



PROGRESS REPORT—MGE TECHNICAL WORK GROUP

TECHNICAL WORK GROUP MEMBERS:

- Citizens Utility Board
- Clean Wisconsin
- Madison Gas & Electric

Great Plains Institute provides technical support and facilitates the Technical Work Group

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EXECUTIVE SUMMARY

Madison Gas and Electric (MGE), Citizens Utility Board and Clean Wisconsin began working together as a Technical Work Group (TWG) in late 2014 to examine rate design issues in a focused, deliberative fashion. Recognizing the continuing need for MGE to be responsive to its customers and to fairly and appropriately recover costs of providing safe, reliable, environmentally protective, and affordable electric service at a time of new challenges and opportunities in the electric utility industry, the TWG developed the following consensus problem statement:

The energy landscape is in a state of transition due to a number of major forces, including technical, market, policy, and societal changes. These changes are taking place at a range of scales from local to global, and will affect utilities and their customers, including MGE and those within MGE's electrical service territory.

Electrical rate structures are important drivers of behavior for all participants in the energy landscape. However, current rate structures were not designed with the shifting landscape in mind. As a result, they may not lead to a system that maximizes, for all customers and other participants, the potential benefits from the changes taking place. In particular, the current rate structures and current legal / regulatory framework may not provide sufficient flexibility nor incentive for MGE to act to, or aid its customers acting to, maximize a clean, dependable, and efficient integrated system of energy use and generation.

In particular, the TWG agreed to work toward addressing the challenges and opportunities laid out in that statement in ways that would:

- Enable MGE to be responsive to the evolving wishes of their customers while maintaining sufficient revenues to ensure a modern and sustainable electric system and harnessing the benefits of technological advancements and broader industry changes for all customers.
- Draw on the best thinking and practice from across the country to identify potential pilot projects—appropriate to MGE's particular situation, customer base and regulatory framework—that position the company to effectively begin to address the challenges posed in the TWG's consensus problem statement.
- Recommend the most promising pilot project ideas for further development and vetting.

Those most promising pilot projects were determined through a series of meetings starting with a broad list of innovative pilot programs and demonstration projects. Project ideas came from the TWG members themselves and from research that GPI conducted on what utilities around the United States are doing and considering. The process was also informed by GPI's review of relevant peer-reviewed literature from around the world on similar and related pilot concepts.

Throughout 2015 and into early 2016, the TWG worked to distill the list of pilot and demonstration ideas into a prioritized list for further research, development and potential implementation. This progress report summarizes the results of this process to date, provides the current list of Pilot Program and Demonstration Projects under evaluation by the TWG, and briefly outlines expected next steps.

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This Progress Report was prepared by the Great Plains Institute (GPI), Citizens Utility Board, Clean Wisconsin, and Madison Gas & Electric. GPI supports the TWG with energy expertise and facilitation. GPI is located at 2801 21st Ave S., Suite 220, Minneapolis, MN 55407 | www.betterenergy.org

MGE TECHNICAL WORK GROUP

The Technical Work Group (TWG) is a collaborative effort of Madison Gas and Electric (MGE), Citizens Utility Board (CUB), and Clean Wisconsin that started in late 2014. Following MGE's 2014 Rate Case (3270-UR-120), the TWG set out to examine alternative rate design approaches and structures, and ways for MGE to be responsive to the changing electric utility industry landscape.

COLLABORATIVE APPROACH

A definition of collaborate is “to work jointly with others or together especially in an intellectual endeavor.” The organizations participating in the TWG have different missions and purposes. However, by participating in a collaborative effort, these organizations are engaged in an ongoing good faith effort to discuss and evaluate the evolving issues and challenges in the electric utility industry, and potential responses to those issues and challenges. The TWG's work, including this progress report, is taking place outside the pressures of a contested case, and is not meant to dictate or establish an organization's position on any particular issue outside the TWG process.

TWG PARTICIPATING ORGANIZATIONS

The following organizations comprise the Technical Working Group:

Madison Gas and Electric

Madison Gas and Electric generates and distributes electricity to 146,000 customers in Dane County and purchases and distributes natural gas to 152,000 customers in seven south-central and western Wisconsin counties.

Citizens Utility Board

CUB is a member-supported nonprofit organization that advocates for reliable and affordable electric, natural gas and water service on behalf of Wisconsin's residential and small business utility customers before regulatory agencies, the legislature, and the courts.

Clean Wisconsin

Founded in 1970 as Wisconsin's Environmental Decade, Clean Wisconsin works on behalf of its 20,000 members and supporters statewide to protect our air and water and to advocate for clean energy and energy efficiency.

Great Plains Institute (*Facilitator*)

The mission of the Great Plains Institute is to transform the way we produce, distribute, and consume energy to be both environmentally and economically sustainable. Through research and analysis, consensus policy development, technology acceleration, and local action, we are leading the transition to clean, efficient, and secure energy.

CONSENSUS PROBLEM STATEMENT

The energy landscape is in a state of transition due to a number of major forces, including technical, market, policy, and societal changes. These changes are taking place at a range of scales from local to global, and will affect utilities and their customers, including MGE and those within MGE's electrical service territory.

Electrical rate structures are important drivers of behavior for all participants in the energy landscape. However, current rate structures were not designed with the shifting landscape in mind. As a result, they may not lead to a system that maximizes, for all customers and other participants, the potential benefits from the changes taking place. In particular, the current rate structures and current legal / regulatory framework may not provide sufficient flexibility nor incentive for MGE to act to, or aid its customers acting to, maximize a clean, dependable, and efficient integrated system of energy use and generation.

GOALS

While the Technical Work Group set out to identify a set of pilot projects and demonstrations to help MGE address its strategic challenges, the group also viewed pilots and demonstrations, and the TWG process itself, as serving some larger goals:

1. Address complex energy challenges through a collaborative approach.
2. Keep electric service safe, affordable, reliable and equitable while transitioning to a more environmental sustainable energy supply.
3. Provide customers with options they want today and in the future.
4. Help customers control their energy use and costs.
5. Take steps to help all customers share in the benefits of changing technology.
6. Test different products/services with customers (followed by feasibility analysis on most promising ideas).
7. Minimize the need for costly new electric generation & distribution systems.
8. Transition MGE to a more environmentally sustainable energy supply.
9. Provide a dynamic grid that supports a range of distributed & centralized energy technologies, and reliable service at reasonable cost.
10. Explore alternative utility business models that respond to changes in the industry.

PROJECT OBJECTIVES

Upon initiating their work together, the TWG sought to proactively help assist the utility and its customers to address not only the challenges emerging in the electric sector, but also the opportunities. Specific project objectives were to:

- Enable MGE to be responsive to the evolving wishes of their customers while maintaining sufficient revenues to ensure a modern and sustainable electric system, and harnessing the benefits of technological advancements and broader industry changes for all customers.
- Draw on the best thinking and practice from across the country to identify potential pilot projects—appropriate to MGE’s particular situation, customer base and regulatory framework—that position the company to effectively begin to address the challenges posed in the TWG’s consensus problem statement.
- Recommend the most promising pilot project ideas for further development and vetting.

PILOT PROGRAM AND DEMONSTRATION PROJECT CRITERIA

Throughout the year 2015, the Technical Work Group identified potential new pilot programs and initiatives that could help position MGE as a leader in the fast-evolving electric utility landscape.

After conducting a literature review and casting a broad net to collect potential pilot and demonstration ideas, the TWG agreed that it needed a set of criteria by which to evaluate each potential pilot concept and select those with the highest priority and potential to best fit MGE’s needs, benefit its customers and contribute to the shared goals of the TWG. Criteria considered included:

- Customer Value Proposition
- Degree of Impact
- Ability to Achieve Multiple Goals
- Scalable and Replicable
- Ease of Implementation
- Impact on Customer Classes
- Cost
- Meets MGE Objectives
- Builds on Existing MGE Efforts
- “Cutting Edge” Nature
- “Platform” for Future Progress
- Avoids Unintended Consequences

Developing these criteria allowed the TWG to select a set of prioritized pilot programs and demonstration projects to consider further. The next section of this report discusses these programs in greater detail.

LIST OF POTENTIAL PILOT & DEMONSTRATION PROJECTS

These are the pilot program ideas that the TWG will be evaluating for further research and potential implementation.

| Index of Pilot Programs and Demonstration Projects | |
|---|---|
| # | Title |
| Electrical Rate and Billing Pilots and Programs | |
| 1 | Time of Use Rates, Critical Peak Pricing, Demand Metered Service, and/ or Minimum Bills |
| 2 | Low Income Rates |
| Demand Response Pilots and Programs | |
| 3 | Residential Load Control |
| 4 | Automated Demand Response (Commercial and Industrial) |
| Renewable Energy Pilots and Programs | |
| 5 | Large-User Clean Power Rate |
| 6 | Community Solar Program |
| 7 | Outdoor Solar Lighting Tariff |
| 8 | Advanced Solar Inverters |
| Electric Vehicle Pilots and Programs | |
| 9 | Multi-Family and Commercial Electric Vehicle Charging Stations |
| 10 | Electric Vehicle Fleet Enabling Programs |
| Energy Management Pilots and Programs | |
| 11 | Bundled Residential Energy Service Packages |
| 12 | Micro-Scale Combined Heat and Power Demonstration |

DESCRIPTION OF PILOT AND DEMONSTRATION COMPONENTS

Time of Use Rates

Time of use rates provide pricing signals to customers by increasing electrical charges during pre-established peak times when there tends to be more demand for energy, and decreasing charges during established off-peak times.

Critical Peak Pricing

“Critical peak pricing” offers similar price signals to “Time-of-Use” electric rates, but the timing of price increases are generally allowed to vary and are tied to real-time highest-peak hours on the highest-peak days.

Demand Metered Service

Demand metered service includes charges based on the maximum amount of electricity used by a customer at a given time. While demand can be calculated using various methods, typically demand is measured over either a 15 minute or 60 minute period and typically applies only to the highest period(s) of use during a year, or during a month, or during a combination of months.

Minimum Bill

A minimum bill is a fixed amount below which a customer's bill cannot be further reduced, to provide a utility with enough revenue from each customer to cover the costs of providing electric service that are fixed over the long-term. It only affects those customers whose usage would otherwise bring them below that level.

Low Income Rates

Low-Income Rates provide special pricing for customers whose household incomes fall below a specific level, to allow them to cost-effectively meet their energy needs.

Residential Load Control

Residential Load Control programs afford customers the opportunity to reduce their energy bills by allowing the utility to remotely control their electrical load, for example through smart thermostats.

Automated Demand Response

Automated Demand Response programs use smart automated energy management systems or building controls to stage and monitor loads to reduce overall peak demand (e.g. controlling lighting, refrigeration, or other load sources).

Large-User Clean Power Rate

Large customers interested in having some or all of their electricity come from renewable energy sources (such as wind or solar) can be offered a different electricity rate reflective of the long-term cost structures of renewable energy technologies.

Community Solar Program

Community solar programs offer interested customers the opportunity to buy a share (or membership) in a separately-located community solar project. This allows customers to participate in renewable energy generation when their circumstances wouldn't otherwise allow (e.g. houses without appropriate roofing, condos, or apartments).

Outdoor Solar Lighting Tariff

Solar-powered LED lights can stand-alone (i.e. are not required to be grid-connected) by using batteries charged by a PV array mounted on the light pole.

Advanced Solar Inverters

Advanced solar inverters allow use of "smart functions" for system restoration and voltage and frequency support. When owned by the utility, these advanced inverters can better integrate PV into the grid and are able to deliver and to take advantage of benefits like voltage regulation and grid support.

Multi-Family and Commercial Electric Vehicle Charging Stations

Electrical vehicle charging stations at multi-family and commercial sites allow for multiple people to benefit from a single infrastructure investment.

Electric Vehicle Fleet Enabling Programs

There are a number of ways for utilities to investigate the electrification of vehicle fleets, such as special incentives, leasing arrangements, offering “one stop shops” for setting up charging stations, and other arrangements.

Bundled Residential Energy Services Packages

Utilities can offer a variety of packages of clean energy and energy management products and services bundled together. Combining these can maximize the benefits of both to offer customers energy services that meet their desires and add value in ways that neither management nor alternative sources of generation can individually.

Micro-Scale Combined Heat and Power Demonstration

Combined heat and power offers additional system efficiencies by taking advantage of energy that would otherwise be wasted. Historically, these systems have been very large in scale, but with technological advances there is an opportunity for smaller-scale installations.

PROGRESS-TO-DATE

Informed by the collaborative work of the TWG, MGE is proceeding with several new pilots and programs that directly advance ideas on the list of potential pilot and demonstration projects presented in this report.

Shared Solar and Advanced Solar Inverters

MGE is proceeding with a Shared Solar pilot program as a way for customers to add locally-generated solar-electricity to their individual energy mix without installing solar panels directly on their own homes or businesses. Participating customers will pay an up-front fee as well as a fixed rate per kilowatt-hour (kwh) for up to 50 percent of their annual electric usage to support the installation and operation of a 500 kW solar system on the roof of the City of Middleton Municipal Operations Center.

As part of this pilot, MGE will also be studying the benefits of utility ownership of the advanced solar inverter that is part of the connection of this PV system to the electric grid.

Demand Response Programs

Two programs will test strategies to reduce MGE's system peak electric demand, which typically occurs on hot summer days when air-conditioning load is high. During these periods, utilities must run most or all of their electric generating facilities. Utilities also must use the maximum amount of the transmission and distribution grid to deliver electricity to homes and businesses.

The programs will explore the potential for reducing peak electric demand to decrease the need for utility generation, transmission and distribution infrastructure. Over time, this would reduce the costs of serving all MGE customers. These two programs are:

Smart Thermostat Demand Response Pilot for Residential Customers:

This program will test the use of smart thermostats to automatically manage residential central air conditioners' electricity use to reduce peak power demands.

MGE will enroll 500 residential customers with central air conditioning who already own smart thermostats. Smart thermostats learn and adapt to household occupancy and behaviors. They are Wi-Fi enabled so they can be controlled remotely. MGE will, with customers' permission, use their smart thermostats' communications to increase slightly the temperature settings during MGE summer peak load events. Smart thermostats can pre-cool and monitor comfort inside the home during a peak event and make adjustments accordingly. MGE will monitor temperature parameters, send control signals and evaluate customer experiences and satisfaction.

MGE expects that this program will reduce energy use both at time of system peak as well as reduce overall energy use for participants.

Participants will receive a \$25 enrollment incentive and an additional \$25 per summer participation incentive.

Demand Savings Pilot for Business Customers:

This pilot builds on a previous pilot program conducted in partnership with Focus on Energy.

A group of business customers with monthly electric demands greater than 20 kilowatts and an existing energy management system (EMS) at their facility will use a “pulse isolation relay/meter” and access to an “energy dashboard” to help them better use their EMS to manage their facilities’ electric loads and thereby reduce peak demand, costs and energy use.

Each customer will receive an annual payment for each MGE meter they have in the program as well as training to help them identify electric-demand limiting strategies and improve the use of their Energy Management Systems to help them manage their overall energy use.

Outdoor Solar Lighting Tariff

Through this program, customers can choose to have MGE install and maintain solar overhead lighting structures. These units will include a combination of solar panels and battery storage. The lighting systems will not be connected to the utility electric grid. Customers will pay a daily fee for the solar lighting on their MGE bill.

Adding this solar option will encourage the use of renewable energy for outdoor lighting applications and help the company gauge customer interest in this option and develop more service options in the future.

Electric Vehicle Charging

MGE has already installed a network of 27 public charging stations to help support the growth in use by customers of electric vehicles.

An electric vehicle charging pilot program - Charge@Home - will offer drivers a faster way to charge their vehicles where they live. MGE will install and maintain level two chargers at a customer’s home to provide faster, more convenient charging that can be controlled remotely with a smartphone. In addition, this will allow MGE to research remote control of charging as a next step for understanding how to potentially manage electric system demand as the adoption of electric vehicles increases over time.

Large-User Clean Power Rate

MGE proposed a Renewable Energy Rider (RER) in its most recent rate case. The proposed RER provides a framework for MGE to enter into an individual contract with a new or existing customer to provide dedicated renewable energy for that customer. The Commission directed MGE to revise the proposed RER to address three concerns, and delegated the final approval to Administrator of the Division of Energy Regulation at the PSCW. MGE plans to amend the tariff to provide more flexibility in the structure of the renewable resource rate and the treatment of renewable energy credits. And MGE will be working with PSCW staff to develop tariff language that more clearly outlines the process and legal requirements for Commission approval of the individual contracts for participating customers. MGE plans to file the amended RER as soon PSCW staff and MGE agree upon the revisions.

NEXT STEPS

In addition to implementing the above programs, the TWG has formed a Project Team to evaluate additional pilot program or demonstration projects ideas. An important first step in that evaluation is some initial customer research, which the TWG is planning as one of its 2017 activities.

APPENDIX A

TECHNICAL WORK GROUP PARTICIPANTS

Participants of the Technical Work Group include the following:

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Daniele Thompson

Sr. Corporate Attorney
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Mike Varda

Office of General Counsel
Public Service Commission of Wisconsin

APPENDIX B

MEETING TIMELINE

MGE's Technical Work Group held the following meetings and conference calls in late 2014 through early 2017:

| | |
|--------------------|---|
| September 8, 2014 | Meeting at MGE |
| October 6, 2014 | Meeting at MGE |
| December 8, 2014 | Meeting at MGE |
| December 15, 2014 | Meeting at MGE |
| May 20, 2015 | Meeting at MGE |
| June 03, 2015 | Conference Call |
| June 11, 2015 | Conference Call |
| June 17, 2015 | Meeting at MGE |
| August 11, 2015 | Meeting at MGE |
| December 16, 2015 | Meeting at MGE |
| March 30, 2016 | Meeting at Clean Wisconsin |
| April 20, 2016 | Energy Management Project Team Meeting at Clean Wisconsin |
| Summer – Fall 2016 | Project Team Meetings |
| January 17, 2017 | Meeting at MGE |

OTHER RESOURCES

Clean Wisconsin

<http://www.cleanwisconsin.org/>

Citizens Utility Board of Wisconsin

<http://www.wiscub.org/>

Great Plains Institute

www.betterenergy.org

Justice & Sustainability Associates, Community Energy Conversations Phase II Report

<http://www.jsallc.com/mge/community-energy-conversations/>

MGE's Community Energy Discussion Guide

<https://www.mge.com/images/pdf/cec/cecguide.pdf>

MGE's Energy 2030 Framework

<https://www.mge.com/community-conversations/framework.htm>