

Saskatchewan Municipal

Best Practice

CAMPAIGN NAME: Solar Power for New Infrastructure

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Project video: <https://youtu.be/ua4BGcQGIP4>

THE PRACTICE

What was the issue?

For several years, the Town of Lumsden was investigating solutions to upgrade its existing Lagoon Wastewater Treatment System which was operating beyond capacity and was unable to expand to accommodate population growth. The existing lagoons did not treat liquid stream waste to a high enough standard and emitted methane, a powerful greenhouse gas.

What was the project?

Water Security Agency and the Ministry of Government Relations Community Planning Branch required that the current lagoons be upgraded before any further growth and development could occur in Lumsden. The Town identified a new Tertiary Wastewater Treatment Plant (mechanical system) as the long-term solution. The new facility was operational in 2021.

In addition to vastly improving the treatment of sewage, this new facility also has a very small footprint. It does however use a great deal of electricity. In Saskatchewan much of the electrical generation is from non-renewable energy resources, therefore there is an associated increase in carbon dioxide emissions when a plant is built that uses more electricity than the lagoons it is replacing. While still in the detailed design stage, Lumsden Town Council was concerned about the operating costs and greenhouse gas emissions and looked for options to reduce these.

The goal was to reduce greenhouse gas emissions from four new municipal facilities and contribute to the long-term sustainability objectives of the Town of Lumsden.

Using renewable energy such as solar instead of electricity generated by non-renewables also has environmental benefits relating to air pollution. In Saskatchewan, SaskPower produces electricity that is distributed on an electrical grid throughout the province. Burning fossil fuels for thermal generation produces 83% of the electricity; 49% coal and 34% natural gas (<http://www.nrcan.gc.ca/energy/facts/electricity/20068>). There are associated environmental and human health impacts. Coal combustion produces harmful SOX, NOX, particulate matter, and mercury (<http://www.pembina.org/blog/electricity-from-coal>). Sulphur and nitrogen oxides react with other chemicals in the air to produce acid rain and smog. The acid rain impacts air quality, plants and soils. Photochemical smog from nitrogen oxides impacts productivity of plants. The direct impacts on health include eye irritation, worsening of chronic diseases like asthma and emphysema and damage to the cardiovascular system from long term exposure and from spikes in pollution (http://www.canada.ca/en/environment-climate-change/news/2017/11/taking_action_tophase-outcoalpower). When particulate matter 2.5 is released, it impacts the respiratory system and can be absorbed into the bloodstream. Natural gas is added to the mix of fossil fuels burned, to reduce air pollution and greenhouse gas emissions. It does emit less particulate matter, sulphur dioxide and mercury, however it still contributes nitrogen oxides which are precursors to smog (www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels/environmental-impacts-of-natural-gas#bf-toc-1). Pollution control devices reduce the air pollution caused by these plants. Replacing approximately 660 kW with completely clean energy from solar photovoltaic systems eliminates that fraction of the air pollution and protects ecosystems and communities contributing to a sustainable future.

THE PROCESS

To address the high electrical usage of the Wastewater Treatment System, Lumsden Town Council determined that the best option was to install solar photovoltaic (PV) panels in the required set back area around the new Wastewater Treatment Plant and old lagoons. The land was easily accessible and was close to the new Wastewater Treatment Plant so that the installation could deliver electricity to the plant, reduce greenhouse gas emissions, and contribute to a low-carbon footprint.

Lumsden Town Council established a Solar Committee. They worked with Administration and Public Works staff collaboratively and this group will be referred to as “Lumsden” throughout this report. Lumsden examined the costs and solar energy production of a pilot project at River Park and confirmed that it was economically advantageous and sustainable to operate municipal facilities with solar power where there is a grid tied, net metered connection.

The Solar Committee then cast a wide net and considered all the municipal infrastructure and its suitability for solar. They settled on new buildings where the Town owned land for the solar PV array, close enough to deliver solar power to the building. Lumsden researched and explored the best options to deliver electricity (renewable energy) to the new Wastewater Treatment Plant, the Recycling Centre and two Sewage

Lift Stations. This was done to reduce operating costs, reduce greenhouse gas emissions and contribute to a low-carbon footprint for the Town. The power requirements for existing facilities such as the Recycling Centre were determined from a complete year of SaskPower bills. SaskPower also provided information about projects that could be grid tied and net metered and those that could not. Lumsden received help from professionals working on the Wastewater Treatment Plant Project. Solar experts were hired to help with technical details for the applications.

Lumsden then developed a concept plan. The size of the project was restricted not only by available land but also available funds in reserves. The quantity of power required by the Wastewater Treatment Plant restricted the number of components there could be in this project. Lumsden looked for and applied for funding that became available, with the approval of all of council in the form of a supporting resolution. Lumsden also unsuccessfully lobbied the Provincial Government and SaskPower to match federal funding and reconsider changes to the Net Metering Program.

Following design and site preparation, ground was broken for construction of the Tertiary Wastewater Treatment Plant in the spring of 2019. The sewage treatment plant is the first of its kind for small communities in Saskatchewan. It uses a Biological Nutrient Removal (BNR) system in sequencing batch reactors with UV disinfection to meet and exceed standards for discharge into the Qu'Appelle River. The plant was featured in Business Elite Canada magazine in 2020.

Lumsden worked with miEnergy and Graham Construction on the design of the WWTP Solar which was installed and integrated into the Wastewater Treatment Plant process. Stantec played a role in the design of a zero-export connection required by SaskPower for the WWTP Solar. The other components were completed by solar contractors working with Lumsden. miEnergy built and commissioned by the RC and MLS Solar. Kelln Solar installed the SLS Solar, working with Lumsden.

Lumsden coordinated the installation and solar generated power connection for the RC, MLS and SLS Solar. miEnergy completed the RC and MLS solar in 2020. Kelln Solar installed the SLS solar in 2022-23 when the new lift station was ready to receive it. Graham Construction was the contractor completing the Wastewater Treatment Facilities Project. Since the solar production and use of electrical energy was so closely integrated with completion of the building of the Wastewater Treatment Plant, Graham was asked to expand the scope of work to include construction and integration of the Wastewater Treatment Plant solar array, batteries and controller. Construction of WWTP solar was complete in 2022 and commissioning continues.

The Government of Canada, specifically Environment and Climate Change Canada (ECCC), provided funding of up to \$1.1 million under the Low Carbon Economy Fund (LCEF) as a result of a successful funding application by Lumsden.

Lumsden proceeded to apply for grant funding through the Federal Low Carbon Economy Fund, Partners Program and upon approval, proceeded with the following project budget:

Sources of funding:

- Federal Low Carbon Economy Fund \$1,071,739
- Debt Obligation (20-year debenture) \$1,185,488
- Transfer from Internal Reserves \$ 482,321

Total Funding \$2,739,548

Solar Installation costs per facility:

- Wastewater Treatment Plant \$2,589,519
- Recycling Centre \$ 83,361
- 2nd Avenue Sewage Lift Station \$ 47,230
- Rosewood Drive Sewage Lift Station \$ 19,438

Total Project Cost \$2,739,548

The financial resources required were funding from the LCEF, internal reserve funds and a loan. Town owned land was used for the installation of solar PV arrays. The Lumsden team worked with contractors and funders to complete the project.

THE RESULTS

Lumsden, like all communities in Saskatchewan and Canada, benefits when greenhouse gas emissions are reduced.

The Solar Project has been very successful in providing renewable energy, reduced greenhouse gas emissions and contributed to a low-carbon footprint. The solar panels have provided sufficient electricity and contributed to reducing operating costs of four municipal facilities which include: the Tertiary Wastewater Treatment Plant, Main Sewage Lift Station (2nd Avenue), Recycling Centre (located at the Solid Waste Facility) and the South Sewage Lift Station (Schandre/Rosewood).

The Wastewater Treatment Plant is on the east side of Lumsden. The solar array generating electricity for it is close by and about the size of two football fields. It produces approximately 616 kilowatts of electricity that can be saved to a 1.2 megawatt battery energy storage system which does not export electricity onto the SaskPower grid. This provides the power needed to operate the new Wastewater Treatment Plant.

The Recycling Centre is at the Solid Waste Facility and uses electrical energy for heat, light, computers and running a large compactor to divert waste through recycling and reuse. Power bills showed consumption of 37,450 kWh/y (2018). This was the basis used to determine the sizing of the solar system for the Recycling Centre. It is a 25.4 kW system and produces approximately 38,000 kWh/y, satisfying the electrical needs of

that facility. The installation of the solar reduces the carbon footprint of reuse and recycling in Lumsden and makes it a net zero facility.

The Main Lift Station is a new facility moving sewage from downtown Lumsden to the new Wastewater Treatment Plant. The sizing of the MLS Solar system was based on electrical consumption of the old lift station and restricted by the size of the Town owned lot where the array sits. This is a 13.8 kW solar PV array producing 17,730 kWh of power per year. This solar array significantly reduces greenhouse gas emissions associated with moving sewage from the community to the treatment plant. The system operates the pumps, lights and heat in the building, reducing consumption of SaskPower generated electricity.

The South Lift Station is a new, small sewage lift station. A 5 kW solar PV array associated with it makes it a net zero facility.

The Town of Lumsden's Solar Power for New Infrastructure Project generates a total of 660.2 kW of electrical energy adding to the existing pilot project of 10 kW. This is the largest municipal solar generation project in Saskatchewan and one of the first in Saskatchewan to provide energy to municipal utilities in this manner. At the time of construction, it was also the largest battery storage facility (1.2 megawatt battery energy storage system) in Western Canada. This power generation replaces power generated from non-renewable resources such as coal and natural gas and as a result it reduces production of greenhouse gases which contribute to climate change. In a community such as Lumsden, a changing climate could bring weather extremes, potential flooding, or drought. In fact, there will be an annual reduction of 389 tonnes of carbon dioxide equivalents. This is a reduction of 13,482 tonnes over the 30-year life of the project which will be extended indefinitely through sustainable management plans.

Environmental benefits relating to resource conservation helps communities. Switching to renewable energy to power new infrastructure in Lumsden reduces the demand for coal and natural gas and the environmental impact of extraction. Strip-mining for coal in southern Saskatchewan causes habitat loss and contributes to air pollution. The Recycling Centre facilitates recycling in the community and the surrounding rural municipality and promotes reuse of items. Recycling and reuse divert waste from the landfill, reduce pollution and extend the life of the landfill. There is a significant environmental and economic cost to running the facility on electricity generated from non-renewable resources. Installation of a solar-photovoltaic system to generate 100% of the needed electricity contributes to Lumsden's Sustainable Future in terms of the environment and economics. The Wastewater Treatment Plant replaces undersized exfiltrate sewage lagoons located beside the Qu'Appelle River. This reduces nutrient loading, helps clean up the river and contributes to healthy aquatic ecosystems downstream. It is important that these environmental benefits not be outweighed by running the plant on greenhouse gas emitting electricity. Therefore, to increase environmental benefits, Lumsden runs the plant and two lift stations with renewable energy.

The community also benefits from cost savings over the life of the project. The project will save the Town approximately \$2 million at the Wastewater Treatment Plant and \$200 thousand at the other three facilities over a 30-year period. Money saved is expected to be put into a solar reserve for other climate change initiatives in the Town and to replace solar panels and other parts to keep the generation facilities operating optimally into the future.

The Solar Project and the practice of using renewable energy has a positive impact on the community of Lumsden and other communities. It reduces greenhouse gases (GHG) emissions that contribute to climate change. It supports the Town of Lumsden taking action to protect the health of the Qu'Appelle River ecosystem. It improves air quality with clean energy generation and conserves resources. There will be future financial savings for the community. This project is both environmentally and economically sustainable.

The solar installations have monitors that show how much energy they are producing. For example, the Recycling Centre 25.4 kW system was sized based on power bills for the facility. Using 1499 hours of sunlight/y production should calculate to 38,074.6 kWh/y. The monitor shows 38,212.05 kWh/y in 2021. This generates sufficient SaskPower savings for the annual pay back to the reserve fund. Such monitoring is also in place for the other solar facilities. The monitors are checked regularly to be sure the systems are generating power. The amount of the power generated is paid back to the reserves or the loan annually. The small projects will pay back over 10 years. The loan for the WWTP Solar will be paid off in 20 years. The production or generation data is used to calculate actual reductions in carbon dioxide equivalents.

LESSONS LEARNED

The Town of Lumsden has faced a number of challenges during the project. This included:

- Attaining accurate power requirements for facilities that haven't been commissioned.
- Once the concepts and details were defined, Lumsden needed a funding partner for the business case to be viable.
- Civil engineering on one of the sites to make it usable for solar array installation.
- Supply chain issues caused difficulty getting the parts in a timely manner.
- SaskPower net metering program changed during the project development, and this impacted the business case.
- Monitors not working.
- Getting the WWTP solar project complete and operational because there are many stand-alone components that need to work together. This project is one of the first of its kind in Saskatchewan so there was no other project to model after.

The challenges showed that councillors and municipal staff working as a team can coordinate procurement of small solar systems.

- When a solar system is large with batteries and has complicated connections, professionals need to be contracted to manage construction and commissioning of the project.
- Need to have a monitoring system so staff can see if there are problems with power generation from the array.
- Patience is an asset regarding delays and supply chain difficulties.
- Need to have municipal owned land big enough for installation of a solar system.
- Easier to maintain a ground mount system.
- Good to have reserve funds that can be used to match grant funding and pay the municipality's portion of the costs of a project such as this.