UNIVERISTY OF MICHIGAN SCHOOL OF NATURAL RESOURCES AND ENVIRONMENT

Michigan Green Communities

Strengthening Municipal Sustainability Practices through Statewide Network Building

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1 Team Biographies

Benjamin Bunker, MS 2012, Natural Resources and Environment

Benjamin holds a bachelor's degree from Bates College majoring in Political Science and Economics with a focus on international environmental cooperation. As a graduate student at SNRE, he continues to strengthen his understanding of energy policy, renewable energy, and smart grid technology. Benjamin is particularly interested in how to bring together local and state governments with utilities and corporations to transition to a low carbon future.

Antonia Chan, MBA/MS 2013, Ross School of Business | Natural Resources and Environment, Erb Institute for Global Sustainable Enterprise

Antonia holds a bachelor's degree from the University of Michigan and has extensive experience in scientific research and managing a small business prior to returning to grad school. Through work in these fields, Antonia brings to the team her understanding of client management, multi-stakeholder engagement, complex systems thinking, and design systems principles. Her interests lie in business implications on sustainability efforts. Because of this, she is extremely excited about the implication for a strong MGC network on the economic, social, political, and environmental progress for the State of Michigan.

Seth Federspiel, MS 2012, Natural Resources and Environment

Seth holds a bachelor's degree in environmental studies from Brown University and taught middle school science for three year before returning to graduate school. At SNRE, he is focused on building climate change policy development and analysis skills. He is particularly interested in the potential to construct effective regional climate policies through the efforts of networks such as MGC in the absence of comprehensive federal climate legislation.

Andrew Fang, MS 2012, Natural Resources and Environment

Andrew holds a bachelor's degree in chemical engineering from Northwestern University and came to SNRE to further his interests in industrial ecology and renewable energy. Through his studies, he's become drawn to urban metabolism; the study of material and energy flows into and out of cities. Andrew brings knowledge of energy systems and data analysis skills to the team. He is particularly interested in how energy consumption facts can be used to create a compelling economic and political case for pursuing sustainable practices.

Courtney Lee, MS 2012, Natural Resources and Environment

Courtney holds a bachelor's degree in Economics from the University of Colorado. She is currently focusing on energy policy and renewable energy at SNRE. She has extensive experience in government budgeting for the US Department of Energy and is interested in gaining expertise at the state and local level.

2 Abstract

The Michigan Green Communities network was formed in 2010 in order to connect communities throughout the state and encourage increased sustainability activity through capacity-building, information sharing, and teamwork among municipalities. Since then, the network has grown to over 100 members and features the Green Communities Challenge activity reporting program, an annual conference, monthly newsletters, and bi-weekly conference calls. The goal of this master's project team of five graduate students at the School of Natural Resources and Environment and the Ross School of Business was to strengthen Michigan Green Communities' (MGC) sustainability outcomes through three components: Policy, Economic Energy Analysis, and Outreach.

The Policy component strove to incentivize sustainability actions in communities through guidance and friendly competition by revamping the Green Communities Challenge (GCC) to be more accessible, informative, and relevant to municipal needs. The team researched program models nationwide and collaborated with the GCC Advisory Committee and MGC members to develop, review, and launch new program features: Sustainability Action Lists, which are a collection of specific Action Items with comprehensive Action Guides, will direct and support community initiatives. A certification system will recognize differential levels of community achievement. A new web-based design will facilitate implementation, tracking, and updating of the program. The success of these initiatives depends on completion of their implementation, assistance to members transitioning over to the new GCC structure, and continued research into case studies and model programs to strengthen the resources available to GCC members.

The Economic Energy Analysis component developed an Excel-based model using the city of Wyandotte as a case study to help communities determine their energy usage and related emissions and expenditures. Serving as an Action Item for the updated Green Communities Challenge, this baseline awareness should motivate municipalities to pursue other actions to reduce their consumption and long-term costs.

The Outreach component worked to improve connections and information sharing between communities by developing an online map to illustrate sustainability actions around the state and by organizing three regional workshops. Hosted by regional energy offices, the workshops provided occasions for the team to present its tools to MGC members, a venue for non-profits to share their services, and networking opportunities for communities at the regional level for more targeted sustainability discussions. The enthusiasm of workshop participants illustrated the value of MGC and the master's project; it was clear that Michigan communities are eager to improve their sustainability practices and appreciate opportunities to gain support and share ideas with their peers.

The master's project thus succeeded in directly strengthening the network by bringing new MGC members together in regional settings. Furthermore, the products created by the three components will serve as lasting tools for MGC and the GCC and function synergistically by providing motivation and information to feed into one another. Future work identified by the project team includes further developing these tools to incorporate new practices and resources, establishing a permanent nonprofit institution to host MGC, and pursuing coalitions with local, state, and regional entities and seeking financial support for network operation and community projects to ensure the growth and longevity of MGC.

3 Acknowledgments

The team would like to thank our clients, Luke Forrest of Michigan Municipal League and Jamie Kidwell of Ann Arbor, and our advisor, Professor Josh Newell, for their continual guidance, encouragement, and support throughout the project process. We also appreciate the input of Matt Naud from Ann Arbor, and the participation of Laura Matson, the MGC Fellow, in addition to her willingness to continue with the implementation of our goals. The sponsors of our regional workshops, the Energy Demonstration Center at Northwestern Michigan College, Michigan Energy Options, Michigan Alternative and Renewable Energy Center, Next Energy, and the Southeast Michigan Regional Energy Office were all instrumental to the great success of the workshops. We greatly appreciate Sustainable Jersey's willingness to explain their program to us and their generosity in sharing their materials for us to build off in revamping the Green Communities Challenge. We also appreciate the cities of Holland and Wyandotte for partnering with our Energy Economic Analysis component to help us access important information to create an effective analysis tool. Peter Garforth, of Garforth International, was also very generous with his time to help us better understand the community energy plan development process. All of the Michigan Green Communities were very receptive to our work, and we especially appreciate the GCC Advisory Committee members who took the time to participate in our GCC revision session, the communities who participated in our GCC pilot calls, and all of those who attended and contributed to our regional workshops. Finally, we would like to that the School of Natural Resources and Environment for its support and for giving us the opportunity to take on this valuable project.

4 Introduction

The success of many sustainability initiatives involves the efforts of individual cities and communities. Michigan cities currently face budget constraints that limit their ability to address sustainability concerns. Nonetheless, there is a strong interest in pursuing projects which increase sustainability outcomes.

Originally funded by a small grant, Michigan Green Communities (MGC) was formed in July 2010 to build a peer-learning network of local government and university staff throughout the state of Michigan. MGC is the largest statewide network within the Midwest Regional Sustainability Network (MRSN), which began as a network of small- and medium-sized communities throughout the states of Michigan, Ohio, and Indiana to work with network members to identify and address unique sustainability challenges that were common across these states. Commonalities including a manufacturing industry, economic challenges, and similar environmental challenges which pose comparable sustainability challenges for local governments.

The goals of the MGC network are to further sustainability initiatives and policies of its members, to produce a model for statewide sustainability networks, and to establish a stable financing mechanism to maintain the network going forward. MGC now includes the support of approximately one hundred local governments and universities throughout the State of Michigan interested in supporting and learning about sustainability initiatives.

> *Michigan Green Communities Mission: MGC is a network of local government and university staff in the state of Michigan that will collaborate with one another, through peer learning and information sharing, to promote innovative solutions and move sustainability initiatives forward at the local, regional, and state level.*

The network is currently supported by various state organizations including the Michigan Department of Environmental Quality, the Michigan Economic Development Corporation, the Michigan Municipal League, the Michigan Association of Counties and the Michigan Townships Association. Appendix A lists the participating communities of varying size across the state of Michigan. To date, MGC is administrated primarily by Jamie Kidwell of the City of Ann Arbor and Luke Forrest of Michigan Municipal League with the support of state grant funding. Kidwell and Forrest thus served as the client contacts for the master's project team.

In fall 2011, MGC was able to hire a graduate level student intern from the University of Michigan through funding from a Michigan Department of Environmental Quality Pollution Prevention Grant. This MGC Fellow (Laura Matson) at the City of Ann Arbor was tasked with supporting the administrative activities for the MGC. Recommendations resulting from this Master's Project report are directed to Jamie Kidwell, Luke Forrest, and Laura Matson.

4.1 Project Purpose

The challenges of pursuing sustainability projects in Michigan are complex because of a confluence of economic, social, and political factors. MGC proposes that a strong network of communities with adequate resources will be able to overcome these obstacles. The Michigan Green Communities Master's Project team composed of five graduate students at the University of Michigan School of Natural Resources and Environment and the Ross School of Business believes that sustainability projects in Michigan will become more feasible if the economic benefits of increased sustainability are communicated through focused outreach and fostered collaboration. The team worked with MGC in order to *determine how to develop mechanisms to strengthen and support the Michigan Green Communities network.*

In order to address the project goals, the team chose to work with MGC along three separate yet related components in order to strengthen and support the network effectively: *Policy*, *Economic Energy Analysis*, and *Outreach*. The goals of these components are to create policy mechanisms to support the network, inform cities about their energy and economic flows, and support outreach mechanisms to strengthen the network. These specific project component areas and their synergies address the unique and urgent need to strengthen the MGC network by providing cities with tools to increase their environmental and economic sustainability.

4.2 Adaptation Relevance

The MGC project addresses climate change adaptation in two fundamental ways. First, cities become more resilient by identifying their dependence on distant energy sources that may become scarce in the future and gaining understanding of an economic argument for why they should diversify their energy sources. Energy efficiency and diversification can be used to improve the reliability of energy supplies as severe heat and extreme weather events increase the vulnerability of power systems to excessive electricity demand. Second, by strengthening the network, cities will share information and resources that increase their capacity to adapt to climate change. Specifically, the Policy component of the project has developed a Climate Adaptation Plan (CAP) Action Guide that provides adaptation planning resources and direction for cities in the network. This guide demonstrates why other cities around the country have developed adaptation plans and shows MGC members what steps need to be taken in order to create their own adaptation plans.

4.3 Report Structure

The purpose of this reporting document is to explain the background, methodology, results, and implications of the development of tools to address the three components of this master's project. It is important to note that while this document should serve as a useful overview of our activities, our most substantial deliverables are the new tools and products that we developed and are being used directly by MGC, including the revised Green Communities Challenge, the Economic Energy Analysis tool, the online map, and the regional workshops.

This report is divided into three sections which corresponding to the three major components of our project: *Policy Analysis, Economic Energy Analysis,* and *Outreach*. Each component discusses its background and goals, methods, results, and conclusions. Following these sections, we present a synthesis of the three components, which complement each other by providing motivation and information to feed into one another. We also summarize our recommendations and areas of future research for the MGC Fellow to pursue. Appended are more detailed lists of the tools we created and "user guides" explaining their use for MGC members.

5 Policy Component

The Policy component strove to incentivize sustainability actions in communities through guidance and friendly competition by revamping the Green Communities Challenge (GCC). The Policy component aimed to make GCC more accessible, informative, and relevant to municipal needs. In this section, we explain our methods, results, and conclusions. We researched program models nationwide and collaborated with the GCC Advisory Committee and MGC members to develop, review, and launch new program tools. These tools include a new tier-based certification program designed to recognize differential levels of community achievement. The new program is organized into four sustainability categories called Action Lists. Each category contains a series of Action Items (or individual sustainability initiatives) that are paired with comprehensive Action Guides that direct and support community initiatives. A new web-based design will facilitate implementation, tracking, and updating of the program. The success of these initiatives depends on completion of their implementation, assistance to members transitioning over to the new GCC structure, and continued research into case studies and model programs to strengthen the resources available to GCC members.

5.1 Green Communities Challenge Background

The Green Communities Challenge (GCC) was created in 2009 through a collaborative effort between the Michigan Department of Energy, Labor, and Economic Growth (now the Michigan Economic Development Corporation—MEDC) and the Michigan Municipal League (MML). The purpose of the GCC was to promote the pursuit of energy efficiency and renewable energy strategies in Michigan communities, specifically taking advantage of the Energy Efficiency and Conservation Block Grant (EECBG) funding that was provided through the 2009 American Recovery and Reinvestment Act (ARRA). Encouraging information sharing and friendly competition between communities, the GCC involved municipalities adopting a resolution of commitment and completing an annual Progress Report checklist of energy efficiency and renewable energy activities, with points awarded for each successful initiative.

By 2011, ninety communities across the state had adopted the GCC, aided by the 2010 union of the GCC and the Midwestern Regional Sustainability Network represented by the city of Ann Arbor to create the Michigan Green Communities (MGC) network. A number of communities completed Progress Reports, and MML began compiling a searchable database of state-wide

municipal projects. However, as ARRA funds were consumed, the program's narrow focus on energy efficiency and renewable energy development failed to include a broader range of sustainable community practices. The Progress Report became less able to capture the full array of municipal projects, and its paper medium made it cumbersome to update, complete, and track results. The GCC Advisory Committee composed of MML and MEDC staff and community representatives began a series of conversations to consider means of updating the GCC. Priorities included broadening the scope of the Progress Report and dividing it into categories, providing communities with greater guidance and resources to carry out sustainability projects, and transitioning to a more user-friendly and dynamic web-based format.

Policy Component Goals

The Policy project component saw the revision of the GCC as a valuable deliverable and a means of consolidating many of our master's project goals. In developing new material for the GCC, we could communicate with MGC member communities to gain a better understanding of their environmental policy priorities and goals. We could respond to these with concrete guidance and resources to implement practical sustainability programs. In creating this guidance, we would strive to tie together information, funding, and best practices drawn from the Michigan state level and models from other states. To further support the program, we would create new policies in the form of sample municipal ordinances at the local level and potential legislation to enable the development of MCG at the state level. Ideally, in rebuilding the GCC we would not only update the reporting program itself but also help develop the resources and policy environment for MGC as a whole to become a more robust and sustainable institution.

5.2 Methods

Based on the goals outlined above, the Policy component began developing a strategy for revising the Green Communities Challenge (GCC) in late August, 2011. With the aide of Luke Forrest at the Michigan Municipal League (MML), we coordinated with the GCC Advisory Committee to adopt the four categories into which they wished to divide the Progress Report. In mid-September, we met with Forrest and Jeff Spencer from the Michigan Department of Environmental Quality Office of Environmental Assistance, who was one of the original authors of the Progress Report. Together, we mapped out a sequence of steps to update the GCC, including assessing community performance on the Progress Report and researching other sustainability reporting programs, developing new lists of items to be presented at the late-October MGC annual conference, creating additional supporting material for the lists, and considering other changes to the GCC structure. These methods provided the basic outline and considerations that would guide our work for the remainder of the project.

5.2.1 Model Sustainability Reporting and Incentive Programs

In addition to analyzing the contents of the current Progress Report, the team researched other reporting programs around the country to gain models of both content and design for the new GCC. ICLEI USA's STAR Community Index lays out guiding principles for sustainable

community development and identifies 81 potential goals across the categories of natural systems, planning and design, energy and climate, economic prosperity, employment and workforce training, education, arts, and community, health and safety, affordability and social equity, and innovation and process (ICLEI USA, 2010). While not yet a fully developed rating system, these principles, categories, and goals provided helpful ideas of new items to consider for the GCC. GreeningUSA provided a more developed evaluation system based on "12 Traits of Sustainable Communities" (GreeningUSA, 2010). These Traits include a variety of sustainability practices and management applied across the triple bottom line of environmental, economic, and equity considerations. This creates a total of 36 scoring criteria, which can be summed across both traits and categories. Although not completely compatible with the Advisory Committee's four categories, this system again provided a number of helpful actions and principles to consider for the GCC, as well as a model for scoring across actions.

The Massachusetts Green Communities program evaluates municipalities based on five energy-related criteria (MA Department of Energy Resources, 2011). Once recognized as Green Communities, cities and towns in Massachusetts are eligible for energy efficiency and renewable energy-related funding from the Department of Energy Resources, using resources largely gained from the auction of carbon credits in the Regional Greenhouse Gas Initiative. While an effective program, MA Green Communities' relatively narrow focus and predication on state financing making it less applicable for the GCC. The North Carolina Community Practices Assessment provides a simplified approach to measuring community sustainability practices (N.C. Sustainable Communities task Force, 2011). Divided into six principles, the Assessment asks communities straightforward "yes" or "no" questions about specific sustainability practices. "Yes" responses could then be tallied across categories for a final score. The team preferred the clear approach of this assessment, but also found the questions to be sometimes lacking in nuance and flexibility. We found it helpful that each principle section included short case study examples of their application.

The state model that jumped out as the best fit for MGC is New Jersey's Sustainable Jersey program (Sustainable Jersey, 2012; SJ). Created in collaboration between the New Jersey League of Municipalities, the New Jersey Sustainable State Institute at Rutgers University, and the Municipal Land Use Center at the College of New Jersey, the program was launched in 2009 and currently has 358 community members. With the goal of promoting "prosperity, planet, and people" (ie: economy, environment, equity), SJ formed a series of working groups with municipal staff, academics, business, and community representatives to create a comprehensive list of sustainability actions and guides with resources for each action. The core program is based around completion of these actions, which are divided into fifteen categories, in order to achieve certification at the "bronze" or "silver" level by completing mandatory actions, a certain number of priority actions, and reaching a point threshold. Certified communities are recognized on the SJ website, in publications, and at events, given a logo to use in their community, and have priority access to a handful of grant opportunities. In partnership with state agencies and

corporate entities, SJ provides general grant opportunities and resources related to specific actions. The program also offers monthly conference calls, three annual regional workshops, and additional training seminars and webinars to help walk communities through the certification process as well as specific sustainability topics. Currently supported by a single staff member at Rutger's reporting to a board of directors, SJ is in the process of establishing official non-profit status and increasing the program's capacity in response to the rapid growth of memberships across the state.

The SJ website was found to be clean, informative, and intuitive with streamlined Action Lists and with sub-actions shown by clicking on a given category. Clicking on an action brings up the guide which provides much more thorough information and resources, including: "who to involve, timeframe, project costs, why important, what to do, submission requirements, spotlight, and resources." The "spotlight" section provides case studies of communities currently carrying out the action, and links to an interactive map which can be sorted by certification level or action category to help communities connect and share information (similar to the map developed by the Outreach component). Communities check off actions they have completed and their score is automatically calculated, with additional records of the community action submitted through the website.

Randy Solomon, SJ administrator, was contacted in order to learn more about the program and discuss options for using SJ as a template. SJ was very receptive to MGC borrowing their concepts, and offered to help provide more specific fee-based support in the future. We found that the material available on the SJ website to be sufficient for the basic development of our Action Lists and Guides (see below), but would recommend that the GCC Advisory Committee consider further program design and implementation consultation with SJ in the future.

5.2.2 Action List Development

With Sustainable Jersey in place as a solid model, we were able to delve into development of a new version of the Progress Report, which would take the form of Action Lists. The terms Action Item and Action List were chosen to reflect a more proactive stance toward achieving sustainability initiatives. We outlined the concepts behind the new model and answered questions about its implementation for the GCC Advisory Committee. The Committee was receptive to the model and helped brainstorm factors to take into account for the transition from the Progress Report to the new Action Lists, such as translating between the scoring systems and ensuring consistency among the communities.

Categories and Aggregation

Our Action Lists would be divided into the four categories established by the Advisory Committee: *Administration and Planning, Built Environment, Natural Resources,* and *Economic Development*. The Committee had considered additional, more specific categories, but decided to stick to four to add simplicity. Administration and Planning would incorporate organizational measures carried out by the municipality such as developing sustainability teams and plans. Built

Environment would encompass energy efficiency and renewable energy, building sustainability, and transportation. Natural Resources dealt with urban forestry, air and water quality, and waste management. Economic Development would encourage green business practices and opportunities to sustainably develop the community.

Jeff Spencer of DEQ proposed specific Action Items for each of the categories, which we used as a baseline along with the outgoing Progress Report items to brainstorm lists of potential actions. We also gained action ideas from Sustainable Jersey, ICLEI Star, GreeningUSA, Massachusetts Green Communities, the North Carolina Community Practices Assessment, and the 2011 Annual MGC Conference. This resulted in a combined total of over 100 items. The Advisory Committee, however, had specified a goal of no more than 10-15 items per list. Thus, our next challenge was aggregating items and weeding out all but the most relevant. By establishing broader Action Item headings, such as implementation of renewable energy projects, and then listing Sub-actions with specific options such as wind, solar, and geothermal beneath the larger action. By using a nested format similar to that on Sustainable Jersey's website, we can avoid overwhelming the user with options while still providing sufficient detail in each category. We also consulted with the Advisory Committee regarding the relevance of potential Action Items and how to best distribute them between the categories (see review process below).

Scoring

For the scoring of the Action Items, we similarly drew a baseline from the models and then refined the results to meet the needs of MGC. Using a common score of ten points for most Items, we then adjusted up or down based primarily on the time, effort, and financial resources which would be required to complete each Action. We also considered the impact of each Item and strove to give ones with greater priority more of a point reward. In addition to the scoring of individual items, we developed a concept certification system to recognize differential levels of community sustainability achievement. Using Sustainable Jersey as a model, we conceived of a similar three-level system (Member, Bronze, Silver) based on some prerequisite action, priority items and diversity requirements across the categories, and scoring thresholds for each level. Our Advisory Committee meetings and community pilot calls further informed this process (see below).

Client Review and Revision

The first opportunity to gain client feedback on our product came at the October 28th MGC annual conference in Lansing. During the Government Operations and Planning section, we gave a brief presentation to outline our goals, process, and preliminary results. For the conference, we had developed a pilot version of the Economic Development List, which we considered to be the most innovative category and likely appealing to the communities. During the breakout session following the presentation, we answered questions about the program design and solicited feedback. Participants were positive about the new design and the concept of a certification system, and encouraged us to ensure that sufficient support was made available to communities, particularly smaller communities with limited human and capital resources.

By December we had completed the other three Action Lists, and we arranged a workshop with the Advisory Committee to work through the Action Items and scoring in detail. Hosted by the city of Farmington Hills, this workshop proved a very helpful mechanism to gain feedback from a number of the communities that would ultimately be implementing the new GCC. Participants were able to suggest significant revisions to the organization, content, and wording of the lists to make them more streamlined and relevant for the communities. While we did not have time to score the lists item-by-item, we discussed the criteria and thresholds for the certification system. Committee members suggested adding a Gold certification level to help further differentiate communities, while using caps to limit the scoring in any one Item. They also raised the possibility of using percentile-based scoring to ensure continued improvement, an idea we ultimately adopted in conjunction with community classes to ensure equity across varying jurisdictions and community characteristics.

Having incorporated the Advisory Committee's feedback into the Lists, we conducted a series of calls with GCC communities in January to test the effectiveness of the new GCC. A variety of community locations, sizes, and jurisdictions were selected to provide a cross-sectional representation of GCC members. Each community was sent the Lists to review ahead of time, and during the call we went through each Item to gauge how the community would score. We also solicited additional feedback regarding the wording, relevance, and scoring of each Item.

We spoke to six communities: Ann Arbor, Birmingham, Meridian Township, Milford Township, Monroe County, and the village of Quincy. Overall, communities reacted well to the Lists, scoring on a variety of items across each category. While larger communities with greater resources certainly scored higher than smaller ones, it did not seem like there was skew in the scoring system; these results helped us determine the appropriate diversity thresholds and classes for the certification system. Community feedback helped us further clarify some of the Action Items, and illustrated the importance of the Action Guides (see below) for further elaboration on each Item. It was apparent that having someone provide guidance in completing the Challenge was very helpful for the communities, and this could be a particularly useful service to provide as GCC members transition over to the new system.

5.2.3 Action Guide Development

To provide further guidance and resources to GCC members, we decided to adopt the documentation system that Sustainable Jersey provides to supplement each Action Item, which we call Action Guides. With an introduction and sections on the importance of the action, who to involve, projected costs and time frame, a step-by-step to-do guide, submission requirements, a spotlight highlighting current activity, and a list of informational and financial resources, these guides are the largest substantive addition to the GCC program, providing much more detailed resources than were available in the Progress Report.

For those actions which corresponded to Sustainable Jersey's list, we began adopting SJ's guides for the GCC in late October, borrowing the substance of the guides while changing the details to

match GCC's mission and context in Michigan. For new actions, we used the same template and solicited expert input to develop the guides. The MGC conference in October proved particularly helpful, connecting us to community practices in a number of sustainability categories. For example, Steven Cohen in Auburn Hills was able to adapt their electric vehicle infrastructure ordinance fit within the format of our guide. While we have basic guide content for each of the Action Items, further developing the resources for each one and adding case studies to the "spotlight" is a priority for future work. Ideally, the online format of the new GCC will allow for easy revision to incorporate both new resources and feedback on the guide format and content from GCC members.

Client Review and Revision

Due to the quantity and length of the Guides, we were not able to pilot them with the communities as extensively as the Action Lists. However, we explained the guide format and content at the October conference, December Advisory Committee meeting, and February regional workshops, in each case gaining positive feedback for the concepts and helpful ideas regarding specific types of resources to include in the guides. Many of the detailed suggestions for the Action Items in the pilot calls also helped raise issues to address in the guides, proving the value of much more in-depth documents to supplement the more streamlined Action Lists.

5.2.4 Website development

In early March, we met with the Michigan Municipal League web developer to discuss the design of GCC's new online format. Again using Sustainable Jersey as a model, we hope to produce a website that is streamlined, intuitive, and informative. Most of the design elements are technically feasible, leaving room to consider programmatic elements such as submission requirements for certification. GCC has been based on self-reporting, and its administrators are interested in maintaining this approach. However, increased data monitoring along with submission would help track the results of the program and provide material for the "spotlights" and map components (see Outreach section). Therefore, we suggest a design that allows for collection of basic description of community actions, which could be stored and expanded upon in the future. Thanks to the help of the Michigan Municipal League, the website framework should be available by late spring, at which point data entry will govern the timing of the full GCC launch, slated for mid-summer, 2012.

5.3 Results

Our team was able to successfully revise the Michigan Green Communities Challenge in such a way that communities are now better equipped to understand how to implement sustainability activities and initiatives. Achieving this goal required creating Action Lists, putting together individual guides for each Action Item, and revising the overall program structure to include a level-based certification system. Although we were able to accomplish these goals, we were not able to draft state-level policy to support the network.

The four Action Lists we created reflect the four categories proposed by the GCC Advisory Committee (see Appendix B). Each Action List contains 10-15 individual Action Items. As we drafted these Action Lists we incorporated feedback from our client and the Advisory Committee through meetings and conference calls. We were also able to incorporate feedback from individual communities through calls as well as email communication following the Michigan Green Communities Conference in October 2011 and the regional workshops held in February 2012.

Each Action Item has a respective point score. For some Action Items this score is absolute while for others it may range depending on the scope of the project that a community undertakes. In other words, we aimed to reward communities for partial completion of projects or initiatives that require larger inputs of human or financial capital or time. To increase functionality, communities will now be able to total their point scores for each Action List using a web-based interface and their total point score will be calculated accordingly. As mentioned in the previous section, we collected input into the point scoring system during our January pilot calls within individual communities.

Another major change in the new GCC is the provision of detailed Action Guides for each Action Item (see Electronic Appendix files). This was one of the major strengths we identified with the SJ model that we chose to adopt into the GCC. In creating these guides we drew from the SJ guides and added our own research while also ensuring that the guides were as Michigan specific as possible. Each guide follows an identical format and includes the following sections: *introduction, why important, who to involve, timeframe, project costs, what to do, submission requirements, spotlight, resources,* and *appendices*. We are particularly excited about the potential of the spotlight section to foster the networking aspect of the challenge. The spotlight section is a means to highlight exemplary community sustainability initiatives through short case studies. The idea is that communities will be more likely to network and collaborate if they are given clear examples of other communities in Michigan that are undertaking projects of interest to them. In the end we were able to form individual Action Guides for most of the Action Items we had created.

The GCC certification was the final major structural change we made to the original Progress Report. The purpose of the GCC certification program is to incentivize productive competition between Michigan communities related to sustainability, to recognize outstanding community performance, and to provide a benchmark by which communities can compare their sustainability activities to each other. The certification system seeks to achieve all of these key goals through a tiered system that recognizes varying levels of community sustainability action. Communities can achieve one of four certification levels: Member, Bronze, Silver, and Gold (see Appendix D for a detailed explanation of the pre-requisites for each certification level).

The certification system is also designed to reflect that communities differ in their resources and capacity to pursue sustainability initiatives. Therefore the certification system is divided into a

number of community classes that ensure that municipalities are evaluated against their peers. These community classes include villages, general law townships, counties, cities and charter townships with less than 10,000 residents, and cities and charter townships with more than 10,000 residents.

5.4 Conclusions

The Policy component was able to achieve all of its goals with the exception of drafting state level policy to support the Michigan Green Communities network. This was primarily due to the fact that creating the other sections of the project including the Action Lists, Action Items, Action Guides, and certification system was extremely time-consuming. Although we were unable to create state-level policy, we do have a number of strategic recommendations for the MGC network that will ensure its growth and long-term success.

5.4.1 Challenges and Next Steps

Our team came away from the project with a number of important lessons learned. Communities in Michigan vary greatly in their size, resources, and ultimately their ability to complete sustainability initiatives. We were conscious of this fact throughout our process and tried to tailor the GCC program so that it was applicable to all types of communities in Michigan. Feedback from our conference presentation and regional workshops indicate that communities are interested in combining sustainability with economic development; communities seem eager to pursue sustainability projects, but not without some type of economic or business case for their completion. Thus it is crucial for the GCC in the future to be able to make the economic and business case for sustainability, to clearly identify funding resources, and to provide guidance and support for communities as they undertake sustainability initiatives.

Our work was both challenging and at times frustrating. We often struggled to receive feedback from our client and the Advisory Committee, especially concerning needs of communities themselves and direction on how our work might help to meet those needs. Overcoming this required us to take an independent approach at times where we would proceed without guidance to produce multiple drafts for evaluation. Another challenge was to find a balance between providing enough detail within the Action Lists and Guides so that communities would easily understand how to accomplish each initiative without providing so much detail that they would be overwhelmed. In the end, we believe we struck such a balance in our work.

We identified a number of future research opportunities that could be conducted by either the MGC Fellow or an intern. More research needs to be done to identify spotlight case studies and Michigan specific resources for each Action Guide. There is also a strong need and demand on the part of communities for financial resources. Research should target state and federal grant and loan opportunities as well as partnerships with private sector companies that might provide funding for GCC actions. As we learned over the course of our project, financial incentives are one of the strongest motivators for community action. Ideally MGC should collaborate with the state including the MEDC to consider legislation and other statewide initiatives to support MGC

and the GCC. Although MGC has chosen to remain apolitical up to this point, the MGC network will increasingly represent a strong constituency made up a diverse set of communities that has the potential to push for sustainability related legislation on the state level.

5.4.2 Recommendations

Michigan Green Communities should provide webinars and one-on-one support for communities as they work through the new GCC Action Item lists. Such support would also be helpful for communities transitioning from the previous Progress Report program. Communities identified the availability of support mechanisms as an important component in any new program structure early on in the project. While the resources available to the GCC are limited, the current MGC Fellow or a future fellow or intern could perform this type of support function.

Incorporating data collection into the GCC website to allow for administrators to track results should be a priority. Having information about the sustainability projects communities are pursuing, their costs, and their impacts is critical for targeting resources and revising the program in the future. Collection of this and similar data will also provide the program with transparency, something that was absent from the previous Progress Report. This data can also be used to expand the spotlight section of the Action Guides and provide material for the Outreach map. As discussed earlier, we feel that the spotlight section (including its connection to the map tool) is key to fostering an atmosphere of collaboration between communities and strengthening the network component of the program.

The GCC should expand both within Michigan as well as help other members of the Midwestern Regional Sustainability Network set up similar certification-based programs. The MGC has an opportunity to become a sustainability leader in the region. However, this will not be possible until communities successfully complete the transition from the Progress Report to the new GCC program. In other words, MGC should focus on strengthening the GCC program in Michigan before reaching out to provide development assistance to programs in other states.

Finally, the Advisory Committee should consider consulting with Sustainable Jersey or similar established municipal networks in the future to refine the program design and consider strategies for growth and resource development. Learning from the experience of other programs and their knowledge of informational and funding channels would help GCC and MGC expand smoothly and efficiently. The upcoming workshop being organized by Ann Arbor and Dearborn with the Montpelier-based Institute for Sustainable Communities is an excellent example of an opportunity to take advantage of existing expertise.

6 Economic Energy Analysis Component

The Economic Energy Analysis component developed an Action Item for the updated Green Communities Challenge using the City of Wyandotte as a case study to help communities determine their energy usage and related emissions and expenditures. In this section, we explain our methods, results, and conclusions.

6.1 Economic Energy Analysis Background

The state of Michigan consumes an enormous amount of energy due to its large population, a northern climate, and a large industrial sector. Energy demand is only expected to increase in the future. Michigan has a relatively low amount of local energy resources and in order to accommodate local energy demands, the state relies heavily on importing energy from other states and countries. Michigan imports 97% of petroleum, 82% of natural gas and 100% of its coal and nuclear fuel needs (MI Public Service Commission, 2011). Approximately 67% of primary energy consumption occurs in cities (International Energy Agency, 2008). Therefore, cities are an effective unit for studying ways to improve energy efficiency and greenhouse gas (GHG) emissions.

To import this energy, Michigan is using significant financial resources that could otherwise be invested in local economies. In 2009, the state spent a total of $31.1 billion for energy of which $22.6 billion was used for energy imports alone (MI Public Service Commission, 2011). This equates to a 72% economic loss for the state. This economic loss trickles down to vastly impact local communities' economies, jobs and energy security.

Furthermore, sustainability initiatives and the greening of communities have not been consistent across the state of Michigan. Communities like Grand Rapids, Ann Arbor and the City of Holland have led the way with projects such as updating city streetlights with LED bulbs and implementing energy efficiency programs. However, many communities are not as receptive to the idea of sustainability initiatives due to other political, economic, and social concerns.

The American Recovery and Reinvestment Act of 2009 provided funding for the US Department of Energy's, Energy Efficiency and Conservation Block Grants (EECBG) program that helped get sustainability on the radar for many communities around the nation. Many cities in Michigan were eligible to obtain these grants for energy efficiency improvements and used this opportunity to jump start sustainability projects within their communities. However with EECBG funding winding down, cities often do not know where to find additional resources or how to go about continuing sustainability projects.

Budgetary concerns and receptiveness to sustainability are two major obstacles that communities face. The Economic Energy Analysis component of the MGC project addresses two significant questions:

1. How can MGC help local communities develop their economies by keeping dollars in cities and creating jobs in Michigan?
2. How can MGC encourage and promote sustainability to communities across the state given their economic situation?

The MGC student team looked at addressing these two concerns. Initial research on sustainable communities led the team to the concept of community energy planning. Holland, Michigan recently conducted a comprehensive, long-term Community Energy Plan (CEP) to roadmap how the city can ensure economic competitiveness, provide reliable and affordable energy, and reduce environmental impacts over the next 50 years (Garforth International, LLC, 2011). The plan sets a baseline target for energy efficiency and GHG emissions and outlines where improvements can be made. The rationale for the study was driven by the proposed expansion of a local coal plant that drew the ire of environmental groups. The community hired a consultant to evaluate alternatives to meeting the future electricity demands. The CEP is a great example of how a small community is taking the initial steps to become more sustainable.

The team decided to expand upon this long-term energy-planning concept and formalize a standard process to assess energy consumption patterns at the city-level. This helped us to scope our analysis to identify the deficiency in knowledge of local energy consumption, how that knowledge can save money in the long run, and how communities can focus on reallocating energy cost savings to sustainability projects. Therefore, the energy component of the MGC project conducted an Economic Energy Analysis and established a framework to encourage communities to determine their baseline energy consumption and identify potential cost savings. Our standardized framework helps to make an economic argument in favor of sustainability projects.

Based on the Holland CEP, the team conducted an Economic Energy Analysis for the City of Wyandotte, an active MGC member. The analysis assessed Wyandotte's energy consumption patterns, identified opportunities to reduce costs and emissions, and evaluated appropriate areas for the implementation of energy efficiency projects. We selected Wyandotte as a case study city to look at the energy usage for the residential, commercial, municipal, and industrial sectors and to evaluate city-wide energy consumption.

The Economic Energy Analysis tool identifies the following:

- Areas of high energy consumption activity
- Energy consumption patterns by sector(s) (residential, municipal, commercial, and industrial)
- Baseline conditions to help develop targets for energy consumption and GHG reductions
- Where to apply energy efficiency projects and grants

The analysis will serve as a tool used to make long-term economic and policy decisions that will help Michigan communities in becoming more sustainable. Having knowledge of baseline energy consumption will increase a community's ability to apply for and receive energy efficiency grants. The analysis puts an economic value on energy consumption losses so communities can start to re-think long-term energy planning. Given the value of this analysis for communities' understanding of their energy consumption, it is included as an Action Item in the revised Green Communities Challenge (see Policy section).

6.2 Methods

This section describes how the team went about conducting the Economic Energy Analysis. Various conversations with community energy managers, regional coalitions and utility personnel were necessary in order for us to collect the appropriate data for the analysis. The scope of this analysis, its assumptions and the GIS mapping component are further described below.

6.2.1 Choosing a City

The Economic Energy Analysis involved several steps. With over 90 communities in the MGC network, the team needed to narrow down the list to a few selected cities. Dialogues with the City of Ann Arbor and the Michigan Municipal League were conducted over a three-month period and certain characteristics and criteria in choosing an initial city were formulated.

The first criterion was the city needed to be a member of the MGC network. Second, the team wanted a city that was representative of Michigan's pursuit of sustainability initiatives: a city neither too progressive nor too conservative. The ideal city would be one that was interested in sustainability, but lacked the staff and financial resources to thoroughly pursue sustainability initiatives. We also needed a city that was receptive to the project and to working with university students.

Most critically, it was important that the case study city have available energy consumption data for the analysis. Thus, the team looked at cities with municipally owned utilities. The thought process being, it would be easier to gather and collect electricity consumption data if the city had their own electric utility. Municipalities that generate and supply electricity have energy costing information (i.e. how much they need to generate on an annual basis, operation costs, etc.) as well as individual metered consumption data. Furthermore, selecting a community with a municipally owned utility increased the likelihood of readily available data.

Given the criteria, the cities of Coldwater, Holland, Flint, Lansing, Wyandotte, and Kalamazoo were suggested as potential communities to work with. We reached out to energy managers and city government contacts in each of the six municipalities. Five cities responded back and wanted to learn more about the project. We did not receive a response from the City of Kalamazoo. We discussed our project via conference calls with the four cities that showed interest in our analysis, while Flint was unable to commit time to pursue the project.

The City of Lansing had information available, but obtaining data involved an additional formalized government process and the timeline of the project could not accommodate. Initial discussions with the cities of Coldwater and Wyandotte were very receptive and data was readily available. After continued talks we determined that Wyandotte had the data at the granular level necessary to conduct the Economic Energy Analysis.

Furthermore, dialogues with the City of Holland led us to find out that they had just completed a similar analysis, the Holland Community Energy Plan (CEP), and were more than willing to share information and contribute to the project. Along with Holland, the team began to re-scope our project into a comparison study of Holland and Wyandotte.

6.2.2 Scoping the Project

In order to compare the City of Wyandotte to Holland, the team needed to assess Wyandotte's energy consumption using the same methods found in Holland's CEP. We met with an external consultant, Peter Garforth from Garthforth International LLC, who led and conducted Holland's CEP. We wanted to get a better understanding of how the Holland CEP was performed and what kind of data was needed. Garforth recommended gathering data at a fine level of detail and then aggregating from there.

We scoped the study based on what data was necessary and available from Wyandotte to conduct our Economic Energy Analysis. Data needed to be at a manageable level of detail, with individual meter electricity consumption data being the ideal level of resolution. Wyandotte provided data from approximately 13,000 individual meters on electricity usage each for a 24-month period (years 2010-2011). This resolution of data made for a more accurate analysis that was then aggregated to a total yearly consumption per meter.

We also scoped our analysis based off the Holland CEP using the total yearly electricity consumption classified by sector, such as residential, commercial, industrial and municipal buildings (Garforth International, LLC, 2011). This made for different levels of comparison in identifying those sectors that the city could target for energy efficiency improvements. Wyandotte's meter data was classified into 13 different rate classes; we worked with the city to re-group the rate classes down to specific sectors (See GIS section below).

Furthermore, the team also scoped the analysis to create energy density maps using ArcGIS. Using the raw metered data to map energy consumption within a city would provide us a different depth of analysis. Again based off Holland's CEP, we decided to create energy districts using Census tract and Census block data. A Census tract as defined by the US Census Bureau is a geographic region which represents a homogeneous unit of population characteristics, economic status, and living conditions and averages about 4,000 inhabitants per tract (US Census Bureau 2012). Census blocks are essentially Census tracts at a higher resolution. Blocks are typically bounded by streets, roads, or creeks and are usually referred to as a city block. Energy

data can be aggregated to the Census tract or Census block level to help identify energy districts and areas with high-energy consumption patterns.

The Holland CEP used both electricity and heating data. Because of Michigan's latitude, the state is susceptible to colder weather meaning greater energy consumption to heat homes and buildings. Peter Garforth informed us that heat was essential to include in order to assess the entire energy picture. During the 2010-2011 period there was an average of 5900 of heating degree-days per year and an average of 801 cooling degree days per year for the state of Michigan. Heating data was important in capturing the baseline energy needs for the city of Wyandotte, however data was difficult to obtain. Working with regulated energy companies like DTE and Consumers Energy--two primary suppliers of heat within the state of Michigan--can be challenging due to proprietary issues and information privacy rights. It was recommended that if we came across these proprietary problems, we should use heating factors from Holland under the assumption that the building sizes were fairly similar in Wyandotte.

6.2.3 Data Availability/Assumptions

Unfortunately, most cities in Michigan only have access to electricity and heating consumption data for municipally-owned buildings. This data does not take into account residential, commercial, or industrial consumption. Additionally, many cities do not have up-to-date records of which buildings are municipally owned, nor do they have complete building assessor records that would show building area (square feet). Therefore, it is difficult to assess consumption even at the municipal level.

Because most city governments are not able to keep track of energy consumption in the entire city, it is necessary to work with local utilities who track monthly consumption by meter in order to bill their customers. Utilities are usually unwilling to share their data with their standard justification being that sharing data will compromise the privacy of their customers. In our case, we worked with the General Manager of a municipally-owned utility, Wyandotte Municipal Services (WMS). This enabled information sharing at a level that an investor-owned utility, such as DTE or Consumers Energy, would most likely be unwilling to provide. Specifically, WMS was able to provide us with monthly electricity consumption data for each customer in the city of Wyandotte over a 24-month period from January 2010 to December 2011.

Heating consumption is similar to electricity consumption, in that the local utility has access to city-wide usage. Unfortunately, we were only able to work with an investor-owned utility in this case. Michigan Consolidated Gas Company (MichCon) is the natural gas provider for the City of Wyandotte. The company is a subsidiary of DTE Energy and is an investor-owned utility. Because of privacy issues, MichCon could only provide us with natural gas consumption data for municipally-owned buildings. The Accounts Payable Department at the City of Wyandotte was able to supply us with the natural gas meter numbers of the accounts paid by the city. We provided these meter numbers to an account manager at DTE and received the 18-month consumption history of all municipal buildings in Wyandotte that had natural gas meters. This

enabled us to compare natural gas and electricity usage for municipally owned buildings in the City of Wyandotte.

Emissions due to electricity consumption were also calculated for the City of Wyandotte. While WMS is required to report its annual CO2, SOx, and NOx emissions, not all municipalities have the information availability that comes with a municipally-owned utility. We therefore turned to the Emissions & Generation Resource Integrated Database (eGRID), published by the USEPA (EPA, 2010). This is a comprehensive source of emissions data from almost all electric power generation facilities in the United States. The most up-to-date database has emissions data for the year 2007. Because electricity generation varies year-to-year based upon electricity demand, emissions will also vary year-to-year. Emissions data for the year 2007 may not always be indicative of emissions occurring in the 2010-2011 timeframe of our project, but eGRID is the best way to estimate emissions occurring at the utility scale. By quantifying the electricity usage at the city level, we can determine the allocation of utility emissions caused by the city.

6.2.4 Case Study Analysis

Determining baseline energy consumption and greenhouse gas emissions for a community is essential to measuring the impact of sustainability projects. The community needs to know where it is starting from in order to figure out how much progress is being made. Because Michigan communities are working with a limited budget, it is important to know how much energy is being consumed, how much that energy costs, and how many tons of greenhouse gases are being emitted within these communities to begin with. Knowing these baseline quantities will enable communities to make educated decisions about which sustainability initiatives to pursue. For example, in the case of Wyandotte, community sustainability leaders found that they struggled in determining the effectiveness of the municipal building energy efficiency measures that were put in place using funding from EECBG. This was due to the fact that the efficiency improvements occurred at the same time as the economic recession. It was unclear if the reduced energy consumption was due to reduced activity or was a direct result of the energy efficiency upgrades. Knowing the amount of energy being used in the buildings before and after the upgrades would likely have helped in discerning this relationship. On a larger scale, community-wide energy (electricity/heating) consumption should be measured to evaluate how efficiently energy is being used in the community and how much more can be done to improve this.

While cities in Michigan are concerned about energy and emissions, the economic reality is that they need funding to invest in efficiency and renewable energy endeavors. Therefore, it was necessary to calculate the cost of energy to the city's economic vitality. We sought to quantify the amount of money being lost by the city due to electricity consumption. After determining the amount of electricity consumed annually by the city as a whole, it was necessary to determine what portion of this cost was dedicated to fuel purchases. Fuel purchases are the only costs that we know are not being re-invested in the city due to the characteristics of Michigan's fuel imports/exports. Amount of fuel purchased is calculated using kWh of electricity consumption, heat rate of the local utility's generation sources, and the local utility's grid mix as specified by

eGRID. Fuel costs were generated using figures from Holland Board of Public Works, Wyandotte Municipal Services, Energy Information Administration. Similarly, emissions (CO2e) were calculated using kWh of electricity consumption, utility heat rate and grid mix, and the average emissions rate according to eGRID.

6.2.5 Geographical Information Systems (GIS)

A significant component of the Economic Energy Analysis was mapping energy consumption patterns found in Wyandotte. Our objectives in using ArcGIS, a program for analyzing and mapping data (ESRI 2012), were to analyze energy consumption by area to allow for better energy planning strategies and to target those areas in need of improvements. ArcGIS is a useful program in displaying energy density patterns by Census tract and/or Census block to create energy districts and to determine which individual buildings and/or areas of a city to apply energy efficiency grants and projects (ESRI 2012). Additionally, with the demographic data from the US Census Bureau, GIS could identify energy consumption in comparison to income levels found in a community. Using ArcGIS, we were able to geographically map the 13,000 meters of electricity consumption data. Furthermore, we were able to display the rate class (residential, commercial, industrial, etc.) of each meter and the amount of electricity used per meter and identified which exact meters to target for energy efficiency improvements.

Six energy density maps were created for the City of Wyandotte.

1. Total Electricity Consumption per meter by Rate Class
2. Total Electricity Consumption per meter for Non Residential by Rate Class
3. Total Electricity Consumption per meter for municipal buildings
4. Total Electricity Consumption by Census Tract
5. Total Electricity Consumption by Census block
6. Total Electricity Consumption for the Residential sector by Census Tract

The methods used to create the six energy density maps are described below.

Layers

GIS data layers for the State of Michigan can be publicly found online, usually at no cost. The Michigan Department of Technology, Management and Budget Center for Geographic Information (MIGDL) hosts numerous GIS data files specific to the State of Michigan. GIS demographic and Census data can be obtained from the US Census Bureau geography database. Figure 1 shows the layers used in each map:

Figure 1: GIS Data Layers Used and Sources

Layer	Source	File Name and Description
Wyandotte City Limits	MIGDL	File name: MI Geographic Framework Cities Description: Displays polygons that represent boundaries of cities in MI
Wyandotte Census Tract	US Census Bureau or MIGDL	File name: 2011 Census Tract, MI Description: Displays MI by Census tract
Wyandotte Census Block	US Census Bureau or MIGDL	File name: 2011 Census Block, MI Description: Displays MI by Census blocks
Wyandotte Streets	MIGDL	File name: MI Geographic Framework All Roads Description: Displays all roads in the state of Michigan
Wyandotte Metered Electricity	Wyandotte Municipal Utility	File name: Geocoded and created layer from x and y coordinates Description: Displays all 13,000 metered data within the city of Wyandotte

*Sources: MI Geographic Data Library & US Census Bureau

All MIGDL and Census Bureau data layers displayed information for the entire state of Michigan that was then clipped down to the Wyandotte city limits.

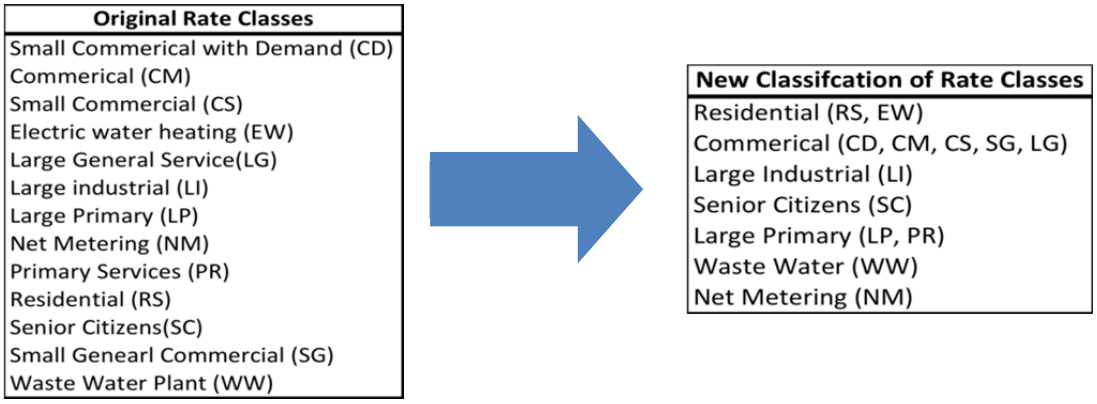
To geographically display each of the 13,000 meters of electricity consumption we needed to assign an ‘x’ and ‘y’ coordinate (latitude and longitude), or what is known as geocoding. Each meter that was provided to us also had an address as a reference to a location in the city of Wyandotte. There are many programs online that can geocode an address at no cost, however to geocode the large number of addresses we used Bulk Geocoder (Bulk Geocoder, 2012), a web application that geocodes address data to latitude and longitude; at approximately $0.02 per address, we externally geocoded 13,000 meters. We uploaded a comma separated values (CSV) file, which can be created using Microsoft Excel, containing the data, street number, street name and city. With a quick turnaround we received the file back with the appropriate geocodes. Zip codes were not necessary but preferred and prices can vary depending on the amount of data geocoded. Bulk Geocoder is one of the many other companies that can geocode in bulk. Other resources can be found in the Appendix E.

After geocoding each meter, we converted the CSV file back to a standard Excel file and in ArcGIS created a map using the 'x' and 'y' coordinates. We first defined the projection for the coordinates using a standard geographic coordinate system, WGS 1984. Then we projected into our Wyandotte database using the NAD 1983 Hotline Oblique Mercator Azimuth Natural Origin geographic coordinate system. The projection made each meter align with the street and boundary layers in the map.

Maps

For the energy density maps by sector we displayed each meter based on its rate class and consumption levels. After discussions with the Wyandotte's energy manager, we re-grouped the 13 original rates classes into six sectors. Figure 2 depicts how and what we re-grouped:

Figure 2: GIS Rate Classes Re-grouped



We set six yearly electricity consumption kilowatt ranges to display each meter's consumption. The range of electricity consumption ranged from 0 to 104,000 megawatt hours. The smaller the data point, the lower the energy consumption was; the larger the data point, the more energy was consumed. The majority of the points displayed were residential and thus for simplicity we separated out non-residential building. This helped us to depict and hone in on which buildings and areas were larger electricity consumers.

For the Census tract and Census block maps we joined each map with the metered data to create a new layer that aggregated the total yearly electricity consumptions by each tract or block. We displayed a color gradient to reflect which tract or block summed to the large amount of electricity consumed. For Census tract the scale ranged from 10,000 MWh to 133,300 MWh that was separated into five color gradient districts. The Census block map had a yearly consumption ranging from 0.5 MWh to 104,000 MWh. That range was also divided into five gradient colors. The darker the color the more electricity that tract or block consumed and the lighter the color the less consumed (See Appendix).

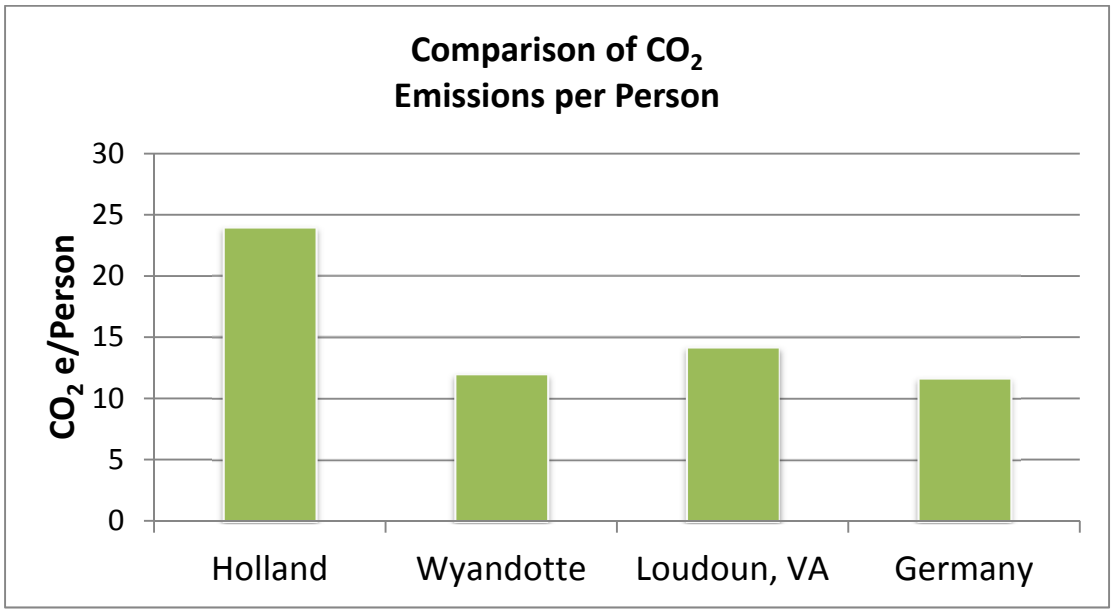
6.3 Results

We broke down the results into two sections. First we will discuss our results from our comparison analysis between the cities of Holland and Wyandotte. Then we will discuss the results for the MGC network.

6.3.1 Case Study Results

Wyandotte spends ~$12 million annually on importing fuels used for electricity generation and emits approximately 12 metric tons CO_2e/person, assuming 65% of GHG emissions are a result of electricity generation. It is interesting to note that although Wyandotte and Holland are of similar sizes and have similar climates, Wyandotte has ½ the per capita emissions compared to Holland (see Figure 3). This can be attributed to the fact that Holland has a 30% greater population, but three times more electricity usage (likely due to industry). Although, Wyandotte appears to be very energy efficient according to our results, we recommend a full-scale Community Energy Plan in order to validate our findings.

Figure 3: City per Capita CO_2 Emissions



Our GIS analysis consisted of creating and analyzing six energy density maps for the City of Wyandotte. The results of the analysis identified areas of high-energy consumption activity, the percentage of consumption attributable to the residential, commercial, and industrial sectors, and areas for energy efficiency improvements. Two maps will be described under “Mapping results”; an electricity consumption by rate class map and an electricity consumption by Census tract map. For further information about all maps, please see Appendix H.

Analytical results:

- The majority of the mapped meters belong to the residential sector, however residential is only approximately 26% of the total electricity consumed.

- The majority of non-residential buildings belong to the commercial sector. There are 1,272 Commercial buildings that comprises of 24% of the total electricity consumption for non-residential meters in the city of Wyandotte.
- There is only one large industrial building consuming 44% or approximately 103,412,991 kWh of electricity of non-residential meters.
- The upper northeast corner or tract 5801 consumes the most energy. The larger industrial sector is located in this tract, thus making it an area to target energy efficiency improvements (See Figure 4).

Mapping results:

Figure 4: Wyandotte Non-Residential Electricity Consumption

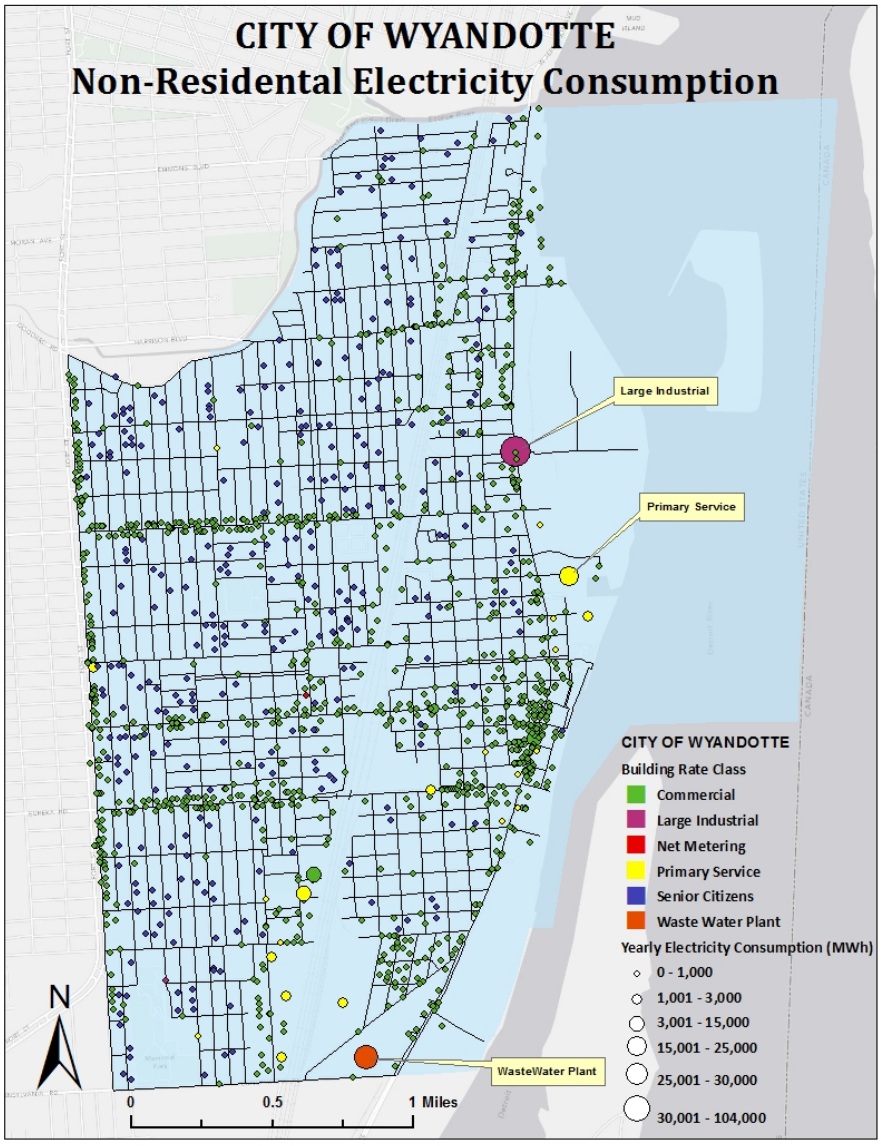


Figure 4 displays non-residential meters for the City of Wyandotte. Each meter or dot has two representations. 1. The rate class (residential, commercial industrial, etc.). 2. The electricity consumption in Megawatt hours (MWh), characterized by the size of the dot (i.e. the larger the dot the more energy consumed).

Figure 5: Wyandotte Electricity Consumption by Census Tract

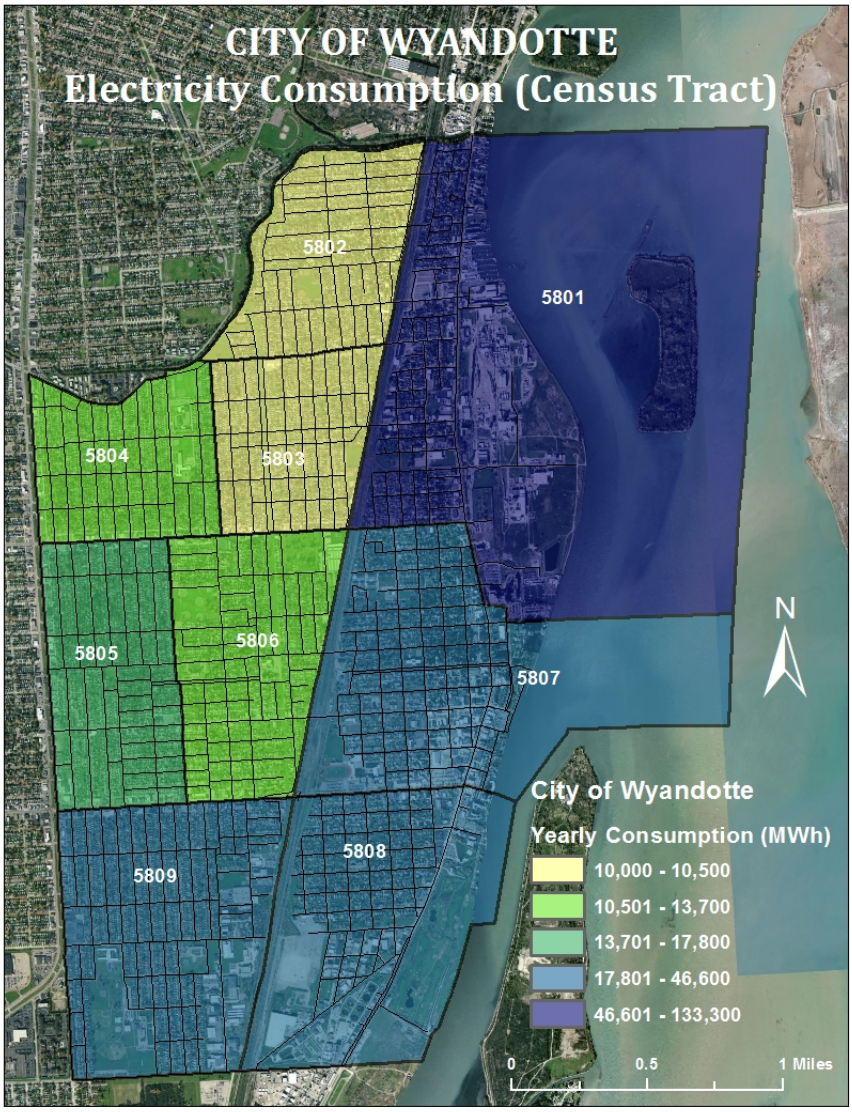


Figure 5 displays the City of Wyandotte's electricity consumption by Census tract. The map displays what districts or areas in the city need improvements and where energy efficiency grants could be applied. The color gradient displays what tract consumes more electricity. The yellow districts use less energy, while the darker tracts use more.

6.3.2 MGC Network Results

The Economic Energy Analysis component of the UM master's project resulted in two deliverables for the MGC network. (1) A case study comparing the cities of Holland and Wyandotte's energy consumption patterns, and (2) a framework of how communities can conduct and baseline their own energy demands which includes an Excel-based costing and emissions model (See Appendix E for more information). This framework also serves as an Action Item and Guide for the GCC.

The case study described throughout this paper gives communities in the MGC network additional resources. It encourages information sharing, increased dialogue, and networking amongst members who want to pursue sustainability projects throughout their communities. It provides the support for our second deliverable, the framework, and engages communities to strive to keep track of their city-wide energy usage and begin to develop strategies for implementing energy conservation measures. Additionally, the case study can be used by other Michigan cities to compare themselves against one another and provide a baseline for Michigan as a whole.

The framework on conducting an Economic Energy Analysis engages communities to take part in the Green Communities Challenge. It is one of the Action Items listed in the Challenge and completing this action can increase the ability of communities to become recognized as leaders in sustainability practices. The framework and Excel-based tool give communities the starting resources to develop a baseline of their energy consumption patterns. It brings added value to the MGC network by showing communities the need to purse energy efficiency investment and where to target those investments.

6.4 Conclusions

The Economic Energy Analysis component was able to create a step-by-step framework (Appendix E) that provides the resources and guidance for other communities to conduct their own economic energy analyses. Additionally, the team was able to analyze electricity consumption for the City of Wyandotte through GIS mapping to identify areas in need of energy efficiency improvements. We were able to gain a better understanding of some of the challenges communities face, specifically with regards to electricity and heating data availability. However, we were unable to get the full energy picture due to proprietary issues with obtaining heating data.

6.4.1 Challenges and Next Steps

As mentioned previously, a full analysis would require more heating consumption data as well as more building data. In order to fully evaluate energy consumption in the built environment, it is necessary to consider heating consumption because of its prevalence in a cold climate, such as Michigan's. Building data, specifically square feet of residential, commercial, industrial, and municipal buildings, would enable the calculation of energy use per square feet of building space. This is important in looking at how efficiently the heating or electrical energy is being

used. When compared to European buildings, these figures demonstrate the need for better building codes in the United States. They also demonstrate where energy efficiency improvements can be made, since highly inefficient buildings will provide the most financial gain and should be targeted first. Additionally, California and Massachusetts have instituted more stringent standards for metering, which allow for studying energy consumption patterns in commercial buildings at a much finer time scale. Similar standards in Michigan would allow energy consumption to be studied in real-time, which would enable building managers to use building modeling software to observe consumption patterns and come up with strategies to decrease overall building consumption.

While the project team was unable to obtain all the data we sought, other communities have run into similar problems and were able to circumvent these challenges. The City of Holland had difficulty acquiring natural gas consumption information from their local utility, Semco Energy Gas Company. Privacy was once again cited as the reason consumption data could not be released at the meter level. In order to remedy this, the Holland CEP team sent the utility a GIS map of the city segregated into energy districts. Semco was able to aggregate consumption data into these districts, bypassing the release of meter data. This strategy is similar to the idea of collecting electricity consumption data on a Census tracts or Census block scale.

Collecting building area data is dependent on the city government. Working with the Southeast Michigan Council of Governments (SEMCOG) we were able to obtain a database of information for each building in the City of Wyandotte. However, this database was dependent on the completeness of the building audits collected by the city assessor's office. Due to understaffing at the city assessor office, many reports had incomplete information. We, therefore, only obtained information for 300 out of the approximately 13,000 buildings in Wyandotte, while other communities performing this analysis may have access to more complete building information. One way around this challenge is to use GIS land use maps to estimate building area by sector (residential, commercial, industrial, etc.). Of course, city assessor data would be more accurate, but this method could allow for some preliminary analysis.

The team also compared the results from Wyandotte and Holland to those of other case studied performed by Peter Garforth and other consultants. From a per capita emissions standpoint, Holland and Wyandotte emit double the best practices set in Europe. Other North American examples in Guelph, Ontario and Loudoun County, Virginia also have significantly lower per capita emissions. Results from Holland and Wyandotte may be misleading due to the presence of heavy industry in both communities, but it is clear that Michigan can improve the management of its electric generation to produce fewer emissions, while still maintaining a high quality of life.

Additionally, improving the efficiency of the electricity grid and increasing the presence of clean energy in the state is not only beneficial for environmental reasons, but also from an economic and competitive standpoint. The cost of purchasing fossil fuels for energy generation is money

that leaves the state and never comes back. By decreasing its dependence on these fuels, Michigan keeps more money in the state and is less susceptible to energy price volatility. From a competitive standpoint, if Michigan improves the efficiency associated with its electricity grid, it is more likely to attract international companies and job creators. Many companies like LG and BASF have internal company emissions standards that comply with international mandates to reduce GHG emissions. If they decide to build a plant in the United States, these standards still apply to these plants. Therefore, these companies are attracted to communities that have clean, reliable energy and electricity resources.

6.4.2 Recommendations

Communities in Michigan can perform analyses similar to the one we performed in order to determine their baseline energy consumption and emissions. They can use this to determine how they compare to other communities across the country and around the world. When they find that other communities have found ways to more efficiently harness the full potential of their energy resources, Michigan communities can learn from these examples. Ludwigshafen, Germany provides a great example of how industry and community can work together to recover as much wasted energy that occurs due to electricity generation and industrial processes (Industry Week, 2009). By learning how to better manage their energy consumption, communities in Michigan can reduce their emissions in concurrence with increasing competitiveness and contribute to economic development goals. Community Energy Plans by various local governments in North America (Holland, 2011, Arlington County, 2011, Guelph, 2007) demonstrate that competitiveness, energy security, and environmental goals are achievable through renewable energy and energy efficiency policies at the local level.

7 Outreach Component

The Outreach component worked to improve the connections and information sharing between communities by developing an online map to illustrate sustainability actions around the state and by organizing three regional workshops. In this section, we explain our methods, results, and conclusions from supporting the network's communication programs.

Hosted by regional energy offices, the regional workshops provided a venue to share expertise, provided opportunities for the team to present its tools to MGC members, and provided networking opportunities at the regional level for more targeted sustainability discussion. The enthusiasm of workshop participants illustrated the value of MGC and the master's project; it was clear that Michigan communities are eager to improve their sustainability practices and appreciate opportunities to gain support and share ideas with their peers.

The results of all these initiatives support the Outreach component of the master's project accomplished the goal of establishing and maintaining a strong network and is well equipped to share information and leverage their common resources to effectively respond to sustainability challenges and goals in the near and long term.

7.1 Outreach Background

The Michigan Green Communities network depends on the collaboration between local governments and university staff (as stated in its Mission Statement). Currently, limited opportunities exist for communities to learn about the network and its resources and to meet other communities in the state that have similar sustainability goals and challenges. Examples of current MGC collaboration measures include: organizing an annual state-wide conference, hosting monthly conference calls, and distribution of monthly newsletters and information about events. MGC relies on communities to participate in any of these network events in order to develop an electronic roster and to establish regular contact with a representative at the local government. Additionally, an electronic library and forum, Micheen.org, had been established to encourage document sharing, which were only accessible for members.

All current MGC communication initiatives promote collaboration between municipalities with the intention of sharing innovative solutions and moving sustainability initiatives forward at the local level in Michigan. However, with limited avenues of communication, MGC has a challenge to effectively strengthen and grow the network. This provides a great research opportunity to understand possible outreach measures to improve communication within the network.

Sustainability projects through the state will become more feasible if local government decision-makers are able to readily identify regional and collaborative solutions and their benefits. The key to this process is effective communication with network members and it is through the findings of this project that MGC can gain ground in accomplishing this. The master's project team will support the MGC network by focusing on creating strategies, offering new tools, and creating greater opportunities for successful collaboration. Research into what methods of communication are most effective was conducted through stakeholder interviews throughout the 12-month process. It was determined that a robust website, a visual and interactive tool representing sustainability projects throughout the state, and a method to encourage more regionalized sharing of resources would be required to improve recruitment and engagement of member communities.

7.2 Methods

The purpose of the Outreach component was to research, develop, coordinate, and carry out the implementation of communications programs that supported the strengthening and growth of the MGC network focusing on collaboration and peer-learning possibilities. With initial contact with project sponsors: representatives from MGC, Urban Sustainability Directors Network (USDN), and supporting organization Michigan Municipal League (MML), several methods to facilitate rich peer-learning discussion opportunities and to provide collaboration opportunities were explored.

7.2.1 Workshops

MGC successfully conducted two annual state-wide MGC conferences in October, 2010 and 2011, for which 60 communities across the state traveled to Lansing, MI for a full-day

discussion. Here, municipalities from across the state each presented their current initiatives as it related to Economic Development, Natural Resources, Government Operations and Planning, and Built Environment. The challenge that a state-wide conference posed was the difficulty to showcase the full variety of sustainability initiatives being carried out by member communities. The central location still made it difficult to gather representatives from distant municipalities, and initiatives often portrayed the grandest municipality projects, which many smaller communities did not have the capital to support.

The Master's Project team also participated in the 2011 conference and used it as an opportunity to meet members of the MGC and premiere the concepts and proposals of their component area projects. The Policy component presented their work on updating the Green Communities Challenge, the Outreach component presented their work in building an interactive map as well as regional workshops in Spring 2012, and the Energy component presented their work in building an Economic Energy Analysis tool. Participant communities were very receptive to all proposed ideas and offered many resources to guide the project implementation process.

Common themes that surfaced in this state-wide conference were the economic implications for the community such as the benefits of "green" jobs and energy efficiency policy and project challenges. Also, many communities addressed that projects needed to provide long-term solutions, but there existed a disconnect with the short-term mindset of local officials. However, it was apparent that the main drivers and resources differed between different regions of the state. Thus, conference members supported the idea of a more regionalized discussion in order to share information and collaborate within a more localized region of the state based on localized and similar needs.

In order to maximize the relevance of regional discussions, the team chose to coordinate three regional workshops around the state of Michigan in February, 2012. Northern Michigan was chosen as a focus region because of the difficulty for communities in this region to physically participate in previous MGC events. Western Michigan was chosen as a focus region because of the large collection of member communities located between Lake Michigan and the capital, Lansing. Southeastern Michigan was chosen as the last focus region because of the high participation of communities within this region and their relationship with Ann Arbor and Detroit, both communities with progressive sustainability goals.

The workshop locations were determined by the presence of Michigan Energy Demonstration Centers (MEDC, 2012). Michigan Energy Demonstration Centers "promote energy efficiency, renewable energy, green building, and sustainable living solutions for Michigan residents and businesses." Furthermore, in 2011, Michigan Energy Demonstration Centers received grants from the Michigan Energy Office on the condition that the Centers would "facilitate economic recovery in Michigan" by serving as "Subject Matter Experts" for regional and local economic development organizations and Michigan Municipal League Green Community participants" (MEDC, 2011). The alignment between the goals of the Energy Demonstration Centers and the

purpose of the MGC Regional Workshops were significant and served as an opportunity to provide event hosting and sponsorship along with supporting Network members.

The common goal of regional workshop became to provide a venue for regional communication and collaboration opportunities between municipalities and non-profit organizations. The planned audience was a mixture of existing members of the MGC network, local communities unfamiliar with MGC, and local non-profit partners. The general goal of this mixture of audience was to gain a healthy understanding of all the initiatives and resources in the area.

Although the primary audience was municipalities, non-profit partners were greatly utilized during the workshop strategic process. (1) Their local positioning was utilized to invite strong and diverse local government presenters to participate in the workshop. (2) Their internal and external networks were utilized to promote and advertise the workshop event and recruit event participants. (3) In order to promote the wealth of regional resources, these non-profit organizations were offered the opportunity to share their unique offerings to a wide audience of new and MGC member communities.

In order to announce and advertise the workshops, the team worked with the hosts and sponsors in each of the regions to determine the local marketing strategies. Since local non-profit organizations were most attuned to local challenges and initiatives, they were determined to be a great resource for municipalities. These organizations also knew whether certain municipal officials preferred electronic invitations or answered to traditional telephone invitations. Non-profit partners made recommendations as to which municipality speakers to extend invitations. Since they were aware of what types of projects were happening in the region, they were able to give the most insight to planning a diverse set of projects. The insight and connections from these local partners were invaluable to carrying out the workshop planning process.

With the aid of Luke Forrest from Michigan Municipal League, Jamie Kidwell from City of Ann Arbor and a member of MGC, and the event hosts from each location, the agendas for each of the workshops were organized to maximize the benefit to the participants at the workshop. For all three workshops, half of the time was dedicated to learning about current region projects and the other half dedicated to learning about non-profit resources. Representatives of MGC member local municipalities were invited to present 10-15 minute overviews about their latest sustainability projects in their community. It was important that these representatives spoke about the benefits of the MGC network and what partnerships they had participated in. The discussion was then extended in a round-table format to the other workshop participants allowing other communities (within and outside the network) to share their current projects or challenges. Then representatives from non-profit organizations were invited to present 10-15 minute overviews about the resources their organizations offered and after hearing from communities, offer opportunities to partner and collaborate. A question and answer period followed the presentations allowing communities to learn more.

Throughout the half-day workshops, communities and non-profit partners were offered ample opportunities to network. This time was used to encourage representatives to start collaboration ideas and learn more about their community of peers. The workshop was organized to end with an opportunity to tour the Energy Demonstration Center and learn more about the facilities. We believed all of these methods would accelerate pursuit of the outreach goals.

7.2.2 Interactive Map Tool

With the aid of Matthew Naud, Environmental Coordinator at the City of Ann Arbor and a member of Urban Sustainability Directors Network, we determined that MGC needed a more effective way for communities to interact online. With the mission of MGC in mind, this online tool needed to have an interactive component which allowed communities to learn about projects occurring around the state, encourage communities to participate in the network, and educate communities about possible resources and peer-learning opportunities. A map that displayed current sustainability initiatives around the state and successfully promoted through the network would allow communities to showcase their initiatives, encourage communities to proceed with undergoing other projects, and allow communities access to information to learn about programs.

In addition to serving as a model for the Policy component, the Sustainable Jersey website also incorporated an interactive map that MGC could use as an exemplary model (Sustainable Jersey, 2012). This map conveyed information regarding particular categorized initiatives and cities very cleanly and intuitively. As the Sustainable Jersey model was able to successfully integrate their certification system along with their map, it was apparent that the MGC map tool could also integrate with the GCC in the Policy component. Sustainable Jersey used a web development firm Vertices (Vertices, 2012), based in New Jersey. With limited resources, MGC needed a more cost effective alternative method to develop a map.

Another example of an organized and intuitive interactive map tool to visual sustainability initiatives in an area is University of Michigan's Campus Sustainability map (University of Michigan, 2012). This map successfully uses Google Fusion Tables to visualize geocoded data from a database. The locations of initiatives are geocoded and loaded onto the database in Google Fusion Tables, the geocodes can be connected with a label to visualize the location, and the data is filtered so to display common text onto the web interface. To update the database and tool is relatively intuitive and many web developers are familiar with the Google Fusion Table tool.

> *"Google Fusion Tables is a modern data management and publishing web application that makes it easy to host, manage, collaborate on, visualize, and publish data tables online." (Google, 2012)*

7.3 Results

The Outreach component resulted in the delivery of three successful traveling regional workshops and an interactive map tool for the web for the Michigan Green Communities project client. This section describes these results in more detail.

7.3.1 Workshops – regionalized discussion

The goal of the 2012 MGC regional workshops was to provide a venue for regional communication and collaboration opportunities between municipalities and non-profit organizations. During these half-day workshops, communities had opportunities to learn about current projects in their region, visualize the newest tools available to MGC network as a result of the Master's Project, network with regional communities and non-profit partners to start partnerships, discover benefits of having a strong state-wide and regional network, and tour local state-of-the-art energy demonstration centers.

The Northern Regional MGC Workshop was hosted at the Energy Demonstration Center at Northwestern Michigan College in Traverse City, MI and co-sponsored by Michigan Energy Options in Marquette, MI. The Michigan Alternative & Renewable Energy Center (MAREC) at Grand Valley State University in Muskegon, MI hosted the Western Regional MGC Workshop. The Southeastern Regional MGC Workshop was co-sponsored by WARM Training Center and NextEnergy in Detroit, MI. Although not an Energy Demonstration Center, NextEnergy in Detroit, MI was chosen to host the event because their goals as a non-profit accelerator with experience in technology demonstration and public sector collaboration aligned with the goals of the workshop. (Figure 6)

Figure 6: Summary of 2012 MGC Regional Workshops and Sponsors

Workshop Name	Date/Location	Sponsors (Live Image Web Link)
Northern MGC Regional Workshop	February 16, 2012 Traverse City, MI	Michigan Energy Demonstration Centers MICHIGAN energy options
Western MGC Regional Workshop	February 17, 2012 Muskegon, MI	GRAND VALLEY STATE UNIVERSITY MICHIGAN ALTERNATIVE AND RENEWABLE ENERGY CENTER
Southeastern MGC Regional Workshop	February 24, 2012 Detroit, MI	NEXTENERGY accelerating advanced-energy technologies through collaboration southeast michigan regional energy office

In addition to facilitating the three half-day workshops, the Master's Project team presented two presentations regarding the newest tools available to the network. These presentations summarized the major deliverables as a result of the project with the MGC. We presented Green Community Challenge Updates and explained to the audience the process and results from new certification system and web-based platform. We also presented updates to the map as it planned to incorporate GCC data. Lastly, we presented the results from the Wyandotte and Holland Energy Economic Analysis and explained the benefits of using this tool throughout the network. Participants were highly receptive of all the deliverables and were able to ask questions

regarding the timeline of the release of these tools. We noticed that this venue allowed for candid and constructive feedback.

Northern Michigan Regional Workshop
This region brought together 15 different local government and tribe officials and representatives from 8 different local non-profit organizations. Speakers included four local government officials describing various projects, the Northwest Michigan Council of Governments, and three local non-profit partners. A complete agenda can be viewed in the Appendix C. Discussions allowed for municipalities to share what current projects and challenges the Northern Michigan region was participating in and experiencing. Non-profit partners engaged in a successful conversation to gather information about what resources the communities at the workshop were seeking and explaining what solutions exited regionally or state-wide.

Discussion from the Northern Michigan region workshop frequently addressed the regional importance of water quality preservation, local economic development, and energy improvement strategies. The Northern Michigan region is bounded by three of the Great Lakes: Lake Michigan, Lake Huron, and Lake Superior. Presentations about storm water management, wastewater management systems, and reducing waste through recycling all suggest that water issues are of utmost importance to this region.

Western Michigan Regional Workshop
This region brought together 17 different local government officials and representatives from 8 different local non-profit organizations. Speakers included three local government officials describing various projects and three local non-profit partners. A complete agenda can be viewed in the Appendix C. Similarly, these discussions allowed for municipalities to share current projects and examine challenges the Western Michigan region.

Projects presented by cities during the Western Michigan region workshop included public works projects, energy and sustainability planning, energy conservation, efficiency planning. Discussions included how to use the strategic assets of the community to maximize the energy future of the region. Non-profit organizations urged municipalities to continue their planning process and offered resources to help plan.

Southeastern Michigan Regional Workshop
This region brought together 20 different local governments and representatives from 8 different local non-profit organizations. Speakers included three local government officials describing various projects, the Southeast Michigan Council of Government, and three local non-profit partners. A complete agenda can be viewed in the Appendix C. Similarly, these discussions allowed for municipalities to share current projects and examine challenges the Southeastern Michigan region.

Energy projects, successful recycling initiatives, and electric vehicle infrastructure were a few projects that were presented by speakers. Participant municipalities were very excited to share

about some of their other initiatives throughout the region. They were also willing to share challenges that they were currently facing in trying to start recycling initiatives. It was apparent that even in a more localized region, there were still many differences within local governments. Municipalities also called upon the non-profit and state representatives that were present during this conversation to ask for action at the policy level. The partnerships between municipalities and non-profit organizations within the Southeastern Michigan region appeared to me the most robust.

7.3.2 Interactive Map Tool

The concept of the web interactive map was first introduced to MGC at the October, 2011 Annual Conference. Feedback from member communities was very positive as they saw the map as an opportunity to visualize member projects and get to showcase new projects. Data regarding EECBG funded projects around the State of Michigan acted as the initial data source and Google Fusion Tables were used to design the Version 1 map.

The team worked with MML web developer to upload the Google Fusion Table map onto the Green Communities web space. As a result, this map can be viewed publically online (Figure 7).

Figure 7: Interactive Map on MML Website

In order to create a uniform website, the map display properties were chosen to coordinate with data from the Green Community Challenge. The database that the Google Fusion Table is based upon will be gathered from GCC data. As communities fulfill Action List items and certify with the GCC, their data is to be incorporated into the interactive map. Projects that qualify as

economic development, built environment, natural resources, and administrative planning actions are to be geocoded and displayed with a blue, red, green, and yellow icons, respectively (Figure 8). These colors were chosen to provide continuous visual cues from the GCC. Additionally, spotlight stories highlighting GCC communities and their initiatives are be easily accessible using the map tool.

Figure 8: Map Geo-coding Icons

Color	Project Category
	Economic Development
	Built Environment
	Natural Resources
	Administration Planning

7.4 Conclusions

The team successfully conducted the first MGC regionalized workshops and proposed the groundwork for an interactive map. One of the largest concerns of Michigan communities was long-term environmental, social, and economic vitality in the community (MML Green Communities presentation, 2010). These initiatives accomplish the goal of increasing communication to strengthen the network through sharing information and leveraging their common resources to effectively respond to sustainability challenges in the near and long term.

The MGC regionalized workshops offer complementary benefits to those outreach methods that MGC currently uses. The annual October conference in Lansing focuses on state-level policy, model sustainability initiatives, and frames discussion within larger state objectives. In Lansing, there is less emphasis on regional issues. On the other hand, the workshops offer from a regional approach to specific discussion around local challenges and goals. These discussions may focus on a singular important issue, such as water conservation in the Northern region, or document various projects like in the Western region. Most significantly, local government representatives and local partners may not be able to travel long distances to Lansing, MI where the conference has historically been held. The discussion has often focused on Central and Southeastern cities that have been in attendance. The greatest benefit that travelling workshops offer is the ability for localized communities to get together to participate in relevant conversation.

MGC also hold monthly conference calls where communities can dial in and participate for an hour. The agenda of these calls is usually surrounding network updates and features one community that shares about their latest sustainability projects. These conference calls are a wealth of information to communities who are interested in that one particular featured project. On the calls there are few networking opportunities and the communication usually focus on past

achievements. One of the great different benefits that the regional workshops provide is the opportunity to directly network with peers and partners and participate in progressive discussion leading to change within the network. Additionally, meetings and workshops allow for the initial personal contact needed to bolster active conversations on conference calls.

7.4.1 Challenges and Next Steps

Although the Outreach initiatives were developed by the team, the success of these initiatives in bringing sustained results relies on the network and coordinators. It was apparent that much of the network relies on relationship management. Especially for the workshops, had it not been for the local non-profit organizations, regional municipalities and partners would not have been notified. In order to grow the network, not only are resources and peer-learning opportunities needed, but those communities must be aware of the network.

Regional Workshops

The workshops provided the network with the first concentrated interaction between regional non-profit organizations and municipalities. The workshops were successful because the mission and objectives of the non-profit organizations aligned with that of MGC and those of the municipalities. This alignment brought about successful discussion and networking opportunities. In order to coordinate continuing opportunities for collaboration, the network must identify the constraints of their members (location, relevancy) and address those by finding the correct partners. For example, if the network identifies that municipalities in a certain region are focusing on economic development Action Items, it may be beneficial to develop opportunities with local business development organizations.

The future for annual regional workshops depends on the coordination of the network. Tasks for the MGC Fellow would include continued communication with existing MGC members and encouragement to participate in MGC events. Strategic coordination is necessary to put together regional resources for municipalities to access. Partnering with local partners and energy demonstration centers with common goals may help elevate some financial and marketing burdens.

Interactive Map

The interactive map has great potential in being a successful tool that communities go to for common information as well as encouragement for MGC participation. The platform exists for a very complete database to be assembled. However, the success of the map relies on information data gathered for the GCC. The map currently is based on data from EECBG funded projects and thus all these projects would fall under the same categorized Action List. Also, the MGC may want to use the expertise of a firm such as Vertices to build a customized and integrated certification website and map. Such an investment would take capital, however, it would make for the most streamlined process between GCC certification and display on the map. Vertices offered a quote of $10,000 to build a comprehensive certification website and interactive map, similar to Sustainable Jersey.

Tasks for the MGC Fellow include compiling the data from Green Community Challenge participants onto the common database and uploading it onto Google Fusion Tables. The Fellow should also work with the MML web developer to update and upload the new Google Fusion Tables onto a website for viewing.

7.4.2 Recommendations

As the MGC continues to grow, it will need to continue the relationship building and networking to establish a strong and collaborative network. In addition to conference calls, web resources, annual conference, and now regional workshop discussions, the MGC can benefit from establishing a new 501(c)(3) non-profit entity to oversee and strengthen the MGC network. This permanent institution, managed with the help of university student fellows, will lend legitimacy, effectiveness, and staying power to MGC network to build off the work done by this project team. The role of an institution will specifically benefit the sustained outreach goals by being able to continue managing relationships, facilitating the collaboration operations, and maintaining the interactive map tool.

Lastly, the team has proposed to work with supporting organizations, like the MML, to redesign a website that offers easily accessible information and resources in order to continually provide value to Michigan cities and communities. The website that exists currently is unable to incorporate the GCC tasks, the interactive map, spotlight projects, and complete resources into one streamlined unit. Once communities begin to participate in the GCC, the data collected in electronic format can be incorporated into the data for the map that will be displayed online with links to the electronic spotlight documents.

8 Synthesis

8.1 Project Goals and Connections between Components

Overall, the Michigan Green Communities master's project was successful in meeting its goal of developing mechanisms to strengthen and support the Michigan Green Communities network. Each of the three components created concrete tools to improve the functioning of MGC: The Policy component provided a significant overhaul of the Green Communities Challenge in order to facilitate communities' reporting of their sustainability activities and foster increased action through friendly competition. The Economic Energy Analysis component developed a detailed model which communities can use to assess their energy use and expenditures. The Outreach component created an interactive map to encourage information sharing among communities, as well as successfully running three regional workshops which can serve as a model for future opportunities for MGC members to interface with communities in their area. Each of these outcomes stands alone as useful additions to MGC.

However, the connections between the three components add further value to the project outcomes. The Economic Energy Analysis tool provides communities with clear motivation to

pursue energy-saving measures which are included in the Green Communities Challenge. The tool is therefore included as an Action Item in the Built Environment Action List. While participation in the GCC can be motivated by the Economic Energy Analysis, its use and results will be publicized through the mechanisms introduced by the Outreach component. Collection of case studies for the "spotlights" within the Action Guides should provide direct inputs to the sustainability action database portrayed in the map tool. The map, in turn, will help communities see what kinds of activities are being completed by their neighbors or where they can find a model for a particular project. This should encourage further action within the GCC. The regional workshops proved an effective means of further recruitment and explanation for the GCC, and will likely lead to increased GCC and MGC membership. The workshops and the annual conference will also serve as important venues at which to recognize community GCC achievements. Finally, an improved website will increase the accessibility of the GCC, Economic Energy Analysis tool, and the network as a whole. Additional development of all of these project components, as outlined below, is important for the continued strengthening of MGC.

8.2 Adaptation Relevance

Potential changes in temperature, precipitation, ecosystems and extreme weather events are all threats that communities face as the result of climate change. Because these impacts are localized and different for each community, it is the responsibility of local governments to determine how best to prepare for these potential challenges. Given the nascence of climate change action and adaptation planning, collaboration between communities is crucial to successfully developing plans with limited time and budget constraints. The development of a robust institution to support the MGC network will provide a means for cities to meet their adaptation needs now and in the future.

Municipalities can take action to prepare for the risks associated with climate change and reduce the cost of responding to it. Such preparation will also encourage sustainable community development while cutting costs and result in more pleasant communities regardless of climate change. By developing a Climate Adaptation Plan (CAP) such as describe in the Action Guide created for the GCC, municipalities can identify feasible and effective policies to prepare for the impacts of climate change and gain these benefits.

A Climate Adaptation Plan (CAP) is a set of strategies and actions designed to reduce a municipality's vulnerability to the impacts of climate change. A CAP establishes a timeline for achieving specific climate preparedness goals, identifies key strategies for achieving these goals, and tracks progress through the use of measures or indicators. A CAP can also help prioritize the allocation of funding and resources, and analyzes the costs and benefits that result from implementing new strategies. A CAP includes actions to address climate change vulnerability at these two different levels: Municipal actions will target improving climate resilience in municipally-managed facilities, infrastructure, operations, and services. Community actions will

require joint efforts of the public and private sectors, and include policy changes that will affect the lives of residents and operations of local private businesses.

Additionally, our project seeks to identify where a city gets its energy from and where the electricity demand comes from within the city. By identifying its mix of energy source(s), the city can determine how reliable its energy supply is and how vulnerable these sources are to the effects of climate change. Meanwhile, identifying where its energy demand is coming from can help the city to strategically reduce demand as climate change forces increased peaks in electricity consumption due to extreme weather events. In order for cities to effectively adapt to climate change, resilience is essential. By determining where energy systems are susceptible to climate change impacts, the city can develop contingencies for future emergencies and decide which infrastructure and operations need to be invested in to prepare for these impacts.

8.3 Future Research

There are a number of opportunities for future research, including specific tasks that the MGC Fellow or an intern might undertake. As mentioned above, further research into “spotlight” case studies and financial resources are both in great need. A researcher should look into state and Federal grant and loan opportunities as well as private companies as potential funding sources.

Demographic studies done using GIS would allow cities and utilities to better target their energy efficiency efforts. This would involve using Census block or Census tract data, to compare energy consumption to demographic data (i.e. income levels). This would be particularly helpful in comparing energy consumption between neighborhoods of similar income level. While Wyandotte was a great case study, the network will benefit from learning the baseline of other cities. By knowing energy consumption baseline, communities can determine the effectiveness of their sustainability initiatives in the future and realize the economic potential of energy savings

There are also opportunities to research where energy imports are coming from and ways to reduce imports. Due to time constraints, fuel imports were not sourced. In determining future vulnerability and volatility of energy supplies, communities should determine which fuel sources they are most dependent on and where these fuels are being imported from. Additionally, determining opportunities for localizing energy resources (both renewable and non-renewable) can increase the energy security of MGC and the state as a whole.

Finally, the MGC Fellow or intern can play an important role in the development of the program moving forward. The future for annual regional workshops depends on the coordination of the network. Tasks for the MGC Fellow would include continued communication with existing MGC members and encouragement to participate in MGC events. Also, coordination is necessary to put together regional resources for municipalities to access. The Fellow could also compile the data from Green Community Challenge participants onto the common database and

upload them onto Google Fusion Tables. The Fellow should work with the MML web developer to update and upload the new Google Fusion Tables onto a website for viewing.

8.4 Recommendations

Each of the three components had a number of recommendations worth emphasizing.

8.4.1 Policy

- The GCC should provide webinars and one-on-one support for communities as they work through the new Action Lists and certification system.
- Increasing the depth and scope of the resources provided in the Action Guides should also be a priority, with emphasis placed on expanding the "spotlight" section and the financial resources sections.
- The GCC should also pursue a leadership role in helping develop similar programs in other member states in the MRSN.
- Continue to consult with Sustainable Jersey and organizations such as the Institute for Sustainable communities to efficiently increase GCC and MGC's capacity and resources.

8.4.2 Economic Energy Analysis

- Develop partnerships with DTE, Consumers, and other utilities to increase information availability for an accurate representation of energy consumption at the city-wide level. Utilities may be interested in this exercise if it can decrease their peak demand.

8.4.3 Outreach

- Continued relationship management is a key factor to the strength of network.
- Soliciting supporting organizations to help sponsor Regional MGC Workshops will help foster strong relationships with external resources for community members.
- Focus communication programs to provide additional opportunities for collaboration and peer-learning.
- MGC can benefit from establishing a new 501(c)(3) non-profit entity to oversee and strengthen the MGC network. This permanent institution, managed with the help of university student fellows, will lend legitimacy, effectiveness, and staying power to MGC network to build off of the work done by this project team. The role of an institution will specifically benefit the sustained outreach goals by being able to continue managing relationships, facilitating the collaboration operations, and maintaining the interactive map tool.
- Work with MML to redesign a website that offers easily accessible information and resources. Use GCC data to populate the interactive map.

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10 Appendices

10.1 Appendix A: List of Supporting Michigan Communities

Albion
Alcona County
Allegan
Alma
Alpena County
Ann Arbor
Ash Township
Birmingham
Boyne City
Brandon Charter Township
Briley Township
Charlevoix
Corunna
Dearborn
Delta Charter Township
Detroit-Wayne County Port Authority
Dexter
Douglas
East Lansing
East Tawas
Emmet County
Farmington Hills
Ferndale
Ferrysburg
Flushing
Forestville
Gladwin
Grand Blanc
Grand Haven
Grand Rapids
Greenville
Grosse Pointe
Grosse Pointe Woods
Harbor Beach
Highland Charter Township
Holland
Huntington Woods
Imlay City
Isabella County
Ishpeming
Ithaca
Jonesville
Kalkaska
Kinross Charter Township
Lathrup Village
Lenawee County
Leslie
Lincoln Park
Linden
Mackinaw City
Madison Heights
Manistee County
Marquette
Mason
Meridian Charter Township
Milford
Milford Charter Township
Missaukee County
Monroe County
Muskegon County
New Haven
Norton Shores
Oak Park
Orion Charter Township
Osceola County
Otsego
Quincy
Rogers City
Roscommon
Roscommon County
Roseville
Saint Clair
Saline
Southgate
Spring Lake
Springfield
Sturgis
Swartz Creek
Three Rivers
Tittabawassee Township
Traverse City
Troy
Tuscarora Township
Union Charter Township
Utica
Vassar
Wayland
Wayne
Westland
Williamstown Township
Wyandotte Municipal Services
Ypsilanti

10.2 Appendix B: Action Item Lists

10.2.1 Admin/Planning Action List

- Sustainability Team
    - Establish a Community Sustainability Team composed of local residents and businesspeople who are representative of the larger community to advise and assist the local governing board on policies and practices dealing with the environment, energy efficiency and conservation. (10 points)
    - Establish a Government Sustainability Team composed of a diverse cross-section of departmental staff members to interface with Community Sustainability Team and coordinate sustainability initiatives within the local government. (10 points)

- Sustainability Planning
    - Complete and adopt a community sustainability plan to identify priority resources, issues, and actions to achieve community sustainability goals. (40 points for complete plan, or 5-10 points for each component)
        - Community asset mapping (5 points)
        - Vision statement and goals (10 points)
        - Indicators and targets (10 points)
        - Action plans (10 points)
    - Establish sustainability targets and indicators within municipal master plans (10 points)
    - Integrate environmental equity goals and actions into the community master plan and land development ordinances and policies. (10 points)
    - Establish joint planning initiatives through collaboration with neighbor communities (15 points)
    - Establish a comprehensive community energy plan (15 points)
    - Complete and adopt community climate change plans to reduce the impacts of climate change and increase community resilience to these impacts. (15 points each)
        - Municipal (15 points)/community (additional 10 points) carbon footprint
        - Climate action plan—mitigation
        - Climate action plan—adaptation
    - Create an Open Space and Recreation Plan to examine open space and recreation needs and lay out a plan of action to protect and maintain these resources. (10 points)
    - Create a Comprehensive Farmland Preservation Plan to support community agricultural heritage while envisioning a robust future food system. (10 points)

- Coordinate with school district to reduce school energy consumption, waste production, and other environmental impacts. (10 points)

- Adopt community ordinances which enable and/or encourage the development of sustainable projects, such as renewable energy technologies. (5 points each)

- Participate in a collaborative regional initiative related to the category of Administration and Planning with other communities. (15 points for each regional initiative not yet counted)
- Describe an additional community sustainability action that fits under the category of Administration and Planning but does not appear on this list. (Points assigned based on scope of action)

10.2.2 Built Environment Action List

- Pursue outreach programs in partnership with utilities, non-profit organizations, and government agencies to provide education and incentives to increase energy efficiency in the community outside of municipal government. (10 points each)
    - Organize a community energy outreach and education program
    - Promote efficient home heating and cooling
    - Encourage home energy audits and upgrades
    - Promote Energy Star appliances and products
    - Establish PACE financing

- Implement or partner with utility or developer to install distributed energy resource technologies that significantly increase energy efficiency, or innovative renewable energy demonstration projects. (25 points each)
    - Solar Photovoltaic
    - Solar Thermal
    - Wind
    - Geothermal
    - District heating and cooling systems
    - Combined heat and power systems
    - Cogeneration systems
    - Energy storage systems
    - Other

- Pursue programs to improve the efficiency and reduce the impact of outdoor municipal lighting fixtures. (10-30 points each)
    - Develop a policy to encourage energy-efficient and dark sky-compliant outdoor light fixtures. (10 points)
    - Replace municipal traffic signals, street lighting, and parking illumination with energy efficient lighting technologies, including light emitting diodes or any other technology of equal or greater energy efficiency. (30 points, depending on scope)
    - Encourage replacement of non-municipal owned outdoor lighting fixtures in partnership with county, utility, or other lighting owners/operators. (10 points)

- Complete energy audits for municipal facilities, utilizing partnerships with non-profit organizations when available. (5 points per baseline audit per building; 10 points per comprehensive audit per building, up to 50 points total)

    - Use Economic Energy Analysis tool to measure community energy use, expenditure, and environmental impact. (20 additional points)

    - Institute systematic tracking and record-keeping (such as Energy Star Portfolio Manager) of municipal energy bills for electricity, natural gas, and transportation fuels. (10 points)

- Implement sustainable design standards for new and renovated municipal buildings. (10 points each)
    - Adopt sustainable building policy/resolution.
    - Adopt new construction standards and checklists, such as LEED or similar.
    - Build a LEED (or similarly)-certified building. (25 points-LEED; 20 points other)
    - Adopt sustainable historic buildings policy, encouraging re-use of existing buildings.
    - Upgrade/retrofit municipal buildings- water conservation. (5 points per building, up to 25 points)
    - Upgrade/retrofit municipal buildings- lighting efficiency. (5 points per building, up to 25 points)
    - Use performance contracts to fund building upgrades. (5 points per building, up to 25 points)
- Promote sustainable design and construction in commercial and residential buildings. (10 points each)
    - Implement a Sustainable Building Scorecard, such as LEED checklist or similar, for new construction and renovation permit applications.
    - Encourage the construction of LEED (or similar)-certified buildings. (10 points per building, up to 30 points)
    - Provide public sustainable building technique education/training.
- Adopt municipal staff behavioral policies or programs to conserve energy and save money in municipal buildings. (5 points)
- Implement a program such as “Complete Streets” to facilitate equitable use of roadways by all types of travelers including pedestrians, bicyclists, and motorists in order to create a healthier and safer community.
    - Propose program through resolution or ordinance. (5 points)
    - Develop thorough non-motorized plan. (10 points)
    - Implement plan within community and measure results. (15 points)
- Encourage municipal employees to reduce their transportation impact by providing benefits for ride sharing, walking, biking, or taking public transit to work and allowing employees to participate in alternative work schedules or telework. (10 points)
- Install or partner to achieve installation of electric vehicle infrastructure to facilitate the adoption of EVs in the community. (10 points)
- Participate in a collaborative regional initiative related to the category of Built Environment with other communities. (15 points for each regional initiative not yet counted)
- Describe an additional community sustainability action that fits under the category of Built Environment but does not appear on this list. (Points assigned based on scope of action)

10.2.3 Economic Development Action List

- Acknowledge companies that pledge to implement sustainable practices through a business recognition program. (15 points)

- Create local food and agriculture programs to support and strengthen the local food production sector. (10 points each)
    - Identify and promote farmers markets and cooperatives
    - Establish a buy local produce program
    - Support and track community gardens

- Pursue economic gardening as an alternate economic development strategy to create new business and employment opportunities through local entrepreneurial activity. (15 points each)
    - Provide business development and marketing support
    - Establish a buy local campaign targeted at local businesses or support existing programs

- Implement an economic development plan that makes existing businesses more sustainable, identifies opportunities for collaboration, and supports the development of clean economy industries in the region including green construction, clean energy, and recycling. (20 points)

- Encourage the growth of a green workforce through partnerships. (10-15 points each)
    - Collaborate to develop workforce training programs (10 points)
    - Track green jobs and assess workforce capacity (15 points)
    - Create green jobs advisory council (10 points)
    - Create local green job corps (10 points)

- Adopt a brownfields development plan that reinvests in marginal land to benefit the community as a whole. (20 points)
- Participate in a collaborative regional initiative related to the category of Economic Development with other communities. (15 points for each regional initiative not yet counted)
- Describe an additional community sustainability action that fits under the category of Economic Development but does not appear on this list. (Points assigned based on scope of action)

10.2.4 Natural Resources Action List

- Adopt forestry management plans and programs to protect and conserve street tree and woodland resources. (10-20 points each)
    - Develop a community forestry plan and canopy goal (15 points)
    - Create tree planting programs (10 points)
    - Perform tree hazard and health assessment inventory projects maintenance programs (10 points)
    - Arbor Day Tree City designation program (10 points)

- Adopt a community wide anti-idling policy. (10 points)

- Adopt "green fleet" policies that improve local air quality and encourage alternative fuel use. (10-30 points each)
    - Perform a fleet inventory of municipal vehicles (20 points)
    - Create a driver training program (10 points)
    - Convert existing fleet vehicles to run on clean and efficient fuels (15 points)
    - Adopt anti-idling policy for municipal vehicles (10 points)
    - Purchase an alternative fuel vehicle (20 points)
    - Incorporate consideration of vehicle efficiency and life cycle costs into new municipal vehicle acquisitions (5 points)
    - Make progress towards fuel efficiency target for green fleets (up to 30 points)

- Develop water protection and conservation plans, ordinances and programs to ensure the availability and quality of community water resources while also protecting the surrounding watershed. (10-20 points each)
    - Develop and implement a water conservation, watershed protection and/or storm-water management plan (15 points for each)
    - Treat storm-water as a utility service (15 points)
    - Create water conservation education program (10 points)

- Implement waste, recycling, and compost programs to ease pressure on waste disposal sites and lower landfill disposal costs. (10-20 points each)
    - Develop recycling and waste programs for residents, businesses, and/or municipal buildings (10 points for each)
    - Establish a procurement policy for municipal buildings of a minimum of 30% postconsumer recycled content for everyday office paper use (10 points)
    - Establish a recycling depot or drop off station (15 points)
    - Perform a waste audit of municipal buildings (15 points)

  - Establish a citywide composting program (10 points)
  - Provide hazardous waste, e-waste, or pharmaceutical waste disposal services (10 points)

- Participate in a collaborative regional initiative related to the category of Natural Resources with other communities. (15 points for each regional initiative not yet counted)
- Describe an additional community sustainability action that fits under the category of Natural Resources but does not appear on this list. (Points assigned based on scope of action)

10.3 Appendix C: MGC Regional Workshop Agendas

Figure C - 1: Northern Workshop Agenda

Northern Michigan Green Communities Workshop

Thursday, February 16, 2012
11:30AM – 4:00PM, Optional Tour to follow
The Energy Center at Northwestern Michigan College
University Center, Room 7, 2200 Dendrinos Drive, Traverse City, MI 49686

Thursday 2/16/2012	**Agenda item**
11:30 AM – 12:00 PM	Lunch Provided & Check In
12:00 PM – 1:00 PM	*Introduction to Michigan Green Communities Network and Newest Tools Available to MGC* Presentation by University of Michigan student group consulting with Michigan Green Communities
1:00 PM – 1:10 PM	*Regional Focus: Municipalities – City of Charlevoix (10 min)* Presentation by Rob Straebel
1:10 PM – 1:20 PM	*Regional Focus: Municipalities – Emmet County (10 min)* Presentation by Elisa Seltzer
1:20 PM – 1:30 PM	*Regional Focus: Municipalities – Traverse City (10 min)* Presentation by Ken Gregory
1:30 PM – 1:40 PM	*Regional Focus: Municipalities – Manistee County (10 min)* Presentation by Glenn Lottie, Jim Krolczyk, and Rachel Nelson – Activities of Manistee County's Green Team
1:40 PM – 1:50 PM	*Regional Focus: Regional Planning Agency – Northwest Michigan Council of Governments (10 min)* Presentation by Patty O'Donnell
1:50 PM – 2:20 PM	*Regional Focus: DISCUSSION* (30 min) Open up floor for all municipalities in region to share current projects, question/answer period
2:20 PM – 2:45 PM	Networking and coffee break
2:45 PM – 2:55 PM	*Regional Focus: Local Non-Profit Partners – Northwestern Michigan College (10 min)* Presentation by Bill Queen - How the Energy Demonstration Center at Northwestern Michigan College Can Support Your Programs
2:55 PM – 3:05 PM	*Regional Focus: Local Non-Profit Partners – MI Energy Options (10 min)* Presentation by John Kinch
3:05 PM – 3:15 PM	*Regional Focus: Local Non-Profit Partners – Michigan Land Use Institute (10 min)* Presentation by Brian Beauchamp
3:15 PM – 3:45 PM	*Regional Focus – Discussion led by Panel* Question and Answer period (30 min)
3:45 PM – 4:00 PM	Wrap-up discussion
4:00 PM – 5:00 PM	Optional tour of The Energy Center: Aero Park Laboratory Building 2525 Aero Park Drive Traverse City, MI 49686

Figure C - 2: Western Workshop Agenda

Western Michigan Green Communities Workshop

Friday, February 17, 2012
11:00 AM – 4:00 PM, Optional Tour to follow
Michigan Alternative & Renewable Energy Center (MAREC) at Grand Valley State University
200 Viridian Drive, Muskegon, MI 49440

Friday 2/17/2012	**Agenda item**
10:00 AM – 11:00 AM	Pre-workshop talk by Gregory Truex – How can Michigan PACE Energy Program help your city
11:00 AM – 12:00 PM	Lunch Provided & Check In
12:00 PM – 1:00 PM	*Introduction to Michigan Green Communities Network and Newest Tools Available to MGC* Presentation by University of Michigan student group consulting with Michigan Green Communities
1:00 PM – 1:15 PM	*Regional Focus: Municipalities – Grand Haven (15 min)* Presentation by Ian Blanding – "5000 Trees" presentation
1:15 PM – 1:30 PM	*Regional Focus: Municipalities – Muskegon County (15 min)* Presentation by Leslee Rohs – Muskegon County Sustainability Programs
1:30 PM – 1:45 PM	*Regional Focus: Municipalities – Holland (15 min)* Presentation by Mark Vanderploeg
1:45 PM – 2:15 PM	*Regional Focus: Municipalities* (30 min) Breakout Session - Open up floor for all municipalities in region to share current projects, question/answer period
2:15 PM – 2:45 PM	Networking and coffee break
2:45 PM – 2:55 PM	*Regional Focus: Local Non-Profit Partners – MAREC (10 min)* Presentation by Kim Walton
2:55 PM – 3:05 PM	*Regional Focus: Local Non-Profit Partners – Sustainability Coalition (10 min)* Presentation by John Koches - Muskegon Area Sustainability Partnership
3:05 PM – 3:15 PM	*Regional Focus: Local Non-Profit Partners – West Michigan Strategic Alliance (10 min)* Presentation by Greg Northrup - Communities Strategic Assets
3:15 PM – 3:45 PM	*Regional Focus: Local Non-Profit Partners* Discussion / Question and Answer period (30 min)
3:45 PM – 4:00 PM	Wrap-up discussion
4:00 PM – 5:00 PM	Optional tour of MAREC facility
Afterwards	Additional networking opportunity & Happy Hour

Figure C - 3: Southeastern Workshop Agenda

Southeastern Michigan Green Communities Workshop

Friday, February 24, 2012
8:00 AM – 12:45 PM, Optional Tour to follow
NextEnergy, 461 Burroughs, Detroit, Michigan 48202

Friday 2/24/2012	**Agenda item**
8:00 AM – 8:30 PM	Breakfast & Check in – NextEnergy atrium
8:30 AM – 9:30 AM	*Introduction to Michigan Green Communities Network and Newest Tools Available to MGC:* *(1) Green Communities Challenge Update* *(2) Economic Energy Analysis* Presentation by University of Michigan student group consulting with Michigan Green Communities
9:30 AM – 9:40 AM	*Regional Focus: Municipalities – Detroit (10 min)* Presentation by Brad Dick – "Greening" of Detroit City Operations
9:40 AM – 9:50 AM	*Regional Focus: Municipalities – Wyandotte (10 min)* Presentation by Melanie McCoy
9:50 AM – 10:00 AM	*Regional Focus: Municipalities – Eastpointe (10 min)* Presentation by Steve Duchane
10:00 AM – 10:10 AM	*Regional Focus: Municipalities – Huntington Woods (10 min)* Presentation by Claire Galed – Energy Initiatives for Better Future
10:15 AM – 10:45 AM	*Regional Focus: Municipalities - BREAKOUT SESSION* (30 min) Divide into 2 groups: Open up floor for all municipalities in region to share current projects, question/answer period
10:45 AM – 11:15 AM	Networking and Lunch pick up (Catering by Mudgies) – Atrium
11:20 AM – 11:30 AM	*Regional Focus: Regional Agency – Southeast Michigan Council of Government (10 min)* Presentation by Angela Ayers – Regional Green Infrastructure Efforts
11:30 AM – 11:40 AM	*Regional Focus: Local Non-Profit Partners – NextEnergy (10 min)* Presentation by Chris Detjen
11:40 AM – 11:50 AM	*Regional Focus: Local Non-Profit Partners – Southeast Michigan Regional Energy Office (10 min)* Presentation by Sam Offen
11:50 AM – 12:00 PM	*Regional Focus: Local Non-Profit Partners – Clean Energy Coalition 10 min)* Presentation by Jenny Oorbeck
12:00 PM – 12:30 PM	*Regional Focus: Local Non-Profit Partners PANEL* Discussion / Question and Answer period (30 min)
12:30 PM – 12:45 PM	Wrap-up discussion
12:45 PM – 1:30 PM	Optional tour of NextEnergy facility

10.4 Appendix D: Michigan Green Communities Challenge How-to Guide

Introduction

The Michigan Green Communities Challenge is a certification and recognition program designed to promote information sharing and friendly competition between communities as they attempt to become more sustainable. The Green Communities Challenge has been recently revised from its previous form as the Challenge Progress Report to a new certification-based program. This new program, now simply called the "Green Communities Challenge" (GCC), expands upon the previous Progress Report by providing communities with the guidance and the resources they need to accomplish various sustainability initiatives and projects. The new program is now also completely web-based. Communities familiar with the previous Progress Report will notice a number of similarities between the two programs; however, the new GCC addresses a number of new sustainability topics and is structured much differently. The purpose of this how-to guide is to provide information and instruction on how to use the new program for those communities both familiar with the previous program and those new to the Michigan Green Communities Challenge.

Becoming a Member

Becoming a member of the Green Communities Challenge is a straightforward process. A community needs to pass a resolution indicating that the governing board wants to participate in the challenge and is committed to pursuing the sustainability goals of the GCC. A sample resolution is available on the Michigan Municipal League website and is also included in the Appendix. It is also important that a community assign responsibility for the administration of the Challenge within the community. This could be done by a staff member or an advisory commission. Communities should also be ready to promote the GCC among community residents.

Action List Categories

Sustainability initiatives and projects within the Green Communities Challenge are organized into four different Action List categories. These categories are: *Administration and Planning*, *Built Environment*, *Natural Resources*, and *Economic Development*. Administration and Planning incorporates organizational measures carried out by the municipality such as developing sustainability teams and plans. Built Environment encompasses energy efficiency and renewable energy, building design and practices, and transportation infrastructure. Natural Resources is focused on urban forestry, air and water quality, and waste management. Finally, Economic Development encourages green business practices and opportunities to sustainably develop the community.

Action Items and Action Lists

Each of these four Action Lists contains 10 to 15 sustainability initiatives or projects referred to throughout the program as "Action Items." Action Items replace the "goals and activities" listed

as part of Step 5 of the old Progress Report. Each Action Item is assigned a point value ranging from 5 to 50 points based on the human and capital resources that are required for its successful completion. In some cases, communities can gain partial points based on their progress towards a particular Action Item. In order to gain credit for completing an action, communities should be ready to submit a short paragraph through the web-based interface explaining how their project qualifies as a particular Action Item (this process is still in development). Submissions will be accepted until a month before the annual Michigan Green Communities conference in order to provide time for administrators to review the material. See the "Benefits to Communities" section for more information on the connection between the GCC and the annual conference.

Action Item Guides

The GCC provides communities with clear guidance on how to successfully complete Action Items. A new page will open on the website when a user clicks on any of the Action Items in any of the Action Lists. This new page will contain an "Action Item guide" that will lead the user through how to complete the Action Item. Each guide follows an identical format and includes the following sections:
Introduction

- Why important
- Who to involve
- Timeframe
- Project costs
- What to do
- Submission requirements
- Spotlight
- Resources

More specifically, the spotlight section highlights exemplary community sustainability initiatives through short case studies. The idea is to provide communities with a starting point for networking and collaboration. The spotlight section will expand as more communities submit project descriptions described above to the website. The resources section will be updated with further informational and financial resources in the future as well.

Certification System

The purpose of the GCC certification program is to incentivize productive competition between Michigan communities related to sustainability, recognize outstanding community performance, and to provide a benchmark by which communities can compare their sustainability activities to each other. The certification system seeks to achieve all of these key goals through a tiered system that recognizes varying levels of community sustainability action. Communities can achieve one of four certification levels: Member, Bronze, Silver, and Gold.

Additionally, the certification system recognizes that communities differ in their resources and capacity to pursue sustainability initiatives. Therefore the certification system is divided into a number of community classes that ensure that municipalities are evaluated against their peers. These community classes include villages, general law townships, counties, cities and charter townships with less than 10,000 residents, and cities and charter townships with more than 10,000 residents.

The following provides an outline of the pre-prerequisites for each certification level:

Member: The only pre-requisite to becoming a Member level community is to sign the GCC resolution or letter of commitment. As such, all currently participating communities in the GCC are automatically considered Member communities because they have already signed the GCC resolution. Communities who join the challenge in the future will have to sign the resolution to achieve Member status. The GCC resolution shall include a designated contact person within the government of each community, and a statement of community goals within the Challenge. Member status is a prerequisite to Bronze level certification.

Bronze: Achieving Bronze level certification requires that a community organize a Sustainability Team to oversee MGC challenge activities. The Sustainability Team may consist of either municipal staff members or community volunteers, or ideally both. These team members leverage their skills and expertise to provide leadership, develop plans, and implement programs related to the GCC. Additionally, gaining Bronze certification requires communities to perform at least two Action Items in each of the four Action Item categories. Bronze status is a prerequisite to Silver level certification.

Silver: Silver level certification requires communities to perform at least four actions in each of the four Action Item categories. A community's total score will then be calculated by adding up the total point value of the completed actions across the four categories. In order to achieve Silver certification, a community's total score must be within the top 50th percentile of scores reached by communities of similar scale and jurisdictional structure. Silver level communities are also expected to participate in at least one Michigan Green Communities event per year, either in person or by phone. Silver status is a prerequisite to Gold level certification.

Gold: Gold level certification requires communities to perform at least six actions in each of the four Action Item categories. A community's total score will then be calculated by adding up the total point value of the completed actions across the four categories. In order to achieve Gold certification, a community's total score must be within the top 75th percentile of scores reached by communities of similar scale and jurisdictional structure.

Community Recognition

Communities at each level of certification will be recognized on the GCC and Michigan Green Communities websites, honored at annual conferences (MGC, MML), and given official virtual certification seals to acknowledge their accomplishments. A most-improved award will be given in each community class. A press release template will be developed to help certified communities share their achievement. Over the long term, financial incentives and priority access to funding opportunities for certified communities will be pursued.

Transition from the Progress Report

Communities that have previously filled out the Progress Report will need to fill out the new Green Communities Challenge as well. This is simply due to the fact that the new GCC is significantly different both in content and structure. Assistance may be available to assist communities in transferring their prior records to the new system, in addition to new GCC members working to navigate the system. Also, feel free to contact [Luke Forrest], [Laura Matson], or [Jamie Kidwell] with questions regarding joining and completing the GCC.

[Contact Information]

10.5 Appendix E: Economic Energy Analysis Guide

Introduction

An Economic Energy Analysis tool is a framework to encourage communities to measure their baseline energy consumption and identify potential cost savings. The analysis puts an economic value on energy consumption within a community and can provide guidance to re-think long-term energy planning.

The Economic Energy Analysis tool will identify the following:

- Areas of high-energy consumption activity
- Areas for energy efficiency improvements
- Energy consumption patterns by sector(s) (residential, municipal, commercial, and industrial)
- Current energy consumption and greenhouse gas emission patterns and establish targets for reductions
- Areas to apply energy efficiency projects and grants
- Energy or heating districts

The framework and Excel-based tool is the starting point for estimating baseline energy consumption patterns in order to influence alternative energy development and energy efficiency improvements. Furthermore it can serve as a tool to make long-term economic and policy decisions and will help unify communities to lead Michigan in becoming a more sustainable state.

Why Important

Due to a high population, a northern climate and heavy industrial sector, the State of Michigan consumes an enormous amount of energy that is expected to increase. The state relies heavily on importing energy from other states and countries and currently imports 97% of petroleum, 82% of natural gas and 100% of its coal and nuclear fuel needs (MI Public Service Commission, 2011). In 2009, the state spent a total of $31.1 billion for energy in which $22.6 billion was on energy imports alone (MI Public Service Commission, 2011). The cost of purchasing fossil fuels for energy generation is money that leaves the state and never comes back and can greatly impact local economies, jobs and energy security.

A comprehensive, long-term Economic Energy Analysis can roadmap how a city can ensure economic competitiveness, provide reliable and affordable energy, and protect the environment for future planning. It is important that cities start to decrease their dependence on foreign fuels and shelter Michigan’s economy from electricity price volatility. Additionally, it can lead to increased competitiveness in attracting big companies like LG and BASF who have internal company emissions standards that have to comply with international GHG emission mandates. These types of companies will be drawn to cleaner cities that have reliable energy and electricity

resources.

Communities struggle to measure the impacts of their energy efficiency initiatives, but knowing their baseline energy consumption will be help determine how much energy consumption can been reduced by investments and improvements. Furthermore, in order to project future energy needs a community needs to know its current demand and energy needs. The framework and Excel-based tool gives communities the guidance to develop a baseline for their energy consumption patterns in order to make informed planning decisions.

Who to Involve

Conducting an Economic Energy Analysis requires coordinated activity among many different municipal departments and members of the community. Therefore it is necessary to involve leaders and staff from all of the entities that will likely need to implement an Economic Energy Analysis.

Those involved should include:

1. *City Energy Managers* (someone who knows municipal building energy consumption or one who pays the energy bills)
2. *City Assessors* – provides building data such as the number of buildings a given community has, square footage and value of each building
3. *Regional Coalitions/Planning Organizations* – Can provide building data such as square footage, demographics, and Census data
    a. Southeast Michigan Council of Government (SEMCOG)
    b. Southwest Michigan Planning Commission (SWMPC)
    c. Northwest Michigan Council of Government (NWMCOG)
    d. Northeast Michigan Council of Governments (NEMCOG)
4. *Utilities and power providers* – can provide metered, Census tract or block electricity and energy data
    a. Municipally owned and operated utilities
    b. DTE
    c. Michigan Consolidated Gas Company (MichCon)
    d. Consumers Energy

Timeframe

The time needed to complete an Economic Energy Analysis depends on the amount of resources a city has, the coordination amongst all stakeholders, scope of the project and data availability. The Economic Energy Analysis on average can range from 6 months to a year. If data is not readily available and there is a limited amount of human capacity it can lead to a long and time-consuming project. The project should have a least 3-4 people dedicated to conducting the analysis.

Project Costs

Municipalities can hire an external consultant to perform the assessment. While this can be expensive and less time consuming to municipality officials, an Economic Energy Analysis can be done at little or no cost. The analysis may incur small data costs such as GIS geocoding costs or buying data from utilities, but the major expenditure will be staff hours. Many additional resources are free and can be found on the MGC website.

If you're looking to assess end-use energy consumption, there are a number of programs that can assist. These can be found in the resource section of this guide. However some of these modeling programs may require consultation from experts.

What to Do

a. *Coordination*
    i. Reach out and coordinate with energy managers, regional coalitions, the local utility service provider or city utility representative and city assessors (See Who to Involve). Holding frequent discussions amongst key stakeholders involved to better frame the analysis. Ensure those involved are receptive to the project and identify what each person should contribute and what is expected from each person. The Bronze certification level of the GCC in which a sustainability team is created could be used to administer this analysis. Also reaching out to universities and other organization such as MGC, WARM training center, and other local non-profits can help bring support and additional resources.

b. *Scope the analysis*
    i. Discussions with those involved will lead to the scope of the project. Define the limits and boundaries of what needs to be assessed and what the community wants to look at. Looking at resources like the City of Holland's Community Energy Plan (CEP) can aid in scoping the analysis. Define what questions you want to get answered and what you want to get out of this Economic Energy Analysis. Examples of some questions are:
        1. Where is the highest energy consumption in my city?
        2. What is the largest energy consumer?
        3. Where can we decrease consumption most cost effectively and where can we apply energy efficiency grants?
        4. What are the baseline energy needs for my city?

    All analyses should have the following defined:
        1. Include at least either electricity or heating consumption depending on data availability
        2. Define if you want to look at residential, commercial, municipal, and industrial buildings

3. The resolution of the data being gathered (i.e. metered data, Census tract, Census block)

Additional ideas while scoping the analysis can include an analysis of energy efficiency projects, comparing energy consumption against income levels, and assessing what is the largest end-use consumption (See Modeling resources for end-use programs)

c. *Gather the data needed*
   i. Data needed for the Economic Energy Analysis is dependent on what is scoped. The standard set of data is outline below:
      1. Metered electricity consumption provided by the utility provider
      2. Metered data should be classified into rate classes corresponding to building type (i.e. residential, commercial, industrial, and municipal).
      3. Emissions factors for municipally owned utilities
      4. EPA's Emissions & Generation Resource Integrated Database (eGrid) – a comprehensive source of emissions data from all electric power generation facilities in the US
      5. Heating consumption data

d. *Run the analysis*
   i. Use the MGC network Economic Energy Analysis costing and emissions model to calculate the costs of energy consumption and emissions. For a step-by-step on using the model please see model instructions.
   ii. For the GIS component, someone who is familiar with how to use ArcGIS program is preferred. Michigan basic GIS data layers can be found at the Michigan Department of Technology, Management and Budget Center for Geographic Information (MIGDL) (See GIS Resources). Energy density maps can depict where energy consumption improvements are needed and will help in future energy planning and decision-making.

Resources

a. Additional Reports
   i. City of Holland Community Energy Plan
   ii. ICLEI reports
b. Regional Coalitions
   i. SEMCOG - http://www.semcog.org/
   ii. SWMPC - http://www.swmpc.org/
   iii. NWCOG - http://www.nwm.org/main-site/

iv. NECOG - http://www.nemcog.org/

c. Modeling Resources

i. DOE EnergyPlus – is a building energy simulation program that allows users to model energy and water use in buildings. It models heating, cooling, lighting, ventilation and other energy flows and water use. Energy plus uses a bottom up approach and is fairly extensive, but with the right data can assess end-use data at a finer level. More information can be found at http://apps1.eere.energy.gov/buildings/energyplus/

ii. EPA ENERGYSTAR Portfolio manager – a free interactive energy management tool that allows you to track and assess energy and water consumption for buildings. More information can be found at http://www.energystar.gov/

iii. First Fuel – is a building assessment platform that uses building utility consumption data to produce complete building analysis and energy savings. More can be found at http://firstfuel.com/

d. GIS Resources

i. Bulk Geocoder offers bulk geocoding at a low cost (www.bulkgeocoder.com)
ii. USC's GIS Research Laboratory offers geocoding services for individual addresses or bulk (https://webgis.usc.edu/Services/Geocode/BatchProcess/Default.aspx)
iii. Michigan Department of Technology, Management and Budget Center for Geographic Information (MIGDL) – provides GIS data files specific to Michigan (http://www.mcgi.state.mi.us/mgdl/)
iv. US Census Bureau – provides GIS Census tract, Census block, cities, districts, roads, etc. (http://www.Census.gov/geo/www/)

e. Consulting Resources

i. Garforth International, LLC – Private consulting firm that specializes in community Energy evaluation and planning. Peter Garforth is based out of Toledo, OH and recently conducted the city of Holland's Community Energy Plan

10.6 Appendix F: Economic Energy Analysis: Excel-based Model Step-by-Step Guide

The objectives of the Excel model are to determine costs and emissions associated with electricity consumption on a city-wide scale. Using the model, a city can determine how much money is being spent to import fuels used to generate electricity and how much of the city's emissions are a result of electricity consumption. This can be useful in establishing the monetary effect of energy efficiency improvements and quantifying the money being spent by the city on electricity/fuel imports. Additionally, it can be used to compare city-wide emissions to other communities around the world. The following will detail how the model should be used and what questions it can answer for a city.

Steps

1. *GATHER INFORMATION ABOUT ELECTRICITY CONSUMPTION*
    a. Electricity Consumption data from local utility
        1. City-wide annual Electricity Consumption (kWh/year)
        2. Electricity Consumption by building type/rate class (kWh/year)

    Item 1 may be difficult to come by due to the fact that the utility is the only one with access to all this data. Because there are various electric customers in a city, the utility may not be willing to release this information at first. One way to make it easier for the utility to release the data is to ask for electricity consumption aggregated by building type or rate class (residential, commercial, industrial, municipal, etc.) By aggregating the electricity consumption data, this should eliminate any privacy issues the utility has. If the utility is still unwilling to provide consumption data, it may be necessary to develop a Community Energy Task Force of civic leaders, business leaders, and non-profits. Community involvement is the best way to persuade the utility to compile and release this information. Arlington County, Virginia ran into this data availability issue in performing their community energy plan, but the task force was able to pressure the local utility into providing the necessary information.

2. *GATHER INFORMATION ABOUT THE ELECTRICITY GENERATION*
    a. Percentage of electricity generated by the city
    b. Percentage of electricity purchased from utility/grid
    c. Electricity Generation Grid Mix for both self-generated/purchased electricity

    This information should be publically available from the utility (DTE, Consumers Energy, etc.) or the municipal utility (if one exists). The EPA's eGRID database can also be used to determine the grid mix for local electricity production. It is best to obtain this information from the local commercial or municipal utility, if possible. For our case study, we spoke with the General Manager of Wyandotte Municipal Services and an

Account Manage at DTE Energy to obtain the relevant data. This information informs the model of what fuel sources are used to generate the electricity.

3. *GATHER INFORMATION ABOUT THE CITY*
    a. Current Population
    b. Number of Buildings by type (Residential, Commercial, Industrial, Municipal, etc.)

    This information helps in determining the per capita emissions of the city and the average emissions for different building types. For our case study, Wyandotte's population information was determined based on the 2010 Census and city-wide building information was obtained through SEMCOG and the City Assessor's office.

4. *INPUT INFORMATION INTO EXCEL MODEL*
    a. Relevant data should be placed into the cells highlighted yellow

    If the user has any additional inputs, orange cells can be edited without affecting the outputs of the model.

5. *OUTPUTS OF THE MODEL*
    a. Annual cost of fuels used for electricity generation for the city
    b. Per capita CO_2e emissions due to electricity consumption
    c. Average emissions per building type
    d. Graphical Comparison of city emissions to other communities

    Outputs can be found in the cells highlighted in green.

Summary:

This exercise is useful for two reasons:

1. It is difficult to quantify city-wide electricity consumption because of the various different electric customers. However, it is important to know the total electricity use in the city in order to develop a baseline for community energy planning.
2. Many cities find it hard to invest in energy efficiency and renewable energy due to high upfront, capital cost. Determining the annual cost of energy (electricity, fuels, heat) will go a long way to determining if efficiency improvements are a prudent investment for the city.

If cost is not an issue, then the team recommends hiring a community energy consultant such as, Peter Garforth, who has done studies in Holland, Arlington County and Guelph (shown below). However, if there are city staff who can devote time to this type of study, these guides should help get them started.

Resources:

- **eGRID: http://www.epa.gov/cleanenergy/energy-resources/egrid/index.html**
- **Holland, Michigan - http://yourcityyourdecision.com/the-plan/**
- **Arlington County, Virginia - http://news.arlingtonva.us/pr/ava/community-energy-plan.aspx**
- **Guelph, Ontario - http://guelph.ca/living.cfm?subCatID=1831&smocid=2407**

Figure F - 1: Model Electricity Costs

Cost of Imported fuels used for the city-wide generation of electricity

Input				**Imported**		**SelfGenerated**	
				Grid Mix		Grid Mix	
Total Elec Usage				70%	Coal	50.06%	Comp Coal
313696895	kWh			1%	Oil	24.78%	MS Coal
				12%	Natural Ga	19.53%	TDF
176182.833				15%	Nuclear	5.62%	NG
50%	% Purchased from Grid			2%	Renewabl	0%	Renewables
174936.331				1%	Other	0%	Other
50%	% Self Generated						
Output				Heat Rate		Heat Rate	
$ 3,546,440.41	Cost Imported			8684.022478	Btu/kWh	16876.65021	Btu/kWh
$ 8,503,068.39	Cost Self-Generated			1.36691E+12		2.63768E+12	

Figure F - 2: Model Electricity Emissions

Greenhouse gas emissions per sector and per capita due to electricity consumption

Input			Output							
Total Elec Usage										
3.14E+08	kWh		14.12172641	Annual per Capita CO2e (metric tons)						
			20.46627016	Estimate of total per capita emissions based up 69% Elec (Holland)						
176182.8										
50%	% Imported		Residential	Commercial	Primary Services	Industrial				
174936.3			8.389978601	51.72348745	4177.287367	18275.63	metric tons CO2e per building			
50%	% Generated									
			RFC-M	CO2 (lb/MWh)	CH4 (lb/GWh)	N2O (lb/G	CO2e (lb/M	MMBtu	MWh	
25,883	Population			1651.1144	32.5549	27.7902	1660.413	8.22E+08	94701550	
			Residential	Commercial	Primary Services	Industrial				
			26%	18%	32%	15%				
			11327	1272	28	3				

10.7 Appendix G: Economic Energy Analysis: GIS Step-by-Step Guide

The objectives in using GIS are to display and analyze energy consumption patterns within a city. It can allow for better energy planning strategies and target areas in need of improvement. Using ArcGIS, one can identify areas of high-energy consumption activity, the percentage of residential, commercial, and industrial sectors and how much each sector consumes, and areas for energy efficiency improvements. This guidance is written for someone who has some experience working with the ArcGIS program. Throughout this step-by-step guide, the City of Wyandotte, MI will be used as a case study example.

Steps

1. *GATHER AND ORGANIZE METERED ELECTRICITY DATA*
   Data is probably the most difficult to come by. Options for gathering electricity data are described below.

   a. Meter data - Basic raw meter data needed
      i. Meter ID or account
      ii. Total electricity consumption (kWh or MWh) per meter
      iii. Rate class (residential, Commercial, Industrial, etc.) per meter
      iv. Address for each meter

   Data can come in a variety of ways, but you should aggregate to each meter. For example for the case study analysis, the City of Wyandotte supplied electricity consumption data for 24 months per meter by rate class. The 24 months per meter was aggregated to total yearly consumption per meter.

   If you cannot get individual metered data, for example if you are working with a non-municipally owned utility company like DTE, or Michcon who have proprietary issues when releasing data, you can ask for the data at the aggregated level by rate class. Utilities have the capacity to aggregate electricity data as well as supply it on a GIS level, but you may have to supply them with additional information such as a GIS layer on how you want the electricity data to be aggregated like by Census tract. It is suggested to persistent in gathering data and to continue working with utility managers.

   b. Municipal addresses – Gather building addresses or meter IDs for each municipal building. There are two ways to pull municipal data out.
      i. Organize and pull out individual municipal meters when aggregating the metered data. Then you can geocode and create a municipal GIS layer (described below).
      ii. You can select by attribute (address or by meter ID) in the meter layer all the municipal buildings (see step 6)

2. *GEOCODE METER DATA*
    a. Use a web application such as Bulk Geocoder (www.bulkgeocoder). This application will geocode the addresses and give you a x and y coordinate (latitude and longitude) for that address location

    b. Other geocoding resources can be found on the web or in the reference section

3. *CREATE GIS DATA LAYER FROM THE METERS*
   Now that you have an x and y coordinate assigned to each meter, a layer can be created

    a. Within ArcCatalog, find the folder where your excel table is located. Right click and select 'from xy table'

    b. First define the projection for the meters using a standard coordinate system, such as the WGS 1984

    c. Project the WGS 1984 map (using the project toolbox) using a common geographic coordinate system that will be used in the other map layers. Projecting is necessary in order for each meter to align with the other layers in your map. For example, our analysis created a geo-database for the city of Wyandotte and when we projected the metered data, we used the NAD 1983 Hotine Oblique Mercator Azimuth Natural Origin geographic coordinate system.

4. *GATHER ALL OTHER RESPECTIVE GIS DATA LAYERS*
   GIS data layers for the State of Michigan can be publicly found online, usually at no cost.
    a. Use the Michigan Department of Technology, Management and Budget Center for Geographic Information database (MIGDL) - (http://www.mcgi.state.mi.us/mgdl/?rel=ext&action=sext)
        i. Layers that can be found:
            1. City limits/Boundaries
            2. Street layers
            3. Census tract and Census Block
    b. US Census Bureau - (www.Census.gov/geo/www)
        i. Layers found:
            1. Streets
            2. Census Tract and Census Block

5. *CLIP LAYERS TO YOUR RESPECTIVE CITY BOUNDARIES OR AREA OF INTEREST*
   Some layers may not come in the same extent. A street layer could come at countywide extent, or a boundary layer may display information at a statewide level. For the case

study analysis, a layer containing all local government boundaries for the State of Michigan was downloaded. We then selected only the City of Wyandotte boundary and created a layer from that selection.

6. *CREATE MAPS*
    a. Electricity consumption maps (See Figure 1)
        i. Under Symbology within ArcGIS, draw out multiple attributes of information in the meter layer
            1. Rate class – will display each meters rate class using a different color (i.e. a residential meter will be red, a commercial meter will be yellow, etc.)
            2. Electricity consumption – will display how much electricity each meter using. (i.e. a small dot meter will represent less usage, while a larger dot will represent that meter is consuming more)

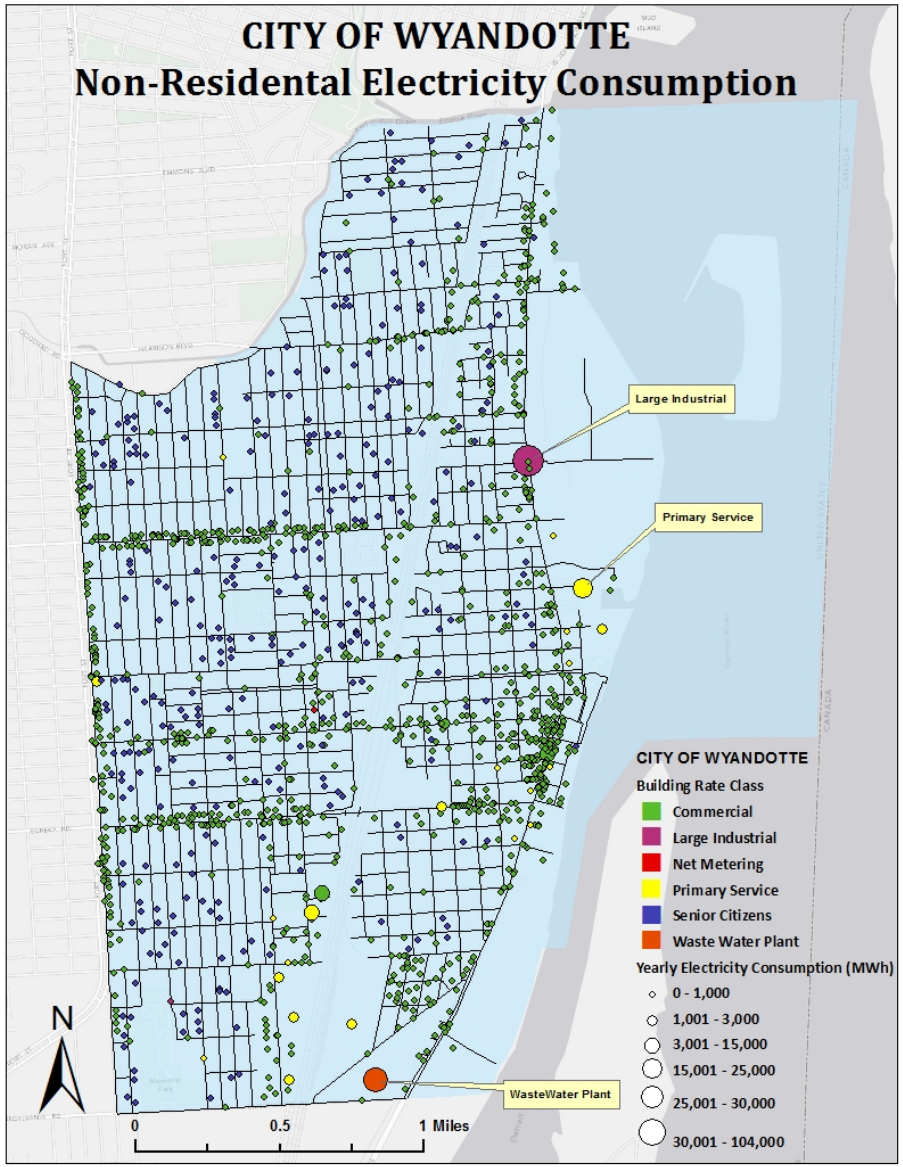
        ii. Using the selection by attribute tool, you can highlight what information needs to be displayed. For example, the city of Wyandotte created a non-residential map by selected those meters whose rate class was non-residential and created a layer from that selection (see Figure 1). A municipal buildings map was also conducted this way.

        iii. Once the attributes are selected (i.e. non-residential meters), a layer needs to be created from the selection. It is also suggested that the data from the selection be exported to create a shapefile or stored in a personal geodatabase. This makes it easier to share data layers.

    b. Census data maps (See Figure 2)
        i. Using ArcGIS, join Census track or block data with the meter layer data to get a total consumption per block or tract. Joining data from another layer on spatial location can allow you to summarize attributes that fall within the tract polygons. For the city of Wyandotte, the yearly consumption was totaled (sum) and averaged.

        ii. Under symbology within ArcGIS, display the quantities of the total yearly electricity consumption with a color gradient (i.e. for the city of Wyandotte, the darker the color the more electricity being consumed in that tract where as the it transitions to yellow the less electricity consumed in that tract. In the example case, Wyandotte, a natural break classification was used.

Figure G - 1: GIS Electricity Consumption Maps



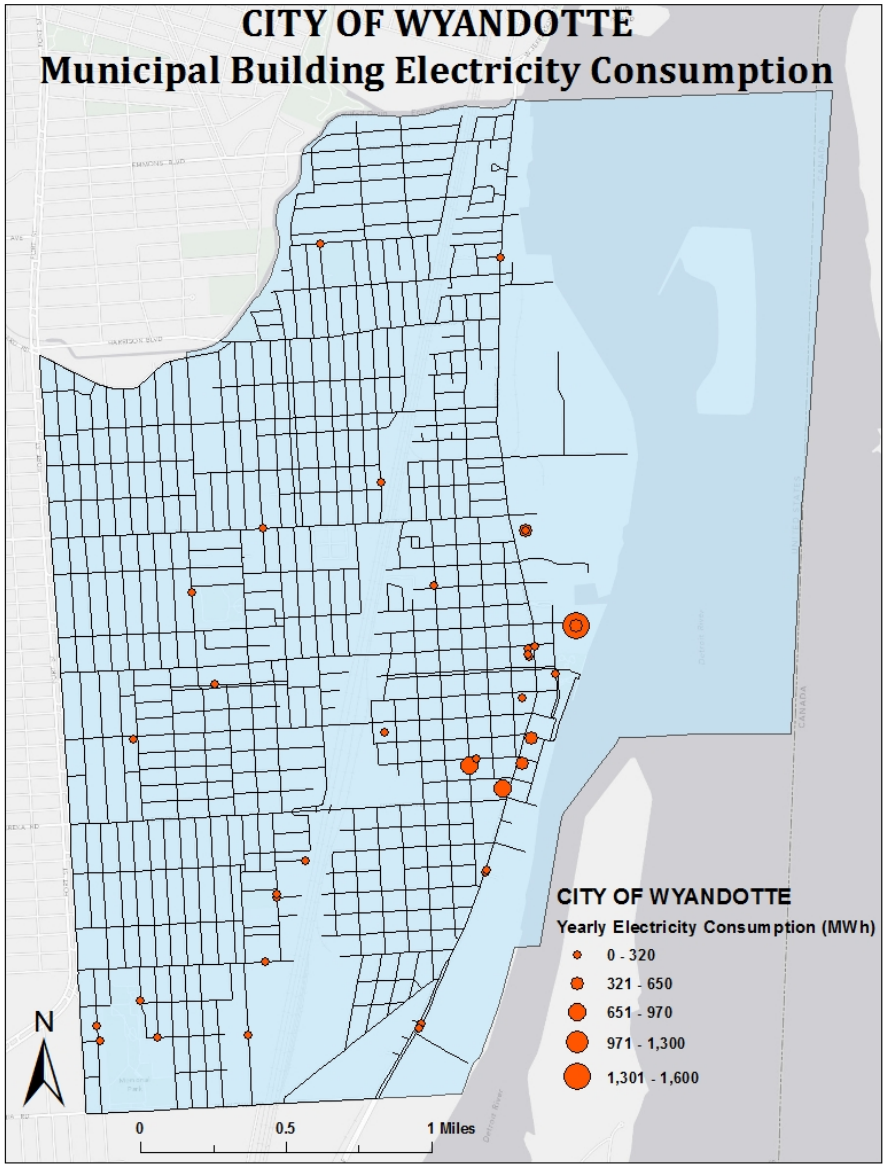
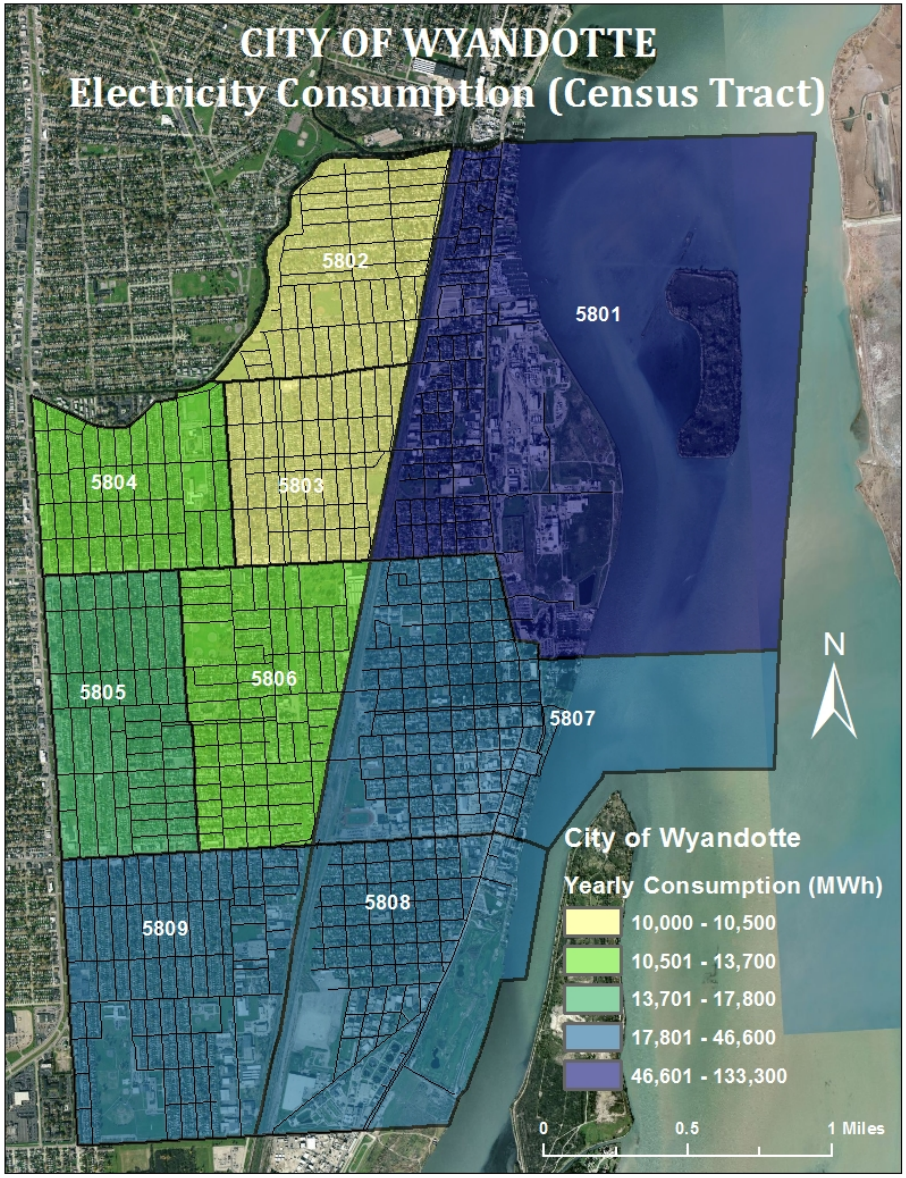


Figure G - 2: GIS Census Maps



10.8 Appendix H - Economic Energy Analysis Wyandotte Case Study

THE CITY OF WYANDOTTE: GIS MAPPING REPORT

We used ArcGIS to create six energy density maps for the city of Wyandotte. Our objectives were to display and analyze energy consumption patterns that can allow for better energy planning strategies and to target those areas in need of improvements. Using ArcGIS, we were able to identify areas of high-energy consumption activity, the percentage of residential, commercial, and industrial sectors and how much each sector consumes, and areas for energy efficiency improvements.

GIS DATA

What we got

The city of Wyandotte supplied us with the following data used for the GIS analysis:

- The electricity consumption for 24 months (2010-2011) per meter by rate class
  - Each meter included the rate class and address
- List of municipal building addresses
- GIS data layers from Michigan Department of Technology, Management and Budget Center for Geographic Information (MIGDL) and US Census Bureau

What we did with the data:

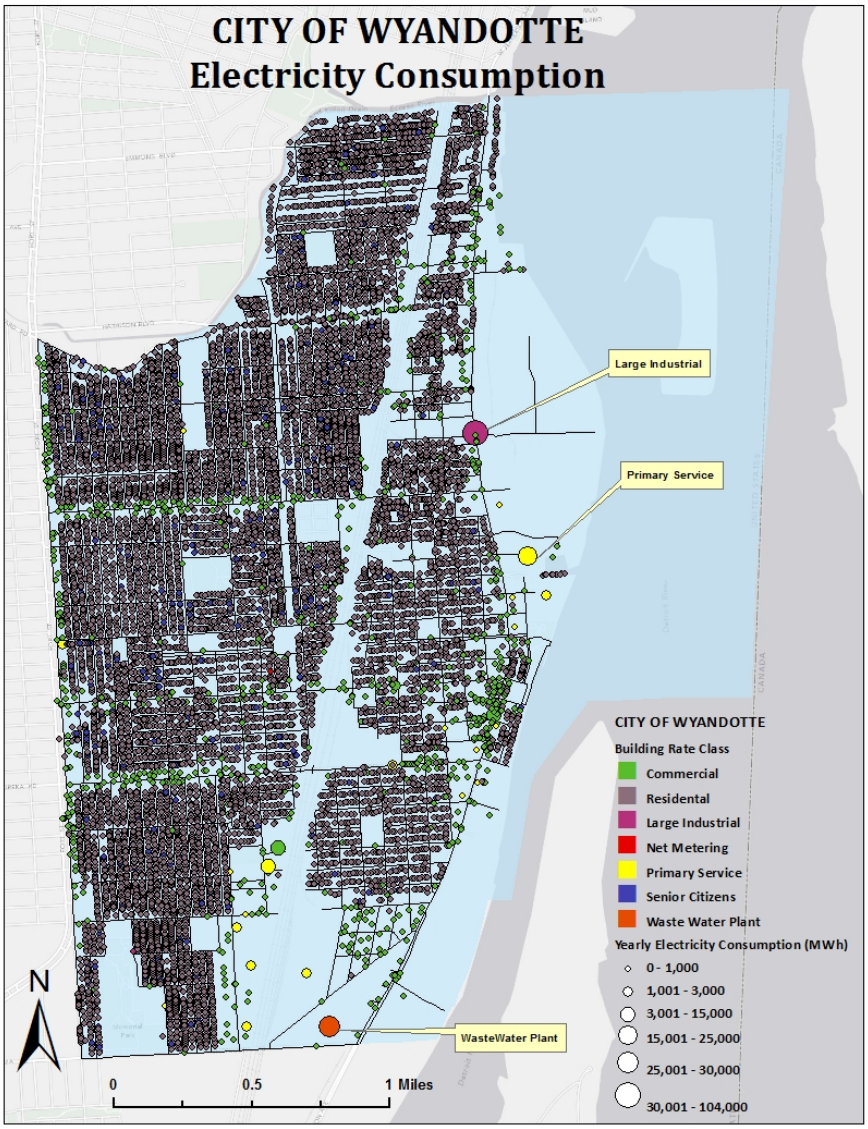
1. Sorted raw electricity consumption data
   a. We aggregated the electricity consumption and calculated a total yearly consumption for electricity for each meter
      i. Using pivot tables, we sorted the data by Meter ID and aggregated the electricity consumption for each meter
         1. Total consumption divided by 24 months = average monthly consumption
         2. Multiplied by 12 to get the total yearly consumption
   b. Re-grouped rate classes
2. GIS Mapping
   a. Geocoded (assigned an x and y coordinate) addresses of each meter using Bulk Geocoder (www.bulkgeocoder.com)
   b. Joined Census track and block data with metered data to get a total electricity consumption per block or tract
   c. Selection of municipal buildings, non-residential, etc., was used depending on what we was analyzed

GIS RESULTS

The following pages displays the six maps. A brief description and results are discussed.

Map 1. City Wide Electricity Consumption by Rate Class
Map 2. Non-Residential Electricity Consumption by Rate Class
Map 3. Municipal Electricity Consumption
Map 4. City Wide Electricity Consumption by Census Tract
Map 5. City Wide Electricity Consumption by Census Block
Map 6. Residential Electricity Consumption by Census Tract

Figure H - 1: Map 1 City Wide Electricity Consumption by Rate Class



Description:

This map shows approximately 13,000 electricity meters in the city of Wyandotte. Each meter has two representations.

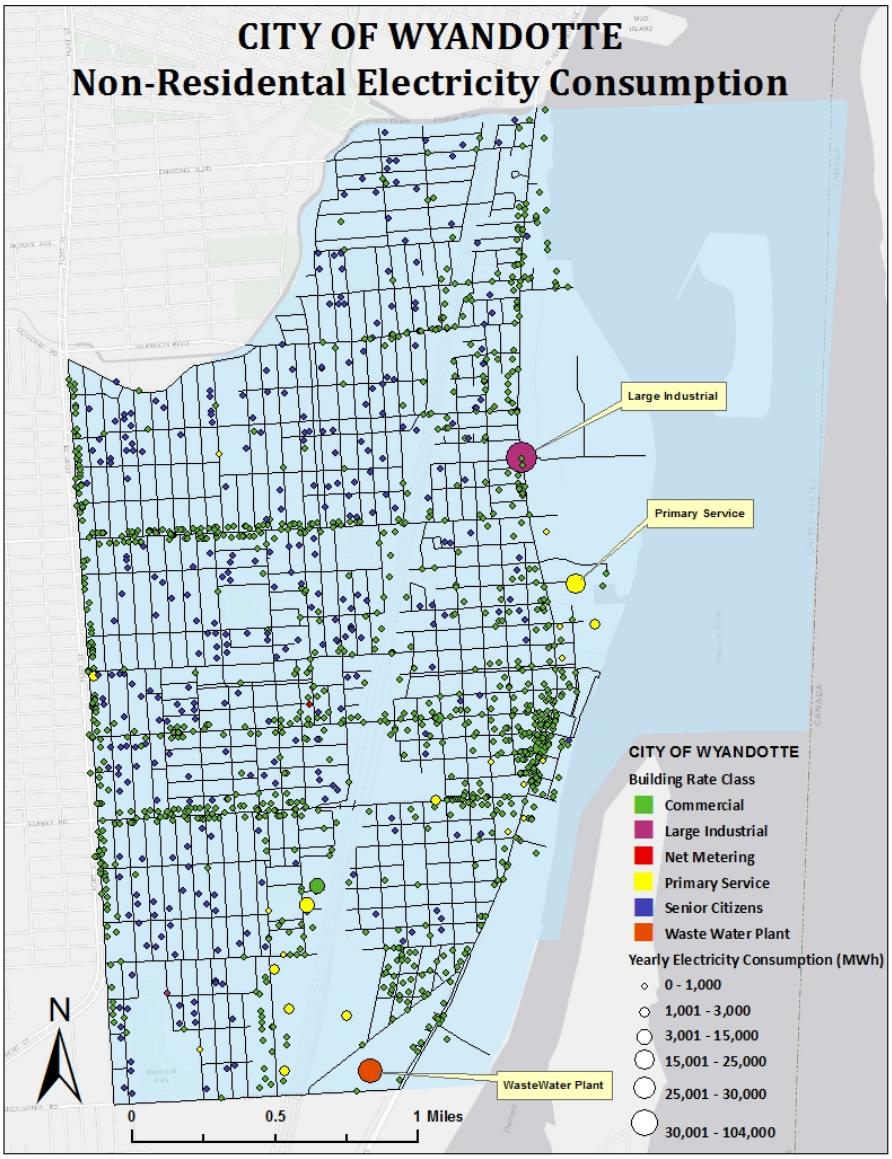
1. The rate class (residential, commercial, industrial, etc.)
2. The electricity consumption in Megawatt hours (MWh) - characterized by the size of the dot. A large circle represents a higher consumption level for that meter.

This map helps depict which sector to target for energy efficiency improvements

Results/Trends:

- The majority of the mapped meters belong to the residential sector, however residential is only approximately 26% of the total electricity consumed compared to the 32% consumed by the large industrial sector.

Figure H - 2: Map 2 Non-Residential Electricity Consumption by Rate Class

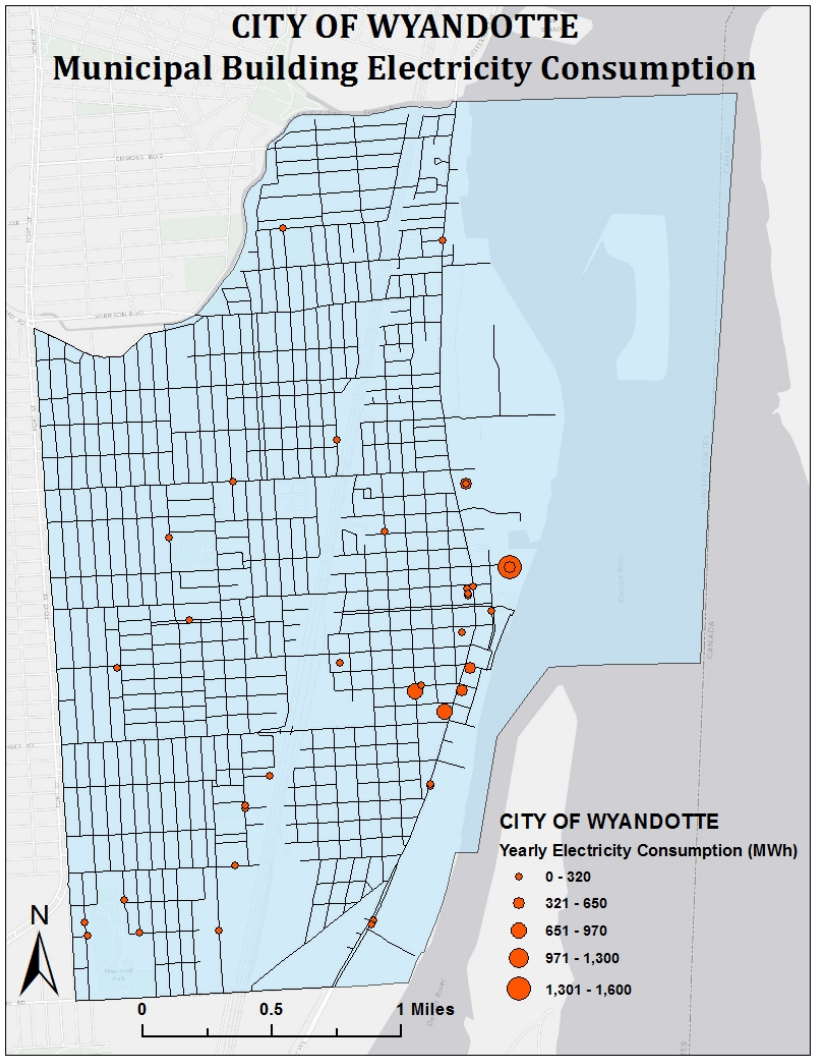


Description:
This map displays the meters of non-residential buildings and depicts where electricity use is concentrated most in the city of Wyandotte.

Results/Trends:

- The majority of non-residential buildings belong to the commercial sector. There are 1,272 Commercial buildings that comprises of 24% of the total electricity consumption for non-residential meters in the city of Wyandotte
- There is only on large industrial building consuming 44% or approximately 103,412,991 kWh of electricity of non-residential meter

Figure H - 3: Map 3 Municipal Electricity Consumption

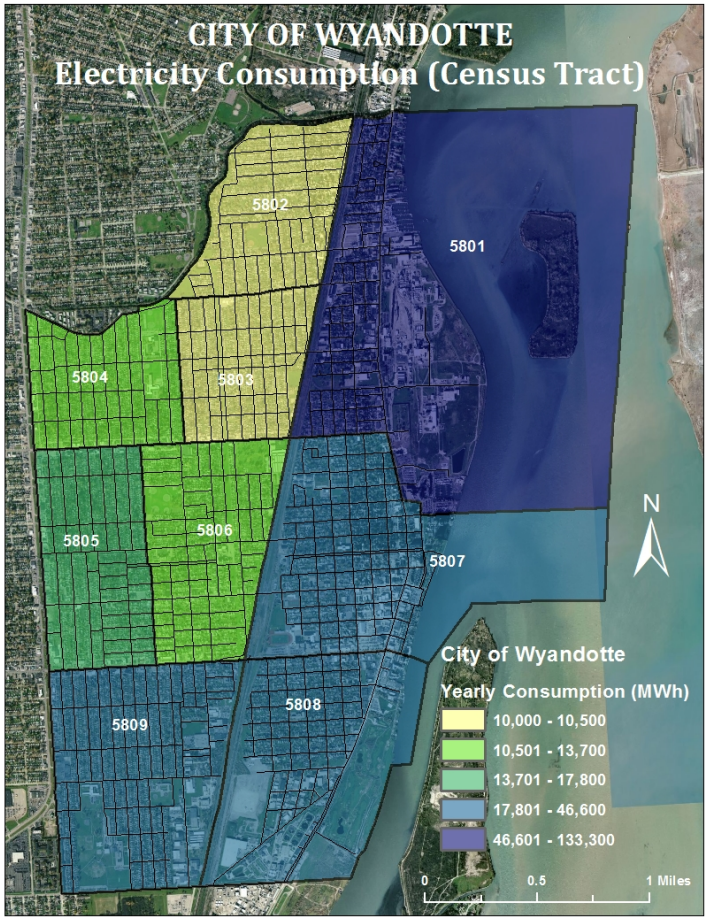


Description:
This map displays electricity consumption for municipal buildings in the city of Wyandotte. Forty-two municipal buildings were pulled from the original metered data, using building addresses, to create a map that assesses how much consumption is due to municipal operations. The larger the circle the more energy consumed. The list of municipal building data may contain meter's that are not necessarily buildings (i.e. field lights) and thus may not correctly reflect the complete picture of consumption.

Results/Trends:

- Top consumers are listed below by address and corresponding building names according to our data
    1. 2555 Van Alstyne Blvd – Wyandotte Power Plant
    2. 3200 Biddle Ave. – Bank One Bldg.
    3. 3131 3rd St. – Wyandotte Yack Arena
    4. 3005 Biddle Ave. – Wyandotte Department of Municipal Services
    5. 2015 Biddle Ave. – Wyandotte Police Station

Figure H - 4: Map 4 City Wide Electricity Consumption by Census Tract



Description:

The map displays electricity consumption in nine Census tracts for the city of Wyandotte. Census tracts represent a subdivision of a county containing homogeneous population characteristics, economic and living conditions and usually have 4000 inhabitants per tract. Census tract ID numbers labels each district. Census tracts are joined with metered data to create an aggregate total of electricity consumption per tracts. The color gradient used displays what tract consumes more electricity. The yellow districts use less energy, whereas the darker the tract the more energy that is being consumed. The table to the right displays how much energy is consumed per tract.

Census Tract Number	Total Electricity Consumption (kWh)
5802	10,082,434
5803	10,441,300
5804	11,995,432
5806	13,784,677
5805	17,853,845
5809	35,860,732
5808	40,606,051
5807	46,682,585
5801	133,335,348

Results/Trends:

- The northeast corner or tract 5801 consumes the most energy. The larger industrial sector is located in this tract, thus making it an area to target energy efficiency improvements
- This map represents which district(s) need improvements first and where energy efficiency grants could be applied.

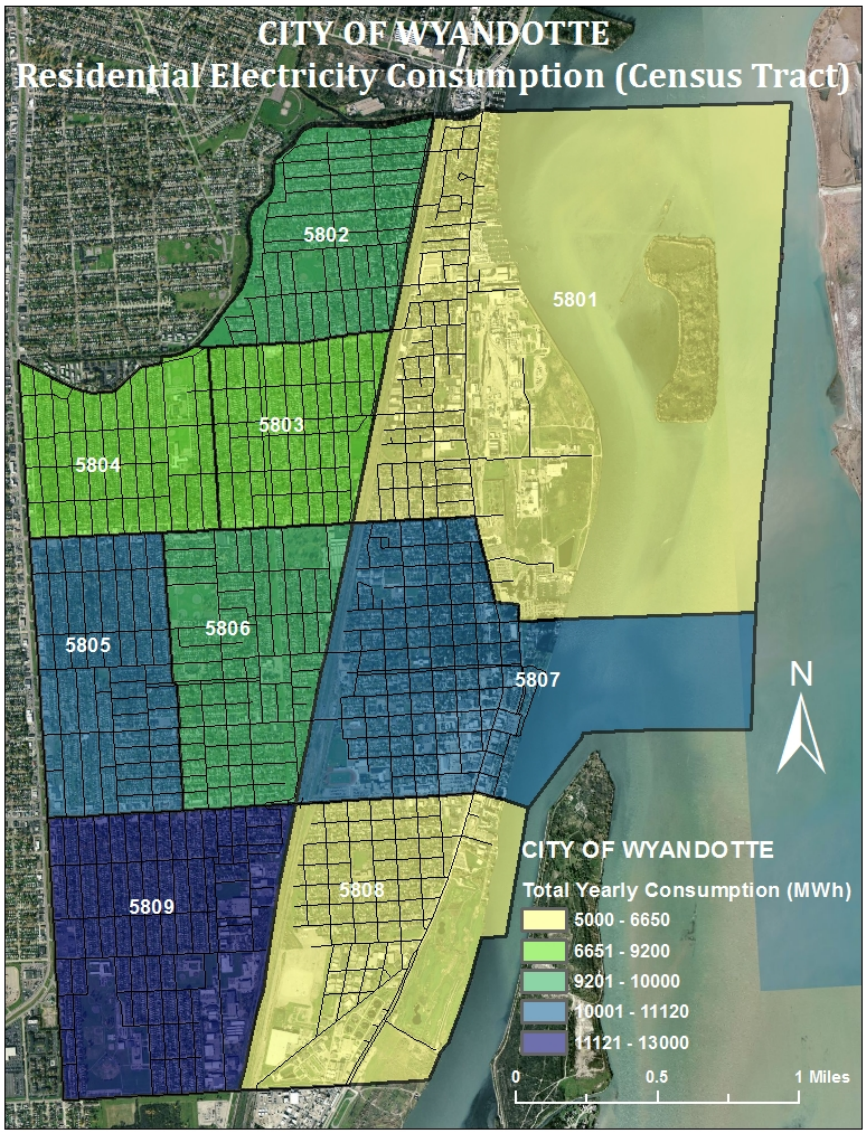
Figure H - 5: Map 5 City Wide Electricity Consumption by Census Block

Description:
This map shows electricity consumption by Census block, a finer resolution of the Census tracts. Census blocks are bounded by streets, roads, and creeks and are referred as a city block. Census blocks were joined with metered data to create aggregated total electricity consumption per block. Areas that are not colored are blocks where meters did not overlay and are nulled.

Results/Trends:

- Large industrial and the wastewater plant are high-energy consumers.

Figure H - 6: Map 6 Residential Electricity Consumption by Census Tract



Description:

The map displays electricity consumption for the residential sector in nine Census tracts for the city of Wyandotte. This map helps highlight which residential areas or neighborhoods should be targeted for energy efficiency improvements. Census tract ID numbers labels each district. Census tracts are joined with residential meter data to create an aggregate total of electricity consumption of residential buildings per tract. The color gradient used displays what tract consumes more electricity. The yellow districts use less energy, whereas the darker the tract the more energy that is being consumed. The table to the side displays how much energy is consumed per tract

Results/Trends:

- High residential energy consumption occurs in the lower southwest corner or tract 5809 in the city of Wyandotte.

GIS REPORT DISCUSSION

Notes

- The accuracy of the xy coordinate position for each meter may not be precise and meter positions could be slightly misaligned. This affected the Census Block map in that certain blocks are not colored because metered points did not overlay in those areas. In this case those blocks were nulled. The Census block map has one small area with very high electricity consumption and because some meters may not have aligned correctly, the large industrial sector is incorporated in this small block.

- Municipal data may contain meter's that are not necessarily buildings (i.e. field lights) and thus may not correctly reflect the complete picture of consumption.

Recommendations

- We suggest working with the large industrial sector to produce an energy efficiency plan road mapping how this sector can become more energy efficient

- We suspect that the list of municipal buildings contains buildings that are not really buildings (i.e. field or parking lights) and suggest the city to create a centralized database of municipal building data. This will allow for a better estimate of how municipal buildings are preforming and which buildings should be targeted for energy efficiency improvements.

Future Work

- Compare income levels with electricity consumption
- Measure energy efficiency investments

THE CITY OF WYANDOTTE: ENERGY COSTS AND EMISSIONS REPORT

OVERVIEW OF MICHIGAN'S ENERGY SITUATION

Michigan imports 97% of petroleum, 82% of natural gas and 100% of its coal and nuclear fuel needs (MI Public Service Commission, 2011). To import this energy, Michigan is losing significant financial resources that could otherwise be used in local economies. In 2009, the state spent a total of $31.1 billion for energy of which $22.6 billion was for energy imports alone (MI Public Service Commission, 2011). Approximately 67% of primary energy consumption occurs in cities (International Energy Agency, 2008). Therefore, cities are an effective unit for studying ways to improve energy efficiency and GHG emissions.

MODEL RESULTS

- Annual Electricity Consumption: 314,000 MWh
- Comparison of Emissions Rates:
    - Wyandotte - FY 2010 - 1169.3 lbs CO_2/MWh
    - Wyandotte - FY 2009 - 1234.8 lbs CO_2/MWh
    - Wyandotte - FY 2007 (eGRID) - 3463.0 lbs CO_2/MWh
    - Holland - FY 2010 (Garforth) - 2491.2 lbs CO_2/MWh
    - Holland - FY 2007 (eGRID) - 1229.5 lbs CO_2/MWh

- Cost of Fuels for Wyandotte: $12 million
- Per Capita GHG Emissions: 12 tonnes/person
- Per Building GHG Emissions:
    - Residential – 4.7 tonnes/building
    - Commercial – 28.7 tonnes/building
    - Industrial – 10,142 tonnes/building

Wyandotte spends ~$12 million annually on importing fuels used for electricity generation and emits approximately 12 metric tons CO_2e/person, assuming 65% of GHG emissions are a result of electricity generation. The Per Building GHG Emissions indicate the average emissions resulting from electricity use in residential, commercial, and industrial buildings. Emissions Rates listed for Wyandotte and Holland are those reported for the local power plants. The variability in emissions rates between different years of operation indicate the need to keep track of these rates year to year and come up with a standard procedure for accounting for this variability.

It is interesting to note that although Wyandotte and Holland are of similar sizes and have similar climates, Wyandotte has ½ the per capita emissions compared to Holland. This can be attributed to the fact that Holland has a 30% greater population, but three times more electricity usage

(likely due to industry). Although, Wyandotte appears to be very energy efficient according to our results, we recommend a full-scale Community Energy Plan in order to validate our findings.

Figure H - 7: Comparison of Holland/Wyandotte Emissions