs. (n=72)

Farms and Agribusiness

Respondents that owned or operated farms or agribusiness were asked about the types of energy used at their facilities. Nearly all respondents indicate use of electricity and 44 percent indicated high use. Less than 30 percent of respondents indicated use of natural gas and over half of those rated their usage as moderate. Propane use was reported by 70 percent of respondents and again, most ranked usage as moderate. Eighty percent of respondents reported using gasoline or diesel at their facilities and just under half reported high use. A small percentage of respondents also reported using biomass and solar energy.

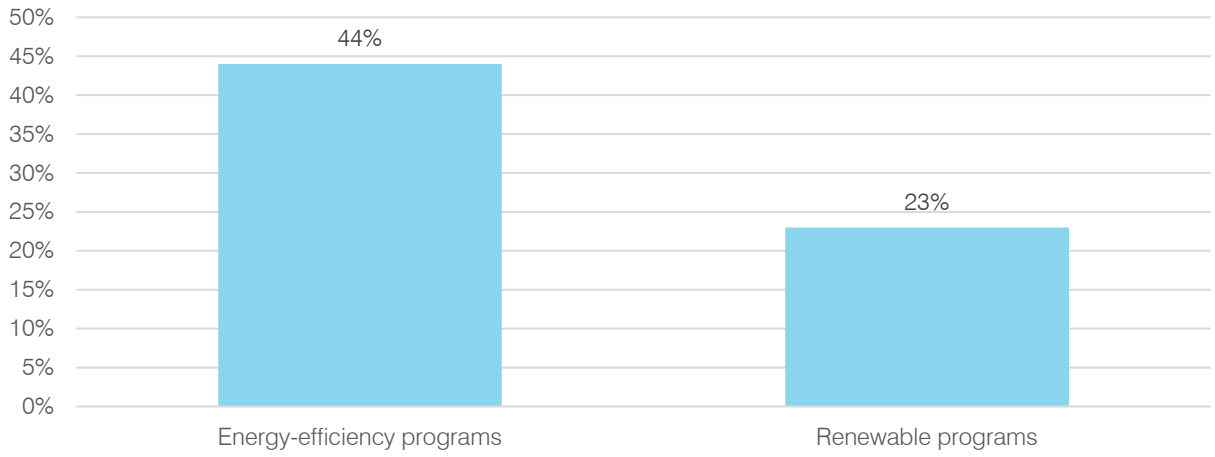
EXHIBIT 42. Farm and Agribusiness Energy Use



Source: PSC analysis of survey of agriculture and rural communities—owners/operators of farms or agribusiness.(n=49)

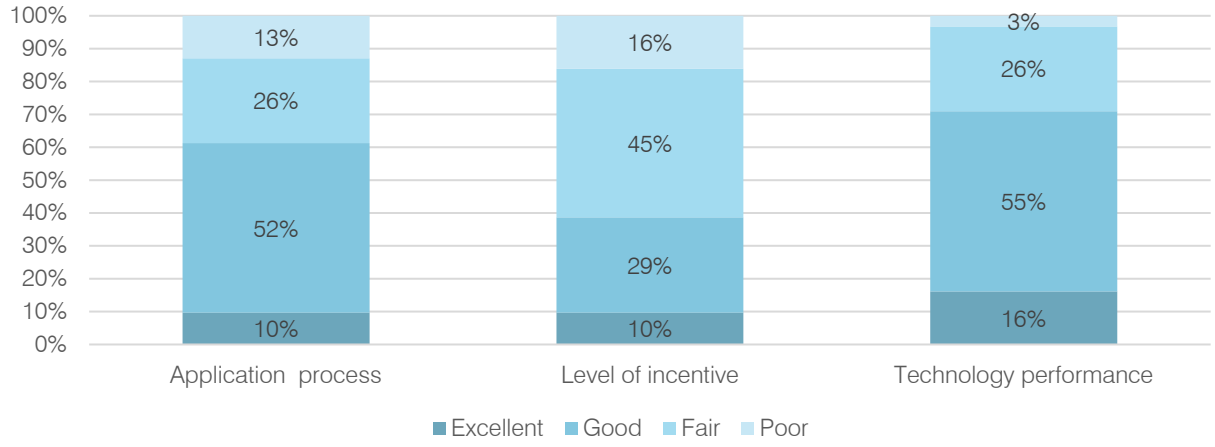
Farm and agribusiness respondents reported participating in programs at a somewhat higher rate than residents of rural communities. Type of energy-efficiency improvements made include lighting, insulation, milk cooling improvements, variable-speed drives, and geothermal heating and cooling systems. Renewable program participation included solar panel installation, use of biomass to produce synthetic gas and electricity, and leasing of land for construction and operation of wind energy. Satisfaction with programs showed a similar pattern to that of rural community residents—71 percent rated performance of energy-efficient or renewable technology as excellent or good while only 39 percent provided those ratings for the level of incentive received.

EXHIBIT 43. Program Participation—Owners/Operators of Farms and Agribusiness



Source: PSC analysis of survey of agriculture and rural communities. (n=49)

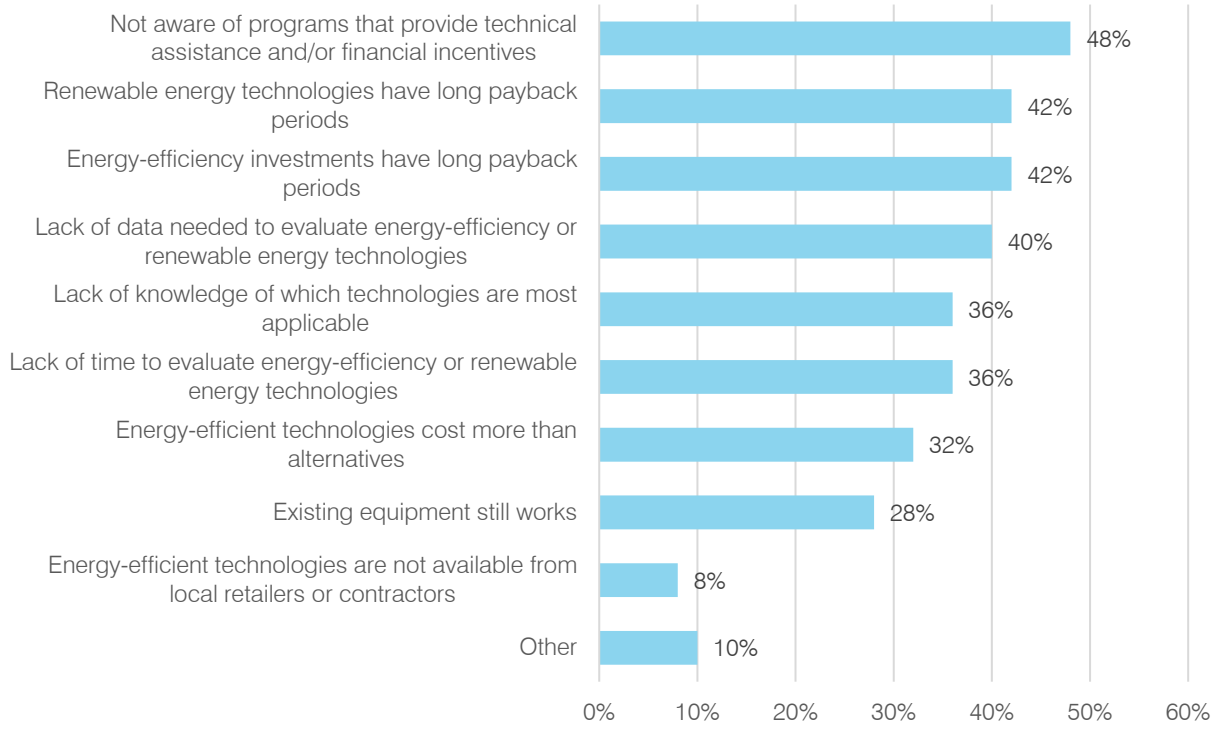
Exhibit 44. Satisfaction with Program Elements—Participating Owners/Operators of Farms and Agribusiness



Source: PSC analysis of survey of agriculture and rural communities. (n=32)

When asked about the barriers to investing in energy-efficiency or renewable technologies, lack of awareness about programs was noted by nearly half of the respondents. Long payback periods for both energy-efficiency and renewable energy technologies were noted by over 40 percent of respondents. Lack of data or time to evaluate investments were noted by over one-third of respondents. Only 8 percent of respondents noted a lack of availability of energy-efficient technologies from retailers or contractors. (Exhibit 45).

EXHIBIT 45. Barriers to Investment in Energy Efficiency or Renewable Energy—Owners/Operators of Farms or Agribusiness

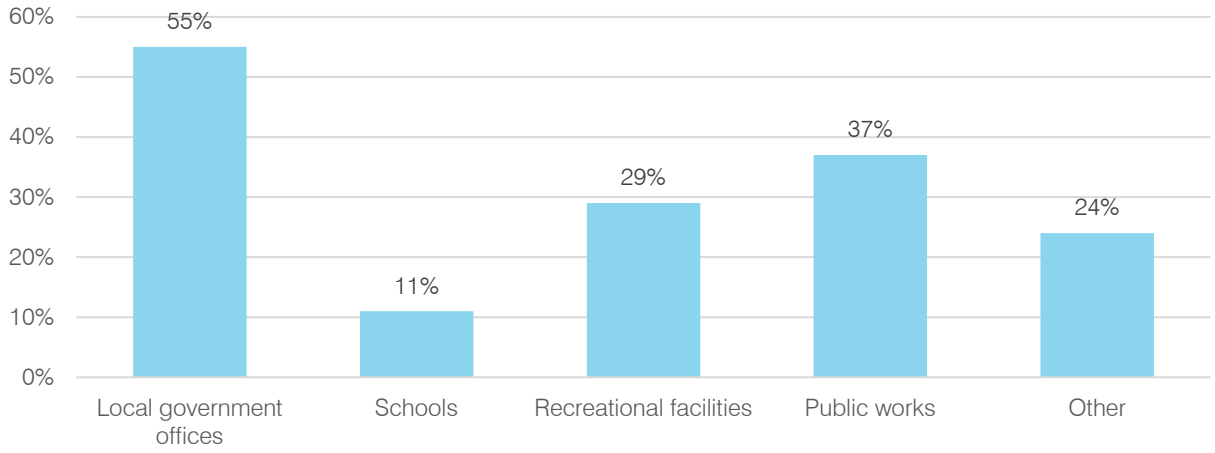


Source: PSC analysis of survey of agriculture and rural communities. (n=49)

Local Government and Community Leaders

Local government and community leaders were responsible for a variety of facilities as shown in Exhibit 46. Those that reported in the category of other were members of planning commissions or were responsible for religious facilities.

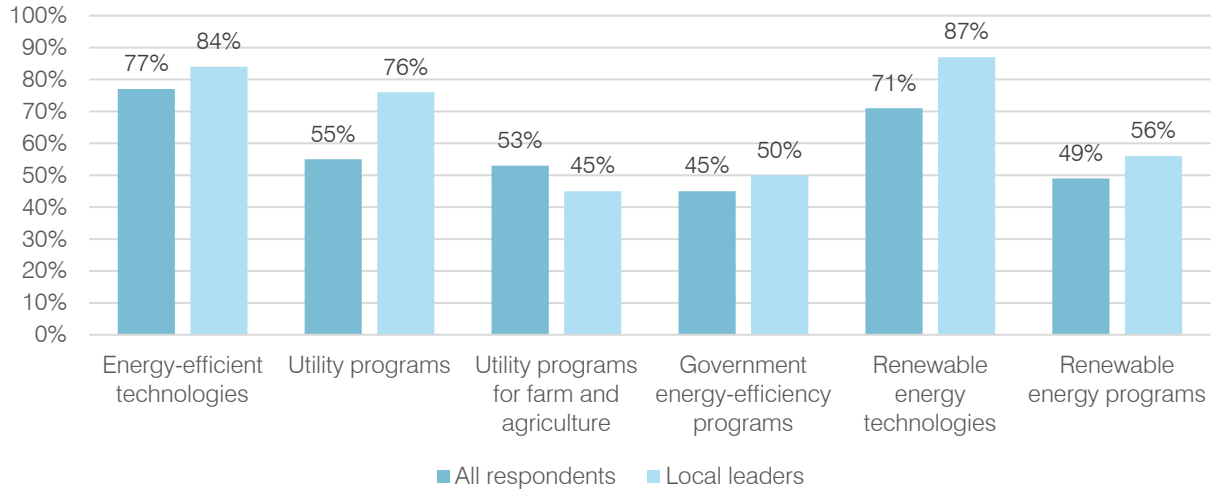
EXHIBIT 46. Types of Facilities Managed—Local Government and Community Leaders



Source: PSC analysis of survey of agriculture and rural communities. (n=38)

Local government or community leaders reported somewhat higher awareness of energy-efficiency and renewable technologies and programs. Exhibit 47 compares the level of knowledge for local leaders compared to the overall sample.

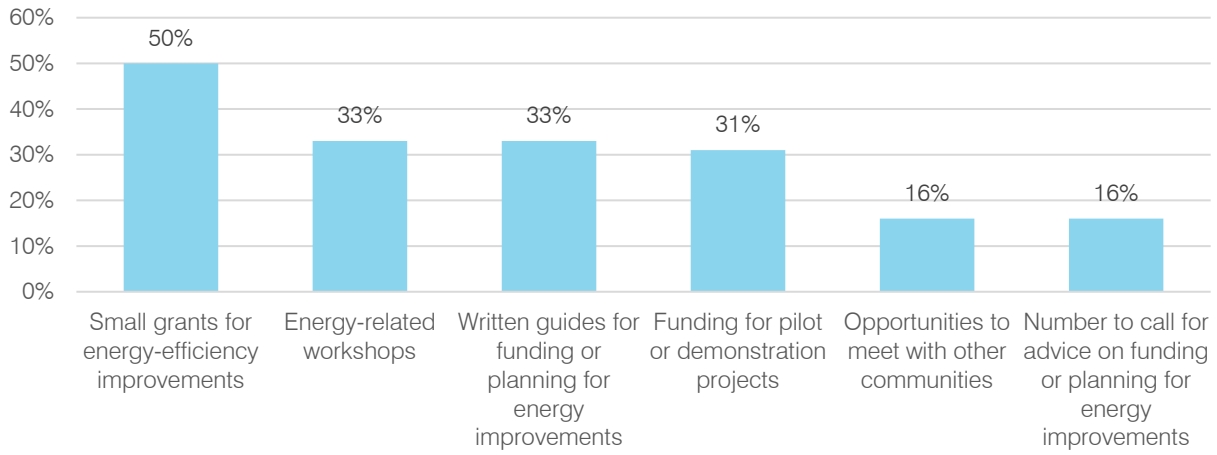
EXHIBIT 47. Awareness of Technologies and Programs—Local Government and Community Leaders



Note: Percentage awareness reported includes responses for very and somewhat knowledgeable.
Source: PSC analysis of survey of agriculture and rural communities. (n=38 and 205)

Local leaders were asked about the types of supports they would find useful to pursuing advanced energy options in the facilities they were responsible for. Half of the local leader respondents said that small grants for energy-efficiency improvements would help to implement projects. One-third of respondents indicated workshops or written guides would be useful. Somewhat fewer respondents were interested in meeting with other communities or access to a hotline for advice on funding or implementing projects.

EXHIBIT 48. Type of Assistance or Supports Wanted—Local Government and Community Leaders

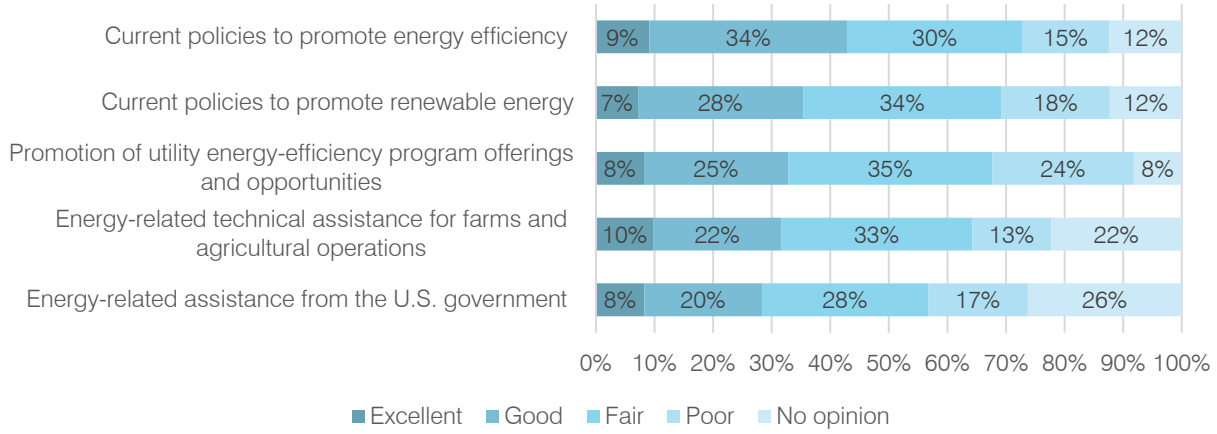


Source: PSC analysis of survey of agriculture and rural communities. (n=38)

Program and Policy Assessment

All respondents were asked to rate the current policies and program offerings in Michigan. The highest ratings were provided for current policies to promote energy efficiency and renewable energy, with 43 and 35 percent rating those as excellent or good respectively. Promotion of existing programs was rated as fair or poor by 59 percent of respondents.

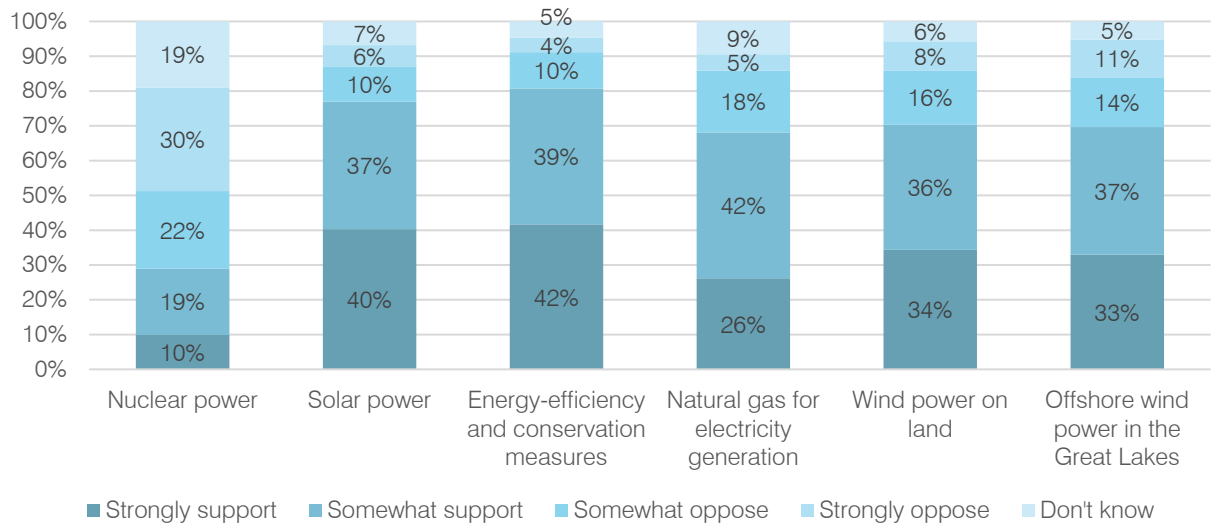
EXHIBIT 49. Assessment of Current Policies and Programs—All Respondents



Source: PSC analysis of survey of agriculture and rural communities. (n=195)

When asked about perspective for new resources, support for energy efficiency and conservation was highest, with 42 percent of respondents indicating strong support and 39 percent somewhat supporting. This was followed by solar power, with 40 percent strongly supporting and 37 percent somewhat supporting. Over half of the respondents strongly or somewhat opposed new nuclear power resources. Moderate support for natural gas electric generation was expressed as well, with 42 percent of respondents saying they somewhat supported and 26 percent saying they strongly supported that resource. Development of wind power on land or offshore were equally supported.

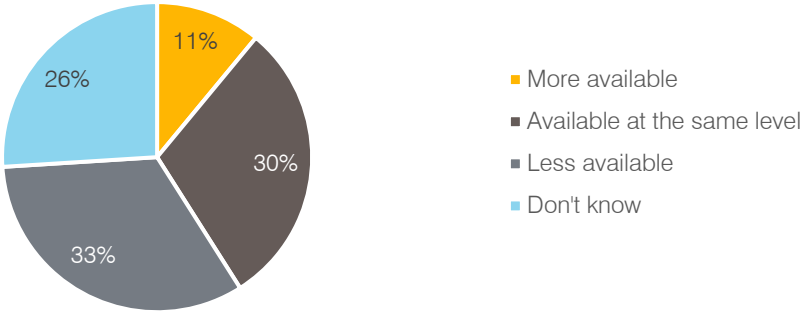
EXHIBIT 50. Support for New Resources—All Respondents



Source: PSC analysis of survey of agriculture and rural communities. (n=192)

Survey respondents were asked about the availability of programs for energy-efficiency and renewable energy options in rural areas. Overall, one-third of respondents indicated that programs were less available; however, more than a quarter of respondents indicated they did not know. This high rate of respondents that felt they could not answer the question could indicate a general lack of awareness and availability.

EXHIBIT 51. Availability of Energy-efficiency and Renewable Energy Programs—All Respondents



Source: PSC analysis of survey of agriculture and rural communities. (n=191)

Key Informant Interviews

In addition to inventorying existing policies and programs through secondary research methods, the project team collected stakeholder input on the existence, availability, and effect of these policies and programs to provide a more comprehensive understanding of the environment for energy efficiency and renewable energy in Michigan's agriculture sector and rural communities. Stakeholder input gathered through key informant interviews has been integrated into policy and program inventory section as it pertained to specific policies and programs. The following section focuses on stakeholder feedback related to the barriers and opportunities for energy efficiency and renewable energy in targeted communities.

Barriers for Energy Efficiency and Renewable Energy

One of the primary objectives for the development of the Agriculture and Rural Communities Energy Roadmap is to determine how current and future policies and programs may be better aligned to meet the needs of these populations. Through the course of key informant interviews the project team solicited input from stakeholders about existing barriers for energy-efficiency and renewable energy development. A summary of these key themes is provided below. The barriers listed should not be interpreted as a comprehensive list, as there are likely additional barriers that were not discussed in detail during the key informant interview process. However, the barriers included in this report offer a basis for new efforts to provide opportunities in the agriculture sector and rural communities.

Other Priorities Often Take Precedence over Energy

Agricultural customers have many other things that are competing for their attention. In general, stakeholders commented that these customers are more concerned about commodity prices, labor availability, and weather patterns affecting their operations than they are about energy costs. Energy efficiency and renewable energy, though they can save money in the future, represent an upfront cost and even a net positive investment can be difficult to initiate because of harsh economic conditions that farmers face. One stakeholder reported that farm income has dropped 50 percent over past few years and costs continue to rise. This environment is not conducive to investing in energy efficiency. This is less of a deal breaker for the agribusiness sector, as commodity prices are more impactful for producers than processors, but it remains a relatively large hurdle to overcome.

Program Awareness Remains Low

During the key informant interviews, the project team asked stakeholders to rate the level of awareness for specific energy-efficiency and renewable energy programs available in Michigan and for programs specifically targeted to customers in the agriculture sector and rural communities. Their responses were gathered to get a better understanding of the general awareness for different programs and should not be interpreted as a definitive statement of customers' actual awareness. The project team describes the awareness for several programs below.

Overall, stakeholders suggested that energy-efficiency programs offered by utilities had a moderate level of awareness, and higher than other state and federal programs. These utility programs are by far the largest in terms of the number of customers served and the level of investment made. While respondents overall suggested that statewide awareness of these programs is relatively high, several stakeholders suggested that awareness is lower in rural communities due to the fact that program administrators have

no incentive to target rural populations and instead focus on more populous areas, where communication and outreach can be easier. Additionally, stakeholders noted that contractors often contribute to outreach efforts but the availability/density of contractors in rural communities is lower. For example, Michigan Saves works with contractors serving every county in the state, but in rural communities, there is less capacity and contractors are serving larger territories.

Stakeholders purported that customers are generally aware of programs available through the USDA. The suggestion was made because farmers interact with the USDA for a number of things, and they are tuned into communication from the department and view it as a source of vital information. It was also suggested that the longevity/consistency of programs offered through the USDA contribute to better awareness, as customers have heard about the offerings more often.

Stakeholders were also asked about customers' awareness of programs offered through the Michigan Energy Office. Stakeholders reported that their awareness of MEO's programs is lower than other programs. This is due in part to the nature of programs available from the MEO, which are often targeted at specific types of communities or businesses. Stakeholders suggested that more could be done to increase the outreach for MEO's programs.

The project team also asked stakeholders to describe their awareness of the Michigan Farm Energy Program. Only a few participants had awareness of this program, so it is difficult to draw a strong conclusion as to customer awareness, but overall responses suggested that awareness is low.

Deliverable Fuels Customers are Left Behind

Many customers in rural communities lack access to natural gas service for home heating. Statewide, less than 14 percent of households use deliverable fuels, such as propane, heating oil, wood, or other sources, for their heating needs. In Michigan's rural communities, however, nearly 40 percent of households rely on deliverable fuels. The highest proportion of deliverable fuel use in rural communities comes from propane and wood. This creates a challenge for customers when accessing energy-efficiency programming because deliverable fuel providers are not required to provide these programs to their customers. While customers can access energy-efficiency services through their electric provider or on their own, they are likely not getting the same exposure to energy-efficiency offerings as customers who have natural gas providers, which are required to invest in energy efficiency.

Additionally, lack of natural gas service in rural areas was cited as a limiting factor for agriculture operations, specifically in grain drying operations.

Costs and Benefits Must Be Clearly Articulated

Another barrier for energy-efficiency and renewable energy adoption highlighted was that customers need to be able to see future payback clearly. By articulating the payback period for investment in energy efficiency, customers are more willing to invest their limited capital. A shorter return on investment is better, but for some farmers and rural customers even a short payback is not enough to overcome the difficulty justifying the initial capital outlay. Stakeholders suggested that having a payback period of fewer than eight years seems to be an important threshold.

In addition to having costs and benefits clearly articulated, customers also need to be able to trust this information. As these groups can be skeptical of utilities and government programming, it was suggested that the closer an organization is to the local community (i.e., local township official, economic development office, or municipality) the more likely these customers are to trust the information.

Administrative Burdens Are Deterrents

In the case of grant and loan programs, specifically those available through the USDA, agriculture customers can sometimes be deterred by the administrative burden required to apply to and comply with the program. Stakeholders noted that there are already many regulations that agriculture operations have to deal with, and customers are reluctant to sign up for more administrative paperwork as required by federal or state grants. In addition, stakeholders suggested that the amount of money available through grant portions of programs (e.g., REAP) can make the administrative time more worthwhile, but that these funds are generally limited.

Identifying and Targeting Agriculture Customers Is Difficult

Another barrier for providing energy-efficiency and renewable energy programs to agriculture customers is that electric utilities' ability to identify agriculture customers is sometimes limited. Utility stakeholders reported that there is not a separate customer class for agriculture and these customers are either grouped with commercial or residential customers. The customer class can vary depending if a farm has multiple energy meters. Without being able to identify agriculture customers, it is difficult to identify the right people to target with agricultural programs versus standard residential or commercial program offerings.

Additionally, respondents noted that in recent years, commercial and residential electricity rates have flipped. Historically, residential electric rates were lower than commercial rates, but in the last ten years, commercial rates have decreased and residential rates have increased.

Building and Electric Codes Do Not Apply to Agriculture Customers

Stakeholders noted that agriculture customers are exempt from existing building and electric codes. This creates two sets of issues for implementing energy-efficiency measures. First, lack of compliance with building codes could create safety concerns for those implementing new measures. Second, older or outdated electrical work might limit what energy-efficiency measures are possible without requiring additional building upgrades.

Farm Energy Audits Represent an Additional Cost

Energy audits are a useful tool for many different customers to determine the best energy-efficiency measures to help save on energy costs. The same is true for the agriculture sector. Farm energy audits are seen as a valuable tool for farmers, but utility rebates only cover a portion of the cost and the upfront costs associated with audits can be seen as a deterrent. Those interviewed noted that the audit findings, in many cases, could lead to energy savings, but certain customers are still hesitant to spend the time and money on an audit. Additional financial support could increase the number of completed audits, but there are still other concerns about these audits leading to implementation.

Farm Energy Audits Do Not Reflect True Costs

Farm energy audits have been widely available through the Michigan Farm Energy Program for more than a decade. According to the MSU Extension, through 2017, the MFEP has completed 340 energy audits and

154 renewable energy assessments (Gould and Proctor February 2019a). While these audits are considered thorough and high quality, stakeholders noted that the audit process is time intensive and compensation for energy auditors is sometimes too low. The MFEP pays auditors between $2,000 and $3,000 per farm energy audit, but the actual cost of conducting an audit can be much higher depending on the type of operation and amount of time necessary to complete an audit. Additionally, stakeholders highlighted that there is often a delay between when an audit is completed and receipt of payment from MFEB. Stakeholders noted that these factors have contributed to auditors being less active than they once were.

Implementation from Farm Energy Audits Has Been Limited

Agriculture customers will only reap the benefits identified in their farm energy audit if they implement the recommended measures. One of the challenges identified through key informant interviews was the difficulty of getting agriculture customers to invest in energy efficiency and renewable energy after they have been presented with the results of an energy audit. This is due in part to the financial challenges facing certain agriculture sectors. Respondents highlighted the fact that dairy producers in the state have essentially stopped conducting energy audits in recent years because the economics for milk producers are challenged and farmers cannot commit to investing in their operations even for cost-saving measures. Implementation of recommended energy-efficiency improvements remains a crucial component of a successful farm energy audit program, but current programs are often not able to overcome economic hurdles. This suggests that having attractive financial incentives and/or financing available from their utility companies could be very important.

The Michigan Farm Energy Program Faces Critical Challenges

One of the challenges related to the success of Michigan's farm energy audits is that the MFEP does not have the funding for the personnel to assist farmers with implementation efforts. There is separate, ongoing work to evaluate the sustainability of the MFEB and as such this report will not delve deeply into the program's operation; however, it cannot be overlooked that the MFEP has helped numerous agriculture operations in the state, and farms that implement energy-efficiency and renewable energy measures where attainable can become more sustainable long term. To ensure the continued success of farm energy audits, more needs to be done to help convert audits to implementation projects. To accomplish this, ensuring successful audits needs to be part of the identified mission of the MFEP and appropriate funding must be allocated to accomplish this.

Energy Efficiency in the Agriculture Sector Requires a Unique Approach

Targeted energy-efficiency programs for the agriculture sector have been a relatively recent development in Michigan. As discussed above, energy-efficiency policies and programs have been in place for more than a decade, but, to date, only a couple of energy providers have developed specific programs for their agricultural customers. This has led to a patchwork of energy- efficiency offerings from various providers. Coupled with the fact that there has not been a concerted effort to understand the overall potential for energy efficiency in Michigan's agriculture sector, it has been difficult for providers to devote limited program budgets to tailored solutions for the agriculture sector.

Stakeholders noted that Michigan's agriculture sector is very diverse and as such represents a challenge for designing programming for these customers. In addition to prescriptive measures for agriculture operations, energy-efficiency programs also need to include customized options to meet the needs of unique operations.

Energy-efficiency program providers also need to consider the seasonal nature of agriculture production which makes it essential to get timing right for outreach and implementation. Beyond the consideration of seasonal operations, customer outreach and communication in the agriculture sector can be difficult for other reasons. Stakeholders suggested that it takes more direct outreach to reach agriculture customers and it is also vital that customer outreach is handled appropriately. Outreach specialists need to know how to talk to customers in the agriculture sector in part due to the fact that farm operations vary substantially, and specific knowledge of different business operations is key. Trust is a key component of customer outreach and program administrators need to ensure that their representatives will be able to connect with customers.

The Future of Energy-efficiency Programming is Uncertain

Several stakeholders responded that there is concern over the future of energy-efficiency programs statewide as PA 342 of 2016 removes the requirement for municipal utilities and electric cooperatives to continue to offer energy-efficiency programming for customers after 2020. This policy aspect would clearly adversely affect the availability of energy-efficiency programs for customers in rural areas. While certain stakeholders suggested that the expiration of this mandate does not mean customers will be unable to invest in energy efficiency, it does create the possibility that energy-efficiency investment in these communities will slow as the communication and incentives provided by existing programs diminish.

Another concern pertaining to the future of energy efficiency was that the most cost-effective measures for energy efficiency, such as LED lighting, are reaching a saturation point and the next level of energy-efficiency investments may be more expensive and could potentially slow uptake. On the other hand, given the relatively low historical participation in energy-efficiency programs in this sector, there should be considerable energy-efficiency potential remaining.

Rural Population Demographics Are Unique

Many stakeholders provided comments related to the demographics of Michigan's rural population and how these characteristics interact with energy decisions. However, the project team's review of demographic data does not correspond with the suggestions made that Michigan's rural population has a higher proportion of low-income customers or faces unique challenges related to age of their housing stock. Michigan's rural population does skew slightly older than the statewide population, with a higher percentage of rural residents above the age of 65 and fewer under the age of 18. However, perceptions of these factors may affect how program outreach is conducted and how programs are then received. A full discussion of the rural population's demographics is provided earlier in this report.

Renewable Energy and Agriculture Integration Is Challenged by Existing Programs

The majority of discussions with stakeholders centered on opportunities for energy efficiency in the agriculture sector and rural communities; however, there were several comments related to the opportunity for renewable energy development in the agriculture sector. One barrier identified to greater renewable energy development comes from the current limitation on using farmlands enrolled in the

Farmland Preservation Program, also referred to as PA 116, for commercial solar facilities. Until recently, MDARD did not accept commercial solar as an applicable use of PA 116 lands (MDARD May 2017). In June 2019, MDARD issued revised guidance for solar on PA 116 land that enabled new commercial solar development, recognizing the potential agricultural uses/benefits of siting solar on farmland (e.g., pollinator habitats). The use of farmland for commercial solar presents an opportunity not only for agriculture customers to benefit from renewable energy to meet their own onsite needs, but also to provide stable lease payments that could supplement farm incomes (MDARD June 3, 2019).

Onsite Renewable Energy Development Has Limits

Another barrier related to renewable energy development, according to stakeholders, relates to the availability of customers' onsite renewable energy installations. Several stakeholders commented that more customers could potentially realize long-term benefits from generating their own electricity from renewable sources like solar. However, stakeholders noted there is a lack of clarity with the current tax structure for customer-owned renewable energy that creates uncertainty for quantifying the true costs and benefits of these investments. Additionally, stakeholders noted that the current rate structure for customer-owned renewable energy is in flux, as PA 342 required the MPSC and energy companies to establish new cost-of-service-based rates for customer-owned renewable energy. Until new rates can be established, customers have the ability to enroll under the existing system. This adds to uncertainty for customers who are considering renewable energy investments and could potentially reduce renewable energy adoption in the short term.

Other Energy-related Challenges

Single Phase to Three Phase Power Conversion

A common theme expressed by stakeholders from the agriculture sector was that access to three-phase electric power has been a limiting factor for upgrading equipment and expanding their operations. Three-phase power is necessary for many modern agriculture operations, including center-pivot irrigation and variable frequency drive (VFD) motors on livestock farms. Three-phase power provides agriculture customers with a variety of benefits, such as lower investment cost (VFD motors cost about half of single phase), better efficiency, control-system design, lower cost maintenance, and no stray voltage (Harsh 2014 and Kelley 2013).[15]

Three-phase power is not widely available in rural areas, but limited data exists for how many customers lack access to three-phase power. Rough estimates of the type of service for two Michigan utilities are shown in Exhibit 52.

[15] Stray voltage refers to unintended electrical potential between two objects, resulting in inefficiency and possible safety risks.

EXHIBIT 52. Distribution Line Type

Mile of Line	Consumers Energy	Indiana Michigan Power
Single phase	34,000	9,000
Two phase	4,500	550
Three phase	14,200	4,000

Source: Harsh 2014

Customers bear the responsibility of upgrading their service to three-phase power, and with an estimated cost of $3,300 to $5,000 per quarter mile, plus additional site installation costs, this option may be most feasible only if the payback period is short (Harsh 2014).

Power Quality and Availability

Another infrastructure concern expressed by agriculture stakeholders was that agriculture customers, by the nature of their operations, are often located in rural areas at the periphery of utility systems, which can mean they are limited in the amount of electricity they can draw or the amount of natural gas capacity available. These limitations can impair customers' ability to expand their operations, and also creates a challenge for siting new operations because systems may not be prepared to handle new load and upgrades will have to be covered by the prospective customer.

Opportunities for Enhancing Policies, Programs, and Services

The goal of the Agriculture and Rural Communities Energy Roadmap goes beyond simply identifying issues and barriers. The goal for the roadmap is to engage stakeholders to find opportunities that will improve policies and enhance programs for energy efficiency and renewable energy. Throughout the key informant interviews, the project team asked stakeholders to identify opportunities that should be considered in developing new policies and programs. The opportunities identified through the key informant interviews have been summarized and are provided below. These opportunities do not constitute consensus recommendations from stakeholders, and instead provide a comprehensive view of the range of perspectives.

There Is Much Potential Remaining

Throughout the key informant interviews, participants suggested that there is a significant amount of untapped energy-efficiency potential remaining. While there has not been specific analysis of energy-efficiency potential in the agriculture sector or rural communities, stakeholders noted that the majority of investment for energy efficiency has occurred in more-populated areas and industries that are easier to reach. Analysis of utility data show that while there is significant penetration of energy programs in agricultural and rural communities, the total savings impact falls short of a proportional share based on the number of customers residing or operating in rural zip codes.

Better Collaboration Between Organizations and Enhanced Communication

One opportunity that was highlighted by the majority of stakeholders was that there needs to be greater collaboration between program providers and other groups that provide services to the agriculture sector and rural communities. Stakeholders noted that these customers may be more difficult to reach due to their location or other characteristics, but there are opportunities to partner with local civic organizations,

nonprofits, or community institutions (e.g., community foundations, economic development offices, or local government). The opportunity for collaboration is perhaps greatest in the agriculture sector where there are existing networks of organizations related by their agricultural operations, such as Farm Bureau, MSU Extension, commodity groups, local USDA offices, MDARD, or conservation districts. By developing a system to identify and conduct periodic outreach to these groups through a coordinated approach with various partners, program administrators can improve awareness of the opportunities in harder-to-reach communities.

Expand Stakeholder Involvement in Program Design

One reason stakeholders cited for the perceived gap between agriculture and rural customers and other customer groups is that agriculture and rural groups have not been represented in conversations related to program design and implementation. To ensure that new programs and policies reflect the needs of these customers there needs to be a concerted effort to collect input from customers and engage stakeholders.

Designate an Entity to Aggregate Information

Information related to opportunities for energy efficiency and renewable energy is largely disaggregated and only available from the entity that administers a program. While some community institutions or membership organizations disseminate information to their customers, the information is often published infrequently. To improve the availability and accuracy of information, stakeholders commented that policy and programming information should be available in one place and disseminated to the appropriate groups.

Leverage Current Poor Farm Economics to Drive Energy-efficiency Investment

While low commodity prices present a limitation for agriculture customers to invest in energy efficiency, they also mean that agriculture customers have a strong incentive to reduce input costs wherever they can. Stakeholders suggested that programming that can help address the up-front costs associated with energy-efficiency investment will present tremendous potential to expand adoption and help vulnerable farmers.

Improve Communication of the Value of Energy Efficiency

Access to capital is certainly a major barrier for investing in energy efficiency; however, it is not the only thing holding back adoption. Customers need to be able to easily understand that many energy-efficiency investments can have lasting impacts on energy consumption and bills. Stakeholders noted that both agriculture and rural customers stand to benefit from energy efficiency, but if they don't have the information they need to understand the value proposition, then getting them to participate will be challenging. Improving how program administrators, contractors, and other vendors communicate about energy efficiency will give customers better understanding of how they might benefit from it. In addition, education efforts could promote peer-to-peer learning opportunities, where customers can share their experiences related to energy efficiency.

Improve Education About Renewable Energy Applications

Renewable energy presents an opportunity for many customers, especially as costs for technology (e.g., solar) are on the decline, to reduce energy costs or to address capacity charges associated with peak demand. Yet, stakeholders report that renewable energy adoption in the agriculture sector and rural

communities remains low. Stakeholders suggested that there is more be done to educate customers about the potential value of onsite renewable energy production to increase customer awareness and ultimately drive adoption. This is especially important given ongoing changes to customer-owned renewable generation policies and compensation structures in the state, it is important that customers understand what the costs and benefits will be for their operations.

Emphasize Benefits of Combining Efficiency and Renewables

Just as it is important to communicate the benefits of energy efficiency and renewable energy on their own, stakeholders recognized the importance of emphasizing the potential benefits from combining efficiency with renewables. Stakeholders noted that often these topics are considered individually, but there could be greater potential for savings/benefits if customers were presented with a holistic approach to managing their energy use.

Provide More Financing Options

As one of the limiting factors for energy-efficiency and renewable energy adoption has been customers' concern about costs, stakeholders suggested implementing strategies to improve access to financing options and incentives that make energy-efficiency investment more attainable. One suggestion that was made was for more utilities to provide on-bill financing for energy-efficiency investments. This option can help customers make a connection between their energy-efficiency improvements and their monthly energy consumption/savings. Additionally, programs could be expanded to include better incentives for high cost measures. Increase Requirements for Energy Efficiency

One way suggested to expand energy efficiency in the agriculture sector and rural communities would be to increase utilities' required annual energy savings targets and to develop specific targets for the agriculture sector and rural communities. Stakeholders commented that agriculture and rural customers are being relatively neglected as program providers focus attention on more populous, easier-to-reach populations. Setting a specific savings targets for the agriculture sector and rural communities would ensure that program administrators make a concerted effort to develop programs and design communication strategies that target underserved customers.

Continue to Expand Eligible Measures

One of the barriers to energy efficiency in the agriculture sector is the unique nature of agriculture operations. Over the past ten years, the number of approved energy-efficiency measures for the agriculture sector has increased dramatically, yet new measures are coming to market and should be integrated into existing programs to ensure that customers have the right solutions for their energy needs.

Provide Policies and Funding for Energy Efficiency for Deliverable Fuels

As noted, a substantial portion of rural customers do not have access to natural gas service and instead rely on deliverable fuels such as propane or fuel oil. At present, Michigan has no policies or funding specifically for energy efficiency relating to deliverable fuels. Two options for addressing this would be to place a similar requirement for energy-efficiency programs on propane and fuel oil suppliers and/or to allow the electric utilities serving these customers to provide efficiency services and claim credit for deliverable fuel savings toward their electricity savings requirement.

Growing Access to Broadband Internet

An emerging opportunity for the agriculture sector and rural communities is the expansion of broadband Internet access in rural communities. Spurred in part by programs provided by the USDA, Michigan is beginning to see increased broadband access and adoption in rural communities. This presents a large potential for residents of Michigan's rural communities and could lead to more opportunities for energy-efficiency and renewable energy investment through improved outreach and education.

The key takeaways identified through the Agriculture and Rural Communities Energy Roadmap process provide important context for the needs of agricultural and rural customers in the state and offer potential paths forward to improve access and adoption in these populations. Addressing the barriers and opportunities for energy efficiency and renewable energy will take collaborative efforts from stakeholders and policymakers to implement policies and improve programs. This report will inform this dialogue and serve as a foundation for efforts going forward.

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Appendix A: Exemplary Programs

Southern Minnesota Municipal Power Authority

EXHIBIT A1. Program at a Glance[16]

Program Element	Description
Implementation organization	Southern Minnesota Municipal Power Agency (SMMPA) and collaborators, including Slipstream (formerly the Wisconsin Energy Conservation Corporation) and University of Minnesota Clean Energy Network Teams
State where offered	Minnesota[17]
Customer segment(s) included	Residential, commercial, and industrial
Funding source	Ratepayer dollars
Website	smmpa.com/energy-efficiency
Contact for program information	John O'Neil Manager of Energy Efficiency and Member Support Programs Southern Minnesota Municipal Power Agency jp.oneil@smmpa.org

SMMPA is a nonprofit joint-action agency (i.e., a group of public utilities that coordinate on planning and operational efforts) that provides wholesale electricity and related services to its 18 municipal utility members throughout Minnesota. SMMPA has three energy service representatives (ESRs) that work closely with 15 of their member utilities that provide power to relatively small communities, offering the utilities energy-efficiency program design, development, and marketing services. The 2016 populations of these communities ranged from about 1,300 to 10,400 residents. The other three of the 18 member utilities serve larger communities—Rochester, Austin, and Owatonna—and have in-house staff who implement energy-efficiency programs. The populations of these larger communities range from about 25,100 to 113,300 residents. The U.S. Environmental Protection Agency has awarded SMMPA and its member utilities multiple ENERGY STAR awards, including (most recently) the 2016 Energy Efficiency Program Delivery Partner of the Year award.

SMMPA's ESRs build relationships with contractors, appliance retailers, and customers to deliver energy-efficiency programs, funding these programs with ratepayer dollars. As member utilities lend up-front costs for customer efficiency rebates, then SMMPA reimburses them for this expense.

SMMPA offers several core programs, including Be Bright as well as CERTs Commercial Outreach Project and ENERGY STAR rebates.

[16] This case study comes from a recent ACEEE report, *Reaching Rural Communities with Energy Efficiency Programs* (Shoemaker, Gilleo,and Ferguson 2018).

[17] SMMPA serves 18 municipal utility members: Austin, Blooming Prairie, Fairmont, Grand Marais, Lake City, Litchfield, Mora, New Prague, North Branch, Owatonna, Preston, Princeton, Redwood Falls, Rochester, Saint Peter, Spring Valley, Waseca, and Wells. However, the CERTs program excludes SMMPA's largest three communities: Austin, Rochester, and Owatonna.

Be Bright Lighting Campaign

From October to December, SMMPA runs an annual fall lighting campaign. Through this program, SMMPA works with its program partner, the Wisconsin Energy Conservation Corporation (WECC), to provide discounted ENERGY STAR LED light bulbs for purchase from participating retailers. SMMPA provides an instant rebate and WECC partners with manufacturers to further buy down the cost of the bulbs. This residential upstream strategy minimizes the barriers to program participation by reducing the cost and improving access to energy-efficient LED bulbs. WECC also delivers this program on behalf of several other utilities in Minnesota. Exhibit A2 summarizes program impacts.

CERTS Commercial Outreach Project and ENERGY STAR Rebates

During 2014 and 2015, SMMPA worked with the University of Minnesota's Clean Energy Resources Teams to increase awareness of SMMPA's commercial and industrial rebate programs. CERTs staff met with all local businesses in the territories of target municipal utilities and provided an introductory letter and contact info for the SMMPA ESR, a list of current rebates, a utility-specific CERTs *Right Light Guide*, and a form through which participants could sign up for email updates from their local utility (CERTs 2015; CERTs n.d.). While the outreach effort with CERTs has ended, SMMPA continues to offer a variety of rebates for energy-efficient commercial and industrial ENERGY STAR equipment. Exhibit A2 summarizes some of the impacts from the CERTs project.

Notable Program Elements

Energy Savings Targets for Retail Municipal Utilities

Since 2010, the Minnesota Conservation Improvement Program (CIP) requires municipal utilities and cooperative utilities to reduce electricity sales by 1.5 percent annually (State of Minnesota 2018). Between 2010 and 2017, SMMPA's members collectively exceeded the state savings and spending requirements each year, with an average annual energy savings of 1.77 percent of utility retail sales and efficiency spending of 2.71 percent of utility revenues (SMMPA 2017). In 2018, SMMPA saved 1.9 percent of retail electric sales, reimbursed member utilities $4.4 million for customer energy efficiency rebates, and lowered annual usage by 54,117 MWh (SMMPA 2018a).

Multiple Program Types

SMMPA offers a variety of programs to capture as many customers across market segments as possible. For its residential customers, SMMPA offers several rebates for energy-efficient lighting, appliances, air conditioners, and heat pumps (SMMPA 2019b). They also work with industrial facilities that package and process food items and manufacture HVAC systems, boats, and steel (SMMPA 2017). Initially SMMPA offered measures such as basic lighting, cooling, and motors that applied to many industrial types. More recently they have expanded into specialty customer segments, such as food services and will soon offer a retro-commissioning pilot program for up to six commercial or industrial customers (SMMPA 2019a). SMMPA members serve few agricultural customers, so they do not have programs targeted specifically for them. However, agricultural customers participate in SMMPA's residential and commercial programs and are often interested in lighting and cooling measures (John O'Neil, pers. comm.).

Lessons Learned

Partnerships That Enable SMMPA to Leverage Existing Resources

SMMPA has forged several partnerships to make their efficiency program dollars go further. Over 15 years ago, SMMPA became an ENERGY STAR partner, which gave them access to ENERGY STAR marketing materials, tools, and resources; let them participate in nationwide promotions; and included them in the online ENERGY STAR database of utility incentives. Working with WECC enabled SMMPA to take advantage of an energy-efficiency campaign with multiple larger utilities, such as Xcel Energy and Great River Energy. SMMPA's partnership with CERTs enabled an extensive outreach effort that did not require additional SMMPA staff resources.

Customized Electronic Marketing by Member Utility

To build the relationship between municipal utility members and customers, SMMPA markets their energy-efficiency programs as if they were coming from the retail utilities themselves. Most customers are unfamiliar with SMMPA. SMMPA uses an in-house graphic designer to tailor their efficiency program marketing by customizing logos and sometimes messaging for each utility. They use an electronic newsletter to market programs, a less-expensive alternative to printing and mailing paper materials. SMMPA noticed that most of their member utilities have a minimal Web presence, so they created simple, custom-branded websites for each of their members within the SMMPA website (SMMPA n.d.). Through these portals, customers can access their energy bills, obtain efficiency program rebate forms, and sign up for email updates.

EXHIBIT A2. Program Performance

Be Bright Campaign	2017	CERTs Commercial Outreach Project	2014–2015
Electricity savings	1,057,850 kWh	Electricity savings	1,038,911 kWh
Participating local retailers	38	Customers visited	1,438
Members with at least one participating local retailer	16		

Note: Energy savings are gross and Minnesota does not have a net-to-gross savings adjustment. Source: SMMPA 2018b; SMMPA 2016.

Entergy Arkansas Agricultural Energy Solutions

EXHIBIT A3. Program at a Glance[18]

Program Element	Description
Implementation organization	ICF
State where offered	Arkansas
Customer segment(s) included	Agricultural customers
Program state date/year established	2012
Budget	$1.1 million (2018), $1.1 million (2019)
Funding source	Entergy Arkansas Energy Efficiency Cost Recovery rider
Website	www.entergy-arkansas.com/your_business/save_money/EE/agricultural.aspx
Contact for program information	Beau Blankenship Project Manager, Energy Efficiency Entergy Arkansas 501-377-3913 bblanke@entergy.com

The Agricultural Energy Solutions Program helps farmers and other agribusinesses make their property more energy efficient by offering farm audits; prescriptive and custom incentives; education for suppliers of agricultural equipment; and trade ally oversight, training, and quality control. The goal is to produce long-term, cost-effective electric savings. The program targets both existing facilities and new construction, and any agricultural customer at a facility receiving electric service from Entergy Arkansas is eligible.

The program includes both prescriptive and custom components. Prescriptive measures include efficient lighting technologies. The prescriptive option is a way for farm customers to make efficient choices on predefined energy-efficiency lighting measures. The program sets incentives and claimed savings based on predefined technologies and calculation methods. The custom component supports customers implementing site-specific opportunities through measures not addressed by the prescriptive option, such as variable-frequency drives (VFDs). In 2018, the program added additional custom measures, including pump tune-ups, ventilation fans, and integrated high-performance pumping systems for animal and plant production.

Entergy Arkansas partners with the consulting firm ICF, whose account managers work with lighting supply trade ally networks to promote the program. The program supports account managers with print, radio, and digital advertising targeted to the agricultural sector.

Notable Program Elements

Supportive policy environment. Arkansas is one of the only southeastern states with energy efficiency resource standard that includes long-term savings electric and gas targets. The Arkansas Public Service Commission (APSC) established these requirements in 2007 as part of the Rules for Conservation and

[18] This case study comes from a recent ACEEE report *The New Leaders of the Pack: ACEEE's Fourth National Review of Exemplary Efficiency Programs* (Nowak, Kushler, and Witte 2018).

Energy Efficiency Programs. In 2018, the APSC increased savings targets for program years 2020–2022, requiring electric utilities to save 1.2 percent and natural gas utilities to save 0.5 percent of 2018 baseline sales. APSC awards performance incentives to Arkansas utilities for meeting energy-efficiency goals; however, it undermines potential savings by allowing large customers to opt out of efficiency programs (ACEEE 2018).

Persistent energy savings, cost-effectiveness, and high customer satisfaction. The program has doubled annual MWh savings since 2015 while remaining cost effective. Surveys show a 95 percent satisfaction with program customer service, and 100 percent of participants were very likely to inform other farmers about the program. Word of mouth among farmers has given credibility to the process, with participants affirming that energy efficiency is good for their business.

Lessons Learned

Meet with farmers onsite. With small profit margins, many farmers are hesitant to make energy-efficiency improvements. To be successful, program implementers had to meet with farmers onsite to demonstrate how they could save energy and money through specific energy-efficient replacement measures.

Leverage USDA resources. Even with financial incentives, some farmers lack funds to invest in energy efficiency. Implementers learned to work with the USDA's REAP program to help secure low-interest loans and to work with trade allies to incorporate innovative financial solutions.

Understand industry-specific challenges that farmers face. Implementers also learned that understanding the limitations farmers face in terms of biosecurity, disease outbreaks, and other unique issues builds trust for future energy efficiency.

EXHIBIT A4. Program Performance

Program spending (total dollars)	$765,606
Program participants	51
Annual electric energy savings (MWh net)	7,609
Annual peak demand savings (MW)	1.04
Lifetime electric energy savings (MWh net)	76,872
Cost-effectiveness results, total resource cost	4.42
Most recent program evaluation: www.apscservices.info/EFilings/Docket_Search_Documents.asp?Docket=07-085- TF&DocNumVal=662	

Florida Office of Energy's Farm Energy and Water Efficiency Realization Program and Florida Renewable Efficiency Demonstration

EXHIBIT A5. Programs at a Glance

Program Name	Farm Energy and Water Efficiency Realization (FEWER)	Farm Renewable Efficiency Demonstration (FRED)
Implementation organization	Florida Office of Energy and the Suwannee County Conservation District, with delivery by EnSave	Florida Office of Energy, Florida A&M University, University of Central Florida, and University of Florida
Location	Suwanee County	Statewide
Customer segment(s) included	Agriculture	Agriculture
Program duration	2015–2017	2017–2018
Budget	$5 million	$3 million
Funding source	State funding and USDA Rural Business Enterprise Grant (RBEG) funds	State funding and USDA Natural Resources Conservation Service (NRCS) funds
Incentive amounts	75 percent cost share up to $25,000	Free energy evaluations up to $4,500; 80 percent cost share up to $25,000
Program focus areas	Energy and water audits and upgrades	Energy audits (including renewable energy) and upgrades
Website	No longer active	No longer active
Contact for program information	Kelley Smith Burke Director Office of Energy Florida Department of Agriculture and Consumer Services Kelley.SmithBurk@freshfromflorida.com	

Sources: OOE 2017; EnSave 2017; OOE 2018; Shoemaker, Gilleo, and Ferguson 2018

The Florida Office of Energy (OOE) is housed within the state's Department of Agriculture and Consumer Services. Due to its placement, the OOE staff report to the agriculture commissioner and communicate regularly with agricultural producers. The staff have developed several efficiency programs to directly address their energy needs. In 2015, the OOE launched the Farm Energy and Water Efficiency Realization program as a pilot in Suwannee County. Through the program, the OOE provided agricultural producers with free energy and water audits, a grant to cover part of the cost of implementing recommended energy-efficiency measures, and a preliminary analysis of renewable energy technologies upon request. Due to the success of this pilot, the OOE launched the statewide Farm Renewable Efficiency Demonstration program in 2017 (Kelley Smith Burk, pers. comm.). According to the Florida OOE's 2017 Annual Report, the FRED program received 134 applications, conducted 72 energy evaluations, and processed payments and produced audit reports from several applicants.

The OOE offers a variety of other efficiency programs for farms and other rural community members. In early 2018, it announced the availability of funding for its Small Community Energy Efficient Lighting Grant Program designed to help local governments upgrade indoor and outdoor lighting in community-oriented facilities, such as libraries, museums, parks, and community centers. Through the Efficiency and Renewable Improvements in Commercial Aquaculture (ERICA) program, OOE provides grant reimbursements to the University of Florida's Tropical Aquaculture Laboratory to research energy-efficiency and renewable energy technologies for this sector. Lastly, through its Florida Low Income Rural Energy Efficiencies (FLIREE) Grant program, OOE upgrades public-use facilities, street lights, and traffic lights in partnership with eligible local government serving low-income communities (OOE 2017; OOE February 2018).

Notable Program Elements

Packaging renewable energy and energy efficiency. While the FEWER pilot focused solely on energy and water efficiency, the FRED program also includes eligible renewable technologies. Many farmers are interested in renewable energy, and the program helps educate them on efficiency opportunities that would reduce the payback period of renewable energy investments. When combining these technologies, auditors evaluate the efficiency of buildings before considering recommendations for renewable energy integration.

Comprehensive audits leading to a range of savings opportunities. Because both FEWER and FRED require complete audits, the programs can incorporate a variety of measures. The OOE offered incentives for lighting, HVAC, motors and motor controls, insulation for poultry houses, milk-harvesting equipment, irrigation pumps, variable-speed drives, and sprinklers and water regulators. The programs also allowed for fuel switching—usually from diesel to electricity.

Lessons Learned

Aligning program implementation with farming seasons. Both FEWER and FRED have had significant interest from agricultural producers. However growing seasons impact when farmers can complete recommended upgrades. This leads to fluctuating program uptake that aligns with the agricultural production cycle, making it difficult to provide year-round steady work for contractors. To address this issue, the OOE worked with producers to establish a schedule. The OOE then extended its contracts with implementers to ensure all participants received work and contractors had a more predictable workflow.

Aligning program implementation with federal requirements for financing. For larger projects, program implementers steered participants toward USDA RBEG and NRCS financial assistance, which require an energy audit. Program staff structured FEWER and FRED audits to match those needed for USDA loan applications as well as Environmental Quality Incentives Program funding, so program participants would not need to complete a second audit to apply for USDA financing. The OOE gave priority to producers who were eligible or would become eligible for the NRCS EQIP cost share to help fund the practices and projects as a result of the onsite evaluation.

The table below presents FEWER program impacts. Data for FRED are not yet available.

EXHIBIT A6. Program Performance

	FEWER (2015–2017)	FRED (2017–2018)
Program spending (total dollars)	$3.9 million	$1.1 million
Audits	192	101
Projects completed	132	64
Identified energy savings	116,473 MMBtu	-
Realized energy savings	45,310 MMBtu	-
Annual electric savings	$1.5 million	-

Energy savings are cumulative. The project team was unable to determine whether they are net or gross (OOE 2017; OOE 2018).

Wisconsin Focus on Energy Rural Engagement Effort

EXHIBIT A7. Initiative at a Glance

Program Element	Description
Implementation organization	APTIM on behalf of Wisconsin Focus on Energy, which implements energy-efficiency and renewable energy programs on behalf of participating utilities[19]
State where offered	Wisconsin
Customer segment(s) included	Various (see individual program descriptions)
Program state date/year established	2016
Budget	$7.5 million annually [a]
Funding source	Ratepayer dollars collected by Statewide Energy Efficiency and Renewable Energy Administration
Website	WisconsinIsIn.com

[a] Budget is for rural and agriculture energy-efficiency programs.

In 2016, as part of its 2015–2018 Quadrennial Planning Process, the Wisconsin Public Service Commission (Wisconsin PSC) set a goal to increase rural engagement and participation in energy-efficiency programs administered by Focus on Energy (Focus).[20] Previously, APTIM and Focus on Energy faced several challenges reaching these communities, including the lack of trade ally contractors in rural areas, direct-install programs' focus on urban areas, marketing difficulty, and a prevalence of nonparticipating electric cooperatives in rural areas. Focus on Energy identified 582 rural Wisconsin zip codes in which 40.4 percent of participating utility customers reside (Wisconsin PSC 2016).[21] They then worked to increase participation by these rural customers in existing core residential and commercial efficiency programs, establishing program-specific key performance indicators for rural enrollment.[22] Focus on Energy also designed and began offering several new rural-focused energy-efficiency programs, tracking these programs as a separate rural portfolio. Moreover, Wisconsin Focus on Energy has consistently had an energy-efficiency program for agricultural customers (Amelia Gulkis, pers. comm.).[23]

Notable Program Elements

Supportive policy environment. In fall 2016, the Wisconsin PSC issued a notice of investigation to determine whether rural customers are receiving equal benefits from Focus on Energy's energy-efficiency

[19] This includes participating electric and gas investor-owned, municipal, and co-operative utilities listed here: focusonenergy.com/about/participating-utilities.

[20] Wisconsin statute § 196.374(5m)(b) requires the Wisconsin PSC to provide equal opportunity to customers across the state to participate in energy-efficiency and renewable energy programs. Moreover, Wisconsin statute § 196.374(2)(a)2.c. requires that statewide efficiency programs address the needs of individuals or businesses who need efficiency services most. Finally, Wisconsin statute § 196.374(3)(b)1. requires the Wisconsin PSC to prioritize programs that promote rural economic development, among other goals. The Wisconsin Public Service Commission order in docket #5-FE-102 opened an investigation to study rural customers' access to Focus on Energy's energy-efficiency and renewable energy programs and the role of broadband in expanding access.

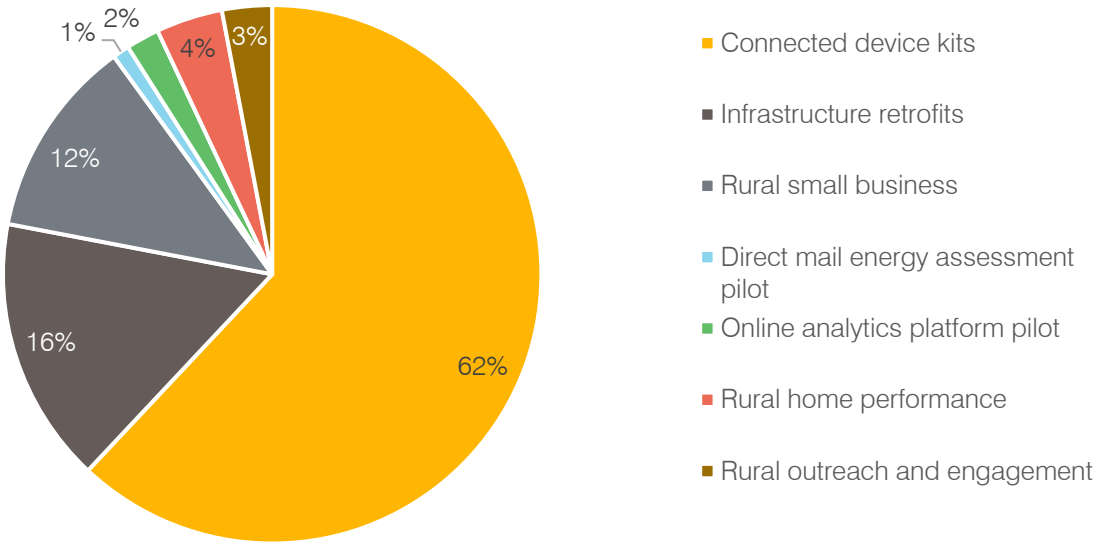
[21] According to 2010 Census data (Cronin, K. February 2019).

[22] Focus on Energy operated rural components in the following core programs: Business Incentive, Home Performance with ENERGY STAR, Simple Energy Efficiency, and Small Business. Several pilot programs were also operated in conjunction with core programs listed above, including Strategic Energy Management and the ENERGY STAR Retail Products Platform (Cadmus 2019b).

[23] The Wisconsin PSC worked with Cadmus to evaluate the sector-specific energy savings potential from efficiency programs between 2019 through 2030. For the agricultural sector, Cadmus found that the dairy segment made up 50 percent of the electric economic potential, miscellaneous agriculture accounted for 32 percent, and irrigation accounted for 18 percent (Focus on Energy 2017).

programs and to determine what role Wisconsin utilities might play in expanding broadband access in these communities (Wisconsin PSC 2016). In December 2016, the Wisconsin PSC approved $26 million for pilot energy-efficiency and broadband programs to run from 2017 through 2018 across the participating electric and gas utilities served by Focus on Energy. The pilot programs launched in spring 2017 and included connected device kits, a communication provider initiative, and targeted marketing and incentives for rural homeowners and businesses. Communications providers own and operate the broadband infrastructure. Exhibit 53 depicts the break-down of spending across these activities.

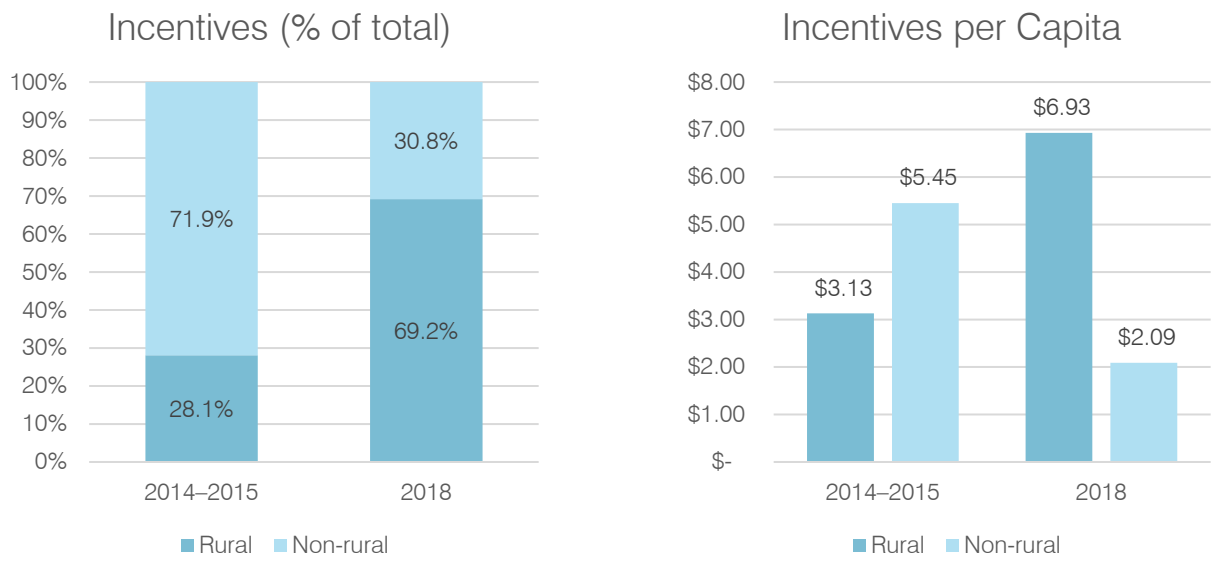
EXHIBIT 53. Focus on Energy's Rural Portfolio Allocation.



Source: Cronin 2019

Targeted rural marketing initiative. As part of its "Wisconsin Is In" campaign, APTIM used specialized messaging and marketing techniques to reach rural Wisconsin residents and businesses. They designated an $867,000 budget for targeted marketing technique by mail, radio, television, newspaper, and a Web landing page (Cronin 2019; Focus on Energy 2019). Throughout this messaging, APTIM minimized jargon, emphasized proven monetary savings, and underscored energy efficiency as a source of pride for the state of Wisconsin. They found that rural residents particularly cared about the connection between energy efficiency and the economy. APTIM also gradually disseminated campaign materials to the rural market, analyzing effectiveness of methods and updating tactics accordingly. In part because of this rural engagement campaign, Focus on Energy increased their residential single-family incentive spending on rural customers (see Exhibit 54).

EXHIBIT 54. Focus on Energy Rural Versus Nonrural Residential Single-family Incentive Spending[24]



Source: Cronin 2019

Expanded rural-specific initiatives in 2019. APTIM and Focus on Energy plan to expand their rural engagement activities between 2019 and 2022. They set a $9 million annual budget for programming in the agricultural and industrial sectors during this time frame. Across their portfolio of programs, APTIM will continue increased incentive levels for rural participants in statewide programs. APTIM is also appointing new energy advisors to conduct technical and outreach support. Some of these advisors have expertise with specific technologies or customer segments, while others support different geographic regions. Finally, during this time frame, APTIM will launch several rural-targeted programs like a rural residential behavioral pilot, industrial benchmarking program, a farmhouse program, and rural retail pop-up program (Focus on Energy 2018; Cronin 2019).

Program Performance

Focus on Energy's rural programs and pilots reached 48 percent of buildings in communities with a population under 30,000, exceeding their 25 percent goal (Cadmus 2019b). Moreover, rural programs contributed substantially toward portfolio-level natural gas savings goals, accounting for about 9.5 percent of natural gas savings in 2018.

[24] This analysis includes the following Focus on Energy programs: Appliance Recycling, Assisted Home Performance with ENERGY STAR, Connected Device Kit Program, Design Assistance—Residential, Enhanced Rewards, Express Energy Efficiency (E3), Home Performance—Flood Relief, Home Performance with ENERGY STAR, Low-E Storm Windows Pilot, Manufactured Homes Pilot, New Homes, Renewable Rewards—Residential, Residential Rewards, Rural Broadband Home Performance with ENERGY STAR, Seasonal Savings, Simple Energy Efficiency (K. Cronin, APTIM, pers. comm., May 2019).

EXHIBIT 55. Focus on Energy Rural Broadband 2018 Program Descriptions and Impacts

Program	Description	kWh	Therms
Connected Devices Kits	Kits containing Wi-Fi-connected household items (i.e., smart thermostats, Wi-Fi thermostats, LEDs, and advanced power strips)	9,516,825	506,608
Rural Home Performance	Comprehensive energy-efficiency retrofits in single-family homes with enhanced incentives for rural customers	107,462	8,825
Community Small Business Offering	Free energy assessments and energy-saving kits with incentives for rural customers 50 percent higher than those offered to nonrural customers	6,625,964	39,709
Rural Communications Providers Initiative	Dedicated funding and technical support for energy-related projects, with increased incentives for custom projects	1,219,566	4,446
Total		**17,469,817**	**559,588**

Note: Energy savings are verified net.
Source: Cadmus 2019a

Winneshiek County Energy District

The Winneshiek Energy District is a nonprofit organization in Northeast Iowa. It was launched by community members in 2010 and modeled after the soil and water conservation districts created in the 1930s to help local farmers access state, federal, and private funds for energy-efficiency and renewable energy projects. A unique model of energy-efficiency programming outside of the utility framework, WED has helped establish energy districts in Howard, Clayton, and Dubuque Counties and is planning additional energy districts in three other counties (WED 2019a).

EXHIBIT A8. Program at a Glance

Program Element	Description
Implementation organization	Winneshiek Energy District
State where offered	Iowa
Customer segment(s) included	Residential, commercial agricultural, institutional
Program state date/year established	2010
Budget	$200,000
Funding source	Grants (60 percent), membership dues (25 percent), and revenue from services (15 percent)
Website	energydistrict.org/about
Contact for program information	Andy Johnson Director Winneshiek Energy District andy@energydistrict.org 563-382-4207 ext. 1

Notable Program Elements

Multisector energy audit and planning process. WED works with homes, businesses, institutions, and farmers to conduct an energy audit then analyze the technical and economic potential for energy-efficiency, renewable energy, and transportation improvements. They then work with customers to install technologies of interest. To pay for these improvements, they help customers apply for utility, state, and federal resources. For example, WED helps Farm Energy Planning customers apply for incentives from the USDA NRCS, EQIP, and REAP (WED 2019a).

Market transformation activities. WED looks beyond the traditional program delivery services mentioned above to transform local energy-efficiency markets. They offer workshops and trainings for contractors; coordinate with community colleges on energy-efficiency, renewable energy, and green building trainings; build knowledge of clean energy programs with financial sector partners; engage with vendors and dealerships; and develop tools for the real estate industry (WED 2019a).

Lessons Learned

Engage the right partners. WED partners extensively with state and local stakeholders. They work with the Green Iowa AmeriCorps (GIA) program, housed at the University of Northern Iowa's Center for Energy and Environmental Education, to install energy-efficiency measures in participating homes, with a focus on low-income, elderly, disabled, and veteran households (WED 2019b).

State policies matter. WED advocates for state policies that can support the energy-efficiency and renewable energy programs they implement. While Iowa utilities have long records of providing comprehensive portfolios of energy-efficiency programs across customer classes, the state passed legislation in 2018 to scale these efforts back (ACEEE May 2018; State of Iowa 2018). WED is working to design energy-efficiency programs to fill this void (Andy Johnson, pers. comm.). They participate in Iowa Utilities Board dockets in order to protect the state's net metering policy and they are advocating for legislation that would enable energy districts to administer utility funds for energy-efficiency and renewable energy programs (Russell 2018; Andy Johnson, pers. comm.). WED also gives tours to legislators of their solar and energy-efficiency project districts.

EXHIBIT A9. Program Performance

	2010–2018
Program spending (total dollars)	$14 million
Program participants	Delivered energy planning services to 1,000 households and 60 farms
Conversion of audit customers to implementing efficiency measures	75 percent

Note: Impacts are estimated for the following programs: Farm, Home, and Business Energy Planning; SolSmart Regional Acceleration; and Green Iowa AmeriCorps' First Step Home Efficiency program (Andy Johnson, pers. comm.)
Source: WED 2019c

Appendix B: Exemplary Policies

Minnesota Conservation Improvement Plan

EXHIBIT A10. Policy at a Glance[25]

Policy Element	Description
Policy type	Legislative
State where offered	Minnesota
Customer segment(s) included	All
Contact for program information	Adam Zoet, Project Manager Minnesota Department of Commerce, Division of Energy Resources adam.zoet@state.mn.us 651-539-1798

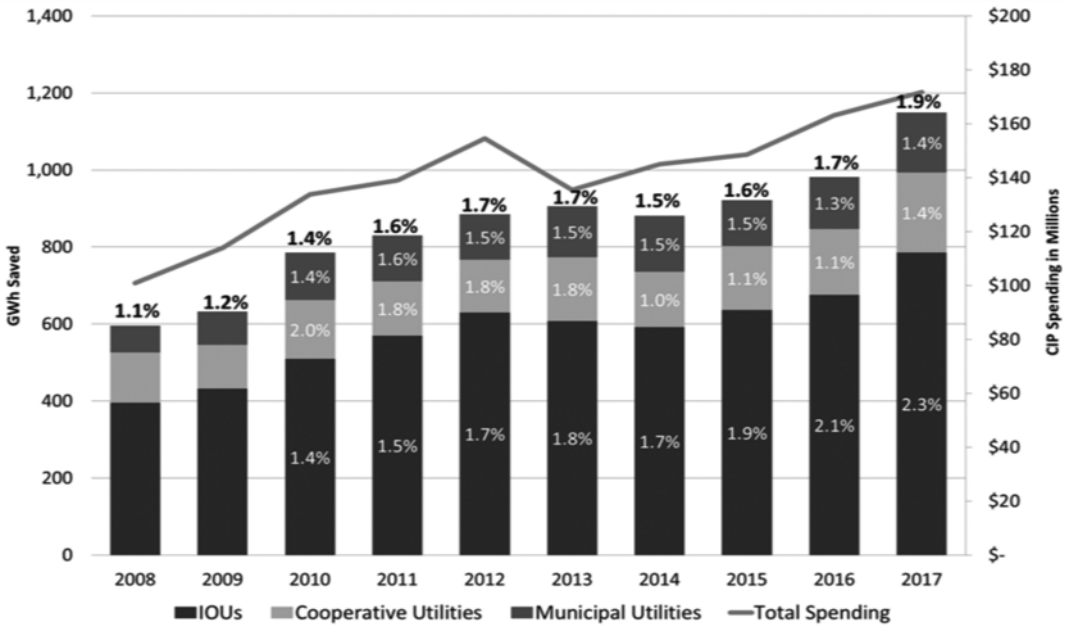
Minnesota's long-running Conservation Improvement Program requires electric and natural gas utilities to invest a portion of state revenues in energy-efficiency programs. Out of 213 Minnesota utilities, CIP encompasses 79 municipal utilities, 35 distribution cooperative utilities, and eight investor-owned utilities (CEE, Optimal Energy, and Seventhwave 2018).[26] CIP requires co-op electric associations providing retail electric services to over 5,000 members to spend 1.5 percent of gross operative revenues on energy efficiency. CIP also requires municipal utilities providing electric service to over 1,000 retail customers and/or over 1 billion cubic feet in annual natural gas sales to retail customers to spend on 0.5 percent of gross operative revenues from gas sales and 1.5 percent of gross revenues from electricity sales on energy efficiency. However, CIP requirements also allow large electric customers to opt-out of efficiency programs (State of Minnesota 2018).[27] For perspective, municipal and cooperative utilities served 15 percent and 23 percent of Minnesota's electric load in 2016, respectively (CEE, Optimal Energy, and Seventhwave 2018). As depicted in Figure 56, Minnesota municipal and cooperative utilities have a history of meeting or almost meeting CIP requirements.

[25] For a more detailed case study about an energy efficiency implemented under CIP requirements, see the SMMPA case study above.

[26] Legislation in 2017 exempted 18 smaller cooperatives and 51 municipal utilities from CIP requirements (CEE, Optimal Energy, and Seventhwave 2018).

[27] Minnesota statute defines a "large customer facility" as one with a peak electrical demand over 20,000 kW or that consumes at least 500 million cubic feet of natural gas annually (State of Minnesota 2018).

EXHIBIT 56. Minnesota Electric Utilities' Historic Energy-efficiency Spending and Savings (GWh as a Percentage of Total Sales), 2008–2016



Source: CEE, Optimal Energy, and Seventhwave 2018

Notable Policy Elements

Streamlined online reporting and program data collection. Minnesota municipal and cooperative utilities annually file their energy-efficiency plans online with the Minnesota Department of Commerce, including the previous year's expenditures and energy savings and the upcoming year's budgets, energy savings goals, and changes to program design (CEE, Optimal Energy, and Seventhwave 2018; Energy Platforms n.d.). While the department can suggest changes to municipality and co-op energy-efficiency plans, it does not generally mandate such changes (Ehrendreich, Payleitner, and Dreher 2019).

Lessons Learned

Cooperation amongst utilities. Because many Minnesota municipal and cooperative utilities lack resources and staff capacity to implement energy-efficiency programs, power marketing membership organizations coordinate efficiency programs for their members and help them achieve CIP requirements. Four co-op member organizations serve 41 of 48 co-ops, and six municipal power pools (i.e., groups of multiple municipal utilities that share planning and operational functions) cover 70 of 118 small municipalities (CEE, Optimal Energy, and Seventhwave 2018). These joint program models can also be used to help municipal and cooperative utilities deliver energy efficiency to agricultural customers with distinct energy use characteristics. See Exhibit 57 for examples of generation and transmission providers that help their members implement energy-efficiency programs.[28]

[28] For a list of municipalities and co-ops included in CIP requirements, as well as the groups in which they submit CIP reports, see Docket 18-500, document 20194-151731-01, filed on April 5, 2019. This docket also identifies municipalities and co-ops that are voluntarily reporting on energy-efficiency programs. See the Minnesota Department of Commerce's eDocket search: www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showeDocketsSearch&showEdocket=true.

EXHIBIT 57. Examples of Aggregated Energy-efficiency Program Models from Municipal and Cooperative Utilities

Program Administrator	Efficiency Services Offered to Members
Great River Energy (GRE)	Designs programs and marketing materials for member cooperatives, but individual cooperatives set incentive levels and run programs themselves
Minnkota Power Cooperative	Markets, promotes, and runs program with third-party service providers on behalf of member municipal and cooperative utilities
Southern Minnesota Municipal Power Agency	Develops, markets, implements, and reports upon programs for municipal members
Missouri River Energy Services (MRES)	Coordinates and packages efficiency programs for member municipal utilities under the "Bright Energy Solutions" brand

Source: CEE, Optimal Energy, and Seventhwave 2018

California Rural Hard-to-reach Working Group

EXHIBIT A11. Policy at a Glance

Policy Element	Description
Policy type	Regulatory
State where offered	California
Customer segment(s) included	Hard-to-reach local governments
Contact for program information	Courtney B. Kalashian Executive Director San Joaquin Valley Clean Energy Organization ckalashian@pesc.com

Source: Shoemaker, Gilleo, and Ferguson 2018California energy-efficiency program implementers formed a Rural Hard-to-reach Working Group (RHTR) to coordinate about practices for serving local governments in less-densely populated parts of the state. The working group consists of California investor-owned utilities, efficiency program administrators, nonprofits, housing authorities, and others. RHTR working group members bring a rural perspective to ongoing conversations around statewide efficiency policy and program development, for example, by submitting comments in formal CPUC proceedings and participating in statewide energy-efficiency committees (e.g., the California Energy Efficiency Coordinating Committee and the Energy Data Access Committee). The RHTR working group is currently pursuing becoming a Rural Energy Network, which would give them consistent CPUC funding to administer efficiency programs for rural community members across the state (CPUC n.d.; Courtney Kalashian, pers. comm.).[29] Looking beyond the local government-focused scope of the RHTR working group, the CPUC requires that all utilities describe their energy-efficiency strategies and strategic plans for all six sectors, including agriculture (NRDC 2016).

Notable Policy Elements

Collaborative troubleshooting. While the members of the RHTR working group come from geographically diverse areas, they work to identify and understand replicable solutions across utility service territories. Members leverage working group conversations to speak candidly about technical and programmatic challenges they face trying to serve a particular rural customer (e.g., an isolated local government building) and seek recommendations from other working group members. As a result, members develop a better understanding of program design components necessary to make them more successful in rural areas.

Energy efficiency guidelines for hard-to-reach customers. The CPUC, for example, allows utilities to claim a higher savings for serving hard-to-reach customers, including rural businesses and residents.[30] According to the CPUC, customers qualify as hard to reach if they lack access to efficiency program

[29] In 2012, the CPUC invited local governments to apply to administer energy-efficiency programs that complement those offered by investor-owned utilities. The CPUC then approved efficiency program funding for two new Regional Energy Networks (SoCalREN and BayREN) so long as they focus on hard-to-reach markets and avoid duplication with investor-owned utility programs (CPUC n.d.).

[30] Efficiency program implementers can report either net or gross savings. Gross savings include all savings expected from an energy-efficiency program. Net savings calculations exclude savings from free riders (program participants who would have implemented or installed the measures without or with a lesser incentive) and free drivers (utility customers who install efficiency measures as a result of a program but are not themselves participants in the program). Program evaluators apply a net-to-gross ratio to convert gross savings to net savings (Berg et al. 2017).

information or do not generally participate in efficiency programs due to geographic, language, income, housing type, or homeownership barriers. Customers who are located outside the San Francisco Bay Area, Greater Los Angeles Area, Greater Sacramento Area, or metropolitan statistical areas of San Diego County and meet one of the other criteria qualify as hard to reach (CPUC 2014). However, the implementation of this policy could be improved by making sure all California utilities take advantage of it and working with installers or third-party contractors to go into more rural communities (Courtney Kalashian, pers. comm.).

Lessons Learned

Develop a local contractor base. RHTR working group members found a lack of trust from rural community members for contractors from outside of their communities, so they worked to improve the contractor base in these communities (Courtney Kalashian, pers. comm.). By using trusted community-based agencies and organizations to deliver efficiency services and offering targeted local workforce development, implementers saw increased participation rates in some efficiency programs. Southern California Edison, for example, added a green job skills training component and comprehensive community outreach strategy to its Direct Install Program for hard-to-reach small commercial customers and increased participation from 36 percent to 56 percent between 2009 and 2010 (Rodriguez and Goforth 2012). Finding that contracting firms could not always afford to send their workers to existing investor-owned, utility-run training centers, the RHTR working group aggregated rural contracting firms and workers, demonstrates demand for trainings, and encourages utilities to host trainings in these communities (Courtney Kalashian, pers. comm.).

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