

City of Lake Crystal

**State of Electric Utility
Summary Report**

November 2024



Small Minnesota communities have a tremendous number of existing assets: beautiful natural areas; essential built environments; economic strengths, and human capabilities to build upon community strengths, meet their challenges, and move toward their aspirations.

The Empowering Small Minnesota Communities (ESMC) program is a University of Minnesota initiative focused on community-centered collaboration with the University of Minnesota to support small communities in becoming well-positioned to benefit from federal, state, and local investments.

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Executive Summary

The City of Lake Crystal has been experiencing unreliable electricity for many years due in part to Xcel Energy's galloping lines that feed the City. According to the City's outage log, the City's power was out for 21 hours on December 23, 2020, and has had 37 additional full or partial outages lasting from a few minutes to a few hours from December of 2020 through October 17, 2024. The situation has been made worse by the recent loss of redundancy from the Rapidan Dam in the summer of 2024. Due to the loss of the Rapidan Dam line, power to the City is now only fed by one Xcel Energy transmission line. The lack of redundancy and reliability is made worse by aging diesel generators.

The City of Lake Crystal currently purchases electricity from Heartland Energy, and is under a contract for purchase (Appendix A), which was extended through 2040 (Appendix B). The City is seeking a more flexible contract agreement in the future and has sought legal advice regarding this contract, which found that the purchase contract is valid and fully binding (Appendix C). A separate agreement for energy sales to Heartland Energy is set to expire in 2026. Currently, the electric utility makes a profit of close to \$200,000 at the end of the year, which is after it has contributed 5% of gross sales to the City's tax levy. The City will be working over the next 15 years to plan its energy future and provider.

The Lake Crystal Utility operates a diesel generator power plant and adjacent small footprint substation within City limits. The generator facility, diesel generators, cooling systems, and existing substation are all aging and in need of replacement or heavy repair. The City has decided to pursue the construction of a new substation, which carries its own unique burdens. The City contracted DGR Engineering to develop a memo detailing the capacity and condition of current facilities, which is accurate through 2021 (Appendix D). This report addresses changes to those conditions since the DGR memo.

Current Facilities

The City's existing diesel generators, while capable of supporting 90% of the community under ideal conditions, are hampered by building limitations that prevent continuous high-capacity operation. Lake Crystal has endured multiple full-town outages since 2021, ranging from 3 hours to 21 hours, and several partial outages, pointing to an urgent need for infrastructure improvements. The condition and capacity of relevant facilities and technologies are detailed below.

Generators

The City of Lake Crystal operates four diesel generators, two of which are functional, one of which requires repairs, and one of which is beyond repair. The generators vary in age and capability, contributing to the City's overall electricity reliability challenges. In outage



circumstances, current generator capacity would not meet demand in hot summer months, but could potentially meet demand in colder months. Conditions of the generators are detailed below.

- **1998 Caterpillar Generator**
 - **Capacity:** 1.825 MW
 - **Fuel Consumption:** 125 gallons of diesel per hour
 - **Features:** Push-button start, self-contained battery system
 - **Usage:** First line of backup in case of blackouts
 - **Issues:** Installed at a low bid, with corners cut, including proximity issues with sensitive electronic controls (within 2-3 feet of the engine), requiring a temporary plywood barrier to protect the controls.
 - **Maintenance:** Contracted quarterly maintenance from Caterpillar technicians for regular maintenance and small repairs.
- **1971 Fairbanks Generator**
 - **Capacity:** 2.07 MW
 - **Fuel Consumption:** 300 gallons of diesel per hour
 - **Features:** Air-start system with a large air compressor tank
 - **Usage:** It acts as a secondary backup generator in case of power failures.
 - **Issues:** This generator is functional but aged, and its efficiency is declining.
 - **Maintenance:** Maintenance records are sparse. No formal system for repairs or records in place currently.
- **1954 Cooper Generator**
 - **Capacity:** 1.25 MW
 - **Condition:** Non-functional but with potential for repair
 - **Issues:** The generator was last run for a few hours at a time following a necessary repair, but a significant failure occurred due to a cracked cylinder sleeve. The cooling water mixed with engine oil, leading to a system shutdown. City staff believe the generator is also rusted out on the inside. A diesel mechanic is required for a full diagnosis.
 - **Status:** The Public Utilities Commission approved and spent \$100,000 for work on this generator in 2023, but it is still not operational. The City is unable to obtain vendors or parts for future repairs.
- **1960s–1970s Fairbanks Generator**
 - **Capacity:** Not operational
 - **Condition:** Deemed non-functional with no plans for repair or replacement at this time. Parts were taken from this generator to repair the 1954 Cooper Generator.

Generator Facility and Building

The facility housing the diesel generators was originally constructed in the 1930s and underwent its most significant upgrade in 1998 when the Caterpillar generator was installed. The aging of the building has been exacerbated by a lack of consistent maintenance and high



rates of employment turnover in offices of utility management. Facility conditions are detailed below.

- **Building Condition:**

The building suffers from numerous structural issues, most notably a leaking roof that affects both the original structure and the newer addition. Repair costs for the roof are estimated at over \$100,000, based on two official quotes. The roof also houses cooling towers for the 3 oldest generator engines, installed around the 1998 upgrade. Maintenance has been sporadic, with little formal record-keeping or regular testing conducted. The engine room is overcrowded and runs hot, reaching temperatures between 95 and 110 degrees Fahrenheit, limiting the effective operation of the engines. Additionally, the facility is running out of space for future expansion, both inside the building and in the adjacent substation yard. Space constraints within the building have required non-ideal solutions for heat management, most notably a piece of plywood placed between the Caterpillar generator and the facility's electrical controls in order to prevent heat damage from the nearby engine.

- **Cooling Systems:**

The facility is equipped with three cooling towers for the older generators and a separate roof-mounted radiator for the Caterpillar generator. The three older generators also utilize pipes carrying water and coolant to manage high temperatures. These systems are dated, and maintenance has been minimal.

- **Basement Issues:**

The facility's basement is prone to water accumulation, which can affect the piping systems for heating and cooling the generators. The piping, water heaters, and pumps are old and likely in need of replacement.

- **Diesel Tank:**

An above-ground 14,000-gallon diesel fuel tank, installed in 1998, supplies fuel to the generators. However, it has never been maintained or tested, despite guidelines recommending semi-annual to five-year intervals for cleaning and testing. There is a significant risk of sludge buildup and contamination, with an estimated 6-8 inches of sludge accumulation currently. There is currently no quoted cost to bring the tank to safe condition.

Substations and Transmission Lines

Lake Crystal's electrical grid is currently fed by a single Xcel Energy transmission line, which dates back to the 1970s. This line is prone to galloping (high amplitude, low frequency oscillations of electrical lines during wind and ice storms), which causes semi-regular disruptions to the City's energy supply. As these occur during storm conditions, often during winter months, it is critical that the City maintains backup power to support necessary operations.



Within the City limits, Lake Crystal operates a single substation located next to the generator facility. This substation was reviewed in detail in the DGR Engineering memo, which found that the facility is in need of updating in order to consistently meet demand for the community. The City has decided to pursue a new substation facility, which will supplement the weaknesses of the current facility. The City plans to use the existing substation as a backup to help create redundancy within Lake Crystal. However, this redundancy will not address outages caused by Xcel's galloping lines.

- **Existing Substation:**

The current substation, situated next to the generator facility, relies on aging switchgear and infrastructure, with limited capacity for handling peak loads or future physical expansion. The small footprint of the substation creates difficult conditions for regular maintenance and repair. While some repairs have been attempted, the facility is in need of upgrades to ensure reliability.

- **New Substation Plans:**

Lake Crystal is in the process of planning a new substation across the City from the existing power plant. This new facility will include larger transformers while taking up a small footprint. However, connecting the new substation to the distribution system is a challenge, especially since the single Xcel Energy transmission line remains uninspected and unmaintained. Xcel Energy has expressed reluctance to assume responsibility for upgrading or maintaining the line, leaving the City to explore alternative energy partners.

Rapidan Dam

The City's grid stability has been further compromised by the loss of the Rapidan Dam line in June of 2024, leaving Lake Crystal reliant on one outdated line. Prior to the loss of the Rapidan Dam, Lake Crystal's grid could be fed from East (Rapidan Dam) or West (Xcel switch pole), allowing for greater reliability and redundancy. That redundancy no longer exists.

The Rapidan Dam is located 6 miles east of the City of Lake Crystal, along the Blue Earth River. It was initially constructed in 1911. Before the current facility outage, the dam's functionality had been compromised several times between 1965 and 2020 due to flooding. The dam's most recent large-scale renovation was in 1984, which brought its total nameplate capacity to 8.6 MW. Following the closure caused by flooding in 2024, Blue Earth County commissioners voted unanimously to remove the dam infrastructure and restore the Blue Earth River, permanently removing this option from Lake Crystal's grid in the future.



Heartland Energy Contract

The City of Lake Crystal is bound by a purchase contract with Heartland Energy until 2040. To amend this agreement, Lake Crystal must provide Heartland with a five-year notice. This long-term arrangement, initiated with Heartland in 2006 and extended in 2014, limits Lake Crystal's flexibility but ensures a continuous power supply and support for Heartland's infrastructure commitments (a recent coal plant development). Heartland has maintained stable rates, but the City has had to raise its rates to cover maintenance on the aging infrastructure listed in the above section, which has not been properly maintained over the years. As of 2024, Lake Crystal charges some of the highest reported electricity rates in Minnesota, at \$0.177/KWH. The average for the state is \$0.14/KWH. This may be changing soon, as co-op rates are beginning to rise in the state.

Lake Crystal is seeking options for a future arrangement that will allow for greater flexibility in energy purchases. A legal opinion requested by the City in 2014 confirmed that the Heartland Energy purchase contract was valid and that the City was legally bound to see it out.

A separate sale agreement with Heartland, which sets Lake Crystal Utility's electricity sale rates, is due to expire in 2026. Through this contract, Lake Crystal sells energy produced by their generator facility to Heartland Energy. The City takes in \$7,940 monthly for the power produced by the two functioning generators (2024). This income serves as a slight offset of purchased power costs from Heartland, which are approximately \$1.6 million.

The City is uncertain if it will continue the contract with Heartland Energy beyond 2040, as it is motivated to find a more cost-effective and sustainable option. As a Minnesota GreenStep City, Lake Crystal is interested in pursuing a future that decreases air emissions in order to improve local air quality and that removes barriers to the installation of cleaner or renewable energy generation. Future options would ideally result in kW costs comparable to other Minnesota cities, reduce dependence on fossil fuels, and improve air quality health impacts for Lake Crystal residents. The terms of future agreements should follow new models by providing a way out of the contract as a way to hold the vendor more accountable.

Discussion

The City of Lake Crystal currently faces three central challenges impacting energy reliability and sustainability. Each of these issues carries its own financial and logistical considerations, which are especially difficult to address given the City's limited resources as a small community.

Aging Infrastructure

One of the most immediate challenges is the condition of Lake Crystal's infrastructure, which includes the diesel generators, power plant facility, and single transmission line. Much of



this infrastructure has surpassed its intended lifespan, which contributes to breakdowns and costly repairs that strain both budget and personnel capacity. Specific issues include:

- **Diesel Generators and Facility:**

The generators are either aged or non-functional, limiting their capacity to cover community demand during outages, especially during extreme high heat. The facility housing these generators is also outdated, complicating maintenance and threatening long-term functionality of equipment. Replacing or upgrading these components would require substantial investment, and while such improvements would support reliability, they may not be feasible under current budget limitations. Due to the multitude of issues facing this facility, the City has determined that the cost difference of installing new generators in a new location over repairing the current facility is negligible.

- **Transmission Line Vulnerability:**

With the City dependent on a single transmission line, power reliability is more likely to be compromised, especially during winter storms. The loss of the Rapidan Dam in 2024 has removed redundancy, leaving Lake Crystal more vulnerable to prolonged outages.

Addressing these infrastructure needs will likely require creative funding approaches, whether through grants, regional partnerships, or phased improvements that spread costs over time. While large upgrades may be ideal, development of a more manageable repair plan could provide benefits within the City's reach.

Lack of Formal Maintenance Protocols

The absence of a structured maintenance and record-keeping system has contributed to equipment wear and higher operating costs over time. Specific concerns include:

- **Diesel Tank and Generator Maintenance:**

Lack of routine maintenance on the diesel fuel tank increases the risk of sludge accumulation that could prove to be expensive and difficult to address in an emergency. Irregular generator maintenance has also allowed minor issues to escalate, requiring more costly diagnostic work and drawn-out repairs.

- **Cooling and Building Upkeep:**

Minimal maintenance on cooling systems and the facility's structure has compounded existing challenges, like basement flooding and high temperatures that affect generator performance. A leaking roof and outdated cooling systems are examples of preventable issues where routine upkeep schedules could extend equipment life and reduce repair costs over the long term.

Given the City's budget limitations, implementing a basic, low-cost maintenance and record-keeping system could be a practical first step, ensuring that critical equipment remains operational and that major repairs can be anticipated and budgeted.



Limited Options for Long-Term Flexibility

Lake Crystal's reliance on aging diesel systems, combined with contractual restrictions with Heartland Energy, reduce its flexibility in meeting community energy needs in a cost-effective manner. Transitioning to renewable energy options like solar or wind could gradually offset diesel reliance, yet budget constraints and contract terms limit the City's ability to take on these investments independently. The upcoming expiration of the sales agreement with Heartland in 2026 could present an opportunity to negotiate terms that support future flexibility.

Current Situation is Revenue Negative

Under current conditions, the generator plant is revenue negative for the City of Lake Crystal. Monthly revenue from generated power sold to Heartland is \$7,940 each month, or \$95,280 yearly. This rate will not be going up due to the poor condition of the two inoperable generators, but could go down if one of the working generators fails or is out of service for repairs.

The cost to operate and maintain the generator facility outpaces the revenue from generated electricity. As of November 7, 2024, the expenses for the generator plant were \$131,987.88. With consistent expenses, the City is expected to spend \$158,386 by the end of 2024. These costs exclude the cost of fuel for the generators, as this is covered by the sale rate in the Heartland sale contract.

With an anticipated cost difference of approximately \$63,106, the City is experiencing a significant financial loss because of the operation of the generator facility. Under circumstances where 3 to 4 of the generators were operational, the generator facility was more comfortably revenue positive. As it stands, with only 2 functioning generators, the City cannot afford to continue operation of this generator facility. However, due to the loss of redundancy from the Rapidan Dam and the previously mentioned galloping Xcel lines, the generators remain necessary in case of severe outages for the Lake Crystal community.

Next Steps

In order to adequately address the multitude of issues present in their power generation and provision, the City of Lake Crystal should work to develop two plans that can be used to guide internal action and review, as well as set the standards for new agreements when the Heartland Energy contract is set to expire.

Maintenance Plan

Interviews with both the City Administrator and the Electric Superintendent for the City revealed that facility and technology conditions are declining, due in part to a lack of a formal



maintenance schedule or record. The development of a maintenance plan would help the City prepare for future costs of maintenance and decrease the severity of long-term costs, as well as help to maintain any new additions to the infrastructure of the electric utility in optimal condition. A maintenance plan for the City should include:

- Prioritized tasks based on both cost and importance to operations
- A clear repair schedule that takes staffing capacity into consideration
- Estimated costs that could be anticipated over the next ten years
- A routine and proactive maintenance schedule to supplement repairs and be continued into the future

Lake Crystal Energy Plan 2040

In the process of crafting this report, the City of Lake Crystal demonstrated a desire to create a comprehensive energy plan for where the City aims to be by 2040. While the title of the plan includes the year 2040, the planning phase will begin much earlier, likely in the early 2030's. The Lake Crystal Energy Plan 2040 will be divided into the following three sections:

- **Short Term Plan:**
 - Build out a schedule, estimated costs, and preparatory steps for the *new substation*, along with tasks and needed information.
- **Mid-Range Plan:**
 - Establish strategies for how the City will address the existing, aging infrastructure through repairs.
 - Research opportunities for improvements/replacements to facilities over the next 15 years.
- **Long-Term Energy Plan**
 - Define long-term goals of the Lake Crystal Utility, specifically pertaining to energy costs and support of Lake Crystal's GreenStep City status.
 - Identify missing or needed information that must be gathered.
 - Craft a timeline of tasks that must be completed in order to prepare for a new purchase agreement in 2040.



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