MADISON PROGRAM PLAN

for the

Georgetown University Energy Prize

Submitted by:
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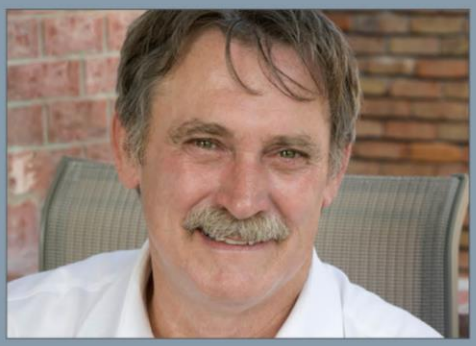
A VISION FOR MADISON'S SUCCESS ...

Innovative strategies ***Inspired*** people ***Incentivized*** to act



Meet Bob.

Bob lives on Fair Oaks Avenue, in a small home built in 1911. His family complains about their drafty living room. He stresses over their utility bills, but doesn't have time to investigate options.

Their neighbor Peggy invited him to an Energy House Party at her home where an Energy Analyst walked them through how much she could save monthly by a few simple improvements. Peggy organized the house party because she was excited about the Georgetown University Energy Prize – **a chance for Madison to win $5 million dollars!** She heard about it on News 3, where Bo Ryan, University of Wisconsin's head basketball coach, challenged the City to join him and the Badgers in fighting for the prize. Peggy got her neighborhood group to join the energy challenge.

After the party, Bob signed-up for his own energy audit, and was relieved to discover part of the cost would be covered by a new city program. **He also received some free low-flow showerheads and CFL bulbs at the house party through a city partnership with the Ace Hardware around the corner**. He's happy to save money, and also to contribute to their neighborhood's progress in the challenge. He likes to use Green Button to watch how much energy he and his neighbors are saving, and encourages his friends and family to do the same. If his neighborhood wins, they'll win a neighborhood block party catered by program sponsor HyVee.

He's also learned how to save energy at home from his daughter, Kimberly, who goes to East High. They're participating in a school-to-school challenge. She and her classmates are also competing to see who can save the most energy at home. In science class they're learning about energy production and consumption. The winning class gets a pizza party which is cool, but she also cares about climate change. She keeps the family on track and has started a tumblr of her father's energy failures. **Together they've reduced energy use by more than 15%.**

Executive Summary

Introduction

The City of Madison is pleased to submit its Program Plan for consideration in the Georgetown University Energy Prize competition. This plan serves as a roadmap for in a comprehensive approach to reducing energy consumption in residential, municipal and K-12 buildings across the community. Madison has a strong foundation with engaged stakeholders and some energy programs in place, but uptake and long term energy savings have not been achieved communitywide. In short—there is plenty of work to be done. This plan endeavors to inspire action by incentivizing participation through an array of innovative strategies that target building and occupant behavior. Quantifiable metrics for each strategy will allow the City to assess progress and make adjustments as needed, and in the end, to document Madison's total energy savings and other benefits at the end of the two year implementation phase.

Through implementation of this plan, the City of Madison will achieve:

3 percent annual energy reduction =
445.5M kBtu and **$10M** total

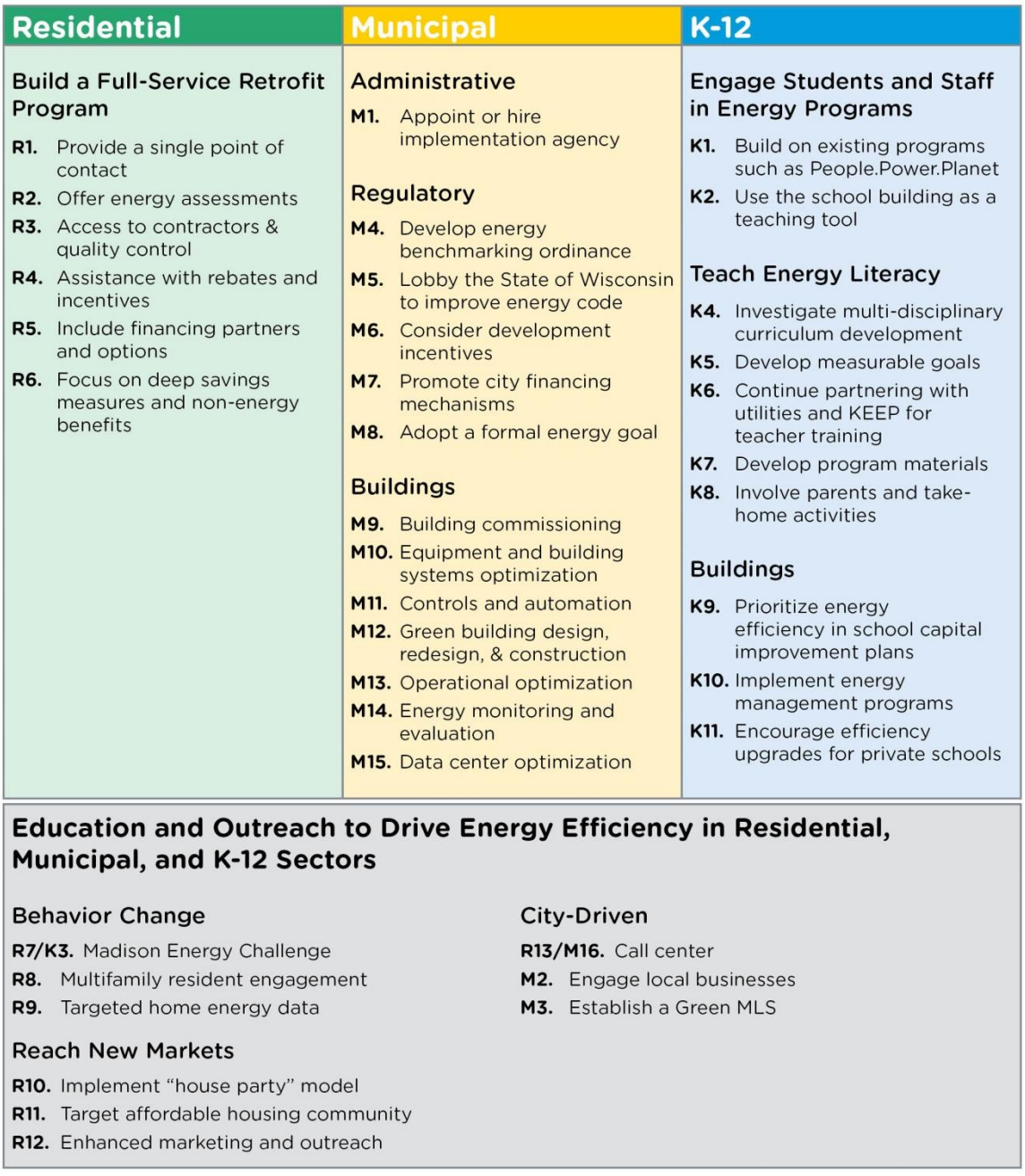
How this Program Plan is Organized

The Competition Guidelines for the Georgetown University Energy Prize (version 7.2) provide details on what information should be included in the Program Plan. The following eight sections include information that will assist the panel in assessing Madison's plan for reducing energy consumption across residential and municipal sectors across the entire community. The following strategy snapshot provides an overview of all recommended strategies for the city to meet its goal. In order to remain consistent with the Competition Guidelines, the strategies are explained throughout the document within their appropriate section, and may not be in the order listed below. Use the numbering system to identify each strategy throughout the document. Strategies that cover multiple sectors are listed in both areas.

Snapshot of Strategies

The below illustration shows a snapshot of the strategies discussed in the following Program Plan. Each strategy was developed with an analysis of baseline energy consumption, existing energy programs, stakeholder interest and potential, and a series of implementation criteria and considerations. Energy savings potential for each strategy was determined using a per-unit calculation, and then scaled up based on Madison's communitywide adoption goals. Strategies are focused on driving energy efficiency for Residential, Municipal, and K-12 Sectors. Because Education and Outreach strategies are vital to driving enrollment in all efficiency programs, they are called out separately. These strategies are still embedded within each sector throughout the plan and are numbered accordingly.

Figure 2. Strategy Snapshot



Section 1: Program Management and Partners

Program Management

Description of Program Leadership and Management

The City of Madison organized a program team (GUEP Team) in mid-2014 that worked to develop a well-thought out program plan for the Georgetown University Energy Prize competition.

The GUEP Team is comprised of three highly qualified agencies that came together in this mission. The team has broad experience in developing municipal energy and sustainability plans and a proven track record delivering, implementing and meeting program goals at the local and state level. Specifically, Elevate Energy is an expert in residential energy programs both locally and statewide; Brendle Group has extensive experience delivering energy efficiency and conservation solutions to municipal buildings; and COWS (the Center on Wisconsin Strategy) brings knowledge and experience on existing City of Madison energy efforts and the broader Madison community.

This GUEP Program Plan builds on the City's current progress with actionable steps to implement an energy efficiency program that will deliver impactful energy savings and for the basis of a long-lasting, comprehensive, and innovative energy efficiency program for the City of Madison.

Staffing and Funding

In addition to the hired GUEP Team, rounding out the full scope of the team are four staff persons at the City: Jeanne Hoffman, Facilities and Sustainability Manager; Linette Rhodes, Grants Administrator; Matthew Wachter, Housing Initiatives Specialist; and Karl van Lith, Organizational Development Manager.

The City of Madison has taken steps to fund the GUEP Program Plan in two phases. A phase one level of funding was approved in mid-2014 to assist in the development of this plan for the contracted amount of $68,113. Additionally, the City approved Sustainable Madison, its sustainability plan in 2012 and has set aside $1,000,000 per year (2015-2020) for its implementation, which includes the implementation of this plan as well.

We Are Madison!

How the Community-at-Large will be Engaged and Motivated

The GUEP Team envisions a highly engaged, communitywide effort that capitalizes on Madison's long history of achieving energy efficiency. To do this, our approach will target three main actions: coordination, communication and facilitating action.

Coordination. Madison is home to many organizations with national expertise in energy efficiency program development and implementation. The GUEP Team's approach with this plan is to build on that history of success. To oversee and coordinate efforts in Madison, the City and its partners will serve as a "single point of contact" to engage Madison's residents, building owners, and other stakeholders. This

streamlined approach will allow Madisonians to take advantage of the myriad of existing and new programs while removing the confusion of multiple program rules and regulations.

Communication. The City and its partners will develop a comprehensive communications plan to share the good work already happening, encourage participation, and highlight success along the way. This work will be coordinated with multiple stakeholders, so that we can identify and amplify successful messages. Elements of communication tactics are also embedded within the strategies for the residential sector, such as energy house parties, competitive energy challenges, and using local star power to encourage participation. This is not your ordinary "post a flyer up at City Hall" kind of program.

Facilitating Action. The City and its partners will employ a "concierge" model for residential energy efficiency improvements in which participants quickly learn that this is the first and last stop you make in the program. This model has proven successful in other markets like Chicago, and works for both single-family and multifamily building owners. In this model, a participant follows a process that includes (when applicable) an audit, identification of applicable incentives, rebates and financial assistance, bid/contractor selection, construction oversight, inspection of work, and eventually, energy savings verification.

In addition to retrofit work, "non-retrofit" actions will be thoughtfully incorporated into citywide energy programs. There are significant savings to be captured just through the daily activities of a building's occupants. The City will work with already-identified program partners to engage as many Madisonians as possible in one or several citywide energy challenges that will focus on behavioral modification as an energy efficiency strategy. In the Madison Energy Challenge, a game-like atmosphere will allow participants to learn about what actions they can take to achieve energy savings in a fun and engaging manner. Widespread participation in the challenge coupled with standalone commitments to embrace similar actions will result in a sizeable impact when calculated across a community. The City and its partners will utilize key themes in its work to reach as many people as possible in Madison, including goal-setting and information, feedback and incentives, segmentation and targeting, community-based social marketing, and gamification.

Local Government Involvement

Existing Agencies and Committees

As mentioned above, four staff members are dedicated to working as part of the GUEP Team to implement this plan. The City's Sustainable Madison Committee is responsible for the oversight of the implementation of Sustainable Madison, the City's Sustainability Plan. In addition, the following departments, boards, commissions, and committees will be involved in various capacities throughout the two year implementation period:

- Departments
  - Mayor's Office
  - Community Development Authority (public housing)
  - Facilities Management
  - Facilities Operations
  - Public Health
  - Engineering
  - Police

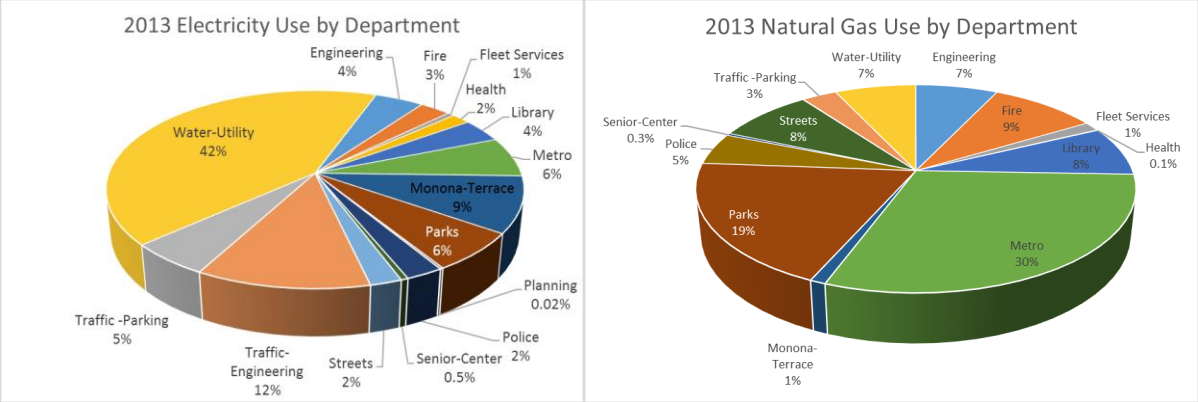
    - Fire
    - Parks
    - Streets
    - Water Utility
    - Community Services
    - Library
    - Traffic Engineering
    - Senior Center
    - Monona Terrace
    - Information Technology
- Committees, Boards, and Commissions
    - City Council
    - Community Development Authority Board and CDA Housing Operations Subcommittee
    - Committee on the Environment
    - Education Committee
    - Board of Estimates (finance and budget committee)
    - Board of Park Commissioners and Warner Park Community Recreation Center Advisory Subcommittee
    - Board of Public Works
    - City-County Liaison Committee
    - Committee On Aging
    - Community Development Block Grant Committee
    - Community Services Committee
    - Madison Public Library Board
    - Monona Terrace Community And Convention Center Board
    - Water Utility Board

In addition, the project team will work with the Madison Metropolitan School District (MMSD) and the Board of Education to support their energy saving efforts. It should be noted that MMSD is a separate governmental unit over which the City has no jurisdiction but regularly partners with.

Municipal Energy Efforts

The City of Madison employs nearly 2,800 full time equivalent (FTE) staff and operates almost 3.2 million square feet of building space. In total there are nearly 460 electrical meters serving the City facilities, and most of these facilities receive both electricity and natural gas services. As such, the GUEP Team developed a Community Baseline Report which highlights energy consumption in the City's building stock and recent energy efficiency efforts. The following pie charts indicate the 2013 energy consumption between these buildings. (Figure 3.) The City has already taken some great first steps to improve the energy efficiency of its operations through addressing HVAC and mechanical equipment, lighting, controls, and data tracking and monitoring. For a detailed analysis of energy consumption across the city's buildings and current energy efficiency efforts, please see Appendix 1. Community Baseline Report.

Figure 3. Electricity and Natural Gas Use by City Department



Operations of the Water Utility consumed over 40 percent of the electricity city-wide in 2013, followed by Traffic Engineering/Parking. The majority of use for the Traffic agency is streetlights and traffic signals throughout the city. Monona-Terrace is the next largest department with regard to electricity consumption. The Metro agency represented 30 percent of total gas consumption in 2013, largely due to the age and inefficiency of the Metro Maintenance building. The other largest contributor to natural gas consumption is the Parks agency at 19 percent of total consumption. From the full analysis of existing conditions, the GUEP Team developed strategies to be implemented during the two year implementation phase in seven key focus areas: Building commissioning; equipment and building systems optimization; controls and automation; green building design, redesign and construction; operational optimization; energy monitoring and evaluation; and data center optimization. A full description of strategies can be found in the Strategy Snapshot (page 4 and Appendix 2).

Table 1. Municipal Strategies - Buildings		
Strategy		**Tactics**
M9	Building Commissioning	-Retro-commissioning -Monitoring-based commissioning -New building commissioning
M10	Equipment and Building Systems Optimization	-Lighting upgrades -HVAC energy recovery -Demand controlled ventilation (DCV) -Pool covers -Piping insulation -Steam trap surveys -Process optimization (water plants) -Solar PV streetlights and LEDs
M11	Controls and Automation	-Citywide BAS integration -Automated demand response -Plug load controls -Programmed residential thermostats -Lighting controls
M12	Green Building Design, Redesign and Construction	-Solar PV -Active solar thermal -Passive solar thermal -Geo exchange -Transpired solar/DOAS/radiant conditioning
M13	Operational Optimization	-O&M assessments -Staff training -Daytime cleaning -Behavior change and occupant engagement

M14	Energy Monitoring and Evaluation	-Sub-metering
M15	Data Center Optimization	-Outside air economizer -Waterside economizer/free cooling -Containment strategies -Set-point optimization -Co-location -Virtualization -Thermal storage -Advanced UPS

Consideration of Long Term Municipal Incentives

In addition to leading by example and building on existing resources, the City has the ability to impact energy consumption citywide by encouraging voluntary actions, or requiring energy savings via ordinance or contract. These might include requiring private sector energy benchmarking, incentivizing energy efficiency in new development, or requiring upgrades when receiving city financing. The City's influence also includes the ability to bring together community stakeholders and partners in other areas.

The City of Madison offers several types of funding that could be used to pay for private sector energy efficiency upgrades. Deferred payment loans and installment loans are available for owner-occupied buildings up to four units. These are income limited, but together cover households up to 125 percent of the area median income. A similar loan is available to landlords of properties with one to eight units. Larger properties can access the Capital Revolving Fund, which provides up to $250,000 per project. Madison's Small Cap TIF programs, which are currently available in two neighborhoods, assist in the purchase and/or rehab of properties (up to four units) that are currently rental and will become owner-occupied. These loans are forgivable over 10 years. These and other mechanisms will be leveraged by the City to incentivize and increase accessibility to energy efficiency retrofits.

The strategies below describe the strategic regulatory and administrative actions that the City will examine and the anticipated benefit relative to reducing energy consumption. City-led Outreach and Education strategies are also listed.

Table 2. Municipal Strategies –Administrative and Regulatory		
Administrative Strategies		**Anticipated Benefits**
M1	Appoint or hire implementation agency with expertise in energy efficiency, retrofit markets, and innovative outreach to manage program plan implementation.	Serve as single-point-of-contact to implement retrofit and behavior change strategies and achieve high impact energy savings across Madison.
Regulation Strategies		**Anticipated Benefits**
M4	Develop energy benchmarking ordinance based on current ordinance in process which includes commercial buildings and phased-in multifamily over time. Support City committee on benchmarking ordinance and assist with enhancing education around the benefits and potential financing mechanisms.	Building owners and operators become more aware of energy use; guide high users into efficiency programs. According to the EPA, buildings that consistently benchmark energy use save an average of 2.4 percent per year.
M5	Lobby the State of Wisconsin to improve energy code (via building code) to ensure it meets the most recently approved IECC standards. Improve enforcement of existing building energy code by	Reduce energy consumption of new construction as much as possible during current construction boom of multifamily housing in Madison.

	triaging building inspectors	
M6	Provide incentives (such as density bonuses; expedited processing) to new development for high efficiency projects	Incent usage of new technologies and reduced energy consumption.
M7	Require or encourage inclusion of energy efficiency in major renovation projects receiving city financing	Incorporate energy goals directly into policies around building rehab loans such as TIF, Capital Revolving Funds, and other loan programs to make efficiency more accessible and desirable.
M8	Adopt, via resolutions, a formal goal for energy use reduction in city facilities and report annually to elected leaders and the public on that goal.	Increased awareness among policy makers and the public. Increased accountability within city staff.
Education and Outreach Strategies		**Anticipated Benefits**
M2	Engage local businesses and community leaders for best practice development, competition endorsement opportunities, and to serve as spokespersons for the Madison Energy Challenge.	Assist in widespread participation in behavior modification strategies.
M3	Investigate potential for establishing a Green MLS or energy score that incorporates energy into real estate transactions with realtors and vested partners.	Homebuyers become more aware of energy consumption/costs; create value for energy efficiency.
M16 /R13	Implement a full-service Call Center to support residents, trade allies, and program partners.	High-quality customer service, information dissemination, and technical support.

Local Business Involvement

Prior to the implementation phase that begins in January 2015, the City and its partners will work to identify appropriate businesses and spokespersons whose participation and donations would bring significant value to the Madison Energy Challenge. Further, local businesses can play a key role in driving innovation and new ideas for energy efficient technologies and for reaching customers. For example, Mpowering Madison and the Sustainable Business Network are two local resources working with the business community to encourage adoption of sustainable best practices. These enterprises are also great outreach avenues for educating residents through both employee and customer networks.

Local Utility Involvement and Incentives

Two utilities serve Madison residential and municipal buildings—Madison Gas and Electric (MGE) and Alliant Energy. Both utilities committed to their involvement in Madison's GUEP participation in early 2014, provided initial data for baseline analysis, and remain committed to the program. Both utilities offer incentive-based energy efficiency programs to their customers, though they are administered by a state coordinating agency known as Focus on Energy. The following energy efficiency programs are available to Madisonians:

Appliance Recycling

All residential customers can sign up for a free pick-up of old, but working refrigerators and freezers for recycling and a $40 incentive payment.

Business Incentive Program

Focus on Energy Business Programs offer both custom and prescriptive incentives for energy efficiency projects. These incentives are designed to motivate customers to upgrade equipment,

or implement energy efficiency projects that they would not have done otherwise. These incentives are available for municipal buildings for projects categorized as HVAC, lighting, steam system, information systems, motors and drives, compressed air, refrigeration, and process equipment upgrades or replacements.

Design Assistance

Financial and technical support to enhance the net energy efficiency of newly constructed and substantially renovated buildings.

Express Energy Efficiency

Residents receive free, professional installation of energy saving products for their homes such as CFL light bulbs, LED light bulbs, high-efficiency showerheads, kitchen and bathroom faucet aerators, and water heater thermostat setback assistance. This program is available to single-family and multifamily residences of three units or less.

Lighting

Focus on Energy partners with retailers to offer instant discounts on ENERGY STAR qualified products, up to $1.50 discount per qualified CFL light bulb.

Home Performance with ENERGY STAR

Homeowners can receive professional home energy assessments and incentives available to off-set costs of recommended air-sealing and insulation improvements. Owners of single-family and multifamily residences of three units or less are eligible for a home energy assessment from a qualified Trade Ally. The Trade Ally then assists the resident in making improvements, with an additional instant reward. Income-eligible homeowners may qualify for a free energy assessment and additional improvement discount.

Residential and Enhanced Rewards

Residents replacing their heating and cooling equipment or adding insulation can receive Cash-Back Rewards ($100-$1000) from Focus on Energy when installing qualified energy efficient heating and cooling equipment or adding attic insulation. Income-eligible homeowners may qualify for additional incentives.

Renewable Rewards

Cash-Back Rewards are available from Focus on Energy when installing qualified Geothermal Heat Pumps and Solar Electric Systems. Funding for renewable projects is fixed each year and availability is on a first-come, first-served basis.

New Homes

The Focus on Energy New Homes Program pairs prospective homeowners with builders and energy experts to construct new homes that are between 10 and 100 percent more efficient than homes built to Wisconsin's Uniform Dwelling Code. Focus on Energy Building Performance Consultants partner with local builders to develop plans and review construction to ensure energy efficiency standards are met.

Multifamily Direct Install and Energy Savings

Owners and managers of multifamily properties (four or more units) including condos and student housing are eligible for both direct install and financial incentives toward energy efficient equipment. Direct install options include free energy saving products and installation of CFL bulbs, high-efficiency showerheads, and faucet aerators. Multifamily properties can also receive a free building energy assessment and optional calculations of projected energy savings for recommended upgrades. Prescriptive and custom incentives are available for specified equipment upgrades or custom retrofit projects.

Community Involvement

The GUEP team has worked diligently to engage a variety of Madison's stakeholders early in the planning process. The below Stakeholder Report is a brief description, history, and current status of existing community energy-savings efforts. The GUEP Team has had conversations with the following stakeholders, and hopes to have their participation in the competition.

Focus on Energy:

As described above, Focus on Energy delivers Wisconsin's Public Benefit Fund to homeowners and businesses in Madison. The program provides incentives and rebates for appliance recycling, efficient lighting, upgraded mechanical systems, insulation and air sealing, and renewable energy generation. It also administers a Home Performance with ENERGY STRAR energy assessment and retrofit program. Additional benefits are available depending on home income level. Focus on Energy has a long track record of generating reliable energy consumption reductions as a result of their incentive programs. They have an extensive Trade Allies program that connects program participants with certified contractors.

Cool Choices:

Cool Choices is a local organization that seeks to reduce waste and reduce greenhouse gas emissions through social marketing, contests, and gamification. It works with organizations and communities including offices, churches, and schools, to run eight-week games where employees compete for points that relate to sustainable actions they take at work and at home. These competitions develop leadership, deepen local knowledge of solutions, and result in significant financial savings and pollution reductions. Last year alone, Cool Choices participants saved more than $460,000. This local sustainability and psychological knowledge could be significantly scaled up as part of a citywide campaign.

Green Apartment Network:

The Green Apartment Network is a collaboration formed to address the overall environmental sustainability of Madison's rental property market. It has a significant energy efficiency focus, and works on strategies to overcome the landlord/tenant split incentive. The collaboration aims to achieve quantifiable results and build a brand that helps energy efficiency and other green features drive market choice, resulting in increased adoption of these strategies.

Madison Community Development Agency:

The Community Development Agency (CDA) manages nearly 1,200 public housing units and administers housing choice vouchers for about 1,600 families. Clientele is all low income, and

many are very low income. The CDA is committed to making sure that all new units constructed are state of the art and highly energy efficient. They have tried, over the years, to improve the efficiency of existing units in various ways, but are committed to doing more. They may also be interested in exploring how to involve landlords who rent to Section 8 tenants and improve the energy efficiency of those homes. Finally, they see tenant behavior as a key opportunity to increase energy savings.

Madison Metropolitan School District:

Madison's school district is just finishing a three-year contract with McKinstry, an energy services corporation, aimed at reducing the school district's energy consumption. Results are still pending, but are promising: within the first year alone, the school district saved more than $250,000. The district's approach involved pairing relatively modest infrastructure upgrades with significant behavioral and educational efforts. High schools have participated in energy challenges to compete to see how much school energy use can be reduced, backed by data provided by McKinstry diagnostic tools. McKinstry hired a coordinator to work with teachers and students on energy efficient behavior, recruiting energy champions from each school. This, in turn, led to social campaigns to change behavioral norms, including turning off lights and computers. These efforts have reached nearly three quarters of the school district. See additional information in the attached report.

MPowering Madison:

Sustain Dane's MPower Business Champion Program is a one-year, fully-customizable program for businesses and organizations in the Greater Madison Region that want to reduce their environmental impact while saving costs and creating a healthier and more engaging workplace and community. The MPower Champions Program is a proven and nationally recognized model for achieving sustainability success from within an organization. While MPower has a broader focus than energy efficiency, it includes significant energy efficiency components. MPower participants (mostly businesses) have collectively saved 18.6 MKwh and 506,337 Therms.

Project Home:

Project Home operates Madison's Low Income Home Weatherization program, which is funded by the federal and state governments. Additionally, the program operates a social enterprise retrofit program which is not income-limited. Project Home partners closely with Focus on Energy, Wisconsin's Public Benefit Fund residential program administrator. It provides Building Performance Institute, Inc. (BPI) energy assessments and whole-home retrofits, including air sealing, insulation installation, appliance replacements (low-income only), and other house upgrades. Project Home works on multifamily low-income projects. For market-rate efficiency projects, it was one of the main contractors for Green Madison. Project Home has a well-established and well-regarded energy retrofit program, and could significantly scale up if the Prize spurred higher demand.

University of Wisconsin – Madison:

The University of Wisconsin–Madison has been working on energy efficiency projects for more than 20 years. It has invested more than $90 million dollars in energy efficiency programs that have reduced energy intensity by more than 30 percent. This work has been performed through a combination of performance contracting and in-house efforts. Significant reductions have been found through lighting retrofits, laboratory air exchange protocol changes, behavior change efforts, and occupancy management. Additionally, there is a strong student-focused energy efficiency awareness campaign, which may lead to crossover potential with the broader city. The University has a great depth of in-house energy efficiency technical expertise.

Wisconsin Energy Conservation Corporation:

The Wisconsin Energy Conservation Corporation (WECC) is a Madison-based national nonprofit specializing in the design and implementation of energy efficiency and renewable energy programs. WECC partnered with the City of Madison on the development of the American Recovery and Reinvestment Act-funded Green Madison residential retrofit program, and has worked with Focus on Energy for many years.

Private Schools:

Several private schools in Madison have expressed interest in energy saving programs, and may be potential partners in the GUEP competition, especially as conduits to further home action for students and parents. Some, like the Isthmus Montessori Academy, are interested from a curriculum point of view, while others were interested in possible financial savings. Nineteen of the 29 private schools in Madison are religious, and the majority of those are located in the same building as a church, meaning that engaging both the school and the congregation would be important. Please see more on participation of private schools in Section 3 Utility Data Reporting.

In addition, Badger Rock Middle School, a public charter school located in the new Resilience Research Center, presents both an example and an opportunity. The school follows a “sustainability-focused and urban agriculture-integrated” curriculum. The Resilience Research Center is a learning laboratory, featuring cutting edge energy technology, including intensive water re-use, natural daylighting and Solatubes, an impressive PV array, and a geothermal system. The building will be certified LEED Platinum, and uses about half the energy of a comparably-sized, building. In addition, the center is 100 percent green-powered.

New Green Challenge:

The New Green Challenge was developed in partnership with the Urban League, Centro Hispano, the African American Council of Churches, and La Movida, supported by MGE. It challenges Madison’s Latino and African American communities to live greener lives for six months. In addition to energy efficiency, the New Green Challenge is focused on a number of sustainability goals including eating well, reducing waste, conserving water, and driving less. Participants receive expert advice, share their strategies, and set goals.

EnACT:

EnACT is a community program run by the Madison Environmental Group. It is based around a book that features steps to greener living, including many that are focused on energy use. Neighborhoods, classrooms, or businesses can create EnACT teams that work together to implement strategies from the book.

WI Interfaith Power and Light:

WI Interfaith Power and Light works with people of all faiths and denominations to respond to climate change through implementing conservation, energy efficiency, and renewable energy systems.

Letters of Commitment

The City has already started engaging partners and stakeholders and has secured letters of commitment for support and participation from the following organizations in Madison: Cool Choices, Energy Center of Wisconsin, Project Home, Sustain Dane, and Madison Gas & Electric. These letters can be found in Appendix 3.

Section 2: Energy Savings Plan

Summary of Energy Savings Goals and Methods

The City anticipates an overall **annual** energy savings of 222.7 kBtus, which according to a 2013 baseline of residential, municipal, and K-12 buildings is an annual 3 percent reduction. The associated cost savings is at approximately $4.9M dollars for building owners and occupants. The energy savings below (Figure 4.) include hardline estimates and do not include residual savings that might be achieved through other actions including enhanced communications and outreach, municipal regulatory authority, and K-12 educational pursuits that may result in increased cumulative savings.

Figure 4. Energy Savings Goals

ANNUAL SAVINGS			2-YEAR IMPLEMENTATION SAVINGS GOAL		TOTAL ANNUAL PERCENT SAVINGS
Strategies by Sector	**Energy Savings (kBtu)**	**Cost Savings**	**Energy Savings (kBtu)**	**Cost Savings**	
Residential	114,840,602	$2,423,156	229,681,203	$4,846,312	3%
Municipal	65,312,796	$1,960,430	130,625,591	$3,920,860	
K-12	42,586,258	$570,011	85,172,516	$1,140,021	
Total	222.7M kBtu	$4.9 million	**445.5 kBtu**	**$10 million**	

Our Approach

The City of Madison and its partners have already begun significant energy and sustainability work which provides a strong foundation for implementing a competitive energy savings plan for the Georgetown University Energy Prize. Our program approach will rely heavily on strong local relationships with many stakeholders including residents, city staff and elected officials, utilities, and

more. This plan is rooted in localized data which has informed the selected strategies implemented, and thereby result in maximum impact. Throughout our work, the team will focus on:

1) Actions that yield immediate energy use reduction results;
2) Programs that can ramp up quickly and be effective in the two-year prize period;
3) Strategies that will have an impact in the short term but also lay the framework for reductions in energy use for years to come;
4) Programs that develop the ability for the City to continually evaluate the impact and contributions from the implemented strategies for continuous improvement; and
5) Programs that reach a breadth and depth of Madison's residents, municipal agencies, and community stakeholders, including historically underserved geographies and demographics.

Our team knows from long experience that our energy efficiency plan must have extremely clear targets and detailed but flexible goals to allow for successful implementation. Technical knowledge and research alone is insufficient – plans must be able to be implemented. That is, plans must be flexible enough to be responsive to local realities, and focused enough to provide the implementation team with the direction necessary to overcome hurdles and obstacles. Successful implementation is also dependent on having the right people guiding the implementation, bolstered by abundant local data and national thinking. The art of this plan is in defining strategies, recruiting partners, and building structures that are both timely and responsive to the needs of the competition, and that also build the foundation for a culture of energy efficiency throughout the community, resulting in a cleaner, more sustainable city.

Energy Efficiency as Single Most Important Source of Energy

Energy efficiency is the single most important source of energy available to the world's economies, and will be for years to come. As our society continues to plan for future energy needs, it is vital that we utilize all potential energy savings and efficiency opportunities to curb demand. Further, buildings are the top user of energy across our cities. To this end, it is our goal to achieve innovative, replicable, scalable, and continual reductions in the energy-per-capita consumed from local natural gas and electric utilities across the City of Madison. The following goals and strategies outline an innovative, yet data-driven plan for drastically increasing uptake of energy efficiency opportunities and driving down building energy use.

The Increasingly Significant Role of Behavior Modification

Energy efficiency programs can benefit greatly by incorporating insights and techniques from behavioral science, which has identified both structural and psychological barriers that impede wider uptake of conservation strategies. Psychological barriers include limited knowledge about the problem, sunk costs and behavioral inertia, perceived risks of change, and positive but insufficient behavior change (Gifford, 2011). The energy efficiency industry provides many evaluations and examples of programs that seek to address such barriers. In an evaluation of 300 programs run by 100 utilities, the American Council for an Energy-Efficient Economy (ACEEE) found that behavior programs achieved an average cost of saved energy (CSE) of 1.61 cents per kWh saved (Mazur-Stommen and Farley, 2013). Strategies for inducing behavior change fall broadly into antecedent interventions, which are implemented prior to the

performance of a given behavior (i.e., an informational campaign about energy conservation) and consequence interventions, which provide feedback to an individual after they have consumed energy (i.e., feedback on a household's electricity usage). Best practices include providing frequent feedback to consumers, targeting high intensity users and/or segmenting a population to better understand variations in energy consumption, and incorporating social diffusion and trusted partners into marketing strategies for energy efficiency programs.

A thorough analysis and inventory of these best practices was conducted to inform this plan and is included in Appendix 4. Recommendations in this plan incorporate these key best practices:

- Goal-setting and information
- Feedback and incentives
- Segmentation and targeting
- Community-based social marketing
- Gamification

Reaching Diverse Aspects of the Community

Trends in Madison's Residential Buildings

The City of Madison's housing has grown over the last several years. New multifamily housing for students and permanent residents, as well as new employers coming to the area, brings new opportunities for people to join the Madison community. Further, half of the city's housing stock is rental. These properties are managed by a combination of large management companies, and mom and pop operations. For multifamily developers, energy efficiency savings and paybacks can be better incorporated in to property viability. Additionally, energy efficiency can be a key service for mom and pop owners of older, buildings with 4 to 20 units. Energy use benchmarking is another innovative incentive that can motivate and inform building owners of the benefits of energy efficiency.

Madison's utilities and other agencies have worked hard to offer energy efficiency programs and incentives for these buildings. However, cost-effectiveness of these services is always a constraint. The recommendations in this plan take into account these successes and barriers in order to both build off of current efforts and propose new innovations. The City will work closely with these agencies in order to augment programs and increase efficiency. For example, Focus on Energy's incentive programs could include a Special Offer, related to the GUEP competition, which would also increase program visibility over the long term.

For single-family homes, high conversion rates have been achieved in many areas. Trade allies are committed to driving rebate programs and have become adept at providing home audits that lead to retrofits. Madison is home to the highest population of BPI certified professionals in the region. This resource will continue to be tapped and leveraged for implementation of new programs.

There has, however, been significantly less uptake by sectors such as the affordable housing community. For example, in comparing the Assisted Home Performance Program (low-moderate income) and Standard Home Performance Program (market rate), conversion of single-family projects is much lower in the Madison area than in Milwaukee. See Table 3 below.

Table 3: Number of Projects (2014, Year to Date)

Geography	Assisted Home Performance	Standard Home Performance
Dane County (includes Madison)	17	315
Milwaukee	165	249

Increased and innovative marketing and outreach will be a key component of successful implantation of these strategies throughout the residential sector. Many energy efficiency tools and incentives already exist, but the City of Madison can drastically increase participation through strategic outreach to new markets and streamlining services for both single and multifamily homes.

The following is a description of the key Outreach and Education strategies for the residential sector.

R10	Implement "House Party" Model

Madison is home to an engaged and well-educated sector of single-family and 2-4 unit homeowners, many of whom are interested in sustainability and energy efficiency. Elevate Energy has demonstrated success in such a sector by using a community-based house party model to spread the word about energy efficiency, demonstrate a home energy assessment, employ trusted messengers, and connect homeowners with contractors who can perform energy upgrades.

Following the Elevate Energy model, partners in Madison will recruit homeowners to host a house party, to which they will invite 15-20 friends, neighbors, and acquaintances. The host explains his or her interest in energy efficiency, and invites guests to share how they think their home might be losing energy. A home energy expert then gives a short presentation on common problems, tools to fix the problems, and costs, and proceeds to walk the host and guests through a 25-minute energy assessment. The expert ends with his or her recommendations to the homeowner. At the end of the house party, guests are invited to sign up to host house parties and/or to have an energy assessment conducted at their home.

R7 /K3	Madison Energy Challenge

Madison and its partner organizations will facilitate an energy competition that pits churches, offices, schools, and city departments against each other with a goal of reducing electricity and gas consumption. The competition will be modeled after Cool Choices, which engages participants at work to make energy-saving decisions at home. Likewise, the Madison Energy Challenge will create four participant sectors: churches, private and non-profit offices/organizations, schools, and city departments. A typical Madison family might hear about the program at their place of worship, in the workplace, or via a flyer sent home with their kids. Teams will first compete against similar organizations (churches versus churches, offices versus offices) and individuals will track their energy consumption via a web-based system. This system will foster competition among similar organizations by showing progress to date.

To encourage participation and engagement, the partner organizations will recruit leaders within each of the four sectors to form teams, encourage competition, and maintain enthusiasm in the competition. For example, a local pastor with a congregation of 500 families might help strategize how to recruit participants, mention the challenge from his or her pulpit, and foster a good-natured competition with other churches in the neighborhood. Congregants will track their progress at home, and hope to win the grand prize to help their local food pantry program.

The group that has the largest percent reduction in energy consumption over the course of two months will win a preliminary prize and will move on to the "final four" round, where the winning team in each sector competes for the grand prize. Households will also be eligible for individual prizes for those with

the most energy savings over the two month period.

The Madison Energy Challenge would recommend specific improvements that participants could make in their homes and apartments to reduce energy use, including but not limited to:

- Replacing light bulbs with LEDs
- Using power strips to reduce phantom loads
- Adjusting thermostat settings
- Replacing A/C filters

R13/ M16	Establish Call Center

Implement a full-service Call Center to support residents, trade allies, and program partners. Call Center operations include inbound and outbound customer service calls, as well as assistance with information dissemination and technical support. The Call Center will function as the hub to connect building and homeowners with the information and resources necessary to take full advantage of energy efficiency programs. The Call Center will facilitate calls and emails regarding program processes, frequently asked questions, and direct callers to resources.

To address the trends and barriers, the City and its partners will design strategies around meeting the needs of diverse communities and streamlining participation in retrofit programs that achieve holistic, cost-effective retrofits.

R11	Target Affordable Housing

Affordable housing is a large, untapped market for energy efficiency. Elevate Energy has a longstanding commitment and expertise in addressing this underserved population and will work with the City and partners to do so. Energy efficiency is a proven mechanism for preserving affordability of housing choices within a community, making this a vital strategy to the social, economic, and environmental vitality of the Madison community.

However, a variety of factors including a lack of awareness, access to capital, inability to incur more debt, and legal and regulatory barriers result in additional barriers for affordable and subsidized multifamily building owners and managers interested in making energy efficiency retrofits. Reaching these buildings will require stronger relationships with organizations that operate specifically in the affordable housing market. To overcome some of these additional barriers, more focused and dedicated follow-up services, strategic outreach, and other program modifications are required.

Tailored Incentive and Financing Options

Focus on Energy has an understanding of the types of rebates that resonate most with affordable housing owners and developers. Tailoring incentive options to meet the needs of low- or moderate-income building owners will continue to be effective. The City and Focus on Energy should leverage existing measures such as Direct Install upgrades and the Common Area Lighting Package and create similar programs that lower upfront costs. Further, tiered incentive levels can be used to reward all multifamily building owners (affordable and market rate) for achieving deeper energy savings. Lastly, low-cost financing options (as described previously) can be particularly suitable for affordable housing developers as they often complement other forms of affordable housing financing. Elevate Energy will work with the City and affordable housing partners such as the CDA to understand these options and ensure they are aligned with all partners involved.

Additional Liaison Support

The single-point-of-contact approach becomes even more valuable when assisting affordable housing buildings. Barriers to successful retrofits exist at every stage of the program process, but most prominently after the audit is completed. Providing dedicated staff for additional follow-up services will assist building owners in investing time and resources in energy efficiency improvements, especially in conjunction with improved financing opportunities, and result in deeper energy savings for each building.

Targeted Outreach

Reaching these buildings will require stronger relationships with organizations that operate specifically in the affordable housing market. Working with organizations and agencies to identify building projects that are actively planning capital improvement or reinvestment projects in the near future will allow for more strategic outreach. The City will partner closely with these organizations to reach new buildings, such as:

- City programs and agencies:
  - Housing authorities
  - Low-income housing agencies
  - Section 8 program
  - Capitol funds management
  - Tax credit properties
  - Wisconsin Housing and Economic Development Authority (WHEDA) projects

R12 Enhanced Marketing and Outreach

In addition to targeting the affordable housing community, marketing and outreach efforts overall can be enhanced to drive more demand for energy efficiency programs in both single and multifamily buildings. Working with Focus on Energy, the City and partners can absorb some customer acquisition resources by providing supplemental marketing and outreach in underserved and untapped markets. This will occur by both utilizing existing successful outreach channels, as well as developing new avenues.

Existing Outreach Networks

The City and partners will work with Focus on Energy to identify and leverage existing, successful outreach channels, including but not limited to:

- Utilities: Madison Gas & Electric has been an extremely valuable partner in coordinating both localized outreach by building type and mass marketing.
- Apartment networks and neighborhood associations: Host housing events with established, trusted outreach organizations. Leverage partnership with the Green Apartment Network as a resource of sustainability-minded building owners that can help spread our message and be early adopters.
- Trade Allies: Programs geared toward engaging contractors and their networks are very effective in delivering upgrades and incentives.

New Markets and Messaging

Untapped markets such as affordable housing also exist with additional landlord groups, building types, and populations. The City can help augment current outreach efforts by tapping new audiences and offering new messaging. Assistance with revisiting old leads, and accessing buildings such as condominiums, can alleviate current outreach resources and create increased demand. Further, the City and its partners can assist in reaching traditionally hard-to-reach demographics. Translation of materials and services into Spanish, and working with the New Green Challenge can help ensure the benefits of energy efficiency reach Madison's growing and diverse communities.

One key strategy will be to target landlord markets such as those that rent mostly to students at UW-Madison, which have potential for deep energy savings. The City will engage with students and other UW-

Madison stakeholders that are motivated to save energy and money. Off-campus housing stock is often older and therefore provides opportunity for energy savings. This stock is also owned and managed by a subset of landlords that can be engaged to achieve widespread adoption. Outreach efforts can build relationships with these particular landlords that own and manage large portions of building stock for highest possible impact.

Messaging is also important in increasing program participation. During Madison's cold winters, marketing messaging can stress the non-energy benefits of energy efficiency such as increased comfort and decreased maintenance. These benefits are also useful in addressing the split-incentive barrier for multifamily building owners. Benefits such as these are often under-represented, and can be stressed in order to convince building and homeowners to invest in energy efficiency. The City and its partners will also strategically target tenured homeowners and building owners who manage properties for long periods of time with a message of reduced maintenance costs and increased property values which will be important drivers for this group.

Inclusion of Energy Retrofits and Capital Improvements

The energy savings goals specific to retrofit and capital improvements include residential, municipal and K-12 sector strategies for the physical buildings. In the residential sector, the City anticipates a 1.5 percent penetration rate across single family homes and a 5 percent penetration rate across multifamily units. Table 4 depicts the total energy savings for retrofit and other capital improvements to the building stock.

Table 4. Energy Savings from Retrofit/Capital Improvement Activity

Sector	Energy Savings
Residential – Whole Building Retrofit Strategies	38,592,979 kBtu
Municipal – Building Strategies	65,312,796 kBtu
K-12 –Building Strategies	42,586,258 kBtu
Total retrofit/capital improvement savings	**146,492,033 kBtu**

Building a Full-Service Residential Retrofit Program

The best way to achieve a high conversion rate of homes to retrofits is to assist with every step of the process. This best practice has been proven in other cities with a similar climate to Madison. While smaller, one-off efficiency measures may be cheaper for homeowners, they do not achieve deep energy savings. In order to drastically decrease energy use in both single and multifamily buildings, the City and its partners will develop a full-service "concierge" retrofit program. This program is designed to assist building and homeowners through every phase, from audit through completion of construction. This program design addresses split incentives barriers, educates owners and tenants, and connects residents with financial partners, utility incentives, and qualified contractors.

Key strategies that make up this program are listed below. In the implementation phase, the City and partners will decide what agencies and stakeholders will provide these services.

R1	Provide a Single Point of Contact

Establishing dedicated staff to serve as liaisons for owners is key in driving retrofits with deep energy savings across housing stock. The City and its partners will create a staffing mechanism to fill this role as it is critical to offering the below services, which together create a full-service model that will drive retrofits.

R2	Offer Energy Assessments

Energy assessments are a crucial first step in helping owners and residents understand their energy use and assess the most cost-effective improvements. As such, they will be a key component of the Full Service Retrofit program. Every retrofit project will begin with a whole-building assessment to identify energy efficiency options and assist the owner in energy and cost savings. This assessment will also include guidance on financing and rebate options in order to give owners a holistic view of upgrades, costs, and payback. This will allow for deep energy savings measures such as building shell upgrades, which have large energy saving potential and quick payback periods.

R3	Access to Contractors and Quality Control

Madison has a vast pool of qualified energy contractors as well as trade allies. The City will assist owners in accessing these contractors for energy assessments and building upgrades. Quality control and assurance are crucial in achieving deep energy savings and building a reputable program, so this will be a core component of this strategy.

The City will continue to leverage and promote these professionals and encourage their participation with owners from start to finish from providing an energy assessment to converting to retrofits and rebate completion. To do this, the City will:

- Ensure trade allies can easily access retrofit programs by keeping program guidelines consistent and straightforward and aligned with their business models.
- Bring leads to contractors to supplement projects in their pipeline in order to continue to support and grow their businesses.
- Ensure owners have access to energy assessment services in addition to construction to increase owner understand of deep energy savings opportunities.
- Support quality control and assurance efforts to help promote reputations to owners and decrease risk.

R4	Assistance with Rebates and Incentives

Focus on Energy and Madison's utilities offer a spectrum of programs to incent energy efficiency upgrades. The owner liaison will provide support in navigating these options to help the owner take advantage of the best available incentive. Support in completing paperwork and appropriate documentation will increase uptake in these programs and funding leveraged by building owners.

R5	Include Financing Partners and Options (Multifamily)

Low-cost, hassle-free financing can be an important component, particularly for multifamily energy efficiency retrofits. The upfront cost for building owners is often one of the biggest barriers to completing more expensive, whole-building energy efficiency retrofits. Integrating existing financing options more coherently into the retrofit process while developing new financing products in coordination with local and national partners will help building owners reduce or eliminate upfront costs and allow them to pay for their investments over time. The City will explore ways of integrating potential financing partners and options into multifamily retrofit services.

Targeting High-Return Opportunities

The City and its partners are focused on holistic energy savings. We believe deep, cost-effective measures are more sustainable and beneficial than smaller measures with little or no upfront cost. Madison has been successful in implementing these simpler measures and will continue to conduct outreach and marketing for these programs. However, the new, innovative strategies revolve around larger, untapped resources such as the affordable housing community, building shell measures, and behavior modification.

The following is a description of the residential measures that focus on deep savings and education and outreach strategies focused on residential behavior change.

R6	Focus on Deep Savings Measures and Non-Energy Benefits

Building owners unfamiliar with air sealing, insulation, and other similar measures are likely to overlook them, despite being cost-effective and long lasting, unless someone from the program or a contractor explains their importance at the beginning of their participation. The City and partners will encourage building owners to investigate whether these types of upgrades are a good investment for their buildings. Further, a more efficient building can have non-energy benefits beyond increased cash flow, including increased tenant comfort, higher tenant retention rates, and decreased maintenance costs. These benefits can further make the case for deeper, long-lasting efficiency measures.

Air sealing and insulation (both installed in the building envelope and on mechanical equipment and distribution) and similar measures are complimentary to existing prescriptive rebates and potentially applicable to every age and type of multifamily building. Older buildings constructed before energy codes existed will likely achieve the deepest savings but opportunities may also exist for newer buildings. Air sealing and insulation can also reduce the load that the building's HVAC systems are required to produce and smaller systems may be able to be installed as a result. Air sealing is particularly cost-effective because, if participating buildings also use air conditioning in the summer months, significant therm *and* kW savings can be achieved.

While return on investment is often touted as the most important motivator for multifamily building owners (and this is certainly true in many circumstances), it should not be considered an overarching rule. This is true for the low-income housing market, where an owner's profit margin may come entirely from a competitive advantage in reducing turnover. Communicating non-energy benefits during the program process is an important aspect of the full-service model.

R8	Multifamily Resident Engagement

Many of the multifamily buildings in Madison are clustered near the UW-Madison campus and include a mix of undergraduate and graduate students and staff, as well as those who do not have such an affiliation. We recommend collaborating with UW-Madison to engage such tenants of apartment buildings to form teams for the Madison Energy Challenge, set goals for reducing energy use, or target specific outreach to such populations. Another opportunity for engagement is to recruit multifamily tenants to participate in some aspect of "Be the WE," UW-Madison's campaign to conserve energy and eliminate waste.

R9	Targeted Home Energy Data/Reports

The Madison team will work with Madison Gas & Electric to facilitate access to home energy data and reports for homeowners. Green Button is an initiative that standardizes data sharing for utility customers. Participating utilities add a "green button" to their websites that allows customers to download their

energy usage in a standardized format. If implemented in Madison, it would allow MGE customers to download their own energy usage and share it with a third party that can help interpret their data, set goals for reduction, and suggest strategies for behavior changes.
Companies like Opower and others partner with utilities to take such individual-level data and produce home energy reports that compare a homeowner's consumption to neighbors, and suggest goals for consumption reduction.

Summary of Residential Strategies

In summary, the residential strategies described above fall into three categories: building retrofits, behavior modification by occupants in the household, and innovative communications and outreach. Table 5 below is a snapshot of these strategies.

Table 5. Summary of Residential Strategies	
Building Retrofits	
R1	Provide a Single Point of Contact
R2	Offer Energy Assessments
R3	Access to Contractors and Quality Control
R4	Assistance with Rebates and Incentives
R5	Include Financing Partners and Options (multifamily)
R6	Focus on Deep Savings Measures and Non-Energy Benefits
Behavior Change	
R7/K3	Madison Energy Challenge
R8	Multifamily Resident Engagement
R9	Targeted Home Energy Data
Education and Outreach	
R10	Implement "House Party" Model
R11	Target Affordable Housing Community
R12	Enhanced Marketing and Outreach
R13/M16	Implement a full-service Call Center to support residents, trade allies, and program partners.

Strategies for Municipal Buildings

Table 6 below provides a snapshot of all municipal strategies, including those with non-energy benefits. In general, strategies can be described in three categories: administrative, regulatory and physical buildings, with education and outreach components embedded within. The physical buildings strategies are ones which we can directly attach to energy savings.

Table 6. Summary of Municipal Strategies	
Administrative Strategies	
M1	Appoint or Hire Implementation Agency
Education & Outreach Strategies	
M2	Engage Local Businesses and Community Leaders
M3	Investigate a Green MLS
M16/R13	Implement a Full-Service Call Center
Regulation Strategies	
M4	Develop Energy Benchmarking Ordinance
M5	Lobby the State of Wisconsin to Improve Energy Code
M6	Consider Development Incentives

M7	Promote City Financing Mechanisms
M8	Adopt a formal energy goal
Buildings Strategies	
M9	Building Commissioning
M10	Equipment and Building Systems Optimization
M11	Controls and Automation
M12	Green building Design, Redesign, and Construction
M13	Operational Optimization
M14	Energy Monitoring and Evaluation
M15	Data Center Optimization

While an overview of these strategies is also discussed in Section 1 of this Program Plan, below is a detailed description of technologies recommended for each Building Strategy.

M9: Building Commissioning

- Retro-commissioning: Establish and execute process to perform periodic building and building system investigation and analysis, to ensure the building systems are operating at optimal efficiency. Municipal buildings should be included in a rolling period such that every municipal building is re/retro-commissioning every 5 years.
- Monitoring-based commissioning: Establish and execute process to utilize software (BAS) enabled continuous monitoring of building system performance, to identify operational faults and inefficiencies in near-real time. This system will enable automated fault detection, continuous performance verification, and diagnostic trending to inform building operations. This is a robust platform which supersedes simple threshold-based alarm notification and can replace a 10-month warranty review under enhanced new commissioning.
- New building Commissioning: Establish and execute process to ensure that buildings and building systems are designed, constructed, and operated in accordance with the City's project requirements and performance targets. New commissioning should include activities of LEED NC enhanced commissioning, and should be included in the integrated design process.

M10: Equipment and Building Systems Optimization

- Lighting Upgrades: Ensure that lights with highest efficacy are installed in all locations. This could likely include LED lamps, super-efficient fluorescent lamps, and matched drivers and ballasts.
- HVAC energy recovery: Utilize energy recovery systems on HVAC air-side (exhaust/outside air) operations. This strategy will be especially useful on 100% outside air systems, and during winter and summer operations.
- Demand-controlled ventilation: Control building ventilation rates based on occupancy and concentration of CO2 instead of prescriptive ventilation rates.
- Pool Covers: Establish and execute process to evaluate automated or manual covers for installation and use where appropriate.
- Piping Insulation: Establish and execute process to ensure that all process piping (chilled water, condenser water, steam, refrigeration) is fully insulated and free from moisture damage.

- Steam trap surveys: Establish and execute process for surveying all steam traps on a recurring basis to identify malfunctioning traps to be replaced.
- Process optimization: Establish and execute process to evaluate performance of process systems and equipment, such as pumps and motors at water well sites and other buildings.
- Solar PV Streetlights and LEDs: Establish and execute process to convert all streetlights to LED lamps, and utilize photo-cell controls and PV/battery storage to offset grid electrical use.

M11: Controls and Automation

- Citywide BAS integration: Continue to implement a standardized building automation system front end in all municipal buildings, and provide ongoing training and support to building staff from FO/FM.
- Automated demand response: Establish and execute process to integrate buildings with robust BAS installations into an automated demand-response program for load shedding during peak demand periods.
- Plug load control: Establish and execute process to utilize automated plug load monitoring/control systems in order to eliminate unnecessary plug loads during unoccupied periods and hours outside of normal business hours.
- Residential thermostats (NEST or similar) Establish and execute process to integrate web-enabled, occupancy-based, or "smart" programmable thermostats in city-owned multifamily housing, to provide enhanced controls and improved operation.
- Lighting controls: Establish and execute process to integrate lighting controls into the BAS installations in buildings, as well as standalone lighting controls which operate lighting zones based on occupancy or ambient light levels.

M12: Green building design, redesign, & construction

- Solar PV: Increase the amount of solar PV on municipal buildings and land.
- Active solar thermal: Establish and execute process to utilize active solar thermal systems to augment or replace traditional methods of providing domestic hot water in municipal buildings.
- Passive solar thermal: Establish and execute process to retrofit or include in the design of new buildings, passive solar strategies such as outside air pre-heating with transpired solar collectors.
- Geo-exchange: Establish and execute process to investigate the feasibility of geo-exchange systems for building or process heating and cooling, and implement where feasible.
- Transpired solar/DOAS/Radiant Conditioning: Associated with Passive Solar Thermal strategy, augment the system served with dedicated outside air ventilation and radiant conditioning in the spaces served.

M13: Operational optimization

- O&M assessments: Complete assessments on operations, preventative and reactive maintenance, and staff training and certifications to identify opportunities for efficiency and productivity improvements.

- Staff training: Provide staff training on energy efficiency initiatives, building operations, and controls and automation systems.
- Daytime cleaning: Modify cleaning activities in municipal buildings to occur during daytime hours to reduce nighttime lighting and HVAC loads.
- Behavior change and occupant engagement: Provide city energy use data, at building or department level, to City staff via webpages, display dashboards, or targeted communication as a means of establishing behavior change programs to reduce energy use.

M14: Energy monitoring and evaluation

- Sub-metering: Implement sub-metering in City buildings to determine end-use breakdown. Target 50% of sub-metering of the three largest energy end-uses as a best practice.

M15: Data center optimization

- Outside air economizer: Utilize outside air provide wintertime cooling for City data centers when ambient conditions are favorable.
- Waterside economizer/free cooling: Utilize waterside economizer to provide free cooling and increased efficiency of direct expansion (Dx) cooling systems in data centers.
- Containment strategies: Establish and execute process to implement hot aisle/cold aisle containment in data centers to provide targeted conditioning and optimized cooling.
- Set-point optimization: Increase data center cooling set-points based on hot aisle/cold aisle containment and control the HVAC systems to maintain a rack discharge temperature in the hot aisle.
- Co-location: Arrange servers in the racks in data centers to maximize cooling, containment, and power distribution in higher density arrangements.
- Virtualization: Remove data center servers and virtualize server functions to off-site locations outside of the City buildings.
- Thermal Storage: Utilize thermal storage to provide cooling capability on a continuous basis, while shifting the refrigeration load of typical data center cooling systems to off-peak hours.
- Advanced UPS: Utilize advanced UPS technology which bypasses UPS during good power quality conditions to reduce power losses due to power conversion.

In order to properly integrate retrofits and other capital improvements into the municipal facilities, an accurate Community Baseline Report which highlights energy consumption in the City's building stock and recent energy efficiency efforts was completed. As part of this analysis, the individual City facilities, agencies, and uses with the highest absolute energy use as well as energy use intensity were identified. This identification will allow the City to focus on these largest energy using buildings/agencies as well as the highest energy use intensity facilities and assets to pursue the greatest energy reduction potential early on in the implementation phase of the plan.

The approach for realizing the energy savings potential in the target facilities and assets will build on previous City programs that have shown success. The approach will also leverage various Focus on Energy programs that the City has not used extensively in the past. These energy programs and

strategies are identified in Section 1 of this document, and include building commissioning, building systems optimization, building controls and automation, data center optimization, occupant education, and pursuing implementation projects in areas such as HVAC, lighting, motors and drives, and green building programs.

In addition to the technology and equipment side of the energy efficiency improvements, the City will develop opportunities to engage staff in various City agencies to facilitate energy competitions between City staff, buildings, and agencies. The competitions will be created to promote awareness and energy efficiency persistence. To ensure this persistence of energy-use reduction, the City will track progress and performance of buildings or agencies using EnergyCAP and Energy Stewards both of which are currently used by City staff. GUEP also considers K-12 strategies as part of the municipal sector. Please find those strategy descriptions in Section 7 of this Program Plan.

Measuring and Evaluating Program Success

In addition to utility data reporting and the overall aggregate energy consumption in residential and municipal buildings, the City will actively track a set of metrics and targets for each strategy, including non-energy benefit measurements. This set of metrics and targets will be kept in a monitoring and performance management tool for which the City will assess monthly progress of each strategy. The purpose of this tool is two-fold.

First, it is a means by which the City can quickly assess how well a strategy is performing and, if it is not, allow the City to make program adjustments early on, long before any annual program evaluation takes place and valuable time is lost. Second, the results of the tool can be made public. Program transparency is a key element of a program that requires so much from implementation partners and those stakeholders who are participating in one or some of the strategies.

The City is currently developing a platform to track all strategies. Below is a snapshot of a draft reporting tool. (Figure 5.)

Figure 5. Draft Performance Management Tool

#	Strategy	Measurement: Aggregate energy savings associated with Madison Energy Challenge commitments						Source	From Baseline	
		Primary Measurement	Measure 2	Measure 3	Measure 4	Measure 5	Measure 6			
R7	**Madison Energy Challenge:** Madison and its partner organizations will facilitate an energy competition that churches, offices, schools, and city departments can play against each other with a goal of reducing electricity and gas consumption. The competition will be modeled after Cool Choices, which engages participants at work to make energy-saving decisions at home. See full description in Madison Program Plan for the Geogetown University Energy Prize.	Verified/tracked energy savings (kwh; therms; kBtu)	Total # of energy-reducing activities committed to	# of participating households	# of recruitment events			HH energy bill tracker; commitment forms; program records	From annual 2014 baseline for aggregate annual residential energy consumption	↓

The City's internal program staff will track metrics monthly and discuss them at monthly meetings with implementation partners of the plan. In addition to these metrics, the City will work closely with

Madison Gas & Electric and Alliant Energy to ensure that GUEP utility reporting deadlines are met. During the first year of implementation, the City will make public a six-month report, and host a public "results" meeting at the end of years one and two.

Long-Term Program Components

While aspects of this plan will kick off in the short term, there are more ambitious goals and strategies that will not come to fruition until the mid and long term portions of the competition, and afterward. The City's benchmarking ordinance, for example, is currently being developed by a committee, will need to go through the City's legislative process and will therefore not have immediate impact on energy use if and when it is adopted. Additionally, municipal and K-12 efforts, particularly around behavior modification, will take some time to gain momentum and reduce energy. Rather, these types of legislation and campaigns will lay the groundwork for longstanding energy efficiency considerations. Finally, design and set-up of retrofit programs for both single and multifamily buildings will be planned for continuation long after the two-year competition period. The City of Madison and GUEP team foresee many strategies realizing their full potential after the first two year implementation phase. While a focus is on immediate energy savings, there is also a long-term goal of continually increasing update and adoption of strategies beyond the prize timeline and creating a sustainable program into the future.

Section 3: Utility Data Reporting

Cooperation between Program Leadership and Utilities

Community Baseline Report

At the onset of the development of this plan, the GUEP Team endeavored to develop an energy baseline that would inform the City in establishing preliminary goals and targets for this plan. In doing so, Madison Gas & Electric (MGE) and Alliant Energy supplied residential energy data. Next, the team added energy consumption data provided by the Madison Metropolitan School District (MMSD), and the City's buildings via its energy data management platform, EnergyCAP. EnergyCAP utilizes data directly fed into the online system via the utilities. (See Appendix 1 for the Community Baseline Report.)

Energy Programs and Incentives

As referenced in Section 1, both utilities offer incentive-based energy efficiency programs to their customers, though they are administered by a state coordinating agency known as Focus on Energy. This plan highlights recommendations that enhance existing program offerings and builds upon this strong foundation.

Energy Data

In addition to the Community Baseline Report, the City has met with both utilities and will continue to do so to finalize the reporting process in the aggregation of residential and municipal energy data. Below is a more detailed description of how data will be collected and aggregated for both sectors by Madison Gas & Electric and Alliant Energy.

Data Aggregation

How will the utility identify residential energy consumers in order to aggregate their energy use?

For the utilities' full responses to the Energy Data Collection Form, please see Appendix 5. Alliant Energy will identify residential energy consumers by billing rate class GS (general services) 001, while Madison Gas & Electric will identify residential energy consumers by a different billing rate class – residential services. In this manner, both utilities will capture both single family and multifamily homes.

Both utilities will report a baseline monthly aggregate for 2013 and 2014 in May 2015 as described in the GUEP Guidelines, version 7.2, as well as the monthly aggregate residential energy consumption in electricity and natural gas on a quarterly basis.

How have the community and utilities identified municipal accounts in order to aggregate their energy use?

Municipal – City of Madison

The City of Madison uses EnergyCAP, a database platform, to track energy consumption. All electricity and natural gas accounts from both MGE and Alliant Energy are uploaded directly from the utilities into the EnergyCAP system. Both utilities can confirm that these accounts are the only accounts attributed to the City of Madison. To cross-check this list, both utilities will confirm this through their own database by billing rate class to ensure an equal match. This will be verified well before the first baseline data and quarterly reports are due in May 2015.

Municipal – K-12 Schools

GUEP requires two sets of school data: public schools and private schools. The Madison Metropolitan School District (MMSD) is a public school district and serves 83 percent of Madison's student population. MMSD has actively tracked its energy consumption in buildings for years, and in particular, the last three years, with the assistance of an energy consultant. The school district has provided a list of those accounts, and both utilities will confirm this through their own database by billing rate class to ensure an equal match. This will be verified well before the first baseline data and quarterly reports are due in May 2015.

Approximately 17 percent of Madison's student population attends private schools in Madison[1]. The City has actively reached out to thirty private schools to attempt to gain their participation in planning efforts, however, just four have responded with approval to use energy data, and three have declined to share information. The City will continue to follow up with the additional schools through early 2015. The City proposes that all private schools be officially excluded from the competition, per GUEP Guidelines 7.2 (p. 7) which state that, "In special circumstances (e.g. privately operated schools that refuse to cooperate), a school may be excluded, but in each case permission must be obtained from GUEP. Overall, excluded schools cannot together serve more than 20% of the school-aged children in the community." We will, however, continue to engage as many private schools as we can, as noted above.

[1] http://www.privateschoolreview.com/town_schools/stateid/WI/townid/8032

Both utilities will report a baseline monthly aggregate for 2013 and 2014 in May 2015 as described in the GUEP Guidelines, version 7.2, as well as the monthly aggregate municipal energy consumption in electricity and natural gas on a quarterly basis.

Section 4: Innovation

Our strategies are innovative and inspiring.

Multifamily and affordable housing markets are extremely hard-to-reach populations. Elevate Energy's mission is to design and implement efficiency programs that reach those who need them most. Plan implementation and outreach will focus on these underserved markets in order to deliver the benefits of energy efficiency to all citizens of Madison. Design of the full-service retrofit model is meant to reach multifamily building owners in utilizing energy efficiency to help preserve affordable housing. Further, the addition of a financing option within this program will continue to appeal to affordable housing developers and make energy efficiency retrofits cost-effective and accessible.

Incorporation of behavior change philosophy is key in inspiring participation from across the Madison community. Behavior change strategies are often seen as the "last frontier" in energy efficiency once retrofit programs have been optimized. Utilization of the outreach "House Party" model and the Madison Energy Competition will be not only be fun and engaging, but also, and more importantly, spread energy efficiency far and wide.

Using this plan to engage local businesses and the private sector will serve as a catalyst to spur economic growth through innovation in the community, and also has the potential to create an atmosphere that draws new innovation and business to Madison.

Section 5: Potential for Replication

Identify Planned Resources That Could Become a Model for Other Communities

Many of the elements of Madison's Program Plan can be replicated in other communities and include the following:

- **Stakeholder engagement to gauge receptiveness and concerns:** Meet with the people that these efforts will impact; and with those who the City would like to engage as implementation partners.
- **Identify and utilize more than one implementation partner:** Most communities have multiple agencies that are strong potential resources in a variety of capacities including outreach, environmental concerns, financial interests, political leaderships, and more.
- **Involve utilities at the onset as a resource for important energy data:** Use agreements in place and establish a formal request for data. Develop a baseline report to better understand how buildings are currently performing.

- **Development of performance monitoring and metrics:** Identify in advance all of the key measurements that will determine each strategy's success. Track the measurements and ensure transparency.

Identify Procedural Aspects of the Plan That May be Replicated

While any of the strategies of the Madison Program Plan can be replicated, we specifically note the following that may be particularly suited for certain communities:

Table 7. Replicability of Strategies

Strategy for Replication	Characteristics for Other Communities to Consider
Multifamily full-service retrofit program	High concentration of multifamily buildings
House parties	Communities with strong neighborhood groups
Multifamily and single-family deep energy savings measures	Climates similar to upper Midwest when seasonal differences strongly impact energy consumption
Benchmarking	Communities with strong interest in energy/sustainability; municipalities with an elected official that champions energy as an issue; strong utility/municipal partnerships
Behavior Competition, with linked and overlapping "divisions"	Communities with strong neighborhood groups; stakeholders already thinking about/taking action on energy efficiency
Comprehensive baseline data collection and analysis; goal setting based on results	Communities with strong interest in energy/sustainability from wide array of stakeholders; communities with utilities committed to external partnerships
Integration and streamlining of existing efforts across multiple sectors + single point of entry	Communities with multiple significant barriers to retrofit activity across one or more building sectors

Section 6: Likely Future Performance

Energy Savings Goals, Targets, and Permanency

As described in Section 2, the energy savings generated by the City's strategies will achieve significant energy savings in residential, municipal and K-12 buildings. (Table 8.)

Table 8. Energy Savings by Sector

Strategies by Sector	Annual Energy Savings (kBtu)	Annual Cost Savings	Two-Year Implementation Savings Goal	
Residential	114,840,602	$2,423,156	229,681,203	$4,846,312
Municipal	65,312,796	$1,960,430	130,625,591	$3,920,860
K-12	42,586,258	$570,011	85,172,516	$1,140,021

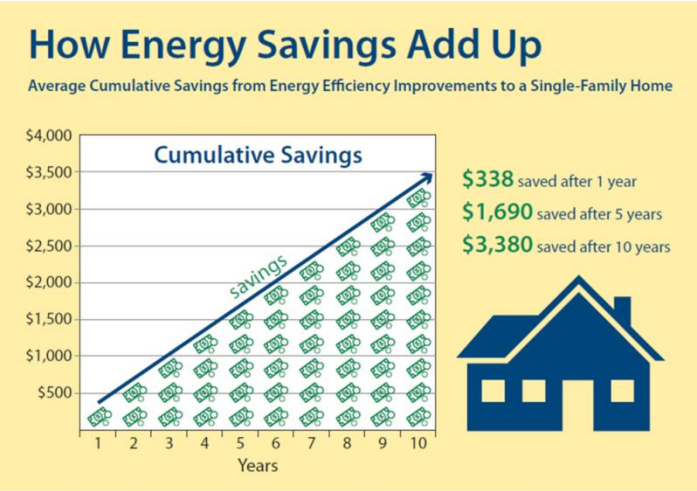
The total annual energy savings for all strategies is 222.7M kBtu, with 146.5M kBtu (Table 4. in Section 2) from retrofit activity and other capital improvements to buildings. Changes to the physical structure of a building have much longer lasting results than that of the changes of occupancy behavior tendencies. Nearly 62 percent of the energy savings will derive from these physical building strategies, and therefore are likely to be permanent savings.

Other savings attributed to behavior modification by occupants in buildings will certainly have permanent effects, but they may wane in impact and penetration rates over time. It will be crucial for the longer term strategy of the City to keep residents, City staff, and the school district engaged in fresh activities and learning experiences, while drawing in additional sectors such as small business, large commercial, and institutional, when possible. The role of the City's implementation partners will not be underestimated in this endeavor.

Long-Term Energy Savings

Energy savings will continue to mount after the competition for two reasons. First, the retrofit activity and capital improvements initiated during implementation do not suddenly stop performing at the end of the second year. Rather, these lasting physical building improvements will continue to save energy for building owners and occupants. "Cumulative savings" is a term often used to describe this. For example, a household that saves $338 in year one saves over $1500 after five years, as shown in Figure 6. These cumulative savings at the program scale level will amount to millions of kBtus and dollars saved across the City of Madison each year.

Figure 6. Example of Cumulative Savings



More importantly, the residential retrofit strategy in particular is designed to develop a longer term strategic approach to engage residential building owners over time. The design of this ongoing, full-service retrofit program is just the beginning. Year one and two penetration rates are realistic, but as program success grows, it is expected that penetration into both the single family and multifamily markets will increase. Years one and two are targeting 750 single-family homes and 2,500 multifamily units, and the following years could potentially grow faster than that. This same type of full-service retrofit program has experienced similar significant growth in other markets.

Data Collection and Management

Performance Management and Monitoring

The City will gather data in two ways. First, the City will work with its utilities (Madison Gas & Electric and Alliant Energy) to complete the required baseline and quarterly data reports and ensure they are submitted in a timely manner. The City has met several times with staff at both utilities including

government/legislative affairs and data staff to ensure that aggregate electricity and natural gas data can be easily and efficiently assembled by the utility and reported to GUEP officials in the required format. The City understands that it is this energy data supplied by the utilities that will be the measure by which the overall GUEP competition is governed.

However, as described in Section 2 of this Program Plan, the City will actively track a set of metrics and targets for each strategy, including both energy and non-energy measurements. This set of metrics and targets will be kept in a monitoring and performance management tool for which the City will assess monthly progress of each strategy. The purpose of this tool is two-fold.

First, it is a means by which the City can quickly assess how well a strategy is performing and if not, allow the City to make program adjustments early on, long before any annual program evaluation takes place and valuable time is lost. Second, the results of the tool can be made public. Program transparency is a key element of a program that requires so much from implementation partners and those stakeholders who are participating in one or some of the strategies. A snapshot of this draft tracking tool is depicted in Section 2, Figure 5. The City's internal program staff will track metrics on a monthly basis and discuss them at monthly meetings with implementation partners of the plan, while engaging the public in strategic reporting and annual meetings, also described in Section 2.

Strategies Involving Data

Because the City will be tracking progress and associated metrics for all strategies, in some respects, all strategies involve data. However, there are several strategies in which the core nature of their purpose involves access to energy data. These include the following strategies:

M4 Benchmarking: The City's support of a benchmarking ordinance requires that building owners have access to at least one year's worth of energy data. Best practices in benchmarking also call for strong data analyses of benchmarking results and findings, which would require a potential need for both the knowledge of, and access to auxiliary datasets. Data partners would include both utilities, at minimum.

R9 Home Energy Data: This strategy allows residents to compare their energy use with their neighbors. This requires a significant amount of access to data, and in such a way that does not compromise the privacy of those nearby property owners/occupants. Lead partners in this effort would be both utilities.

M8–14 EnergyCAP: The City will continue to track the energy consumption of its buildings in EnergyCAP. This platform features an automatic upload of energy data from the utilities, and without it, would become tedious.

K10 K-12 Energy Management: The Madison Metropolitan School District (MMSD) recently ended its contract with an energy consultant. The City recommends that MMSD continue this stellar record of tracking its district-wide energy consumption in a platform similar to ENERGY STAR Portfolio Manager or another reputable energy management system. Data partners will again include both utilities, as it would be most efficient that the data platform be set up to automatically upload energy data directly into the system.

Section 7: Education

K-12 Schools

How will the local K-12 school system be involved?

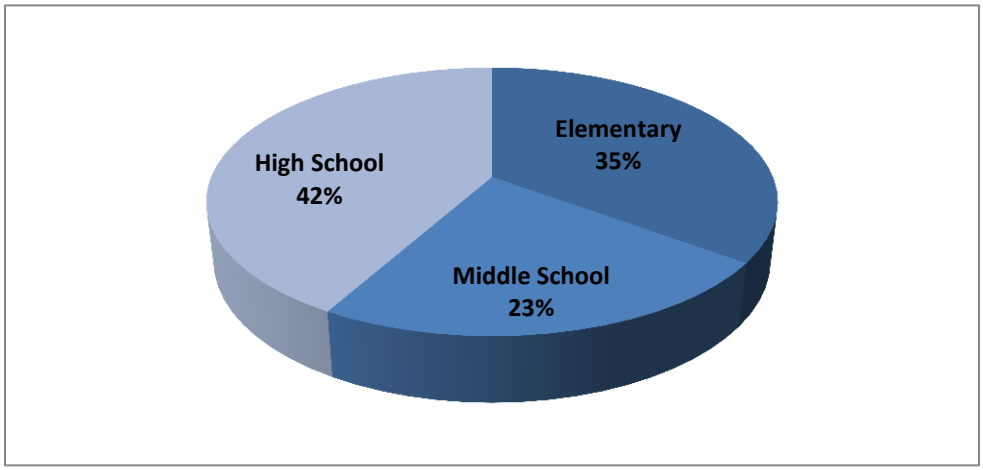
The GUEP Team met with the Madison Metropolitan School District during the preparation of this plan and anticipates a strong, mutually beneficial relationship as the two seek to continue reducing energy consumption that is within direct control, while educating those within their respective audiences. For the City, this includes the entire community, but for MMSD this audience is comprised of teachers and students. The GUEP Team examined MMSD's existing efforts and best practices in K-12 energy education which led to the strategies the City will embark on during the two-year implementation phase.

Existing Efforts: Buildings and Students

The Madison Metropolitan School District serves 83 percent of the student population in Madison with remaining students being served by approximately 30 private schools. In 2013[2], MMSD's 41 public schools consumed 310,338,612 kBtu of energy across 4.3 million square feet.

MMSD's 41 schools are comprised of 26 elementary schools, 11 middle schools, and four high schools. In just these four high schools, however, 42 percent of all MMSD K-12 energy is consumed. This is most likely due to the sheer size of the buildings. (See Appendix 1. Community Baseline Report for full details.) Figure 7 also shows that the 26 elementary schools can be attributed to 35 percent of the energy consumption in public schools while the 11 middle schools use the least amount of energy consumption at 23 percent.

Figure 7. Breakdown of Madison Municipal School District Energy Consumption



Energy in Buildings

The Madison Metropolitan School District has been committed to energy conservation since the 1980's. Improvements over time have resulted in more than 25 percent energy savings since baseline efforts began in 1981. The MMSD should be commended for achieving this reduction while experiencing an

[2] MMSD data spans the fiscal year of July 2012 through June 2013, however for the sake of this report, this data is used as a proxy for the calendar year of 2013.

increase of more than 400,000 square feet. Within the last year alone under the final contract year with an energy consultant, MMSD reduced energy consumption by 45M kBtus and saved more than $600,000 in energy costs. MMSD's energy efficiency efforts include the following actions in buildings: building envelope improvements, building systems and technology improvements, and lighting improvements. More on these improvements can be found in the Community Baseline Report (Appendix 1.) MMSD continues to explore ways to reduce energy consumption and to reach students as it enters its fourth decade of addressing energy efficiency in its building stock. Staff-developed Energy Management Guidelines establish a roadmap to continue down this path with energy-related procedures and considerations in the areas of lighting, scheduling/facility use, heating and air conditioning, computers/office machines, food service and personal appliances.

Students and Energy

Further, over the last three years, the Madison Metropolitan School District has paired physical work with significant behavioral and educational efforts through a program called People.Power.Planet. In this program schools have embraced energy challenges in which they compete to see how much school energy use can be reduced, backed by data provided by the consultant's diagnostic tools. Local organization SustainDane worked with teachers and students on energy efficient behavior, recruiting energy champions from each school. This in turn launched social campaigns to change behavioral norms, including turning off lights and computers. These efforts reached nearly three quarters of the school district. The learnings here can have quantifiable results outside of school walls, with carryover into homes.

Best Practices in K-12 Energy Education

When considering how to build upon the Madison Metropolitan School District's existing efforts, the GUEP Team researched best practices in engaging students in energy education. The team found that energy education at the K-12 level can serve a variety of valuable purposes in a broader energy plan. In particular, a report from the Energy Center of Wisconsin on the K-12 Energy Education Program (KEEP) suggests that students can bring energy knowledge home and teach their families about energy conservation, encouraging more energy efficient behaviors at home. Research has also shown that with the right program design, environmental education can promote more sustainable behaviors among K-12 students and their families. (Please see Appendix 4 for a snapshot on Best Practices in K-12 Energy Education Programs.)

The GUEP Team identified the following best practices in standalone and curriculum-based programs:

- Program design:
  - Start at the top to ensure buy-in from key decision makers in the school district and build on existing projects and resources. Establish connections with existing energy programs in the school district and the larger community.
  - A clear statement of measurable goals about what students are expected to learn. Programs should build in measurable goals and performance benchmarks during program design, to ensure effective program evaluation.
  - Teacher training and supplementary materials designed to promote consistent program implementation.

  - To promote learning among both students and parents, programs should actively involve parents and focus on local energy issues

- Curriculum design:
  - Practical applications should tie energy concepts to the everyday lives of students. Use hands-on, real-world examples of energy and energy efficiency by helping students collect and analyze energy data from their homes or the school building. Incorporating the example of the school building can improve education and enable students to get involved in energy efficiency efforts at their schools, while using energy data from students' homes can encourage conservation among students and parents.
  - A multi-disciplined approach to teaching energy, including science, math, technology and geography as learning opportunities, as well as incorporating best practices for science education at the appropriate grade level.
  - Age-appropriate information with different learning experiences and depths of knowledge for different age groups.
  - Creative, attractive materials and innovative teaching practices using the internet and other technological tools for learning.
  - Establish a synergy between energy and environmental education, by linking educational programs and curriculum.
  - Programs should build in measurable goals and performance benchmarks, including learning outcomes for students.

Strategies for K-12 Buildings

Table 9 below provides a snapshot of all K-12 strategies, including ones with non-energy benefits. In general, strategies can be described in two categories: engaging students and physical buildings. The physical buildings strategies are ones for which we can directly attach to energy savings.

Table 9. Summary of K-12 Strategies	
Engage Students and Staff in Energy Programs	
K1	Build on existing programs such as Sustain Dane's People.Power.Planet, which has been successful in encouraging public school students and staff to practice energy efficiency. These types of programs should be continued and expanded to include all of Madison's K-12 schools.
K2	Look for opportunities to use the school building as a teaching tool. As students and staff see results from energy conservation at school, they are encouraged to practice energy conservation at home.
Teach Energy Literacy	
K4	Investigate developing an energy curriculum for schools. A multi-disciplinary approach to energy education can meet state learning standards and incorporate science, math, technology, history, and geography.
K5	Develop measurable goals and performance benchmarks, including learning outcomes for students.
K6	Continue partnering with energy utilities to provide teacher training, in-class education, and materials through the Wisconsin K-12 Energy Education Program (KEEP).
K7	Provide program materials that incorporate local energy issues and energy data from the school buildings or students' homes.
K8	Actively involve parents in programs, through take-home energy efficiency kits, at-home energy competitions, or other initiatives.
Buildings Strategies	

K9	Prioritize energy efficiency in school capital improvement plans. This includes: • Energy benchmarking data for the Madison Metropolitan School District (MMSD) shows that not all schools use energy equally. Use the CIP to prioritize energy efficiency improvements for the biggest users, such as MMSD's four high schools. • Continue with MMSD's successful energy efficiency building upgrade program. • Investigate options for providing long-term consistent funding for school energy efficiency improvements.
K10	Implement energy management programs, such as: • Formally adopt and implement the Energy Management Program Guidelines at MMSD schools. • Create a process for citywide monitoring of energy use in school buildings, to create track progress on building efficiency improvements. The U.S. Environmental Protection Agency's ENERGY STAR Portfolio Manager is a free tool that can help schools perform robust energy benchmarking and tracking. • Perform ongoing energy monitoring and adjust the energy management program as needed, for low-efficiency schools.
K11	Encourage efficiency upgrades for private schools: • Consider developing a collaborative energy efficiency peer learning network, to facilitate knowledge sharing between facilities staff at public and private schools. • Encourage private schools to invest in energy efficiency upgrades and energy management programs through targeted incentive programs.
Behavior Change	
K3/R7	Develop a citywide school energy competition to engage students and staff with quantifiable energy savings. (See Strategy R7)

Community-wide Educational Programs

The Madison Energy Competition will combine K-12 strategies with home energy savings and community-wide education. The competition will leverage new student activities and curriculum and excite students and their families to get involved and participate at home. Further, the competition will reach other community centers where residents spend their time such as religious institutions and workplaces. This, in turn, will continue to spread educational efforts. Involvement by community leaders and spokespeople will further position energy efficiency and the Georgetown University Energy Prize as a central theme to Madison's already engaged culture.

In addition, the House Party model (R10) is based on the idea of community-wide education. Inviting energy efficiency experts into your home, along with friends and neighbors, creates an environment where all participants learn about building science and home energy efficiency. This then ripples outward as more social circles tap into the program.

Finally, several strategies are based on the idea that knowledge is power. Unlocking energy use information and making it accessible to building owners, tenants, and users, is proven to decrease overall consumption. Strategies R9 (Targeted Home Energy Data), M4 (Develop Energy Benchmarking Ordinance) and M3 (Establish a Green MLS) all create increased visibility and access to energy use data, allowing users to interact with that information and learn how to lower their usage. These strategies also create a direct tie between energy efficiency and other benefits as motivators for these groups. For example, homeowners with access to their home energy data will understand how their actions can save them money. These efforts create the infrastructure needed to allow this to happen on a community scale.

Section 8: Prize Purse

The City of Madison's commitment to energy efficiency and sustainability is evidenced by its past and present efforts, and further, by its commitment to develop and implement this plan to target and reduce energy consumption across the residential, municipal, and K-12 buildings and occupants.

If so honored to win the $5 million prize purse, the City of Madison will continue to fund its efforts in reducing energy consumption. The energy landscape is changing rapidly, so it is difficult to pinpoint exactly what projects would be funded. For example, over the last five years, LEDs for residential usage have dramatically dropped in price, making them a feasible choice for installation around the home. However, CFLs are still much cheaper. In two years, it may be the case that LEDs may be cheap enough to consider in a massive direct install program which could help further reduce energy consumption in the residential sector. That being said, certainly there are a host of potential projects and considerations for that significant influx of money. Table 11 below describes some of these projects. And, of course, the level of success and lessons learned with the proposed strategies in this Program Plan will also dictate where we would direct additional funding.

Last but not least, the City of Madison realizes that for much of these strategies to take root, Madison's residents, businesses and other stakeholders will transform into doers and implementers. In an effort to publicize the Program Plan, the City will solicit input on how Madison should spend the prize money. This effort will also get Madisonians excited about the Georgetown University Energy Prize program and inspire the community to participate both now and later. The City of Madison is strongly committed to participatory planning and collaboration, and this is just another way to engage our residents and stakeholders while getting them excited at the kickoff of the implementation phase.

However the prize purse is spent, it is likely that criteria for funding would include the following:

- Impact: Ability to achieve significant energy savings, and when applicable, other non-energy benefits
- Ease of Implementation: Does the implementation fall solely on the City, or are there engaged stakeholders that may align program goals and be able to assist with some facet of implementation?
- Quantifiable: Can we track energy savings achieved via the proposed actions?
- Feasibility: Are there political, financial or legal barriers to implementation?

Below is a list of ideas for potential projects that could be funded by the prize purse. This list is neither exhaustive nor final in any manner. (Table 10.)

Table 10. Potential Projects for Prize Purse Funding

One-Off Projects (Not meant for long term implementation but would have long term energy benefits)	Longer Term Projects (Programs intended for multi-year implementation)
• Direct install program for LEDs and CFLs in residential sector • Invest in large scale municipal energy efficiency and	• Create and capitalize an energy or sustainability fund • Create a loan loss reserve or an energy efficiency

renewable energy projects • Consider assisting large scale energy efficiency project at Madison water facilities • Assist funding for a major K-12 energy efficiency capital improvement project • Hire third-party verification agency for all energy efficiency strategies to assure impact (and use results to further guide next steps)	revolving loan fund • Continue a contract to implement behavior-based programs • Continue a contract to engage retrofit activities through a single-point-of-contact agency that covers all phases from audit to construction oversight • Capitalize a PACE fund • Expand energy efficiency programming and targeting to commercial sector or large institutions • Partner with the Community Development Authority (Madison's public housing authority)to benchmark their buildings and create a capital improvement plan for energy efficiency • Create an incentive system for departments and employees that encourages them to reduce energy use and identify facilities improvements that will do the same. • Provide training for contractors, pre-qualifying contractors, partnering directly with high-quality contractors, or a creating a publically available contractor rating system.

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Appendix 1: Community Baseline Report

ELEVATE ENERGY
Smarter energy use for all

Community Baseline Report

to inform the Madison Georgetown University Energy Prize (GUEP) Program Plan

Submitted by:
Elevate Energy, COWS, and Brendle Group

COWS | BUILDING THE HIGH ROAD

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October 2014

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Table of Contents

Section 1: Introduction

Baseline

1: A measurement, calculation, or location used as a basis for comparison.

A primary objective of the Madison Georgetown University Energy Prize (GUEP) Program Plan is to present clear implementation strategies and projects for the City, local schools and residents to implement in order to make measurable impacts towards reducing energy consumption and associated emissions. Prior to the formation of strategies and establishing energy reduction goals, however, it is necessary to determine exactly where the community is starting from. Thus, a baseline analysis is a measurement, calculation or location used as a basis for comparison. This 2013 baseline will provide an *energy consumption analysis* and a review of *existing energy programs and efforts* for municipal, school and residential buildings across Madison.

Energy Consumption Analysis

This section of the baseline report will examine exactly how much energy is being consumed in the targeted building sectors in Madison. Data from the City of Madison was provided via the City's energy data management platform EnergyCAP, in which electricity and natural gas data is automatically uploaded into the software program from the energy utilities. For schools, the Madison Metropolitan School District (MMSD) supplied energy data for public schools while individual private schools provided data directly from their individual utility accounts. Finally, residential energy consumption data was provided by Alliant Energy and Madison Gas and Electric (MGE).

Existing Energy Programs and Efforts

Madison is certainly not new to the concepts of sustainability and energy efficiency, and this portion of the baseline report will summarize the myriad of existing energy programs and efforts across the community. The City already engages a variety of efforts to reduce municipal energy consumption, and so too does the school district. In addition to physical building energy improvements, MMSD also engages its students on the topic of energy. Focus On Energy, a state-sponsored implementation agency, has had a long term presence in championing energy efficiency among residential and commercial sector building owners. These programs are not in addition to utility programs, rather, Focus essentially steers program participation on behalf of the two utilities, Alliant and MGE.

How the Baseline Analysis Will Be Used

This analysis of the "existing conditions"—or how energy is consumed in Madison and the current suite of energy program tools—will be used to help determine the appropriate strategies and energy reduction goals designed to significantly reduce municipal and residential energy consumption over the two year implementation phase and beyond. In addition, tracking this baseline data over time will also allow the City and GUEP program participants to better measure progress, and serve as a quantitative base for amendments to policy, strategies, and priorities as necessary.

Section 2: Energy Consumption Analysis

Municipal Operations

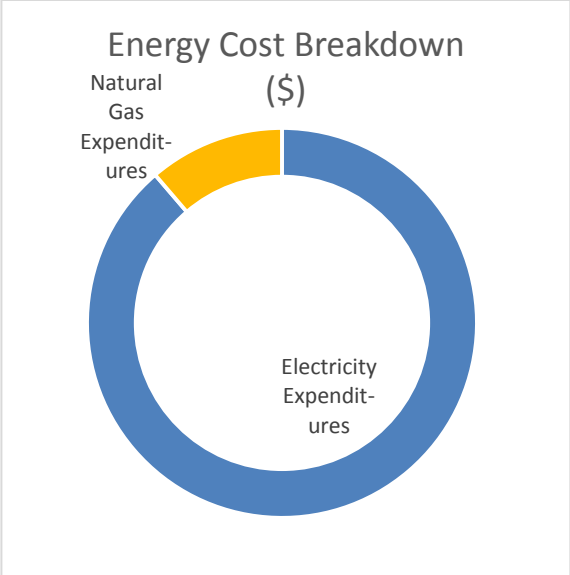
The City of Madison employs almost 2,800 Full Time Equivalent (FTE) staff (in 2014) and operates almost 3.2 million square feet of building space. The City facilities receive both natural gas and electricity services to over 460 separate electric meters. Madison Gas and Electric provides all natural gas service and the large majority of electricity service to City facilities. A small portion of electricity is supplied by Alliant Energy. The table below provides a summary of the facilities occupied and operated by the city, broken down by agency. Generally, the facilities are operated by the occupying agency, however various types of assistance is provided by both Facilities Operations (FO) and Facilities Management (FM).

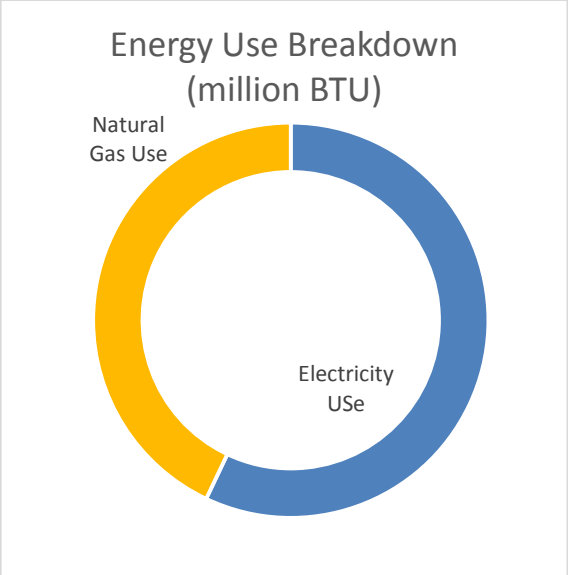
Agency	Building Name	Building Size (ft^2)	Agency Facility Characteristics and Operations
Engineering	• Engineering Services Building	• 42,742	2 General Office buildings, 1 Maintenance building, plus 30 Pumps and lift stations are maintained and monitored by FO. Support from FM for design, construction administration (including punch list and close-out) for all new construction and substantial renovations.
	• Fairchild	• 53,329	
	• Madison Municipal	• 74,154	
Fire	• Fire Maintenance	• Unknown	1 Vehicle Maintenance building and 13 Fire Stations are maintained and monitored by FO. Support from FM for design, construction administration (including punch list and close-out) for all new construction and substantial renovations. Fire Stations 12 and 13 LEED NC Platinum (2010) and EBOM Gold (2014) Certified, respectively.
	• Stations #1 - #13	• 13,724 (max) • 9,165 (avg.) • 119,142 (total)	
Fleet Services	• Fleet Service	• 52,840	Vehicle Maintenance, maintained and monitored by FO. Support from FM for design, construction administration (including punch list and close-out) for all new construction and substantial renovations.
Health	• East Health Hawthorne	• 11,500	Maintained and monitored by FO
Library	• Alicia Ashman	• 11,829	Libraries manage their own operations, with some support from FM for design, construction administration (including punch list and close-out) for all new construction and substantial renovation projects. Central Library (EBOM Gold, 2014), Goodman South Library (CI Gold, 2010), and Sequoya Branch Library (CI Silver 2010) are all LEED Certified.
	• Central Library	• 119,200*	
	• Goodman South	• 12,010*	
	• Lakeview	• 9,335	
	• Meadowridge	• 17,565	
	• Monroe Street	• 2,300	
	• Pinney	• 11,200	
	• Sequoya Branch	• 20,000*	
Metro	• Metro Maintenance	• 282,250	Manage own operations with minimal support from FM for design, construction administration (including punch list and close-out) for all new construction and substantial renovations
Monona Terrace	• Monona Terrace	• 303,000*	Manage own operations with some support from FM for design, construction administration for all substantial renovations. Monona Terrace is LEED NC Silver (2010) Certified.

Agency	Building Name	Building Size (ft^2)	Agency Facility Characteristics and Operations
Parks	• Goodman Pool	• 6,117	Manage own operations, some support from FM for design, construction administration (including punch list and close-out) for all new construction and substantial renovations. Parks maintenance building is LEED NC Silver (2010) Certified.
	• Olbrich Gardens	• 47,553	
	• Warner Park Community	• 31,200	
	• Parks Maintenance	• 43,300*	
	• Warner Park Shelter Maint.	• 35,000	
Police	• East District Police	• 16,460	Maintained and monitored by FO. Support from FM for design, construction administration (including punch list and close-out) for all new construction and substantial renovations.
	• West District Police	• 12,100	
	• South District Police	• 11,237	
	• North District Police	• 8,195	
	• Police Storage Facility	• 10,000	
	• Police Training Facility	• 39,186	
Senior Center	• Madison Senior Center	• 20,000	Maintained and monitored by FO.
Streets	• East Streets Maintenance	• 149,234	Maintained and monitored by FO. Some support from FM for design, construction administration (including punch list and close-out) for all new construction and substantial renovations.
	• Transfer Station	• 28,800	
	• West Streets Maintenance	• 75,922	
	• West Streets Storage	• 22,953	
Traffic Engineering / Parking	• Capitol Square North	• 234,500	Manage own operations, with some support from FO which provides support for maintenance (HVAC) as well as FO support for Sayle Street facility which was built in 1967 - not only maintaining facility, but also assisting with upgrades of HVAC, roof, etc… (limited design and construction work).
	• Government East	• 206,700	
	• Overture Center	• 206,200	
	• State Street Capitol	• 342,720	
	• State Street Frances	• 168,139	
	• State Street Lake	• 187,850	
	• Traffic Operations	• 37,877	
Water Utility	• John B. Heim Administration	• 25,148	Manage own operations.
	• Paterson Maintenance	• 22,000	
	• Paterson Vehicle Storage	• 26,038	

Current Performance

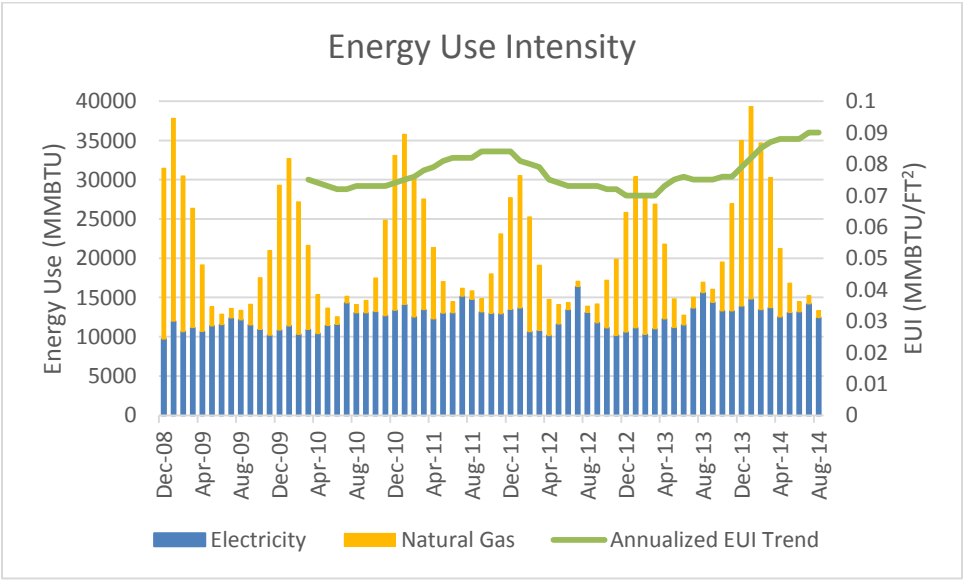
In 2013, the City of Madison spent $6.5 million on electricity and natural gas utilities, almost 90 percent of which was spent on electricity serving the City's nearly 3.175 million square feet of facilities and assets, including streetlights. The remaining 10 percent is for natural gas consumption. The estimated energy unit costs in 2013 were $0.13 per kWh for electricity and $0.64 per therm for natural gas.



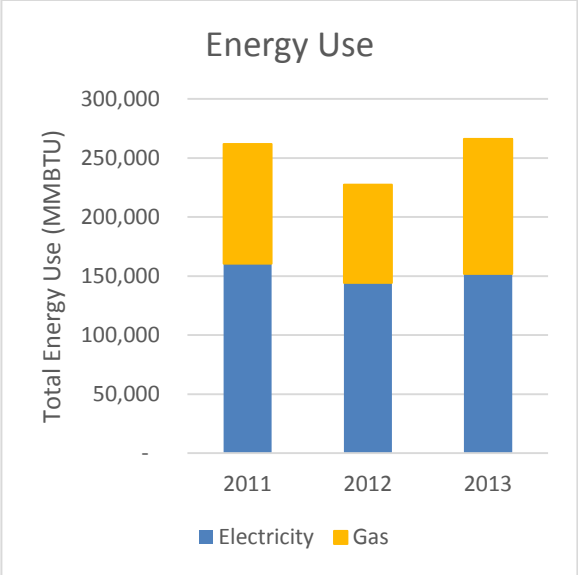


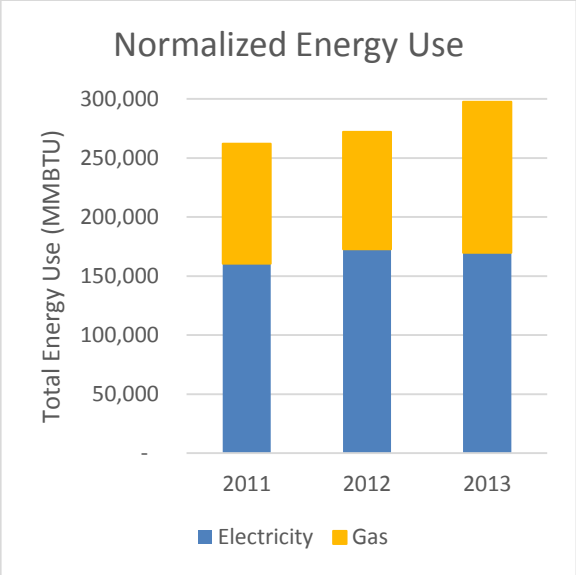
The total energy consumption in 2013 was 266,000 million BTU, split almost 60/40 between electricity and natural gas, respectively.

Natural gas use varies seasonally as expected, however electricity use has seen a slow, but steady increase over the past five years. The overall energy use per square foot of City owned space (EUI) is currently nearly 30% higher (0.09 MMBTU/ft^2 in August 2014) than the lowest value in the past five years (0.07 MMBTU/ft^2 in February 2013), as seen in the following figure.



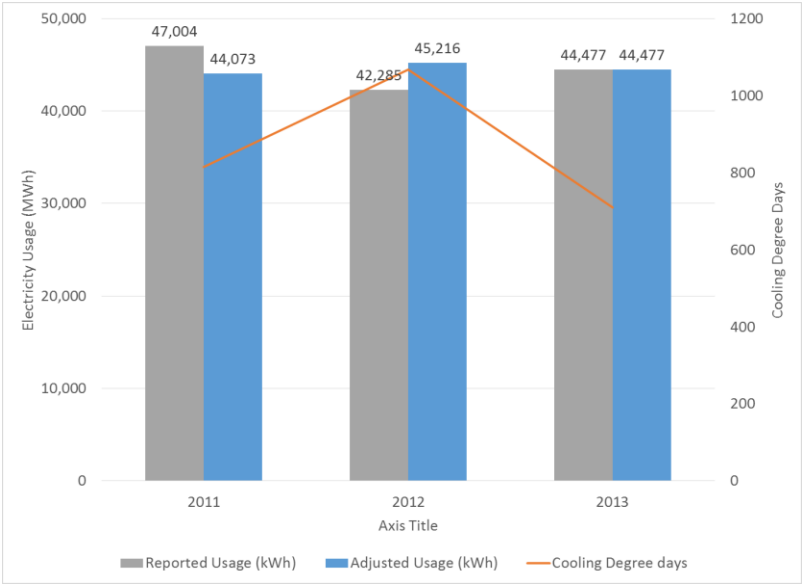
The City saw a 13% decrease in energy consumption from 2011 to 2012 but then a 17 percent increase was observed from 2012 to 2013.





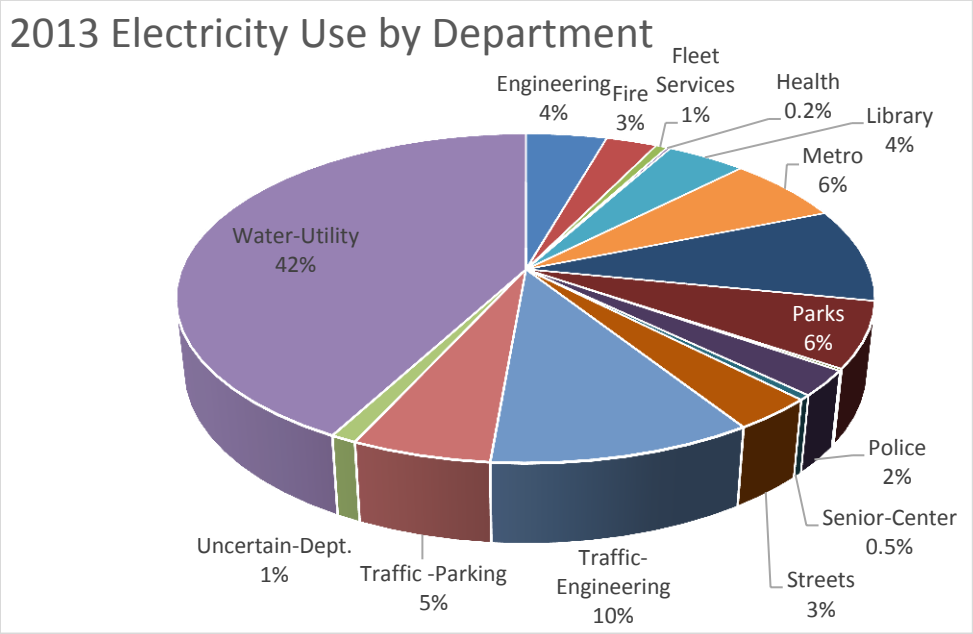
This large variance indicates that electricity and natural gas consumption data should also be analyzed after being normalized for potential weather impacts on usage. These weather normalized data can be seen in the adjacent graph.

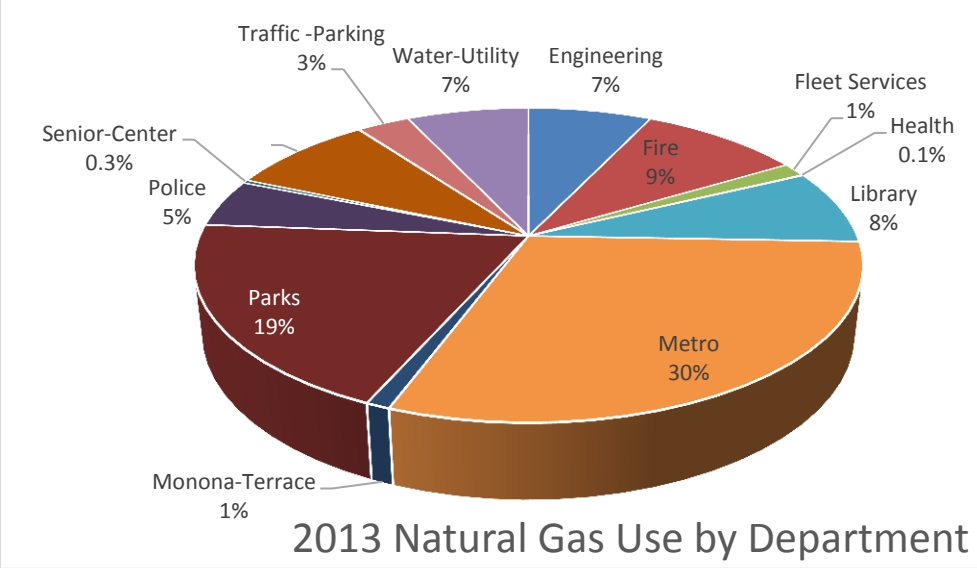
For electricity, there was also one anomaly identified in the historical data, resulting in unexpectedly high reported usage in 2011 followed by very low usage in 2012. These data were originally labeled as streetlights, however because streetlights aren't directly metered and usage is estimated based on number of units, the assumption is that this is potentially an error in the data. To rectify this issue, data entries have been re-categorized under the Traffic Engineering agency. The following figure shows both actual usage reported in EnergyCAP as well as adjusted usage that assumes the average of Traffic Engineering agency usage for 2011 and 2012 for both years. With this adjustment and the re-categorization of the data entries, the total electricity consumption more closely follows the fluctuation in cooling degree days from year to year.



The following two charts compare energy usage within the different city agencies. Operations of the Water Utility consumed over 40 percent of the electricity city-wide in 2013, 4 times greater than the next largest contributing agency, Traffic Engineering/Parking. The majority of use for the Traffic agency is streetlights and traffic signals throughout the city. Monona-Terrace is the next largest at 9 percent of total electricity consumption.

When evaluating natural gas consumption, the Metro agency represented 30 percent of total consumption in 2013, largely due to the age and inefficiency of the Metro Maintenance building. The other largest contributor to natural gas consumption is the Parks agency at 19 percent of total consumption.





Finally, getting down to the most granular level of detail presented in this assessment, the building level, the following tables list the top 10 buildings in the city for 2013 with the highest energy use and 5-year average energy use intensity (EUI). From a total energy use perspective, the Metro Maintenance building is by far the largest consumer at 16 percent of total energy use for the city. This is likely due to the age and inefficiency issues mentioned earlier that are contributing to the significant natural gas consumption for the Metro agency. Overall, the top 10 buildings made up almost 40 percent of total energy use in the city in 2013.

The average EUI for all city buildings is 72 kBtu per square foot while the average for the top 10 buildings in the city is 152 kBtu per square foot, over twice as high as the overall average. Goodman Pool has the highest EUI of all city facilities at 276 kBtu per square foot, however this value includes all building and process loads, such as pool water heating.

Building	Square Footage	2013 Total Energy Use (MMBtu)	Percentage of Total
Metro Maintenance	282,250	43,719	16%
Monona Terrace	303,000	15,092	6%
Olbrich Gardens	47,553	10,795	4%
Madison Municipal Building	74,154	6,419	2%
East Streets Maintenance	149,234	5,812	2%
Central Library	119,200	5,261	2%
Parks Maintenance	43,300	4,368	2%
Fire Station #1	24,000	3,752	1%
West Streets Maintenance	75,922	3,719	1%
Engineering Building	42,742	3,254	1%
Total		**102,190**	**38%**

Note: This list only includes buildings; there are potentially some other City assets, such as streetlight and water utility well installations that may fall within the top 10 energy consuming accounts in the City but they have not been included in this list.

Building	Square Footage	5-Year Average EUI (kBtu/sf)	Percentage of Average
Goodman Pool	6,117	276	283%
Olbrich Gardens	47,553	184	156%
Fire Station #5	8,399	178	148%
Fire Station #1	24,000	154	114%
East Health Hawthorne	11,500	140	94%
Metro Maintenance	282,250	126	75%
Monroe Street Library	2,300	120	66%
North District Police	8,195	119	65%
Fire Station #9	5,564	115	59%
South District Police	11,237	113	58%
Average		**152**	**112%**

Current Initiatives

The City has already taken some great first steps to improve the energy efficiency of its operations. Below is a summary of some of these efforts.

HVAC and Mechanical Equipment

City-wide the majority of boilers and hot water heaters have been replaced with condensing and modulating models to improve efficiency and allow for easier operations. Newer buildings and recent renovations are also installing better insulation, windows, and air sealing. In locations with significant hot water usage, solar hot water systems have been installed. Solar PV systems have also been installed in various locations. Additionally, most pumps and fans though out the city are set up with variable frequency drives while newer DX systems have variable speed compressors.

Lighting

The majority of lighting throughout the city has been upgraded to higher efficiency T8 linear fluorescent fixtures. Additionally, the facilities building has been testing various LED technology and LED upgrades to traffic signals and street lights are being made.

Controls

Many buildings operated by the city are controlled by a building automation system. The Facilities Management building is used to test different operations and controls. The building is set-up with an occupancy schedule that adjusts the heating and cooling temperatures accordingly as well as motion and CO2 sensors. The goal is to have all city buildings on the BAS system in the near future as well as upgrade all systems to the same level of control as the FM building.

The city also has lighting controls – whenever lighting is upgraded within a facility, motion sensors are installed with the replacement. A good portion of the City's street lights have been upgraded from HID to LED and in many instances motion sensors have also been installed. As another form of control the city also implements dimming ballasts.

Data Tracking and Monitoring

- EnergyCAP (historical data for most buildings dating back to 2009)
- Energy Stewards – limited participation and engagement
- Portfolio manager
- BAS systems has some capabilities – for SOME of the buildings we have pulse meters installed
- Pilot with MGE where – where we have a web interface using the pulse meters to see 15 minute data – which gets into managing demand… however the city does not do a good job of managing demand.

High Performers

Current high performance buildings, as tracked through the EnergyStewards website are indicated below. These buildings include those that have high Energy Star ratings or current LEED certifications.

Building	Change from Baseline: Energy Use	$/ft^2	Recent Data	LEED Category/ Level/Award Year
Goodman South Madison Library	-3.7%	$2.12	8/2014	LEED CI Gold - 2010

Central Library	-3.6%	$1.61	7/2014	LEED EB:O+M Gold - 2014
Goodman Parks Maintenance	-3.2%	$1.51	7/2014	LEED NC Silver - 2010
Monana Terrace	1.2%	$1.40	3/2013	LEED NC Silver - 2010
Sequoya Branch Library	7.7%	$2.73	8/2014	LEED CI Silver - 2010
Fire Station #12	N/A	$1.29	7/2014	LEED NC Platinum - 2010
Fire Station #13	N/A	N/A	N/A	LEED EB:O+M Gold - 2014

Schools, K-12

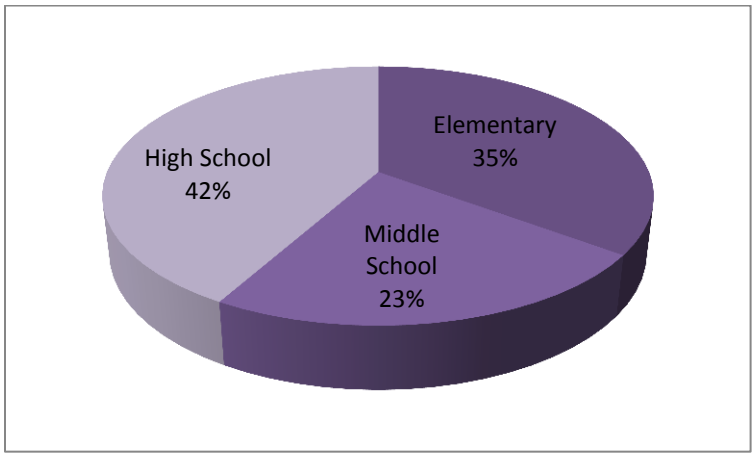
Introduction

The Madison Metropolitan School District (MMSD) serves 83% of the student population in Madison with remaining students being served by approximately 30 private schools. In 2013[3], MMSD's 41 public schools consumed 310,338,612 kBtu of energy across 4.3 million square feet. The Team is still working to gather energy data from private schools, however their relative small size and building complexities such as shared meters for non-school building uses may ultimately preclude their inclusion in this report.

Current Performance

MMSD's 41 schools are comprised of 26 elementary schools, 11 middle schools, and four high schools. In just these four high schools, however, 42% of all MMSD K-12 energy is consumed. This is most likely due to the sheer size of the buildings as seen below in Table 4. Figure 6 also shows that the 26 elementary schools can be attributed to 35% of the energy consumption in public schools while the eleven middle schools use the least amount of energy consumption at 23%.

Figure 6. Breakdown of Madison Municipal School District Energy Consumption



[3] MMSD data spans the fiscal year of July 2012 through June 2013, however for the sake of this report, this data is used as a proxy for the calendar year of 2013.

Below, Tables 4, 5 and 6 provide a closer look at energy consumption by individual school building.

Table 4. Energy Use in K-12 Public Schools – Elementary Schools (26)

School	Sq. footage	kBtu/sq. foot	% of total
Allis	82,929	44	1.18%
Chavez	88,246	51	1.45%
Crestwood	68,193	62	1.36%
Elvehjem	72,032	85	1.97%
Emerson	70,712	63	1.44%
Falk	66,604	72	1.54%
Franklin	51,455	65	1.08%
Glendale	79,409	66	1.69%
Hawthorne	54,158	81	1.41%
Huegel	64,298	58	1.20%
Kennedy	67,126	66	1.43%
Lake View	40,659	55	0.72%
Lapham	73,892	85	2.02%
Leopold	93,405	58	1.75%
Lincoln	58,866	77	1.46%
Lindbergh	34,631	80	0.89%
Lowell	69,231	83	1.85%
Mendota	49,731	74	1.19%
Midvale	65,263	55	1.16%
Muir	69,574	58	1.30%
Olson	85,657	42	1.16%
Randall	61,927	79	1.58%
Sandburg	43,213	53	0.74%
Shorewood	61,289	47	0.93%
Stephens	72,393	58	1.35%

Table 5. Energy Use in K-12 Public Schools—Middle Schools (11)

Middle Schools (11)			
School	**Sq. footage**	**kBtu/sq. foot**	**% of total**
Blackhawk- Gompers	105,264	76	2.58%
Cherokee	89,123	55	1.58%
Hamilton Van Hise	125,364	83	3.35%
Jefferson	80,890	52	1.36%
Marquette Okeefe	137,353	57	2.52%
Sennett	97,735	49	1.54%
Sherman Shabazz	130,638	63	2.65%
Spring Harbor	32,591	84	0.88%
Toki-Orchard Ridge	112,639	78	2.83%
Whitehorse Schenk	118,599	70	2.67%
Wright	55,563	62	1.11%

Table 6. Energy Use in K-12 Public Schools—High Schools (4)

High Schools (4)			
School	**Sq. footage**	**kBtu/sq. foot**	**% of total**
East	463,163	78	11.64%
LaFollette	331,731	88	9.41%
Memorial	364,011	79	9.26%
West	361,173	99	11.52%

Existing Energy Programs and Efforts

MMSD has been committed to energy conservation since the 1980's. Initially these efforts began when the school district took advantage of a federal grant to implement a variety of physical improvements including boiler modification and controls, pipe insulation, pool covers, ventilation reductions, lighting retrofits and programmable time clocks. Energy efficiency improvements over time have resulted in more than 25% energy savings since baseline efforts began in 1981. The MMSD should be commended for achieving this reduction while experiencing an increase of over 400,000 in square footage. Within the last year alone under the final contract year with an energy consultant, MMSD reduced energy consumption by 45M kBtus and saved over $600,000 in energy costs.

Building Envelope Improvements

Over the years, MMSD maintenance staff has addressed improvements to building envelopes or "the shells" of buildings in order to improve facility performance. Improvements have included window replacements, roof insulation and pipe insulation.

Building Systems & Technology Improvements

Within various building systems, improvements have included the conversion of steam systems to water, installation of automated building controls, the placement of variable frequency drives on large equipment motors, occupancy controls on HVAC systems, using computer management software to automatically shut down computers during times of non-usage, and replacing pneumatic control systems to DDC (direct digital controls).

Lighting Improvements

MMSD has worked to replace T-12 lamps with T-8 lamps, replace magnetic ballasts with electronic ones, changing incandescent bulbs to compact fluorescent lamps, installing LED exit lights and the installation of occupancy controls on lighting.

People.Power.Planet

In conjunction with contract work to reduce energy consumption in MMSD's building stock, MMSD paired physical work with significant behavioral and educational efforts. Through People.Power.Planet, high schools have had energy challenges where they compete to see how much school energy use can be reduced, backed by data provided by the consultant's diagnostic tools. Local organization SustainDane worked with teachers and students on energy efficient behavior, recruiting energy champions from each school. These in turn launched social campaigns to change behavioral norms, including turning off lights and computers. These efforts reached nearly ¾ of the school district. In a recent stakeholder meeting with MMSD staff, they indicated a strong desire to continue this important work.

Building Strong Partnerships

- 1988, Honeywell: Energy performance contract with guaranteed energy savings
- 2001 (ongoing), Focus on Energy grants and rebates for wind studies, steam tap replacement, boiler upgrades and lighting retrofits
- 2004, Solar Mining: Installation of solar pool heating systems at four high schools
- 2010, McKinstry: operational efficiency and behavior-focused energy awareness program for students and teachers

Consistent Recognition

- 1999, U.S. Environmental Protection Agency: Recognition for top performance of school districts nationwide
- 2006, Governor's Award for Excellence in Energy Efficiency
- 2009, U.S. Environmental Protection Agency, Energy Star certification in 19 schools, comprising nearly 60% of the Energy Star buildings in Madison

Board of Education Policy and Supporting Energy Guidelines

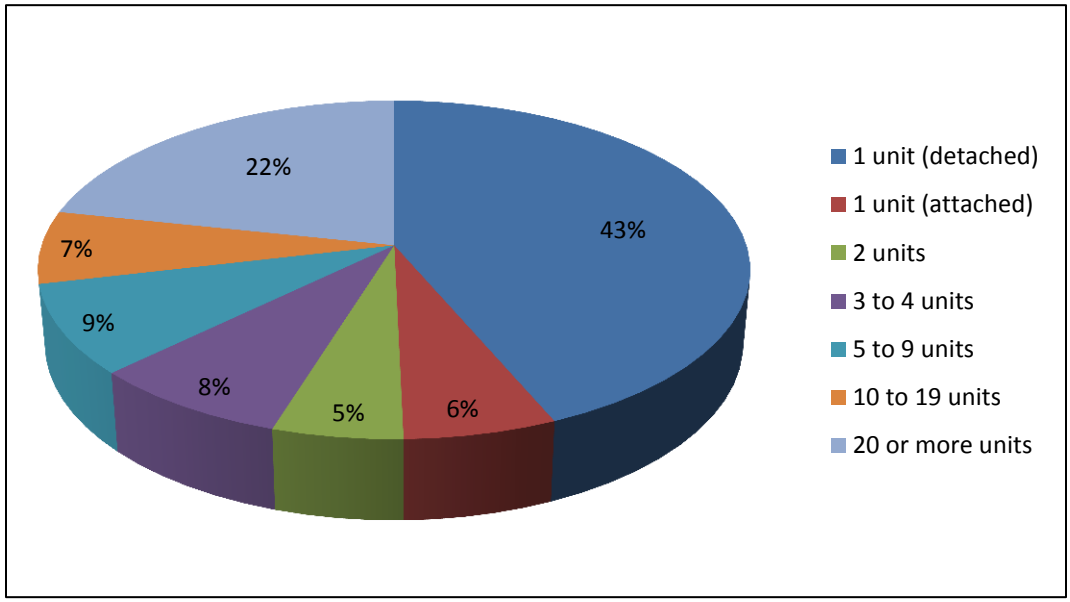
MMSD continues to explore ways to reduce energy consumption and to reach its students as it enters its fourth decade of addressing energy efficiency in its building stock. Recently moving away from its three year contract with McKinstry, MMSD will work to continue the important energy management program that took place over the last three years. The Energy Management Guidelines establish a roadmap in which continue down this path with energy-related procedures and considerations in the areas of lighting, scheduling/facility use, heating and air conditioning, computers/office machines, food service and personal appliances.

Residential Buildings

Introduction

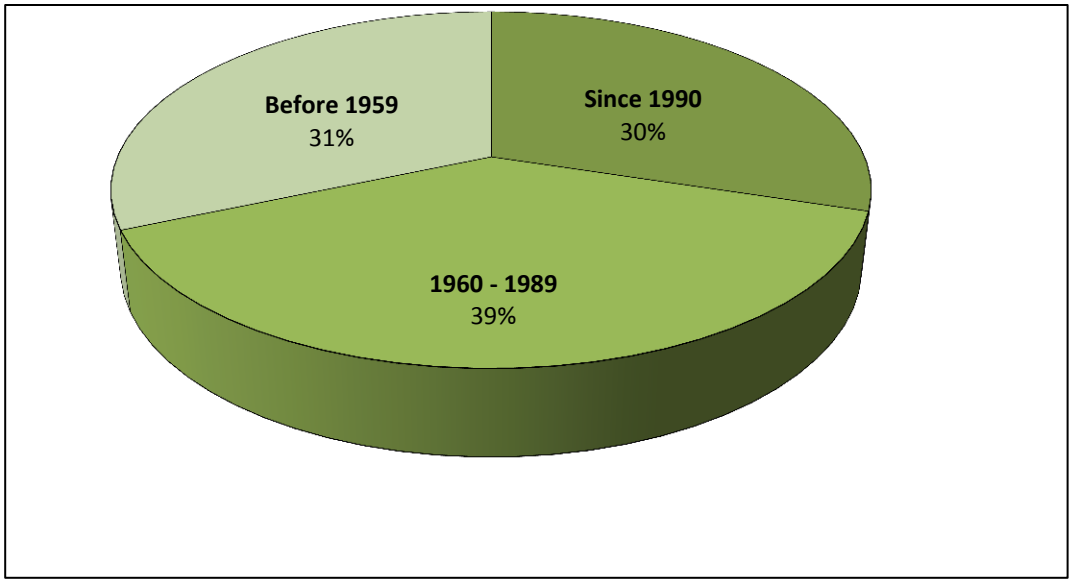
The housing stock across Madison is characterized by some unique factors that will likely play into the selection of appropriate energy efficiency strategies further in the GUEP planning process. In 2013 there were 102,516 households. Among them, ownership and rental occupancy were nearly identical according to the U.S. Census Bureau's American Community Survey, and this is largely due to the presence of University of Wisconsin. Home ownership rates are different from the national average of about 66%. Related to this, just under half (49.3%) of all residential structures are single family homes, while the remainder are two- and multifamily homes. Notably, buildings with 20+ units represent 22% of the entire residential building stock as seen in Figure 7.

Figure 7. Percent of Housing Structure Types



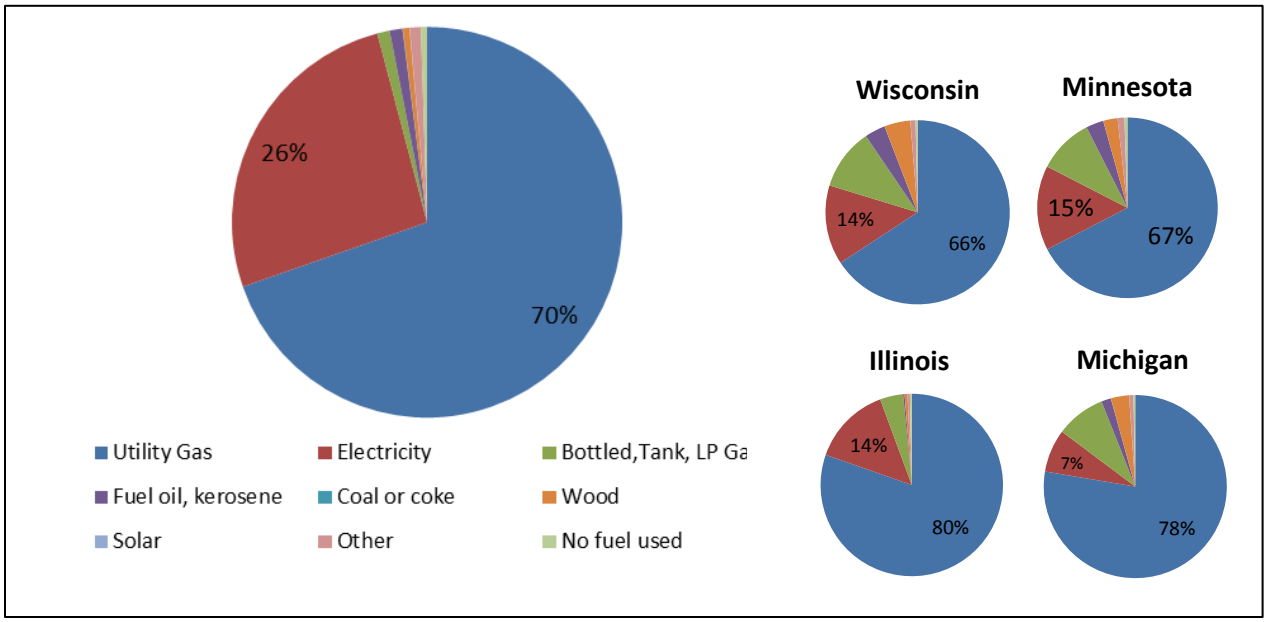
When examining the "year built" for housing structures, it is apparent that growth in Madison's residential sector has remained constant and somewhat linear except within the last few years. Figure 8 depicts this trend.

Figure 8. Percent of Housing Structures by Year Built



Lastly, 26% of Madison's residential housing stock uses electricity as their heating fuel source as shown in Figure 9, which is quite a bit higher than the state's 13.9% and in the surrounding upper Midwest states as well.[4] There are likely a variety of reasons that can be attributed to this but regardless of them, it may be something to consider in the development of specific strategies for reducing residential energy consumption across the community.

Figure 9. Home Heating by Fuel Source, Madison and Surrounding States



Below (Table 7) is a brief summary of how Madison's housing characteristics can impact residential energy use and therefore, may inform the development of Madison's approach to energy reduction strategies.

Table 7. Madison building characteristics that impact energy

Building Characteristic	Possible energy impacts
Owner/Rental Occupancy	• Rental properties (versus owner occupied) result in split incentives in which the renter has no incentive to upgrade a property he doesn't own while the owner doesn't always directly benefit from reduced energy consumption
Type of Structure	• Size of home can impact energy consumption (smaller units use less) • Ownership considerations as described above
Year Built (Age)	• Age of a building is sometimes a predictor of efficiency, as older buildings were sometimes built to less stringent energy codes
Heating by Fuel Source	• The large number of electric heat homes should be considered; there may be opportunities to target these homes while at the same time, some natural gas strategies will have little bearing for some

[4] According to the U.S. Census Bureau 2012 American Community Survey electric heat in Illinois is 15%, 7% in Michigan and 15% in Minnesota.

It is an important time for Madison to understand its energy consumption and develop strategies for reducing that consumption. At the very least, energy efficiency means using less energy, which translates to reduced costs during a time that rising energy prices are the norm. In the bigger picture, as the nation (moreover the world) begins to address the effects of climate change, there are continued funding commitments at utility, state and federal levels, and even among private entities like the Georgetown University Energy Prize program. It stands to reason that if Madison can accurately benchmark its energy usage, use that data to improve and enhance energy strategies, and then measure success through reduced energy consumption, the city is putting itself in a good position to receive funding from these competitive funding sources, which are seeking innovative, well thought out strategies that result in measurable reductions in energy consumption.

Current Performance

This portion of the baseline analysis provides resident energy consumption data obtained from the two utilities that serve Madison: Madison Gas and Electric (MGE) and Alliant Energy. This data was collected and analyzed to provide a picture of how energy is used by residents. Understanding this consumption will help Madison enhance and develop programs that more effectively reduce energy consumption, and provide the basis for measuring the impact of programs that are implemented across the community.

Madison Electricity Consumption

In the residential building sector, electricity is consumed primarily in air conditioning, lighting, and appliances. Nationwide, residential electricity consumption is on the rise. Residential sector increases are driven by growth in consumer electronics and information technology equipment, as well as by growing home size and increased air conditioning use due to the standardization of HVAC amenities in newly constructed buildings. Electricity is measured in kilowatt hours (kWh) and in Madison, is supplied by two utilities: Alliant Energy and Madison Gas and Electric.

In Madison, total electricity consumption was 636.9 million kWh in 2013 across 102,516 households. The utility cost per kWh 2013 varies by utility and is $0.12 through Alliant and $0.144 through MG&E. The total cost of electricity consumption for Madison residents amounted to $89.4 million in 2013 as depicted in Table 8 below.

Table 8.

Madison Residential Electricity Consumption, 2013		
Total kilowatt hours	636,989,914	
Cost per kWh	$0.12 (Alliant)	$0.144 (MG&E)
Total Cost, Electricity	$89,487,984.05	

Total residential electricity consumption across Madison may be somewhat overwhelming for one not used to looking at energy consumption at a community scale, but energy consumption and costs for the average household is easier information to digest for the typical person. Based on the number of Madison households in 2013, average annual electricity household consumption is 6,214 kWh that amounts to $872.92. (Table 9.) It should be noted that average takes into account a fairly large number

of households that use electricity as the source fuel for heating their homes. Depending on heating fuel source and home size, one's annual consumption and costs may look different from the average presented here.

Table 9.

Residential Electricity Consumption Comparison, Madison and Average Per Household		
	Madison	**Per Household**
Electricity, kWh	636,989,914	6,214
Cost for kWh consumption	$89,487,984.05	$872.92

Madison Natural Gas Consumption

In Madison and in general across the Midwest, natural gas is the primary space heating fuel. In the residential sector it is also used for hot water heating, clothes dryers, and cooking. As mentioned above, however, more homes in Madison use electricity as their primary heating fuel source than compared to the rest of Wisconsin, and among neighboring states as well. In general, residential natural gas consumption per household has been decreasing slightly over time as homes become more efficient. Natural gas is measured in therms and is only supplied by MGE in Madison.

For 2013, total natural gas consumption was 54.3 million therms across Madison 102,516 households. It should be noted that only about 70% of Madison households use natural gas as their heating source, while about 26% heat by electricity.[5] MGE's cost per therm was $0.776, which means the total cost of natural gas consumption for Madison residents amounted to $42.1 million in 2013 as depicted in Table 10 below.

Table 10.

Total Residential Natural Gas Consumption, 2013	
Total Therms	54,311,937
Cost per Therm	$0.776
Total Cost	$42,146,063.11

Based on the 2013 total natural gas consumption and costs above, we can estimate average natural gas consumption and costs by comparing these numbers to the number of households in Madison during this same time period. Keep in mind that this is just an average and does not necessarily represent every household, such as those who do not use natural gas as a source for heating their homes.

Table 11.

Residential Natural Gas Consumption Comparison, Madison and Average Per Household		
	Madison	**Per Household**
Natural Gas, therms	54,311,937	530
Cost for NG consumption	$42,146,063.11	$411.12

[5] 2012 American Community Survey of the U.S. Census Bureau

Summarizing Energy Consumption in the Residential Sector

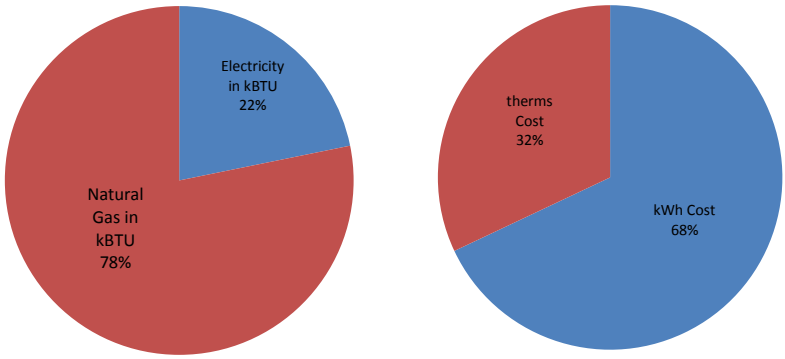
Electricity and natural gas consumption are by far the largest sources of energy consumption in residential buildings across Madison. To compare these sources of energy side-by-side, units of kWh and therms can be converted to a common unit known as the kilo British thermal unit (kBtu). Table 12 depicts Madison's total energy consumption amounts to 7.6 billion kBtu. Total energy costs across the residential sector totals $131.6 million.

Table 12.

Madison Energy Consumption and Costs			
	Energy Unit	**kBtu**	**Cost**
Electricity, kWh	636,989,914	2,173,409,587	$89,487,984.05
Natural Gas, therms	54,311,937	5,431,139,700	$42,146,063.11
Total		7,604,603,287	$131,634,047.16

With this measurement, we then see that over three quarters of Madison's total residential energy consumption (78%) can be attributed to natural gas consumption. However, due to different rate costs per unit of energy, when we examine the cost of energy in residential buildings, the majority is attributed to electricity consumption. (Figure 10.)

Figure 10. Residential Energy by Consumption (kBTU) and Cost ($)



Existing Residential Programs and Efforts

Utility Programs

Focus on Energy is Wisconsin utilities' statewide energy efficiency and renewable resource program and is the leading provider of energy efficiency programs and incentives for residents in Madison. Since 2001, the program has worked with eligible Wisconsin residents to install cost-effective energy efficiency and renewable energy projects. The information, resources and financial incentives provided help residents implement energy saving projects that otherwise would not be completed, or to complete projects sooner than scheduled. Focus on Energy is funded by the state's investor-owned energy utilities, as required under Wis. Stat. § 196.374(2)(a), and participating municipal and electric cooperative utilities. Below is a summary of current energy efficiency programs available to Madison residents.

Appliance Recycling

All residential customers can sign up for a free pick-up of old, but working refrigerators and freezers for recycling and a $40 incentive payment.

Express Energy Efficiency

Residents receive free, professional installation of energy saving products for their homes such as CFL light bulbs, LED light bulbs, high-efficiency showerheads, kitchen and bathroom faucet aerators, and water heater thermostat setback assistance. This program is available to single-family and multifamily residences of three units or less.

Lighting

Focus on Energy partners with retailers to offer instant discounts on Energy Star qualified products, up to $1.50 discount per qualified CFL light bulb.

Home Performance with Energy Star

Homeowners can receive professional home energy assessments and incentives available to off-set costs of recommended air-sealing and insulation improvements. Owners of single-family and multifamily residences of three units or less are eligible for a home energy assessment from a qualified Trade Ally. The Trade Ally then assists the resident in making improvements, with an additional instant reward. Income-eligible homeowners may qualify for a free energy assessment and additional improvement discount.

Residential & Enhanced Rewards

Residents replacing their heating and cooling equipment or adding insulation can receive Cash-Back Rewards ($100-$1000) from Focus on Energy when installing qualified energy efficient heating and cooling equipment or adding attic insulation. Income-eligible homeowners may qualify for additional incentives.

Renewable Rewards

Cash-Back Rewards are available from Focus on Energy when installing qualified Geothermal Heat Pumps and Solar Electric Systems. Funding for renewable projects is fixed each year and availability is on a first-come first-served basis.

New Homes

The Focus on Energy New Homes Program pairs prospective homeowners with builders and energy experts to construct new homes that are between 10 and 100 percent more efficient than homes built to Wisconsin's Uniform Dwelling Code. Focus on Energy Building Performance Consultants partner with local builders to develop plans and review construction to ensure energy efficiency standards are met.

Multifamily Direct Install & Energy Savings

Owners and managers of multifamily properties (4+ Units) including condos and student housing are eligible for both direct install and financial incentives toward energy efficient equipment. Direct install options include free energy saving products and installation including CFL bulbs, high-efficiency showerheads, and faucet aerators. Multifamily properties can also receive a free building energy assessment and optional calculations of projected energy savings for recommended upgrades.

Prescriptive and custom incentives are available for specified equipment upgrades or custom retrofit projects.

Vested Stakeholders

In addition to the established utility programs designed to help consumers reduce their residential energy consumption, Madison is home to a network of agencies already working to improve energy efficiency across Madison's residential homes and apartments. Understanding their programs and tapping into their leadership will be vital to ongoing efforts.

Cool Choices

Cool Choices is a local organization that seeks to reduce greenhouse gas emissions through a host of "behavior modification" tools and strategies. They work within organizations and established networks via schools, offices, and churches to run competitive game-like contests among participants competing to reduce energy consumption and other sustainability related targets.

Green Apartment Network

This network is a collaboration formed to address the overall environmental sustainability of Madison's rental property market. It has a major energy efficiency focus and works on strategies to overcome the landlord/tenant split incentive. They aim to achieve quantifiable results and build a brand that results in energy efficiency driving market choice, thereby resulting in increasing adoption of these strategies.

Project Home

Project Home operates Madison's Low Income Home Weatherization program, which is funded by the federal and state governments. They additionally operate a social enterprise retrofit program which is not income-limited. They have a well-established and well-regarded energy retrofit program.

EnAct

EnAct is a community program of Madison Environmental Group LLC that encourages people to take actions in their daily lives to reduce their environmental impact through the development of tools and tips, organizing people and show measurable change through tracking actions taken.

WECC

The Wisconsin Energy Conservation Corporation (WECC) is a Madison-based national nonprofit specializing in the design and implementation of energy efficiency and renewable energy programs.

Appendix 2: Strategies

Other than the Strategy Snapshot (Figure 2), the full list of strategies is not described in consecutive order in the Program Plan. Below are strategies to be implemented by the City of Madison during the implementation phase.

Residential Strategies	
Buildings Strategies	
R1	**Provide a single point of contact.** Establishing dedicated staff to serve as liaisons for owners is key in driving retrofits with deep energy savings across housing stock. The City and its partners will create a staffing mechanism to fill this role as it is critical to offering the below services, which together create a full-service model that will drive retrofits.
R2	**Offer Energy Assessments.** Energy assessments are a crucial first step in helping owners and residents understand their energy use and assess the most cost-effective improvements. As such, they will be a key component of the Full Service Retrofit program. Every retrofit project will begin with a whole-building assessment to identify energy efficiency options and assist the owner in energy and cost savings. This assessment will also include guidance on financing and rebate options in order to give owners a holistic view of upgrades, costs, and payback. This will allow for deep energy savings measures such as building shell upgrades, which have large energy saving potential and quick payback periods.
R3	**Access to Contractors and Quality Control.** Madison has a vast pool of qualified energy contractors as well as trade allies. The City will assist owners in accessing these contractors for energy assessments and building upgrades. Quality control and assurance are crucial in achieving deep energy savings and building a reputable program, so this will be a core component of this strategy. The City will continue to leverage and promote these professionals and encourage their participation with owners from start to finish from providing an energy assessment to converting to retrofits and rebate completion. To do this, the City will: • Ensure trade allies can easily access retrofit programs by keeping program guidelines consistent and straightforward and aligned with their business models. • Bring leads to contractors to supplement projects in their pipeline in order to continue to support and grow their businesses. • Ensure owners have access to energy assessment services in addition to construction to increase owner understand of deep energy savings opportunities. • Support quality control and assurance efforts to help promote reputations to owners and decrease risk.
R4	**Assistance with Rebates and Incentives.** Focus on Energy and Madison's utilities offer a spectrum of programs to incent energy efficiency upgrades. The owner liaison will provide support in navigating these options to help the owner take advantage of the best available incentive. Support in completing paperwork and appropriate documentation will increase uptake in these programs and funding leveraged by building owners.
R5	**Include Financing Partners and Options (Multifamily).** Low-cost, hassle-free financing can be an important component, particularly for multifamily energy efficiency retrofits. The upfront cost for building owners is often one of the biggest barriers to completing more expensive, whole-building energy efficiency retrofits. Integrating existing financing options more coherently into the retrofit process while developing new financing products in coordination with local and national partners will help building owners reduce or eliminate upfront costs and allow them to pay for their investments over time. The City will explore ways of integrating potential financing partners and options into multifamily retrofit services.
Education and Outreach Strategies	
R6	**Focus on Deep Savings Measures and Non-Energy Benefits.** Building owners unfamiliar with air sealing,

	insulation, and other similar measures are likely to overlook them, despite being cost-effective and long lasting, unless someone from the program or a contractor explains their importance at the beginning of their participation. The City and partners will encourage building owners to investigate whether these types of upgrades are a good investment for their buildings. Further, a more efficient building can have non-energy benefits beyond increased cash flow, including increased tenant comfort, higher tenant retention rates, and decreased maintenance costs. These benefits can further make the case for deeper, long-lasting efficiency measures. Air sealing and insulation (both installed in the building envelope and on mechanical equipment and distribution) and similar measures are complimentary to existing prescriptive rebates and potentially applicable to every age and type of multifamily building. Older buildings constructed before energy codes existed will likely achieve the deepest savings but opportunities may also exist for newer buildings. Air sealing and insulation can also reduce the load that the building's HVAC systems are required to produce and smaller systems may be able to be installed as a result. Air sealing is particularly cost-effective because, if participating buildings also use air conditioning in the summer months, significant therm and kW savings can be achieved. While return on investment is often touted as the most important motivator for multifamily building owners (and this is certainly true in many circumstances), it should not be considered an overarching rule. This is true for the low-income housing market, where an owner's profit margin may come entirely from a competitive advantage in reducing turnover. Communicating non-energy benefits during the program process is an important aspect of the full-service model.
R7	**Madison Energy Challenge.** Madison and its partner organizations will facilitate an energy competition that pits churches, offices, schools, and city departments against each other with a goal of reducing electricity and gas consumption. The competition will be modeled after Cool Choices, which engages participants at work to make energy-saving decisions at home. Likewise, the Madison Energy Challenge will create four participant sectors: churches, private and non-profit offices/organizations, schools, and city departments. A typical Madison family might hear about the program at their place of worship, in the workplace, or via a flyer sent home with their kids. Teams will first compete against similar organizations (churches versus churches, offices versus offices) and individuals will track their energy consumption via a web-based system. This system will foster competition among similar organizations by showing progress to date. To encourage participation and engagement, the partner organizations will recruit leaders within each of the four sectors to form teams, encourage competition, and maintain enthusiasm in the competition. For example, a local pastor with a congregation of 500 families might help strategize how to recruit participants, mention the challenge from his or her pulpit, and foster a good-natured competition with other churches in the neighborhood. Congregants will track their progress at home, and hope to win the grand prize to help their local food pantry program. The group that has the largest percent reduction in energy consumption over the course of two months will win a preliminary prize and will move on to the "final four" round, where the winning team in each sector competes for the grand prize. Households will also be eligible for individual prizes for those with the most energy savings over the two month period. The Madison Energy Challenge would recommend specific improvements that participants could make in their homes and apartments to reduce energy use, including but not limited to: • Replacing light bulbs with LEDs • Using power strips to reduce phantom loads • Adjusting thermostat settings • Replacing A/C filters
R8	**Multifamily Resident Engagement.** Many of the multifamily buildings in Madison are clustered near the UW-Madison campus and include a mix of undergraduate and graduate students and staff, as well as

	those who do not have such an affiliation. We recommend collaborating with UW-Madison to engage such tenants of apartment buildings to form teams for the Madison Energy Challenge, set goals for reducing energy use, or target specific outreach to such populations. Another opportunity for engagement is to recruit multifamily tenants to participate in some aspect of "Be the WE," UW-Madison's campaign to conserve energy and eliminate waste.
R9	**Targeted Home Energy Data/Reports** The Madison team will work with Madison Gas & Electric to facilitate access to home energy data and reports for homeowners. Green Button is an initiative that standardizes data sharing for utility customers. Participating utilities add a "green button" to their websites that allows customers to download their energy usage in a standardized format. If implemented in Madison, it would allow MGE customers to download their own energy usage and share it with a third party that can help interpret their data, set goals for reduction, and suggest strategies for behavior changes. Companies like Opower and others partner with utilities to take such individual-level data and produce home energy reports that compare a homeowner's consumption to neighbors, and suggest goals for consumption reduction.
R10	**Implement House Party Model.** Madison is home to an engaged and well-educated sector of single-family and 2-4 unit homeowners, many of whom are interested in sustainability and energy efficiency. Elevate Energy has demonstrated success in such a sector by using a community-based house party model to spread the word about energy efficiency, demonstrate a home energy assessment, employ trusted messengers, and connect homeowners with contractors who can perform energy upgrades. Following the Elevate Energy model, partners in Madison will recruit homeowners to host a house party, to which they will invite 15-20 friends, neighbors, and acquaintances. The host explains his or her interest in energy efficiency, and invites guests to share how they think their home might be losing energy. A home energy expert then gives a short presentation on common problems, tools to fix the problems, and costs, and proceeds to walk the host and guests through a 25-minute energy assessment. The expert ends with his or her recommendations to the homeowner. At the end of the house party, guests are invited to sign up to host house parties and/or to have an energy assessment conducted at their home.
R11	**Target Affordable Housing.** Affordable housing is a large, untapped market for energy efficiency. Elevate Energy has a longstanding commitment and expertise in addressing this underserved population and will work with the City and partners to do so. Energy efficiency is a proven mechanism for preserving affordability of housing choices within a community, making this a vital strategy to the social, economic, and environmental vitality of the Madison community. However, a variety of factors including a lack of awareness, access to capital, inability to incur more debt, and legal and regulatory barriers result in additional barriers for affordable and subsidized multifamily building owners and managers interested in making energy efficiency retrofits. Reaching these buildings will require stronger relationships with organizations that operate specifically in the affordable housing market. To overcome some of these additional barriers, more focused and dedicated follow-up services, strategic outreach, and other program modifications are required. Tailored Incentive and Financing Options Focus on Energy has an understanding of the types of rebates that resonate most with affordable housing owners and developers. Tailoring incentive options to meet the needs of low- or moderate-income building owners will continue to be effective. The City and Focus on Energy should leverage existing measures such as Direct Install upgrades and the Common Area Lighting Package and create similar programs that lower upfront costs. Further, tiered incentive levels can be used to reward all multifamily building owners (affordable and market rate) for achieving deeper energy savings. Lastly, low-cost financing options (as described previously) can be particularly suitable for affordable housing developers as they often complement other forms of affordable housing financing. Elevate Energy will work with the City and affordable housing partners such as the CDA to understand these options and ensure they are aligned with all partners involved. Additional Liaison Support The single-point-of-contact approach becomes even more valuable when assisting affordable housing buildings. Barriers to successful retrofits exist at every stage of the program process, but most prominently after the audit is completed. Providing dedicated staff for additional follow-up services will

	assist building owners in investing time and resources in energy efficiency improvements, especially in conjunction with improved financing opportunities, and result in deeper energy savings for each building. Targeted Outreach Reaching these buildings will require stronger relationships with organizations that operate specifically in the affordable housing market. Working with organizations and agencies to identify building projects that are actively planning capital improvement or reinvestment projects in the near future will allow for more strategic outreach. The City will partner closely with these organizations to reach new buildings, such as: • City programs and agencies: ➢ Housing authorities ➢ Low-income housing agencies ➢ Section 8 program ➢ Capitol funds management ➢ Tax credit properties • Wisconsin Housing and Economic Development Authority (WHEDA) projects
R12	**Enhanced Marketing and Outreach.** In addition to targeting the affordable housing community, marketing and outreach efforts overall can be enhanced to drive more demand for energy efficiency programs in both single and multifamily buildings. Working with Focus on Energy, the City and partners can absorb some customer acquisition resources by providing supplemental marketing and outreach in underserved and untapped markets. This will occur by both utilizing existing successful outreach channels, as well as developing new avenues. **Existing Outreach Networks** The City and partners will work with Focus on Energy to identify and leverage existing, successful outreach channels, including but not limited to: • Utilities: Madison Gas & Electric has been an extremely valuable partner in coordinating both localized outreach by building type and mass marketing. • Apartment networks and neighborhood associations: Host housing events with established, trusted outreach organizations. Leverage partnership with the Green Apartment Network as a resource of sustainability-minded building owners that can help spread our message and be early adopters. • Trade Allies: Programs geared toward engaging contractors and their networks are very effective in delivering upgrades and incentives. **New Markets and Messaging** Untapped markets such as affordable housing also exist with additional landlord groups, building types, and populations. The City can help augment current outreach efforts by tapping new audiences and offering new messaging. Assistance with revisiting old leads, and accessing buildings such as condominiums, can alleviate current outreach resources and create increased demand. Further, the City and its partners can assist in reaching traditionally hard-to-reach demographics. Translation of materials and services into Spanish, and working with the New Green Challenge can help ensure the benefits of energy efficiency reach Madison's growing and diverse communities. One key strategy will be to target landlord markets such as those that rent mostly to students at UW-Madison, which have potential for deep energy savings. The City will engage with students and other UW-Madison stakeholders that are motivated to save energy and money. Off-campus housing stock is often older and therefore provides opportunity for energy savings. This stock is also owned and managed by a subset of landlords that can be engaged to achieve widespread adoption. Outreach efforts can build relationships with these particular landlords that own and manage large portions of building stock for highest possible impact. Messaging is also important in increasing program participation. During Madison's cold winters, marketing messaging can stress the non-energy benefits of energy efficiency such as increased comfort and decreased maintenance. These benefits are also useful in addressing the split-incentive barrier for multifamily building owners. Benefits such as these are often under-represented, and can be stressed in order to convince building and homeowners to invest in energy efficiency. The City and its partners will

	also strategically target tenured homeowners and building owners who manage properties for long periods of time with a message of reduced maintenance costs and increased property values which will be important drivers for this group.
R13/ M16	**Establish a Call Center.** Implement a full-service Call Center to support residents, trade allies, and program partners. Call Center operations include inbound and outbound customer service calls, as well as assistance with information dissemination and technical support. The Call Center will function as the hub to connect building and homeowners with the information and resources necessary to take full advantage of energy efficiency programs. The Call Center will facilitate calls and emails regarding program processes, frequently asked questions, and direct callers to resources. To address the trends and barriers, the City and its partners will design strategies around meeting the needs of diverse communities and streamlining participation in retrofit programs that achieve holistic, cost-effective retrofits.

Municipal Strategies	
Administrative Strategies	
M1	Appoint or hire implementation agency with expertise in energy efficiency, retrofit markets, and innovative outreach to manage program plan implementation.
Regulation Strategies	
M4	Develop energy benchmarking ordinance based on current ordinance in process which includes commercial buildings and phased-in multifamily over time. Support City committee on benchmarking ordinance and assist with enhancing education around the benefits and potential financing mechanisms.
M5	Lobby the State of Wisconsin to improve energy code (via building code) to ensure it meets the most recently approved IECC standards. Improve enforcement of existing building energy code by triaging building inspectors
M6	Provide incentives (such as density bonuses; expedited processing) to new development for high efficiency projects
M7	Require or encourage inclusion of energy efficiency in major renovation projects receiving city financing
M8	Adopt, via resolutions, a formal goal for energy use reduction in city facilities and report annually to elected leaders and the public on that goal.
Building Strategies	
M9	**Building Commissioning** •Retro-commissioning: Establish and execute process to perform periodic building and building system investigation and analysis, to ensure the building systems are operating at optimal efficiency. Municipal buildings should be included in a rolling period such that every municipal building is re/retro-commissioning every 5 years. •Monitoring-based commissioning: Establish and execute process to utilize software (BAS) enabled continuous monitoring of building system performance, to identify operational faults and inefficiencies in near-real time. This system will enable automated fault detection, continuous performance verification, and diagnostic trending to inform building operations. This is a robust platform which supersedes simple threshold-based alarm notification and can replace a 10-month warranty review under enhanced new commissioning. •New building Commissioning: Establish and execute process to ensure that buildings and building systems are designed, constructed, and operated in accordance with the City's project requirements and performance targets. New commissioning should include activities of LEED NC enhanced commissioning, and should be included in the integrated design process.
M10	**Equipment and Building Systems Optimization** • Lighting Upgrades: Ensure that lights with highest efficacy are installed in all locations. This could likely include LED lamps, super-efficient fluorescent lamps, and matched drivers and ballasts. • HVAC energy recovery: Utilize energy recovery systems on HVAC air-side (exhaust/outside air) operations. This strategy will be especially useful on 100% outside air systems, and during winter and summer operations. • Demand-controlled ventilation: Control building ventilation rates based on occupancy and concentration of CO2 instead of prescriptive ventilation rates. • Pool Covers: Establish and execute process to evaluate automated or manual covers for installation and use where appropriate. • Piping Insulation: Establish and execute process to ensure that all process piping (chilled water, condenser water, steam, refrigeration) is fully insulated and free from moisture damage. • Steam trap surveys: Establish and execute process for surveying all steam traps on a recurring basis to identify malfunctioning traps to be replaced. • Process optimization: Establish and execute process to evaluate performance of process systems and equipment, such as

	pumps and motors at water well sites and other buildings. • Solar PV Streetlights and LEDs: Establish and execute process to convert all streetlights to LED lamps, and utilize photo-cell controls and PV/battery storage to offset grid electrical use.
M11	**Controls and Automation** •Citywide BAS integration: Continue to implement a standardized building automation system front end in all municipal buildings, and provide ongoing training and support to building staff from FO/FM. •Automated demand response: Establish and execute process to integrate buildings with robust BAS installations into an automated demand-response program for load shedding during peak demand periods. •Plug load control: Establish and execute process to utilize automated plug load monitoring/control systems in order to eliminate unnecessary plug loads during unoccupied periods and hours outside of normal business hours. •Residential thermostats (NEST or similar) Establish and execute process to integrate web-enabled, occupancy-based, or "smart" programmable thermostats in city-owned multifamily housing, to provide enhanced controls and improved operation. •Lighting controls: Establish and execute process to integrate lighting controls into the BAS installations in buildings, as well as standalone lighting controls which operate lighting zones based on occupancy or ambient light levels.
M12	**Green building design, redesign, & construction** •Solar PV: Increase the amount of solar PV on municipal buildings and land. •Active solar thermal: Establish and execute process to utilize active solar thermal systems to augment or replace traditional methods of providing domestic hot water in municipal buildings. •Passive solar thermal: Establish and execute process to retrofit or include in the design of new buildings, passive solar strategies such as outside air pre-heating with transpired solar collectors. •Geo-exchange: Establish and execute process to investigate the feasibility of geo-exchange systems for building or process heating and cooling, and implement where feasible. •Transpired solar/DOAS/Radiant Conditioning: Associated with Passive Solar Thermal strategy, augment the system served with dedicated outside air ventilation and radiant conditioning in the spaces served.
M13	**Operational optimization** • O&M assessments: Complete assessments on operations, preventative and reactive maintenance, and staff training and certifications to identify opportunities for efficiency and productivity improvements. • Staff training: Provide staff training on energy efficiency initiatives, building operations, and controls and automation systems. • Daytime cleaning: Modify cleaning activities in municipal buildings to occur during daytime hours to reduce nighttime lighting and HVAC loads. • Behavior change and occupant engagement: Provide city energy use data, at building or department level, to City staff via webpages, display dashboards, or targeted communication as a means of establishing behavior change programs to reduce energy use.
M14	**Energy monitoring and evaluation** •Sub-metering: Implement sub-metering in City buildings to determine end-use breakdown. Target 50% of sub-metering of the three largest energy end-uses as a best practice.
M15	**Data center optimization** •Outside air economizer: Utilize outside air provide wintertime cooling for City data centers when ambient conditions are favorable. •Waterside economizer/free cooling: Utilize waterside economizer to provide free cooling and increased efficiency of direct expansion (Dx) cooling systems in data centers. •Containment strategies: Establish and execute process to implement hot aisle/cold aisle containment in data centers to provide targeted conditioning and optimized cooling. •Set-point optimization: Increase data center cooling set-points based on hot aisle/cold aisle containment and control the HVAC systems to maintain a rack discharge temperature in the hot aisle. •Co-location: Arrange servers in the racks in data centers to maximize cooling, containment, and power distribution in higher density arrangements. •Virtualization: Remove data center servers and virtualize server functions to off-site locations outside of the City buildings. •Thermal Storage: Utilize thermal storage to provide cooling capability on a continuous basis, while shifting the refrigeration load of typical data center cooling systems to off-peak hours. •Advanced UPS: Utilize advanced UPS technology which bypasses UPS during good power quality conditions to reduce power losses due to power conversion.
Education and Outreach Strategies	
M2	Engage local businesses and community leaders for best practice development, competition endorsement opportunities, and to serve as spokespersons for the Madison Energy Challenge.
M3	Investigate potential for establishing a Green MLS or energy score that incorporates energy into real estate transactions with realtors and vested partners.
M16 /R13	Implement a full-service Call Center to support residents, trade allies, and program partners.

K-12 Strategies	
Engage Students and Staff in Energy Programs	
K1	Build on existing programs such as Sustain Dane's People.Power.Planet, which has been successful in encouraging public school students and staff to practice energy efficiency. These types of programs should be continued and expanded to include all of Madison's K-12 schools.
K2	Look for opportunities to use the school building as a teaching tool. As students and staff see results from energy conservation at school, they are encouraged to practice energy conservation at home.
Teach Energy Literacy	
K4	Investigate developing an energy curriculum for schools. A multi-disciplinary approach to energy education can meet state learning standards and incorporate science, math, technology, history, and geography.
K5	Develop measurable goals and performance benchmarks, including learning outcomes for students.
K6	Continue partnering with energy utilities to provide teacher training, in-class education, and materials through the Wisconsin K-12 Energy Education Program (KEEP).
K7	Provide program materials that incorporate local energy issues and energy data from the school buildings or students' homes.
K8	Actively involve parents in programs, through take-home energy efficiency kits, at-home energy competitions, or other initiatives.
Buildings Strategies	
K9	Prioritize energy efficiency in school capital improvement plans. This includes: • Energy benchmarking data for the Madison Metropolitan School District (MMSD) shows that not all schools use energy equally. Use the CIP to prioritize energy efficiency improvements for the biggest users, such as MMSD's four high schools. • Continue with MMSD's successful energy efficiency building upgrade program. • Investigate options for providing long-term consistent funding for school energy efficiency improvements.
K10	Implement energy management programs, such as: • Formally adopt and implement the Energy Management Program Guidelines at MMSD schools. • Create a process for citywide monitoring of energy use in school buildings, to create track progress on building efficiency improvements. The U.S. Environmental Protection Agency's ENERGY STAR Portfolio Manager is a free tool that can help schools perform robust energy benchmarking and tracking. • Perform ongoing energy monitoring and adjust the energy management program as needed, for low-efficiency schools.
K11	Encourage efficiency upgrades for private schools: • Consider developing a collaborative energy efficiency peer learning network, to facilitate knowledge sharing between facilities staff at public and private schools. • Encourage private schools to invest in energy efficiency upgrades and energy management programs through targeted incentive programs.
Behavior Change	
K3/R7	Develop a citywide school energy competition to engage students and staff with quantifiable energy savings. (See Strategy R7)

Appendix 3: Letters of Support

GEORGETOWN UNIVERSITY
ENERGY PRIZE

LETTER OF SUPPORT
UTILITY

Madison Gas + Electric (name of "Utility"), through this letter of commitment, expresses its support of City of Madison 's (name of "Community") effort to compete in the Georgetown University Energy Prize ("GUEP") and its commitment to provide timely, accurate, energy data as required by the Competition Guidelines (see guep.georgetown.edu/rules-timeline).

Utility provides the following energy services to the below types of customers within the Community (check all that apply):

[✓] Electric
[✓] Natural Gas
[✓] Residential Customers
[✓] Municipal Customers

Utility will support Community's GUEP effort by providing the Georgetown University Energy Prize, quarterly, with the total (aggregate) monthly energy directly supplied by natural gas and electric utilities to all of their residential and municipal customers in the community, as well as the current number of residential accounts. Aggregate data will be reported separately for the residential and municipal sectors.

Utility will work with Community to comply with all current and future energy data requirements in the Competition Guidelines. Georgetown University is working with our partners and communities in the Letter of Intent Program to ensure that data requirements are as simple as possible, however, it is ultimately the Community and the Utility's responsibility to ensure that data is supplied

Utility understands that Georgetown University will use the energy to: (1) administer the GUEP Competition and select the Finalists in accordance with the Competition Guidelines; (2) educate the public through our Competition Dashboard, as well as other media outlets; (3) conduct research directly and in conjunction with collaborating organizations; and (4) conduct all other activities consistent with the Master Team Agreement signed by Community during Phase 1 and Phase 2 of the Competition.

Utility may provide additional support for the Community's GUEP effort, consistent with the Community's Energy Efficiency Program Plan, submitted in Phase 2 of the Competition.

Lynn A. Hobbie 6/27/14

By: Lynn K Hobbie (Name of Representative) Senior Vice President (Title) (date)
Madison Gas and Electric Company (Organization)
133 S. Blair Street (Street Address)
Madison WI 53788 (City, State Zipcode)

guep.georgetown.edu

cool choices

act today, preserve tomorrow

June 23, 2014

Georgetown University Energy Prize
Georgetown University
Washington DC

To Whom it May Concern:

Please accept this letter of support for the City of Madison's participation in the Georgetown University Energy Prize. Our organization is excited about the opportunity this competition presents to increase energy efficiency in the Madison area.

Cool Choices is a Madison-based nonprofit created to inspire sustainable practices that reduce greenhouse gas emissions. We use an innovative game format to engage broad populations within a specific community (like a workplace or a school) and then, via the game, make it fun, social and easy to adopt sustainable behaviors that save energy, reduce transportation costs and lead to healthier food and waste choices. To date we've worked with a variety of corporations and schools throughout the Midwest, including various Madison-based entities. In 2013 we implemented a game at a Madison law firm where more than 2/3 of the employee base participated and the game helped to shift corporate norms so that, after the game, efficient practices are the norm rather than the exception.

Cool Choices looks forward to working with the City as it designs an Energy Plan for the competition, and as it implements that plan. We have deep expertise in designing and implementing behavior change programs that yield measurable results and intend to share that expertise with the City. Cool Choices' work has been recognized and showcased by energy efficiency organizations like the American Council for an Energy Efficient Economy (ACEEE) and our corporate partners have won regional and national awards for the employee engagement games we implemented. We look forward to supporting the City's effort over the next few years to permanently shift energy behaviors within our community. And we look forward to Madison successfully completing the Georgetown University competition.

Sincerely,

Kathy Kuntz
Executive Director

www.coolchoicesnetwork.org
222 N Midvale Blvd, Suite 29 · Madison, WI 53705
Phone 608.443.4270 · Fax 608.443.4278

ENERGY CENTER
OF WISCONSIN

June 26, 2014

Georgetown University Energy Prize
Georgetown University
Washington DC

To whom it may concern:

Please accept this letter of support for the City of Madison's participation in the Georgetown University Energy Prize. Our organization is excited about the opportunity this competition presents to increase energy efficiency in the Madison area.

The Energy Center promotes sustainability through research, program design, and hands-on demonstration in buildings nationwide. We inspire evolution in how the market approaches energy efficiency by focusing on the next generation of solutions to energy issues. We believe that reducing negative impacts on our environment will help build a strong economy and improve human health and well-being. As a research analyst and project manager with the Energy Center, I have also served on the Sustainable Madison Committee for 4 years and am personally motivated to ensure that Madison continues to foster an energy efficient and sustainable city.

Our organization is interested in working with the City as it designs an Energy Plan for the competition, and as it implements that plan. In addition to providing technical expertise in a range of energy efficiency programs, I am especially interested in developing programs that focus on hard-to-reach residential markets such as low-income neighborhoods and historically undeserved communities. Furthermore, applying theories that address behavior and attitudes toward energy efficiency are of additional interest.

We look forward to supporting the City's effort over the next few years, and to Madison successfully completing the competition.

Sincerely,

Jeannette LeZaks

Madison • Chicago • Minneapolis | 608.210.7100 | www.ecw.org

projecthome

June 24, 2014

Georgetown University Energy Prize
Georgetown University
Washington DC

To Whom It May Concern:

We support the City of Madison in its application to participate in the Georgetown University Energy Prize. Energy efficiency is important to the City and to its stakeholder groups, like Project Home, and to its citizens.

Project Home is a nonprofit organization that provides weatherization for low income households. In this program, eligible households receive no cost services that significantly improve the comfort of their homes, reduce their utility bills, and reduce our dependence on foreign oil and use of contaminating fossil fuels. We provide a similar service for those households not eligible for weatherization through the collaboration of our social enterprise with the state's Focus on Energy program. In this program, eligible households receive rebates for energy work completed. In both cases, energy conservation is a winning proposition for all – households, utility companies, and the environment.

We look forward to being an active partner with the City when it is designing its Energy Plan for the competition and also during the implementation phase. We are eager to provide more services to Madison households, ideally in conjunction with the City's low-interest housing rehab loan programs for income eligible households. The City can count on us to support their efforts to save energy in our community.

Sincerely,

Jan Reek
Director of Programs

1966 South Stoughton Road
Madison, Wisconsin 53716
608.246.3737 Phone
608.246.3722 Fax
www.projecthomewi.org

home energy+

DANE COUNTY Community Development Block Grant Home Investment Partnerships

CDBG CITY OF MADISON

Building strong communities for 40 years

6/27/14

Georgetown University Energy Prize
Georgetown University
Washington DC

RE: Letter of Support for City of Madison Grant Proposal for the Georgetown University Energy Prize

To whom it may concern:

Please accept this letter of support for the City of Madison's participation in the Georgetown University Energy Prize. Our organization is excited about the opportunity this competition presents to increase energy efficiency in the Madison area.

Sustain Dane is a non-profit in Madison, WI that envisions the Greater Madison Region as a national model for sustainability and sustainability innovation. We work toward our vision by fostering a rich and diverse community of sustainability champions. Our programs and partnerships provide the tools, knowledge and network for individuals to make positive change happen in their own sphere of influence – be it at home, at school or at work.

We have effectively partnered with The City of Madison on many initiatives over the past fifteen years, including developing the nationally recognized MPower Champion Program – a one year, fully customizable program for businesses and organizations that want to reduce their environmental impact while saving costs and creating a healthier and more engaging workplace and community through green development and project implementation. Since 2009, over 70 Madison area businesses and organizations have collectively implemented over 325 sustainability projects savings over 26,110 tons of CO_2 emissions and over $1.6 million.

Our organization is interested in working with the City as it designs an Energy Plan for the competition, and as it implements that plan. We look forward to supporting the City's effort over the next few years, and to Madison successfully completing the competition. If I may provide further information, please do not hesitate to contact me.

Sincerely,

Jessie Lerner
Executive Director
Sustain Dane
Jessie@sustaindane.org

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Operations Manager
Kathleen M. Cryan
Mapping Section Manager
Eric T. Pederson, P.S.
Financial Manager
Steven B. Danner-Rivers
Hydrogeologist
Brynn Bemis

June 27, 2014

Georgetown University Energy Prize
Georgetown University
Washington DC

To Whom It May Concern:

Please accept this letter of support for the City of Madison's participation in the Georgetown University Energy Prize. The City of Madison is excited about the opportunity this competition presents to increase energy efficiency locally and throughout the region.

The Sustainable Madison Committee advises City of Madison elected officials and administrators on a variety of topics including but not limited to energy efficiency. Our goal is to ensure that Madison builds on its history of innovation and environmental stewardship to promote uniquely effective approaches to climate change mitigation and adaptation.

The Georgetown University Energy Prize can catalyze of our work to better align public and private resources with public sentiment that demands a strong and flexible community response to the growing social and environmental challenges posed by a warming planet.

The Sustainable Madison Committee will work closely with the City as it designs an Energy Plan for the competition, and as it implements that plan. We are acutely aware of the need for citizens to engage at the personal level and know that Madison's schools, small businesses and active neighborhoods are eager to participate alongside City officials and the dedicated staff. We look forward to supporting the City's effort over the next few years, and to Madison successfully completing the competition.

Sincerely,

Raj Shukla
Chair, Sustainable Madison Committee

Lance Green
Vice Chair, Sustainable Madison Committee

6/27/2014-SMCGUEPSupportletter

Appendix 4: Best Practices Research

ELEVATE ENERGY
Smarter energy use for all

Best Practices Snapshots: Behavior Modification Strategies & K-12 Energy Education Efforts

Research to inform the Madison Georgetown University Energy Prize (GUEP) Program Plan

Submitted by:
Elevate Energy, COWS, and Brendle Group

COWS | BUILDING THE HIGH ROAD

brendle GROUP

October 2014

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Behavior Modification for Residential Energy Use: Inventory of Best Practices

Energy efficiency programs can benefit greatly by incorporating insights and techniques from behavioral science, which has identified both structural and psychological barriers that impede wider uptake of conservation strategies. Psychological barriers include limited knowledge about the problem, sunk costs and behavioral inertia, perceived risks of change, and positive but insufficient behavior change (Gifford, 2011). The energy efficiency industry provides many evaluations and examples of programs that seek to address such barriers. In an evaluation of 300 programs run by 100 utilities, the American Council for an Energy Efficient Economy (ACEEE) found that behavior programs achieved an average cost of saved energy (CSE) of 1.61 cents per kWh saved (Mazur-Stommen and Farley, 2013). Strategies for inducing behavior change fall broadly into antecedent interventions, which are implemented prior to the performance of a given behavior (i.e., an informational campaign about energy conservation) and consequence interventions, which provide feedback to an individual after they have consumed energy (i.e., feedback on a household's electricity usage). Best practices include providing frequent feedback to consumers; targeting high intensity users and/or segmenting a population to better understand variations in energy consumption; and incorporating social diffusion and trusted partners into marketing strategies for energy efficiency programs.

In addition, adding behavior-based interventions to traditional hardware-based energy efficiency programs can greatly increase their efficacy (Friedrich et al, 2014).

Goal-setting and Information

Antecedent interventions include public or private commitments to reduce energy use, goal-setting, and providing information. An early example of commitment was a program in Iowa City, which provided 20-minute home visits to participants in which conservation strategies were explained. Participants were asked to make either a private or public commitment to reduce consumption. A control group received no such home visit. At the end of the first month, those who had made a public commitment had reduced their natural gas and electricity consumption by 10 to 20 percent relative to the other two groups (Pallak et al, 1980).

Goal-setting involves giving a household a specific reduction target. It is often combined with feedback or other interventions. In one study, households that received a difficult conservation goal of 20 percent reduction combined with feedback conserved the most, and an easy goal was not effective at all (Becker, 1978). In a study of laundry use, participants who were given a goal and provided with continuous feedback saved more energy per washing trial than those who received feedback without a goal (McCalley and Midden, 2002).

Providing information to encourage behavior change can include workshops, home-visits, media campaigns, marketing, and informational pamphlets and booklets. While information has been shown to increase self-reported knowledge about conversation, it has had mixed results in terms of actually reducing energy use (Abrahamse et al, 2005). In an evaluation of 30 years of programs in the residential energy efficiency market, researchers at the Lawrence Berkeley Lab (LBL) concluded that simply providing information is not enough to spur widespread uptake of energy improvements, and that

information should be paired with one or more other strategies to spur behavior change (Fuller et al, 2010).

Feedback and Incentives

Consequence interventions respond to a given behavior and seek to change it in some way. In the realm of residential energy efficiency, these include feedback of various forms, comparisons that refer to social norms, and rewards. The most successful feedback on electricity consumption is given frequently and sustained over a long period of time, includes a breakdown by appliance (load disaggregation), is presently clearly and in an appealing way, and has some kind of interactive and/or computerized aspect (Fischer, 2008). Households that received continuous feedback over an 11-month period reduced electricity use by 12 percent versus a control group (McClelland and Cook, 1979). In a study that compared continuous feedback to monthly feedback on gas consumption, households that received continuous feedback saved the most gas (12.3 percent) versus those that had received monthly reports (7.7 percent) and those that had been taught to read their gas meter (5.1 percent) (Van Houwelingen and van Raaij, 1989). A review of feedback programs found that they reduced household electricity consumption between 4 and 12 percent (Mazur-Stommen and Farley, 2013).

Real-time feedback and dynamic pricing use immediate feedback to encourage consumers to shift their demand for energy. In combination with web-based interfaces, smart phone apps and text updates, and in-home displays, real-time feedback can reduce peak loads by as much as 13 percent (Potter, 2013). Dynamic pricing programs implemented by Elevate Energy in Illinois have demonstrated between 26-31 percent average electricity savings for customers (Becker, 2014). These programs combine marketing and outreach, education, high price alerts, and a customer support call center.

Comparative feedback incorporates research on social norms to compel behavior change. These programs provide participants with comparative information based on social science research, which demonstrates that people shape their own behavior according to accepted norms. A classic study of social norms examined the type of messaging that was most effective in convincing hotel occupants to re-use towels rather than have them washed and replaced daily. The most effective message was one that appealed to social norms and had specific information that closely matched individuals' circumstances: "the majority of guests in this room reuse their towels" (Goldstein, 2008). In 2005, several hundred households in the city of San Marcos, CA received door hangers that included how much energy the household had consumed that month, descriptive information about the energy use of the average household in their neighborhood, and tips for conserving energy. Three weeks after receiving the information, households that had above average energy use had reduced their electricity use by 6 percent. Households that received a descriptive normative message ("most people in your community are finding ways to conserve energy at home") saw bigger reductions in energy use than households whose door hangers had included appeals to self-interest, the environment, or social responsibility (Cialdini and Schultz, 2004).

Home energy reports often incorporate aspects of social norms. Opower (formerly known as Positive Energy) piloted several successful programs that delivered home energy reports to residential utility customers. An evaluation of this program in Minnesota found that households that received the reports reduced energy consumption by 2 percent relative to those who did participate (Allcott, 2009).

Incentives have been shown to encourage the choice to do home upgrades and reduce energy consumption. One program in Oregon began a residential weatherization program, but reported that getting customers to have home energy audits was like "pulling teeth" until incentives became available (Fuller et al, 2010). An ACEEE study of four subsidy and eight rebate programs found that they had an average CSE of 3 cents per kWh (Mazur-Stommen and Farley, 2013). While incentives do increase participation in programs, one study found that marketing and implementation may be more important than the size of the incentive (Fuller et al, 2010).

Segmentation/Targeting

Several programs have demonstrated the importance of segmenting a population by energy use, income, housing type, or other criteria. By segmenting a population, the intervention can be targeted to those users for whom it is anticipated to make the largest impact. Segmenting can be paired with either antecedent or consequence interventions. Disaggregation of households in California yielded wide variation in energy use by income, language spoken at home, dwelling type, and energy usage (Lutzenhiser and Lutzenhiser, 2006). Segmenting houses in Chicago by construction type, year built, and number of floors allowed researchers to identify six housing types that make up 71 percent of all homes in Cook County. Geospatial analysis revealed the prevalence of each home type by community and revealed opportunities for reducing costs and targeting resources most efficiently (Scheu et al, 2014).

The California Home Energy Analyzer Program directs users with high HVAC use to a retrofit program, and targets households with high plug loads with phone intervention with recommendations for low- or no-cost changes. The program resulted in over $14,000 in cost savings, a 3% reduction in electricity use, and an 8% reduction in natural gas usage (Stern and Bates, 2014). An early program by Opower (then known as Positive Energy) produced a model that showed that profiling households based on energy use and other demographics would have resulted in larger conservation savings from the program (Allcott, 2009). In an examination of 14 residential energy efficiency programs, the Lawrence Berkeley National Laboratory found that it was critical to evaluate the target population and tailor outreach to particular subgroups such as early adopters and those most likely to benefit from the intervention (Fuller et al, 2010).

Residents of multifamily buildings are an underserved market with the potential to provide significant energy savings from behavior programs at a relatively low cost. However, the programs must be carefully designed, particularly to avoid complicating factors such as split incentives (Farley and Mazur-Stommen, 2014). An ACEEE survey of energy efficiency programs in multifamily buildings found that the most common methods that owners used to spur behavior change included emails, letters, and other communications, and talking to family and friends about energy (Farley and Mazur-Stommen, 2014).

Community-Based Social Marketing

Community-based social marketing (CBSM) is a framework for encouraging behavior change that was developed by Doug McKenzie-Mohr and that is rooted in social psychology. It emphasizes local campaigns that involve contact with real people, and is an alternative to information-based campaigns. CBSM involves four steps: identifying barriers and benefits to behavior modification; developing a strategy based on effective tools; pilot program; and evaluation of the strategy's effectiveness (McKenzie-Mohr, 2011). CBSM uses a variety of tools previously discussed, including:

- Commitment/Goal-setting
- Social diffusion
- Social norms
- Prompts
- Incentives

An example of CBSM is Project Porchlight, which is a grassroots energy efficiency program in New Jersey, Vermont, and Canada that delivers free compact fluorescent bulbs via community events and door-to-door canvassing.

Energy Impact Illinois has implemented a successful house party model for encouraging neighbors and friends to discuss home energy improvements and upgrades. House parties for retrofits bring together contractors, homeowners, and neighbors, who walk through the house to see a blower door test and other techniques for identifying opportunities for energy savings. Over one year, over 3,000 people attended a house party, and 900 households completed upgrades (U.S. Department of Energy).

Gamification

Game-based programs can involve competitions and challenges at the home, neighborhood, or city level. Examples include:

- Cool Choices is a Wisconsin-based program that uses a game where participants earn points for actions that reduce carbon emissions. Players are part of a team made up of their co-workers, and they report various actions taken at home, including switching their furnace fan to “auto” or turning off the TV when no one is watching. The program achieved a 60 percent participation rate (Kuntz et al, 2012).
- Energy-Smack down was a pilot program in which Massachusetts neighborhood teams competed against each other with a goal to reduce greenhouse gas emissions. Three teams (consisting of 100 households) recruited members, and provided a free energy assessment at the beginning of the program. The program saw an annual reduction of 14 percent in energy use, with the winning household achieving a 73 percent reduction (Fuller et al, 2010).
- The Take Charge Challenge encouraged six towns in Kansas to reduce energy use, and achieved a savings of more than 6 million kWh in the first year. The program was launched with a community-wide party hosted by each town, and encouraged behaviors like switching light bulbs, installing programmable thermostats, weatherization, and participation in utility-run programs for appliance rebates and home energy assessments. Lessons stemming from the challenge included the importance of peer-to-peer communication, engaging towns that are already rivals, and the importance of leadership teams of trusted individuals to convey the competitions message (Fuller et al, 2010).

Best Practices in K-12 Energy Education Programs

Energy education at the K-12 level can serve a variety of valuable purposes in a broader energy plan. In particular, a report from the Energy Center of Wisconsin on the K-12 Energy Education Program (KEEP) suggests that students can bring energy knowledge home and teach their families about energy conservation, encouraging more energy efficient behaviors at home (Schepp 1999). Research has also shown that with the right program design, environmental education can promote more sustainable behaviors among K-12 students and their families (Osbaldiston and Schmitz 2011). Educational policies and programs on sustainability and the environment are common in the U.S., but vary widely in terms of the agencies involved (federal, state and local), the level of resources available, and the overall approach (Feinstein 2009). Comprehensive energy education programs at the school district level are less common, but energy education is often incorporated into environmental or sustainability education programs formally or informally, and can be a regular component of science instruction. In a general sense, education is likely to be an effective tool for influencing the attitudes and values of tomorrow's citizens, and energy education can be an effective way to support a sustainable future (Newborough and Probert 1994).

However, only a few studies have been conducted on the results of specific energy education programs. For example, one early study used a survey to evaluate an energy education program in Greece that used hands-on experiences and project-based learning related to energy savings, renewable energy and the relationship between energy and the environment. Participation in the education program was associated with increased energy efficient behaviors among students and their parents, including behaviors such as efficient use of appliances, turning off lights, and using shades to block sunlight during the summer (Zografakis et. al 2008). Another study evaluated a program in a small Midwestern city in the U.S., which used energy data from 9th grade students' homes in two hour-long interactive classes on energy, and included an energy bill game and a simplified home energy audit performed by the students (Osbaldiston and Schmitz 2011). Students were instructed on where energy comes from and other general energy knowledge as well as principles of energy conservation in the home. A survey conducted four weeks after the program found that it had positive effects on students' knowledge, motivation, and energy-related behaviors, and that parents also learned about energy efficiency. Some examples of program effects are: more students saying they care about saving energy and are motivated to conserve energy, parents learning about air filter maintenance, and more parents reporting efforts to turn off the lights or conserve energy in general. The influence of this very brief program implies that a more substantial and longer-term education program could have a significant impact on the attitudes, knowledge, and behavior of students and their families.

More recently, a joint elementary education program of Nicor and ComEd in Illinois achieved an estimated energy savings of over 240,000 therms and over 2 million kWh, with 15,000 participating 5th grade children (Agapay-Read and Zook 2014). This program included an educational presentation, energy savings kits distributed to students that included water conservation equipment like low-flow showerheads, and a household report card for students to evaluate energy use in their homes and report information about their families' participation. The substantial energy savings was most likely achieved through the size of the program and the use of best practices by involving parents and teaching through the example of children's homes.

Actively involving parents in energy education is a critical component of programs designed to influence parents' energy knowledge and behavior; active parental involvement is also valuable for student learning, school attendance, and other important educational goals (Duvall and Zint 2007; Zelezny 1999). As an alternative approach, programs can also be designed to use the school building as a tool for energy education, combining education with campaigns to turn off lights in unused rooms or other behavioral energy conservation measures in schools (Lane et. al 2014). Although more research is needed to determine the effects of energy education programs of different designs, investing in energy literacy among today's K-12 students will encourage students to develop attitudes, values, and behaviors that are associated with lifelong energy efficiency practices.

An effective energy education program should emphasize core principles and learning outcomes for energy and environmental literacy. After a comprehensive literature review the Wisconsin Center for Environmental Education (WCEE) developed a framework for environmental literacy assessment, which includes: cognitive learning outcomes focusing on knowledge; affective learning outcomes focusing on values and emotions; beliefs about personal efficacy and responsibility for environmental problems; and environmentally responsible behaviors (Champeau et. al 1996). A similar framework for energy education programs should incorporate recommendations for energy literacy from the U.S. Department of Energy's energy education framework, as well as resources and lessons learned from the Wisconsin K-12 Energy Education Program (U.S. Department of Energy 2014; Wisconsin KEEP 2014).

Energy education programs should also incorporate the following best practices:

- Program design:
  - Start at the top to ensure buy-in from key decision-makers in the school district and build on existing projects and resources. Establish connections with existing energy programs in the school district and the larger community.
  - A clear statement of measurable goals about what students are expected to learn. Programs should build in measurable goals and performance benchmarks during program design, to ensure effective program evaluation (Isaacson 2007).
  - Teacher training and supplementary materials designed to promote consistent program implementation.
  - To promote learning among both students and parents, programs should actively involve parents and focus on local energy issues (Duvall and Zint 2007; Zelezny 1999).
- Curriculum design:
  - Practical applications tying energy concepts to the everyday lives of students. Use hands-on, real-world examples of energy and energy efficiency by helping students collect and analyze energy data from their homes or the school building. Incorporating the example of the school building can improve education and enable students to get involved in energy efficiency efforts at their schools (Lane et. al 2014), while using energy data from students' homes can encourage conservation among students and parents (Osbaldiston and Schmitz 2011).
  - A multi-disciplined approach to teaching energy, including science, math, technology and geography as learning opportunities, as well as incorporating best practices for science education at the appropriate grade level (National Academy of Sciences 2012).
  - Age-appropriate information with different learning experiences and depths of knowledge for different age groups (Isaacson 2007).

- Creative, attractive materials and innovative teaching practices using the internet and other technological tools for learning.
- Establish a synergy between energy and environmental education, by linking educational programs and curriculum (Kandpal and Broman 2014).

Sources—Behavior Modification Best Practices

Abrahamse, Wokje, Linda Steg, Charles Vlek, and Talib Rothengatter. "A Review of Intervention Studies Aimed at Household Energy Conservation." *Journal of Environmental Psychology* 25 (2005): 273-291.

Allcott, Hunt. "Social Norms and Energy Conservation." *MIT Center for Energy and Environmental Policy Research* (2009).

Becker, Lawrence. "Joint Effect of Feedback and Goal Setting on Performance: A Field Study of Residential Energy Conservation." *Journal of Applied Psychology* 63.4 (1978):428.

Becker, David. "The Smart Grid is Coming: Why Hourly Pricing is Key." *EUEC Conference,* Phoenix, AZ. (2014).

Cialdini, Robert, and Wesley Schultz . "Understanding and Motivating Energy Conservation via Social Norms." Report prepared for the William and Flora Hewlett Foundation. 2004.

Farley, K and Mazur-Stommen, Susan. "Saving energy with Neighborly behavior: Energy Efficiency for MF Renters and Homebuyers" (2014) ACEEE White Paper.

Fischer, Corinna. "Feedback on Household Electricity Consumption: A Tool for Saving Energy?" *Energy Efficiency* (2008) 1: 79-104.

Friedrich, K; Amann, J; Vaidyanathan, S; Elliott, RN "Visible and Concrete savings: Case studies of effective behavioral approaches to improving customer energy efficiency." (2014) ACEEE

Fuller, Merrian, Cathy Kunkel, Mark Zimring, Ian Hoffman, Katie Lindgren Soroye, "Driving Demand for Home Energy Improvements: Motivating residential customers to invest in comprehensive upgrades that eliminate energy waste, avoid high bills, and spur the economy." (2010) Lawrence Berkeley National Laboratory.

Gifford, Robert. "Dragons of Inaction: Psychological Barriers that Limit Climate change Mitigation and Adaptation." *American Psychologist* 66.4 (2011):290-302.

Goldstein, Noah, Robert Cialdini, and Vladas Griskevicius, "A Room with a Viewpoint: Using Social Norms to Motivate Environmental Conservation in Hotels." (2008) *Journal of Consumer Research* 35.

Kuntz, Kathy, Rajan Shukla, Ingo Bensch. "How Many Points for That? A Game-Based Approach to Environmental Sustainability." *2012 ACEEE Summer Study on Energy Efficiency in Buildings.*

Lutzenhiser, Loren, and Susan Lutzenhiser. “Looking at Lifestyle: The Impacts of American Ways of Life on Energy/Resource Demands and Pollution Patterns.” *2006 ACEEE Summer Study on Energy Efficiency in Buildings.*

Mazur-Stommen, Susan and Kate Farley. “ACEEE Field Guide to Utility-Run Behavior Programs.” (2013) American Council for an Energy-Efficient Economy, Report Number B132.

McCalley, L.T. and Cees Midden. “Energy Conservation through product-integrated feedback: The roles of goal-setting and social orientation.” *Journal of Economic Psychology* 23.5 (2002): 589-603.

McClelland, Lou, and Stuart Cook. “Energy Conservation Effects of Continuous In-Home Feedback in All-Electric Homes.” *Journal of Environmental Systems* (1979) 9.2:169-173.

McKenzie-Mohr, Doug. Fostering Sustainable Behavior: An Introduction to Community-Based Social Marketing. Third ed. Gabriola Island, British Columbia: New Society Publishers, 2011.

Pallak, Michael., D.A. Cook and J.J. Sullivan. "Commitment and Energy Conservation." In L. Bickman (ed.), Applied Social Psychology Annual (1980): 235-253, Beverley Hills, CA: Sage.

Potter, Jennifer. “SMUD’s SmartPricing Options—Interim Evaluation Report and Project Update.” Presentation delivered to DOE SEE Action Behavioral Working Group. (2013).

Scheu, Rachel, Emily Robinson, and Anne Evens. “Energy and Housing Stock Segmentation to Achieve Community Energy Savings.” *2014 ACEEE Summer Study on Energy Efficiency in Buildings.*

Stern, Stephanie, and David Bates. “Achieving Residential Energy Savings: Combining Behavior Change and Home Upgrades.” *2014 ACEEE Summer Study on Energy Efficiency in Buildings.*

U.S. Department of Energy. “Energy Impact Illinois Learns that Parties Sell Upgrades.” Better Buildings Focus Series.

Van Houwelingen, Jeannet and Fed van Raaij. “The Effect of Goal-Setting and Daily Electronic Feedback on In-Home Energy Use.” *Journal of Consumer Research* (1989) 16.1:98-105.

Vigen, Michelle, and Susan Mazur-Stommen. “Reaching the ‘High-Hanging Fruit’ through Behavior Change: How Community-Based Social Marketing Puts Energy Savings within Reach.”(2012) *ACEEE White Paper*.

Wu, May. “Impact & Persistence Evaluation Report : Sacramento Municipal Utility District Home Energy Report Program.” (2012) Integral Analytics.

Sources—K-12 Energy Education Best Practices

Agapay-Read, L. and C. Zook. 2014. “Elementary Education Program GPY2/EPY5 Evaluation Report.” Navigant Consulting

Champeau, R., et. al. 1996. "Are we walking the talk? Environmental education in Wisconsin." Wisconsin Center for Environmental Education, Stevens Point, WI.

Isaacson, M. 2007. "Re-energizing Illinois: Building real demand for energy efficiency." Community Energy Cooperative, Chicago, IL.

Duvall, J. and M. Zint. 2007. "A Review of Research on the Effectiveness of Environmental Education in Promoting Intergenerational Learning." *Journal of Environmental Education* 38(4): 14-24.

Feinstein, N. 2009. "Education for Sustainable Development in the United States of America." International Alliance of Leading Education Institutes and University of Wisconsin-Madison.

Kandpal, T.C. and L. Broman. 2014. "Renewable energy education: A global status review." *Renewable and Sustainable Energy Reviews* 34: 300-324.

Lane, J.F., K. Floress and M. Rickert. 2014. "Development of school energy policy and energy education plans: A comparative case study in three Wisconsin school communities." *Energy Policy* 65: 323-331.

National Academy of Sciences. 2012. "A Framework for K-12 Science Education: Practices,

Crosscutting Concepts, and Core Ideas." Committee on Conceptual Framework for the New K-12 Science Education Standards; National Research Council.

Newborough, M. and D. Probert. 1994. "Purposeful Energy Education in the UK." *Applied Energy* 48: 243-259.

Osbaldiston, A. and H. Schmitz. 2011. "Evaluation of an energy conservation program for 9th grade students." *International Journal of Environmental and Science Education* 6(2): 161-172.

Schepp, C. 1999. "K-12 Energy Education Program Baseline Study: An Evaluation of Teacher Practices and Student and Parent Learning." Report number: 188-1, Energy Center of Wisconsin, Madison, WI.

U.S. Department of Energy. 2014. "Energy Literacy: Essential Principles and Fundamental Concepts for Energy Education."

Wisconsin K-12 Energy Education Program website. University of Wisconsin, Stevens Point, WI. Accessed Oct. 2014: http://www.uwsp.edu/cnr-ap/KEEP/Pages/default.aspx

*Zelezny, L.C. 1999. "*Educational Interventions That Improve Environmental Behaviors: A

Meta-Analysis." *Journal of Environmental Education* 31(1): 5-10.

*Zografakis, N., A.N. Menegaki and K.P. Tsagarakis. 2008. "*Effective education for energy efficiency." *Energy Policy* 36: 3226-3232.

Appendix 5: Utility Data Collection Forms

GEORGETOWN UNIVERSITY ENERGY PRIZE

ENERGY DATA COLLECTION INFORMATION

The following form is an adaptation of the optional attachment many communities submitted along with their Application utility commitment letters. The purpose of this form during the Quarterfinals (August – November 2014) is to gather data that will help communities, utilities and the Georgetown University Energy Prize (GUEP) team to standardize data collection procedures for all competing communities prior to the January 2015 start of data collection.

Community Name: Madison

Utility Name: Madison Gas and Electric

Utility Type (check one):

- ■ Investor Owned
- ☐ Municipally Owned
- ☐ Co-op

Energy Type (check all that apply:

- ■ Gas
- ■ Electricity

The community and utility understand that, during the two-year energy competition (Semifinals), the utility must report at least quarterly to GUEP the total (aggregate) monthly energy directly supplied to all of their residential and municipal customers.

Aggregate data will be reported separately for the residential and municipal sectors. A given month's aggregate energy use is defined as the total of the energy billed during that month.

The quarterly reports are due within 45 days of the quarter's end. When submitting the first quarterly report, the utility must also report the community's baseline energy use: the monthly aggregate residential and monthly aggregate municipal energy supplied during the 24 months prior to the start of the Semifinals.

guep.georgetown.edu

GEORGETOWN UNIVERSITY ENERGY PRIZE

ENERGY DATA COLLECTION INFORMATION

1 Identifying Contributors to the Residential and Municipal Aggregate Energy Usage

1.1 Identifying Accounts or Addresses within the Municipality

Utility is be able to identify properties served in the municipality, with at least 95% accuracy, by these methods [*check all that could be used*]:

☑	Identify by selecting for municipality name in service addresses
☑	Identify by Zip Codes
☑	Identify by Tax Districts
☑	Other Identification Method(s) – [*please describe*] Rate class

Comments: [*insert any comments, e.g., about concerns regarding difficulty or reliability*]

Rate class is the preferred method for identifying residential/municipal accounts.

1.2 Identifying Residential Accounts or Addresses

Given the properties selected via 1.1 (above), Utility will be able identify residential properties by these methods [*check all that could be used*]:

☑	Identify by billing rate class
☐	Identify by other database field [please *describe*]
☐	Other identification method(s) – [please *describe*]

GEORGETOWN UNIVERSITY ENERGY PRIZE

ENERGY DATA COLLECTION INFORMATION

Will all energy consumption by multi-unit residential apartment buildings or complexes be includes?

☑	Yes (all energy consumption will be included)
☐	No – [*please describe any problems, estimate the significance, and propose a solution*]

Additional Comments: [*insert any other comments, e.g., about concerns regarding difficulty or reliability*]

By billing rate class, MGE can pull all residential accounts, including multifamily units.

GEORGETOWN UNIVERSITY ENERGY PRIZE

ENERGY DATA COLLECTION INFORMATION

1.3 Identifying Municipal Accounts or Addresses

Given the GUEP's definition of municipal energy use, as described in the Competition Guidelines (guep.georgetown.edu/rules-timeline), Utility will be able to identify all contributors to the municipal energy use by these methods [*check all that could be used*]:

☑	Identify by enumeration of relevant accounts, given that the community provides a reliable list of contributors
☐	Identify by enumeration of relevant service agreements (SAIDs), given that the community provides a reliable list of contributors
☑	Identify by enumeration of relevant service addresses, given that the community provides a reliable list of contributors
☐	Identify by enumeration of relevant meters given that the community provides a reliable list of contributors
☑	Identify by billing rate class
☐	Other identification method(s) – [please *describe*]

GEORGETOWN UNIVERSITY ENERGY PRIZE

ENERGY DATA COLLECTION INFORMATION

2 Computing Aggregate Energy Usage

Utility will need to report to GUEP the aggregate residential and (separately) the aggregate municipal energy uses, as well as the number of contributors to the aggregates. Given the residential and municipal property identification methods discussed above in 1.0, Utility would be able to compute the aggregates based on information from [*check all that could be used*]:

☐	Energy use meters
☐	Energy use bills
☑	Energy use accounts
☐	Energy use service agreements (SAIDs)
☑	Other Identification Method(s) – [*please describe*] Billing rate class

Comments: [*insert any comments, e.g., about concerns regarding difficulty or reliability*]

Prefer not to use meters, since meters can change, go offline, etc.

ENERGY DATA COLLECTION INFORMATION

3 Special Circumstances

This section addresses circumstances that may complicate energy data collection in some communities.

3.1 Fuel Switching Programs

Is there likely to be a significant amount of "fuel switching" during the competition – i.e., switching from fuel oil or propane to gas or electricity?

☑	No
☐	Yes – [*please describe and estimate the extent of likely fuel switching*]

Will the fuel-switching coincide with the installation of new gas or electric service or meter?

☑	No (There won't be any new service lines or newly installed meters – additional gas or electric energy will be delivered via an existing service)
☐	Yes – (New gas or electric service with new metering will be installed)

Comments: [*insert any comments, e.g., about concerns regarding difficulty or reliability*]

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3.2 Renewable Energy Installations

Are there likely to be significant installations of renewable energy sources during the competition (e.g., residential rooftop solar panels)?

☑	No
☐	Yes – [*please describe and estimate the likely extent*]

Will the installed renewable energy sources reduce the amount of gas or electricity that is delivered to residential and municipal accounts by utilities? For example, residential rooftop solar panels typically reduce the amount of utility-delivered electricity, but a community field of solar panels might be handled differently.

☐	Yes (consumption from utilities will be reduced)
☑	No – [*please explain*] MGE doesn't anticipate any significant number of renewable energy installations.

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The following form is an adaptation of the optional attachment many communities submitted along with their Application utility commitment letters. The purpose of this form during the Quarterfinals (August – November 2014) is to gather data that will help communities, utilities and the Georgetown University Energy Prize (GUEP) team to standardize data collection procedures for all competing communities prior to the January 2015 start of data collection.

Community Name: Madison

Utility Name: Alliant Energy

Utility Type (check one):

- ■ Investor Owned
- ☐ Municipally Owned
- ☐ Co-op

Energy Type (check all that apply:

- ☐ Gas
- ■ Electricity

The community and utility understand that, during the two-year energy competition (Semifinals), the utility must report at least quarterly to GUEP the total (aggregate) monthly energy directly supplied to all of their residential and municipal customers.

Aggregate data will be reported separately for the residential and municipal sectors. A given month's aggregate energy use is defined as the total of the energy billed during that month.

The quarterly reports are due within 45 days of the quarter's end. When submitting the first quarterly report, the utility must also report the community's baseline energy use: the monthly aggregate residential and monthly aggregate municipal energy supplied during the 24 months prior to the start of the Semifinals.

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ENERGY DATA COLLECTION INFORMATION

1 Identifying Contributors to the Residential and Municipal Aggregate Energy Usage

1.1 Identifying Accounts or Addresses within the Municipality

Utility is be able to identify properties served in the municipality, with at least 95% accuracy, by these methods [*check all that could be used*]:

☑	Identify by selecting for municipality name in service addresses
☑	Identify by Zip Codes
☑	Identify by Tax Districts
☑	Other Identification Method(s) – [*please describe*] Rate Class

Comments: [*insert any comments, e.g., about concerns regarding difficulty or reliability*]

Rate class is the preferred method for identifying residential/municipal accounts.

1.2 Identifying Residential Accounts or Addresses

Given the properties selected via 1.1 (above), Utility will be able identify residential properties by these methods [*check all that could be used*]:

☑	Identify by billing rate class
☐	Identify by other database field [please *describe*]
☐	Other identification method(s) – [please *describe*]

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Will all energy consumption by multi-unit residential apartment buildings or complexes be includes?

☑	Yes (all energy consumption will be included)
☐	No – [*please describe any problems, estimate the significance, and propose a solution*]

Additional Comments: [*insert any other comments, e.g., about concerns regarding difficulty or reliability*]

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1.3 Identifying Municipal Accounts or Addresses

Given the GUEP's definition of municipal energy use, as described in the Competition Guidelines (guep.georgetown.edu/rules-timeline), Utility will be able to identify all contributors to the municipal energy use by these methods [*check all that could be used*]:

☑	Identify by enumeration of relevant accounts, given that the community provides a reliable list of contributors
☐	Identify by enumeration of relevant service agreements (SAIDs), given that the community provides a reliable list of contributors
☑	Identify by enumeration of relevant service addresses, given that the community provides a reliable list of contributors
☐	Identify by enumeration of relevant meters given that the community provides a reliable list of contributors
☑	Identify by billing rate class
☐	Other identification method(s) – [please *describe*]

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ENERGY DATA COLLECTION INFORMATION

2 Computing Aggregate Energy Usage

Utility will need to report to GUEP the aggregate residential and (separately) the aggregate municipal energy uses, as well as the number of contributors to the aggregates. Given the residential and municipal property identification methods discussed above in 1.0, Utility would be able to compute the aggregates based on information from [*check all that could be used*]:

☐	Energy use meters
☐	Energy use bills
☑	Energy use accounts
☐	Energy use service agreements (SAIDs)
☑	Other Identification Method(s) – [*please describe*] Billing rate class

Comments: [*insert any comments, e.g., about concerns regarding difficulty or reliability*]

Prefer not to use meters, since meters can change, go offline, etc.

ENERGY DATA COLLECTION INFORMATION

3 Special Circumstances

This section addresses circumstances that may complicate energy data collection in some communities.

3.1 Fuel Switching Programs

Is there likely to be a significant amount of "fuel switching" during the competition – i.e., switching from fuel oil or propane to gas or electricity?

☑	No
☐	Yes – [*please describe and estimate the extent of likely fuel switching*]

Will the fuel-switching coincide with the installation of new gas or electric service or meter?

☑	No (There won't be any new service lines or newly installed meters – additional gas or electric energy will be delivered via an existing service)
☐	Yes – (New gas or electric service with new metering will be installed)

Comments: [*insert any comments, e.g., about concerns regarding difficulty or reliability*]

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ENERGY DATA COLLECTION INFORMATION

3.2 Renewable Energy Installations

Are there likely to be significant installations of renewable energy sources during the competition (e.g., residential rooftop solar panels)?

☑	No
☐	Yes – [*please describe and estimate the likely extent*]

Will the installed renewable energy sources reduce the amount of gas or electricity that is delivered to residential and municipal accounts by utilities? For example, residential rooftop solar panels typically reduce the amount of utility-delivered electricity, but a community field of solar panels might be handled differently.

☐	Yes (consumption from utilities will be reduced)
☑	No – [*please explain*] Alliant Energy doesn't expect significant renewable energy installations during the two year implementation phase.