

Alternative Energy Opportunities in Rosemount, MN



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Introduction

The City of Rosemount, Minnesota is a small but growing suburb, with a population of 21,874 as of the 2010 census. Located just fifteen miles south of the Twin Cities metropolitan area, the city currently encompasses both urban and rural elements. As Rosemount expects development to increase in the near future, the city is considering opportunities for incorporating energy efficiency practices and renewable energy sources into its broader plans.

Rosemount would like to be a leader in sustainable energy and to model these practices for the city's residents. The city has demonstrated a commitment to sustainability practices through membership in the Minnesota GreenStep Cities program. Since it joined the program in December of 2011, Rosemount has achieved the second of three major steps. The city has also been awarded a 3-STAR Community Rating,

recognizing accomplishments in sustainability.¹

This project examines best practices in energy efficiency and renewable energy technologies that may be of interest to Rosemount, including: LED lights, Fleet Management, Solar Heating, Solar Photovoltaic, Wind Power, and Geothermal Heating (Ground Source Heat Pump). As detailed in the main body of the report, any one of these practices would assist Rosemount in meeting environmental goals such as reducing carbon emissions and energy use. However, some options provide better opportunities for demonstration. This report seeks to provide Rosemount with the knowledge and tools necessary to select the practice(s) best suited to the city's needs and aspirations.

¹ <http://www.starcommunities.org/press-releases/rosemount-mn-smallest-city-to-receive-star-community-rating/>

Case Studies by Technology Type

ENERGY EFFICIENCY

LED STREET LIGHTS

According to the census of 2010, the population of Crookston was 7,891². Minnesota Highway 2 runs through the city, serving as one of its major roadways. In an effort to conserve energy, the City of Crookston recently converted the streetlights along Highway 2 to LED bulbs.

Background: LED Street Lights

Light-emitting diodes, or LEDs, are commonly used for street lights and parking lights because of their efficiency. With the help of new technology, manufacturers are creating more efficient LED lights³. LEDs not only consume less energy, but also have longer lifetimes than conventional light bulbs, which reduces costs associated with maintenance and replacement of lights. Apart from being energy efficient and financially viable, there are several other advantages of LED street lights. For example, since LEDs do not have mercury and lead like conventional bulbs, they do not release poisonous gases when damaged. Furthermore, LEDs provide improved visibility, which can help to prevent road hazards.

LED Street Lights in Crookston

The streets and a highway passing through the City of Crookston have never been so bright and efficient before. After receiving \$120,000 in the form of an Energy Efficiency and Conservation Block Grant (EECBG), the City of Crookston decided to invest the grant money to replace 165 conventional street light heads with LED lights that run along Highway 2 on the east and west sides of town⁴. By installing the energy efficient LED lights, the city aimed to reduce its energy use. The previous light bulbs required 250 watts of electricity to power each fixture whereas the new LED lights required only 188 watts to illuminate the same amount of space. Ottetail Power Utility Company is the energy provider in Crookston and they provided the city with a \$5,700 wattage reduction rebate.

² United States Census Bureau. 2011. <http://www.census.gov/2010census/news/press-kits/summary-file-1.html>.

³ U.S. Department of Energy. Adoption of Light-Emitting Diodes in Common Lighting Applications. Revised May 2013. http://apps1.eere.energy.gov/buildings/publications/pdfs/ssl/led-adoption-report_2013.pdf

⁴ <http://www.cleanenergyresourceteams.org/publication/bright-idea-led-streetlights-crookston-minnesota>

It has been only a year since the City of Crookston replaced 165 streetlights with LED lights, but they began to notice the success of the project immediately⁵. Exactly as estimated, the city saw a 10% reduction in energy use after the implementation of LED street lights. However, they also experienced reduced labor expenses and concluded that they saved 15% of the total streetlight budget. Crookston's Public Works Director Pat Kelly claims that this has added up to \$21,000 in savings in a single year.

In addition to saving money by reducing the energy bills, Crookston has received positive feedback from people driving through the city at night. The new LED lights not only save energy but also ensure public road safety by improving visibility.

CITY FLEET MANAGEMENT

Concerns about the potential impacts of climate change are growing worldwide. In the face of rising fuel costs and controversy about the nature of fuels, several alternatives to fossil fuel are gaining attention. To tackle these problems with one solution, several cities across the world are pursuing better and more efficient fleet management strategies. With efficient fleet management, the city can reduce carbon emissions and dependency on fossil fuels, and eventually contribute less to serious global issues like climate change.

Fleet Management in the City of Woodbury

In the state of Minnesota voluntary programs like GreenStep Cities provide assistance to cities to help them achieve their sustainability goals by implementing best management practices, which are focused on cost savings and energy savings. The City of Woodbury offers a prime example of efficient city fleet management⁶. Woodbury has addressed the best practices for efficient fleet management recommended by GreenStep Cities; most of these have been successfully implemented, while others are in progress.

The City of Woodbury has revised and adopted its Shared Vehicle Program, which ensures the least but best use of city vehicles. To better enforce the program, the city has come up with various ways to encourage trip bundling, carpooling, video conferencing, etc. The city is also committed to purchasing vehicles that are of optimal size, economical, and fuel-efficient. Additionally, the city has made efforts to expand the number of electric, hybrid or alternative fuel vehicles in its fleet.

⁵ <http://www.cleanenergyresourceteams.org/publication/bright-idea-led-streetlights-crookston-minnesota>

⁶ <http://ci.woodbury.mn.us/13-efficient-city-fleets>

Furthermore, the city has adopted some policies to encourage no-idling practices. For instance, in the City of Woodbury it is prohibited to idle a vehicle for more than 30 seconds⁷. The city has implemented very sophisticated vehicle maintenance software to track fuel use, distance travelled, and to ensure that periodical service is provided as needed. The City of Woodbury Public Safety Department uses a bike patrol program as a method for encouraging residents to bike as often as possible.

Woodbury has done a lot of work to manage its city fleet efficiently and will continue to do so. As of now, the city is in the process of adopting the MPCA DERA (Diesel Emission Reduction Act) grant to retrofit trucks with an upgraded exhaust muffler. By implementing all of these best practices, Woodbury has been very successful in efficiently managing its city vehicle fleet.

RENEWABLE ENERGY

SOLAR TRANSPIRED HEATING SYSTEM

Bemidji had a population of 13,431 as of the 2010 census⁸. Bemidji is also the central hub of three Indian reservations and probably the most commercialized in Northwest Minnesota⁹. Bemidji State University (BSU) is located in the heart of the city and is a very integral part of the town. BSU has been particularly involved in sustainability practices, which contributes to Bemidji's reputation as a sustainable city¹⁰.

Background: Solar Transpired Heating System

As the issue of climate change is gaining momentum all over the world, the demand for sustainable and renewable energy is rapidly increasing both locally and globally. Solar power has been more accessible than other sources of renewable energy due to its affordability, convenience, and broader implementation.

With the help of advanced technology, solar energy is being used in different ways to fulfill hefty energy demands. One of the most efficient, cost-effective, and convenient of all the solar technologies available today is the solar transpired heating system. There are many names for this technology: solar air heating, solar wall heating, solar transpired heating system, and so on.

⁷ <http://ci.woodbury.mn.us/13-efficient-city-fleets>

⁸ United States Census Bureau. 2011. <http://www.census.gov/2010census/news/press-kits/summary-file-1.html>
Accessed March 4, 2015.

⁹ <http://www.ci.bemidji.mn.us/>

¹⁰ <http://www.bemidjistate.edu/sustainability/projects/energy/>

Scientifically, the solar transpired heating system follows the principle of thermodynamics and is also referred to as solar thermal. A solar transpired heating system consists of black metal cladding with holes that is attached over the fresh air intake vent through which cold fresh air enters and is heated by the sun before going into the heating system¹¹. This technology is adapted and suitable for large-scale installations, such as industrial, commercial, and even residential buildings.

The primary application for transpired air is to pre-heat fresh air as it is drawn inside, reducing the amount of fuel needed to keep a building warm. Essentially, it is the recycling of air that is already inside the building. Besides being very cost-effective, the solar transpired heating system is very sustainable as well. It has the potential to significantly reduce the amount of carbon emissions compared to a conventional heating system. In addition, it provides fresh air into the buildings and the cost of installation is relatively low.

Bemidji State University Feasibility Study

Bemidji State University is one of the most sustainable campuses in Minnesota. As an enthusiastic member of the American College and University Presidents Climate Commitment (ACUPCC), BSU has been working very aggressively to reduce their campus carbon emissions and to achieve carbon neutrality. In order to reach this goal, BSU have committed to the installation of a solar transpired heating system. With this sustainable effort the campus will significantly reduce both carbon emissions and dependency on fossil fuels to heat campus buildings.

In the summer of 2011, BSU appointed Rural Renewal Energy Alliance (RREAL) to conduct a feasibility study of a solar transpired heating system in different campus buildings to determine the following: costs, savings, time, and return on investment associated with installing these durable energy systems¹². The feasibility study found that several large buildings on the BSU campus are very suitable for the installation of black metal cladding. The study also determined how much energy would be produced by the system, how much heat would be captured, and how much carbon would be saved. Erika Bailey-Johnson, sustainability coordinator at the Bemidji State University, is very happy with the results the solar transpired heating system installation. Johnson stated, “I would definitely recommend a solar-transpired air installation, especially after evaluation of your HVAC system”¹³

¹¹ http://www.mepcsolartoolkit.org/wp-content/uploads/2012/07/BSU_Transpired_Air_Feasibility_Study.pdf

¹² Ibid.

¹³ Bailey-Johnson, Erika. Email Communication with authors. May 7, 2015.

SOLAR PHOTOVOLTAIC

Solar Photovoltaic, or Solar PV, is the use of solar panels to convert solar energy directly into electricity. The following section describes findings from two other cities in the Twin Cities Metro region that have recently installed solar PV systems on city-owned buildings.

Falcon Heights Municipal Solar Installation

In 2012, the City of Falcon Heights installed 220 solar panels in a 40kW system on their city hall roof. Dakota Electric Association is currently contracted with the City of Falcon Heights to monitor the solar panel output on a monthly basis¹⁴. With a flat roof, the Falcon Heights City Hall offered an ideal site for solar panels. The CEO of Dakota Electric Association, Greg Miller, noted that the solar results will be impacted by snow cover in Minnesota and that cities should evaluate the roof prior to installation¹⁵. Solar panels would need to be removed and re-installed after re-roofing. The Falcon Heights City Hall roof is relatively new and was evaluated in an engineering study as a part of the decision process. The City of Falcon Heights was able to arrange with Ameresco, an energy management company, to assess the City Hall's energy use free of charge, prior to the installation of the solar photovoltaic system¹⁶.

Lessons Learned in Financing

Mayor Peter Lindstrom noted that changes by the Minnesota Public Utilities Commission and Xcel rebates early in their planning process made for a long journey before the project was implemented[11]. The City of Falcon Heights chose to work with Energy Alternatives, a private company which has since been bought out. By taking advantage of a tax credit, the solar provider was able to offer a system worth \$321,000 to Falcon Heights for \$50,000¹⁷. This agreement included \$38,000 lease for six years, in which the company will maintain the system. After the six years, the City will purchase the panels for \$12,000 and will be responsible for maintenance. Lindstrom expects that the savings will pay for the cost of the system within 11 years.

If he had to do the project again, Lindstrom would be more critical of the purchase agreement. With the current agreement, the City of Falcon Heights will own solar panels which they will need to maintain. He would now look at an alternative, the solar power purchase agreement (SPPA), where the developer still receives the tax credit, but owns the system and is responsible

¹⁴ Sieminski, Barb. February 11, 2105. Powering city hall with the sun.

<http://www.themunicipal.com/2015/02/powering-city-hall-with-the-sun/> Accessed March 6, 2015.

¹⁵ Ibid.

¹⁶ Lindstrom, Peter. Personal conversation with author. February 25, 2015.

¹⁷ Lindstrom, Peter. Personal conversation with author. February 25, 2015.

for the long-term maintenance. Lindstrom's understanding is that the federal government is moving out of ownership towards the SPPA model.

Other Benefits

Two non-financial benefits that were important for Falcon Heights were the reputational benefit for the city and the use of the system to encourage more solar investment by residents. Lindstrom noted that the solar system has given him many opportunities to talk about Falcon Heights, providing the city leadership ways to show off the community¹⁸. In promoting the Falcon Heights system, Lindstrom quickly learned that the claim should not be made that the solar panels "power" the city hall, as the panels feed into the total electric grid, not directly to the city hall. A better expression that he now uses is that the panels offset 50% of the power used. Lindstrom also cites the local quality of the installation as positive publicity for the city: the system consists entirely of materials made in Minnesota, with panels from the Bloomington-based tenKsolar, which incorporate a film produced by 3M company.

The city used a Solar Panel Roof Celebration to also kick off a residential solar initiative. Besides the City Hall serving as a demonstration project, Falcon Heights was able to arrange an opportunity for residents to purchase solar systems for their homes at a reduced rate. The City of Falcon Heights partnered with a non-profit organization, Cooperative Energy Futures, and the City of Minneapolis to offer residents the opportunity to buy in a bulk purchase agreement with reduced costs¹⁹. The residents were able to realize a 20% savings. The city's sole contribution was to provide marketing for this opportunity, which was easily done in conjunction with the Solar Panel Roof Celebration.

Long-term Sustainability Planning in Oakdale, Minnesota

The City of Oakdale installed a 40 kW solar system on its City Hall in April 2012. The projected savings of energy consumption by 49,900 kWh annually, on average, offsets 12% of the total building energy consumption²⁰. The City of Oakdale started with one pilot solar array on the City Hall, and then planned to add solar on two city fire stations. One advantage for Oakdale is its long-standing Environmental Management Commission (EMC), first formed in 1994, which

¹⁸ Ibid.

¹⁹ City of Falcon Heights, Minnesota. Join us to celebrate the Solar Panel Installation and attend the Solar Panel Workshop. October 31, 2012. http://www.falconheights.org/index.asp?SEC=3218C2AD-81CC-47A7-8EBE-FA876F9E3BA2&DE=F91EF7A8-0202-46E0-82F5-43B3D00B5BEC&Type=B_PR. Accessed March 6, 2015.

²⁰ City of Oakdale. Generation Green Sustainability Plan. <http://www.ci.oakdale.mn.us/vertical/Sites/%7B9D2ABE6F-4847-480E-9780-B9885C59543F%7D/uploads/Recycling-sustainabilityplan.pdf> p. 6.

has helped in prioritizing energy conservation and alternative energy in the long-range strategy of the city²¹.

Energy Efficiency and Building selection

The City of Oakdale had building energy efficiency assessments completed prior to the solar installation. The City Hall roof needed replacement due to its age and condition, and the city decided to replace it with an energy efficient white roof and improve the insulation²². The new roof on this building gives the city confidence that it should last as long as the solar installation on it. Jen Hassebroek, Senior Community Development Specialist for the City of Oakdale, notes that the condition of the roof on one of the fire stations has become a barrier for moving forward with another solar installation²³. Additional factors were considered for the installation on a fire station roof, such as whether roof penetrations, an automatic shut-down system, and/or strength to withstand high winds would be needed²⁴.

Developer Selection Considerations

Hassebroek also recommends substantive research into the selection process for a developer: “Finding the right development partner was a challenge, everyone was trying to be a developer but few actually knew what they were doing.” She suggests other cities obtain references and project examples before proceeding with an agreement. For the potential system to be installed at one of their fire stations, the City of Oakdale chose to work with Adolfsen and Peterson Construction, which has installed a solar system on Woodbury’s public safety building and has experience in other states²⁵.

Another key recommendation from Hassebroek is to make sure that the developer offers a fair sharing of the benefits by reviewing the costs and benefits with other knowledgeable resources, such as the Department of Commerce, Clean Energy Resource Teams (CERTs) or cities that have already installed similar systems. She believes that some cities have overpaid, recommending, “Make sure the financials of the deal benefit the city and the developer equally, too many cities are just happy to have a project and the developer makes all the

²¹ http://www.ci.oakdale.mn.us/index.asp?Type=B_BASIC&SEC={BC958B45-63E5-49CF-BD77-F28ED29CA7BC}

²² City of Oakdale. Generation Green Sustainability Plan. Page 6.

²³ Hassebroek, Jennifer. Personal communication with author. March 7, 2015

²⁴ Holmquist, Alex. January 23, 2013. “Solar panels recommended for Oakdale fire stations.”

http://www.bulletin-news.com/content/solar-panels-recommended-oakdale-fire-stations#.VP5_OC5h68U

Accessed March 5, 2015.

²⁵ Holmquist, Alex. January 23, 2013. “Solar panels recommended for Oakdale fire stations.”

http://www.bulletin-news.com/content/solar-panels-recommended-oakdale-fire-stations#.VP5_OC5h68U

Accessed March 5, 2015.

windfall.²⁶ She also believes that there are still sufficient rebates to justify a project, but they have changed since the City of Oakdale initiated their project back in 2011.

Changing Financial Incentives

For the City Hall solar installation, the City of Oakdale was able to take advantage of both rebates available from Xcel and federal tax credits, which paid for 85% of the system costs²⁷. The city initially calculated an eight-year payback for the system, but Hassebroek expects that earlier payback can be realized on a system today due to changes in the market²⁸. The projected energy savings for the lifetime of the system are expected to be \$137,875. Two popular rebates have been the Solar Rewards program and the Made in Minnesota rebates for systems of 40-kW or less which are manufactured in the state. Made in Minnesota rebates are still available by lottery each year until 2023 but have a ten-year payback instead of five, and the previous rebate is no longer available. These changes have decreased Oakdale's interest in purchasing installations for either of the two fire stations²⁹. The perceived incentives for the City of Oakdale to consider adding solar were both the long-term economic benefit of energy savings and to provide a demonstration project for local homeowners and businesses, which they have now on the City Hall³⁰.

The City of Oakdale has considered other options in lieu of building their own system on one of the fire stations, such as a power purchasing agreement or using community solar gardens³¹. A power purchase agreement was also recommended for consideration by Peter Lindstrom, and has been considered by the City of Oakdale for a smaller system of 28 kW for one of the fire stations. Hassebroek noted that Oakdale's City Council would now look for less than eight years for a return on their investment and she now sees solar gardens as the most attractive option for Oakdale³².

Solar gardens allow residents to purchase a portion of a larger solar photovoltaic system and to be eligible for reimbursement under the Value-of-Solar (VOS) tariff. Minnesota is the first state to offer the VOS tariff, where the producer of solar power gets reimbursed for solar power

²⁶ Hassebroek, Jennifer. Personal communication with author. March 7, 2015.

²⁷ City of Oakdale. Generation Green Sustainability Plan. Page 7.

²⁸ City of Oakdale. Minutes of the Regular Meeting of the Environment Management Commission. March 17, 2014. <http://www.ci.oakdale.mn.us/vertical/sites/%7B9D2ABE6F-4847-480E-9780-B9885C59543F%7D/uploads/Minutes-EMC03172014.pdf>

²⁹ City of Oakdale. Generation Green Sustainability Plan. Page 7.

³⁰ Hassebroek, Jennifer. Personal communication with author. March 7, 2015.

³¹ Ibid.

³² National Renewable Energy Laboratory. Value-of-solar Tariffs.

http://www.nrel.gov/tech_deployment/state_local_governments/basics_value-of-solar_tariffs.html. Accessed March 10, 2015.

generation at a higher rate than the utility base rate[36]. Solar gardens offer the purchaser the advantage of being a subscriber into the system, without having to build a system on a public facility. However, a solar garden offers neither the benefit of a demonstration project nor the tangible sign of commitment to renewable energy as would panels on one of the city's buildings.

WIND POWER

North Saint Paul Wind Turbine Installation

North Saint Paul had a population of 11,460 at the time of the 2010 census. As a small first-ring suburb, the city strives to maintain its small-town atmosphere while developing a more urban infrastructure.³³ Since the city was essentially fully developed when they installed the wind turbine, suitable sites were quite limited.

Finances

North Saint Paul has the unique advantage of owning their local utility, which was originally purchased from a private company in 1898. In 1992, eight cities including North Saint Paul created the Minnesota Municipal Power Agency (MMPA). The agency initiated the Hometown WindPower project in 2006, which supplied each member community with a refurbished (originally from California) 160kW turbine. The kW designation refers to the amount of energy the turbine can produce per hour; this model can supply power for about 100 homes.³⁴

The project received federal funding through the Clean Renewable Energy Bonds (or CREBs) program. Consequently, the residents of North Saint Paul experienced no increase to electricity rates. Brian Frandle, Director of Electric Utilities for the city, suggested that the absence of a financial burden on the community contributed to a more positive public opinion of the project.³⁵

Unfortunately, the CREBs program no longer exists. However, there are other ongoing federal and state programs offering grants, incentives, or rebates to support renewable energy projects.

³³ <http://www.ci.north-saint-paul.mn.us/>

³⁴ http://www.ci.north-saint-paul.mn.us/vertical/sites/%7B5F63881B-2F96-4032-818C-7F4AD3529485%7D/uploads/Hometown_WindPower_Factsheet_-_NSP.pdf

³⁵ Phone interview with author, 3/6/2015

Lessons Learned

Frandle described several of the factors North Saint Paul considered when installing their wind turbine. The primary concerns involved siting, especially: the “flicker effect,” which refers to the way sunlight can reflect off the turbine’s blades, and the need to minimize or altogether avoid this impacting residents; adherence to sound standards, which is less of a concern in an urban area, since the sound of a turbine generally blends in with the general “white noise” of the city.³⁶

Perhaps of greatest importance, Frandle noted the necessity of wind studies to determine the wind resources in the area (40-50% occurrence and 11-12mph wind is generally required to generate electricity). The U.S. Department of Energy has published a map of Minnesota’s wind resources, but as the University of Minnesota Morris discovered, the estimations provided are not always accurate.^{37 38} Additionally, height and flight paths need to be accounted for, but North Saint Paul did not need to alter their zoning ordinances, as they already had zoning in place for a water tower of a height comparable to that of the wind turbine.

GEOTHERMAL HEATING

Eagan Civic Arena Ground Source Heat Pump Conversion

Eagan is one of several suburbs in the Twin Cities metro area to have implemented a ground source heat pump system, commonly referred to as geothermal energy, in recent years. While the main facilities targeted for geothermal conversion have been civic arenas (ice rinks), Eagan also fitted their new Fire Safety Center with a geothermal heat system.³⁹

Eagan stands out in that the city installed geothermal technology in both existing and new buildings. An overview of geothermal projects in similar contexts (public, municipal, etc.) shows that only rarely are buildings retrofitted with geothermal heat systems, which are more commonly selected for new facilities.^{40 41} The data on energy savings from the renovation of

³⁶ Ibid

³⁷ http://apps2.eere.energy.gov/wind/windexchange/wind_resource_maps.asp?stateab=mn

³⁸ <http://renewables.morris.umn.edu/wind/documents/WindResourceAssessmentFinalReport.pdf>

³⁹ <http://www.cityofeagan.com/index.php/news-releases/news/415-eagan-praised-for-energy-best-practices>

⁴⁰ <https://www.geoexchange.org/library/download-category/government-facilities-case-studies/>

⁴¹ http://www.osa.state.mn.us/reports/gid/2008/bestpractices/bestpractices_08_report.pdf#page=35

Eagan's civic arena, detailed below, suggest that the benefits of converting to geothermal energy may outweigh the costs.

Finances

The conversion of the Eagan Civic Arena cost a total of \$3.19 million. Partial funding was awarded to the city as part of the Federal Recovery Act, in the amount of \$1.3 million. In addition, Dakota Electric provided the sum of \$90,000 in energy rebates. The eventual cost to the city was then approximately \$1.7 million. City officials reportedly stated that the remaining costs were sourced from "civic arena revenues and debt restructuring," but not from taxes.⁴² In addition, the city participated in the Guaranteed Energy Savings Program. The program assists with evaluating facilities for energy efficiency, renewable energy options, funding options, selecting a pre-approved Energy Service Company (or ESCO), and more.⁴³ The goal of the program is for the city to pay the contractor for installation costs with the savings they earn as a result of greater energy efficiency.

So far, this arrangement has proved satisfactory to Eagan. The city has seen significant reductions in energy costs: as a result of the geothermal conversion, the civic arena now uses 42% less energy⁴⁴, and the city's natural gas bill has decreased from \$68,000 in 2009 to \$6,100 in 2012.⁴⁵ In the event that the city's savings do not meet the contractor's original projections, the company is required to pay the city.⁴⁶

Cherryl Mesko, Eagan's superintendent of operations, stated that the city would "almost eliminate" the use of natural gas in the civic arena. She further described the environmental impact of these reductions per annum as equivalent to "removing 124 cars from the road or planting 139 acres of pine forest."⁴⁷

⁴² <http://archives.ecmpublishers.info/2010/12/09/civic-arena-debuts-eco-friendly-changes/>

⁴³ <http://mn.gov/commerce/energy/businesses/financial/Energy-Savings-Programs/Government/Guaranteed-Energy-Savings-Program/Program-Goals/>

⁴⁴ <http://www.cityofeagan.com/index.php/news-releases/news/415-eagan-praised-for-energy-best-practices>

⁴⁵ <http://www.startribune.com/local/south/225663261.html>

⁴⁶ Ibid

⁴⁷ <http://archives.ecmpublishers.info/2010/12/09/civic-arena-debuts-eco-friendly-changes/>

Lessons Learned

Along with Eagan, the cities of Woodbury, Brooklyn Park, and Burnsville undertook similar geothermal installations. Of these, only Burnsville was dissatisfied with the outcome.⁴⁸ This second city therefore serves as a useful counter-example, highlighting the value of Eagan's practices.

In the first place, Burnsville's geothermal system was found to be "under-delivering," though the reason(s) for this remained unclear. However, unlike the other cities, Burnsville chose not to participate in the Guaranteed Energy Savings Program. Had they done so, the company that installed the system would now be paying the city for the deficiency. Yet without this contract, Burnsville was compelled to hire a new firm to "diagnose problems."⁴⁹ Mesko also confirmed that, "[t]here is real value in having somebody monitoring this so we can get quantifiable information."⁵⁰

⁴⁸ refer to 45

⁴⁹ Ibid

⁵⁰ Ibid

Rosemount Application

ENERGY EFFICIENCY

Energy efficiency projects can be effective in cost savings and result in positive environmental impacts. The B3 data that Rosemount already has available can be used to screen for savings opportunities. This next section describes the available B3 data, a summary of the electricity usage, and areas to investigate potential energy savings.

Building Efficiency Data from B3: Buildings, Benchmarking & Beyond Database

Rosemount has data for five city-owned buildings in the B3 database. The B3 software generates both a baseline and benchmark comparison. The baseline year is set by the user and then subsequent data is normalized based on weather data in order to compare the energy use. The benchmark is determined by the building use type, space allocation type (office, garage, gymnasium, etc.), square footage, and location, using calculations based on Department of Energy (DOE) formulas for energy use. Comparison of data to the baseline can assist in identifying changes over time and after energy efficiency improvements are completed, it can be used to track future energy savings. The benchmark comparison is an indication of potential areas for efficiency improvements where building energy use is higher than the benchmark.

The initial analysis step is to review the data for anomalies and trends. Our review of the data revealed one area that needs verification. The Steeple Center has high electric use data reported for the time periods ending 1/17/2015, 2/15/2015 and 3/17/2015 (Figure 1). The invoices for November and December 2014 were compared to the B3 data; they were entered correctly into the B3 database and were comparable to previous years. The values for January, February and March 2015 may have been incorrectly entered or there could be a significant change in electricity use. We recommend checking the invoices first and then investigating potential sources of the change.

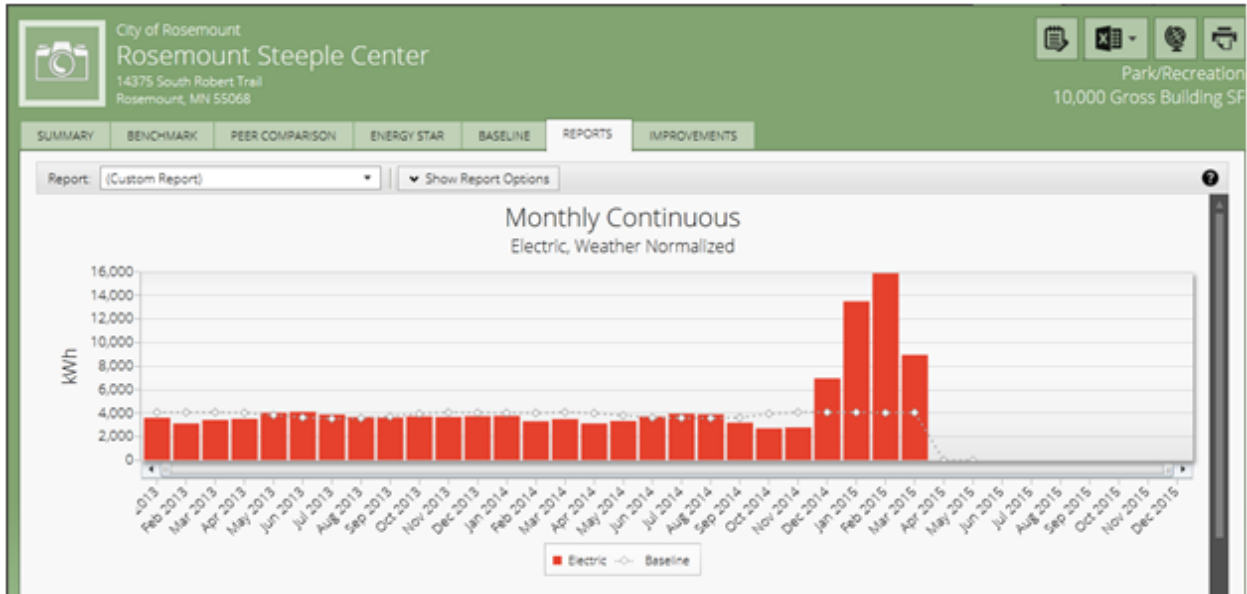


Figure 1. B3 Report for Steeple Center Electricity Use from January 2013 to last reported bill of March 2nd 2015. Baseline year is 2011.

For Overall Electricity Cost Savings, the largest opportunities could be in the Community Center/Arena and City Hall, as they are the biggest users of electricity (Figure 2). They are larger buildings, so it is helpful to look at the energy use per square foot (Figure 3).

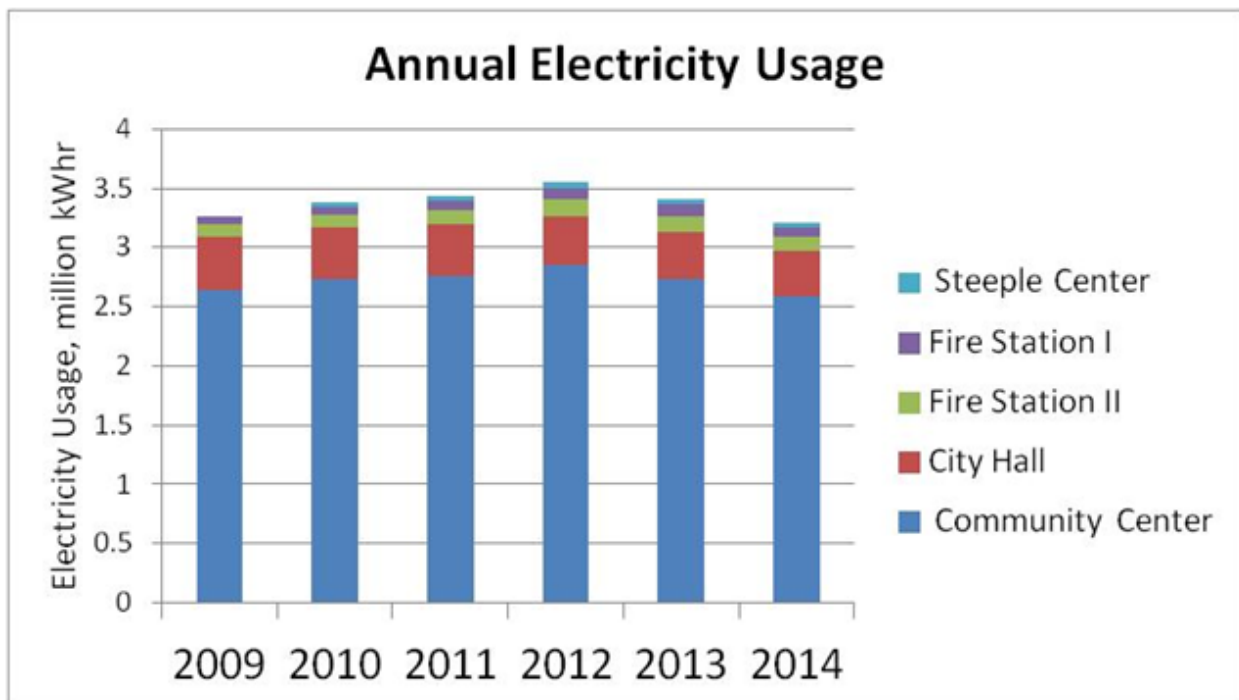


Figure 2. Annual Electricity Use by building, listed in kilowatt hours.

The Community Center and City Hall also have the most electricity used per square foot (Figure 3). Also noted is that Fire Station 2 has more electricity use per square foot than Fire Station 1.

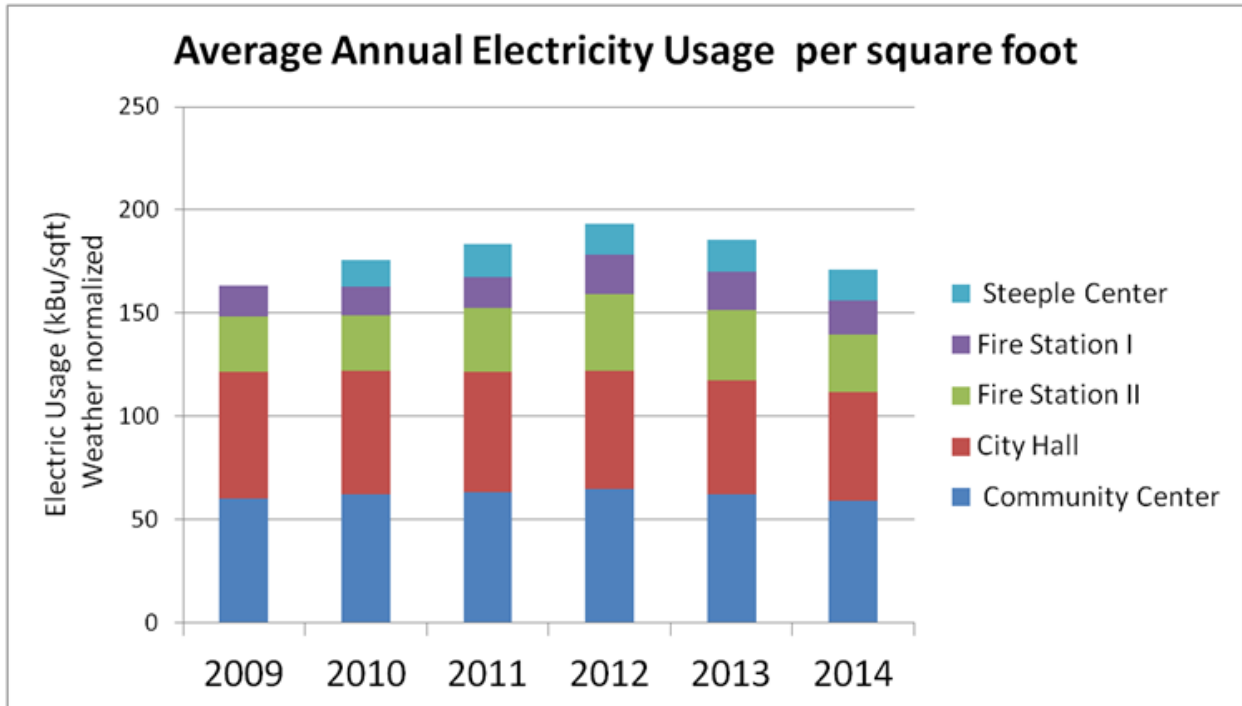


Figure 3. Average Electricity Usage by building. Source: B3 data for Rosemount, MN

It is helpful to look at monthly data to see if the usage follows expected trends. With air conditioning using electricity, the community center uses extensive energy in the summer months (Figure 4). At this point, it is helpful to compare the energy use to the benchmark. The benchmark calculation includes the type of building use as well as the expected number of hours, days per week and months per year each space is used. The B3 database has the Community Center energy benchmark data based on 37% common areas, 27% ice arena, 18% gymnasium and 18% office area. The benchmark value is based on expected efficiency data for a space of the same size for those allocated uses.

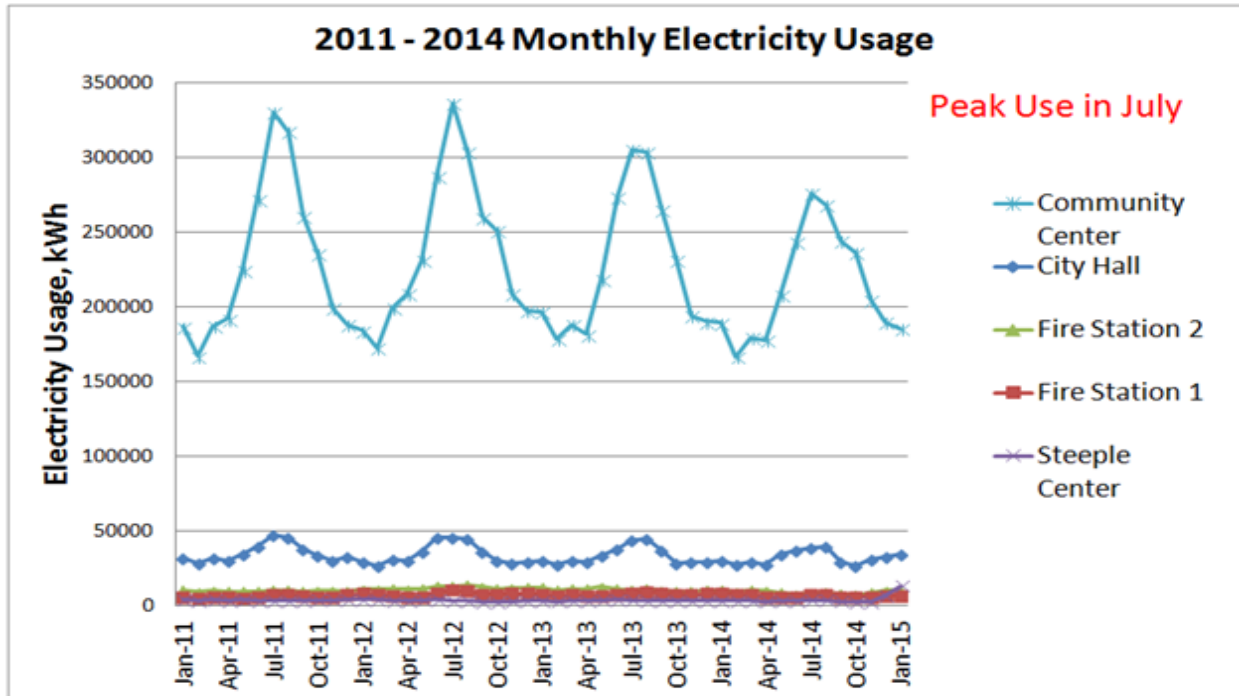


Figure 4. Monthly Electricity Usage by Building

The Benchmark summary table in the B3 database indicates that the five buildings are using in total 31% more than the benchmark (Figure 5). The database estimates the potential savings at \$142,000 per year (\$102,000 in natural gas savings and \$40,000 in electricity savings). The majority of these expected savings are associated with the Community Center and City Hall.

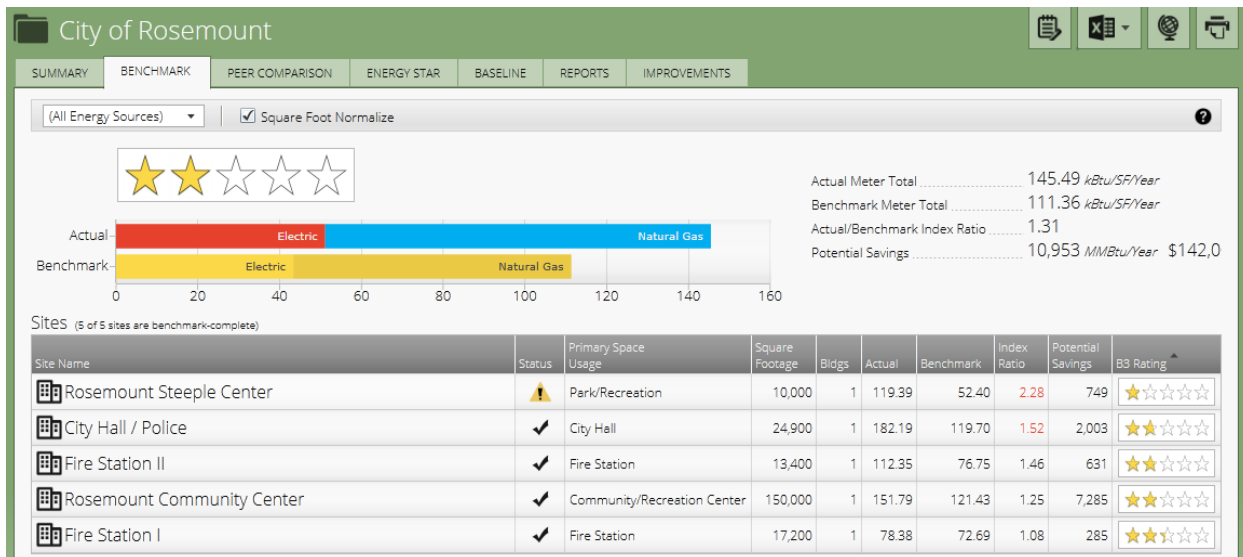


Figure 5. B3 Benchmark Summary Table for Rosemount

LED Street Lights

U.S. Highway 52, Minnesota Highway 3, Minnesota Highway 55, and County Road 42 are four of the main routes that are connected with the city of Rosemount.[11] The streetlights illuminating these highways may not be very energy efficient. With an area of 35.21 square miles and as a part of the Twin Cities Metropolitan area, it would be more efficient for Rosemount to replace the lights along the highways with LED bulbs. The advantages of this project clearly outweigh the disadvantages. By replacing only 165 street lights with LED lights, the city of Crookston was able to save lots of energy and money. As models of LED lights are improving in quality with every batch manufactured and prices also fall, Rosemount could complete a similar project with much lower costs and higher savings compared to that of Crookston just a few years ago.

In addition, the installation cost of the fixtures is not nearly as high as that of conventional lights. The city of Rosemount would have to remove old lights and attach the new wires. This could be a good investment from an economical point of view due to a minimal labor requirement and inexpensive installation. It also has a tremendous lifetime, which reduces the cost of maintenance and repair.

Fleet Management

Like Woodbury, the City of Rosemount can adopt some of the best management practices recommended by GreenStep Cities to improve the city vehicle fleet management. As an established member city, Rosemount can use all the available resources offered by GreenStep Cities. Through the program, Rosemount can gain access to action tools, implementation tools, guidance, and other city reports as references.

Some of the best practices Rosemount can implement are: to adopt Shared Vehicle Program to encourage the minimal and efficient use of city vehicles; to promote biking and walking; and to purchase hybrid, electric or alternative fuel vehicles. The city could also implement some policy changes regarding idling practices, and changes to fuel and operations to ensure sustainable fleet management. In addition, it may be of interest to Rosemount to start a program similar to what the city of Santa Monica has initiated with its “Fleet for Vehicle Replacement” to ensure that city vehicles are available, dependable, cost effective, energy efficient, and safe to operate.⁵¹

⁵¹ <http://www.smgov.net/Departments/PublicWorks/ContentStreetFleet.aspx?id=33294>

RENEWABLE ENERGY

Solar Transpired Heating System

The city of Rosemount has several large buildings, including the city hall (24,900 sq ft), community center (53,300 sq ft), fire station (17,200 sq ft), and a few others. With numerous large buildings, the city of Rosemount must incur significant expenses simply to heat these spaces. The sizes of these public buildings are fairly large and could be suitable for the installation of a solar transpired heating system. The appropriate siding for building walls consists of an exterior metal wall cladding which collects solar energy in order to pre-heat air coming into a building. Roofs can be used to install cladding as well. However, roof installation can be expensive depending on the structure of the roof, installation can be difficult. This system would also help the city of Rosemount to be more sustainable by substantially reducing energy consumption and carbon emissions.

Provided that a building has a suitable structure and location relative to the sun, a solar transpired system could be one of the most cost effective, with a high return on investment and minimal maintenance required. However, if the building's size, structure, or exposure to sunlight is inadequate, this system might not be the best alternative. In that case, it might prove to be less efficient and take longer to produce a return on investment.

There are several other advantages to installing this system. The solar walls that would be installed on a building act as a layer of insulation which reduces the temperature differential between interior and exterior wall surface temperatures and prevent heat loss from recapturing most of the heat. When the heat escapes it enters the plenum and is directed back into the building, which would block summer heat and thus protect the building exteriors from weathering.⁴ At the very least, the city of Rosemount could conduct the feasibility study to learn more about technical suitability. It might lead to the installation of the solar transpired heating system to several public buildings, as in the case of Bemidji State University.

Solar Photovoltaic

Key factors that need to be evaluated when considering the site for a solar photovoltaic installation include solar suitability, the desired size of the installation, and the physical condition of the roof.

Solar suitability

A screening of the buildings owned by the City of Rosemount was conducted by Brendon Slotterback of the City of Minneapolis for the project team. He used solar potential data that is available statewide from a University of Minnesota Lidar Solar Study. This solar study used six years of solar data and considered intermittent shading from trees and adjacent buildings to assist in determining the best solar application sites. Maps of buildings can be viewed on the University of Minnesota website solar.maps.umn.edu. Figure 6 is an example of the solar maps available. This type of map can be helpful in promoting solar to residents of Rosemount, as it is easy to use and available for all of Minnesota. The brighter colored roof indicates the best location for solar panels based on shading and rooftop direction relative to the sun.

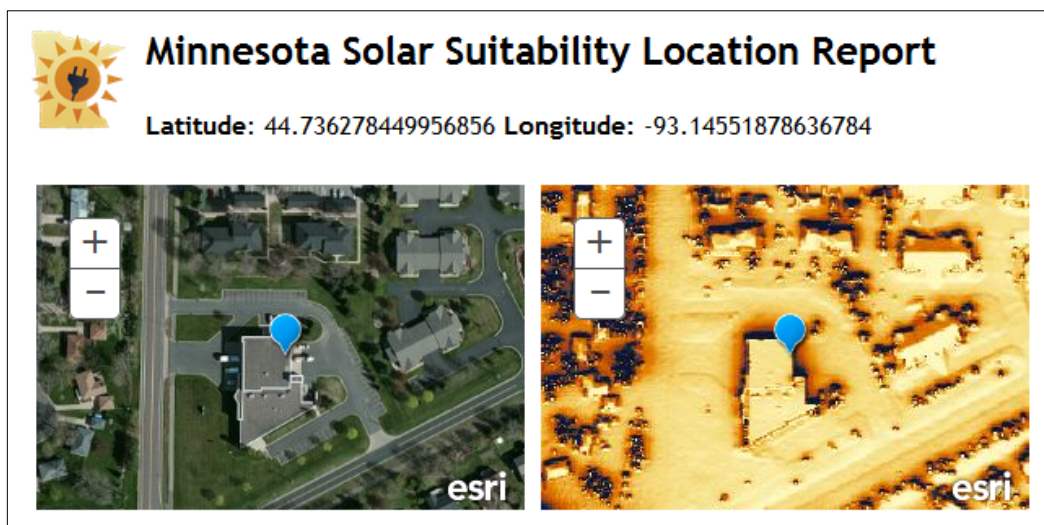


Figure 6. Solar Insolation Map for Rosemount Fire Station 1, 14700 Shannon Parkway

Source: <http://solar.maps.umn.edu/app/#>

Buildings on parcels owned by the City of Rosemount were used to assess which were suitable for solar applications with a minimum threshold of 2 kW. The total maximum number of panels was calculated for each building within those parcels based on roof size and OSHA-required clearances on flat roofs. Calculations were made for both flat and pitched rooftop surfaces and combined where the building has multiple surfaces for a maximum number of panels.

The amount of solar electricity capacity for the maximum number of panels for each building was found for 280W panels. Capacity is a maximum amount of energy from a panel. The capacity of a system, usually described in kilowatt (kW), is important because there are limits on system size for certain types of financial incentives. To calculate the expected amount of electricity from a solar PV system, the capacity must be multiplied by the factor which includes the average hours of full sunlight expected based on the angle of the sun and typical hours of

sunlight. Panel production was calculated by the following equation: Number of panels X 280 X 0.77 capacity factor X 4.2 hours average per day X 365 days per year / 1,000 watts per kilowatt = annual kWh production. This calculation gives the total number of electricity expected per year in kilowatt-hours (kWh). The electricity consumption for the buildings entered into the B3 database was added for comparison of consumption to total expected production potential (Figure 7).

Parcel PIN	Building Description	Total panels	kW Capacity	Annual kWh production	2014 kWh consumption
037-340201055013	Community Center / Armory	2180	621	733,389	2,604,820
037-346660001010	Fire Station I	299	85	100,589	81,760
037-346467801020	Steeple Center	275	78	92,515	40,680
037-340211051020	Fire Station II	197	56	66,274	111,120
037-340370000052	Rosemount City Hall	111	32	37,342	383,520
037-340370000054	Rosemount Public Works	196	56	65,938	
037-340370000043	Rosemount Public Works / City Park	174	50	58,537	
037-340370000054	Rosemount Public Works	150	43	50,463	
037-340370000054	Rosemount Public Works	35	10	11,775	
037-340301086015	Family Resource Center	23	7	7,738	
037-340311050020	Jaycees Park Building	21	6	7,065	
037-340370000052	Rosemount City Hall - smaller bldg	18	5	6,056	
037-340370000043	Rosemount Public Works / City Park	18	5	6,056	
037-340370000054	Rosemount Public Works - smaller bldg	14	4	4,710	
037-340311050017	Well 8 - 15623 Shannon Parkway	11	3	3,701	
037-345410300010	Well 9 - 15260 Shannon Parkway	8	2	2,691	

Figure 7. Estimated Maximum Solar Installation Size

Structural and remaining life of roof assessment

The information in Figure 7 provides a basic screen of which buildings are considered suitable for solar based on solar insolation and the approximate size of an installation that would physically fit on the rooftop. An assessment must be performed by a structural engineer to determine if the roof structure can support the load or if modifications are required. The condition of the roof and expected replacement timelines should also be considered, as most solar installations have an expected lifetime of 25 years, to prevent a new installation on a roof that will shortly need to be replaced.

Expected Installation Costs & Benefits

The desired size of the installation is also dependent on the cost of the system. Solar PV installation prices have reduced in recent years. A conservative estimate is \$5 per watt. Some residential-size installations are near \$4 per watt. Commercial-size installations can take

advantage of the economy of scale and some are as low at \$3 per watt. Estimates are needed from professional installers. Two different production-based incentives which are currently available in Minnesota are: Xcel Solar*Rewards, which offers \$0.08/kWh for ten years for systems between 0.5 kW to 20 kW or Made-in-Minnesota, which offers \$0.15/kWh⁵² for ten years for systems up to 40 kW. These incentives make smaller systems more appealing. Another significant cost reduction to consider is the 30% federal tax credit that is only available through 2016. If Rosemount arranges to host a solar installation that is owned by the developer, the developer can then take advantage of the federal tax credit and lease the system to the City at a lower rate than what Rosemount would pay for installation of a city-owned system.

Costs			Benefits			
System Size, kW	Installation Cost \$4/Watt	Installation Cost \$5/Watt	Expected production, kWh/year	10-year Incentive	Annual Electricity value, \$0.09/kW	CO2-emissions offset, 1.041 lbs/kWh
40	\$ 160,000	\$ 200,000	47,216	M-in-MN \$ 70,825	\$ 3,777	49,152
20	\$ 80,000	\$ 100,000	23,608	Solar*Rewards \$ 18,887	\$ 1,889	24,576

Figure 8. Sample Cost and Benefit Comparison

The Made-in-Minnesota incentive is clearly advantageous, almost double that of the Xcel Solar*Rewards incentive. If the 30% federal tax credit can be taken advantage of with the Made-in-Minnesota incentive, with the \$4/W installation cost, the 40kW system return on investment is about 11 years. **Please note: these are approximate calculations and actual cost estimates need to be provided by professional solar installers.**

Additional, non-monetary benefits include the following: reduction in carbon dioxide emissions associated with the City’s current electricity mix (for Xcel 1.041 lbs/kWh⁵³), educational opportunities for Rosemount residents, enhancing the City’s reputation, and meeting expectations for tangible signs of green investment. With the opportunity to use the Made-in-Minnesota grant for one of the Public Works buildings, Rosemount could consider options for engaging local residents in clean energy efforts.

⁵² For most Made in Minnesota solar modules, the benefit is \$0.15/kWh. For Silicon Energy Voyager SiE-V-275, it is \$0.35/kWh. Kim W. Havey, Minnesota Department of Commerce Solar Rebate Program, Presentation to CERTs 2015 Conference, March 10, 2015.

⁵³ Xcel 2013 Carbon Emissions Report
<http://www.xcelenergy.com/staticfiles/xcel/Corporate/CRR2013/environment/emissions-reporting.html>

Community Engagement

If not already evaluated, Rosemount could consider starting a City Environmental Commission. The Cities of Mahtomedi, Oakdale and Falcon Heights⁵⁴ have long-standing commissions that have been helpful in advising the City Councils on environmental efforts. Cottage Grove also has an active Environmental Commission. Kim Havey from the Department of Commerce spoke to them about state solar incentives on April 8th, 2015⁵⁵. An Environmental Commission can help the City to evaluate different sustainability options, follow-up on Resilient Community Project recommendations, and support the City Council in reaching out to residents.

An open house or ribbon cutting ceremony could be planned for the solar installation that is being considered. Groups such as the Clean Energy Resource Teams, local solar developers, and Xcel energy representatives could be invited to meet with residents and share information about resources and technical assistance available for both residents and businesses to invest in energy efficiency and alternative energy.

Wind

Rosemount is currently well positioned to implement wind technology. In the first place, with much land as yet undeveloped, Rosemount has many potential sites that could accommodate a wind turbine. Secondly, with much open space, Rosemount could consider a wide variety of turbine sizes. Furthermore, the city has the opportunity to consider possibilities for integrating wind and other renewables into the broader context of their development plans. Rosemount would face fewer obstacles due to siting restrictions, as compared to a more developed city like North St. Paul.

If Rosemount plans to install a wind turbine, one of the first steps they should take would be to have their wind resources assessed. Secondly, height restrictions and zoning should be investigated to determine the limits to height that may already be provided for in the city's zoning, as well as how the implementation of new ordinances might be beneficial.

While Rosemount might find sound to be of some concern due to the more rural nature of the city, this environment should also allow the city to place a turbine at a suitable distance from the developed areas so that any sound disturbance or siting issues would be minimal at worst.

36 City of Falcon Heights. Environment Commission. http://www.falconheights.org/index.asp?SEC=D78A3370-C310-4172-A179-5580230D675F&Type=B_BASIC.

⁵⁵ http://swctc.granicus.com/MediaPlayer.php?view_id=2&clip_id=5286

Finally, Rosemount may wish to consider that local production maximizes the energy produced by wind turbines, as “[w]ind power is most efficient when it can be used at the point of generation, rather than being transmitted many miles away.”⁵⁶

Geothermal

With a population of 64,206 at the time of the 2010 census, the city of Eagan is roughly three times the size of Rosemount. Although this disparity certainly affects the scale of city projects in general, Eagan’s civic arena renovation is sufficiently specific and small in scale for Rosemount to use it as a guide for similar projects.

While Rosemount could potentially select any facility for conversion to geothermal, the city also has its own ice rink, which offers a convenient point of comparison. Eagan originally had a larger Olympic size rink, but downsized to “high school league proportions” as a part of the renovation.⁵⁷ This should be comparable to Rosemount’s NHL size rink, since that is considered the U.S. standard. Although the particular site and building features may result in different energy usage and structural concerns, the similarity in size should provide enough common ground for a fruitful study.

The success of the installations in Eagan demonstrates that geothermal heating systems offer a suitable alternative energy source for the city of Rosemount, given the geographical proximity of the two cities and similar resource availability. If considering a geothermal installation, Rosemount should first consult with the Guaranteed Energy Savings Program to determine the most appropriate procedures and to ensure they receive the best services possible.

⁵⁶ http://www.ci.north-saint-paul.mn.us/index.asp?Type=B_BASIC&SEC={D08ABAF1-E56F-4612-8F43-D11FE1A9059D}

⁵⁷ <http://archives.ecmpublishers.info/2010/12/09/civic-arena-debuts-eco-friendly-changes/>

Resources

Programs & Funding Options

The **Guaranteed Energy Savings Program (GESp)**, offered by the Minnesota Department of Commerce, is specifically designed for financing state and municipal energy projects. The concept of GESp is for cities to fund energy-saving projects with future savings. An Energy Services Company (ESCO) is contracted by the city or state agency to develop, install and help finance the projects. The ESCO analyzes energy saving opportunities for the city and develops both cost and savings estimates for recommended projects. The city selects which projects proceed and agrees to repay the project costs to the ESCO with the amount of savings realized by the energy improvements. If these savings are not realized, the ESCO must pay the city the difference in the amount (which is the guarantee in the program name). The Department of Commerce provides template documents and technical assistance and has prescreened the participating ESCOs.

This program is relatively new, having been in existence for about two years. The City of Bemidji was an early adapter.⁵⁸ More information is available at the Minnesota Department of Commerce website:

<http://mn.gov/commerce/energy/businesses/financial/Energy-Savings-Programs/Government/Guaranteed-Energy-Savings-Program/index.jsp>

Solar*Rewards offered through Xcel energy, is a 10-year Solar*Rewards contract for systems that produce between 0.5 and 20.00kW, as long as they produce less than 120 percent of the customer's on-site annual energy use, based on the past 12 months of energy use. The 2015, 2016 reward rate is \$0.08/kWh for 10 years. This can be used for panels made anywhere, not just those in Minnesota. Made in Minnesota and Solar*Rewards incentive programs are mutually exclusive.

http://www.xcelenergy.com/Energy_Solutions/Residential_Solutions/Renewable_Energy_Solutions/SolarRewards_for_Residences

The **Made in Minnesota** program is administered by the Department of Commerce for systems made in Minnesota. Incentives for **solar PV** are performance-based, established by a system's energy production, and paid over 10 years. Owners of an approved and installed PV system will receive payments annually by July 1st based on the kWh output of the system in the previous calendar year. Public systems may have a capacity of up to 40 kW and get paid .15/kWh⁵⁹ per

⁵⁸ <http://www.midwestenergynews.com/2015/01/09/qa-on-efficiency-easy-money-not-always-an-easy-sell/>

⁵⁹ For most Made in Minnesota solar modules, the benefit is \$0.15/kWh. For Silicon Energy

kWh produced the previous year. **Solar Thermal** Made in Minnesota grants are still available for 2015. Both solar PV and solar thermal projects must be located in one of the four participating electric investor-owned utilities' (IOU) service territories. Xcel Energy, Minnesota Power, Alliant Energy and Otter Tail Power are participating. The rebate is projected to be approximately 40% of the installation cost⁶⁰.

<http://mn.gov/commerce/energy/businesses/energy-leg-initiatives/made-in-minnesota/what-is-it.jsp>

Made in Minnesota Solar Thermal: Rebates also available to commercial, multifamily and residential property owners who install Made in Minnesota certified solar thermal systems. The rebate is equal to 25% of the system installed cost up to a maximum of \$25,000 for commercial systems.

Federal tax credit: All residential and commercial solar installations are eligible for a 30% federal tax credit through 2016. To take advantage of this tax credit, Rosemount would need to work with a private company, which would own the system and be able to take advantage of the tax credit.

CERTs Grants The Clean Energy Resource Teams offers Seed Grants for Clean Energy and Energy Efficiency Projects across the state. See their website for sample projects and application information for future years. <http://www.cleanenergyresourceteams.org/rfp>

Power Purchase Agreement (PPA) The local government agrees to a long-term contract with a developer and hosts the installation. Upfront costs are paid by the developer or a third-party investor. The City of Minneapolis used this type of financing for the solar installation on the convention center. The convention center solar installation is owned and operated by Best Power International. It was completed in 2010 with 2,613 solar photovoltaic panels, annually producing 750,000 kWh⁶¹.

Lease-purchase agreement This is the model used by Falcon Heights. The city agrees to pay the developer monthly payments until the developer's costs are covered and then the city owns the equipment. In this case, the city needs to be prepared to take on the maintenance for the system at the time of ownership transfer.

Voyageur SiE-V-275, it is \$0.35/kWh. Kim W. Havey, Minnesota Department of Commerce Solar Rebate Program, Presentation to CERTs 2015 Conference, March 10, 2015.

⁶⁰ Kim Havey. Presentation to Cottage Grove Environmental Commission. April 8, 2015. http://swctc.granicus.com/MediaPlayer.php?view_id=2&clip_id=5286

⁶¹ http://www.ci.minneapolis.mn.us/sustainability/approach/casestudies/sustainability_mcc

Database of State Incentives for Renewables and Efficiency is an information source for federal and state incentives that are currently available. It is funded by the U.S. Department of Energy. www.dsireusa.org

Technical Assistance

[Hiring a Renewable Energy Installer](http://mn.gov/commerce/energy/images/Hiring-Renewable-Energy-Installer.pdf) – Minnesota Department of Commerce, Division of Energy Resources - List of questions to ask energy installers prior to hiring them.

<http://mn.gov/commerce/energy/images/Hiring-Renewable-Energy-Installer.pdf>

The U.S. EPA has developed a publication as part of their LOCAL GOVERNMENT CLIMATE AND ENERGY STRATEGY SERIES , *On-Site Renewable Energy Generation, A Guide to Developing and Implementing Greenhouse Gas Reduction Programs* in April 2014. It is available at:

<http://epa.gov/statelocalclimate/resources/strategy-guides.html>

The U.S. Department of Energy has resources available for municipalities and utilities to assist in outdoor LED applications. <http://energy.gov/eere/ssl/outdoor-lighting-resources>

Clean Energy Resource Teams

Dan Thiede, CERTs Communications Manager with University of Minnesota Regional Sustainable Development Partnerships & Extension, thie0235@umn.edu
612-626-0556, CleanEnergyResourceTeams.org

Minnesota Department of Commerce

Kim W. Havey, Program Coordinator, Made in Minnesota Solar Incentive Program,
Kim.Havey@state.mn.us

Grow Solar Partnership: Minnesota!

Technical assistance, training, promotion, education addressing solar energy development for: plans and planning processes, zoning and development regulation, permitting processes, financing opportunities and interconnection

Brian Ross, AICP, LEED GA, Great Plains Institute, 612-767-7296, bross@gpisd.net

Solar Energy Industries Association: www.seia.org

American Solar Energy Society: www.ases.org

Local Government Resource

ICLEI – Local Governments for Sustainability: www.iclei.org

National Association of Local Governments Environmental Professionals: www.nalgep.org

Recommendations

As the City of Rosemount pursues its sustainability goals, the City's first step should be to consider an energy efficiency audit of buildings and couple energy efficiency improvements with renewable energy investments. Our review of the B3 data for Rosemount revealed one area in particular that requires verification: the Steeple Center has high electric use data reported in January, February and March 2015. We recommend checking the invoices first and then investigating potential sources of the change. The B3 database estimates the potential energy cost savings at \$142,000 per year (\$102,000 in natural gas savings and \$40,000 in electricity savings) when comparing the five facilities against benchmark estimates. The majority of these expected savings are associated with the Community Center and City Hall, so they could be considered as a first priority in energy auditing. Increased implementation of LED lights wherever possible is also recommended as a relatively simple measure to further decrease energy consumption.

Rosemount could easily follow Woodbury's example in efficient city fleet management. Many of the practices adopted by Woodbury are pragmatic and completely feasible for Rosemount. For example, Rosemount could consider implementing a no-idling policy. In addition, if the City of Rosemount intends to add vehicles to its city fleet, we recommend alternative fueled vehicles like hybrid or electric cars if possible.

Installation of a wind turbine could function as an excellent demonstration project in Rosemount in addition to providing an on-site renewable energy source, but the City would first need to have its wind resources assessed by professionals. Geothermal offers a better option, as it does not depend on a variable resource like wind, and ground source heat pumps have successfully been implemented in nearby cities. Thus we recommend that Rosemount consider converting one of the City's buildings to a ground source heat pump system and to consult with neighboring cities, such as Eagan, that have completed a similar conversion.

For solar transpired air systems, a professional feasibility assessment would assist Rosemount in determining whether it should consider this type of system as an alternative. For both solar photovoltaic and transpired air systems, a building assessment of both the structure and the expected remaining roof life is needed. **In addition, we recommend** consulting the Department of Commerce's list of Energy Service Companies and "Questions to Ask", to conduct interviews, and to obtain references from other cities when selecting professional installers. We also recommend checking with other cities to compare the contractual arrangement between the city and solar developer to ensure that Rosemount will receive a comparable portion of the

energy savings and incentives. Finally, public works staff should evaluate the long-term maintenance needs, including training and expertise, for the system in making a decision to either own or lease a solar photovoltaic system.

Finally, we recommend developing a plan for community engagement in promoting Rosemount's investment in energy efficiency and clean energy. Engagement can begin with promotional information on the city's website, using social networking, planning a community event to celebrate the installation of a new energy system or developing a City Environmental Commission.