Maplewood Energy Efficiency and Conservation Strategy Plan

City of Maplewood, Minnesota

SEH No. MAPLE 109799

December 14, 2009

December 14, 2009

RE: Maplewood Energy Efficiency and Conservation Strategy Plan
City of Maplewood, Minnesota
SEH No. MAPLE 109799

Mr. James Antonen
City Manager
City of Maplewood
1830 East County Road B
Maplewood, MN 55109

Dear Mr. Antonen:

Please find the attached the Energy Efficiency and Conservation Strategy (EESC) plan for the City of Maplewood. We feel this document satisfies the City's intention to document the existing energy situation in the City and to develop strategic steps to improve the City's overall environmental sustainability; particularly in the area of long-term energy security. Short, Elliot, Hendrickson (SEH) believes a focused EESC plan will be a great step forward for the City of Maplewood.

The purpose of this plan is to evaluate the existing conditions and identify various energy conservation measures at municipally-controlled facilities in Maplewood. The plan will also help establish policies and priorities to move Maplewood in the direction of improved long-term operational energy efficiency. The City can implement the progressive installation of these measures at the prioritized locations as monies became available.

SEH produced the EECS plan based upon a discussion with City staff, the Maplewood Green Team, the Maplewood Environmental and Natural Resource Commission and the City Council review and comment of requested program elements, site analyses and coordinated efforts between SEH and City staff. We look forward to continuing our work with the City of Maplewood.

We appreciated the opportunity working with you and your staff on this project. If you have any questions, or need additional information, please do not hesitate to call George Johnson at 612.765.2930.

Respectfully Submitted,

Mark L. Lobermeirer, PE
Client Service Manager/Sr. Vice President

George Johnson
Project Manager/Senior Energy Scientist

cc: Chuck Ahl, Assistant City Manager/Public Works Director
Shann Finwall, Environmental Planner
Larry Farr, Chief Building Engineer

\\mw-remote\mwdfsys\pri_data\works\environmental\energy\energy efficiency and conservation strategy final.doc

Executive Summary

As the increasing demand for energy security and the insistence on energy reliability rises, so does the importance of producing safe, clean, reliable energy from renewable sources like the wind and the sun. Many of the key technologies to cost effectively unlock renewable resource energy are already on the market. These innovative power systems are rapidly approaching price parity with fossil fuel energy. Transformation of the marketplace will require thoughtful actions to overcome the remaining barriers to acceptance of the renewable energy paradigm. These barriers include complicated procedures for permitting and interconnecting energy systems into the local power grid, lack of understanding of renewable energy by the general public, higher upfront system costs and the lack of funding for new technologies. There is also a lack of suitably trained installers and inspectors for renewable energy systems. Local government officials and staff are in a unique position to remove or reduce many of these barriers. Local governments can clear the path and lead their communities into the emerging renewable energy economy. The City of Maplewood has risen to the challenge by preparing this Energy Efficiency and Conservation Strategy (EECS) plan.

The International Energy Agency estimates that the United States of America's (USA) economy is the least energy efficient among industrialized countries. This is largely due to the low energy prices the USA has paid in the past, our nation's very high level of per capita income and the large land area in the nation. Many of the "unsustainable" aspects of our current lifestyle relate directly to our use of energy and our acquired dependence on fossil fuels. The Environmental Law and Policy Center estimates that Minnesota could reduce future energy consumption 28 percent by aggressively implementing energy efficiency programs. There are two different ways to reduce energy use: "energy efficiency" and "energy conservation." Efficiency means getting more work from the same energy source. Conservation means choosing to use less energy. Our nation is quite good at energy efficiency, but not so good at energy conservation. Local governments should play a strong role in the reduction of energy use within Minnesota. Maplewood has the potential to decrease energy consumption and costs by using energy more efficiently. Major energy conservation will require that governments, businesses and individuals make a conscious effort to reduce the use of resources while maintaining the quality of life we have become accustomed. The creation of an EECS is the first step to achieving that goal. Following the strategy into the future will require an ongoing level of commitment.

Maplewood will be receiving federal grants totaling $163,900 as part of the Energy Efficiency and Conservation Block Grant (EECBG) program. The EECBG program, funded by the American Recovery and Reinvestment Act, provides grants for projects that reduce total energy use and fossil fuel emissions, improve energy efficiency and stimulate economic growth. The grants also empower local communities to make strategic investments to meet local, state and national long-term clean energy and greenhouse gas reduction goals. This funding is far too limited to complete the work, but it provides an excellent beginning to steer Maplewood towards that future.

Energy efficiency projects covered in this grant include: developing a long-term energy efficiency plan for Maplewood, completing energy audits for all public buildings and facilities, replacing two boilers at City Hall with more energy efficient boilers, completing heating, ventilation, air conditioning (HVAC) efficiency upgrades at City Hall, completing energy efficient lighting upgrades at the Community Center and Goodrich Park and making a contribution to Maplewood Mall parking lot energy efficient lighting upgrades.

As part of the grant requirements the City must complete an EECS that describes the city's energy goals and use of federal grant monies. The Maplewood Green Team, a group of employees assisting the City in sustainable goals, chose the promotion of energy conservation as its 2009 goal. The Green Team's strategy is to help provide a road map for reducing energy use and lowering energy costs for City operations, businesses and the community. Every individual American has the power to shift their energy habits and priorities to a more sustainable future with minor personal behavior modifications. Local governments can help point the way.

Executive Summary (Continued)

The EECS will provide an action plan for the future. It will include a summary of measurable energy efficiency and conservation goals and objectives. There will be a schedule of major energy efficiency and conservation milestones. The schedule will provide an implementation plan for spending EECBG funds as well as establishing priorities for future energy efficiency improvements. It will establish a baseline of energy and facility information and require the collection of periodic data on power, fuel and expenditures to track energy efficiency progress in Maplewood. This data collection has already begun as part of the Minnesota Building, Benchmarking and Beyond (B3) program Maplewood participates in. Collection and analysis of energy use and cost data will raise citizen awareness of the true price of energy.

Most Americans are unaware of the large role energy plays in their everyday lives. Energy production and consumption are directly connected to the condition of the planetary environment, health and safety of the ecosystem, our economy and in the quality of life for our present and future generations. The plan also has an important public participation component. The EECS does not require a formal public hearing, however, Maplewood intends to seek as much public input as possible in developing this plan. This will be accomplished by publicizing the process on Maplewood's webpage and monthly newsletter and inviting the public to meetings where they may comment on the plan. The Green Team and the Environmental and Natural Resources Commission will do much of the initial plan development. Then Maplewood will hold public meetings to discuss the strategy and seek input for improving the plan. The final EECS plan recognizes the inter-relationship of Maplewood to its surrounding local units of government and the overlapping authorities that exist in the Twin Cities Metropolitan area. Maplewood will strive to make its plan consistent with the sustainability efforts of neighboring communities in order to promote the common good through energy efficiency, conservation and sustainability.

The City of Maplewood is committed to becoming a sustainable City by 2050. Maplewood has signed the US Mayors Climate Protection Agreement which commits the City to reducing emissions and pollution in City operations and the community. With the adoption of the EECS in December 2009, Maplewood staff and elected officials have identified critical areas where improved sustainability practices in the community will improve energy efficiency, reduce waste production and improve the conservation of renewable and nonrenewable resources. The three main areas the City must improve and promote are long-term sustainability of our energy use and transportation, resource conservation, waste reduction, water quality and environmental protection. This plan focuses primarily on energy efficiency and conservation activities in the near term. There is much more that must be done in the future. Clearly, some additional work in transportation and waste reduction would also result in major energy conservation. These topics are beyond the scope and budget of this report, but will be critical to the overall sustainability goals of the City.

Maplewood will take the following steps necessary to create and implement the EECS plan:

A. Set priorities

B. Develop an action plan

    1. Strategies – policies

        a. Discuss policies in public forum.

        b. Prioritize problems in terms of cost effectiveness of solutions.

        c. Establish an accelerated capital improvement program focused on energy.

        d. Establish a regular operating and maintenance schedule of energy assets.

    2. Tactics – practices

        a. Develop future ordinances, zoning code and purchasing policies that favor energy

efficiency, resource conservation and local distributed power generation.

b. Rehabilitate existing building and infrastructure with a long-term goal of reducing total energy cost.

c. Continue to apply for all appropriate grants, low interest loans and energy rebate programs available from the federal, state, and county governments or regional utility companies.

d. Increase the percent of Maplewood's operation and maintenance budget spent on energy efficiency and conservation measures.

3. Develop emergency measures for energy brown-outs or interrupted fuel supplies.

4. Focus public education efforts on energy issues in the school system at all levels and through new programming at the Maplewood Nature Center.

C. Assess progress

1. Establish baseline data

a. Electricity - building (quantity and unit cost)

b. Natural gas - building (quantity and unit cost)

c. Petroleum - month/department/vehicle (quantity and unit cost)

d. Supplies (quantity and unit cost)

e. Equipment (quantity and unit cost)

f. Operation and maintenance (budget/month/department)

g. Hours and costs of employees (budget/month/department)

2. Measure and monitor key factors of energy use, cost and variations in weather data.

3. Evaluate trends over time.

4. Report energy use progress periodically to all departments, elected officials and citizens.

5. Make midcourse corrections as trends in data are recognized.

a. Triage and manage future actions based on results achieved in energy reduction.

b. Replace least efficient appliances first.

c. Mitigate largest energy losses first.

d. Increase the full accounting of total energy costs to cover increased energy expenses.

e. Eliminate buildings, equipment, programs in order of least energy efficient first to gradually reduce total energy costs.

6. Work on incremental energy efficiency and conservation improvement through the development and implementation of sustainable energy policies and technologies.

Table of Contents

Letter of Transmittal
Title Page
Executive Summary
Table of Contents

Page

1.0 Introduction 1

2.0 Community Vision for Energy Efficiency and Conservation 2

2.1 Recognition of Stakeholders Who are Part of the Planning Process 4
2.2 Policy Development in the Mid- and Long-Term 4
2.3 Overall Goals 5

3.0 Baseline and Projected Energy Sources and Uses 5

3.1 Overall Electric, Natural Gas, and Petroleum 5
3.1.1 Nature Center Energy Audit 6
3.1.2 Nature Center Building Envelope 7
3.1.3 Nature Center HVAC 7
3.1.4 Nature Center Lighting 7
3.1.4.1 Interior Fluorescent Lighting 7
3.1.5 Nature Center Renewable Energy Considerations 7
3.2 Overall Stationary Buildings 8
3.2.1 Thermal Insulation 8
3.2.2 Building Codes 8
3.3 Overall Transportation 8

4.0 Maximizing the Benefits to the People and Businesses of the Region 9

4.1 Household and Business Cost Savings 9

5.0 Priority Actions by Sector 9

5.1 Building Energy Efficiency 9
5.1.1 Energy Efficiency In City Buildings – Key Aspects 10
5.2 Education for Departmental Managers and Employees 11

6.0 Implementation Action Plans 12

6.1 Implementation Activities at Maplewood Public Facilities 13
6.1.1 Energy Reduction Projects 13
6.1.1.1 Public Works Building 13
6.1.1.2 City Hall/Police Department Building 14
6.1.1.3 Maplewood Community Center Building 15
6.1.1.4 EECBG Funded Projects 15

7.0 Budget, Funding, Leverage, and Sustainability Plan 15

8.0 Communications and Engagement Plan 16

9.0 Jobs and Economic Development Plan 17

Table of Contents (Continued)

9.1 Green Jobs for Maplewood 17

10.0 Alignment with Plans of Adjacent Municipalities and the State 17

11.0 Plan for Tracking and Sharing Progress 18

List of Appendices

Appendix A Analysis of the City of Maplewood's Existing Energy Efficiency and Conservation

Appendix B Outline of Data Collection Needs to Track Energy Efficiency Improvements

Appendix C Project Site Photo

Maplewood Energy Efficiency and Conservation Strategy Plan

1.0 Introduction

The world has recently become aware of how important energy efficiency is to our survival and sustainability. Sustainability planning requires the integration of solutions to social, economic and environmental considerations in mutually beneficial ways while trying to preserve or improve the community's quality of life. It has become apparent in recent years that many of our most unsustainable practices relate directly to our dependence on cheap fossil fuels and the energy these provide. Reducing the use of fossil fuel at every level of American society will decrease the political, economic and environmental stress that is caused by air pollution and global warming. The latest general estimates are that 40 percent of the carbon dioxide emissions generated by burning fossil fuel come from the generation of electricity. Thirty-five percent comes from transportation. The remaining 25 percent comes from all other uses of fossil fuel such as heating industrial, commercial and residential customers.

Energy sustainability means using human intelligence to find strategies and behaviors that use less energy, use energy more efficiently, and increase the percent of renewable energy in our production portfolio. At present, somewhere between 80 and 90 percent of energy used in the USA comes from nonrenewable fossil fuel, generally coal, petroleum and natural gas. As this limited supply diminishes, demand and price will have to increase. As awareness of this harsh future economic reality dawns, we have a limited period to begin to adjust to this new paradigm. Many energy planners and futurists are recommending what Amory Lovins of the Rocky Mountain Institute calls the "soft path" to energy independence. Lovins states that our first priority is to generate "negawatts" which means using energy more efficiently and selecting conservation measures to do the same work with less energy. He says we must, "Act Locally and Think Globally". This means gradually changing our lifestyles to use less energy wherever we can.

Local governments can reduce energy use and fossil fuel emissions to achieve continual improvements in energy efficiency. Maplewood is charged with regulating and controlling land use, public safety, housing and environmental quality. Every one of these activities involves energy consumption. Each offers the potential for increased efficiency. The City has many opportunities to institute improved energy efficiency and conservation of energy resources as a common part of all design and planning processes. Many cities, including the City of Maplewood, have demonstrated their long-term commitment to sustainability in response to the US Mayors Climate Protection Agreement. One key aspect of sustainability is to recognize energy efficiency as the highest priority energy resource.

Maplewood can make a strong, long-term commitment to implement increased energy efficiency as a cost-effective resource management technique. It can broadly communicate the benefits of and opportunities for energy efficiency. It can also promote sufficient, timely and stable program funding to deliver energy efficiency where it's cost-effective. In addition, the City can modify policies to align with available utility incentives by delivering cost-effective energy efficiency and adjusting ratemaking practices to promote energy efficiency investments. Xcel Energy is the primary electric and gas provider for most of Maplewood. They provide a number of programs to assist governments, businesses and residences moving toward greater energy efficiency. Parts of the City are also serviced by North Saint Paul Electrical Cooperative. Electrical cooperatives also provide support in energy conservation.

It is becoming obvious to most informed citizens that we must use less energy worldwide, or suffer environmental consequences and further economic stress. In response to the new energy paradigm, there are only three basic alternatives available:

1. Mitigate our behavior and systems to reduce energy use.
2. Adapt to reduced availability of energy.
3. Deal with the inability to adapt to reduced energy.

2.0 Community Vision for Energy Efficiency and Conservation

The USA and the State of Minnesota are committed to improving energy efficiency, increasing energy conservation and maximizing the local and distributed production of renewable energy resources. These goals are driven by a combination of economic and environmental factors that point to the need to modify our behavior at every level in order to approach a more fully sustainable lifestyle. This paradigm shift will require a deeper realization of our current impact on the environment and a commitment at every level of society to modify their behavior in ways that will reduce our consumption of fossil fuels. The utility companies and federal and state governments finance a wide variety of measures to improve energy efficiency, mostly through loans, grants and tax incentives to local governments, businesses and individual citizens. A number of the techniques discussed have been instituted at the federal and state level, but additional community implementation must be undertaken by local units of government, businesses, industry and individual local residents in order to fully accomplish the changes desired. An energy supply that can meet the demands of the future depends on maximizing existing technologies and the early availability of new technology options.

Increased efficiency of energy use is the most important energy tool that industrialized countries have. This is equally true of all buildings, electrical appliances and heating and cooling equipment. It also applies to the transportation sector and our use of petroleum fuels. In addition, many energy efficiency measures are also economical when measured over the life of the system. The costs saved for many energy improvements are greater than the investment and capital costs for the energy-saving technology when measured over the life cycle of the technology. The pay back period generally accepted by the industry is three to five years, which reflects any rebates and returns on investments. The rapid pace of innovation in areas of renewable and alternative energy technology is outpacing traditional energy efficiency measures in many cases. While improving energy efficiency and promoting energy conservation, Maplewood also supports the increased implementation of all alternative renewable sources of energy in the City. Local distributed renewable power from solar, wind, geothermal, fuel cells or other technologies should be permitted and encouraged.

Making the shift towards more efficient technologies is not automatic. Fossil fuel energy has been inexpensive for so long that the public has forgotten it is a finite resource. The use of these limited fuels has hidden costs. The historic forces that resist the change away from dependence on coal, oil and natural gas are too great. These include the lack of knowledge about efficiency technologies and alternative energy sources, the lack of capital to make changes immediately, the inertia to changing established patterns of behavior and the lack of financial incentives for decision-makers and established business relationships. There is not just one single way of using the potential of increased energy efficiency. An entire tool kit is needed to fix the many problems past energy inefficiency has left us. Local governments can play a key role in promoting sustainable technologies as these become more and more cost-effective.

The City of Maplewood is committed to becoming a sustainable community by 2050. The City has demonstrated this resolve by signing the US Mayors Climate Protection Agreement which commits the City to reduce emissions and pollution in City operations and the community. Maplewood is taking proactive steps to protect its air, water, natural and urban landscape by focusing on carbon emission reduction activities in the areas of energy efficiency and conservation. Target areas include:

1. Improving heating, cooling and lighting efficiency in municipal buildings.
2. Providing a cleaner energy supply, and increased use of alternative fuels in stationary assets and transportation options.
3. Improved recycling and waste reduction.
4. Reforestation and preservation of green spaces.
5. Reduction in storm water runoff and improved water quality.

In order to accomplish these goals Maplewood is committed to a step-by-step incremental policy of gradually improving and replacing existing infrastructure to improve energy efficiency in City-owned buildings, vehicles and City-run programs. This will require continued attention by staff and long-term commitment by managers and elected officials to this over-riding principle of improved efficiency and conservation.

Maplewood should continue to track and apply for appropriate energy efficiency and alternative energy support programs, grants and low interest loans available through the federal and state governments and also Xcel Energy to move towards increased efficiency in energy use. The City should consider either installing alternative energy systems, such as solar or wind energy generators at City-owned property. If these are not feasible, Maplewood should purchase renewable energy certificates which require slightly increased utility rates to subsidize green energy production at remote locations. The Maplewood planning commission, community design review board, Environmental and Natural Resources Commission, City Council and Mayor should officially recognize the importance of energy efficiency and conservation and codify this as a formal City policy or ordinance. Maplewood should institute and mandate an environmentally-oriented purchasing policy that makes energy efficiency and sustainability one of the top criteria for future purchasing decisions.

It is recognized that this community vision cannot be accomplished quickly or inexpensively. Maplewood officials and key staff members have undertaken an ongoing plan to address many aspects of the sustainability issue. Planning for energy efficiency and increased conservation is a key part of a long-term plan. In the next several years, the City will evaluate all City-owned buildings and make the necessary changes to include energy

efficiency, reduce carbon fuels and save taxpayer dollars. Maplewood is participating in the State of Minnesota B3 guidelines to identify and prioritize energy efficiency remediation needs for public buildings. Using this B3 protocol also pre-qualifies the City to apply for future energy assistance funding available from the Minnesota Department of Commerce.

In the last few years, Maplewood has made a number of improvements in its energy efficiency practices and purchasing policies. Still, there are a number of areas where changes are needed. This plan is an attempt to describe the energy efficiency and conservation goals, what steps Maplewood has taken to date, and future steps needed to achieve those goals.

The Environmental and Natural Resources Commission will play an important role in the development and promotion of renewable energy and sustainable practices for Maplewood. The commission is charged with shepherding City resources and balancing conflicting environmental priorities, which makes the commission the obvious choice for developing long-range policies.

2.1 Recognition of Stakeholders Who are Part of the Planning Process

This EECS would not be possible without the combined, ongoing efforts of key members of City staff, elected officials and the citizens of Maplewood. In particular, Maplewood's Green Team and the Environmental and Natural Resources Commission played leading roles in defining the problem, suggesting policy, developing alternatives, and implementing solutions.

The Maplewood Nature Center serves an important environmental education function that can be further focused on issues of energy efficiency and the ecosystem. Maplewood currently distributes a monthly and quarterly publication that helps raise awareness on energy issues for the entire City population. The City also uses its website as another way to educate and inform the public on energy, environmental and sustainability issues.

2.2 Policy Development in the Mid- and Long-Term

The development and promotion to long-term energy efficiency strategy would seem to be the appropriate responsibility of the Maplewood environmental and natural resource commission. This group may need to expand its membership or develop an ad hoc energy subcommittee, including members of the Green Team and City Council. Maplewood should encourage all planning staff, department managers, employees and elected officials to evaluate the effects of existing plans, programs and policies on energy usage. They should try to determine how to reduce energy consumption by making more efficient use of all energy resources. Maplewood should use its zoning and comprehensive plan to incorporate strategies which encourage mobile and non-mobile energy efficiency. The City should develop guidelines and codes for energy-efficient site planning and development, require lead certified or green building techniques that preserve environmental quality, minimize pollution and protects water resources while taking advantage of the natural energy flows in the environment. Modifications should include ordinances and zoning code changes which would allow implementation and installation of appropriate solar energy, wind energy, geothermal and other alternative energy systems in Maplewood.

Maplewood should support the establishment of community garden areas and encourage the production and distribution of locally grown food. The City can do this by providing individual garden plots for City residents on City-owned property or encouraging farmers markets. The City should support and apply for programs from federal, state or county governments or from the local utility companies that reward energy savings or provide grants to encourage energy efficiency, resource conservation, and environmental education on these topics. Maplewood should formally institute a purchasing policy which gives preference to

environmentally benign and energy-efficient products, with an additional preference for purchasing locally produced products to minimize transportation costs. All new City appliances and computer systems purchased should be energy-efficient with an Energy Star certification and the use of power strips.

Transportation is a major consumer of energy. Maplewood can work with Metropolitan Council to promote more public transit locations. The City can offer employee incentives for carpooling, use of public transportation and allow flexible scheduling and telecommuting to reduce vehicle miles traveled by individual employees. League management of emergency and maintenance vehicles can also be used to minimize unnecessary diesel and gasoline fuel consumption by City staff. Future investment in natural gas or hydrogen vehicles should be considered when replacing antiquated City vehicles. A "no idling" policy for City vehicles should be considered. The vehicle should be purchased with the goal of increasing average City fuel economy. The City should strongly encourage walking and biking, especially within the City campus whenever possible or practical.

2.3 Overall Goals

Simply stated the overarching goal of this plan is to promote energy efficiency and stimulate increased energy conservation. The goal requires that we gradually change our habits and expectations to focus on building a new society that uses less. We must reduce power use and fossil fuel emissions in a manner that is environmentally sustainable, maintains our present quality of life while maximizing benefits for local and regional communities. We need to leave a smaller footprint in terms of the resources we use and discard. We need to use our human ingenuity and resilience to find better, more efficient ways to do those things that are important to us. This goal requires a commitment by all parties to work for the common good.

Energy efficiency and conservation must always consider its potential impact on water resource use and consumption. The energy cost of attaining, transporting and purifying water is huge. Sustainability must always balance energy and water factors in any major land use decision. Maplewood should encourage solar water heating units for City buildings, businesses and residents.

Maplewood should develop and encourage appropriate applications of renewable energy production within City limits. The city should support the utilization of on-site distributed generation Tech knowledge on all existing and future City buildings to minimize energy costs paid to the utility. Maplewood should encourage businesses and residences to consider alternative energy production and modify the zoning code to allow these actions.

3.0 Baseline and Projected Energy Sources and Uses

3.1 Overall Electric, Natural Gas, and Petroleum

Utility records for the last five years were examined for electric and natural gas consumption at City-owned buildings. This data is found as graphs in Appendix B. Fuel consumption by City vehicles can be estimated by records of gasoline and diesel fuel dispensed from the City fuel tanks. Xcel Energy had conducted detailed energy audits of the Maplewood City Hall, Community Center and Public Works building in February 2009. A number of the steps funded by the EECBG grant are based on the recommendation of those energy audits.

3.1.1 Nature Center Energy Audit

In addition to the energy audits conducted on the Community Center, City Hall, and the Public Works building in February 2009, the Nature Center was assessed for energy and waste management efficiency as part of the development of this strategy. A team from the Minnesota Retired Engineers Technical Assistance Program (RETAP) conducted the audit on November 10, 2009.

The Nature Center is an approximately 3,000 square foot, single story building with office space, an amphitheater, classrooms and nature exhibit areas. The original section was built in 1979 with a new section added in 1993. The building is similar in construction and size to a residential home with wood studded walls, fiberglass insulation and a framed roof. Part of the roof has 2½ inches of Isocyanurate (Isoboard) insulation. This insulation material has an "R" value of about 7.2 per inch of thickness, so 2½ inches would have an "R" value of about 18 for the insulation alone. Windows and doors are of good quality, constructed of double glass and in good condition. Two windows are listed on drawings as "triple pane". The front entry has a vestibule system with good quality double glass doors.

The energy audit finds that there are some additional measures that can be taken to save energy and reduce waste at the Nature Center with moderate investments of time and money. There are two HVAC systems; both systems are typical residential type, forced air, gas fired furnaces with standard central air conditioning. The associated electric condensing units are located outside. The capacities are 132,000 British, thermal, units (BTU) input, heating and 4 tons cooling for the old section of the building and 110,000 BTU input and 3 tons for the newer section. Conditioned air is distributed to the space via supply and return duct work from the furnaces. Estimated efficiencies of the furnaces are about 75 to 80 percent each. The lighting is predominately T-12 fluorescent with magnetic ballasts, mounted in suspended ceiling tile or suspended from the ceiling.

There is one gas fired 30 gallon water heater, 32,000 BTU input serves the bathrooms and the kitchenette. There is a total of six sodium vapor and two metal halide security lights, five sodium vapor lights on the building and one in the parking lot, with an additional two metal halide lights in the parking lot. The lights are controlled by photocells and are therefore on about 3,650 hours per year. There are five exit signs with 11 watts of compact fluorescent lamps each. These signs are illuminated approximately 8,760 hours each year.

An analysis of the utility bill data indicates that the largest electric usage occurs during December. This could imply several situations:

1. The building has significant use during this time with lights and other equipment on for long hours.
2. The supplemental electric heaters were on significant amounts of time.
3. A combination of numbers 1 and 2 above. The largest gas usage also occurred in December, which is not unusual and could confirm the above comments for electric use and also indicate that December was a long and cold month.

The gas usage for June through September indicates that water heating requires about 7 therms (700,000 BTU) of gas per month during times when no space heat is required. This is not unusual and results in gas use for water heating of about 7 percent of the total gas used for the year.

All information in this report is based on visual observations of the facility, information provided by the representatives of the RETAP team, and the assessor's experience on similar projects and engineering training.

3.1.2 Nature Center Building Envelope

The Nature Center building is fairly well insulated. The windows and doors are good quality; with little potential for improving energy efficiency. Adding more insulation to the roof/ceiling, especially in the older section of the building, would reduce heating cost somewhat, however, payback would be seven to ten years.

3.1.3 Nature Center HVAC

The Nature Center building has two HVAC systems which operate independently of each other. The heating units and cooling condensers are quite inefficient. The City should consider replacing the two systems with new, high-efficient units. New, 95 percent efficient furnaces would reduce gas consumption for heating by about 15 percent, reducing the heating bill by about $185 per year. Replacing the condensers with SEER 14 units would reduce the electric energy requirements by about 60 percent on cooling costs, saving about $65 per year electric, for a total of $250 per year. The City should check local, state and federal incentives and rebates available for making these changes.

To improve the temperature situation in the sunroom and the reception office, the City should consider adjusting the air flow and distribution. This can be done by adjusting dampers in the air ducts/supply registers to reduce the amount of air supplied nearest the heating units (nearest the return air grills) and increasing the air flowing to the supply registers, which are located far from the heat source and return air grill.

The City should consider having saver's switches installed on the air conditioning condensers. These are installed by Xcel Energy at no cost and will provide a credit of $5 per ton, per month, for four summer months. For the 7 tons of air conditioning capacity this would be $5/month x 7 tons x 4 months = $140 per year.

The City should consider having setback thermostats installed for the office heating systems to reduce the space temperature during unoccupied times. Payback for doing this is typically one to three years.

3.1.4 Nature Center Lighting

3.1.4.1 Interior Fluorescent Lighting

The City should consider replacing the existing T-12 fluorescent lamps and magnetic ballasts with T-8 fluorescent lamps with electronic ballasts. The existing fixtures can be reused - only the lamps and ballast need to be replaced. The hallway lamps can be replaced with T-8, U tube shaped, 4-foot, 32 watt lamps and the ballasts with electronic ballasts. The balance of the T-12 fluorescent lamps can be replaced with T-8, linear, 4-foot 32 watt lamps and the ballasts with electronic ballasts. The existing hallway T-12 light fixtures with 34 watt, U tube lamps will use about 82 watts per fixture with their magnetic ballast. The two lamp fixture, T-12 fixtures, with 40 watt linear lamps, use about 92 watts with their magnetic ballast and the three lamp fixtures use about 140 watts with their magnetic ballast and with all lamps on.

Two-lamp fixture, 32 watt, T-8 lamps with electronic ballasts would use about 56 watts and three lamp T-8 units would use about 84 watts per fixture, assuming all have ballasts with factors of 0.88.

3.1.5 Nature Center Renewable Energy Considerations

The City should consider installing a solar thermal system to heat water, taking advantage of local, state and federal incentives and rebates. Estimated savings = about $100 per year. In

addition, the City should review the wind power and financial feasibility of installing a wind turbine to generate most or all electricity needed for the facility.

3.2 Overall Stationary Buildings

Building, heating and cooling requires approximately 40 percent of all energy consumed. There are several approaches for improving energy efficiency in buildings, some of which are discussed below. This initiative will demonstrate a methodology that can be applied to every City-owned building.

3.2.1 Thermal Insulation

One of the most cost-effective ways to improve energy efficiency in buildings is with improved thermal insulation of roofs and outside walls. Many of our older buildings were constructed when energy was cheap. Studies have shown that heating requirements and CO^2 emissions for new buildings can be reduced by an average of about 30 percent with adequate insulation. Building codes can require improved thermal insulation requirements for existing buildings if particular retrofitting measures are made. This single measure could result in substantial improvements in the energy efficiency of Maplewood's building stock.

Insulation can also be improved by caulking or patching air leaks in existing buildings around doors, windows and areas where building additions were added. Window areas are another zone of substantial heat loss. Using smaller windows and/or replacing existing single pane windows with multi-pane windows are recommended. In cases where these options are not feasible, insulating window films can provide additional heat loss prevention. Work must continue to further tighten the standards for the conservation of heat energy in buildings.

3.2.2 Building Codes

Maplewood should use building codes and standards for new construction or rehabilitation of existing structures. Maplewood has already adopted the State Energy Code. These codes may require the replacement of older appliances and equipment with newer more energy efficient models. One way to accomplish this is to take advantage of existing energy improvement loans and subsidies. There are also a number of tax incentives available through the federal and state government that work to encourage energy improvement.

In dealing with existing infrastructure, the City must maintain the existing infrastructure, while slowly and steadily improving the buildings with incremental energy improvements. These improvements will be initiated as items need replacement or new incentives become available.

Overarching regulatory policy coupled with financial support and public education leads to the creation of markets for energy improvements. It is also necessary that the public be aware of these measures and there is transparency of pilot projects in new technologies and innovations that increase energy efficiency.

3.3 Overall Transportation

According to Lawrence Livermore National Laboratory transportation requires approximately 40 percent of all energy consumed in the USA. We have become such a mobility-oriented society that depends on our existing infrastructure which is designed for individual automotive transportation. The Maplewood EECBG funds are not directly programmed to improve energy efficiency in the transportation sector, except through long-term strategies to improve the use of mass transit, biking and pedestrian modes of travel to the maximum extent practical. Maplewood has a diesel and gasoline fuel station for City vehicles. Fuel use should be tracked monthly and by department to determine this aspect of transportation

energy consumption and expense. Vehicle replacement policies should include a strong consideration of higher mileage and more energy efficient vehicles. City staff should endeavor to drive less, carpool and use mass transportation whenever possible.

A number of recent studies have shown that controlling traffic with roundabouts is actually much more efficient than conventional signalized intersections. Maplewood has constructed several roundabouts with new road construction in the last few years. As Maplewood plans for future roadway construction and reconstruction, roundabouts should continue to be evaluated as an alternative to controlling traffic.

4.0 Maximizing the Benefits to the People and Businesses of the Region

4.1 Household and Business Cost Savings

Homeowners and renters are ultimately taxpayers and utility ratepayers. They pay directly and indirectly for all inefficiency through their taxes and utility fees.

Community and economic development to maximize energy efficiency and conservation requires a "Smart Growth" approach to planning and future development. Existing infrastructure must be maintained and upgraded where practical. All new facilities or major remodels should be held to a higher efficiency standard. Energy efficient purchases and operations, reduction in energy use, installation of local renewable energy production where feasible, and an increase in local green space for passive and active use should be part of the City's overriding policies.

Maplewood's livability and environmental quality can be enhanced by establishing pedestrian paths and bikeways and providing areas for community gardens. Targeted tree planting can be used to improve aesthetics and help reverse the extent of the urban "heat-island" effect. Greenhouse gas reductions should be a consideration in all City purchasing and operational decisions.

5.0 Priority Actions by Sector

In order to improve its energy efficiency the City should take these steps:

1. Maplewood must improve existing buildings and facilities to lower the City's energy costs and reduce emissions.
2. Maplewood must commit to continuously improve facility operations through operation and maintenance of existing systems and upgrading facilities and appliances as they are replaced.
3. Maplewood must set an example for the community by creating an administrative office complex focused on energy efficiency and sustainable development.

5.1 Building Energy Efficiency

The greatest potential for conserving energy in buildings can be tapped by insulating roofs and external walls, replacing windows, installing heat recovery systems and low-temperature boilers or gas condensing boilers. The federal government's energy aid is focused on improving building energy efficiency, and providing citizens with financial assistance and information about appropriate and cost-effective energy conservation measures. The federal government covers part of the equipment and supply costs with grants and tax credits. They also encourage implementation of energy conservation measures in government and residential buildings by offering low-interest loans for this purpose. Further assistance is available through the market incentive programs to foster the use of renewable sources of energy.

Besides reducing energy costs, these improvements will enhance occupant comfort, reduce deferred maintenance, decrease the need for capital dollars, replace banned refrigerants with environmentally friendly coolants, and lower the number of hot and cold service calls in these facilities. In the Maplewood City Hall complex there are a number of older windows that could be a major source of heat loss. These windows should be checked for energy tightness with visual inspection and/or an infrared camera. Heat loss can be reduced through caulking and weather-stripping windows. It may also be cost-effective to apply a thermal window film to reduce heat transmission through the windows.

An energy audit should be conducted for every major City building including:

1. Energy demand analysis (computer-modeled energy audit).
2. Required for all new construction and major renovations.
3. Optional for all existing buildings.
4. Building size and materials used.
5. Projected building use and HVAC systems.
6. Climate conditions.
7. Energy use (actual historical usage).
8. Required for all existing buildings (at least the last three calendar years, normalized against weather data).

To accomplish this, Maplewood should continue to work with RETAP and possibly develop a cost-sharing mechanism to involve Maplewood businesses and residences more fully in energy audits and conservation.

5.1.1 Energy Efficiency In City Buildings – Key Aspects

The introduction of energy efficient innovations does not happen automatically. They require changes in the way energy companies and communities make their investment decisions and changes in citizen behavior. Local governments as stewards of the citizen's collective resources have an obligation to adopt energy saving techniques as soon as these are economically practical.

The overwhelming amount of data, lack of comparative information or imperfect knowledge on the part of citizens, facilities managers, equipment vendors, manufacturers and policy makers may prevent introduction of efficiency measures in many situations. People are frequently unaware of all the practices and technologies available to conserve energy. They may have misconceptions about these new technologies.

City planning staff may lack the personnel with expertise on the details of the energy market. They may not know how to implement policies needed to alter existing patterns of energy consumption. Legal barriers may limit the scope of the planning activities of the energy companies. Legal accounting procedures may impede utilities from considering investments in their customers' facilities as part of the utility investment. Institutional and legal barriers may impede rates that allow utilities to recover the costs of energy efficiency and conservation programs.

Many communities will not make investments in energy efficiency because they lack capital to buy new energy-efficient equipment or make the required retrofit in their installations. A certain measure might be very cost effective, with fast payback, but it will not be implemented unless the community can meet the up-front capital costs. In addition, energy efficiency might not be the highest priority for local investment. For instance, a community

considering the purchase of a new refrigerator might prefer a less efficient model if it is available in the color they prefer. An industrial customer may prefer to spend capital on a new line of products rather than consider a retrofit in existing installations. Furthermore, it is often not the person who pays the energy bill who is responsible for the selection and purchase of energy-using equipment.

Several opportunities to produce and to conserve energy depend on new technologies that might not be appropriate in some communities. Many new and efficient technologies incorporate electronic components that rely on good quality power to operate. Voltage fluctuations and frequent power failures will shorten the equipment's designed lifetime.

Electricity rates (tariffs) in many instances have been a barrier to attracting communities to invest in energy efficiency. Very often tariffs do not reflect the marginal costs of producing electricity. Traditional ratemaking encourages sales of kWh (for an electric utility), and discourages efficiency measures.

Energy efficiency programs need to consider the diversity of actors involved and the different perceptions about costs and benefits, along with risks and uncertainties of energy saving measure. The evaluation of the economic attractiveness and the convenience (or inconvenience) of implementing a given measure depends on the perspective and criteria of each perspective.

Most utilities, large communities and the government have access to low-cost capital, which is not the case for the majority of citizens. Government or utilities can afford to make longer-term investments, which often have longer payback periods, and spread the risks of individual investments across a broad range of ratepayers and taxpayers.

The power sector tends to assume a lower discount rate compared to an energy consumer, which reflects its greater access to capital. A perception of greater future risks will also be reflected in the rates used to discount future costs and benefits. A lower discount rate for utilities, for example, will make many investments in energy efficiency cost-effective, but that is not necessarily directly relevant for the client communities.

5.2 Education for Departmental Managers and Employees

Staff, managers, elected officials and members of the public should be educated on the considerations that go into making energy efficient investment and energy conservation-oriented system operations. These factors include:

1. Type of building – whether it is isolated or aggregated, construction should maximize cubic space and minimize surface area of the building exposed to the weather.
2. Geographical position – orientation of buildings to capture sunlight and reduce energy use.
3. Landscaping - landscape material around buildings to help create more energy efficient micro-climates should be reviewed as part of the planning process.
4. Building materials and insulation – a relatively low-cost way to improve energy efficiency. All materials used in new construction and remodeling should improve insulation value and move the building towards reduced heat loss to the environment.
5. Windows - double or triple pane are best for new windows, existing windows should be film coated and targeted for replacement as the operation and maintenance budget permits.

6. Ventilation outlet - air ventilation or centralized ventilation unit with heat recovery or distributed ventilation unit with heat recovery is recommended.
7. Heating systems - combined heat and power use is recommended, perhaps the City campus could move towards a district energy approach combining supplemental wood heating, solar thermal water heating, solar photovoltaic or wind-power systems integrated into the existing fossil fuel system.
8. Promoting clean and renewable energy - solar, wind, geothermal in new construction.
9. Transportation and land use – Zoning and economic development policies should be modified to direct all future development towards a more compact sustainable use of land and other resources. Maplewood geographically is quite extended, so efforts should be made to minimize unnecessary trips to the periphery of the City through better transportation planning of City maintenance activities.
10. Reduced waste and increased recycling – Reducing waste consumption and maximizing recycling is a major tool in energy conservation. This should be required in the workplace and strongly encouraged for all employees and citizens.

Maplewood will continue to emphasize the importance of continued public education to help citizens modify their energy awareness and change their behavior gradually to improve energy conservation. This can be done at every level of public interaction, but the Nature Center offers a particularly rich opportunity to provide environmental education on the role of energy in the ecosystem.

The energy bike is an educational display at the Nature Center. People use their muscle power to create energy from the bike to power a fan, and a fluorescent or incandescent light bulb. The energy bike demonstrates the amount of energy it takes to generate electricity for various electrical appliances and lighting. The energy bike and other energy efficiency and conservation demonstrations should be taken to the Community Center and other City and community venues to help raise citizen and business owner awareness of energy issues.

As stated, the Green Team's 2009 goal is to promote energy conservation. As an introduction the Green Team introduced the Minnesota Energy Challenge to City employees and City residents and business owners. The Minnesota Energy Challenge is a local resource for information on saving money and energy in your home (www.mnenergychallenge.org). It was created by the Center for Energy and Environment, which is a local nonprofit that provides energy services to single-family, multi-family and commercial property owners throughout Minnesota. By taking the challenge, people agree to a few simple steps to conserve energy and reduce emissions. Progress made by the City on the Minnesota Energy challenge should be published in City publications and on the City's website.

6.0 Implementation Action Plans

1. Continue planning efforts with the general population, the Green Team, Environmental and Natural Resources Commission, planning commission, community design review board, City Council and Mayor.
2. Coordinate City actions with overlapping jurisdictions at the watershed, county, state and federal levels on coordinated energy and sustainability projects.
3. Seek all appropriate energy improvement grants from federal, state and utility sponsored programs.
4. Continue to complete energy audits on all City-owned buildings and facilities as resources allow.

5. Complete a five-step building analysis program "retro-commissioning study" on all City-owned buildings.
6. Work with local chambers of commerce, business associations, and large commercial and industrial firms in Maplewood and adjacent cities to cooperate more fully in energy conservation goals.
7. Modernization and renovation work on City buildings should use the latest high-energy efficiency standards in Minnesota Building Codes.
8. In new City and commercial buildings, standards for average heating energy consumption should be reduced by 25 percent.
9. In all newly constructed City and commercial buildings an energy analysis should be provided during the planning and permit process.
10. The City will undertake a long-range program of gradually improving and replacing older HVAC systems as these near the end of their service life.
11. Adopt an energy efficiency purchasing policy for all new equipment and vehicles purchased by the City.
12. Promote energy conservation education through City literature and programs.
13. In all new City-funded buildings, energy ratings must exceed the state energy code by 30 percent.
14. Implement smart grid technology in City operations.
15. Adopt energy policies which will ensure achievement of the City's energy goals.
16. Set aside 5 percent of the City's operation and maintenance budget for yearly energy efficiency upgrades.

6.1 Implementation Activities at Maplewood Public Facilities

6.1.1 Energy Reduction Projects

The following items or projects have been implemented or are in the process for consideration of implementation that would fall under Energy Reduction Projects. These projects are listed by facility so that there is an understanding of the progress being made for each facility.

6.1.1.1 Public Works Building

- 2001
    - Radiant gas heating replacing hot water fan units in lower garage/shop/vehicle parking areas.
    - Trane HVAC rooftop unit, more efficient boiler reheating in heating season.
    - High efficiency hot water heater.
- 2005
    - New boilers with 89 percent efficiency and VAV boxes with boiler reheating.
    - T-8 fixtures in new expansion office areas with occupancy sensors, T-5 fixtures in new vehicle garage area with control panel. Sensors to be added.
    - Facility heating and cooling completely on Summit Energy Management System (EMS) with frequency drives for rooftop motor control, implement hours of usage schedules where applicable.

- Start implementation of preventative maintenance program tied to five-step building analysis program "retro-commissioning study."
- Implement energy star or high efficiency equipment replacement or retrofitting as required.

- 2006
  - Retrofit older second floor, garage, and shop areas with T-8 fixtures.
- 2007
  - Utility use data collected and entered into the B3 program.
- 2009
  - Xcel Energy assessment completed for City Hall, Community Center, and Public Works buildings. Review and recommendation in process.

6.1.1.2 City Hall/Police Department Building

- 1998
  - T-8 fixtures installed in facility with occupancy sensors in offices with a ten-year payback.
  - Frequency drives installed for air handler units (AHU) 1 & 2.
  - UHL energy management system installed for AHU's.
- 2005
  - Summit EMS replaces UHL system, pneumatic control still on VAV boxes, and implement hours of usage schedules where applicable.
  - Start implementation of preventative maintenance program tied to five-step building analysis program "retro-commissioning study."
  - Implement energy star or high efficiency equipment replacement or retrofitting as required.
- 2006
  - Submit proposal to start retrofitting VAV boxes to electronic control for more accurate control of areas, over three years.
  - Investigate-replacement of boilers 1and 2 with high efficiency units and high efficiency pump.
- 2007
  - Replacement of seven rooftop exhaust units with more efficient internally accessible direct drive units.
  - T-8 lamps starting to be replaced with Super T-8's. Beta test for usage and output quality.
  - Investigate utilizing glycol in heating loop to be able to use Summit system to shut down after hours.
  - Investigate replacement of air conditioning compressor units 1 and 2 with multi-stage fans and high efficiency compressors.
  - Utility use data collected and entered into B3 program.
- 2008
  - Investigating T-8 and other styles of LED available lamps and fixtures.
- 2009

- Investigating geo-thermal system for campus usage.
- Investigating solar photo-cells technology to supplement electrical usage for campus.
- Xcel Energy assessment complete. Review and recommendation in process.

6.1.1.3 Maplewood Community Center Building

- 1994
  - T-8 fixtures installed during building of facility.
  - Tracer Energy Management System installed with electronic controls on units. Glycol in system to allow unoccupied time shut down schedules during cold weather.
- 2003 - Summit EMS replaces Tracer system.
- 2005
  - Start implementation of preventative maintenance program tied to five-step building analysis program "retro-commissioning" study.
  - Implement Energy Star or high efficiency equipment replacement or retrofitting as required.
  - Improper mixing of glycols caused acidic condition in loop system flushed only; treated water put back in. Thermo-Dyne loop only part protected by glycol, unoccupied time schedule not used.
- 2006 - Investigated adding glycol back into closed loop system. Cost was too high at the time.
- 2007 – Utility use data collected and entered into the B3 program.

6.1.1.4 EECBG Funded Projects

- December 2009
  - Replacement of two boilers at City Hall with more energy-efficient boilers – The City has awarded the boiler project to Egan with the submittal of their low bid. The boilers have been ordered and the installation is planned in December 2009.
  - HVAC efficiency upgrades at City Hall - The HVAC upgrade at City Hall has been assigned to Trane Company. The installation should be complete by the end of December 2009.
  - Energy efficient lighting upgrades at the Maplewood Community Center and Goodrich Park - The City is testing the lighting conditions of various fixtures for the Community Center court area. This project will be going out for bids in January 2010, with the project complete by the end of February 2010. The energy efficient lighting upgrades at Goodrich Park were complete in October 2009.
  - Contribution to Maplewood Mall parking lot energy efficient lighting upgrades – The Maplewood Mall hired Viking Electric to complete the lighting upgrades at the mall. The work was complete November 2009.

7.0 Budget, Funding, Leverage, and Sustainability Plan

The City will rely primarily on federal and state grants, loans and tax credits to fund energy improvements initially. Local tax increases for energy efficiency are not envisioned in the near future. Maplewood will continue utilizing the B3 system to track energy use and qualify for further energy grants and loans administered by the State of Minnesota, Department of Commerce, Office of Energy Security.

Under the eligible activity Maplewood could use the RETAP energy audit services as a basis for the City's building energy efficiency implementation plan. Maplewood will use the EECBG funds to provide upfront capital for the energy efficiency strategies outlined in the grant agreement. The energy audits will define areas to achieve the target 25 percent reduction in electricity use. Each of the following capital retrofit activities relates directly to reducing energy consumption, providing electricity savings and greenhouse gas reductions. Potential measures that may be implemented include but are not limited to the following:

1. Replace all non-energy efficient lamps in lighting fixtures in all facilities.
2. Replace all existing exit signs with LED exit signage.
3. Replace or upgrade all HVAC systems.
4. Install Smart grid computerized control software and equipment.
5. Conduct selective retro commissioning on City Hall, Community Center, Public Works building, Nature Center and fire stations, as permitted by availability of funding.
6. Cost-benefit analysis of new energy sources to be implemented in City buildings and facilities.
7. At least 5 percent of the City's operating and maintenance budget should be set aside yearly for energy efficiency upgrades.
8. Capital improvement plan should call out all future energy efficiency upgrade projects.

8.0 Communications and Engagement Plan

The Maplewood Green Team and the Environmental and Natural Resources Commission will proactively communicate and engage the plan with the community and City employees. In addition, the City will communicate energy conservation and efficiency news and developments through the City's newsletter, quarterly Maplewood Seasons (environmental insert), Maplewood Review, City website, and distribution of information in a kiosk at the Maplewood Mall. The Maplewood Nature Center will enhance their existing energy focused environmental education as can be programmed into their operating schedule. As new information on energy and sustainability emerges it will be disseminated in print, online and through City outreach programs in housing, education, planning and other areas.

In order to ensure the widest possible outreach on issues of energy efficiency, conservation and sustainability of resource use, the Maplewood Nature Center should use existing partnerships with Independent School District 622 and Century College to distribute information on the City's energy policies to elementary, middle school, high school and college level students in Maplewood and surrounding communities. Building on the recycling and energy efficiency programs that the Nature Center already offers, residents and students can be further encouraged to reduce energy use in school complexes and homes. This information could also be blended into other existing Nature Center environmental education curriculum.

The Maplewood Nature Center can continue to play a special role in environmental education on sustainability and energy issues. Besides being a living laboratory of ecological processes, the Nature Center offers countless opportunities for all citizens, especially from pre-kindergarten to adult, to immerse themselves in natural systems. The Nature Center allows one to experience balanced energy flow at their own pace and at their own convenience. As funding becomes available this resource should be developed further to include more energy-based environmental education in its programming.

9.0 Jobs and Economic Development Plan

9.1 Green Jobs for Maplewood

As Maplewood looks to its sustainable future, its target is to become a sustainable community. Many innovative environmental products are being developed by Minnesota, Mining, and Manufacturing (3M), which is a Maplewood based business. Additional green jobs may involve local food production or manufacturing more environmentally friendly products and services, which require fewer materials for production and less water and energy for transportation. Minnesota is a national leader in finding ways of recycling our water and biomass into ecologically sensitive products.

The Federal Stimulus funding which supports the development of this plan is ultimately targeted at creating and maintaining careers in sustainable energy technology. These are often referred to as "green jobs." In every decision made regarding energy improvements and investment the importance of employment and economic development is a major factor. The USA economy for the last 100 years has been almost completely dependent on fossil fuels such as coal and petroleum. The transition and transformation of our nation to renewable energy will not be quick, easy or inexpensive. We as a society will have to change the way we think, and the way we behave to encompass the new realities of the 21st century.

Transforming the marketplace requires overcoming the inertia of past practices and replacing the remaining barriers to widespread adoption of renewable energy technologies. These barriers include lack of complete understanding of the real long-term cost of fossil fuel and renewable energy technologies, complicated procedures for permitting and connecting energy systems to the transmission grid, challenges of financing new and innovative technology or a lack of trained installers and inspectors. Maplewood officials are in a unique position to lower or remove many of these barriers, clearing the way for renewable energy markets to thrive. One of the key goals of Maplewood's EECS plan is the creation of a substantial number of good paying long-term jobs that promote sustainability and improve local energy independence.

A large number of green jobs would be provided for trades people, union workers, equipment installers and inspectors, who would help implement the equipment upgrading and replacement for the sustainable energy transition. A large number of good paying technical jobs would be available in the areas of solar photovoltaic, solar hot water, wind turbine, fuel cell and geothermal system installation and service. Currently Century College is beginning a number of programs to train technicians for the sustainable future in several appropriate technological specialties. 3M Corporation of Maplewood is currently involved with several renewable energy products. This firm may be willing to establish a cooperative program with the City of Maplewood to provide internships or entry-level jobs for Maplewood residents or students in these areas.

10.0 Alignment with Plans of Adjacent Municipalities and the State

Maplewood has a symbiotic relationship with its adjacent neighbors of Saint Paul, North Saint Paul, Little Canada, White Bear Lake, Oakdale, Woodbury, Vadnais Heights, Newport, Roseville and Ramsey and Washington Counties. Maplewood will strive to cooperate with other adjacent and nearby municipalities and jurisdictions to the extent feasible. As the energy crisis becomes more apparent, cooperation between adjacent jurisdictions and avoidance of unnecessary duplication of goods and services will increase these interactions between adjacent political units.

11.0 Plan for Tracking and Sharing Progress

The Chief Building Engineer and Environmental Planner, or their representatives, will promote, monitor and maintain the capital and operational aspects of the energy efficiency and conservation measures. These positions should expand to address other energy-related initiatives as they develop in Maplewood, providing continuity and a foundation for additional energy use reductions moving forward.

The Green Team participants will meet on a monthly basis to develop ideas, share best practices, and monitor, analyze and package program results. The most effective means of sharing information statewide is to share monthly reports with the department managers and elected officials. The Green Team is responsible for reporting energy reduction progress to the City Council. The City of Maplewood will pursue long-term strategies to strive for constantly increasing energy efficiency and overall reduction in energy expenses.

Energy reductions and cost savings associated with the energy conservation measures will sustain over the lifetime of the installed equipment, with added assurance as a result of the City's regular maintenance and operations schedule and plan for annual retro-commissioning to ensure that all equipment performs optimally. Future City-wide energy cost savings will be needed to support and sustain this critical initiative.

Sustained benefits will also result from the installation of Summit EMS software and equipment in buildings not currently on the campus system. Summit EMS provides centralized real-time energy tracking to identify changes in energy use patterns that could mean mechanical failure or miscalibration. Summit EMS combines environmental controls with facility and energy management features into a low-cost and easy to use solution to track operations and savings, all of which maximizes the benefits of energy efficiency equipment upgrades over the short and long term. Besides reducing energy costs, these improvements will enhance occupant comfort, reduce deferred maintenance and decrease the need for community capital dollars.

Monthly statements of energy performance for each county-owned facility are also available on the website and will continue to be updated as the project moves forward. Key metrics such as energy savings, cost savings per sq. ft., and greenhouse gas emission reductions will be highlighted from among the other metrics. All plans and activities are subject to City Council oversight and approval before and after being vetted through the Green Team and the Environmental and Natural Resources Commission.

The energy efficiency retrofit program will be managed by the Chief Building Engineer with oversight by the Environmental Planner, or their representatives. This plan includes implementing the specific steps specified in the EECBG application.

An outline of many of the specific metrics and data categories required to more closely track Maplewood's baseline energy efficiency and ongoing improvement is provided in Appendix A. A number of these items would be required by the B3 protocol. Staff should collect this data and maintain a database which records the information so trends in energy use and the effects of efficiency and conservation practices implemented can be verified numerically.

Appendix A

Analysis of the City of Maplewood's Existing Energy Efficiency and Conservation

The City is cognizant of the need for energy conservation and has instituted a number of measures to save energy. These measures include:

- Automatic computer shutoff programs when not in use, new power strips and more paperless and telecommuting activity.
- The IT group also ensures all new equipment is Energy Star rated. In reconfiguring the server farms for the City it has moved to virtualization which significantly reduces the number of server units and the power consumption.
- Public Works has moved to a new higher energy saving facility in the existing campus of Maplewood.
- The City has purchased an electric car and is monitoring fuel consumption of all City departments.
- Public Works has gone to a 4 by 10 operations schedule and allows flexibility in scheduling for personal needs.

The Nature Center is well designed to begin with so their efforts have focused on ecological education. This could certainly be expanded to included energy aspects of environmental education. This could possibly be a good demonstration site for advanced renewable energy technology such as solar cells, urban wind turbines and groundwater heat pumps.

Representatives from the Maplewood Mall who are receiving a small share of Maplewood's energy grant stated that they have unique problems with commercial tenants and the energy management techniques and systems they have instituted. They have agreed to assist the City of Maplewood in energy related environmental education by providing a kiosk to distribute relevant information to shoppers at the Mall.

The Chief Building Engineer, Larry Farr, has formidable technical knowledge and is implementing energy efficiency projects throughout the City's buildings. However, based on the existing operations and maintenance budget, these projects will require several years to come to fruition. Due to this lack of funding, there are some operation and maintenance issues which are being neglected.

On the positive side, Maplewood has adopted the new State of Minnesota Energy Code requirements for new buildings and major remodels. The City is using frequency drives on every power system and has upgraded almost all of its lighting to more efficient lamps. All toilets are water savers. The City is retrofitting old light fixtures by changing out ballasts. There is some new energy efficient equipment in a number of places. Day-lighting and lighting control is used in the Public Works building.

On the negative side, there is a great deal of pre-1980's infrastructure that presents significant energy management problems. The roof and windows of the City Hall are not well insulated and there appears to be major energy loss and ice-damming occurring in these roofs. There is a great deal of exposed single pane glass windows that must contribute to heat loss. There are thermal air conditioners with lots of wasted space. The Community Center appears to be a major energy consumer and there could be several increased

efficiencies there. There are a number of old compressors and other units operating in various places in Maplewood. These should be replaced with higher quality units at the end of their service life.

The Gladstone Fire Station is the largest and most modern of the City's five fire stations. The energy consumption in these units is less than in the campus complex but there is always room for improvement. There is an inordinate amount of glass and other minor inefficiencies, but overall it is reasonably energy efficient. Other Maplewood fire stations appear to be in need of much more retrofit than the Gladstone Fire Station.

The Maplewood Nature Center is a small energy user but it has the potential to make a major impact in the area of environmental education on energy efficiency and ecology. Nature Center staff can develop facility programming to make visitors more aware of issues of the flows of energy and water in the ecosystem. This will help increase the overall level of public understanding on the implications of energy use in their lives.

As part of the energy plan, electrical engineers from Minnesota's Retired Engineer Technical Assistance Program (RETAP) will conduct a formal energy audit on the Maplewood Nature Center. It is quite likely that future energy audits will be conducted of Maplewood building and facilities in order of decreasing energy consumption as permitted by available resources. The RETAP audit is at no charge to Maplewood, however due to the increasing demand for this service, in the future Maplewood may be asked to provide some token fee towards this service.

Appendix B

Outline of Data Collection Needs to Track Energy Efficiency Improvements

For each building, vehicle, appliance and system in Maplewood trends in energy use can be more effectively understood if a database of relevant data is established. The following outline presents a conceptual framework for establishing a database to accomplish this measurement.

Buildings Energy Use

A. For each building, collect data in a comments section for:
   1. Hours of operation
   2. Level of employee coverage
   3. Extent of services offered
   4. Flexible scheduling
   5. Evaluate level of fee for service
   6. Contingency planning for unexpected emergencies
   7. Operation and maintenance budget annually
   8. Capital improvement budget needs
   9. Number and type of HVAC units, lamps, computers per building
   10. Specific energy cost data for each building or complex of buildings
   11. Energy use for gas, electric by units consumed, and by cost per unit of fuel
      a. Community Center
         1) Heating
         2) Cooling
         3) Lighting
         4) Computer
         5) Other (Water, Paper, Supplies)
      b. City Hall
         1) Heating
         2) Cooling
         3) Lighting
         4) Computer
         5) Other (Water, Paper, Supplies)

c. Public Works and Parks Buildings
    1) Heating
    2) Cooling
    3) Lighting
    4) Computer
    5) Other (Water, Paper, Supplies)

a. Fire Stations (Five)
    1) Heating
    2) Cooling
    3) Lighting
    4) Computer
    5) Other (Water, Paper, Supplies)

b. Nature Center
    1) Heating
    2) Cooling
    3) Lighting
    4) Computer
    5) Other (Water, Paper, Supplies)

c. Other Facilities
    1) Heating
    2) Cooling
    3) Lighting
    4) Computer
    5) Other (Water, Paper, Supplies)

Transportation Energy Use

A. For each department, collect data in a comments section for
    1. Hours of operation
    2. Level of employee coverage
    3. Extent of services offered
    4. Flexible scheduling
    5. Evaluate level of fee for service
    6. Number and type of vehicles
    7. Mission specific expenses
    8. Contingency planning for unexpected emergencies

9. Operation and maintenance budget annually
10. Capital improvement budget projected
11. Specific energy cost data for each department
12. Energy use for gasoline, diesel or electric vehicles by number of fuel units consumed, and by cost per unit of fuel
    a. Police
    b. Fire
    c. Maintenance
    d. Staff personal vehicles (for work purposes)
    e. Public transportation (for work purposes)
    f. Office supplies

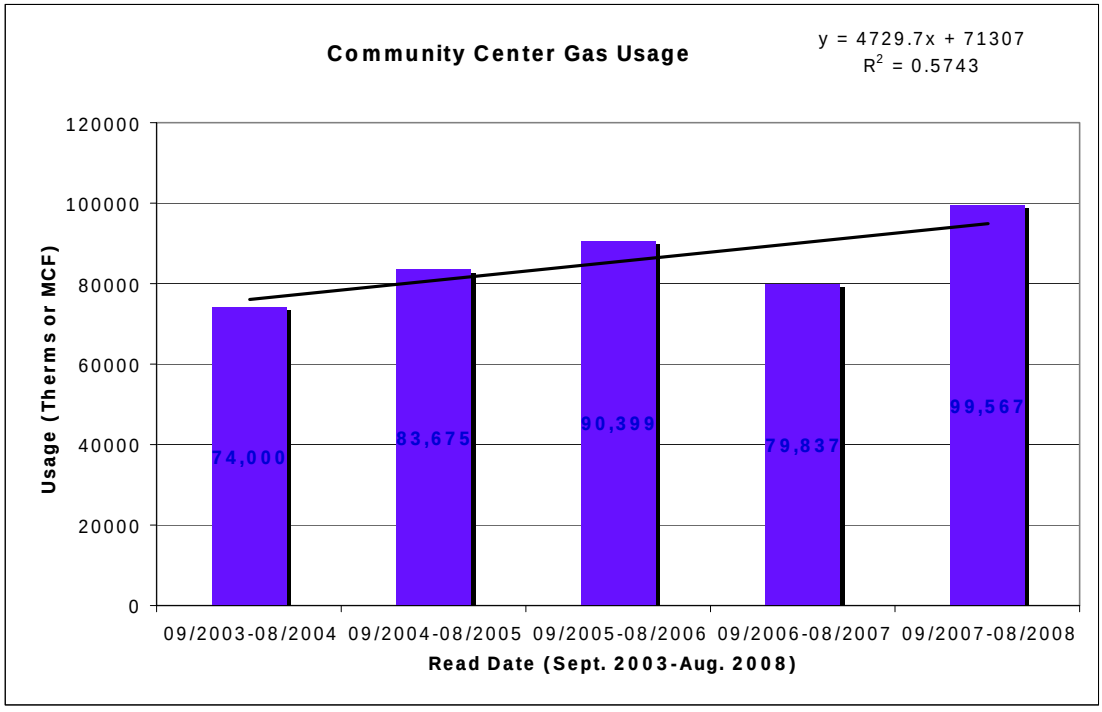
The following four graphs are included to show trends in natural gas and electricity use at the Maplewood Community Center and the City Hall complex. For the five-year period from September 2003 to August 2008 the data is provided by Xcel energy utility statements. These two facilities, both located on the City of Maplewood main campus, are the largest energy users among the City buildings and facilities. These graphs give a quick visual indication of the City energy use. These graphs chart a period when Maplewood was instituting many new energy savings techniques including motion light sensors, more efficient lamps and a new automated computer and heating and cooling system. The overall trends in energy usage cannot be attributed completely to these changes, but may also include variations in weather extremes and incremental modification of employee behavior regarding energy usage.

Graph 1 show the trend in natural gas usage at the Maplewood Community Center. Approximately half of the natural gas goes to space heating of the facility. The other half is used to heat water for the pool or for domestic use in the facility. The Community Center spends approximately $100,000 a year for natural gas. Gas usage in the winter months is significantly higher than during the summer.

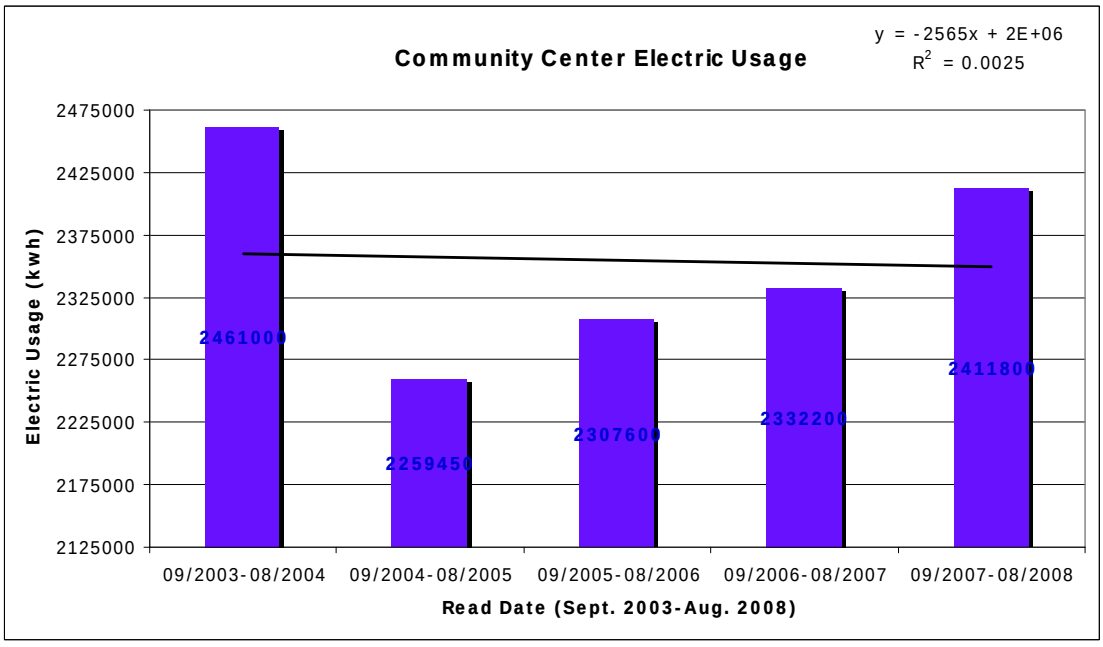
Graph 2 shows the trend in electricity use at the Maplewood Community Center. Nearly 80 percent of the electricity is used for air conditioning, lighting, pumps and fans. A Community Center spends approximately $190,000 a year for electricity. Electricity usage in the summer months is substantially higher than during the winter.

Graph 3 shows the trend in natural gas usage at Maplewood City Hall. Ninety-eight percent of the natural gas goes to space heating of the building. City Hall spends approximately $30,000 a year on natural gas.

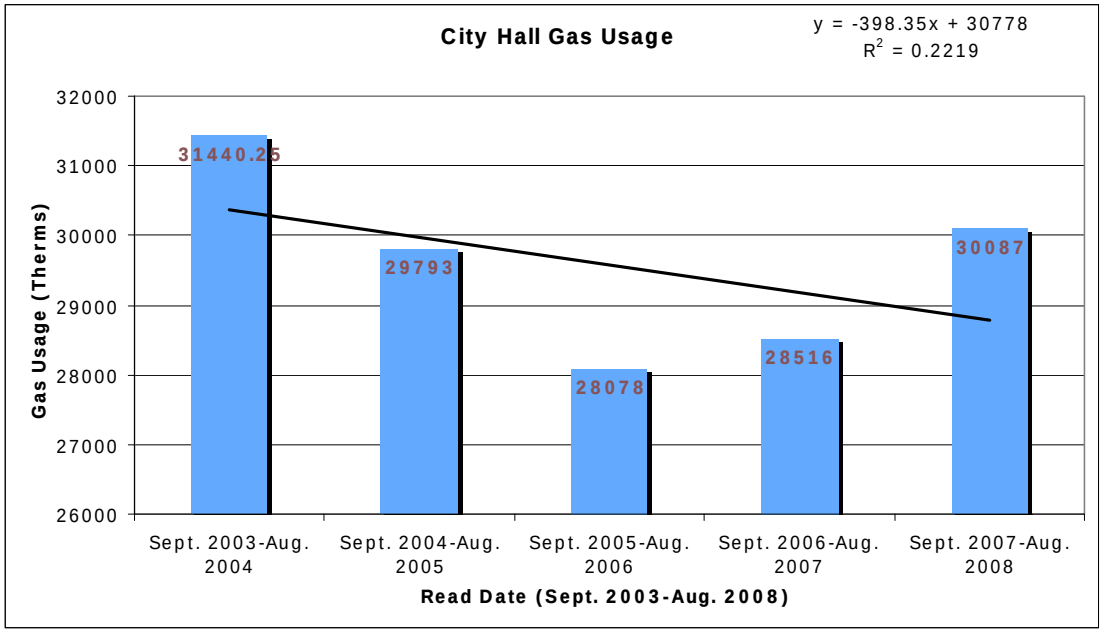
Graph 4 shows the trend in the electricity use at Maplewood City Hall. Electricity consumption is almost equally split among lighting, pumps and fans, air conditioning and miscellaneous office use. City Hall spends approximately $50,000 a year on electricity. Monthly bills are approximately equal throughout the year.



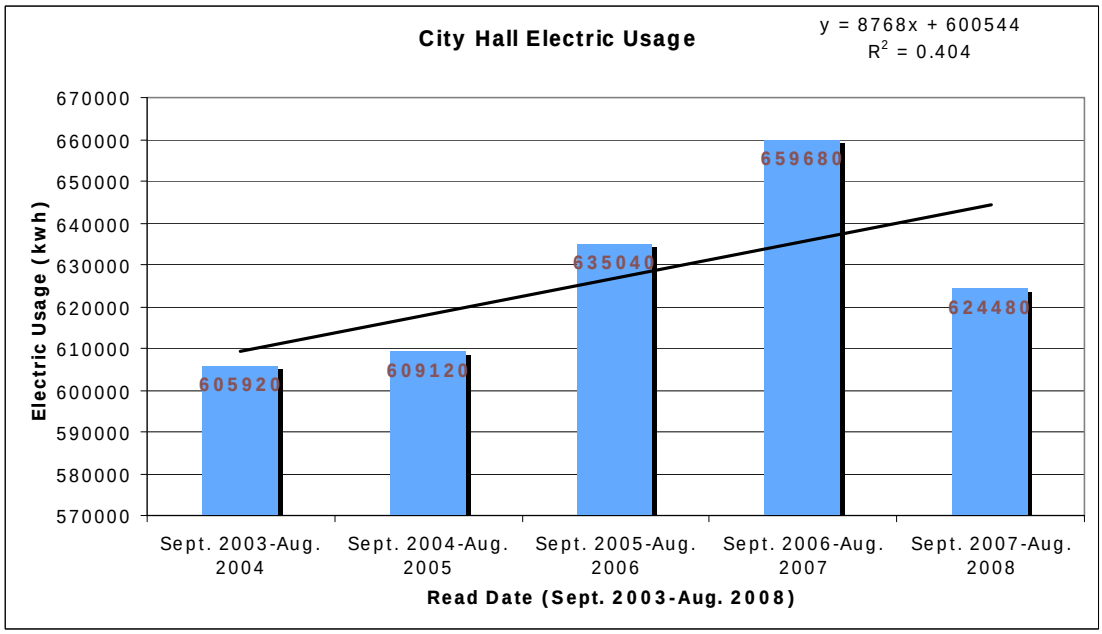
GRAPH 1: Natural gas use at the Maplewood Community Center showing a gradual increase in overall gas usage during the five-year period. 2003 to 2008



GRAPH 2: Electricity use at the Maplewood Community Center showing a slight decrease in overall electricity usage during the five-year period. 2003 to 2008



GRAPH 3: Natural gas use at the Maplewood City Hall showing a gradual decrease in overall gas usage during the five-year period. 2003 to 2008



GRAPH 4: Electricity use at the Maplewood City Hall showing a gradual increase in overall electricity usage during the five-year period. 2003 to 2008

Appendix C

Project Site Photo

Maplewood City Hall Campus