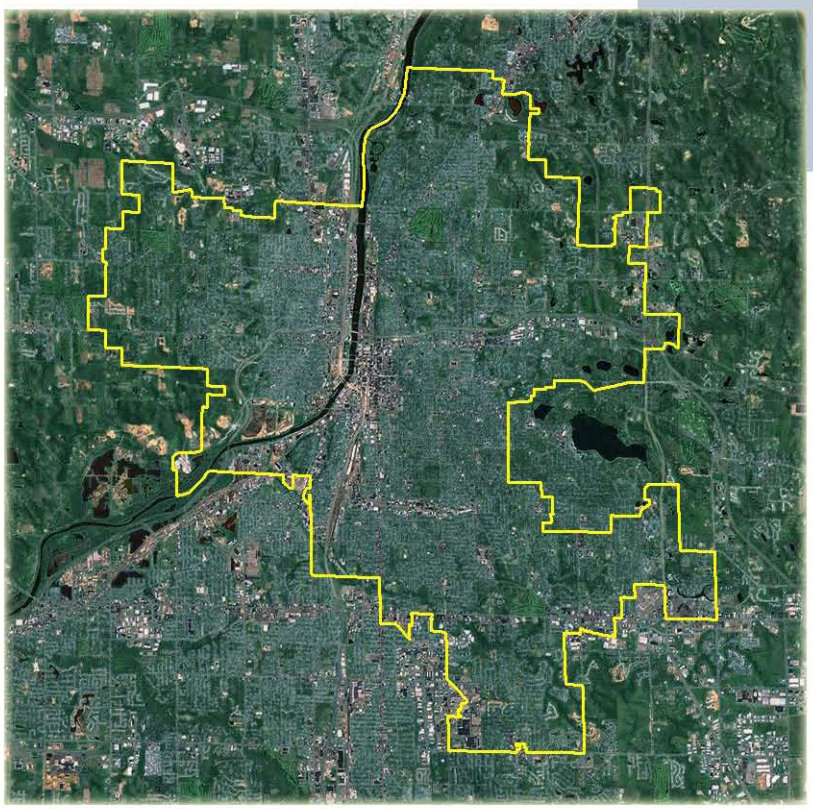
ENERGY EFFICIENCY and CONSERVATION STRATEGY 2009



CITY OF GRAND RAPIDS

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ENERGY EFFICIENCY AND CONSERVATION STRATEGY 2009

CITY OF GRAND RAPIDS

PREPARED FOR:
CITY OF GRAND RAPIDS
GRAND RAPIDS, MICHIGAN

NOVEMBER 20, 2009
PROJECT NO. G090725T1

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LIST OF ABBREVIATIONS/ACRONYMS

AHU	Air Handling Unit
BMS	Building Management System
BOD	Biochemical Oxygen Demand
BTU	British Thermal Unit
CACP	Clean Air Climate Protection
CARC	Community Archives and Research Center
CCF	100 Cubic Feet
CF	Cubic Foot
CFL	Compact Fluorescent Lamp
CH_4	Methane
City	City of Grand Rapids
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CY	Calendar Year
DDC	Direct Digital Control
DHCO	District Heating and Cooling Operations
DHW	Domestic Hot Water
ECM	Energy Conservation Measure
EECBG	Energy Efficiency Conservation Block Grant
EECS	Energy Efficiency and Conservation Strategy
EPA	Environmental Protection Agency
EUI	Electric Utilization Index
FTC&H	Fishbeck, Thompson, Carr & Huber, Inc.
FY	Fiscal Year
GGP	Green Generation Program
GHG	Greenhouse Gas
GHG Protocol	Greenhouse Gas Protocol
GWP	Global Warming Potential
HFCs	Hydrofluorocarbons
HID	High Intensity Discharge
HPS	High Pressure Sodium
HVAC	Heating, Ventilation, Air Conditioning
ICLEI	Local Governments for Sustainability (formerly, International Council for Local Environmental Initiatives)
IPCC	Intergovernmental Panel on Climate Control
kWh	Kilowatt Hours
LED	Light Emitting Diode
LEED®	Leadership in Energy and Environmental Design
LP	Liquefied Petroleum
MAERS	Michigan Air Emissions Reporting System
MDEQ	Michigan Department of Environmental Quality
MLK	Martin Luther King
NOAA	National Oceanic and Atmospheric Administration
N_2O	Nitrous Oxide
O&M	Operation and Maintenance
PFCs	Perfluorocarbons
REC	Renewable Energy Certificates
RTU	Rooftop Unit
sf	Square Foot
SF_6	Sulfur Hexafluoride
US	United States
USDOE	United States Department of Energy
USEPA	United States Environmental Protection Agency
WWTP	Wastewater Treatment Plant

EXECUTIVE SUMMARY

Introduction

This Energy Efficiency and Conservation Strategy (EECS) was developed by the City of Grand Rapids (City) with funding from the federal Energy Efficiency Conservation Block Grant (EECBG) program of 2009.

This strategy document benefitted from the support, efforts, and knowledge of the Mayor, City Commissioners, community leaders, many City staff, and interested parties as listed in Appendix 3. All of these individual contributions were significant; together they are truly greater than the sum of their parts.

This strategy is a vision document, a fluid blueprint that should be updated periodically as technologies evolve and budgets warrant. It is a basis for which benchmarking can be further defined. The document formulates opportunities to select which strategies the City would desire to purse in striving to reduce its greenhouse gas emissions. Costs and emissions are for comparison only based upon an assessment and inventory of various areas within the City.

Development of this strategy allowed, for the first time, the gathering and analyzing of data to provide a comprehensive understanding of greenhouse gas emissions (GHG) for all City facilities and fleet, as well as for the community bounded by the City's geographic limits.

The strategic actions identified and recommended will allow the City to extend a history of leadership in environmental and economic sustainability and bring benefits to the City community for many years into the future.

Results

Total GHG emissions for City facilities and fleet for the 2008 baseline year were found to be equivalent to 98,900 metric tons of carbon dioxide. Energy consumption for City facilities included 109,993,713 kilowatt hours of electricity, 1,339,223 CCF of natural gas, and 9,672,000 pounds of steam, accounting for 85% of GHG emissions. Fleet operations, stationary emergency generators, and miscellaneous direct emissions make up the balance of emissions.

Emissions from within the City geographic boundaries were found to be equivalent to 2,015,648 metric tons of carbon dioxide. Contributions amounted to 57% from transportation, 19% from commercial occupancies, 23% from residential, and the balance made up by industrial and waste processing.

Recommended strategy actions for City facilities will improve the availability of information, assist facility managers in planning energy improvements, and improve tracking of cost savings. Some 30 projects are recommended for immediate implementation, providing $40,000 in annual energy cost reductions based on an initial expenditure of $80,000. An additional 16 capital projects are recommended for funding from the City's EECBG funding, addressing deferred maintenance needs and resulting in approximately $108,000 of energy cost savings per year based on an initial expenditure of $1,830,000 of EECBG funds.

Recommendations for community strategic efforts may revise City policies to incentivize better use of energy and lower the community's GHG profile. Organizational structures for cooperation with governments, community groups, non-profit organizations, and educational institutions could be strengthened or developed to increase the effectiveness of public/private partnerships.

TIER I STRATEGIC ACTIONS – CITY FACILITIES AND FLEET

The 2009 City of Grand Rapids Energy Efficiency and Conservation Strategy (EECS) is a comprehensive City and Community strategy. The strategic actions recommended exceed the immediate 2009 Energy Efficiency Conservation Block Grant (EECBG) funding and provide direction for long term energy improvement. While some strategic initiatives involve grant funding, many are based on communication, awareness, and policy revisions to make improvements at low cost. The strategic actions presented here are those selected for the first implementation of the EECS. Additional opportunities for future implementation are outlined in the body of the strategy.

MEASUREMENT AND VERIFICATION

STATEMENT

As a first step for improving City facility and fleet energy use, an improved measurement and verification regime is required for this report. Past energy reduction efforts suffered from difficulties in documenting actual savings after projects were undertaken. Measurement and verification is a challenging issue, given that facility usage variations, annual weather variations, and other factors affect the consumption of energy in any facility.

An additional challenge for improvement of City facilities is represented in the current management of energy costs. In effect, utility bills are reviewed by individual departments or facility managers and approved for payment by the Controller. Separate energy management systems are now maintained in each department and no central reporting or analysis has been available. The effort involved in researching this data for the Strategy was significant, and it would not be practical to perform that level of investigation each month in order to gain access to current City-wide energy usage. That City-wide data is, however, critical to setting and monitoring long term energy reduction goals.

Difficulties also exist in the apportionment of energy purchased by the City and distributed through the Street Lighting System. This system acts as a sub-distribution system for several City and community facilities. The City purchases energy at known rates and quantities and bills the several users; however, the street lighting power itself is not clearly metered, making improvements difficult to monitor.

ACTION

1. Implement a revised management protocol for utility bills to create:
    a. Assigned responsibility for ongoing energy consumption data management.
    b. Central energy data repository and reporting capabilities.
    c. Implementation of automated meter reading and reporting for City street light customers.

2. Implement a facility based energy improvement tracking system. This system may use the 2008 energy consumption data as a baseline and would rely on monthly data input from utility usage. The tracking system would use established protocols to normalize consumption data based upon heating/cooling degree days, occupancy/use data for each building, and other industry accepted metrics.

3. The tracking system could be implemented selectively for facilities receiving Energy Efficiency Conservation Block Grant (EECBG) funding or capital projects for energy improvement. The tracking system would be in place at the conclusion of energy conservation measures (ECM) projects in order to assist in the management of the United States Department of Energy (USDOE) grant reporting requirements and quantify cost savings for major projects.

ENERGY REDUCTION COLLABORATION

STATEMENT

Current City department structures place responsibility for energy management in the City departments. Each department chooses and implements improvements as deemed most effective. This ensures that the energy reduction efforts are carried out by personnel familiar with the department needs, but does not take advantage of the synergy available if all departments worked together. Benefits that would accrue from a higher level of collaboration include sharing of knowledge, training opportunities, shared costs for engineering, and volume related cost savings for purchasing energy conserving measures.

Implementation of the present EECS will be facilitated by the creation of a collaborative team, involving all City departments dealing with energy consumption.

ACTION

1. A working group for energy collaboration could be formed consisting of a representative of each department. This would be the person in the department tasked with energy management.

2. The City's Office of Energy and Sustainability may participate in the working group, performing facilitation and coordination tasks.

3. The working group should hold regular meetings, not less than quarterly.

4. The working group may plan the implementation and coordination of the Energy Conservation Measures selected by this Strategy.

5. The working group would be responsible for annual review and triennial revision of the Strategy.

ENERGY MANAGEMENT STAFF DEVELOPMENT

STATEMENT

As energy projects are identified and improvements made, City staff may need to be organized to manage the increased technical demand of the effort. This management effort would require highly skilled and credentialed energy management professionals tasked primarily with these energy management duties.

The City would benefit from the full-time services of an experienced professional energy manager possessing a Certified Energy Manager (CEM) credential, Professional Engineer (P.E.) license, or other industry accepted designation of competence. While current budget challenges make the addition of staff problematic, this strategic step should be taken in the light of the potential for continuing cost reductions possible with improved management of City energy consumption.

ACTION

1. Create the position of City Energy Manager, reporting to the appropriate Department or Office, tasked with day-to-day management of energy purchase, cost reduction initiatives, and technical support and analysis of the City's energy efficiency and conservation efforts.

2. Consider an experienced, appropriately credentialed professional for this position.

ENERGY CONSERVATION MEASURES

STATEMENT

Significant improvements in City energy use are possible through the implementation of energy conservation measures identified as part of the Tier I Facility Energy Improvement portion of this Strategy. Implementation of these measures may proceed as summarized below. This approach would provide early, demonstrable cost reductions and the resulting lowered energy costs make funds available for additional investments. While investment capital is available in the form of the City's EECBG, some relatively low cost, high return measures are recommended for immediate implementation from Department funds to speed the associated energy savings and reduce the cost of EECBG reporting.

ACTION

1. Phase 1 – 2009: Implement ECMs listed as less than 2 year payback in the Tier 1 City Facility Improvement plan, using Department funds.
   a. Estimated Cost: $90,000.
   b. Estimated Annual Energy Cost Reductions: $50,000.

1. Phase 2 – 2009-2010: Implement ECMs listed in the Tier 1 City Facility Improvement plan, using EECBG funds.
   a. Estimated Cost:
      1) EECBG Funds: $1,830,000.
      2) Leveraged City Funds: $275,000.
      3) Utility Rebates: $54,200.
   b. Estimated Annual Energy Cost Reductions: $108,000.

2. Phase 3 – 2011: Continue implementation of the balance of identified ECMs, funding with annual energy savings from earlier phases.
   a. Estimated Annual Investment Funds Available: $158,000.
   b. Estimated Annual Energy Cost Reductions: $20,000.

FLEET ENERGY CONSUMPTION IMPROVEMENT

STATEMENT

Fleet operations make a significant contribution to greenhouse gas emissions, and the fuel cost for fleet is volatile and unpredictable. Actions to reduce the fuel consumption related to fleet operations will be important to meeting the City's long term goals.

ACTION

1. Adopt evaluation criteria for vehicle lease and purchase that considers and weighs energy efficiency performance of vehicles equally with vehicle first cost.

2. Evaluate and adopt no-idle policies for City vehicles where justifiable.

3. Re-evaluate "all inclusive" lease offerings to departments where vehicles, maintenance, and fuel are priced together in a "lump sum" fashion. Fuel costs should be transparent to departments and management of fuel costs should be required by each department.

TIER II STRATEGIC ACTIONS – COMMUNITY

The City of Grand Rapids has been a leader in the advancement of sustainability and is recognized for these efforts nationally. The Energy Efficiency and Conservation Strategy development has, therefore, been used to develop a Tier II EECS to encourage the better use of energy City-wide. Initial City strategy initiatives for the Tier II or Community EECS may be implemented as listed below.

PUBLIC PRIVATE PARTNERSHIP

STATEMENT

The City has strong connections with neighborhood and business associations, business districts, and non-profit organizations focused on benefitting residents. This existing network of public and private organizations could be strengthened and used to improve energy use in the City, providing economic and environmental benefits. Existing programs for grants, loans, and low cost/no cost assistance could be more efficiently offered if the several organizations work in concert to maximize benefits to the community.

ACTION

Organize a community working group to act as a clearing house to identify and publicize grant offerings, utility rebate programs, volunteer efforts, and other beneficial opportunities. City support would include facilitation and meeting space, and participation of staff.

CITY STANDARDS AND CODES – BUILDING CONSTRUCTION AND RENOVATION

STATEMENT

Current City standards for construction and energy performance are based on State and national codes. Portions of these Codes are accepted without modification pursuant to State statute, but policies for implementation, permit rules, and City standards may be used to influence improved use of energy with economic and environmental benefits to the community.

A comprehensive review of City codes and standards regarding energy efficiency and conservation would allow the identification of opportunities for these improvements.

ACTIONS

1. Convene a working group of City Code enforcement staff, City Engineering, Office of Energy and Sustainability, and construction and design professionals from the community to evaluate City construction codes and policies.

2. This working group would report to the City on specific potential improvements to the city construction code requirements.

3. Implement changes in the best interest of the community

COMMUNITY ENERGY IMPROVEMENT INCENTIVES AND MANDATES

STATEMENT

New technologies and energy systems regularly become available to the community. Acceptance of these new technologies varies considerably, and a significant part of the potential energy savings available may never be realized. The City has an opportunity to improve the acceptance of these opportunities through public awareness, incentives, and mandates. A carefully considered program to influence acceptance of new energy technologies could be undertaken.

ACTIONS

1. Foster and endorse the transition to simple low cost/no cost technologies; requiring that older, low efficiency lamps (incandescent light bulbs), shower heads, programmable thermostats, and similar low cost, commonly replaced residential and business items are replaced with better performing, newer technologies.

2. Develop incentives to improve the acceptance of investments in improved energy efficiency. Examples include premium efficiency furnaces, water heaters, and air conditioners; controls to avoid wasted energy in unoccupied spaces, and other premium priced equipment.

TRANSPORTATION ENERGY REDUCTION

STATEMENT

Transportation related greenhouse gases represent the majority of the emissions within the Grand Rapids City limits. Other than the State and Federal highways traversing the City, improvements to transportation efficiency are within the City's purview. Reduction of wasted fuel resources is of benefit to the City

residences for environmental as well as economic reasons. Improvements in quality of life due to reduced traffic congestion and delays are realized along with these efficiency improvements.

ACTIONS

1. Use the City's operations and traffic planning capabilities to optimize traffic flow for reduced idle time and greenhouse gas emissions. This effort may use tools and capabilities already in place to re-evaluate traffic light timing and other traffic flow management, providing benefits at relatively low costs.

2. Create a traffic efficiency program of public service information for City residents. This program would promote a range of behavior improvements, including eco-driving, traveling at slower speeds, and smoothing traffic flow.

NEIGHBORHOOD ENERGY RECOVERY

STATEMENT

Many improvements have been made in residential heating, cooling, and lighting technologies. While these are important advancements, optimizing the efficiency of individual residential units does not take advantage of the economies of scale available if energy management and recovery is addressed for groups of residences.

Energy approaches in other parts of the world take advantage of proximity and complementary load profiles of residential and commercial occupancies to gain efficiencies. The City offers many opportunities for a more integrated environmental control regime for commercial and residential properties. A demonstration of this improved efficiency approach would have benefit to City residents and raise the profile of this more integrated technology approach.

ACTION

1. Assist and fund a demonstration project for district heating and cooling on a neighborhood level. This demonstration would use previous study efforts as a beginning point and use geothermal technology.

STRATEGY DEVELOPMENT PROCESS

The City of Grand Rapids has been awarded federal stimulus funds to create an Energy Efficiency and Conservation Strategy (EECS). These funds are provided under the federal Energy Efficiency Conservation Block Grant (EECBG) program and are to be used to reduce energy consumption, reduce greenhouse gas emissions, create jobs, and stimulate economic growth. While there are no matching requirements for the receiving municipal entities, the program encourages leverage of funds.

The City of Grand Rapids has been recognized by the United States Environmental Protection Agency (USEPA) as a member of its Green Power Leadership Club for purchasing 20% of utility sourced electric power from green sources. The Mayor has established a goal of eliminating dependence on non-renewable energy sources by year's end 2020. In pursuit of this goal, the City is developing a comprehensive strategy for energy efficiency and conservation for City facilities and fleet. A second effort included in the Strategy, identifies approaches that will expand the energy efficiency and conservation benefits to the community-at-large for the entire 44 square mile municipality area. The City developed a Request for Proposal to professional consultants with the following charge:

> "The City of Grand Rapids (City) is soliciting proposals from qualified and experienced firms to assist in the development of energy efficiency and conservation strategies for the City that endeavor to reduce fossil fuel emission, decrease energy consumption, and promote energy efficiency. The plan is a requirement of the U.S. Department of Energy's Energy Efficiency and Conservation Block Grant (EECBG) Program, which is funded through the American Recovery and Reinvestment Act of 2009."

On October 20, 2009, Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H) was selected to provide these consulting services. FTC&H has been charged with the following responsibilities:

1. Research City facilities' annual energy usage.
2. Identify initial energy improvement opportunities for City-owned assets.
3. Calculate baseline inventory of annual greenhouse gas emissions for City assets.
4. Calculate baseline estimate of annual greenhouse gas emissions City-wide.
5. Assist with development of a continuing strategy for continuous improvement of energy efficiency and reduction of greenhouse gases.
6. Provide recommendations for the use of funds from the EECGB program.
7. Provide necessary documentation for application to the EECGB program.

APPROACH TO DEVELOPMENT OF STRATEGY AND RECOMMENDATIONS

FTC&H created a team approach to the responsibilities. The roles provided by FTC&H included facilitators, leaders, and technical experts. These skills and capabilities were combined with many City staff resources including the City Office of Sustainability, City Engineering, and City Facility and Fleet Management teams to collect the needed information and to determine the best-fit solutions for defining the City's energy strategy.

The FTC&H project management team organized three technical sub-teams to address specific detailed components of the research, preparation, and recommendation effort. These technical sub-teams worked concurrently to complete the required work.

TEAM 1

The first technical sub-team was tasked with the establishment of an energy and greenhouse gas baseline and inventory for City-owned facilities. Working with existing utility and usage data provided by the City and/or serving utilities, energy consumption for each significant City facility has been benchmarked. FTC&H used a combination of utility bills, City records, and observation to generate an Energy Utilization Index (EUI) for each facility. This index expresses the total of electric, gas, and steam energy inputs to each facility as the quantity of energy measured in BTU per square foot per year.

The greenhouse gas inventory has been established based on the energy consumption benchmark data. The methodology utilized was as contained within the Corporate Accounting and Reporting Standard (known as the GHG protocol) developed by the World Resources Institute and World Business Council for Sustainable Development to inventory greenhouse gas emissions from City facilities and fleet vehicles. This inventory includes Scope 1 (direct emissions) and Scope 2 (indirect emissions) of the six primary greenhouse gas pollutants, expressed in GHG equivalents.

TEAM 2

The second technical sub-team addressed the evaluation of facilities and identification of energy conservation measures (ECM) applicable to the City facilities and fleet. FTC&H gathered facility information such as drawings, energy audits, maintenance records, and interviewed the operations and maintenance managers or staff for each significant building. This effort leveraged the City's knowledge and documentation of facilities to identify the best potential energy optimization projects. Walk-throughs were conducted, as appropriate, to validate potential energy optimization measures identified in the data gathering work.

The Team 2 technical sub-team developed itemized lists of potential energy optimization projects. The list identifies the facility, the measure to be considered, approximate labor and materials cost to implement the measure, and the projected annual energy reduction and avoided greenhouse gas emissions amounts. This list was then sorted by general fund and enterprise departments, and ECMs were prioritized and selected for implementation.

TEAM 3

The third technical sub-team addressed the requirements of the Tier II EECS. This team worked in the larger context of the City and community as a whole. This technical team expanded the analysis boundary to gain an overall understanding of the energy and greenhouse gas impact represented by the Grand Rapids community. FTC&H assessed and reported the greenhouse gas emissions attributable to energy consumption for the entire community. This team engaged with City administration, staff, and community groups and worked to connect the EECS with other sustainability efforts to further leverage the benefits of the EECBG grant to Grand Rapids.

FTC&H contacted and included diverse stakeholders in the Tier II EECS effort, including the City Office of Energy and Sustainability, Community Sustainability Partnership, representatives of community organizations, utility service providers, and representatives of key local community industry.

DATA COLLECTION, REPORTING, AND PREPARATION OF RECOMMENDATIONS

Over a two week period following authorization, FTC&H dispatched Team 1 and Team 2 groups to collect data, perform site assessments, and organize data into initial report formats. As data was collected, the teams sought to identify and eliminate any gaps or overlaps of information. Meanwhile, Team 3 organized and hosted a community participation event on November 4, 2009, to promote the City's efforts to the community and encourage participation in the City's Tier 2 community-wide initiative.

The FTC&H project management team worked with the City and each of the sub-teams to create a report comprised of the data collected, the information derived, and proposed recommendations for direction and implementation. Based on preliminary returns from Teams 1 and 2, the project management team began developing and articulating potential strategic goals, tactical goals, and EECS recommendations. In addition, the overall body of the report was structured, allowing collected data to be organized into the draft report.

An initial draft report was collated and submitted for review with City representatives on November 18, 2009. The purpose of the draft was to identify and agree on report content and direction. In addition, preliminary recommendations were discussed, evaluated, and focused. FTC&H collected feedback from review participants for use in finalizing the report with a publication date of November 20, 2009.

REPORT STRUCTURE

The EECS is divided in two parts. Tier I is focused on improvement in the efficiency of City owned and managed assets. Tier II extends the core focus to a community wide initiative in creating a more sustainable environment.

Tier I: Effort includes: 1) a comprehensive greenhouse gas emissions footprint analysis for all City assets and 2) identification and prioritization of City facility energy improvement projects. It is intended this effort stand as an example for the community by capturing an honest, open picture of energy consumption and creating a comprehensive economic based plan to improve sustainability.

Tier II: Effort seeks to create a network of public/private partnerships toward an improved community wide energy use and greenhouse gas reduction program. In addition to the direct benefits for the community as a whole, the results of this partnership will enhance the Tier I efforts for a whole that is greater than the sum of the parts.

REPORT STRATEGY AND RECOMMENDATIONS

The EECS strategy is developed on the following framework:

Overall Goal:	Core guiding objectives and destination for the EECS program.
Strategic Goals:	Program and policy initiatives to create an environment that fosters success.
Tactical Goals:	Procedures, protocols, and projects for enacting improvement changes.

OVERALL GOALS

1. City facilities to utilize 100% renewable energy by 2020.
2. Reduce greenhouse gas emissions.
3. Encourage job growth and economic benefits from these improvements.

STRATEGIC GOALS – ESTABLISH KEY ENERGY PROGRAMS AND POLICIES FOR CONTINUOUS IMPROVEMENT

1. Establish energy benchmarking, goal setting, and measurement protocols.

   Challenge: Currently, energy usage bills are received, approved, and paid by the City through standard accounting practices. There is not currently a method for collecting data and producing reporting information on actual energy usage. Absolute cost trending is the only currently available metric for energy trend measurement.

   Recommendation: Create protocols for measuring, collecting, and tracking actual energy usage. Develop energy unit trending reports for energy evaluation and analysis.

   Detail:
   - Collect usage data from utility bills and create an individualized database for each resource.
   - Create usage and trending reports of each resource for active use at the local level closest to the users.
   - Collect reports into management department groups and create aggregated reports to assist managers with monitoring and improving efficiency by department.
   - Collect departmental reports into an executive summary document for leadership use.

   Current Status: Calendar year 2008 energy consumption has been collected as part of this Strategy development and is included for use as a baseline for future use.

2. Evaluate facility, fleet, and inventory portfolios for consolidation opportunities.

   Challenge: Recently, the City has experienced a number of organizational and staff changes. The City's collection of resources has been developed based on previous program and organizational priorities.

   Recommendation: Conduct a study of all resources and create a recommendation for consolidation of facilities and fleet with the goal of eliminating unnecessary capacity and reducing energy usage. The resulting consolidation will also reduce operational maintenance and servicing costs.

   Detail:
   - Evaluate and summarize resource requirements by department.
   - Evaluate and summarize resources currently available within the City portfolio.
   - Compare evaluations and consider proposals for consolidation that improve operational performance and allow excess resources to be eliminated.

   Current Status: Current City Management efforts form the basis for this work.

3. Establish policies for improvement programs to incorporate energy reducing initiatives.

   Challenge: Currently, projects are developed and evaluated on functional and financial standards without direct consideration of energy use requirements. There are not clear energy performance standards to assure that future improvements support the energy strategy's reduction goals.

   Recommendation: Create an energy improvement standard policy and evaluation standard for use in qualifying all projects to assure that future improvements are consistent with energy reduction goals.

   Detail:

   - Create a project scoring evaluation that accounts for the improved value of projects that require less energy to create and maintain.
   - Score and compare projects with an established baseline and with other competing projects.
   - Implement projects with the best overall evaluation value.

   Current Status: Initial steps of this work have been performed by the City and FTC&H and are provided as a part of this report. Implementation of the first round of recommendations is pending approval and funding. The process should be repeated annually as noted in subsequent recommendations.

4. Establish an ongoing City wide energy improvement program.

   Challenge: Currently, funding for energy improvement projects competes with many other needs and priorities for available financial resources. Energy improvement initiatives are limited to departmental budget requests or grant initiatives. This creates an environment where projects are randomly implemented and often subordinated to other priorities.

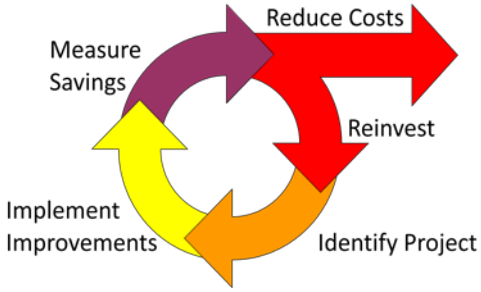
   Recommendation: Create a productivity wheel for continuous improvement of energy efficiency and conservation initiatives and commit to reinvesting a portion of energy savings into further energy reducing improvements.

   Detail:

   - Identify and fund initial energy reducing projects.
   - Establish baseline projects.
   - Implement changes to reduce energy.

- Measure reduction in energy usage and calculate cost savings based on prevailing cost per unit energy.
- Set aside savings toward funding future energy projects.
- Identify future energy reducing projects and outside funding opportunities.

Figure 1 - Energy Improvement Productivity Wheel



- Leverage reinvestment funds with matching grant funding to repeat the process.

Current Status: Tier I strategy actions implement this recommendation.

5. Establish protocols for energy performance standards for procurement programs.

   Challenge: Currently, procurement programs are limited or outdated in regard to considerations for energy usage requirements.

   Recommendation: Create protocols and standards for qualifying future goods and services acquisitions based on best energy performance solutions. Re-evaluate current procurement contracts to incorporate energy reduction initiatives into future purchase commitments.

   Detail:

   - Identify and qualify all procurement programs with the corresponding energy demand engaged by procurement.
   - Incorporate energy usage reporting into procurement requests for proposal submissions.
   - Qualify and select proposals based on overall cost and quality in addition to first cost and quality. Adapt an evaluation model using total cost of ownership.

   Current Status: Recommendation needs approval for implementation.

6. Establish new policies for procurement of energy.

   Challenge: Currently, energy procurement solutions vary depending upon location, resource use, and priority. Policies have been established based on minimizing absolute cost of energy and empirical convenience making comparative analysis difficult between resources.

   Recommendation: Create a model for energy procurement for future projects that optimizes overall costs of energy procurement. Develop a common platform and policy for purchasing energy. Establish a common basis of measurement of use. Assign responsibility for management and usage to the local user based on the common platform. Create an implementation plan for bringing existing facilities to congruence with the future project plan.

   Detail:
   - Set design standards policy for use configuring and contracting energy procurement on future projects.
   - Evaluate current resources in the context of the new policy and develop project proposals for converting existing resources to the new policy where appropriate.
   - Compare project proposals for best performance and return on investment. Implement best opportunity projects as funding comes available.

   Current Status: Recommendation needs approval for implementation.

7. Identify emerging technology improvement opportunities.

   Challenge: Many technologies are near market ready but not yet cost effective for implementation.

   Recommendation: Create a program for monitoring, evaluating, and “cost testing” emerging technologies. Encourage incorporation of new technologies into future projects when return on investment warrants.

   Detail:
   - Establish a technology review task force to identify and qualify emerging technologies.
   - Create metrics for determining return on investments.
   - Encourage on-going projects to be “technology ready” so emerging technologies can be incorporated when validated.
   - Incorporate new validated technologies into consideration for implementation in productivity wheel.

   Current Status: Recommendation needs approval for implementation.

8. Establish the EECS as a living document.

   Challenge: Energy usage is a continuing and evolving demand. Needs, solutions, and technologies are ever changing. Recommendations for continuing improvement must be adaptive to incorporate effects of an ever dynamic environment.

   Recommendation: Create an annual report evaluation and update the team to review performance, set updated milestones, and incorporate new opportunities for improvement.

   Detail:
   - Develop an EECS evaluation board. Include key departmental managers, key outside stake holders, and specialty consultants.
   - Schedule review meetings so results can be considered in annual capital and operation budget planning.
   - Evaluate EECS report for value and relevance to the current status of energy and GHG performance.
   - Set milestones and initiatives for the upcoming year.
   - Review recommendations for updates with the City Management team for refinement and approval to use in annual budget planning.

   Current Status: Recommendation needs approval for implementation.

9. Supplement City staff energy capabilities.

   Challenge: While City facility managers are flexible and capable, there is a lack of specifically trained and credentialed energy professionals available for support of the facility management function.

   Recommendation: Add an accredited energy management professional with specific energy management experience in a position to assist energy efficiency and conservation efforts across all City departments. Provide development opportunity for existing City staff.

   Detail:
   - Develop an energy technical professional/energy manager position within the City departments.
   - Establish position requirements to include Certified Energy Manager credential, ASHRAE High Performance Building Professional, State of Michigan Professional Engineer or other applicable certification.

- Establish experience requirements to ensure the selected professional has the ability to provide a high level of technical support to all City departments. This level of capability would typically require a minimum of 5 to 8 years of energy analysis and management experience.
- Establish incentives for additional training and certification of City staff in energy related disciplines.

Current Status: Recommended for implementation in this Strategy.

TACTICAL GOALS – IDENTIFY AND IMPLEMENT ENERGY PROTOCOLS, PROCEDURES AND PROJECTS

1. Create key stakeholder public/private energy reduction task forces and promote broad based participation. Recommended task forces:
   a. Neighborhood/Business
   b. City
   c. Traffic/Transportation
   d. Codes and Policies
   e. Public Relations

2. Research the Available Body of Knowledge:
   a. Case studies from other municipalities
   b. Educational research and analysis
   c. Private industry models
   d. Ready use and emerging technologies

3. Identify, Qualify, and Develop Sources of Funding:
   a. Public:
      1) Operating revenues
      2) Bond revenues
      3) Energy savings reinvestment
      4) State funding
      5) Federal funding
   b. Private:
      1) Organized grant programs
      2) Special grant programs
      3) Matching funding grants
      4) Private sponsorships
      5) Rebate programs

4. Identify Prime Opportunities:
    a. Eliminate unneeded and inefficient resources
    b. Implement no cost changes to protocols and procedures
    c. Optimize remaining resources with energy reducing improvement projects
        1) Identify and prioritize projects
        2) Match funding sources and projects
    d. Measure and score results
    e. Repeat

TIER II – PUBLIC PRIVATE PARTNERSHIP

The City vision for Energy Efficiency and Conservation extends beyond the basic goals of improving energy performance of City operations, facilities, and fleet toward a vision of total community sustainability. While much can be done from a leadership and management role in providing administrative service to the community, the greatest opportunity for improvement is in capturing the hearts, minds, and commitment of the community-at-large. Seeking to engage the key stakeholders in the community, the City is organizing a public/private partnership program to incorporate input and participation in development of community-wide opportunities.

On November 4, 2009, the City initiated exploration of a public/private partnership program by hosting an Energy Efficiency and Conservation Study Community Work Session. The purpose of the work session was to 1) engage the community, 2) promote the benefits of the partnership approach, and 3) explore community-wide opportunities in energy efficiency and conservation. The session was attended by 33 participants, representing 19 different public and private organizations. The agenda and notes of this event are included in an appendix to this report and include several energy saving ideas in each of following five categories:

1. Building Efficiency
2. Transportation Efficiency
3. Generation/Supply
4. Water Conservation
5. Codes and Policies

This meeting is seen as an initial step in a continuing process of participation, seeking the synergies of collaborating skill sets. Potential synergies of the public/private partnership include the following:

1. Alignment of goals for the community between private industry initiatives and public programs.
2. Coordination of separate initiatives to maximize benefits.
3. Matching publicly available resources, skills, and opportunities with private sponsorships, such as grant and rebate programs.
4. Demonstrate a unity of community leadership as an encouragement and inspiration to the community-at-large toward greater support of and participation in energy conservation and usage improvement endeavors.

The inaugural work session demonstrated a clear support and enthusiasm from a broad representation of the community. Key stakeholder organizations represented included the following:

1. City government.
2. City services providers.
3. County government.
4. Utility providers.
5. Private production industries.
6. Private services providers.
7. Retail providers.
8. Community action groups.
9. Neighborhood associations.
10. Business associations.
11. Community development organizations.
12. Educational organizations.

The following initial recommendations and exploration opportunities were generated as a result of the first collaboration:

1. Create key stakeholder public/private energy reduction task forces and promote broad-based and key champion participation.
    a. Neighborhood/Business:
        1) Brainstorming Goals/Ideas:
            a) Revolving loan fund for energy improvement
            b) Geothermal projects
            c) Biomass projects
            d) Waste harvesting
            e) Transportation improvement incentives
            f) Energy efficiency awards
            g) Set incentives for existing building energy improvements
            h) Collaboration for heat reclaim
            i) On-site energy generation
            j) “Get ready for winter” support for senior citizens
            k) Free energy efficiency improvement audits
            l) Smart metering
            m) Set incentives for reduced water usage
            n) Set incentives for zero-scaping
            o) Set incentives for rainwater management and reuse
            p) Water leak reduction program

b. City:
    1) Brainstorming Goals/Ideas:
        a) Renewable energy policy
        b) Seek coordinated incentives with private industry
        c) Create “collective bargaining” opportunities
        d) Initiate municipal green power generation
        e) Mandates
        f) Incentives
        g) Water conservation
c. Traffic/Transportation:
    1) Brainstorming Goals/Ideas:
        a) Alternative fuel vehicles
        b) Smart stoplights/signaling
        c) Fewer left turns
        d) Roundabouts
        e) Speed management through publicity
        f) Ride share
        g) Lower speed limits
        h) Audit transportation practices
        i) EPA Smart Ways
        j) Promote bicycle transportation
        k) Light rail transportation
        l) Rent by the hour neighborhood vehicles
        m) Enhance busing
        n) Revise site lighting standards
d. Codes and Policies:
    1) Brainstorming Goals/Ideas:
        a) Urban tree preservation
        b) Energy star compliance requirements
        c) Eliminate incandescent lamps
        d) LEED® compliance requirements
        e) Pay for polluting
        f) Recycling requirements
        g) Raise energy performance standards

e. Public Relations:
    1) Brainstorming Goals/Ideas:
        a) Energy store
        b) Awareness campaigns
        c) Demonstration projects
        d) Promote energy saving thinking
        e) Develop buy-out programs for old energy wasting technologies
        f) Educate on CFL disposal
        g) Promote green job creation
        h) Carbon footprint assessments and recommendations
        i) “E-prize” contests
        j) School education programs

2. Research the available body of knowledge:
    a. Case studies from other municipalities
    b. Educational research and analysis
    c. Private industry models
    d. Ready use and emerging technologies

3. Identify, qualify, and develop sources of funding:
    a. Public:
        1) Operating revenues
        2) Bond revenues
        3) Energy savings reinvestment
        4) State funding
        5) Federal funding
    b. Private:
        1) Organized grant programs
        2) Special grant programs
        3) Matching funding grants
        4) Private sponsorships
        5) Rebate programs

4. Identify prime opportunities:
    a. Eliminate unneeded and inefficient resources.
    b. Implement no cost changes to protocols and procedures.
    c. Optimize remaining resources with energy reducing improvement projects
        1) Identify and prioritize projects
        2) Match funding sources and projects
    d. Measure and score results
    e. Repeat

The broad range of support for the inaugural community work session demonstrates the enthusiasm and latent strength available for organizing toward the goals of a more sustainable community. Proposed next steps in the Tier II strategy include the following:

1. Confirm valuable and compelling partnership groups.
2. Identify key champions from the community for each partnership group.
3. Establish a community liaison within the City organization to act as a catalyst between partnership groups and the City.
4. Organize a model calendar to facilitate activities and interactions.
5. Initiate a public service announcement program to publicize activities and opportunities.
6. Create a forum where information and success stories can be shared and publicized.

ENERGY BASELINES AND GREENHOUSE GAS INVENTORY

The City of Grand Rapids (the City) joined the United States (US) Conference of Mayors Climate Protection Agreement that called for local and national action to reduce greenhouse gas (GHG) emissions. Recognizing its leadership role in the effort to reduce emissions and mitigate the potential impacts of climate change, the City, in conjunction with an application for an Energy Efficiency Conservation Block Grant (EECBG) from the US Department of Energy (USDOE), contracted Fishbeck, Thompson, Carr & Huber, Inc. (FTC&H) to complete a greenhouse gas inventory for the City's governmental operations and the community as a whole.

The City is also a member of ICLEI[1] – Local Governments for Sustainability (ICLEI), which is a membership association of local governments and national and regional local government associations that have made a unique commitment to sustainable development. ICLEI is made up of 1,107 local governments, representing over 400 million people worldwide.

The purpose of the GHG inventories is to provide a baseline against which the City of Grand Rapids can measure progress towards the reduction of its emissions. GHG emissions are expressed in metric tons of carbon dioxide equivalent (CO_2e) produced by energy consumption and other activities of the City and community.

The GHG inventory report is presented in two sections: Governmental Operations – Tier I and Community – Tier II. Because there are many sources of data for energy use, demographics, etc., the best quality data was selected, noting the direct source of the information referenced, and, where necessary, when provided with more than one set of data for the same activity, an explanation of why the data selected was considered of a higher quality.

In 2008, the City of Grand Rapids governmental operations generated approximately 94,745 metric tons of CO_2e[2], of which approximately 17,225 metric tons was from renewable energy sources, for a net generation of approximately 77,520 metric tons of CO_2e. As shown in Figure 4, the Water and Environmental Services (wastewater) Departments had the largest emissions of CO_2e (32% and 27%, respectively). The other largest sources were Traffic and Street Lighting and Facility Management, 15% and 9%, respectively. The remaining sources are from the City's mobile fleet, Libraries, Fire Department, Parks and Cemeteries, Police Department, and other miscellaneous sources.

[1] ICLEI is formerly known as the International Council for Local Environmental Initiatives
[2] Please refer to the Protocol section for an explanation of CO_2e.

GREENHOUSE GAS INVENTORY METHODOLOGY

The inventory methodologies selected for both the City of Grand Rapids governmental operations and the City-wide sources follow standards appropriate to the activities in each group.

REPORTING YEAR

A primary aspect of the GHG emissions inventory process is the requirement to select an appropriate baseline year with which to compare emissions among time periods. The US Council of Mayors in its Climate Protection Agreement recommends using 1990 as the baseline year. This would prove difficult for the City of Grand Rapids because the quality of data that is available would not produce an accurate inventory.

The City elected to complete the governmental operations GHG inventory for the calendar year 2008 activities, which does not correlate with the City's fiscal year of July 1 to June 30. In some instances, complete calendar year 2008 data was not available (e.g., natural gas); therefore, where necessary, fuel usages were inferred based on 2009 usages.

For the community GHG inventory, accurate data for the calendar year 2008 was not available for the Transportation Sector, which is the sector with the largest emissions of the community. However, a fairly complete data set for calendar year 2007 was obtained, so the community inventory is based primarily on a combination of the calendar year 2007 and fiscal year 2008 data unless otherwise indicated. If the City elects to prepare GHG inventories for subsequent years, the models and spreadsheet developed in this effort can be utilized, keeping in mind substantive changes that may have occurred between the reporting years.

PROTOCOLS

The six GHGs identified in the Kyoto Protocol were evaluated for this inventory:

- Carbon Dioxide (CO_2)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Hydrofluorocarbons (HFCs)
- Perfluorocarbons (PFCs)
- Sulfur Hexafluoride (SF_6)

Of these gases, CO_2, CH_4, and N_2O occur naturally in the environment and are released through the combustion of fossil fuels, from livestock operations, and from agricultural activities. The remaining gases are man-made and are generally released through specific industrial processes and energy transmission activities.

The City of Grand Rapids elected to complete the GHG inventories in accordance with the guidance and protocols of ICLEI, which developed the International Local Government GHG Emissions Analysis Protocol and the Local Government Operations Protocol (Version 1, September 2008). These protocols provide guidance to local governments in quantifying GHG emissions from both its internal operations (Tier I) and from the whole communities within its geopolitical boundaries (Tier II).

Because of the diverse sources of GHG emissions from the City operations, protocols from additional sources were also utilized to best match the activity to the calculation method. The basis of most of the GHG inventory protocols (including that provided by ICLEI) was established by the World Resources Institute and the World Business Council for Sustainable Development in *Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard, Revised Edition* (2004), hereafter referred to as the GHG Protocol.

In addition, FTC&H relied on protocols developed by The Climate Registry and United States Environmental Protection Agency's (USEPA) Climate Leaders program for select governmental operations sources. The Climate Leaders' protocol utilizes a similar framework as the GHG Protocol; however, it has frequently updated emission factors and assumptions specific to activities in the United States.

A verification process is part of all the protocols employed for this effort, developed to ensure that the data, assumptions, and procedures used to develop the inventory are reliable and defensible. FTC&H has developed this inventory with the intent that it could be verified by a third-party auditor.

The protocols define three categories or "Scopes" of emissions for an inventory. Scope 1 and 2 emissions are direct and indirect emissions, respectively, from the City's operations under its control (e.g., on-site combustion and purchased electricity, respectively).

Direct emissions (Scope 1 Emissions) from City activities result from the following activities:

- Combustion of fuel oil or natural gas in boilers, furnaces, and generators
- Consumption of fuel oil or gasoline in City-owned/leased vehicles
- Fugitive emissions from cooling equipment

Indirect Emissions (Scope 2 Emissions) from City activities result from the following activities:

- Use of purchased electricity
- Use of purchased steam

The activities listed above are not intended to exhaustively catalog of the City's emission sources; they were selected to provide recognizable examples of sources of GHG emissions.

Emission factors for most of the common emission sources from the City's operations are from the following sources:

- GHG Protocol
- Intergovernmental Panel on Climate Change
- The Climate Registry General Reporting Protocol for the Voluntary Reporting Program
- The USEPA Climate Leaders Program
- The California Climate Action Registry
- The USEPA AP-42
- Sound engineering judgment

The community inventory also utilized emission factors provided by ICLEI in its software model employed for the inventory process.

All GHGs are calculated separately and converted to the CO_2e on the basis of their global warming potential (GWP). For instance, the GWP for N_2O is 310 times that of CO_2, and the GWP of SF_6 is 23,900 times that of CO_2. All GHGs in this analysis are presented as their CO_2e value.

SIGNIFICANCE THRESHOLD

Within the City of Grand Rapids' operations, there are emission sources that are categorized as Scope 1 or Scope 2 emissions but are difficult to accurately measure and minimal in magnitude. These sources include select backup generators; fugitive emissions from heating, ventilating, and air conditioning (HVAC) equipment; and fugitive emissions from vehicle maintenance facilities. These are only example sources. The small emission sources were omitted from the inventory if adequate data was not available and appropriate notations were made in the workbooks.

Likewise, there are sources within the community that could not be quantified. For instance, the City was not able to obtain the tons of rail freight that passed through the rail yards in the City limits. Therefore, emissions from this source category were omitted and notations made in workbooks.

UNCERTAINTY ANALYSIS

The GHG inventories are based on the most reliable data available and this inventory fairly represents the GHG emissions from the City of Grand Rapids governmental activities and community as a whole. However, there are uncertainties associated with the emission estimates. Selected estimates, such as those for CO_2 emissions from energy-related activities, are considered to have low levels of uncertainty. For some other categories of emissions, such as the emissions from vehicle use (lack of data or details of the vehicle make/model), increases the uncertainty level associated with the estimates presented.

Generally, stationary source emissions are based on the utility bills and purchase records, with the assumption that all materials and fuels were processed, consumed, wasted, or emitted. However, for certain sources, site-specific knowledge of the activity and/or emission factors are used to determine actual emissions. For this inventory, the assumption is that the information provided by each of the City employees is accurate and verifiable through any audit process. The quality of this GHG inventory is reliant on this assumption. Larger source emissions from the community, such as those from vehicle traffic, are based on modeled data provided by agencies (both governmental and non-governmental) engaged in those activities.

The GHG inventory from the City's operations is based on calendar year 2008; however, in some circumstances, the data was not available within reasonable time constraints. In these instances, the City used the best available data. For example, the City purchases natural gas from DTE Energy (through its MichCon operations). DTE Energy provided a summary of natural gas purchased by the City based on City account numbers. In most instances, the natural gas summaries provided by DTE Energy summarized monthly usages for a 12 to 14 month period prior to May 2009. In these cases, the 2009 natural gas usages were used in lieu of the 2008 months not provided. All assumptions are clearly noted in the calculation workbooks.

RENEWABLE ENERGY CREDITS AND BIOFUELS

The City purchases renewable energy through Consumers Energy's Green Generation Program (GGP). According to City officials, they entered into an agreement to purchase 20% of its electric supply from Michigan-based renewable energy sources through this program. The GGP is Green-e Energy Certified[3], which is an independent certification and verification program for renewable energy sources. According to the Green-e Energy website, the renewable energy sources are certified through a verification process to ensure the following:

[3] http://www.green-e.org/

- The renewable energy is from a new project. The windmill, solar panel, or other generators that produced the renewable energy must have been built after 1997.
- There has been no double-selling. Sellers are reviewed twice a year, and the energy is accounted for and tracked through the annual Green-e Energy verification audit process.
- The certified-renewable energy goes beyond what is required by law or claimed against a mandate.

The Climate Leaders guidance documents for Indirect Emissions from Purchases/Sales of Electricity and Steam and for Green Power and Renewable Energy Certificates (RECs) were used to calculate the City's GHG emissions reduction from its renewable energy purchase. The GHG emission reductions from the renewable energy purchase is credited to the bottom line of the City's inventory in the Renewable Energy Adjustment.

The City also purchases biodiesel (B20) and a gasoline ethanol blend (E10) for use in its mobile fleet. The EPA Climate Leader guidance document for Direct Emissions from Mobile Combustion Sources indicates the mobile source CO_2 emissions from non-fossil fuels, such as ethanol and biodiesel, are considered biogenic emissions. The biogenic CO_2 emissions from mobile source combustion are calculated according to this guidance, and are included as a GHG emission reduction off the bottom line of the City's inventory in the Renewable Energy Adjustment.

TIER 1 - GOVERNMENTAL OPERATIONS INVENTORY

LOCAL GOVERNMENT PROFILE INFORMATION

The City of Grand Rapids, the second largest city in the State of Michigan, encompasses an area of approximately 45 square miles. Grand Rapids is located in west central Michigan, roughly 30 miles due east of Lake Michigan, and is considered the urban center for the region. The Grand River, a major state waterway, runs through the center of the City. According to the U.S. Census population estimate, the City's population was 193,396[4] in 2008. The last official US Census count was in 2000, and the population was estimated to be 197,800. In fiscal year 2008, the City employed approximately 1,700 full time people.

For the fiscal year 2008, the City managed a General Operating Fund budget of approximately $120,000,000[5]. Of this budget, approximately $1,250,000 was spent on utilities for City-owned/leased buildings.[6]

[4] US Census Bureau
[5] http://www.grand-rapids.mi.us/download_upload/binary_object_cache/frontpage_Final%20Fiscal%20Plan%20(Final%20File).pdf, page 71
[6] http://www.grand-rapids.mi.us/download_upload/binary_object_cache/frontpage_Final%20Fiscal%20Plan%20(Final%20File).pdf, page 116

The USDOE's, Building Energy Codes Program has assigned Kent County to climate zone No. 14. A separate USDOE program, the Building Technologies Program – Residential Buildings, assigned the area to the "cold and very cold" climate zone.

The heating and cooling degree day data for calendar year 2008 was obtained from the National Oceanic and Atmospheric Administration (NOAA)[7] and reported 541 cooling degree days and 7,037 heating degree days.

Table 1 – City of Grand Rapids Profile Chart	
Size	45 square miles
Population	193,396
Annual Budget	$120,000,000
Employees	1,700
Climate Zone	14
Heating Degree Days	7,037
Cooling Degree Days	541

The City of Grand Rapids provides a wide variety of services to its residents and the business community. These services include:

- Water Treatment
- Water Distribution
- Wastewater Collection
- Wastewater Distribution
- Fire Protection
- Police
- Mass Transit (Downtown Shuttle Buses)
- Stadiums/Sports Venues
- Convention Center
- Street Lighting and Traffic Signals
- Municipal Solid Waste/Yard Waste Pick-up and Transportation

Not all of the activities of the City are included in this inventory. A detailed narrative regarding the sources of emissions can be found in the Organizational Boundary section.

[7] http://www7.ncdc.noaa.gov/CDO/CDODivisionalSelect.jsp#

ORGANIZATIONAL BOUNDARY

The City of Grand Rapids owns and maintains over 265 properties which are a mix of buildings, parks, pump stations, reservoirs, booster pump stations, and parking structures. This includes the structures at the Lake Michigan Water Filtration Plant in West Olive. A listing of the City properties included in the GHG inventory is provided electronically in an MS®Excel spreadsheet format as Appendix 1.

This GHG inventory was prepared for City activities related to its governmental operations, including City-owned or leased buildings, water and wastewater utility infrastructure, parks, cemeteries, parking facilities, lighting infrastructure, downtown transit, maintenance (infrastructure and street), police, and fire activities. The City did not include the Grand Rapids Public Museum, John Ball Zoo, event/sporting venues, conference centers, or schools. A brief summary of the City's operations included in this inventory follows:

WASTEWATER TREATMENT AND COLLECTION

The City's Environmental Services Department operates both storm water and wastewater treatment and collection. The Wastewater Treatment Plant (WWTP) provides wastewater collection and treatment for the City of Grand Rapids and 10 surrounding communities, totaling approximately 265,000 customers within a 125 square mile geographical area. The WWTP has a design capacity of 61 million gallons per day (MGD).[8] In calendar year 2008, the WWTP had an average flow of 49.2 MGD.[9]

The City maintains over 70 properties associated with its storm water and wastewater treatment and collection. To support the wastewater and storm water systems, the City operates 56 lift stations, a combined sewer overflow basin, storm water and meter stations, regulators, a maintenance garage, and the WWTP.[10]

WATER TREATMENT AND DISTRIBUTION

The City's Water Department supplies an average of 37 MGD of water to the City of Grand Rapids and seven surrounding communities, along with portions of Ottawa County. The City's water distribution system contains over 1,200 miles of pipes.[11]

[8] City of Grand Rapids website www.GRCity.us
[9] City of Grand Rapids Environmental Services Department
[10] City of Grand Rapids Office of Energy and Sustainability
[11] Grand Rapids Water System, 2008 Water Treatment Report

The City operates and maintains the Lake Michigan Water Filtration Plant in West Olive, Michigan. Although not located within the City limits, activities related to the Water Filtration Plant is included in this inventory. To support the water supply system, the City operates pumping stations, reservoirs, regulators, boosters, warehouses, garages, and office space related to water delivery within the City limits.[12]

DEPARTMENTS

- Facilities Management helps to maintain and improve City-owned facilities, including the City's vehicle fleets, with the exception of the Fire Department fleet and DASH buses. Facilities Management maintains over 20 buildings, including City Hall, Community Archives and Research Center, and Public Works; in addition to garages, office space, and storage buildings for other departments use. Therefore, for the purposes of the GHG inventory, emissions from Police Department properties and its fleet, Streets and Sanitation Department properties, and the buildings used by Traffic Safety are included under Facilities Management for the GHG inventory.

- The City's Parking Services Department maintains over 35 ramps and parking lots. The DASH system of 6 diesel-powered shuttle buses is part of the Parking Services Department; however, emissions from the buses are presented separately.

- The Grand Rapids Fire Department occupies 11 fire stations, and operates 2 battalion chief vehicles, 7 engines, 2 rescue engines, 4 ladder trucks, 5 medical squads, and various special response units.[13]. The vehicles operated by the Fire Department are included in its GHG inventory and are not part of the Vehicle Fleet's inventory.

- The Parks and Cemeteries Department maintains over 2,000 acres of parkland throughout the City, 6 cemeteries, the Indian Trails Golf Course, and several recreational facilities.[14] This department is also referred to as the Parks and Recreation Department.

- The Grand Rapids Public Library operates and maintains the main library and 7 branches throughout the City.[15]

- The Traffic Safety Department designs, constructs, operates, and maintains the traffic control and street lighting infrastructure in the City.

[12] City of Grand Rapids Office of Energy and Sustainability
[13] City if Grand Rapids website www.GRcity.us
[14] City if Grand Rapids website www.GRcity.us
[15] City if Grand Rapids website www.GRcity.us

VEHICLE FLEET

The City maintains a fleet of vehicles as summarized in Table 2:

Table 2 – City of Grand Rapids Vehicle Fleet

Vehicle Type[16]	Number of Vehicles	Model Year Range	2008 CY Miles
Gasoline Car	283	1996-2008	3,592,800
Light Trucks, SUVs, Vans	69	1995-2008	468,603
Heavy Duty	86	1991-2008	563,341
Diesel Heavy Duty	235	Various	1,422,525

Vehicles for the Fire Department and DASH bus system are included with the GHG inventories for the Fire Department and Parking Services Department, respectively.

POWER GENERATION FACILITIES

The City does not own or operate any power generation facilities; however, the Covanta Kent Inc. Waste-To-Energy Facility, located at 950 Market Street, SW, generates electricity and steam which is supplied to the District Heating and Cooling Operations (DHCO); and the Veolia Energy Grand Rapids LLC facility, located at 156 West Fulton, generates steam for use within the Central Business District. Neither of these operations is included in the City's governmental operations inventory, but is included in the community inventory. Indirect emissions from City buildings that use steam from the Veolia Energy facility are included in the City's GHG inventory.

Natural gas is provided to the City by DTE Energy (through its MichCon operations) and electricity is provided by Consumers Energy. Neither DTE Energy nor Consumers Energy operates energy-generating assets within the City limits.

SOLID WASTE FACILITIES

The City does not own or operate any municipal solid waste disposal facilities; however, a City-operated yard waste drop off site is located at 2001 Butterworth. There are no municipal solid waste landfills within the City limits.

AGRICULTURAL OPERATIONS

The City does not operate any agricultural operations or composting facilities. Compost waste from City residents is sent to Spurt Industries. This operation has been included in the Community GHG Inventory.

[16] City of Grand Rapids Fleet Management Department

GHG EMISSIONS

Details of each sector are presented in the Organizational Boundary section of this report. A summary of the GHG emissions from each sector in the City's governmental operations is presented in Table 3.

Table 3 - City of Grand Rapids GHG Emissions

Department	Total Indirect CO_2e Emissions (metric tons)	Total Direct CO_2e Emissions (metric tons)	Total CO_2e Emissions (metric tons)	Percent of Total Emissions
Water	27,689.76	2,774.97	30,464.74	32%
Environmental Services (wastewater)	22,603.10	2,685.60	25,288.69	27%
Traffic Safety – Lighting and Signals	13,827.61	0.00	13,827.61	15%
Facility Management, including Streets, Traffic Safety (buildings), Police	7,296.04	863.90	8,159.94	9%
Vehicle Fleet	0.00	7,001.49	7,001.49	7%
Parking	3,726.26	0.47	3,726.73	4%
Library	2,197.12	722.51	2,919.63	3%
Fire Department	754.95	909.80	1,664.75	2%
Parks and Cemeteries	999.68	433.82	1,433.50	2%
DASH Buses	0.00	145.76	145.76	0%
Miscellaneous	51.40	59.19	110.59	0%
Gross CO_2e Emissions	**79,145.93**	**15,597.50**	**94,743.43**	NA
Renewable Energy Adjustment*	**16,683.01**	**540.24**	**17,223.25**	NA
Net CO_2e Emissions	**62,462.93**	**15,057.26**	**77,520.18**	NA

*Includes credits for both renewable electrical energy purchases and biogenic emissions from biofuels in fleet vehicles.

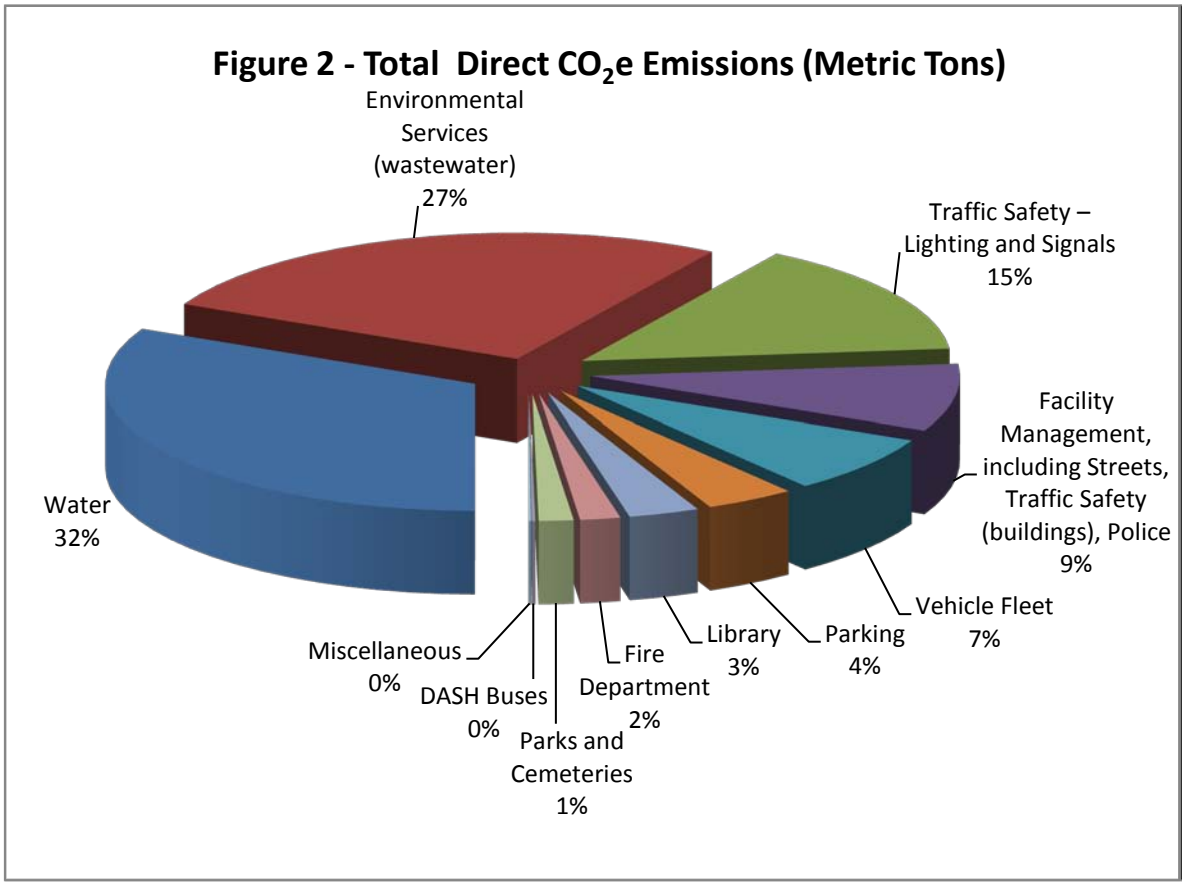


Figure 2 - Total Direct CO_2e Emissions (Metric Tons)
Environmental Services (wastewater) 27%
Traffic Safety – Lighting and Signals 15%
Facility Management, including Streets, Traffic Safety (buildings), Police 9%
Vehicle Fleet 7%
Parking 4%
Library 3%
Fire Department 2%
Parks and Cemeteries 1%
DASH Buses 0%
Miscellaneous 0%
Water 32%

The following table summarizes the City's Indirect GHG emissions from electrical and steam usage by Department.

Table 4 – City of Grand Rapids Indirect Emissions from Electrical and Steam Usage

Department	Indirect CO_2 Emissions (metric tons)	Indirect CH_4 Emissions (kg)	Indirect N_2O Emissions (kg)	Total Indirect CO_2e Emissions (metric tons)
Parks and Cemeteries	936.67	20.33	16.28	942.15
Cemeteries	25.65	0.56	0.45	25.80
Golf	31.55	0.68	0.55	31.73
Environmental Services	2,750.38	59.70	47.80	2,766.45
WWTP (1300 Market)	19,721.40	428.04	342.76	19,836.64
Facility Management	7,171.99	152.67	124.39	7,213.75
Streets and Sanitation	3.67	0.08	0.06	3.70
Traffic Safety (buildings only)	69.66	1.51	1.21	70.07
Police	8.48	0.18	0.15	8.53
Street Lighting and Traffic Signals	13,747.28	298.38	238.93	13,827.61
Parking	3,704.61	80.41	64.39	3,726.26
Fire Department	750.58	16.01	13.02	754.95
Library	2,184.36	47.41	37.96	2,197.12
Water	11,746.42	254.95	204.15	11,815.06
Lake Michigan Filtration Plant	15,782.47	342.55	274.30	15,874.70
Miscellaneous	51.10	1.11	0.89	51.40
Gross Indirect GHG Emissions	**78,686.28**	**1,704.56**	**1,367.29**	**79,145.93**
Renewable Energy Adjustment (electricity)	16,595.68	293.37	261.84	16,683.01
Net Indirect GHG Emissions	62,090.60	1,411.19	1,105.45	62,462.93

The following tables summarize the City's Direct GHG Emissions from natural gas usage, vehicle fleet, and diesel generators.

Table 5 – City of Grand Rapids Direct Emissions from Natural Gas Usage

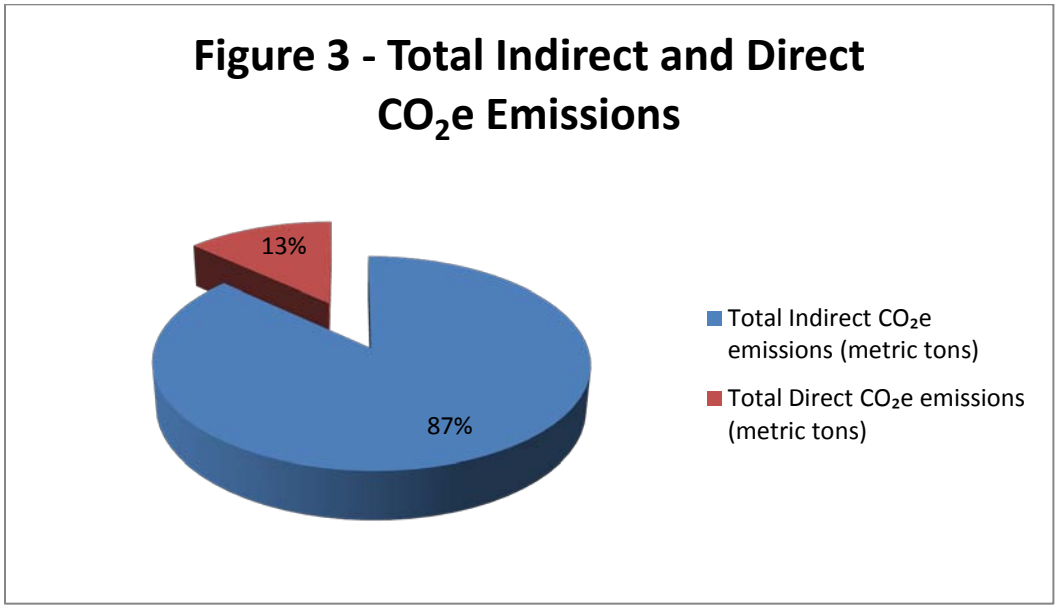
Department	Direct CO_2 Emissions (metric tons)	Direct CH_4 Emissions (kg)	Direct N_2O Emissions (kg)	Total Direct CO_2e Emissions (metric tons)
Parks and Cemeteries	396.86	6.79	6.79	399.11
Cemeteries	26.44	0.45	0.45	26.59
Golf	8.07	0.14	0.14	8.12
Environmental Services	552.30	9.45	9.45	555.42
WWTP (1300 Market)	1,469.62	25.15	25.15	1,477.94
Facility Management	836.40	14.32	14.32	841.14
Streets and Sanitation	-	-	-	-
Traffic Safety (buildings only)	8.91	0.15	0.15	8.96
Police	0.03	0.00	0.00	0.03
Street Lighting and Traffic Signals	-	-	-	-
Parking	0.47	0.01	0.01	0.47
Fire Department	400.95	6.86	6.86	403.22
Library	718.44	12.30	12.30	722.51
Water	705.97	12.08	12.08	709.97
Lake Michigan Filtration Plant	2,053.37	35.15	35.15	2,065.01
Miscellaneous	53.78	0.92	0.92	54.09
SUM	**7,231.60**	**123.78**	**123.78**	**7,272.57**

Table 6 – City of Grand Rapids Mobile Fleet Emissions

Department	Direct CO_2 Emissions (metric tons)	Direct CH_4 Emissions (kg)	Direct N_2O Emissions (kg)	Fugitive HFC R-134 Emissions (kg)	Total Direct CO_2e Emissions (metric tons)
Facility Management	6,909.61	99.29	114.07	54.43	7,001.49
Fire Department	495.61	28.71	12.79	6.40	506.58
DASH Buses	144.44	0.37	0.35	1.20	145.76
Gross GHG Emissions from Mobile Fleet	7549.66	128.37	127.22	62.03	7,653.82
Renewable Energy Adjustment (biodiesel and ethanol)	540.24	NA	NA	NA	540.24
Net GHG Emissions from Electricity Use	7009.41	128.37	127.22	62.03	7,113.58

Table 7 – City of Grand Rapids Diesel Generator Emissions

Department	Direct CO_2 Emissions (metric tons)	Direct CH_4 Emissions (kg)	Direct N_2O Emissions (kg)	Total Direct CO_2e Emissions (metric tons)
Environmental Services	648.53	97.52	5.32	652.23
Facility Management	10.05	1.41	0.08	10.10
Police	3.65	0.51	0.03	3.67
Miscellaneous	5.08	0.71	0.04	5.10



Optional Scope 3 Emissions

Scope 3 emissions are those emissions that are the result of the City's activities, but are from sources not owned or controlled by the City (e.g., employee travel to and from work, emissions from landfills resulting from waste placement, etc). Scope 3 emissions are considered voluntary and are not included in the City's GHG inventory.

Biogenic Emissions

Biogenic Emissions are defined by the USEPA as emissions that result from natural biological processes, such as the decomposition or combustion of vegetative matter. Biogenic emissions are part of a closed carbon loop and are balanced by the natural uptake of CO_2 by growing vegetation; resulting in a net zero contribution of CO_2 emissions to the atmosphere. Examples of biogenic emission sources include burning vegetation (biomass) to produce electricity or using plant-based biofuels for transport.[17] CO_2 emissions

[17] http://www.epa.gov/greenpower/gpmarket/index.htm

from composting performed by the City are considered biogenic. Biogenic Emissions from renewable energy are summarized as renewable energy adjustments in the tables above.

The CO_2 emissions from the decomposition processes at the WWTP are considered biogenic and do not require calculation. The CH_4 and N_2O emissions from WWTP's are not considered biogenic and do require calculation. However, CH_4, and N_2O emissions from wastewater treatment primarily occur from anaerobic decomposition. The City's WWTP uses an aerobic process. The *EPA Technical Support Document For Wastewater Treatment: Proposed Rule For Mandatory Reporting Of Greenhouse Gases*, indicates CH_4 emissions should be calculated for domestic wastewater by multiplying the flow, BOD, maximum CH_4 producing potential (0.6 kg CH_4/Kg BOD default), and CH_4 correction factor (MCF), indicating the extent to which the organic content (measured as BOD) degrades anaerobically. The MCF is obtained from IPCC[18], which indicates the MCF for a well maintained aerobic treatment plant, is zero. Therefore, methane emissions from the decomposition of waste in the City's aerobic WWTP are considered nil. For N_2O emissions, the IPCC guidance indicates the emissions are small, and may be considered a minor source. Typically N_2O emissions would only be considered from wastewater treatment processes with nitrification and denitrification steps. Therefore, N_2O emissions from the WWTP decomposition process were not considered.

[18] Chapter 6 – Waste Water Treatment and Discharge Table 6.3

TIER 2 – COMMUNITY INVENTORY

For the community inventory, the City used the Clean Air Climate Protection (CACP) software provided by ICLEI. Because the City of Grand Rapids is a member of ICLEI, it is encouraged to use this software to aid in calculating GHG emissions from the community's activities. The software is based upon the Local Government Operations Protocol which incorporates the GHG programs, protocols, and methodologies of the ICLEI and the sources discussed earlier in the Protocol section of this report. It is a standard accepted method for determining a community's GHG emissions. Output data is aggregated into six sectors: Residential, Commercial, Industrial, Transportation, Waste, and Other. A summary of the activities included in each sector follows.

RESIDENTIAL

In 2006 to 2008, the City of Grand Rapids had slightly more than 71,000 occupied housing units. Of the total housing units, approximately 67 percent were single-unit structures, 33 percent were multi-unit structures, and less than 0.5 percent were mobile homes.[19] While the City Assessor's Office was able to provide information regarding the number of properties on the tax rolls, this information did not provide a detailed breakdown on types of housing units. The information from the US Census Bureau provided details of housing units, size (single unit/multi unit), and home heating methods necessary for this assessment.

The Residential sector contribution to the Community GHG Inventory results primarily from the use of electricity and natural gas. Electricity is used for lighting, to heat and cool the home, and to power appliances. Natural gas is used for home heating, for cooking, and to power appliances such as hot water heaters and clothes dryers. Home heating can also be accomplished through the use of bottled, tank or LP gas, fuel oil, kerosene, wood/corn, solar or geothermal means.

Electricity is supplied to the area by Consumers Energy, which provided data on the gross amount of electricity used by residential customers in the City for calendar year 2005 and also for the period November 2008 through October 2009. Residential electricity usage for calendar year 2007 was determined based upon US Department of Energy reports for 2007 applied to the electricity data provided by Consumers Energy.[20]

19 US Census Bureau, http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=16000US2634000&-gr_name=ACS_2008_3YR_G00_DP3YR4&-ds_name=ACS_2008_3YR_G00_&-_lang=en&-_sse=on, October 29, 2009

20 US Department of Energy, Energy Information Administration, Electric Power Annual 2007 – State Data Tables, http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html November 10, 2009

Natural gas is delivered to the area by DTE Energy (through its MichCon operations). DTE Energy provided gross residential natural gas delivery information for calendar year 2007 on an "Estimated Actual" basis and for "Normalized" usage (which is based upon weather conditions). Because natural gas is combusted at each individual location, these GHG emissions have been calculated for the Residential Sector-based upon the gross natural gas usage.

The US Census Bureau provided information regarding Home Heating Fuel Use for housing units in the City of Grand Rapids. The US Census Bureau reported occupied home heating usage as follows:

- Utility Gas 92.8%
- Bottled, Tank or LP Gas 0.5%
- Electricity 5.6%
- Fuel Oil, Kerosene, etc. 0.2%
- Other Fuels (Assumed Wood) 0.6%
- No Fuels Used 0.2%[21]

Because there is no single main supplier of bottled, tank or LP gas or fuel oil or kerosene, there was no single source of usage data for these fuels. To determine an approximation of community Residential heating consumption, several assumptions were made. First, it was assumed that the heating demand would be consistent on an energy unit (BTU) basis. Second, it was assumed that the vast majority of natural gas consumed by the Residential sector was used for home heating, while electricity consumed would be split evenly between heating and for lighting and appliances.

The home heating fuel use percentages shown above were applied to the heating value of the gross natural gas delivered to the Residential sector in order to calculate estimated energy usage of bottled, tank or LP Gas, fuel oil, kerosene, etc., and wood. This energy usage (BTU) was then converted into units of fuel based upon standard energy contents of the material.

COMMERCIAL

This sector includes a wide variety of activities including hospitals, institutions, non-City governmental operations, retail, restaurants, motels/hotels, and offices. For informational purposes, 2008 data (2007 data was not provided) from the City Assessor's office revealed that there were more than 2,800 commercial properties occupying approximately 30,034,321 square feet.

[21] US Census Bureau, 2006 – 2008 American Community Survey, http://factfinder.census.gov/servlet/ADPTable?_bm=y&-geo_id=16000US2634000&-qr_name=ACS_2008_3YR_G00_DP3YR4&-ds_name=ACS_2008_3YR_G00_&-_lang=en&-_sse=on, October 29, 2009

The contribution of GHG emissions from the Commercial sector are primarily a result of electricity usage and natural gas consumption. Electricity is used for lighting, to heat and cool the business, and to power equipment such as ovens and office equipment. Natural gas is used for heating and powering equipment such as ovens, heaters, and dryers. Due to the number of commercial properties, it was not possible to obtain an energy usage on an individual basis. Gross energy usage for commercial classification customers was obtained from Consumers Energy and DTE Energy. Select categories of the Commercial Sector are discussed below.

SCHOOLS AND UNIVERSITIES

The Grand Rapids Public Schools operates:

- 31 Elementary Schools
- 16 Middle Schools
- 6 High Schools
- 7 Alternative Education Schools
- 8 Juvenile Justice Schools
- 13 Special Education Schools
- 6 Center for Innovation Schools.[22]

In addition, there are at least 17 private elementary and secondary schools throughout the City.[23]

Within the City limits, there are 10 four-year universities and colleges operating in some capacity (full campuses and distance learning centers), as well as the two-year Grand Rapids Community College.[24]

HOSPITALS

There are 11 hospitals in addition to numerous clinics, specialty centers, and outpatient offices operating within the City.

GOVERNMENTAL OPERATIONS

This category includes the activities that use electricity and natural gas for the City of Grand Rapids, Kent County, the State of Michigan, and the United States Federal government. It is important to note that the data available for the community inventory does not differentiate the City's natural gas or electricity use, and, therefore, it is combined with all of the other activities in the Commercial Sector. The reader should be mindful of this so as to avoid "double-dipping" the City's emissions if comparing the two inventories.

[22] Grand Rapids Public Schools, http://grpublicschools.org/grps1/, November 10, 2009
[23] City of Grand Rapids 2008 Assessor Records, November 4, 2009.
[24] City of Grand Rapids, Final Fiscal Plan FY2010-FY2014, http://www.grand-rapids.mi.us/download_upload/binary_object_cache/frontpage_Final%20Fiscal%20Plan%20(Final%20File).pdf, November 10, 2009

UTILITY USAGE

Electricity is supplied to the area by Consumers Energy, which provided data on the gross amount of electricity used by commercial customers for calendar year 2005 and also for the period November 2008 through October 2009. Commercial electricity usage for 2007 was determined based upon US Department of Energy reports for 2007 applied to the electricity data provided by Consumers Energy.[25] None of the activities in this sector generate electricity.

Natural gas is delivered to the area by DTE Energy (through its MichCon operations). DTE Energy provided gross natural gas delivery information to the community's commercial properties for calendar year 2007 on an "Estimated Actual" basis and for "Normalized" usage (which is based upon weather conditions). Because natural gas is combusted at each individual location, these GHG emissions have been calculated for the Commercial Sector based upon the gross natural gas usage.

INDUSTRIAL

This sector includes a wide variety of industrial activities including process boilers, auto parts manufacturers, welding operations, dynamometers, chemical processes, and asphalt plants. The Veolia Energy Grand Rapids LLC facility[26] and supplemental fuel use at the Covanta Kent Inc. Waste-to-Energy Facility are included in this sector. For informational purposes, 2008 data (2007 data was not provided) from the City Assessor's office revealed that there were nearly 450 industrial properties occupying approximately 23,081,260 square feet.

The contribution of GHG emissions from the Industrial sector are primarily a result of electricity usage and fuel consumption for lighting, to heat and cool the business, and to power equipment. Fuel consumption includes natural gas, gasoline, No. 2 (diesel) fuel oil, No. 6 (residual) oil, and solid waste. Due to the number of industrial customers, it was not possible to obtain an energy usage on an individual basis for electricity and natural gas. Gross energy usage for the industrial classification customers was provided by Consumers Energy and DTE Energy. Usage for other fuels was obtained from the Michigan Department of Environmental Quality (MDEQ), Michigan Air Emissions Reporting System (MAERS) for the 2007 reporting year.

[25] US Department of Energy, Energy Information Administration, Electric Power Annual 2007 – State Data Tables, http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html November 10, 2009

[26] The Veolia Energy Grand Rapids LLC Plant provides steam to facilities within the City. Veolia's network consists of four fossil-fuel fired industrial boilers that produce 450,000 pounds of steam annually to over 130 customers in the City's Central Business District.

UTILITY USAGE

Electricity is supplied to the area by Consumers Energy, which provided data on the gross amount of electricity used by industrial customers in 2005 and also from November 2008 through October 2009. Industrial electricity usage for 2007 was determined based upon US Department of Energy reports for 2007 applied to the electricity data provided.[27] The Covanta Kent Waste-to-Energy facility is the only facility within this sector that generates electricity. The GHG emissions from this facility have been included in the Community GHG inventory.

Natural gas is delivered to the area by DTE Energy (through its MichCon operations). DTE Energy provided gross natural gas delivery information to the community's industrial properties for calendar year 2007 on an "Estimated Actual" basis and for "Normalized" usage (which is based upon weather conditions). Because natural gas is combusted at each individual location, these GHG emissions have been calculated for the Industrial Sector based upon the gross natural gas usage.

Other fuel use at some industrial sources was reported through the MAERS, and reports for CY 2007 and 2008 were obtained for sources with a Grand Rapids facility address. Fuel types and amounts were identified in the MAERS report and aggregated on a total usage basis. The following fuels were identified in the MAERS report: fuel oil, process gas (treated as landfill gas or biogas in the software), and stationary gasoline. While natural gas usage is reported in the MAERS, this data was not used for purposes of this report, as the gross natural gas delivery information from DTE Energy would include natural gas deliveries to small industrial sources that are exempt from reporting to MAERS.

TRANSPORTATION

GHG emissions from the Transportation sector occur from the combustion of fuel in cars, trucks, buses, trains, ships, and aircraft. The most direct method of determining GHG emissions from this sector is to determine the type of vehicle/engine and the associated type and amount of fuel consumed. This information is not readily available for all sources in this sector. A discussion of the categories of GHG emissions and how they were determined for this sector follows.

[27] US Department of Energy, Energy Information Administration, Electric Power Annual 2007 – State Data Tables, http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html November 10, 2009

ROADWAYS

Fuel consumption could not be obtained for most personal or commercial vehicles operating within the City. Fuel purchased within the City is not necessarily consumed in the City. To address this issue, GHG emissions from roadway traffic has been determined using miles of roadway and average annual vehicle miles travelled over those roadways. Roadway classifications and vehicle fleet mix affect the amount of GHG emissions generated.

The road infrastructure in the City is characterized by the US Department of Transportation – Federal Highway Administration as follows[28]:

Table 8 - City of Grand Rapids Road Infrastructure

Road Classification	Miles	Daily Vehicle-Miles	Annual Average Daily
Interstate	51	2,497	63,532
Other Freeways and Expressways	51	2,591	
Other Principal Arterial	184	4,308	
Minor Arterial	403	4,190	
Collector	266	1,309	
Local	1,778	1,249	

The Annual Average Daily Traffic value for roadways other than interstates/freeways was not available from the Federal Highway Administration. Traffic count information for the classifications urban collector, urban local road, and urban minor arterial, and urban principal arterial was provided by the Grand Valley Metropolitan Planning Council (GV-MPC) for 2007, 2008, and 2009. Different sections of roadway were sampled in the different years. Data was reported on an Average Daily Traffic basis, which consists of actual traffic counts taken on a section of road over a 1 week period. This information cannot be converted to Annual Average Daily Traffic. As a result, roadway emissions were calculated using only the freeway classification data.

[28] Office of Highway Policy Information Federal Highway Administration Highway Statistics 2007, http://www.fhwa.dot.gov/policyinformation/statistics/2007/

The Transportation Assistant in ICLEI's CACP calculator uses the miles of roadway, Annual Average Daily Traffic, fuel type, and vehicle stock distribution to determine GHG emissions contributed from the sector. Fuel type was assumed to be split 85% gasoline and 15% diesel. The distribution of vehicle stock was obtained from the US-DOE Energy Information Administration as follows[29].

Table 9 – USDOE Distribution of Vehicle Stock

Residential Vehicles		83%
Passenger Cars	72% of Residential	
Pickup Trucks	17% of Residential	
Sport Utility	5% of Residential	
Large Vans	3% of Residential	
Minivans	3% of Residential	
Non-Residential Vehicles		17%
Business Fleets (includes some Gov't.)	49 – 55% of Non-Residential	
State, County, and Municipal Gov't.	10% of Non-Residential	
Federal Gov't.	2% of Non-Residential	
Unaccounted (includes some Gov't.)	45 – 51% of Non-Residential	

PUBLIC TRANSPORTATION - PASSENGER BUS

Public interurban bus transportation in the City is provided primarily by The Rapid, which is separate from that provided by DASH. GHG emissions from DASH bus service are included with the City's governmental operations inventory. Information on transportation characteristics for The Rapid was obtained from its website and The Rapid's Transportation Manager.[30] Data was provided for The Rapid's 2007 fiscal year, which runs from October 1 – September 30.

The Rapid maintains 117 full-size, diesel-powered buses and 5 hybrid buses. Additionally, there are gasoline powered service vehicles used by The Rapid. Fuel usage for FY 2007 was reported as follows:

Table 10 - The Rapid Fuel Usage For FY 2007

Unleaded Gasoline	22,449 gallons
Diesel Fuel	817,516 gallons

The following information was obtained from The Rapid's Report Card[31]:

Table 11 - The Rapid Report Card Information FY 2007

Passengers	7,753,258
Passengers per Revenue Mile	1.95
Revenue Miles (calculated)	3,976,030

[29] US Department of Energy, Energy Information Administration, http://www.eia.doe.gov/emeu/altfuelvh/stock1.html
[30] The Rapid, The Rapid Report Card, 2007 Annual Report Card; http://www.ridetherapid.org/about/reports-publications/report-card
[31] The Rapid, The Rapid Report Card, 2007 Annual Report Card; http://www.ridetherapid.org/about/reports-publications/report-card

Fuel usage, miles driven and types of vehicle were entered into the CACP calculator to determine the GHG emissions contributed from these sources.

SCHOOL BUSES

Dean Transportation provides bus transportation for preschool, elementary, middle school regular education, and special education transportation for all grades, including high school. The Rapid provides transportation services for regular education high school students, which was presented above.

The following information for the 2007 - 2008 School Year was provided by Dean Transportation: number of buses, type of fuel used, amount of fuel used and total miles traveled. This information was input into the CACP calculator to determine the GHG emissions contributed from these sources.

Table 12 – Dean Transportation 2007 - 2008 School Year

Number of Buses	136 + 12 Spares
Type(s) of Fuel	Ultra Low Sulfur Diesel
Fuel Usage, gallons	318,828
Miles Traveled	2,869,452

RAIL TRAFFIC

Rail traffic in the City of Grand Rapids consists of passenger service and freight service. Passenger rail service is provided by Amtrak. Freight service is provided by two Class I railroads, CSX and Norfolk Southern, and one short line/regional railroad, Grand Rapids Eastern Railroad. There are three rail freight owners in the City of Grand Rapids: CSX Railroad owns 10 miles of tracks within the City limits; Grand Rapids Eastern Railroad owns 6.1 miles of tracks; and Norfolk Southern owns 3.3 miles.[32] None of the rail freight owners or other sources were able to provide the data needed for this inventory in the form of type and amount of fuel used and total rail miles traveled (required by the CACP calculator). Amtrak provided passenger rail data for fiscal year 2008 which revealed there were 57,465 “boardings and alightings," with a total calculated diesel fuel use of 2,586 gallons.

AIRPORTS

There are no airports within the City limits. The City’s international airport, Gerald R. Ford International Airport, is located 15 miles outside of the City. GHG emissions from this source were not calculated.

PORT FACILITIES

There are no commercial or industrial port facilities within the City limits.

[32] Michigan Center for Geographic Information Framework version 9b.

WASTE

The Covanta Kent Inc. Waste-To-Energy Facility is capable of processing 625 tons of municipal solid waste per day and generating up to 18 megawatts of electricity and/or 116,000 pounds of steam per hour for export.[33] This facility burned 177,993 tons of waste from the City of Grand Rapids and other customers in calendar year 2007[34].

The yard waste from city residents and businesses is managed by Spurt Industries in one of its facilities outside of the City. In fiscal year 2008, the City sent 11,093 tons of yard waste to Spurt. Composting produces "negative" emissions or credits, details of which are reflected in Appendix 2.

OTHER OPERATIONS

There are only minimal agricultural operations within the City limits, consisting primarily of household gardens. There are no emissions from these sources included in this inventory.

Operations in this classification also include use or emission of hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. These chemicals are typically used in air conditioning/chilling and in the manufacture of computer parts. There is no single or reliable source on the use of these chemicals due to the number of facilities that use the chemicals and the number of repair personnel who can service this equipment.

GREENHOUSE GAS INVENTORY

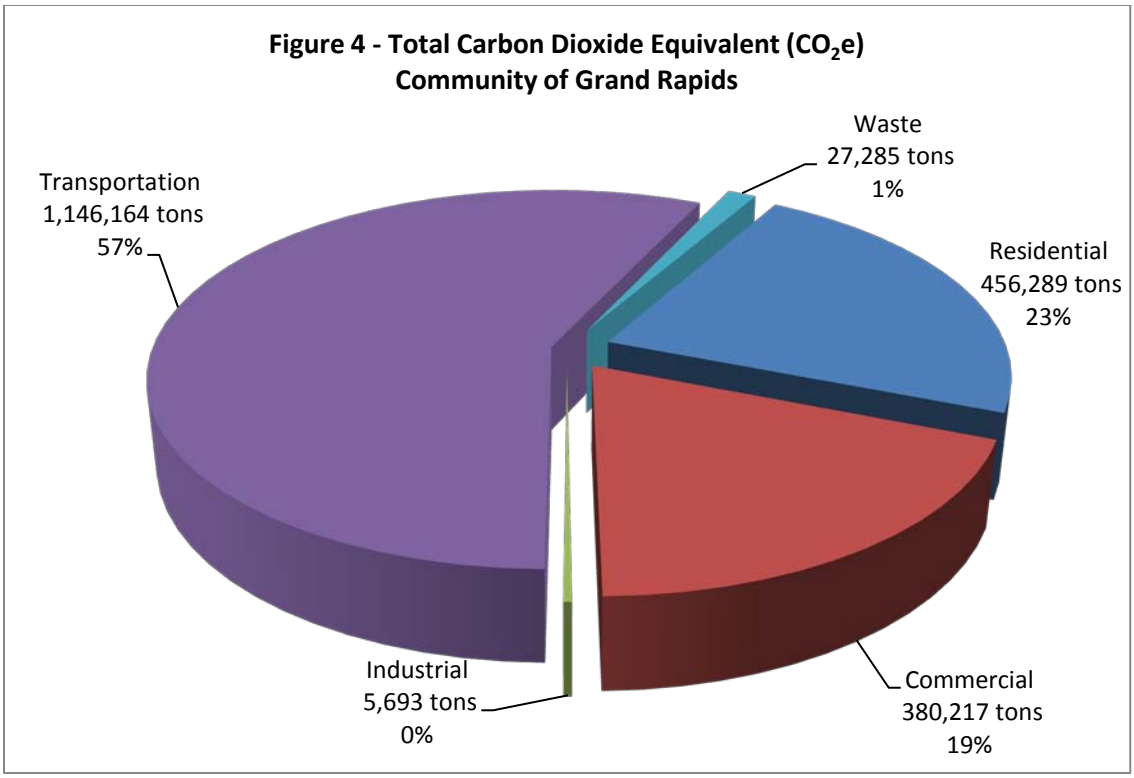
The detailed results of the GHG inventory are presented in Appendix 1. A summary of the community is illustrated below:

Table 13 – Community of Grand Rapids GHG Inventory Summary (Metric Tons)

	CO_2	N_2O	CH_4	CO_2e	%
Residential	454,716	1.09	58.78	456,289	22.6%
Commercial	379,245	0.72	35.74	380,217	18.9%
Industrial	5,683	0.02	0.15	5,693	0.3%
Transportation	1,128,275	54.52	47.04	1,146,164	56.9%
Waste	-	-	1,299.31	27,285	1.4%
Total	1,967,919	56.35	1,441.01	2,015,648	

[33] Kent County Department of Public Works, http://www.accesskent.com/YourGovernment/PublicWorks/wte.htm ; Covanta Kent http://www.covantaholding.com/site/locations/covanta-kent.html

[34] Michigan Air Emissions Reporting System



As illustrated in Figure 4, over half of the GHG emissions from the community are the result of transportation-related activities such as personal and commuter driving, mass transportation, commercial trucking, etc. The Residential Sector is the second highest contributor to the inventory. Interesting to note is that the Industrial Sector accounts for 0.3% of the community's GHG emissions.

TIER 1 – FACILITY ANALYSIS

CITY OF GRAND RAPIDS ENERGY CONSUMPTION

Energy use in the City's buildings in 2008 amounted to approximately 90,466,605 kWh of electricity, 1,339,223 CCF of natural gas, and 9,762,000 pounds of steam. The Traffic Department's street lighting systems distribute an additional 19,527,308 kWh of electricity. This energy consumption represents a significant portion of the City's annual emissions of 98,904 tons of greenhouse gas.

Reducing this energy use by even a small percentage will have benefits for all Grand Rapids residents through lower municipal costs and reduction of GHG emissions. This Tier 1 Energy Efficiency and Conservation Strategy (EECS) addresses energy reduction in City facilities.

CITY FACILITIES STRATEGY PRIORITIES

The City budget has been negatively affected by a continuing economic recession and high unemployment. Past spending levels cannot be maintained and reductions have been necessary, affecting City staff and residents. The 2009 Energy Efficiency Conservation Block Grant (EECBG) award may be used to fund energy efficiency improvements and make deferred repairs to reduce City energy expenses for the future. Projects have been selected to make a primary impact on general fund facilities in order to reduce the City's general fund energy expenditures.

CITY FACILITIES OVERVIEW

The physical assets of the City of Grand Rapids facilities include approximately 275 buildings. Buildings in service range in age from 135 years old to new within the last few years. Energy is provided by electrical, gas, and steam utilities. City facilities and energy consumption are summarized in the following Table. Energy consumption shown is based on the City baseline year of 2008.

Table 14 - Energy Consumption Summary				
Department	**Facilities**	**Electric Usage kWh/year**	**Natural Gas Usage CCF/year**	**Steam Usage 1,000 lbs/year**
Environmental Protection (Wastewater)	67	31,629,903	374,428	0
Water (Treatment and Distribution)	32	38,822,122	510,775	
Facility Management (City Hall, Public Works, Police, Records)	36	8,532,020	155,140	8,928
Fire Department	12	975,302	74,250	834
Libraries	8	3,080,503	133,044	0
Parking	37	5,224,441	87	0
Parks and Cemeteries	84	1,404,141	78,389	0
Street Lighting	N/A	19,527,308		

CITY FACILITIES ANALYSIS

City facilities have been analyzed for potential energy conservation measures by the following process:

- Utility data for each facility or meter was gathered from City records, Consumers Energy electrical billing, Michigan Consolidated Gas natural gas billing, and Veolia Energy steam billing.
- Department or Facility managers were interviewed regarding the building(s) condition, maintenance history, and to document existing energy reduction efforts.
- Facility visits were conducted. Priority effort was expended on large facilities or smaller facilities representative of many similar buildings.
- Energy conservation measure (ECM) opportunities were identified, listed, and costs for implementation and savings calculated.
- Energy conservation measures were arranged into a prioritized list of projects and financial calculations performed to generate an energy savings cash flow projection.

CITY FACILITY REDUCTION STRATEGY

The total energy conservation measures identified in this Tier I strategy effort are conservatively estimated to provide a reduction of approximately 4,250,000 kWh/year, 7,450 CCF/year, and 3,000,000 gallons of water per year. Greenhouse gas emissions would be reduced by more than 3,500 tons. Total implementation cost for these measures would exceed $9,000,000.

Current City budget constraints preclude a simultaneous implementation of all measures. Energy conservation measures have, therefore, been prioritized and are recommended below.

The City will implement three groups of projects as a result of the EECBG funding opportunity and the development of a comprehensive Energy Efficiency and Conservation Strategy. These projects are selected from a total of 187 significant Energy Conservation Measures projects identified during the EECS development.

GROUP ONE PROJECTS

A number of ECM opportunities were identified during the EECS effort that will afford the City a return on investment approaching 50% per year. These projects are relatively inexpensive, totaling approximately $90,000 for implementation and will be undertaken immediately, not requiring the use of EECBG funding. These projects will directly reduce energy consumption and greenhouse gasses emitted annually by approximately 458 tons per year.

1. Upgraded thermostats or setback controls at 6 facilities.
2. Vending machine power controllers at 14 locations
3. Lighting control improvements at 6 facilities.
4. Lighting removal or retrofit at 8 facilities.
5. Outdoor reset control for boiler at 1 location.
6. Installation of low leakage dampers at City Hall air handlers, each floor.

GROUP TWO PROJECTS

A significant number of energy improvement projects were identified with potential for EECBG funding and near term implementation. The projects listed below were selected as having the highest public profile, the most long term value to the City, and would best fit the goals and objectives of the EECBG program.

1. Replacement of single pane windows at City Hall with high performance windows at a cost of $1,200,000, reducing greenhouse gas emissions by 195 tons equivalent per year.

2. A geothermal heating and cooling project for a community center gymnasium facility, leveraging City capital improvement funds with $300,000 in EECBG funds and creating a platform for a future district geothermal implementation.

3. Lighting retrofits at several City facilities, installed at a cost of $275,000, and saving an estimated 407,300 kw-hr per year in electricity and reducing annual electricity costs by approximately $34,600.

4. Installation of a web-based metering system to allow improved data gathering and energy management.

5. Addition of dual technology occupancy sensors for lighting control in City Hall, Police Department, Fire Department, and other facilities.

GROUP THREE PROJECTS

The balance of the projects identified during the EECBG program will be implemented using potential future EECBG, other grants, or as other funding opportunities become available. These projects include:

1. Replacement of single-pane fire station garage doors and windows with high efficiency multi-pane glazing.
2. Building controls improvements in Fire Department facilities.
3. Architectural renovations to reduce light fixture quantities and replace glazing on the first floor of City Hall.
4. Replacement of standard refrigerators with Energy Star rated in approximately 14 locations.
5. Replacement of standard (80%) efficiency furnaces with minimum 92% efficiency in 5 facilities.
6. Replacement of standard efficiency air conditioning condensers with high efficiency at 5 facilities.
7. Replacement of boilers and installation of heat reclaim equipment at 2 facilities.
8. Replacement of water heating equipment at 6 facilities.
9. Replacement of standard efficiency pool heaters with high efficiency units at 2 pool facilities.
10. A total of 57 additional retrofit and improvement projects within the City's enterprise departments, which include water utility, waste treatment facilities, libraries, and parking facilities. Enterprise projects will be performed by the responsible departments as funding allows.

FACILITY AND FLEET MANAGEMENT – CITY HALL

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
300 Monroe NW	City Hall	Office	1969	188,940	79,389

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
CH01	Floor 1: Remove 118 downlights and 94 wall washers in Lobby. Replace lighting with 200 feet of linear fluorescent wall washer and add 32 downlights. Patch, repair, paint ceiling in locations where downlights were removed. Add new daylight harvesting system and sensors to control new lighting system.	$72,700.00	5.2	23,753			$2,108.00		$2,108.00		34.4	17.78
CH02	Floor 1: Of 88 total existing exterior downlights, remove 44 downlights. Patch, repair, and paint ceiling in locations where downlights were removed. Replace 44 downlights with new fixtures.	$14,500.00	1.7	5,010			$425.00		$425.00		34	3.75
CH03	Floors 1 – 9: Revise circuiting for most EM/NL fixtures from 24/7 operation to 12 hours per day, 5 days a week.	$10,000.00		39,087			$3,322.00		$3,322.00		3.0	29.25

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
CH04	Floors 2 – 9: Retrofit and replace existing T12 lighting in City Hall.	$117,130.00	35	128,189			$10,896.00		$10,896.00	$11,780.00	9.6	95.93
CH05	Floors 2 – 9: Add occupancy sensors in open offices and private offices.	$37,750.00	30	86,822			$7,379.00		$7,379.00	$8,348.00	4.0	64.98
CH06	All Mechanical Rooms: Replace T12 industrial fluorescent light fixtures with T8 industrial fluorescent light fixtures.	$12,000.00	1.0	561			$47.00		$47.00	$800.00	238	0.42
CH07	Power monitor at 1 vending and 1 snack machine.	$450.00	1.0	3,628			$308.00		$308.00	$100.00	0.6	2.72
CH08	Replace 4 existing elevators (currently 40 years old) and relay controls with new elevators and controls.	$600,000.00		estimated to be 50% of current usage								
CH09	Evaluate existing DHW heat exchanger to determine if a more efficient method could be used. Electric instantaneous heaters on each floor.											
CH10	Evaluate existing DHW heat exchanger to determine if a more efficient method could be used. Centralized natural gas fired water heating system.											
CH11	Evaluate existing DHW heat exchanger to determine if a more efficient method could be used. Keep using the centralized steam system.											
CH12	Schedule refrigerated drinking fountains using plug-in timers.											
CH13	Install low leakage insulated dampers at AHU.	$30,314.00		28,760	867		$10,655.00		$10,655.00		2.8	68.58

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
CH14	Replace common care area pneumatic thermostats with DDC type on each floor											
CH15	Replace perimeter pneumatic heating water master and slave control valves with DDC type on each floor.											
CH16	Miscellaneous insulation at Monroe Level Mechanical Room.											
CH17	Zero loss drain valves at BMS air compressor and filters											
CH18	Install new high performance windows and storefront frames.	$1,200,000.00	51.3	36,911	3,083			$3,960.00	$39,975.00		17.6	195

ECM CH01: The First Floor Lobby consists of approximately 200 downlights and wall washers. These fixtures are inefficient since the internal housings are black versus white finish or specular finish. Not much light is being delivered to the space. A new lighting system would significantly improve the aesthetics of this public Lobby space. An exhibit could be set up in the Lobby to educate the public on the daylight harvesting system being used.

FACILITY AND FLEET MANAGEMENT – CARC AND OLD FEDERAL BUILDING

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
223 Washington, SE	Community Archives and Research Center	Archives, Research, Storage, Offices	1938	138,658	38,299
155 Division	Old Federal Building (former Grand Rapids Art Museum)	Currently vacant, special events only		64000	11,011

1. Architectural/Engineering Drawings have been completed for the Community Archives and Research Center (CARC). The project drawings are labeled as: Improvements to the Community Archives and Research Center. At this time, the drawings will not be sent out for bids. Some of the ECMs are incorporated in these Drawings. The use of the original building will be changing to an archival space which will require the HVAC equipment to be upgraded to ensure proper climate conditions are maintained around the clock.
2. The Old Federal Building was not reviewed for the following reasons: The building is vacant and is only opened for special events like Art Prize; systems operate at a minimal level; and the City is currently trying to sell this building.

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
MU01	Install a heat scavenging system on the condensate discharge. Direct the recovered heat to preheating the reheat coil heating loop.	$2,000.00			2		$18.00		$18.00		111	0.11
MU02	Add new lighting and lighting control relay panels for the following areas: West Building, Center Building 1st Floor, East Building 1st floor (approximately 67,701 sf).	$169,252.00	35	18,285			$1,554.00		$1,554.00		109	13.68

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
MU03	Revise circuiting for EM/NL from 24/7 operation to 60 hours/week, 52 weeks/year for the following areas: West Building, Center Building 1st Floor, East Building 1st floor (approximately 67,701 sf).	$6,000.00	0	2,499			$2,124.00		$2,124.00		2.8	1.87
MU04	Add new lighting and lighting control relay panels for the following areas: Center Building Basement and 2nd Floor, East Building 2nd and 3rd Floor (approximately 69,603 sf).	$169,252.00	35	18,285			$1,554.00		$1,554.00		109	13.68
MU05	Revise circuiting for EM/NL from 24/7 operation to 60 hours/week, 52 weeks/year for the following areas: Center Building Basement and 2nd Floor, East Building 2nd and 3rd Floor (approximately 69,603 sf).	$6,000.00	0	2,499			$2,124.00		$2,124.00		2.8	1.87

ECM MU01: The heat scavenging system is part of a planned renovation/expansion of the current building.
ECM MU02: ECM indicated is included on Architectural/Engineering Drawings labeled as Improvements to Community Archives and Research Center.
ECM MU03: ECM indicated is included on Architectural/Engineering Drawings labeled as Improvements to Community Archives and Research Center.

FACILITY AND FLEET MANAGEMENT – POLICE DEPARTMENT – HEADQUARTERS

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
1 Monroe Center	Grand Rapids Police Department	Offices	Renovated 2001	245,491	47,674

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PH01	Police Department Parking Garage: Replace 175 watt metal halide fixtures with low bay fluorescent fixtures with integral occupancy sensors to reduce 24/7 operation of lighting.	$24,480.00	153	22,277			$1,893.55		$1,893.55	$1.785.00	12.9	16.67
PH02	Police Department Canopy Lighting: Remove time clock control and connect exterior canopy lighting to lighting control panel. Add UL924 units to allow operation of emergency lighting when normal power circuit is lost.	$400.00	60									
PH03	Police Department Stairways: Lighting is on 24/7. Utilize dual technology occupancy sensors to control lighting. Add UL924 units to allow operation of emergency lighting when normal power circuit is lost.	$4,600.00	76.8	11,182			$950.00		$950.00	$300.00	4.8	8.37

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PH04	Police Department Electrical and Mechanical Rooms: Utilize dual technology occupancy sensors to control lighting. Add UL924 units to shut off emergency/night lights when rooms are unoccupied, but allow operation of lights when normal power is lost.	$5,400.00	107	18,564			$1,577.94		$1,577.94	$286.00	3.4	13.89
PH05	Police Department Locker Rooms/Showers/Toilets: 2 x 4 – three lamp troffers are on 24/7. Add dual technology occupancy sensors to shut off lights when room is unoccupied. Add UL924 units to allow operation of emergency lighting when normal power circuit is lost.	$10,400.00	204	24,694			$2,099.00		$2,099.00	$543.00	4.95	18.48
PH06	Police Department Studio Control Room: Replace incandescent down lights and dimmers with fluorescent down lights and fluorescent dimmer controls. Control lighting circuit with dual technology occupancy sensors used to control fluorescent troffers in ECM PH09.	$4,300.00	60	5777			$491.05	$150.00	$641.05	$352.00	6.7	4.32
PH07	Police Department Computer Room: Add dual technology occupancy sensors to room lighting. Retain double light switching on load side of sensor relays.	$600.00	60	5871			$499.04		$499.04	$161.30	1.2	4.39

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PH08	Police Department Individual Offices: Add dual technology occupancy sensors to room lighting. Retain light switching on load side of sensor relays.	$33,000.00	594	28,829			$2,450.47	.	$4,034.47	$1,584.00	13.5	21.58
PH09	Police Department Archives: Lights are presently on 24/7. Add dual technology occupancy sensors to room lighting.	$1,100.00	72	5,242			$445.57		$445.57	$192.00	2.5	3.92
PH10	Police Department Atrium Area: Provide dimming ballasts in all atrium perimeter lighting. Connect all perimeter lighting to lighting control system. Provide daylight harvesting photocell control to control lighting level. Add UL924 units to allow operation of emergency lighting when normal power circuit is lost.	$21,230	173	16,773			$1,425.00		$1,425.00		14.9	12.55
PH11	Power monitors at 6 vending machines or request vending company provide Energy Star vending machines.	$1,200.00	4.6	14,489			$1,232.00		$1,232.00	$300.00	0.7	10.84
PH12	Energy Star refrigerators.	$1,300.00	0.3	517			$44.00		$44.00		29	0.39
PH13	911 Dispatch Room: Use LCD flat panel monitors instead of CRT monitors (7 quantity). On 27/7.											
PH14	Coffee Makers: Use thermos method instead of warmer method.											
PH15	Reduce shower head flow to save DHW energy.											

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PH16	Schedule refrigerated drinking fountains using plug-in timers.											
PH17	At variable volume flow heat pump loop, remove circuit setters and 3-way valves; and install 2-way valves. Provide VFDs at loop circulating pumps.											
PH18	Install heat recovery runaround loop at exhaust and incoming ventilation air at 2 EFs/MAUs.											
PH19	Replace motor at 5 hp Garage exhaust fan, which operates 24/7, with high efficiency motor.											
PH20	Retrofit quartz lamp humidifier in Liebert air conditioning units.											
PH21	Retrofit electric steam humidifiers with more efficient units (9 quantity).											

ECM PH02: This ECM would be instituted as part of ECM PH10. The advantage is to delete the time clock and include it as part of a computer controlled system.

FACILITY AND FLEET MANAGEMENT – POLICE DEPARTMENT – VICE UNIT BUILDING

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
601 Ottawa	Vice Unit	Offices/Garage	Renovated 2000	23,312	67,582

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PV01	Police Vice Unit Open Office: This area has 2 x 4 troffers with 3 – T8 lamps and parabolic louvers. Footcandle levels are between 40 and 75. The fixtures are controlled by 3 light switches. Cut footcandle levels by reducing fixture numbers (remove center row of fixtures) or disconnecting ballasts and lamps.	$400.00	17.2	2097			$178.25		$178.25	$150.00	2.2	1.57
PV02	Police Vice Unit Rear Open Office: This area has 2 x 4 troffers with 3 – T8 lamps. Footcandle levels are between 28 and 73. The fixtures are controlled by 2 light switches. Cut footcandle levels by disconnecting ballasts and lamps. Add occupancy sensor(s) to control lighting circuit.	$500.00	38	3,232			$274.22		$274.22	$60.00	2.5	2.42

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PV03	Police Vice Unit Individual Offices (4): These offices have 2 x 4 troffers with T8 lamps. Footcandle levels are between 50 and 130. The fixtures are controlled by 2 light switches. Cut footcandle levels by replacing ballasts, add dimmer ballasts, dimmers, daylight harvesting and add occupancy sensor(s) to control lighting circuit.	$6,400.00	46	3355			$285.18		$285.18	$122.00	22.4	2.51
PV04	Police Vice Unit Breakroom, Conference Room, Charger Room, Copy Room, Basement Locker Room, and Exercise Room: Lighting in these rooms is all switch controlled. Add occupancy sensor(s) to control lighting circuits.	$1,800.00	43.2	2621			$222.79		$222.79	$123.00	8	1.96
PV05	Police Vice Unit Exterior Canopy: The canopy has recessed downlights with incandescent lamps. Several lenses are missing and the fixtures are in disrepair. Replace all canopy fixtures with fewer surface mounted fluorescent fixtures. Presently fixture circuit is controlled by a photocell.	$800.00	23	3363			$285.86	$100.00	$385.86	$88.00	2.2	2.52
PV06	Police Vice Garage: Replace natural gas unit heaters with infrared radiant heaters.											
PV07	Police Vice Garage: Replace leaky dampers at north sidewall exhaust fans with insulated thermally broken type.											
PV08	Replace refrigerator with ENERGY STAR type.	$650.00	0.2	395			$34.00		$34.00	$50.00	18	0.30

FACILITY AND FLEET MANAGEMENT – PUBLIC WORKS

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
201 Market	Streets and Parks	Office		56,120	75,283
211 Market	Refuse Building	Vehicle Washdown/Storage and Office	1980	19,040	112,614
245 Market	Parks Garage	Vehicle/Supply Storage	1980	52,631	No electric data
265 Market	Streets Garage	Vehicle/Supply Storage	1980	52,631	No electric data
273 Market	Public Works Stockroom	Warehouse & Office	?	46,613	No electric data
??? Market	Fuel Dispensing	Fuel Dispensing	?	?	?
305 Market	Car Wash	Vehicle Wash	1980	2,210	No data on prop list
333 Market	Fleet Management	Office/Garage	1980	48,668	No data on prop list
509 Wealthy	Traffic Engineering	Office	?	32,781	60,854

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PW01	Fleet Management Locker Rooms: Install occupancy control; 8 T8 2-lamp 4-foot fixtures.	$1,200.00		532			$45.00		$45.00	$41.00	25	
PW02	Fleet Management Garage: Retrofit 74 175-watt HID metal halide fixtures with high bay T8 fixtures.	$19,350.00	9.5	30,730			$2,250.00		$2,250.00	$2,123.00	6.8	23.0
PW03	Fleet Management Tire Shop: Retrofit 9 175-watt HID metal halide fixtures with high bay T8 fixtures.	$2,350.00	1.2	4,260			$306.00		$306.00	$258.00	6.8	3.19

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PW04	Fleet Management Tire Shop and Parks and Streets Garage: Replace natural gas unit heaters with infrared radiant heaters.											
PW05	Streets and Parks (201 Market): Upgrade T12 fixtures to T8.	$33,672.00	6.7	21,000			$1,785.00		$1,785.00	$2,800.00	17	15.72
PW06	Parks and Streets Garage: Install a more efficient water heater for showers.											
PW07	Parks Garage: Retrofit 31 ?-watt HPS with high bay T8 fixtures.											
PW08	Streets Garage: Retrofit 73 ?-watt HPS with high bay T8 fixtures.											
PW09	Refuse Building: Retrofit 23 400-watt HID metal halide fixtures with high bay T8 fixtures in garage area.	$9,479.00		61,448			$2,983.00		$2,983.00	$1,860.00	1.7	46.00
PW10	Retrofit lighting at Refuse Center: Men's locker room 7 T12 3-lamp 4-foot fixtures, Women's locker room 4 T12 3-lamp 4-foot fixtures, Office and Conference areas 9 T12 3-lamp 4-foot fixtures.	$3,014.00		4,615			$498.00		$498.00	$240.00	4.9	3.45
PW11	Refuse Building: Replace natural gas unit heaters with natural gas infrared radiant heaters in tire shop.											
PW12	Repair insulation at roof and wall of Refuse Building. Cover with waterproof wall covering to prevent future damage during operator truck wash down process.											

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PW13	Incorporate daylight harvesting by using existing skylights in Refuse Building garage											
PW14	Install building-wide lighting control systems in all facilities.											
PW15	Install occupancy control in private offices.											
PW16	Install power monitor at 6 vending and snack machines.	$1,200.00	4.6	14,489			$1,232.00		$1,232.00	$300.00	0.7	10.84
PW17	Schedule refrigerated drinking fountain using plug-in timers.											
PW18	Install low flow shower heads in all showers.											
PW19	Refuse Building: ENERGY STAR refrigerator.	$650.00	0.2	395			$34.00		$34.00	$50.00	18	0.30
PW20	Streets and Parks Office: ENERGY STAR refrigerator	$550.00	0.2	1,039			$88.00		$88.00	$50.00	6	0.78
PW21	Traffic Engineering: ENERGY STAR refrigerator.	$550.00	0.2	370			$31.00		$31.00	$50.00	16	0.28
PW22	Fleet Management: Replace refrigerator with ENERGY STAR type.	$650.00	0.2	395			$34.00		$34.00	$50.00	18	0.30
PW23	Parks Garage: ENERGY STAR refrigerator.	$550.00	0.2	1,039			$88.00		$88.00	$50.00	6	0.78
PW24	Fuel Dispensing: CV fuel pumps to VVF system.											
PW25	Car Wash: Radiant Heater in Mechanical Room.											

FIRE DEPARTMENT

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
38 LaGrave	LaGrave Fire Station 1/Weston Administration Offices	Fire Station	1910 /1987	17,337	112,146
115 Franklin Street	Franklin Street Fire Station	Fire Station	1979	10,877	133,352
500 Bridge Street	Bridge Street Fire Station 3	Fire Station	1966	12,930	125,546
1181 Monroe Avenue	Monroe Avenue Fire Station 5	Fire Station	1983	7,868	143,169
2251 Plainfield Avenue	Plainfield Avenue Fire Station 14	Fire Station	1951	3,847	144,042
2451 Kalamazoo Avenue	Kalamazoo Avenue Station 4	Fire Station	1987	11770	103,345
1154 Covell Avenue	Covell Avenue Fire Station 8	Fire Station	1987	5238	36,468*
1002 Chester/230 Diamond	Chester Street Fire Station/Chester 11	Fire Station	1902	5335	134771
1755 Leonard Street	Leonard Street Fire Station	Fire Station	1981	7868	133,868
1734 Division Avenue	Division Avenue Fire Station/Division 20	Fire Station	1926	4025	124,074
2941 Burton Street	Burton Street Fire Station/Burton 6	Fire Station	N/A	7868	164,214

1. Buildings are the local fire stations for the City of Grand Rapids and include typical spaces, i.e., apparatus rooms, dormitories, kitchens, exercise rooms, offices. These buildings are occupied 24 hours/7 days year round.
2. EUI indicated with asterisk (*) does not include natural gas or steam utility input to building.

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
FD01	LaGrave Station 1: Install new high efficiency boiler and discontinue district steam service.	$7,500.00			433.4		$3,900		$3,900		1.9	22.96
FD02	LaGrave Station 1: If steam remains in service, install heat scavenger heat exchanger on condensate line to preheat domestic hot water.	$15,000.00			31.6		$285		$285		8.77	1.68
FD03	LaGrave and Franklin Stations: Install setback thermostats on rooftop units.	$3,900.00			488.4		$4,395.00		$4,395.00		0.88	25.88
FD04	Franklin Station: Replace two RTUs with radiant heaters.	$11,500.00			102.9		$926.00		$926.00		12.4	5.45
FD05	Bridge Station 3: Replace single glazed clerestory windows in the apparatus bay with high performance glazing system.	$3,000.00			4.7		$517.00		$517.00		5.80	0.31
FD06	Bridge Station 3: Replace single glazed windows with high performance glazing.	$9,240.00			34.2		$3,015.00		$3,015.00		3.01	1.82
FD07	Bridge Station 3: Install daylight harvesting controls in apparatus bay.	$1,500.00		11,250			$413.00		$413.00		3.63	8.42
FD08	Monroe Station 5: Integrate controls of heating and cooling equipment to prevent simultaneous heating and cooling.	$2,600.00			8.53		$76.00		$76.00		34	0.45
FD09	Plainfield Station 14: Replace boiler with high efficiency boiler.	$5,000.00			83.7		$753.00		$753.00		6.64	4.44

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
FD10	Monroe, Leonard, Burton, Kalamazoo, Covell, Franklin Stations: Replace existing single glazed overhead doors with new insulated steel with vision panels (estimated 28 total doors).	$95,000.00			489.4		$43,180.00		$43,180.00		2.2	26.05
FD11	Retrofit or replace T12 fluorescent lighting at all stations with T8. Replace HID lowbay at Bridge Station with T8.	$85,000.00	54	220,000			$18,060.00		$18,060.00	$30,000.00	3.05	165
FD12	Install setback time clocks and night thermostats on all apparatus bay heaters – 10 stations total.	$13,000.00			34.4		$310.00		$310.00		41.8	18.27
FD13	Install electric zone valves on radiant heaters and control with setback thermostats.	$83,000.00			95		$8,595.00		$8,595.00		9.69	50.6
FD14	Install low flow aerators on all lavatories.	$500.00				264						
FD15	Install low flush fixtures.	$55,000.00				792						
FD16	Repair garage door gaskets at all stations.	$5,000.00			34.4		$310.00		$310.00		16	1.83
FD17	On hot water heating systems, provide outside air reset on heating water temperature control.	$13,750.00			1,432		$12,892.00		$12,892.00		1.06	145.5
FD18	Install occupancy based lighting controls in all intermittently occupied spaces.	$24,000.00	45	140,500			$11,950.00		$11,950.00	$3,600.00	1.71	105
FD19	Standardize on Energy Star appliances for all future kitchen equipment purchases.											

ECM FD01: Disconnect building from district steam, remove steam to hot water shell in tube heat exchanger, and install new hot water boiler. Include ductwork for ventilation air.
ECM FD02: The steam to hot water heat exchanger currently drains condensate to a drain cooler, but the drain cooler does not work. The heat can be scavenged and used to preheat the domestic hot water.
ECM FD03: Total of 6 rooftop units. 4 at the LaGrave Station and 2 at the Franklin Station.
ECM FD04: Replace two rooftop units at the Franklin Station with radiant heaters.
ECM FD08: Several locations enable the baseboard heat system to heat while the cooling system is trying to cool the space.
ECM FD09: Upgrade the older Weil McClain boiler to high efficiency boiler and controls
ECM FD11: Based on Contractor's estimate for planned project.
ECM FD12: Provide setback function as well as zone valves which would turn off the water flow and fan.
ECM FD13: Replace Danfoss style hydronic valves with electric valves and control with programmable thermostat.
ECM FD14: All lavatories have standard aerators.
ECM FD15: All bathroom fixtures are high flow devices. There are approximately 4 toilets, 2 showers, 4 lavatories, and 2 urinals to each location
ECM FD16: Several locations have overhead door gaskets which appear to be sealing poorly.
ECM FD17: Reset temperature of the heating water based on the outside air temperature.
ECM FD18: Estimated based upon 25% overall reduction in lighting hours.

LIBRARIES

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
111 Library, NE	Main	Library	1904,1968, 2004	153,000	113,896
1563 Plainfield, NE	VanBelkum/Creston	Library	2002	4,632	109,357
1017 Leonard, NW	West Leonard	Library	2002	10,000	115,452
2350 Eastern, SE	Seymour	Library	1981	10,000	137,072
1201 Madison, SE	Madison Square	Library	2001	4,644	101,773
1150 Giddings, SE	Ottawa Hills	Library	1957	3,850	145,308
2025 Leonard, NE	Yankee Clipper	Library	1979	11,000	37,932
713 Bridge, NW	West Side	Library	1907	10,500	212,798

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
LB01	Main Library, Floors 1 - 4: Revise circuiting for stack lighting to include 50% light level control (every other row) for staff use.	$18,760.00	36	42,157			$3,583.00		$3,583.00		5.2	31.55
LB02	Main Library, Basement: Revise circuiting to light main aisles and pathways of high density shelving. Add timer switches to control lighting in remaining areas of high density shelving.	$4,780.00	18.9	82,590			$7,020.00		$7,020.00		0.7	61.81
LB03	Main Library, All Levels: Revise circuiting for EM/NL fixtures from 24/7 operation to 80 hours per week, 52 weeks per year.	$24,000.00	0	67,349			$5,724.00		$5,724.00		4.2	50.4
LB04	Main Library: Add CO_2 sensors to control demand ventilation.	$52,500.00			391.1		$3,520.00		$3,520.00		14.9	20.72

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
LB05	Main Library: Prepare air balance report for main AHUs.	$1,000.00			65.1		$586.00		$586.00		1.7	3.45
LB06	Main Library and All Branches: Add occupancy sensors to replace manual switches for all small private offices/conference rooms, etc.	$9,700.00	26.4	21,979			$1,868.00		$1,868.00	$2,113.00	4.1	16.45
LB07	West Leonard: Retrocommission snowmelt system.	$200.00			0.629		$5.66		$5.66		35.5	.03
LB08	West Leonard: Provide additional insulation at ceiling space.	$11,300.00			31.4		$283.00		$283.00		39.8	1.67

1. ECM LB08 There is currently 12 inches of blown in cellulose at a value of R-36. Above cost of $11,300 is to add an additional 8+ inches for an added R-30. Total R will be 60 assuming some settling of the original has already occurred. There should be a 5% savings in natural gas consumption.

PARKING

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
65 Monroe, NW	Louis Campau Ramp	Parking Ramp	1987	157,700	14,168
28 Pearl, NW	Pearl Ionia Ramp	Parking Ramp	1992	152,300	22,156
60 Ottawa, NW	Monroe Center Ramp	Parking Ramp	2003	173,000	15,324
50 Ottawa, NW	Ottawa Fulton Ramp	Parking Ramp/ Parking Dept. Offices	1997	241,000/ 10,000	17,962
300 Monroe, NW	Government Center Ramp	Parking Ramp	1968	376,700	5,607
41 Cherry, SW	Cherry Commerce Ramp	Parking Ramp	2007	111,000	10,514

1. Parking Services is a self-funded, City department.
2. Safety of patrons is very important; therefore, lighting levels need to be maintained and not reduced.
3. All existing parking garage light fixtures in ramps utilize high-pressure sodium lamps.
4. All existing parking ramps have lights controlled by lighting control system.
5. Existing parking ramp lights (with the exception of emergency/night lights) are shut off automatically at 3 a.m. and turned back on at 6 a.m.

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PR01	Louis Campau Ramp: Replace high pressure sodium parking garage fixtures with fluorescent fixtures that have integral occupancy sensors and photosensors.	$200,170.00	5.4	110,787			$9,417.00	$1,000	$10,417.00		19	82.91
PR02	Pearl Ionia Ramp: Replace high pressure sodium parking garage fixtures with fluorescent fixtures that have integral occupancy sensors and photosensors.	$221,260.00	28	291,462			$24,774.00	$1,000.00	$25,774.00		8.6	218.12

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PR03	Monroe Center Ramp: Replace high pressure sodium parking garage fixtures with fluorescent fixtures that have integral occupancy sensors and photosensors.	$203,500.00	5.5	112,342			$9,549	$1,000.00	$10,549.00		21	84.07
PR04	Ottawa Fulton Ramp: Replace high pressure sodium parking garage fixtures with fluorescent fixtures that have integral occupancy sensors and photosensors.	$291,560.00	7.9	161,321			$13,712	$1,000.00	$14,712.00		19.9	120.73
PR05	Government Center Ramp: Replace high pressure sodium parking garage fixtures with fluorescent fixtures that have integral occupancy sensors and photosensors.	$340,770.00	9.2	188,532			$16,025.00	$1,000.00	$17,025.00		20	141.09
PR06	Cherry Commerce Ramp: Replace high pressure sodium parking garage fixtures with fluorescent fixtures that have integral occupancy sensors and photosensors.	$115,810.00	3.1	64,140			$5,452.00	$1,000.00	$6,452.00		18	48.00

PARKS AND CEMETERIES – LODGES AND GYMNASIUMS

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
723 Van Raalte (49503)	Roosevelt Park Lodge	Gymnasium/ Multipurpose	Unknown	7,000	38,416
900 Fuller, SE	Martin Luther King Park Lodge	Boxing Gym/ Multipurpose	Unknown	8,000	56,730
2111 Madison, SE	Garfield Park Gymnasium	Gymnasium/ Multipurpose	Unknown	4,000	19,232
1400 East Fulton	Wilcox Park Lodge	Lodge/Restrooms	1954	1,830	783
1101 Richmond, NW	Richmond Park Lodge	Lodge/Restrooms	1930's	1,460	
145 Franklin	Paul I. Phillips Gymnasium	Gymnasium	1950's		

1. Roosevelt Park Lodge: Gymnasium on main level; multi-purpose room, kitchen, and locker rooms on lower level. Occupied intermittently (receptions, basketball leagues, etc). Estimate 3 days per week/6 hours per day. Heated and cooled.
2. Garfield Park Gymnasium: Gymnasium and kitchen on main level, with locker rooms on lower level. Occupied intermittently – basketball leagues. Estimate 5 days per week/4 hours per day. Heating only.
3. Martin Luther King Park Lodge: Boxing gym on main level, with pool locker rooms on lower level. Occupied intermittently. Estimate 5 days per week 4 hours per day. Heated only.

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCL01	Roosevelt Park Lodge: Replace gymnasium HPS fixtures with fluorescent.	$8,100.00	135	4,500			$382.50		$382.50	$1,200.00	21.2	3.37
PCL02	Roosevelt Park Lodge: Replace exit lights with LED type.	$2,000.00	1.5	437			$37.12	$200.00	$237.12	$125.00	8.4	0.33
PCL03	Roosevelt Park Lodge: Replace 3 existing air conditioning (condensing) units with high efficiency models.	$6,000.00	1.25	5,000			$600.00		$2,357.00		10	3.74

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCL04	Roosevelt Park Lodge: Add programming for unoccupied setback of space temperatures. Install a timer switch to allow occupants to initiate an occupied mode for a set period of time.	$500.00			140		$1,260.00		$1,260.00		0.40	7.60
PCL05	Roosevelt Park Lodge: Consider upgrading domestic hot water heaters to a high-efficiency (condensing) unit. May only be practical if usage increases (especially showers). Current level of building usage may not warrant replacement.	$5,000.00			18		$162.00		$162.00		30	0.98
PCL06	Roosevelt Park Lodge: Install low flow shower and lavatory fixtures in restrooms and locker rooms.	$1,000.00			65	2,600	$600.00		$600.00		1.6	3.53
PCL07	Garfield Park/Gymnasium: Replace incandescent lamps in boiler room, restrooms and showers, break area, and exterior canopy with fluorescent.	$432.00	60	3,120			$265.20		$265.20	$30.00	1.6	2.33
PCL08	Garfield Park/Gymnasium: Replace 2 x 2 HID fixtures in gymnasium with fluorescent.	$7,560.00	168	5,625			$478.13		$478.13	$1,970.00	15.8	4.21
PCL09	Garfield Park/Gymnasium: Replace exit lights with LED type.	$2,000.00	1.5	437			$37.12	$200.00	$237.12	$125.00	8.4	0.33
PCL10	Garfield Park/Gymnasium: Add programming for unoccupied setback of space temperatures. Install a timer switch to allow occupants to initiate an occupied mode for a set period of time	$500.00			50		$450.00		$450.00		1.1	2.7

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCL11	Garfield Park/Gymnasium: Consider upgrading domestic hot water heaters to a high-efficiency (condensing) unit. May only be practical if usage increases (especially showers). Current level of building usage may not warrant replacement.	$5,000.00			18		$162.00		$162.00		30	0.98
PCL12	Garfield Park/Gymnasium: Install low flow shower and lavatory fixtures in restrooms and locker rooms.	$1,000.00			65	2,600	$600.00		$600.00		1.6	3.53
PCL13	Garfield Park/Gymnasium: Reduce temperature setpoints in the bathrooms adjacent to the gymnasium. Currently each bathroom is heated with an electric unit heater. Consider locking setpoint to prevent occupants from adjusting.											
PCL14	Martin Luther King Park Lodge: Replace fluorescent T12 with magnetic ballast fixtures in rest rooms, back hall, and pool equipment rooms with T8 fixtures with electronic ballasts.	$2,870.64	24	2,012			$171.02		$171.02	$52.00	16.8	1.51
PCL15	Martin Luther King Park Lodge: Replace T12 lamps and magnetic ballasts in gymnasium with T8 lamps and electronic ballasts.	$1,132.32	48.7	4,054			$344.60		$344.60	$28.00	3.3	3.03
PCL16	Martin Luther King Park Lodge: Replace high wattage incandescent fixtures in gymnasium with fluorescent fixtures.	$17,200.00	297	18,533			$1,575.30	$420.00	$1,575.30	$836.00	10.9	13.87

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCL17	Martin Luther King Park Lodge: Consider upgrading domestic hot water heaters to a high-efficiency (condensing) unit. May only be practical if usage increases (especially showers). Current level of building usage may not warrant replacement.	$5,000.00			18		$162.00		$162.00		30	0.98
PCL18	Martin Luther King Park Lodge: Install low flow shower and lavatory fixtures in restrooms and locker rooms.	$1,000.00			65	2,600	$600.00		$600.00		1.6	3.53
PCL19	Paul I. Phillips Gymnasium: Upgrade heating and cooling system using geothermal technology.	$575,000		$71,470	890				$19,350		30	91.82

PARKS AND CEMETERIES – MAINTENANCE/EQUIPMENT/STORAGE BUILDINGS

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
2530 Kalamazoo Avenue, SE	Woodlawn Cemetery Service Building	Maintenance Building	Unknown	1,500	
135 Monroe Center	Rosa Parks Circle Maintenance Building	Maintenance Building/ Equipment Rooms	Unknown	500+	1,919,251
2531 Kalamazoo Avenue, SE	MacKay Jaycee Maintenance Building	Maintenance Building	Unknown	800	
Monroe and 6th Street	Canal Street Maintenance Building	Maintenance Building	Unknown	325	
2776 Kalamazoo, SE	Indian Trails Golf Course	Maintenance	Unknown	1000	
603 Hall Street (49507)	Oakhill Cemetery North Garage	Maintenance Building	Unknown	800	
1401 28th Street (49508)	Oakgrove Cemetery Garage	Maintenance Building	Unknown	320	
2530 Kalamazoo Avenue, SE	Indian Trails Golf Maintenance Building	Maintenance Building	Unknown	1,000	
1761 Rosewood, SE	Mulick Park Wading Pool Building	Equipment Building	Unknown	200	
900 Fuller Avenue, SE	Martin Luther King Park Maintenance Building	Maintenance Building	Unknown	190	
2776 Kalamazoo Avenue, SE	Indian Trails Cart Shed	Equipment Building	Unknown	700	
580 Kirtland Street, SW	SWLL Front Building	Maintenance Building	Unknown	170	
580 Kirtland Street, SW	SWLL Back Building	Maintenance Building	Unknown	700	
1401 Leonard Street, NW	Greenwood Cemetery Mount	Storage	Unknown	1,456	
791 East Fulton	Fulton Street Cemetery	Storage	Unknown	240	
650 Valley, NW	Sullivan Field Grandstand	Storage/Seating	1920's	6,864	
231 Marion, NW	Lincoln Park Lodge	Storage	Unknown	1,725	

1. Woodlawn Cemetery Service Building: This is a metal building, mostly unheated storage. Small lounge area and toilet room that is heated with a gas fired furnace. Occupied regularly for cemetery maintenance.
2. Rosa Parks Circle Maintenance Building and Equipment Rooms: Maintenance garage, restrooms, and 2 below grade mechanical rooms. Maintenance garage is heated with a gas fired furnace. Below grade mechanical rooms and restrooms (above grade) are heated with a gas fired furnace. Below grade mechanical room contains snowmelt pumps, glycol pumps, and heat exchangers. Additional below grade mechanical room contains ice making compressors, evaporator, condenser, and associated pumps. Ice making equipment is used from December through February.

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCM01	Woodlawn Cemetery Service Building: Replace incandescent lighting in garage with more energy efficient fixtures.	$3,200.00	36	2,995			$254.58	$200.00	$454.58		7	2.24
PCM02	Woodlawn Cemetery Service Building: Replace T12 lamps and magnetic ballasts in equipment storage with T8 lamps and electronic ballasts.	$325.00	3	250			$21.25			$24.00	15	0.19
PCM03	Woodlawn Cemetery Service Building: Replace standard efficiency furnace with high efficiency model.	$1,500.00			17		$153.00		$153.00		9.8	0.92
PCM04	Woodlawn Cemetery Service Building: Consider use of an instantaneous hot water heater in lieu of current electric storage tank style.	$200.00			0.54		$5.00		$5.00		40	0.03
PCM05	Woodlawn Cemetery Service Building: Replace non-programmable thermostat with a programmable model to allow setback of temperatures during unoccupied periods.	$200.00			35		$315.00		$621.00		0.6	1.9
PCM06	Rosa Parks Maintenance Building: Replace standard efficiency furnace with high efficiency model.	$1,500.00			17		$153.00		$153.00		9.8	0.92
PCM07	Rosa Parks Equipment Room: Replace standard efficiency furnace serving restrooms with high efficiency model.	$1,500.00			17		$153.00		$153.00		9.8	0.92

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCM08	Rosa Parks Equipment Rooms: Discontinue use of domestic water as heat rejection method for ice rink system. Recommend rejecting waste heat to snowmelt system – possibly using water to water heat pump if necessary to enhance heat transfer performance.					3,000,000	$20,000		$20,000			

ECM PCM03: May be applicable to other heated Maintenance Buildings (MacKay Jaycee, and Canal Street) with similar utility savings.
ECM PCM04: May be applicable to all other Maintenance Buildings listed above that utilize a tank style hot water heater. Similar utility savings may be assumed.
ECM PCM05: May be applicable to other heated Maintenance Buildings (MacKay Jaycee, and Canal Street) with similar utility savings.
ECM PCM08: Further investigation required to compare various scenarios for utilizing waste heat (i.e., snowmelt system, space heating, etc.).

PARKS AND CEMETERIES – MISCELLANEOUS BUILDINGS

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
2776 Kalamazoo, SE	Indian Trails Golf Clubhouse	Clubhouse	Unknown	1,500	93,098
2501 Kalamazoo, SE	Woodlawn Cemetery Chapel	Chapel	Unknown	700	79,887
2735 Monroe Avenue	Riverside Park A-Frame Building	Unknown	1970's	608	
3075 Monroe Avenue	Riverside Park North Building	Unknown	1970's	1,120	
2845 Monroe Avenue	Riverside Park Picnic Shelter	Shelter	1970's	480	
2845 Monroe Avenue	Riverside Park Island Shelter	Shelter	1970's	336	
963 Richmond, NW	Richmond Park Concession Building	Concession	1990	400	54,298
30 Coldbrook	Belknap Community Playfield	Ice Rink/Ballfields	Unknown	Unknown	
1248 6th Street, NW	Sullivan Field Concession Building	Concession	1992	750	
2230 Eastern	Aberdeen Water Playground	Water Playground	1998	156	
6th and Monroe	Sixth Street Bridge Park/Fish Station	Shelter	Unknown	200	
2531 Kalamazoo	MacKay Jaycee Concessions Building	Concession	Unknown	575	
Monroe and 6th Street	Canal Street Park Restrooms	Restrooms	Unknown	300	
921 Alger	Alger School Park Restrooms	Restrooms	Unknown	96	
863 Seventh Street	Stocking School Park Restrooms	Restrooms	1950's	320	
800 Hubbard	North Park School Restrooms	Restrooms	1950's	884	
725 Watson	Westown Commons Restrooms	Restrooms	1950's	288	
647 Monroe	Sixth Street Bridge Park Restrooms	Restrooms	Unknown	320	
624 Front, NW	Fish Ladder Restrooms	Restrooms	Unknown	120	
600 Fuller	Michigan/Fuller Restrooms	Restrooms	1950's	680	
546 Rumsey, SW	Roberto Clemente Park Restrooms	Restrooms	Unknown	160	
3155 Kalamazoo, SE	Ken-O-Sha Park Restrooms	Restrooms	Unknown	380	
2230 Eastern	Aberdeen School Park Restrooms	Restrooms	1990's	714	
223 Grand, NE	Highland Park Restrooms	Restrooms	1970's	512	
220 Front	Ah-Nab-Awan Park Restrooms	Restrooms	Unknown	300	
1500 Aberdeen, NE	Huff Ball Diamonds Restrooms	Restrooms	1990's	1248	
2111 Madison, SE	Garfield Park Restrooms	Restrooms	Unknown	325	
2531 Kalamazoo, SE	MacKay Jaycee Restrooms	Restrooms	Unknown	300	
69 Ionia SE	Heartside Restrooms	Restrooms	Unknown	200	

1. Indian Trails Golf Course – Clubhouse for Golf Course: Small concession area and lounge area. Occupied throughout the late spring and summer (estimate late May through late October). Estimate 7 days per week/15 hours per day. Heated and cooled.

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCC01	Indian Trails Golf Course: Replace incandescent fixtures with dimmable fluorescent fixtures. Utilize dual technology motion sensors or timers, dimmers and daylight sensors for lighting control.	$6,800.00	36	2,184			$185.64	$300.00	$485.64		14	1.63
PCC02	Indian Trails Golf Course: Replace T12 fluorescent fixtures with magnetic ballasts with fixtures that utilize T8 lamps and electronic ballasts.	$678.00	5.6	186			$17.26		$17.26	$24.00	39	0.14
PCC03	Indian Trails Golf Course: Replace (2) existing air conditioning (condensing) units with high efficiency models.	$4,000.00	1.1	2,500			$365.00		$365.00		11	1.87
PCC04	Indian Trails Golf Course: Replace non-programmable thermostat with a programmable model to allow setback of temperatures during unoccupied periods.	$200.00			34		$306.00		$306.00		0.6	1.85
PCC05	Indian Trails Golf Course: Replace standard efficiency furnace with high efficiency model.	$1,500.00			17		$153.00		$153.00		9.8	0.93
PCC06	Indian Trails Golf Course: Consider use of an instantaneous hot water heater in lieu of current storage tank style.	$200.00			0.54		$5.00		$5.00		40	0.03

ECM PCC04: May be applicable to other heated buildings listed above (Woodlawn Cemetery Chapel) with similar utility savings.
ECM PCC05: May be applicable to other heated buildings listed above (Woodlawn Cemetery Chapel, Riverside Park A-Frame Building, Riverside Park North Building) with similar utility savings.

ECM PCC06: May be applicable to all other buildings listed above that utilize a tank style hot water heater (Woodlawn Cemetery Chapel). Similar utility savings may be assumed.

PARKS AND CEMETERIES – OFFICE BUILDINGS

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
647 Hall, SE	Oakhill Cemetery Office	Office	Unknown	1,000	8,607
2530 Kalamazoo Avenue, SE	Woodland Cemetery Office	Office	Unknown	400	255,738
2056 Diamond Avenue, NE	Fairplains Cemetery Office	Office	Unknown	715	387,954
1401 Leonard Street, NW	Greenwood Cemetery Office	Office	Unknown	672	228,828
725 Cherry (49503)	Cherry Park Office	Office	Unknown	575	26,106
250 Burton Street, SE	Garfield Park Lodge Office	Office	Unknown	1,100	9,046
1145 East Fulton (49503)	Fulton Street Market Office	Office	1930's	740	
1042 Lafayette, NE	Mary Waters Park Office	Office	1950's	1,428	31,829
101 East Fulton (49503)	Veterans Memorial Park Office	Office	Unknown	500	422,131
1761 Rosewood (49506)	Mullick School Park Office	Office	Unknown	500	104,448

1. Oakhill Cemetery Office: Old masonry building with offices on main level and storage in basement and attic spaces. Heated only with small window air conditioning unit. Occupied daily (Monday through Friday).

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCO01	Oakhill Cemetery Office: Replace T12 lamps and magnetic ballasts in furnace room and office with T8 lamps and electronic ballasts.	$618.00	5.6	464			$39.44		$39.44	$24.00	15.7	0.35
PCO02	Oakhill Cemetery Office: Replace incandescent lamps in toilet rooms and attic with self-ballasted fluorescent.	$100.00	21.9	182			15.47	$100.00	$115.47	$9.00	0.87	0.14

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCO03	Oakhill Cemetery Office: Replace non-programmable thermostat with a programmable model to allow setback of temperatures during unoccupied periods.	$200			40		$360		$360		0.6	2.17
PCO04	Oakhill Cemetery Office: Replace standard efficiency furnace with high efficiency model.	$1,500			20		$180		$180		8.3	1.09
PCO05	Oakhill Cemetery Office: Consider use of an instantaneous hot water heater in lieu of current storage tank style.	$200			0.54		$5		$5		40	0.03

ECM PCO04: May be applicable to other heated buildings listed above with similar utility savings to be expected, although most offices were indicated to be vacated during winter months.

ECM PCO05: May be applicable to all other buildings listed above that utilize a tank style hot water heater. Similar utility savings may be assumed.

PARKS AND CEMETERIES – POOL BUILDINGS

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
900 Fuller Ave, SE	Martin Luther King (MLK) Pool Maintenance Building	Pool Filter/ Maintenance Building	Unknown	800	246,146
1729 Tamarack, NW	Richmond Park Filter Building	Pool Filter	1990	864	
350 Knapp, NE	Briggs Park Pool Bath House	Bath House	Unknown	4,580	
350 Knapp, NE	Briggs Park Filter Building	Pool Filter	1990	720	
841 S Division (49507)	Campau Park Pool Bath House	Bath House	Unknown	1,450	
525 Grand, NE	Highland Park Pool Bath House	Bath House	Unknown	2,400	
231 Marion, NW	Lincoln Park Pool Bath House	Bath House	Unknown	2,400	
963 Richmond (49504)	Richmond Park Pool Bath House	Bath House	Unknown	8,000	

1. MLK Pool Maintenance Building: Building contains pool heater, filters, pumps, etc. Pool usage occurs between July 1 and September 1. Building is heated with a gas fired furnace to maintain non-freezing conditions during winter months.

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
PCP01	MLK Pool Maintenance Building: Replace standard efficiency furnace (for space heating) with high efficiency model.	$1,500.00			17		$153.00		$153.00		9.8	0.92
PCP02	MLK Pool Maintenance Building: Replace standard efficiency pool heater (82%) with high efficiency model (98%)	$24,200.00			175		$1,575.00		$1,575.00		15	9.5
PCP03	MLK Pool Maintenance Building: Install pipe insulation on hot water piping to and from pool heater.	$500.00			6		$54.00		$54.00		9.3	0.33

ECM 1: May be applicable to other heated Pool Maintenance Buildings listed above, with similar utility savings.
ECM 2: May be applicable to other heated Pool Maintenance Buildings listed above, with similar utility savings.

ENVIRONMENTAL PROTECTION (WASTEWATER)

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
	Wastewater Treatment Plant		varies	>100,000	
	Wastewater Lift Stations		varies	<1,000	

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Green-house Gas Reduced
WW01	North Primary Building: Replace 10 HID fixtures with T5 fixtures.	$5,000.00	1	21,004			$1,044.00			$350.00	4.5	
WW02	South Blower Building: Replace 18 HID fixtures with T5 industrial fixtures.	$9,000.00	1	36,676			$1,824.00			$350.00	4.7	
WW03	North Aeration (Blower) Building: Replace 15 HID fixtures with T5 industrial fixtures.	$7,500.00	1	31,068			$1,545.00			$350.00	4.6	
WW04	Replace existing motors with premium efficiency motors *(per HP basis for motors >10HP; average 3% improvement assumed; Plant staff have inventory and schedule for motors to be replaced).*	$80.00	0.0225	197.1			$16.75		16.75	$7.00	4.36	

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
WW05	Provide variable frequency drives on loads where varying speed is feasible *(per HP basis for motors >10HP; average 5% energy savings assumed; requires study; plant staff have determined not feasible to implement at lift stations).*	$250.00	0.0375	328.5			$27.92		27.92	$60.00	6.81	
WW06	Add temperature control system to prevent boiler(s) and air conditioning equipment from operating simultaneously *(requires study).*	$10,000.00	10	$87,600.00			$4,354.00		$4,354.00		2.30	
WW07	Replace existing aeration system blowers with high speed turbo compressors (already studied by plant staff – future improvement project).											
WW08	Replace existing grit tank blowers with high speed turbo compressors (already studied by Plant staff – future improvement project).											

ECMs WW01, WW02, and WW03: Assumes that the HID lights are turned on 24/7 because of strike time and that fluorescent would be on only 10 hours a day.

WATER – GRAND RAPIDS LAKE MICHIGAN FILTRATION PLANT

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
	Grand Rapids Lake Michigan Filtration Plant (LMFP)		Varies	>200,000	

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
LM01	Replace 80 HID fixtures with 6 tube T5 fixtures in High Bay areas	$17,500.00	5	10,000			$498.00			$1,750.00	33.8	7.48
LM02	Retrofit 100 4-foot 2 lamp vaportight T12 (assume 50% mag ballast) with electronic T8 ballasts and lamps (Note: These fixtures are 24/7 operation)	$10,000.00	1.1	9,986			$699.00			$400.00	13.7	7.47
LM03	Add occupancy controls in offices/administration area. Assume approximately 6 offices/space with 3 fixtures each.	$1,800.00	0	1083			$87.00			$98.00	19.6	0.81
LM04	Study cooling using process water (Lake temperature raw water) instead of replacing very old and oversized air conditioning compressors.	$5,000.00		15,000			$1,000.00				5	11.23

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
LM05	Improve exchange of real-time operating data between LMFP and water distribution facilities in town to optimize water production and pumping based on actual water usage and demands *(requires study and new operating procedures).*	$100,000.00		1%			$20,000.00				5	
LM06	Replace existing motors with premium efficiency motors *(per HP basis for motors >10HP; average 3% improvement assumed).*	$80.00	0.0225	197.1			$16.75		$16.75	$7.00	4.36	0.15
LM07	Provide variable frequency drives on loads where varying speed is feasible *(per HP basis for motors >10HP; average 5% energy savings assumed; requires study).*	$250.00	0.0375	328.5			$27.92		$27.92	$60.00	6.81	0.25
LM08	Provide variable frequency drive on 1 high service pump (1,500 HP) *(requires study and new operating procedures).*	$500,000.00	56.25	492,750			$24,490.00		$24,490.00	$90,000.00	16.74	368.76

WATER – GRAND RAPIDS LAKE MICHIGAN FILTRATION PLANT – LOW LIFT STATION NO. 1

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
	Grand Rapids Lake Michigan Filtration Plant – Low Lift Station No. 1		Varies	~10,000	

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
LN01	Replace 12 1000 Watt Incandescent fixtures with 6 tube T5 fixtures in High Bay areas	$6,000.00	7	7,400			$280.00				13.8	5.54
LN02	Install variable frequency drives on 4 low lift pumps (300HP, 600 HP, 600HP, and 700HP) *(requires building addition and study)*	$2,500,000.00	70	604,000			$30,000.00		$30,000.00	$132,000.00	78.9	452.02
LN03	Replace existing motors with premium efficiency motors *(per HP basis for motors >10HP; average 3% improvement assumed)*	$80.00	0.0225	197.1			$16.75		$16.75	$7.00	4.36	0.15
LN04	Provide variable frequency drives on loads where varying speed is feasible *(per HP basis for motors >10HP; average 5% energy savings assumed; requires study)*	$250.00	0.0375	328.5			$27.92		$27.92	$60.00	6.81	0.25

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
LN05	Operate smaller low lift pump(s) in Low Lift Station No. 1 during summer months as required by plant demands *(requires study and new operating procedures)*	$25,000.00	10	87,600			$4,354.00		$4,354.00	0	5.74	65.56

WATER – GRAND RAPIDS LAKE MICHIGAN FILTRATION PLANT – LOW LIFT STATION NO. 2

SUMMARY

Facility Address	Name	Function	Age (Year Built)	Size (sf)	EUI (BTU/sf/Year)
	Grand Rapids Lake Michigan Filtration Plant – Low Lift Station No. 2		Varies	>100,000	

ENERGY CONSERVATION MEASURES

ECM No.	ECM Description	Implementation Cost ($)	Monthly Demand Savings (kW)	Annual Electric Savings (kWh)	Annual Fossil Fuel Savings (MMBTU)	Annual Water Savings (gal)	Annual Utility Cost Savings ($)	Annual O&M Cost Savings ($)	Total Cost Savings ($)	Incentive Estimate ($)	Simple Payback (years)	Greenhouse Gas Reduced
LS01	Replace 12 HID fixtures with 6 tube T5 fixtures in High Bay areas.	$6,000.00	1	24,384			$1,707.00			$350.00	3.3	5.54
LS02	Install variable frequency drives on 3 low lift pumps (600HP, 600HP, and 900HP) *(requires building addition and study).*	$2,000,000.00	70	604,000			$30,000.00		$30,000.00	$126,000.00	62.5	452.02
LS03	Replace existing motors with premium efficiency motors *(per HP basis for motors >10HP; average 3% improvement assumed).*	$80.00	0.0225	197.1			$16.75		$16.75	7	4.36	0.15
LS04	Provide variable frequency drives on loads where varying speed is feasible *(per HP basis for motors >10HP; average 5% energy savings assumed; requires study.)*	$250.00	0.0375	328.5			$27.92		$27.92	60	6.81	0.25

ECM 1: Assumes that the HID lights are turned on 24/7 because of strike time and that fluorescent would be on only 10 hours a day.

Appendix 1

CD Containing:

1 ECM Ranking
2 Properties List with Energy
3 GHG Fleet Emissions
4 GHG Generator Emissions
5 GHG Utility Emissions

Appendix 2

Community Greenhouse Gas Emission in 2007 – Detailed Report; ICLEI's Clean Air and Climate Protection 2009 Software

Community Greenhouse Gas Emissions in 2007
Detailed Report

	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	Equiv CO_2 (tonnes)	(%)	Energy (MMBtu)
Residential						
Grand Rapids, Michigan						
Gross Energy Usage - Utility Data Combined with Census Data						
Electricity	0	0	0	0	0.0	898,253
Fuel Oil (#1 2 4)	1,197	10	180	1,204	0.1	16,364
Natural Gas	451,003	850	42,499	452,159	22.4	8,499,869
Stationary LPG	2,516	24	438	2,533	0.1	39,838
Wood 12 pct moisture	0	208	15,662	393	0.0	49,562
Subtotal Gross Energy Usage	454,716	1,092	58,779	456,289	22.6	9,503,886

Consumers Energy provided electricity info for 2005 and 11/2008 - 10/2009. Electrical use data for 2007 was extrapolated using annual energy reports from USDOE applied to Consumers data.

DTE Energy/Mich Con provided natural gas information for Calendar Year 2007. DTE Energy provided "Estimated Actuals" and "Normalized" usage which is based on weather information. Normalized values were slightly higher.

Data from the US Census for Residential Home Heating was used to extrapolate residential fuel usage for other fuels. Assumed that all reported natural gas usage was for home heating (overestimate) and normalized on a BTU basis for fuel categories reported in Census data (bottled gas/LPG, electricty, fuel oil/kerosene and other fuels). Assumed that "Other Fuels" was wood. Assumed that residential electricity demand is greater for other items in home (lighting, appliances). Assumption supported as being conservative (overestimate) when compared to reported usage percentages from Upper Peninsula Power Company (UPPCO) website for general electricity usage breakdown: 44% for heating & cooling; 33% for lighting, cooking & appliances; 14% for water heating and 9% for refrigerators.

Number of occupied households was obtained from US Census (2006 - 2008 American Community Survey). This information split housing units into the following categories:
1 unit, detached - 63.3% of total (45,400 units)
1 unit, attached - 6.2% (4,447 units)
2 apartments - 9.7% (6,957 units)
3 or 4 apartments - 5.5% (3,945 units)
5 to 9 apartments - 3.8% (2,725 units)
10 or more apartments - 11.4% (8,176 units)
Mobile home or other type of housing - 0.1% (72 units)

Subtotal Residential	454,716	1,092	58,779	456,289	22.6	9,503,886
Commercial						
Grand Rapids, Michigan						
Gross Energy Usage from Utility Data						
Electricity	0	0	0	0	0.0	2,495,369
Natural Gas	379,245	715	35,737	380,217	18.9	7,147,482
Subtotal Gross Energy Usage	379,245	715	35,737	380,217	18.9	9,642,851

Consumers Energy provided electricity info for 2005 and 11/2008 - 10/2009. Electrical use data for 2007 was extrapolated using annual energy reports from USDOE, using reported data for years provided.

This report has been generated for Grand Rapids, Michigan using ICLEI's Clean Air and Climate Protection 2009 Software.

Community Greenhouse Gas Emissions in 2007
Detailed Report

	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	Equiv CO_2 (tonnes)	(%)	Energy (MMBtu)

DTE Energy/Mich Con provided natural gas information for Calendar Year 2007. DTE Energy provided "Estimated Actuals" and "Normalized" usage whichi is based on weather information. Normalized values were slightly higher.

Number of Commercial Establishments and gross floor area data obtained from Grand Rapids City Assessor's office. Data for FY 08.

Subtotal Commercial	379,245	715	35,737	380,217	18.9	9,642,851

Industrial

Grand Rapids, Michigan

Energy Usage and Calculated GHG from MAERS Data

Fuel Oil (#1 2 4)	517	4	21	519	0.0	7,065
Landfill Gas or biogas	0	0	1	0	0.0	1,055
Stationary Gasoline	123	1	5	124	0.0	1,739
Carbon Dioxide	901	0	0	901	0.0	0
Methane	0	0	40	1	0.0	0
Nitrous Oxide	0	10	0	3	0.0	0
Subtotal Energy Usage and Ca	1,541	15	67	1,547	0.1	9,859

Added usage for other fuels as provided in Calendar Year 2007 Michigan Air Emissions Reporting System (MAERS) report for industrial sources with a Grand Rapids source address. Fuels reported in MAERS: Distillate oil (Diesel), Gasoline, Natural Gas (used report from DTE), Process Gas, Residual Oil (No. 6) and Solid Waste. Process gas assumed to be in the "Landfill Gas or biogas" category. CO2, CH4 and N2O emissions calculated for Residual Oil (No. 6) usage using USEPA GHG Rule emissions factors. GHG emissions from tons of solid waste burned were accounted for in the "Waste" category.

Gross Energy Usage from Utility Data

Electricity	0	0	0	0	0.0	1,012,048
Natural Gas	4,142	8	78	4,146	0.2	78,058
Subtotal Gross Energy Usage	4,142	8	78	4,146	0.2	1,090,106

Consumers Energy provided electricity info for 2005 and 11/2008 - 10/2009. Electrical use data for 2007 was extrapolated using annual energy reports from USDOE.

DTE Energy/Mich Con provided natural gas information for Calendar Year 2007. DTE Energy provided "Estimated Actuals" and "Normalized" usage which is based on weather information. Normalized values were slightly higher.

Number of industrial establishments and gross floor area data obtained from Grand Rapids City Assessor's office.

Community Greenhouse Gas Emissions in 2007
Detailed Report

	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	Equiv CO_2 (tonnes)	(%)	Energy (MMBtu)
Subtotal Industrial	5,683	23	146	5,693	0.3	1,099,965
Transportation						
Grand Rapids, Michigan						
Average Daily Traffic Information						
Diesel	291,806	854	821	292,088	14.5	3,989,142
Gasoline	823,312	53,612	46,171	840,902	41.7	11,615,580
Subtotal Average Daily Traffic	1,115,118	54,465	46,993	1,132,989	56.2	15,604,722

Information from "Highway Statistics 2007" report from the Office of Highway Policy Information, Federal Highway Administration (http://www.fhwa.dot.gov/policyinformation/statistics/2007/); Table HM-71, page 104/266 and Table HM-72, page 114/266.

Annual Average Daily Traffic (AADT) was reported for Limited Access/Freeways in the FHA report.

Average Daily Traffic data was obtained from the Grand Valley Metropolitan Council for Collector, Local, Minor Arterial and Major Arterial roads in Grand Rapids. This information spanned 2007, 2008 and 2009. This data was not able to be converted to AADT.

From US-DOE Energy Information Adm. Vehicle stock findings as follows:
83% Residential Vehicles
- Passenger Cars - 72%
- Pickups - 17%
- Sport Utility - 5%
- Large Vans - 3%
- Minivans - 3%

17% Nonresidential
- Business Fleets - 49 - 55% (includes some govt vehicles)
- State, county and municipal govt. - 10%
- Federal govt. - 2%
- Unaccounted - 45 - 51% (includes some govt vehicles)

Interurban Transit - Ride the Rapid						
Diesel	8,293	25	26	8,301	0.4	113,369
Gasoline	198	13	10	202	0.0	2,789
Subtotal Interurban Transit - R	8,491	38	36	8,503	0.4	116,158

Contacted Transportation Manager at The Rapid to obtain information on number of miles the buses have driven and breakdown on type and amount of fuels used.

From ridetherapid.org website:

	FY 2007
Total fixed route Rapid ridership:	7,753,258
Passengers per revenue mile	1.95
Calculated Revenue Miles Travelled	3,976,029.7
Total paratransit ridership;	212,378

Per Steve @ The Rapid: Fuel usage for FY 07:
Unleaded gasoline (service vehicles) 22,449 gallons
Diesel fuel - 817,516 gallons
Fleet contains 117 full size buses; including 5 hybrid buses.

Community Greenhouse Gas Emissions in 2007
Detailed Report

	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	Equiv CO_2 (tonnes)	(%)	Energy (MMBtu)
Railroads - Passenger						
OFF ROAD Diesel	26	0	0	26	0.0	359
Subtotal Railroads - Passenge	26	0	0	26	0.0	359

Amtrak - Pere Marquette Line services City of Grand Rapids.
Daily Service = 1 train (each way)
Trains are diesel fuel operated.
Energy Content of Diesel Fuel: 140,000 BTU/gal (assumed)
Length of track within City LImits: 1.5 miles

Data from Amtrak:
FY 2008 Passengers, boardings & alightings: 57,465
Energy Consumed per Passenger Mile: 2,100 BTU

Calculated Fuel Used: 2,586 gallons of diesel

School Buses - Dean Transportation						
Diesel	4,640	14	15	4,645	0.2	63,436
Subtotal School Buses - Dean	4,640	14	15	4,645	0.2	63,436

Information from Dean Transportation for School Buses. Information reported on a School-Year Basis as follows:
2007 - 2008: 148 total buses; Ultra Low Sulfur Diesel Fuel; 318,828 gallons fuel; 2,869,452 miles travelled.

Subtotal Transportation	1,128,275	54,517	47,043	1,146,164	56.9	15,784,675

Waste

Grand Rapids, Michigan

Composted Material						*Disposal Method - Compost*
Plant Debris	0	0	-96,668	-2,030	-0.1	
Subtotal Composted Material	0	0	-96,668	-2,030	-0.1	

Amount sent to compost at Spurt Insdustries in FY 08 (7/1/07 - 6/30/08).

Incinerated						*Disposal Method - Controlled Incineration*
Paper Products	0	0	155,108	3,257	0.2	
Food Waste	0	0	217,151	4,560	0.2	

Community Greenhouse Gas Emissions in 2007
Detailed Report

	CO_2 (tonnes)	N_2O (kg)	CH_4 (kg)	Equiv CO_2 (tonnes)	(%)	Energy (MMBtu)
Plant Debris	0	0	31,022	651	0.0	
Wood or Textiles	0	0	62,043	1,303	0.1	
All Other Waste	0	0	930,649	19,544	1.0	
Subtotal Incinerated	0	0	1,395,973	29,315	1.5	

Assumed waste share percentages; City has recycling and composting available. Yard waste is sent to compost. Used data for FY08 (7/1/2007-6/30/2008).

FY 07 Data: Refuse: 31,098 tons (incinerated)
Yard Waste: 10,693 tons (composted)
Recycled: 5,956 tons

FY 08 Data: Refuse: 30,520 tons (incinerated)
Yard Waste: 11,093 tons (composted)
Recycled: 5,841 tons

City's municipal solid waste is incinerated at the Covanta - Kent facility. This facility also accepts waste from other locations. Total amount of waste burned at the facility (from all customers) was obtained from the Michigan Air Emissions Reporting System (MAERS) for Calendar Year 2007 and was reported to be 177,993 tons per year. This includes the solid waste tonnage from the City of Grand Rapids. Supplemental fuel used at this facility are accounted for in the "Industrial" category.

Municipal solid waste incinerated was assumed to consist of:
Paper 25%
Food Waste 35%
Plant Debris 5%
Wood or Textiles 10% and
All Other Waste 25%.

Subtotal Waste	0	0	1,299,306	27,285	1.4	
Total	1,967,920	56,347	1,441,011	2,015,649	100.0	36,031,377

Appendix 3

Strategy Participant List

ftch
engineers
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architects
constructors

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Second Ward Commissioner

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Third Ward Commissioner

Stan Milanowski
Comptroller

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City Manager

Catherine Mish
City Attorney

Lauri S. Parks
City Clerk

Al Mooney
City Treasurer

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Anne Armstrong Cusack
Board of Library Commissioners, Vice-President/Secretary

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CITY OF GRAND RAPIDS

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Gary Szotko
Deputy Fire Chief

Captain Tony Hendges
Fire Department Building/Machine Maintenance

Carlos Sanchez
Grand Rapids Housing Commission

MariBeth Jelks
Director of Human Resources

Paul Klimas
Information Technology Director

Marcia Warner
Library Director

Kenneth Dahlman
Library Facilities Manager

Jay Steffen
Director of Parks and Recreation

CITY OF GRAND RAPIDS

Pamela Ritsema
Director of Parking Services

Kevin Belk
Police Chief

Dave Kiddle
Police Captain

Chris Zull
Traffic System Engineer

Joellen Thompson
Water System Manager

Pat Bush
Director of Public Works

Darrell VanderKooi
Assistant Public Works Director

Wayne Jernberg
Hydraulic Engineer

COMMUNITY

Consumers Energy
- Karen McCarthy
- Andrew Radvansky

Dean Transportation
- Patrick Dean

DTE Energy
- Roger Royer
- Jim Zechlinski
- Skiles Boyd

Federal Highway Administration – Michigan Office
- Chris

Grand Rapids Area Chamber of Commerce
- Andy Johnston

Grand Rapids Eastern Railroad
- Mike Bobic

Grand Valley Metropolitan Council
- Mike Zonyk
- Jim Snell

Grand Valley State University
- Norman Christopher
- Paul Plotkowski

Habitat for Humanity
- Pam Doty-Nation

Home Repair Services
- Dave Jacobs

Kent County
- Jennifer DeHaan

Meijer, Inc.
- Frank Remsburg

Michigan Department of Environmental Quality – Air Quality Division
- Dennis McGeen

North/West Community Oriented-Government (COG)
- Deborah Eid
- Kathleen Lett

Reliable Energy
- John Mika

Sierra Club
- Jan O'Connell
- Dave Petroelje

COMMUNITY

The Right Place
Anne Saliers

The Rapid
Steve Maas

Veolia Energy
Keith Oldewurtel
Mike Marr

West Michigan Association of Energy Engineers
Mark Zoeteman

West Michigan Environmental Action Council
Rachel Hood

West Michigan Strategic Alliance
Greg Northrup

West Michigan U.S. Green Building Council
Jon Cooper
Linda Frey