Greener Together

Lowering Emissions

# Alternative Currents

## An Implementation Plan for Saskatoon's Renewable and Low-Emission Energy Transition

OCTOBER 2022

City of Saskatoon

saskatoon.ca/**alternativecurrents**

# CONTENTS

## Figures

# EXECUTIVE SUMMARY

## Why Alternative Currents?

The *Low Emissions Community Plan (LEC Plan)* sets a framework for electricity to be almost completely provided by renewable energy sources and identifies 12 Actions required to complete this switch. Alternative Currents, an Implementation Plan for Saskatoon's Renewable and Low-Emission Energy Transition, identifies the initiatives and timelines to complete these LEC actions.

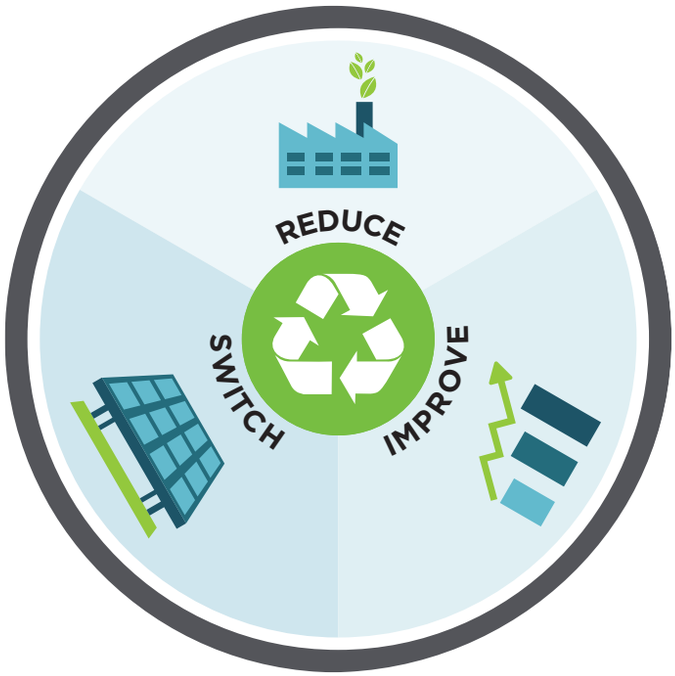
Saskatoon gets most of its energy through non-renewable and high carbon-intensive energy sources such as coal and natural gas from SaskPower. In 2019, almost 94% of Saskatoon's community greenhouse gas (GHG) emissions were attributed to energy consumption. The LEC Plan recommends switching from diesel, gasoline, and natural gas for powering our buildings and vehicles through electrification. This shift requires a drop in fossil fuel use (from 76% now to 21% in 2050) with a corresponding 211% increase in electricity, mostly sourced by renewable and/or low emissions sources.

## What is Alternative Currents?

Alternative Currents provides background around how energy is used and generated in Saskatoon and Saskatchewan and the outlook for low-emissions electricity generation by the City, community, and SaskPower.

It then outlines the opportunities and challenges for Saskatoon to switch fuel sources and support the growth of renewable energy to sustainably cool and power buildings, fuel vehicles, and enable industrial and commercial processes.

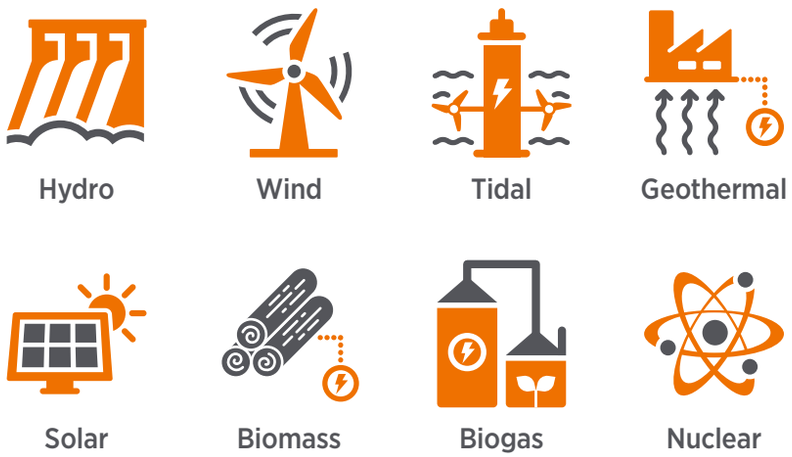
Finally, it identifies every initiative required to complete the LEC actions and provides the timeline for each phase of the initiative.



## Renewable and Low-Emission Energy Technologies

Natural Resources Canada (NRCan) defines renewable energy as *"energy derived from natural processes that are replenished at a rate that is equal to or faster than the rate at which they are consumed;"* this includes wind, solar, and hydro.

Low-emissions energy does not need to be sourced from a renewable resource, but still must have little to no GHG emissions released when producing energy. A summary of renewable and low-emissions energy technologies that could be considered for Saskatoon has been developed to be viewed on the City's Renewable and Low-Emissions Energy webpage.




## Saskatoon's Role in Renewable and Low-Emissions Energy

According to Quest Canada's *Accelerating the Implementation of Renewable Energy Protocol,* local governments have an important role to play in facilitating the switch to renewable energy from installing renewable energy themselves to using a suite of instruments to encourage action by the community.

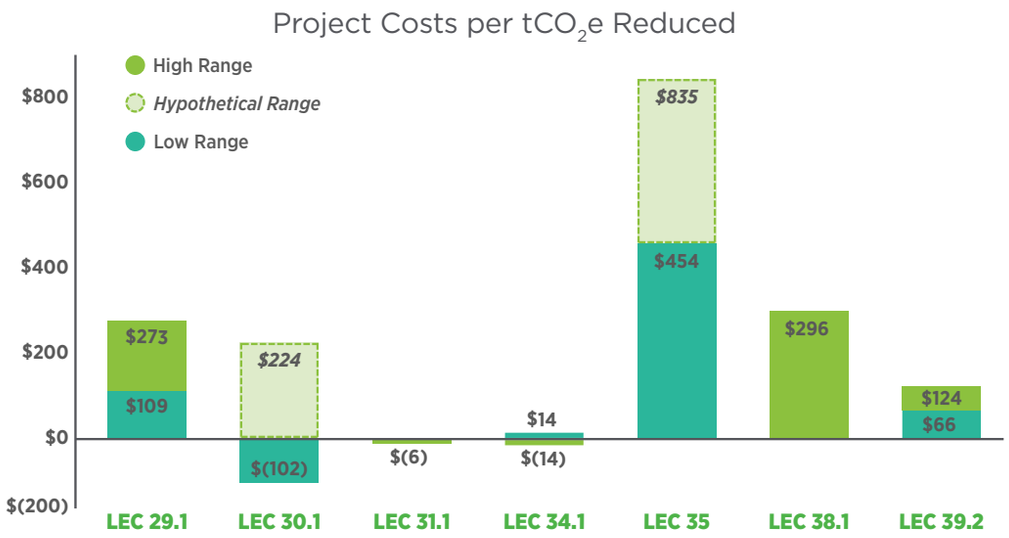
- ***Implementor*** *(i.e., Leading By Example)* – Cities focus on corporate initiatives to diversify their energy portfolio directly and demonstrate opportunities available for the public.
- ***Investor*** – Cities provide financial and non-financial incentives to encourage renewable energy development within the private sector or to provide opportunities for community members to invest in emerging renewable energy technology more easily.
- ***Regulator*** – Cities introduce new or amended regulations, policies, and bylaws to influence the integration of renewable energy alternatives. Thus, steering the market in favour of a clean energy economy.
- ***Encourager*** – Cities leverage their public influence and resources to provide education and advocacy. Sharing knowledge and improving transparency.

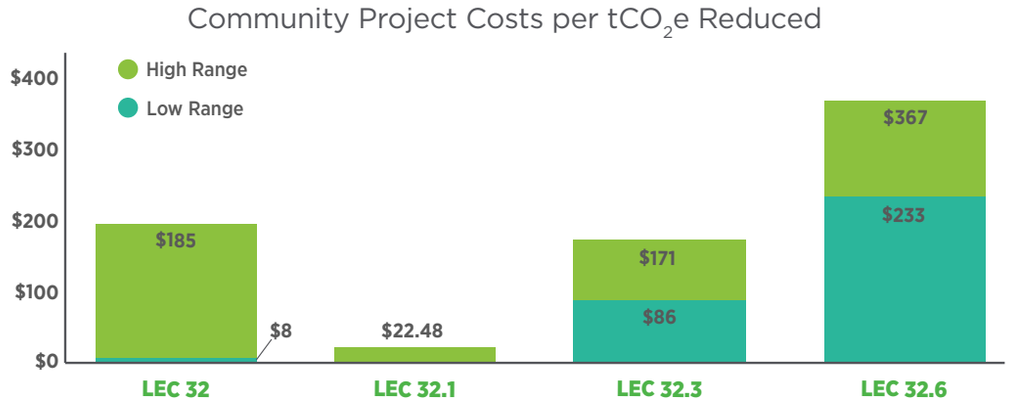
## Comparing Initiatives and Marginal Abatement Costs

Actions to support the switch to renewable and low-emissions energy have been identified and prioritized by considering their greenhouse gas emissions reductions, cost of living impacts, co-benefits, public and industry preferences, and the state-of-readiness of the renewable energy technologies themselves.

The Marginal Abatement Cost (MAC) is a helpful comparison as it shows the cost, or savings, per tonne of $CO_2e$ reduced. In the figure below, MACs have been identified for initiatives where costs and savings are relatively well known (see assumptions for the MAC calculations in Appendix A), including whether external funding is available or not. Projects with bars below the x-axis will result in a savings per tonne of GHG reduced, while bars above the x-axis means it will be a net cost to the City per tonne reduced. Longer bars mean more costs (if positive) or savings (if negative).

***Known Marginal Abatement Costs***




***29.1*** *Install 1–1.5 MW generation capacity of solar PV on up to 10 municipal rooftops*

***30.1*** *Install 2.2 MW generation capacity of ground-mount solar PV at Dundonald Solar Farm*

***31.1*** *Landfill gas expansion*

***34.1*** *Install ~1 MW generation capacity of ground-mount solar PV at the Wastewater Treatment Plant*

***35*** *(related) CHP facility at Shaw & Lakewood*

***38.1*** *Install renewable energy storage over time to meet targets (Dundonald example)*

***39.2*** *RPO opportunity with SaskPower*

***32*** *Install residential solar capacity (Costs to resident)*

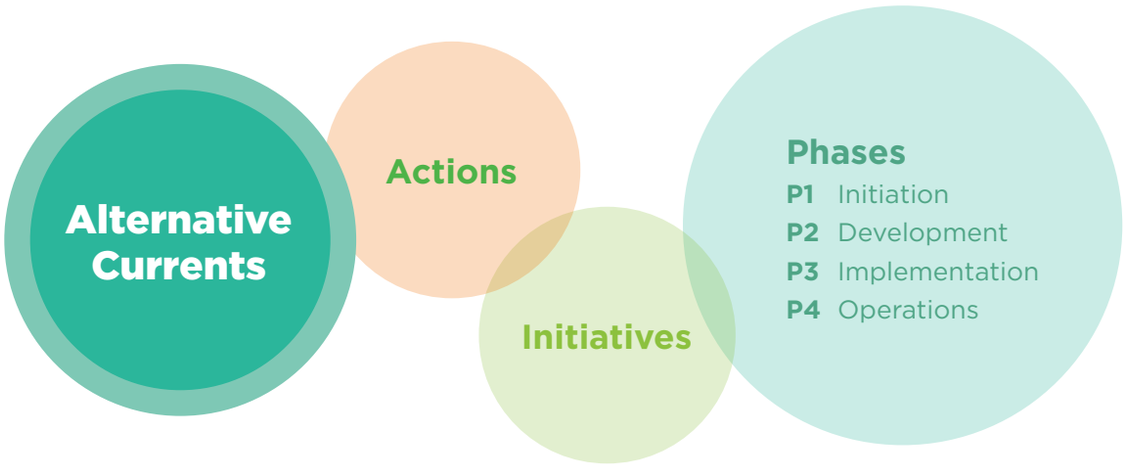
***32.1*** *Home Energy Loan Program (HELP) (costs to City)*

***32.3*** *Residential rebates for renewable energy generation*

***32.6*** *Net metering and power producer updates (SL&P revenue loss)*

## How to follow Alternative Currents?

Alternative Currents outlines an 8-year prioritized plan to progress the 12 renewable and low-emissions energy actions in the LEC Plan through initiatives which are implementor, or Leading by Example measures, or investor, regulator, or encourager instruments. Initiatives under each action are identified along with the phasing for each initiative. In many cases, identified initiatives are dependent on the previous phase, and will only go ahead if recommended. In every case, specific initiatives require funding approval through the City's multi-year budget.




This implementation plan will be updated regularly following updates to the LEC Plan and continued refinement of the initiatives through engagement with residents, businesses, institutions and experts. Some of the identified initiatives will extend beyond 2030, so updates to this implementation plan will reflect extended timelines and any new initiatives that are identified.

As technology develops and more opportunities arise, the City will continue to update its knowledge base of renewable and low-emissions energy technologies that could be considered, ensuring the feasibility, opportunities and barriers for each type of energy in Saskatoon accurately reflects the current status..

All the LEC actions, initiatives, and phases are provided in Table 1.

*Table 1: Low Emissions Community Actions*

| ACTIONS AND INITIATIVES | Phase 2022–23 | Phase 2024–25 | Phase 2026–27 | Phase 2028+ | Respon-sible |
|---|---|---|---|---|---|
| **Implementor** (Leading by Example) Initiatives | | | | | |
| **LEC 29 Install solar PV on municipal buildings** | Install 24 MW of solar capacity by 2026 on municipal buildings. | | | | |
| **29.1** Install 1–1.5 MW generation capacity of solar PV on up to 10 municipal rooftops | **P2** | **P3** | **P4** | | FM/ SUST |
| **29.2** Install additional rooftop Solar PV to meet remaining MW targets | **P1** | **P2** | **P3** | **P4** | SUST |
| **29.3** Alternatives to meet GHG targets | | | **P1** | **P2** | *TBD* |
| **LEC 30 Install solar PV systems on Municipal Lands** | Install a 1 MW capacity solar system on Parcel M or similar land area by 2022. | | | | |
| **30.1** Install 2.2 MW generation capacity of ground-mount solar PV at Dundonald Solar Farm | **P3** | | **P4** | | SL&P |
| **30.2** Dundonald Solar Farm naturalization landscaping | **P2** | **P3** | **P4** | | SL&P |
| **LEC 34 Install new solar PV utility-scale facilities within or adjacent to city boundaries** | Install 20 MW of solar capacity by 2030 (including LEC 30) | | | | |
| **34.1** Install ~1 MW generation capacity of ground-mount solar PV at the Wastewater Treatment Plant | **P2** | **P3** | **P4** | | SW |
| **34.2** Install additional site solar PV to meet remaining MW targets | **P1** | **P2** | **P3** | | SL&P |
| **34.3** Agrivoltaics pilot | | | **P1** | **P2** | SUST |
| **34.4** Alternatives to meet GHG targets | | | **P1** | **P2** | *TBD* |
| **LEC 31 Increase landfill gas capture from the Saskatoon Landfill** | Increase methane capture and destruction from the landfill to 50%, by 2026. | | | | |
| **31.1** Landfill gas expansion | **P3** | | **P4** | | WWO |
| **31.2** Landfill gas Plant upgrade | **P2** | **P3** | **P4** | | WWO |
| **31.3** New engine addition | **P2** | **P3** | **P4** | | SL&P |
| **31.4** Additional expansion and/or upgrades to meet remaining targets | | **P1** | **P2** | **P3** | WWO |
| **31.5** Next steps beyond 2034 agreement expiration | | | | **P1** | WWO |
| **LEC 35 Install a CHP facility at St. Paul's Hospital**[1] | Install two 540 kW CHP units at St. Paul's Hospital | | | | |
| **35.1** Discussion paper on installing CHP units at a facility to meet targets | | **P1–2** | | | SUST |
| **35.2** Alternatives to meet GHG targets | | **P1** | **P2** | **P3** | *TBD* |

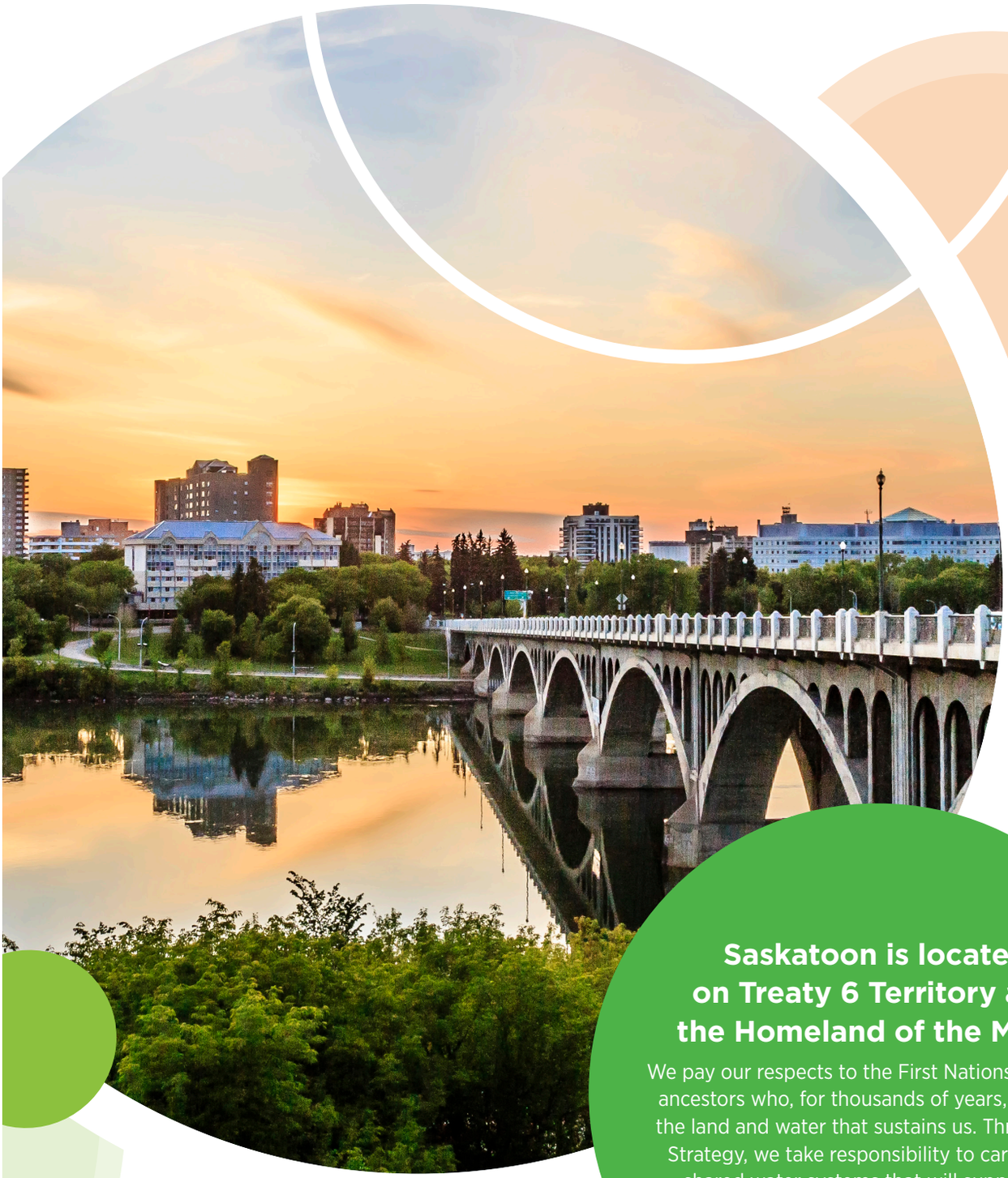
1 While the installation of CHP facility at St. Paul's Hospital has been cancelled, the installation of CHP at a local facility for the reduction of GHG emissions will be investigated for definitive direction on the technology.

| ACTIONS AND INITIATIVES | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 36** | **Implement District Energy Systems in the Downtown and North Downtown Areas**[2] | Create district energy systems to serve the downtown and north downtown areas. The systems will add these components over time:<br>• 2026: 37 MW RNG boiler<br>• 2034: 37 MW RNG boiler and CHP unit (9.6 MW thermal, 10.5 MW electricity outputs)<br>• 2042: CHP unit (6.4 MW thermal, 7 MW electricity outputs) | | | | |
| **36.1** | District Energy opportunities to meet targets | **P1** | **P2** | **P3** | **P4** | SUST |
| **36.2** | Alternatives to meet GHG targets | | | **P1** | **P2** | *TBD* |
| **LEC 37** | **Construct a hydropower plant at the weir** | Complete installation of a 6 MW hydropower project at the weir, with an operational efficiency of 55% or greater by 2027. | | | | |
| **37.1** | Install hydropower at the weir to meet targets | | | **P1** | **P2** | SL&P |
| **37.2** | Alternatives to meet GHG targets | | | | **P1** | *TBD* |
| **LEC 38** | **Install renewable energy storage over time** | 50 MW of grid-tied electricity storage is added gradually between 2025 and 2050 | | | | |
| **38.1** | Install renewable energy storage over time to meet targets | | **P1** | **P2** | | SL&P |
| **38.2** | Alternatives to meet GHG targets | | | **P1** | **P2** | *TBD* |
| **LEC 39** | **Procure renewable electricity from a third-party producer** | Procure electricity from 1,600 MW of renewable energy capacity installed outside of Saskatoon. | | | | |
| **39.1** | Procure renewable energy over time to meet targets | | **P1** | **P2** | **P3** | **P4** | SL&P/ SUST |
| **39.2** | RPO opportunity with SaskPower | **P1** | **P2–3** | **P4** | | | SL&P |
| **39.3** | Alternatives to meet GHG targets | | | | | **P1** | *TBD* |
| **LEC 40** | **Procure renewable natural gas from third party producers** | Import Renewable Natural Gas to displace 50% of natural gas demand | | | | |
| **40.1** | Wastewater Treatment Plant biogas use opportunities | **P2** | **P3** | **P4** | | SW |
| **40.2** | Procure renewable natural gas to meet targets | | **P1** | **P2** | **P3** | SUST |
| **40.3** | Alternatives to meet GHG targets | | | | **P1** | *TBD* |

2 The initiatives under LEC Action 36 will not be limited by the Downtown and North Downtown locations.

| ACTIONS AND INITIATIVES | | Phase 2022–23 | Phase 2024–25 | Phase 2026–27 | Phase 2028+ | Responsible |
|---|---|---|---|---|---|---|
| **Investor**, **Regulator** and **Encourager** Initiatives | | | | | | |
| **LEC 32** | **Encourage existing residential building owners and mandate new buildings to install solar PV system through programming and bylaw.** | Install 10 MW of residential solar capacity by 2030, 50 MW by 2050. | | | | |
| | *Investor* | | | | | |
| **32.1** | HELP program | **P4** | **P3** | **P4** | | SUST |
| **32.2** | Smart grid initiatives | **P1** | | **P2** | **P3** | **P4** | SL&P |
| **32.3** | Residential rebates for renewable energy generation | | **P1** | **P2** | **P3** | **P4** | SUST |
| **32.4** | Incentivizing community solar | | **P1** | **P2** | **P3** | **P4** | SUST |
| **32.5** | Additional investor programming to meet GHG targets | | | | | **P1** | SUST |
| | *Regulator* | | | | | |
| **32.6** | Net metering and power producer updates | **P2** | **P3** | **P4** | | SL&P |
| **32.7** | Solar access and orientation review | **P1** | | **P2** | **P3** | **P4** | P&D/ SUST |
| **32.8** | Solar administration review and update | **P2** | | **P3** | **P4** | SUST |
| **32.9** | Include renewable energy in park development standards | **P3** | | **P4** | | PARK |
| **32.10** | Additional regulator programming to meet GHG targets | | | | | **P1** | SUST |
| | *Encourager* | | | | | |
| **32.11** | Educational programming for energy efficiency and renewable energy generation | **P2** | **P3** | **P4** | | SUST |
| **32.12** | Renewable energy waste recycling | **P1** | **P2** | **P3** | **P4** | WWO/ SUST |
| **32.13** | Additional encourager programming to meet GHG targets | | | | | **P1** | SUST |
| **LEC 33** | **Encourage existing ICI building owners and mandate new buildings to install solar PV systems through programming and bylaw** | Install 20 MW of ICI solar capacity by 2030, 200 MW by 2050 | | | | |
| **33.1** | Industrial, Commercial and Institutional Energy Efficiency program | **P2** | **P3** | **P4** | | SUST |
| **33.2** | Additional programming to meet GHG targets | | | | | **P1** | SUST |

***FM*** *Facilities Management*
***LAND*** *Saskatoon Land*
***PARK*** *Parks*
***P&D*** *Planning and Development*
***SL&P*** *Saskatoon Light & Power*
***SUST*** *Sustainability*
***SW*** *Saskatoon Water*
***WWO*** *Water and Waste Operations*



## Saskatoon is located on Treaty 6 Territory and the Homeland of the Métis.

We pay our respects to the First Nations and Métis ancestors who, for thousands of years, cared for the land and water that sustains us. Through this Strategy, we take responsibility to care for the shared water systems that will support the needs and well-being of both present and future generations.

# INTRODUCTION

The City of Saskatoon (City) signed an agreement with the Global Covenant of Mayors for Climate and Energy in November 2015, which commits to reducing the City and the community's greenhouse gas (GHG) emissions by 80% by 2050 below 2014 levels. This is an international pact that requires the City to take action on both the causes and effects of climate change by reducing emissions and building resiliency plans for our infrastructure and services. Therefore, it is the City's responsibility to enact within our capabilities as a municipal government to meet City goals to improve local resiliency and reduce emissions.

The City has set interim targets of 15% reductions by 2023 for the community and 40% reductions for the City. Meeting our 80% GHG reduction targets will require significant investment in renewable and low-emissions electricity which could be produced by wind, solar, hydro, nuclear, and other technologies.

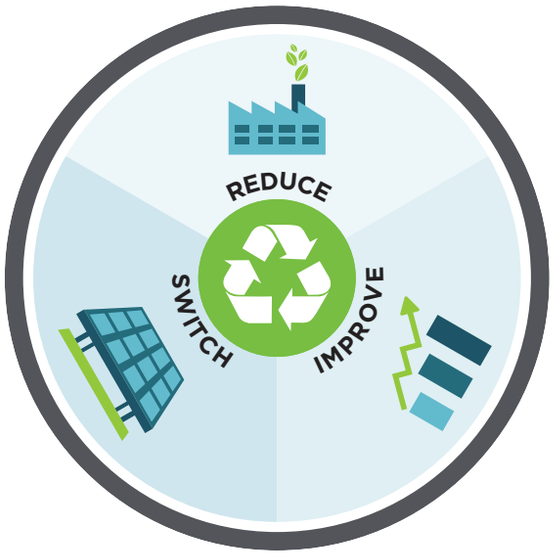
The Low Emissions Community Plan (LEC Plan) sets a framework for electricity to be almost completely provided by renewable energy sources and identifies 12 Actions required to complete this switch. Alternative Currents, an Implementation Plan for Saskatoon's Renewable and Low-Emission Energy Transition, identifies the initiatives and timelines to complete these LEC actions.

Alternative Currents provides background around how energy is used and generated in Saskatoon and Saskatchewan and the outlook for low-emissions electricity generation by the City, community, and SaskPower. It then outlines the opportunities and challenges for Saskatoon to switch fuel-sources and support the growth of renewable energy to sustainably cool and power buildings, fuel vehicles, and enable industrial and commercial processes. Finally, it provides a phased implementation plan to progress Saskatoon's LEC actions and targets.

## Background

Currently, Saskatoon gets most of its energy through non-renewable and high carbon-intensive energy sources such as coal and natural gas from SaskPower. In 2019, almost 94% of Saskatoon's community GHG emissions were attributed to energy consumption including: stationary energy consumed in buildings, fuel used in transportation, and energy used in industrial processes; the other 6% came from waste and agriculture.

The *Low Emissions Community Plan (LEC Plan)* sets out specific actions that the City and the community need to take to achieve these greenhouse gas (GHG) reductions, using the principles of Reduce, Improve, Switch:




***Reduce*** *energy load by improving efficiency and conserving energy and water in our homes, buildings, and vehicles;*

***Improve*** *operations, land use, and transportation networks to optimize functionality, reduce waste, use land more sustainably; and*

***Switch*** *to renewable, low carbon fuel sources.*

It is widely understood that the first two principles of *reduce* and *improve* must be prioritized ahead of *switch*. These principles are being addressed through the *Water Conservation Strategy*, the *Solid Waste Reduction & Diversion Plan*, the anticipated *Electric Vehicle Adoption Roadmap*, and multiple programs, projects, initiatives, and policies that have updates provided in the *Climate Action Plan* progress report, updated annually.

With improvements to operations and technology, such as switching to electric vehicles, and improved building insulation permitting the use of electric heating, there will be an increased demand on the electricity grid. As modeled in the LEC Plan, the current 76% of Saskatoon's energy derived by diesel, gasoline, and natural gas sources would decrease to 21% by 2050. 79%, or 28 million GJ of energy, would be sourced from electricity. This is a 19 million GJ, or 211%, increase in electricity needs from 2017, and would require a total of 7.8 million MWh of electricity generation, annually.

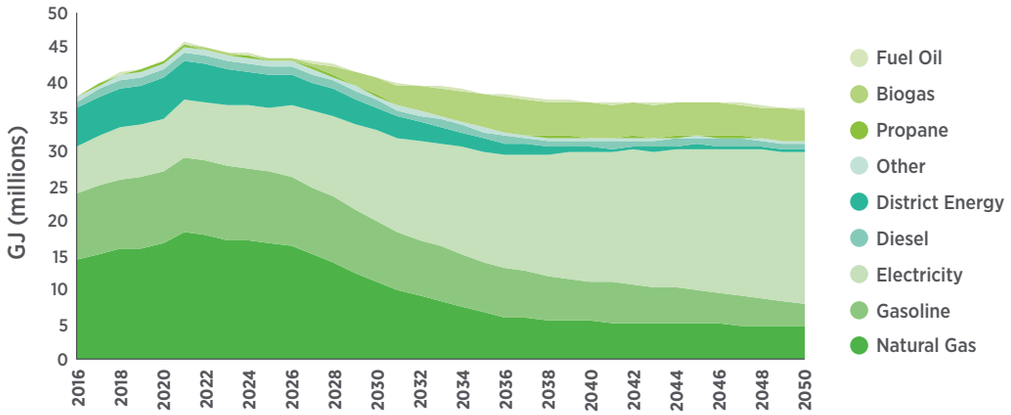



*Figure 1: Energy by Fuel Type Baseline Year-Target Year*

## Benefits of this Implementation Plan

Alternative Currents aligns with the City of Saskatoon 2022–2025 Strategic Plan; in particular, its goal of Environmental Sustainability, which includes the outcome "Greenhouse gases are reduced in a way that maximizes co-benefits and doesn't leave anyone behind." The Strategic Plan includes key actions to achieve this outcome, including:

- Implement climate actions in the Low Emissions Community Plan and the Corporate Adaptation Strategy within proposed timeframes.
- Develop initiatives to increase the use of renewable energy or low emissions energy sources and promote opportunities for property owners to generate their own electricity from renewable sources.

Alternative Currents responds to numerous actions in the *Low Emissions Community Plan* and the *Corporate Climate Adaptation Strategy*. The proposed actions help achieve our GHG Reduction Targets and Saskatoon Light & Power's internal renewable energy target of 10%. This implementation plan also works in alignment with other City plans, including *Saskatoon's Green Infrastructure Strategy*, the *Official Community Plan*, and the *Corporate Asset Management Plans*.


## A Triple Bottom Line Approach

To align with the City's sustainability priorities, the Triple Bottom Line (TBL) Framework and Equity Toolkit were used to improve the implementation plan. The TBL framework provides a way of considering approaches through a connected view of environmental, social, economic, and governance costs and benefits. It aims to minimize adverse effects, highlights trade-offs, and guide decision-making in the face of trade-offs.

The implementation plan intersects with all four sustainability principles of the TBL Policy:

- **Environmental: renewable energy, conservation of resources, emissions reduction, climate change mitigation and adaptation, clean air, water, and land.**
  - 94% of Saskatoon's emissions are from energy consumption in buildings, vehicles, and industrial processes. Reducing energy and switching to low-emissions energy sources is critical to meeting climate commitments.
  - Reducing our dependency on finite resources such as coal, oil, and natural gas will increase our resiliency to supply challenges and price volatility.
- **Social: energy costs and affordability, civic participation, self-sufficiency and living with dignity.**
  - The LEC Plan projects that energy prices will increase by 2% each year for the foreseeable future. Increasing access to renewable energy (solar power), when paired with improving energy efficiency of our buildings, saves residents and businesses money and reduces energy poverty.
  - Fossil fuel-based energy sources are a source of air pollution that are hazardous to humans especially through respiratory illness.

- **Economic: capital investments in system capacity, tax rates, innovation.**
  - Better access and availability of private renewable energy projects can stimulate local job growth.
  - Introducing a greater energy mix to Saskatoon's power system requires better grid interconnectivity and demand management. Investing in modernizing the power grid to better adapt to renewable energy systems would result in a more energy efficient design.
- **Governance: long-term effectiveness of service delivery, drawing on science, research, best practices, educations, communication, engagement, and capacity building.**
  - The field of renewable and low-emission energy is ever-evolving, and the Implementation Plan attempts to present the most recent and relevant information available at the time of development.
  - The Implementation Plan incorporates current City goals and initiatives, and feedback from its internal working group, as well as external engagement with stakeholders and the public.

## Public Engagement

There is strong public support for renewable energy in Saskatoon. In the spring of 2021, a public survey was conducted with 25 closed- and open-ended questions to identify the level of support for the proposed programs and to determine any associated opportunities and barriers. 70% of respondents felt transitioning our current energy supply towards more renewable energy options was extremely important, followed by 15% who felt it was somewhat important. Furthermore, 67% of respondents stated that they had already considered renewable energy generation for personal use in their home or business, with the remaining 23% not and 10% having already installed some form of renewable energy.

Out of the reasons provided for why renewable energy is important respondents identified the following as being the most important:


1. Reducing greenhouse gas emissions (75%)
2. Caring for the environment (75%)
3. Climate change resiliency (68%)
4. Long-term energy savings (56%)
5. Job creation and economic growth (53%)
6. Renewable energy is not important to me (6%)

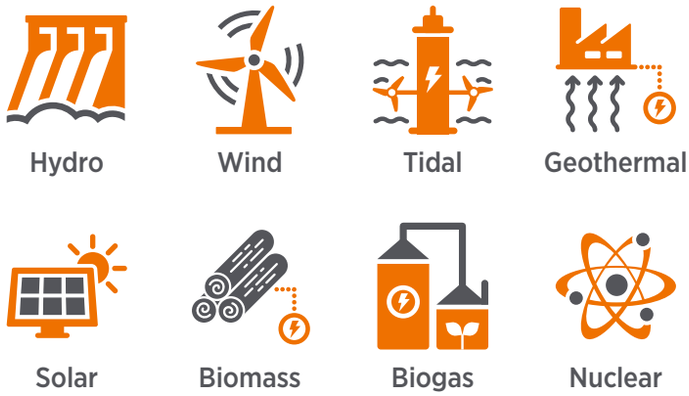
In 2022, the City completed an Environmental Awareness Survey done by Forum Research.[3] The survey asked about support for City-led renewable energy projects; over 85% of resident respondents were supportive of all projects listed, while over 90% of organizations were supportive of all projects listed.

3 Methodology – sample size 876–970. Full results have not yet been released, but will be later this year.

# RENEWABLE AND LOW-EMISSION ENERGY IN CANADA, SASKATCHEWAN, AND SASKATOON

Natural Resources Canada (NRCan) defines renewable energy as *"energy derived from natural processes that are replenished at a rate that is equal to or faster than the rate at which they are consumed."*

This includes wind, solar, and hydro. Low-emissions energy does not need to be sourced from a renewable resource, but still must have little to no GHG emissions released when producing energy. Low-emissions energy includes biomass, nuclear, and carbon-capture coal.




In Canada, electricity market types and generation sources fall under provincial jurisdiction. However, the federal government plays a role in promoting energy efficiency and alternative energies through federal policy and regulations. For example, the Federal government regulates all nuclear-related activities and has developed policies in the national interest of energy security, research, and development.

Saskatchewan's provincial government is responsible for energy matters relating to economic and energy security within their borders. SaskPower, the principal electric utility in Saskatchewan, is a crown corporation established through provincial legislation and reports to the Provincial government through a minister. Rates, taxation, and policies in the provincial interest are established through the provincial government. SaskPower operates power generation facilities across Saskatchewan and distributes power to residents or sells it for further distribution by utilities like Saskatoon Light & Power (SL&P).

SL&P is a utility operated by the City; they purchase power in bulk from SaskPower and distribute it through a system of transmission lines, substations, and distribution lines. Saskatoon's electricity is provided by either SaskPower or SL&P, depending on location. The map in Figure 2 shows the service area for each utility in Saskatoon.

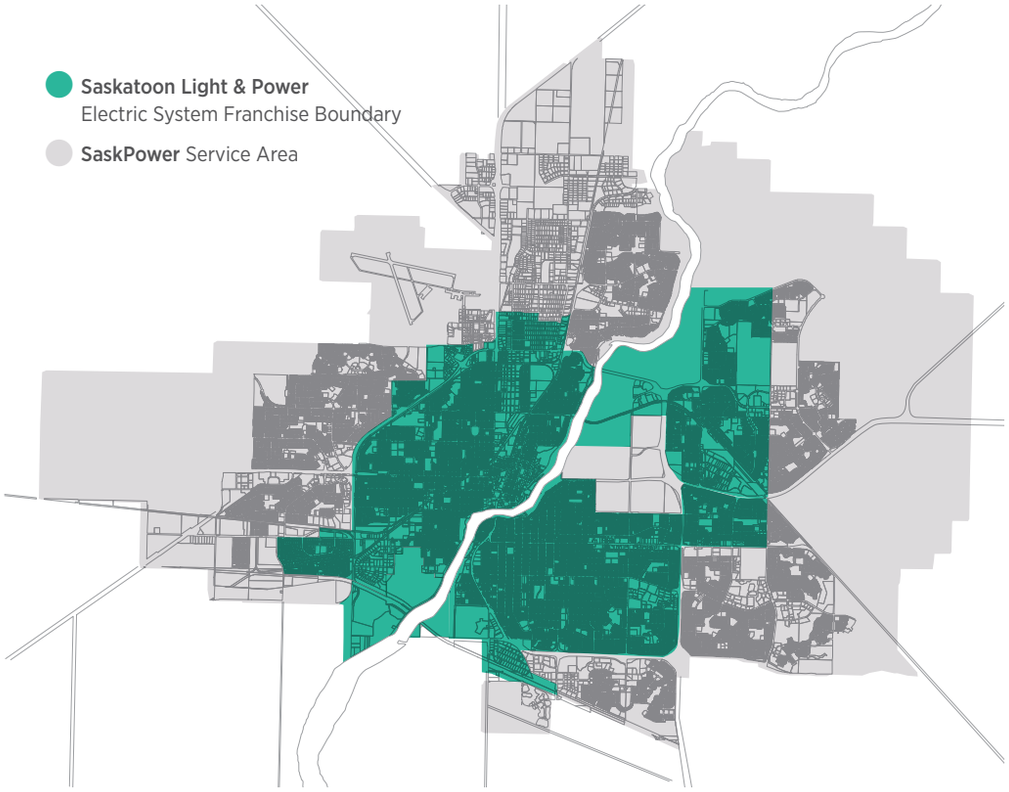



*Figure 2: Saskatoon Light & Power and SaskPower Service Areas in Saskatoon*

The City of Saskatoon sets its utility rates to match those established by SaskPower, and includes the Municipal Surcharge charged by SaskPower. This is to create fairness in rates and equality between utility customers regardless of where they live within Saskatoon Light & Power or SaskPower's service areas.

The following section outlines the targets and actions towards renewable energy for each level of government, highlighting those actions that impact municipalities.

## Federal Status, Goals, and Actions

Currently, about 59.2% of Canada's total energy supply comes from hydropower and 7.4% from other renewables, such as wind or solar. 15.0% of Canada's energy supply comes from nuclear power, 11.3% from gas and oil, and 7.1% from Coal.[4]

Canada has committed to achieving net-zero greenhouse gas emissions by 2050 through the Canadian Net-Zero Emissions Accountability Act, which became law on June 29, 2021. This act establishes a GHG emissions target of 40–45 percent below 2005 levels by 2030. Through the 2030 Emissions Reduction Plan[5], Canada identified a roadmap for achieving this target and included the following commitments for ensuring a clean, affordable, and reliable electricity system:

- Require net-zero electricity by 2035 through a Clean Electricity Standard (approval pending fall 2022).
- Expand non-emitting energy deployment and development through investments in emerging technologies such as geothermal, tidal, Small Modular Reactors (SMRs), carbon capture and storage, and electricity storage.
- Connect regions with higher grid emissions intensities to clean power through investments in regional interties.

4 NRCan Energy Fact Book 2021–2022: https://www.nrcan.gc.ca/sites/nrcan/files/energy/energy_fact/2021-2022/PDF/2021_Energy-factbook_december23_EN_accessible.pdf

5 Canada's 2030 Emissions Reduction Plan - Overview: https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/climate-plan-overview/emissions-reduction-2030/plan/overview.html

## Provincial Status, Goals, and Actions

Saskatchewan is one of three provinces and territories in Canada that relies primarily on fossil fuels (coal and natural gas) for electricity, along with Alberta and Nunavut. As summarized in SaskPower's 2021–2022 Annual Report[6] and shown in Figure 4, 79% of its power supply came from coal and natural gas, 11% came from hydroelectricity, 6% came from wind, 3% came from imports, <1% came from solar, and 1% came from other sources. In 2020–2021[7], 76% of its power supply came from coal and natural gas, 17% came from hydroelectricity, 4% came from wind, 2% was from imports, and <1% came from other sources.

Producing electricity by burning coal and natural gas results in GHG emissions and impacts the emissions intensity of the grid. SaskPower supplied the entire province 25,644 GWh of electricity in 2021 which resulted in 12.8 M tonnes of $CO_2e$ emissions, for a supply grid intensity of 0.583 tonnes $CO_2e$/MWh. This was an increase compared to 2020 with a grid intensity of 0.518 tonnes $CO_2e$/MWh. A summary of available supply emissions intensity can be seen in the graph below, as provided in SaskPower's 2021–2022 annual report.

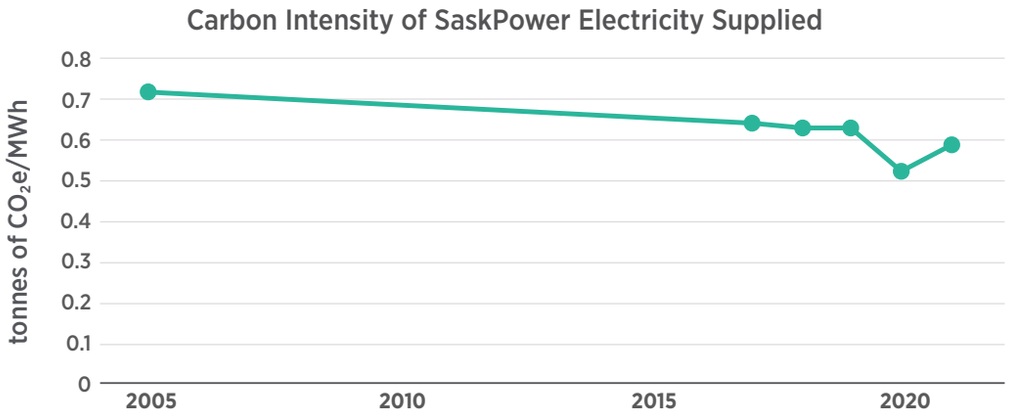



*Figure 3: Carbon Intensity of SaskPower Electricity Supplied*

The province of Saskatchewan has set a goal of reducing GHG emissions by 50% from 2005 levels by 2030 with a longer-term objective of achieving net zero GHG emissions.[8] SaskPower is currently exploring what mix of zero and low-emitting power generation technologies to invest in to achieve their net zero target. Options being explored include nuclear power from small modular reactors, and other emerging technologies, such as utility-scale energy storage.[9] By 2027, SaskPower has forecasted, as shown in Figure 4, that 63% of its power generation will come from Coal and Natural Gas, 19% from Hydroelectricity, 13% from Wind, 4% from Solar, and 1% from other sources.

6 SaskPower 2021–2022 Annual Report: https://www.saskpower.com/-/media/SaskPower/About-Us/Reports/Report-AnnualReport-2021-22.ashx

7 SaskPower 2020–2021 Annual Report: https: //www.saskpower.com/-/media/SaskPower/About-Us/Reports/Report-AnnualReport-2020-21.ashx

8 https://www.saskpower.com/Our-Power-Future/Powering-2030/Help-Plan-Our-Power-Future

9 https://www.saskpower.com/Our-Power-Future/Powering-2030/Help-Plan-Our-Power-Future/Future-Supply-Options-We-are-Considering

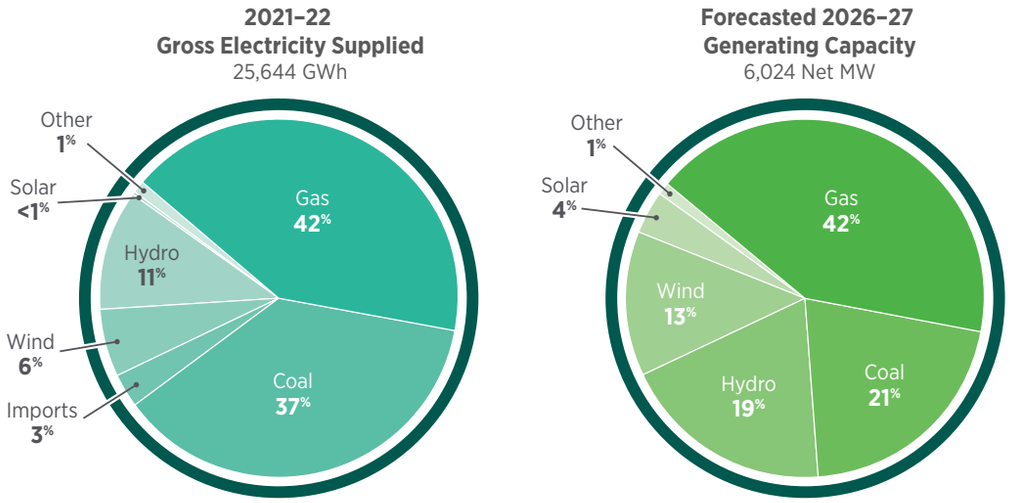



***Figure 4: Saskatchewan's Most Recently Reported Power Mix and Forecasted 2026–27 Generating Capacity***[6]

In 2020, SaskPower reduced generation from its legacy gas-fired plants to utilize the new and more efficient Chinook Power Station and was able to utilize more hydroelectricity due to above-average water levels. The Boundary Dam Power Station also reduced emissions through its Integrated Carbon Capture and Storage facility. In 2021, SaskPower entered a new 100-MW power purchase agreement with Manitoba Hydro and has had additions from their company's customer program initiatives and small independent power producers. In 2021–2022, SaskPower continued to work on renewing the Coteau Creek Hydroelectric Station (to be completed in 2027) as well as refurbishing E.B. Campbell Hydroelectric Station (to be completed in 2025).

# RISKS, BARRIERS AND CHALLENGES TO RENEWABLE ENERGY GENERATION

## Peak Generation vs. Peak Usage

Renewable electricity sources such as solar and wind are intermittent and may not necessarily align with peak demands. It is most efficient and cost-effective to use solar and wind energy at the time it is generated, rather than feeding it into the grid or storing in a battery. However, typical peak usage of electricity for residential homes occurs between 6–9pm when there is little to no sun; also, more electricity is typically consumed during the winter while solar generation is at its lowest. While typically more available than solar in the winter, wind is intermittent and unpredictable, and cannot be relied on as a primary source in Saskatchewan.

## Knowledge Gaps

Common barriers that can reduce uptake of renewable and low-emission energy include insufficient knowledge to carry out the project; uncertainties in the (relatively) new technology's long-term performance; and uncertainty in selecting the best contractor to install the system. A thorough understanding of the long-term energy savings is also required to determine if investing in a low-emission energy project is suitable for a particular individual or organization.

## Costs

59% of Environmental Awareness survey respondents identified cost as the biggest barrier towards having solar panels installed at their households.

The cost to generate electricity depends on several factors including fuel supply, project size, power output, the efficiency of technology, initial capital costs, operation and maintenance fees, and more. Over the last decade, global trends have seen renewable energy generation options progressively improving in efficiency, scalability, and costs with many options reaching cost parity with fossil fuel counterparts.

This trend is not as prominent in Canada where natural gas systems are still the most economically dominating utility-scale energy source. Options like wind, hydro, and nuclear are becoming competitive with traditional coal, while the net present cost of solar, biomass, geothermal, and run-of-river hydro projects over their lifetimes are still higher than most other options available in Saskatoon.

Considering costs and long payback periods are the largest barriers to installing renewable energy systems, 55.3% of engagement respondents thought that renewable energy generation was worth the investment for their home or business, 21.9% thought it was somewhat worth it, 5.7% were unsure, and 17.1% thought it was not worth the investment.

## Levelized Cost of Electricity

Evaluating and comparing different energy generation technologies with vastly different characteristics can be challenging. The Levelized Cost of Electricity (LCOE) allows comparison of energy-generating options by estimating the average price of energy needed to break even over the life of the system; however, it cannot capture all costs of the electricity, and it does not recognize the difference in quality, availability, or reliability of the electricity produced.

Figure 5 compares the LCOE of different electricity generation options in Saskatchewan (in ¢/kWh), from a report published by the Canada Energy Research Institute in 2018.[10]

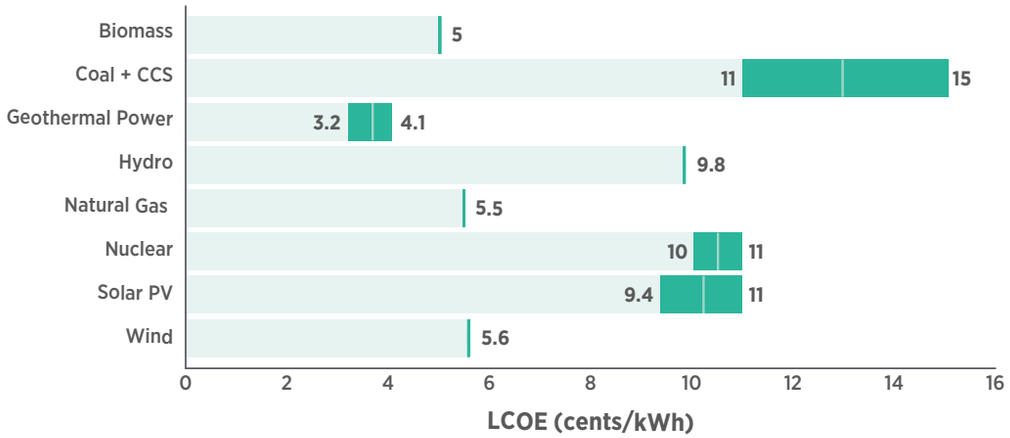



*Figure 5: Levelized Cost of Energy and Carbon Intensity of Different Electricity Generation Options in Saskatchewan*

Studies suggest that if the current high growth rates of rapidly progressing clean energy technologies are maintained for the next decade, costs will continue to decline for renewable energy generation. In fact, there is an estimated net savings in an expedited transitioning to renewable and low-emission energy compared to continuing with a fossil-fuel-based system.[11]

10 As of 2022, Canadian Energy Research Institute has ceased operations. CERI Data and Research is anticipated to be available soon: https://www.policyschool.ca/ceri-canadian-energy-research-institute/

11 No. 2021-01 - Empirically grounded technology forecasts and the energy transition: https://www.inet.ox.ac.uk/publications/no-2021-01-empirically-grounded-technology-forecasts-and-the-energy-transition/

## Carbon Pricing

In 2018, the Government of Canada introduced the federal carbon pricing on fossil fuels as an approach to reduce greenhouse gas emissions and promote clean energy generation. The federal pricing system has two components: the fuel charge, and the output-based pricing system.

## Fuel Charge

The fuel charge applies to 21 types of fossil fuels. The rates for the fuel charge are determined based on the global warming potential factors and emission factors of each fuel type. The fuel charge started at a minimum price of $20 per tonne of $CO_2e$ in 2019, rising by $10 every year to $50/tonne $CO_2e$ in 2022, at which time it will increase by $15 every year until it reaches $170/tonne $CO_2e$ in 2030.

## Output-based Pricing System

The output-based pricing system (OBPS) applies to large industrial facilities including electricity generation. In Saskatchewan, the carbon charge on electricity is determined based on SaskPower's emissions levels where the carbon charge only applies to a portion of their emissions that are above a set limit.

In 2021, carbon charges increased the City's overall electrical utility costs by approximately 1.5%. This charge will continue to be added on to the regular annual rate increases of 4% proposed by SaskPower in both 2022 and 2023. As the national carbon price continues to escalate, maintaining carbon intensive infrastructure will become more financially challenging to operate.

As SaskPower continues increase its renewable and low-emissions power generation to clean their electrical grid, the carbon charges will decrease, but the cost to produce electricity is anticipated to increase, leading to an overall increase in electricity rates.

## Carbon Offsets

A carbon offset can be defined as an action or activity that compensates for the emission of carbon dioxide or other greenhouse gases to the atmosphere. By purchasing carbon offsets, a quantifiable amount of such an activity may be bought, sold, or traded especially as part of a system to reduce pollutants in the atmosphere.

Carbon offsets can be generated and used under government-approved frameworks for regulatory purposes (compliance). For compliance markets, the example is that regulated industrial emitters who continue to emit carbon pollution can meet their regulatory obligations under climate policies by the purchase of offset credits. By contrast, the voluntary market is outside the compliance market and provides credits on a voluntary basis to any business or individual that wants to offset non-regulated emissions.

The Canada Greenhouse Gas Offset System Credit System was announced in May 2022. It includes:

- regulations to implement the operational aspects of the system;
- federal offset protocols that establish the approach for quantifying GHG emissions reductions for a given project type; and
- a tracking system to register offset projects, issue and track offset credits, and share key information through a public registry.

Currently, the City is reviewing the federal system to determine any applicable projects. The City could also purchase or sell voluntary carbon offset credits. Impacts to the GHG inventory and the reporting process will be further assessed.

## Utility Rates and Power Production

SL&P purchases electricity at bulk rates from SaskPower, and there are very few (if any) utility-scale renewable energy systems that can financially compete with these bulk rates, which means that it becomes more costly for the utility to purchase electricity from renewable energy sources, especially small power producers or residents feeding energy back into the grid.

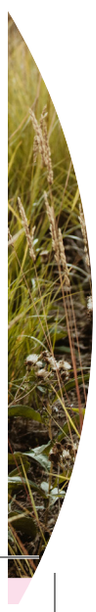
Outside of Saskatoon Light & Power's service area, any Saskatoon-based utility-scale renewable or low-emissions energy facility would sell its energy generated to SaskPower. Municipal and private sector projects are proposed and compete to provide power to SaskPower. If the proposal is successful, rates are negotiated through a Power Purchase Agreement (PPA) and vary depending on the demand and supply of self-generators.

Starting January 2021, SaskPower began an interim Power Class Capacity Reservation Service (CRS) rate model to recover fixed costs associated with accommodating industrial customers who want to self-generate over 50% of their required power on site, while having the electricity system available for back-up and ancillary services. This rate ensures no additional costs be borne by non-generating customer classes. Consequently, CRS rates at which electricity is credited to the producer are lower than current PPA rates, which results in further lowering the return-on investment for renewable self-generation projects. A public review process of the proposed system was completed in April 2020, and a cabinet decision regarding final implementation is anticipated soon.

For small power producers and residents generating their own electricity, the payback period of their system will depend on the rate they are paid or credited for their unused energy fed back to the grid. For example, with a typical 7 kW residential system, the anticipated payback period with SaskPower's net metering rate of $0.075/kWh is 21–23 years, while SL&P's rate of $0.1565/kWh would have a payback period of 16–18 years (before rebates).

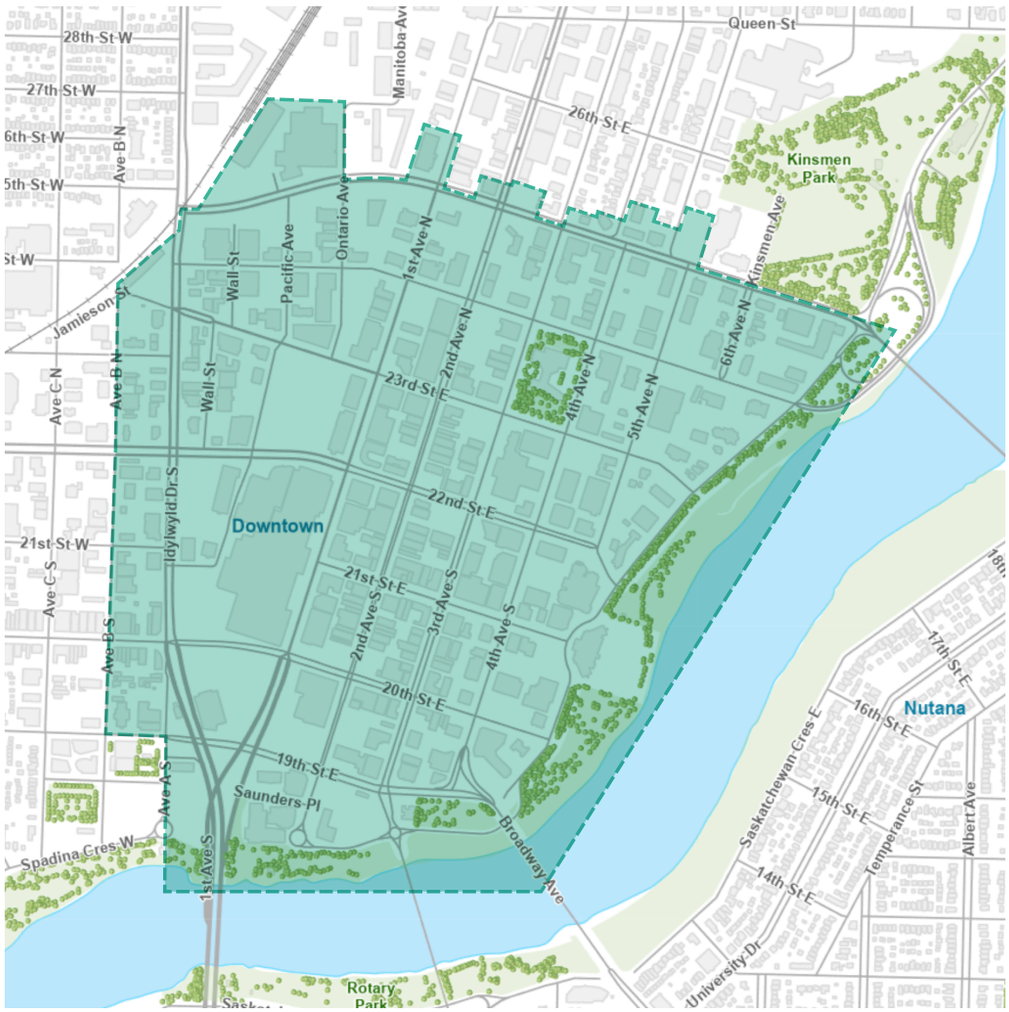
SaskPower is also proposing to redesign rates so that the costs of the fixed components of connecting to the infrastructure, and the variable component from energy consumption, more accurately reflect their true actual costs to serve each customer. This change means that fixed costs to connect to the grid will be raised, and that the energy a home or business may offset through the production of renewable energy will have a smaller impact on lowering their electricity bills.

Some engagement respondents expressed their mistrust and frustration towards the provincial utility provider for not recognizing the importance of renewable energy opportunities. Many respondents felt that there is little support from the utility provider and the provincial government. Respondents also identified government leadership as crucial and as what will drive community changes.



## Utility Grid Limitations

The City Centre's network has a limit on electricity production above consumption within its boundary (as shown in Figure 6). Any excess energy produced by an energy generating system within this area cannot be returned to the grid and must be used at the exact instant the power is created to offset energy consumption. Energy generated can be used either through direct electrical needs or stored in an energy storage system. This limits the potential for the typically more cost-effective larger-scale renewable energy projects to be implemented in the downtown core.




Network Distribution Boundary

*Figure 6: City Centre Network Boundary*

## Potential for Negative Environmental Impacts

While the proposed energy technologies produce little to no greenhouse gas emissions, there are other negative environmental impacts that can be caused by their use. The manufacturing of solar PV panels requires the mining of certain elements as well as the use of hazardous materials. Solar power facilities require land with direct access to sunlight, which may conflict with habitat and wildlife needs. Wind power facilities require less ground acreage than solar, but the moving blades of wind turbines can create challenges and noise disturbances to wildlife. Reservoir hydropower dams can interfere with fish migration, deplete oxygen in reservoirs, mobilize contaminants, and trap sediment that are important for maintaining downstream habitats (including protecting deltas from erosion). Run-of-river facilities, which do not use dams, can also cause disturbances to fish and natural water flow, but to a lesser extent than reservoir hydropower. Bodies of water that are disrupted for the purpose of hydropower electricity generation can also impact traditional and/or indigenous land use.

Geothermal systems can deplete their resources and eventually lead to cooling of the location the heat is extracted from, thus impacting the surrounding habitat. Biomass energy requires feedstock to be processed for energy; the type of feedstock and how it is developed and harvested could have a significant effect on land use.

Out of the proposed barriers for renewable energy use, engagement respondents provided the following ranking for what is currently preventing them from using renewable energy in their home or business:


1. Renewable energy projects are too costly (60%)
2. The energy savings potential is too low with to long of a payback period (40%)
3. There are limited opportunities to sell the power I generate back to the grid (34%)
4. My property is not suitable for renewable power generation (18%)
5. I do not own my home/property (17%)
6. Renewable energy is not as important as other priorities I have (12%)
7. Renewable energy projects are too complex (11%)
8. Renewable energy projects take up land that can be used for other purposes (7%)
9. I do not fully understand the benefits of renewable energy (3%)

# RENEWABLE AND LOW-EMISSIONS ENERGY INITIATIVES

## Saskatoon's Role in Renewable and Low-Emissions Energy

Quest Canada's Accelerating the Implementation of Renewable Energy Protocol highlights four key roles that local governments are seen to be taking on to facilitate renewable energy. These include:

- ***Implementor*** *(i.e., Leading By Example)* – Cities focus on corporate initiatives. Providing market transformation through the diversification of its energy portfolio. Demonstrating opportunities available for the public through the success of municipal administration.
- ***Investor*** – Cities provide financial and non-financial incentive to better encourage renewable energy development within the private sector. Providing opportunities for community members to invest in emerging renewable energy technology more easily.
- ***Regulator*** – Cities design new regulations and amend current policies and bylaws to better influence the integration of renewable energy alternatives. Thus, steer the market in favour of a clean energy economy.
- ***Encourager*** – Cities leverage its public influence and utilize its resources through education and advocacy. Sharing knowledge and providing transparency.

The majority of engagement respondents supported the City playing a role in the energy sector (84%), with only 12% stating that the City should not. When asked to prioritize the four potential roles the City could play in the energy sector, respondents provided the following ranking:


1. Implementor
2. Investor
3. Regulator
4. Encourager

A summary of renewable and low-emissions energy technologies that could be considered for Saskatoon has been developed to be viewed on the City's Renewable and Low-emissions Energy webpage. It details each available type of energy, feasibility, and opportunities in Saskatoon, and explores barriers. These parameters have been considered in the development of the LEC Actions, as well as the initiatives proposed in this Implementation Plan.

The Implementation Plan provides further detail to progress LEC Actions, through initiatives which are *implementor* (Leading by Example) measures, or *investor*, *regulator* or *encourager* instruments. The LEC Actions relevant to the Renewable and Low-Emissions Energy Implementation Plan are:

## Implementor:

**LEC 29** – Install Solar PV on municipal buildings

**LEC 30** – Install solar PV systems in municipal lands

**LEC 31** – Increase landfill gas capture from the Saskatoon landfill

**LEC 34** – Install new solar PV utility-scale facilities within or adjacent to city boundaries. With areas within city boundary to be prioritized first

**LEC 35** – Install a CHP facility at St. Paul's Hospital

**LEC 36** – Implement District Energy Systems in the Downtown and North Downtown areas

**LEC 37** – Construct hydropower at the weir

**LEC 38** – Install renewable energy storage over time

**LEC 39** – Procure renewable electricity from third-party producers

**LEC 40** – Procure renewable natural gas from third-party producers

## Investor, regulator, or encourager:

**LEC 32** – Encourage existing residential building owners and mandate new buildings to install solar PV systems

**LEC 33** – Encourage existing ICI building owners and mandate new ICI buildings to install solar PV systems

## Prioritizing Factors

Actions to support the switch to renewable and low-emissions energy have been identified and prioritized using factors, values, and considerations included in this implementation plan. These include:

**1. Greenhouse Gas Emissions Reduced:** Each initiative will have an impact on reducing the overall emissions intensity of energy consumed and will progress towards LEC Plan targets of reducing GHG emissions for the City and Community of Saskatoon. The scale of this impact will depend on the scale and efficiency of the initiatives. When considering the actions and their initiatives, please note that in 2019 the City's total GHG emissions were 3.8 million tonnes of $CO_2e$.

**2. The marginal abatement cost:** The marginal abatement cost (MAC) is a measure of the cost or savings of reducing GHG emissions for a particular action. The MAC divides the total costs or savings of the action, as represented by the net present value, by the total GHG emissions reductions associated with that action over its lifetime. Assumptions for the MAC calculations in the below table are in Appendix A: Renewable and Low-emission Energy Project Comparison Tool, and a summary of project costs for initiatives that have progressed sufficiently for complete MAC estimations can be found in this chapter (Figure 7 and Figure 8).

**3. Cost of living:** The funding source of the initiatives and its impact to residents, either through property taxes or their utility bills, will be considered in any action's prioritization. Residential incentive programs that prioritize low and moderate-income households or those experiencing energy poverty, including affordable housing and multi-family housing incentives and income-qualified households, will be valued higher.

**4. Co-benefits:** Impact on local wildlife and green infrastructure, as well as the sourcing and end-of-life management of required technology, and any other alignments with other City goals and strategies, will be included in considerations for initiatives.

**5. Public and industry preferences:** Public and industry respondents from engagement in 2021 were asked to provide their level of support for the proposed programs, as well as the role in which the City should participate in renewable and low-emission energy uptake.

**6. State-of-readiness:** with new renewable and low-emission technology emerging regularly, and initiatives at various states of readiness, the City will be prioritizing actions that have known feasibility studies that are relevant to the City's local context or have proven success in City operations.

## Implementation Phases

To progress an initiative from Alternative Currents, there are generally 4 phases: initiation, development, implementation, and operations. These phases require different funding sources and decision points for Council. The path from initiation to operations may not always be linear; as implementation proceeds, recommendations from one phase may require further development phases to implement a recommendation. The phasing for the initiatives is presented based on current estimations, and will be refined as they are progressed. A description of each phase is provided in the table below:

*Table 2: Implementation Phases*

| Phase | Description |
|---|---|
| **P1**<br>**Initiation** | Includes the initial steps to define an initiative's scope, including an assessment of the City of Saskatoon baseline and review of best practices. The outcome of this phase is often a business case. This work is the foundation for pursuing funding applications and preparing options for budget deliberations. |
| **P2**<br>**Development** | Includes feasibility work, research, studies, frameworks, assessments, inventories, engagement, or pilots, and is typically completed using capital funding. The result is often a decision or approval report outlining options, implications, and the Administration's recommendation on how to proceed with the initiative. |
| **P3**<br>**Implementation** | Includes completing everything required to put Council's decision into action. The specific requirements will be defined during the development phase and may include preparing or amending a policy, bylaw, or procedure; creating a management plan or establishing a level of service; preparing or modifying a program; or acquiring land. Implementation typically utilizes capital funding with a transition plan to operating funding, which requires budget approval. |
| **P4**<br>**Operations** | Includes ongoing maintenance and management of green infrastructure, or ongoing delivery of a program to meet expected service levels. Once operational, budget adjustments are made to reflect the actual program cost. |

## Implementor Initiatives

The City can lead by example through investments in renewable and low-emissions energy. These initiatives directly fulfill actions set out by the LEC Plans and they encourage market transformation by demonstrating opportunities available for the public through the success of the municipality.

These initiatives are detailed below with greenhouse gas emissions reductions savings, any additional benefits, the anticipated life of the project (either the life of the system, or the duration of a contract, depending on the project), and the marginal abatement costs of initiatives where possible.

For City-led initiatives, the marginal abatement cost values from the LEC plan were calculated by the LEC Plan's consultant. Since the LEC Plan was developed, more information through progress on specific initiatives has enabled us to update some marginal abatement costs. These updates may not represent the entire target; for example, a proposed action is installing 1–1.5 MW of solar PV capacity on municipal rooftops, which is only a portion of the 24 MW target from the LEC plan, so they cannot be directly compared since their scale differs. However, they do provide a more accurate understanding of current local conditions and market values.

Pending funding, a comprehensive reassessment of the LEC plan will review the GHG projections, financial savings, and status for all actions, is planned for 2025.

If the City needs to explore additional funding for these initiatives, 57.0% of engagement respondents supported borrowing through low-interest loans, 47.7% supported increasing utility rates, 41.3% supported increasing property taxes, and 23.4% did not support any measure to fund these initiatives.

## LEC Action 29: Install solar PV on municipal buildings

Installing solar photovoltaic (PV) panels on municipal buildings can offset the energy required for that building and can contribute solar electricity back to the power grid. Rooftops are typically unoccupied and unused spaces with reasonable solar access, making them ideal for solar siting.

This action was also identified in the *Facilitating Solar Energy Opportunities in Saskatoon* report to City Council in November 2017.

89% of Environmental Awareness survey respondents were very (55%) or somewhat (34%) supportive of solar power on City property.

### Current Status

There are currently no solar PV systems on municipal buildings; however, Saskatoon installed solar hot water systems at Lawson Heights Civic Centre and Harry Bailey Aquatic Centre in 2017. These systems offset approximately 100 MWh of heating energy annually and reduce the City's emissions by 19 tonnes of $CO_2e$.

A rooftop solar PV assessment of 9 representative municipal buildings was completed in 2022 by a consultant. The results found that financial payback would likely occur after the 25-year warranty life of the solar panels, especially for the smaller systems with less than 100 kW generating capacity. Current rooftop solar PV systems typically last beyond 30 years, so the project life and any financial gains were considered within a 30-year timeframe.

### LEC Target

- Install 24 MW of solar capacity by 2026 on municipal buildings
- Reduce a total of 236,000 tonnes $CO_2e$ between 2020 and 2050.

## Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 29:** Install solar PV on municipal buildings | | Install 24 MW of solar capacity by 2026 on municipal buildings | | | | |
| **29.1** | **Install 1–1.5 MW generation capacity of solar PV on up to 10 municipal rooftops** | | | | | |
| **a.** | Complete, through a consultant, rooftop solar PV pre-design studies for 10 municipal buildings | **P2** | | | | SUST |
| **b.** | Pursue external grant funding and internal funding for the installation of 1–1.5 MW generation capacity of solar PV on up to 10 municipal rooftops | **P2** | | | | SUST |
| **c.** | If funding is secured, install 1–1.5 MW generation capacity of solar PV on up to 10 municipal rooftops | | **P3** | | | FM |
| **d.** | 1–1.5 MW Rooftop Solar PV Operations | | | **P4** | | FM |
| **29.2** | **Install additional rooftop Solar PV to meet remaining MW targets** | | | | | |
| **a.** | Business Case to request funding for a feasibility study to meet remaining gaps | **P1** | | | | SUST |
| **b.** | Assess the feasibility of meeting the remaining gaps for Action 29 and identify opportunities | | **P2** | | | SUST |
| **c.** | If feasible, implement the installation to meet remaining gaps | | | **P3** | **P4** | *TBD* |
| **29.3** | **Alternatives to meet GHG targets** | | | | | |
| **a.** | Develop business case to explore alternatives to meet equivalent GHG targets if above initiatives are not sufficient | | | **P1** | **P2** | |

### Benefits

- 1–1.5 MW generation capacity could reduce 7,200–10,290 tonnes $CO_2e$ over 30-year project life
- Energy resiliency through decentralizing electricity sources
- Solar access without using additional land

### Cost

- LEC Action 29: ($144)/$tCO_2e$
- PV on up to 10 municipal buildings: $109 to $274/$tCO_2e$, depending on grant funding
  - Not including SL&P revenue loss, which is estimated to be $12,750 annually over life of project

### Examples

The City of Calgary has been accelerating solar energy projects since 2016. Approximately 3 MW over 20 city facilities has been installed so far, through $5M in contributions from the City, and $1.5–1.7M from external grants.

The City of Lethbridge has completed many solar PV installations on municipal buildings including 31 kW of capacity on their ATB Centre and 2 kW at the Lethbridge Sports Park change room facility. They also have solar PV installations at the following facilities: Civic Ice Centre, Helen Schuler Nature Centre, and Nicholas Sheran Park Picnic Shelter and Washroom.

The City of Moose Jaw has begun installation of solar panels on their City facilities with a total of 730 solar panels to be attached to Yara Centre, City Hall/Moose Jaw Police Service, and Mosaic Place by the end of August 2022.

The Town of Biggar plans to install 249 solar panels and the associated equipment on to the rooftop of their Jubilee Stadium Arena ice plant. The Town has previously installed solar on the roof of its community hall and its arena.

## LEC Action 30: Install solar PV systems in municipal lands

### Current Status

The implementation of a solar farm at Dundonald Avenue was approved by City Council in November 2021. Through a feasibility study, a consultant recommended a site-optimized 2.2 MWdc system. Electricity generated from the project will be fed onto SL&P's electrical distribution system and offset equivalent bulk energy purchases from SaskPower.

Capital costs of the system are estimated to be approximately $4.25 million or approximately $1.88/Wdc. Operation and maintenance costs are projected to be approximately $27,500/year, increasing with inflation each year. The project cost is being offset by external funding

### LEC Target

- Install a 1 MW capacity solar system on Parcel M or similar land area by 2022. (GHGs included in LEC Action 34)

## Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 30: Install solar PV systems on municipal lands** | | Install a 1 MW capacity solar system on Parcel M or similar land area by 2022. | | | | |
| **30.1** | **Install 2.2 MW generation capacity of ground-mount solar PV at Dundonald Solar Farm** | | | | | |
| **a.** | Construction and energization of 2.2 MW generation capacity of ground-mount solar PV at Dundonald Solar Farm | **P3** | | | | SL&P |
| **b.** | Monitoring the Solar Farm, recommendations for future installs or optimizations | | **P4** | | | SL&P |
| **30.2** | **Dundonald Solar Farm naturalization landscaping** | | | | | |
| **a.** | Pursue funding for the Naturalization of the Dundonald Solar Farm site | **P2** | | | | SL&P |
| **b.** | If funding is secured, implement the naturalization landscaping to the Dundonald Solar Farm Site | | **P3** | | | SL&P |
| **c.** | Naturalization operations and maintenance | | **P4** | | | SL&P |

### Benefits

- 2.2 MW generation capacity could reduce 13,500 tonnes $CO_2e$ over 30-year project life.
- Energy resiliency through decentralizing electricity sources
- Local job creation
- Naturalization planned to optimize site's use

### Cost

- ($102)/$tCO_2e$, including grant funding

## LEC Action 34: Install new solar PV utility-scale facilities within or adjacent to city boundaries. With areas within city boundary to be prioritized first.

Larger installations of renewable energy generation can impact Saskatoon's energy profile and reduce GHG emissions of our electrical grid. They also have the potential to create local employment opportunities, mostly during installation but there are some opportunities during operation and maintenance phases as well. The cost for panels and installation can also be much lower if purchased in bulk: the Canada Energy Regulator lists current average costs of utility-scale (50 MW) solar to be $1.46/W and community-scale (200 kW) to cost $2.21/W.[12]

A ground-mount solar PV assessment was completed by a consultant for the open ground area just west of the administration building onsite at the Wastewater Treatment Plant (WWTP). The study found that 16.9 MW of generating capacity could be installed at this site; however, at this time, the system size is planned to be smaller to fit the consumption needs of the Plant, without any excess being fed back into the grid, to avoid the need for a Power Purchase Agreement.

### LEC Target

- Install 20 MW of solar capacity by 2030, 300 MW by 2050. This includes the MW capacity from Dundonald Solar Farm.
- Reduce a total of 1,626,000 tonnes $CO_2e$ between 2020 and 2050.

12 ARCHIVED – The Economics of Solar Power in Canada: https://www.cer-rec.gc.ca/en/data-analysis/energy-commodities/electricity/report/solar-power-economics/economics-solar-power-in-canada-results.html

## Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 34:** | **Install new solar PV utility-scale facilities within or adjacent to city boundaries** | Install 20 MW of solar capacity by 2030 (including Parcel M) | | | | |
| **34.1** | **Install ~1 MW generation capacity of ground-mount solar PV at the Wastewater Treatment Plant** | | | | | |
| **a.** | Pursue external grant funding and internal funding for the installation of ~1 MW generation capacity of ground-mount solar PV at the Wastewater Treatment Plant | **P2** | | | | SUST |
| **b.** | If funding is secured, install ~1MW generation capacity of ground-mount solar PV at the Wastewater Treatment Plant | | **P3** | | | SW |
| **c.** | Operations of the solar PV system | | | **P4** | | SW |
| **34.2** | **Install additional site solar PV to meet remaining MW targets** | | | | | |
| **a.** | Business Case to request funding for a feasibility study to meet remaining gaps | **P1** | | | | SL&P/ SUST |
| **b.** | Assess the feasibility of meeting the remaining gaps for Action 34 and identify opportunities within or adjacent to City limits to further install solar generating capacity, as well as Wind power and Geothermal potential:<br>• Prioritizing City-owned land.<br>• Solar access and minimum generating capacity to ensure cost-effectiveness (e.g., lot must be a minimum of 10 acres for a minimum of 1 MW generating capacity.<br>• Initial intent of the land acquisition and any proposed use for site.<br>• Minimal to no disruption on lands with historical and cultural significance.<br>• Potential for the land to be used for any higher purpose or co-located purposes such as agrivoltaics.<br>• The ability to move solar panels before their end-of life if another development on the land takes precedent. | | **P2** | | | SL&P |
| **c.** | If feasible, begin implementing the installation of solar generating capacity within or adjacent to City limits to meet remaining gaps. | | | **P3** | | SL&P |
| **34.3** | **Agrivoltaics pilot** | | | | | |
| **a.** | Business Case to request funding for the Agrivoltaics pilot through Urban Forest Management Plan | | **P1** | | | SUST |
| **b.** | Develop Agrivoltaics pilot to demonstrate how productive green space and energy can be created at the same time | | | **P2** | | SUST |
| **34.4** | **Alternatives to meet GHG targets** | | | | | |
| **a.** | Develop business case to explore alternatives (such as wind and geothermal) to meet equivalent GHG targets if above initiatives are not sufficient is not feasible | | **P1** | **P2** | | *TBD* |

## Benefits

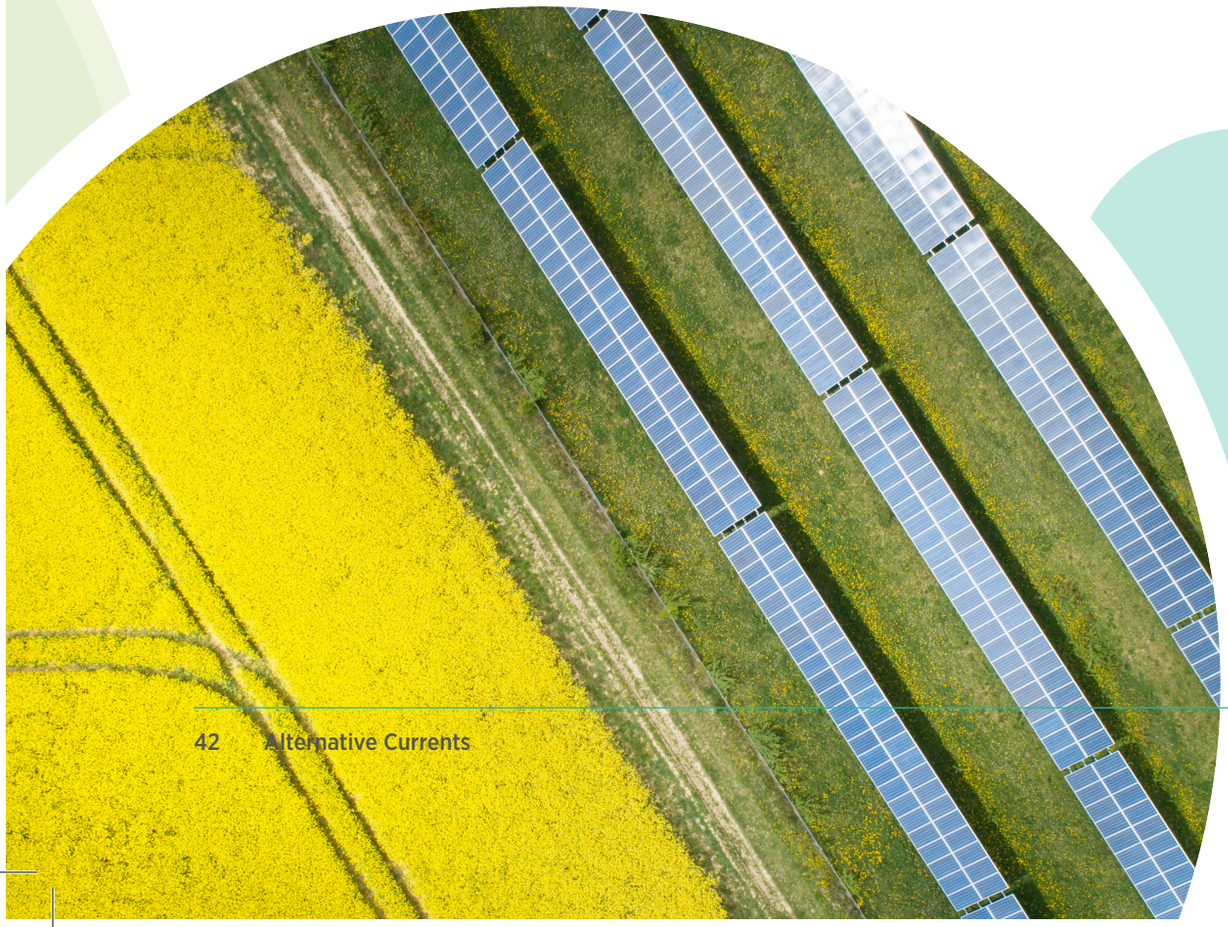
- Every 1 MW of solar PV energy generation capacity could reduce 7,200 tonnes $CO_2e$ over 30-year life of system
- Energy resiliency through decentralizing electricity sources
- Local job creation
- Sites selection and optimization for best use (e.g., including pollinator-friendly plants, agrivoltaics)

## Cost

- LEC Action 34: ($582)/$tCO_2e$
- Estimated costs for 1.5 MW generation capacity of ground-mount solar PV at the Wastewater Treatment Plant: $14 to $192/$tCO_2e$, depending on grant funding

## Examples

SaskPower is planning to construct 60 MW of utility-scale solar power in the coming years with the first 10 MW Highfield Solar Project, located near Swift Current, operational in the fall of 2021. Other SaskPower solar projects in construction are the 10 MW Foxtail Grove Solar Project, located in northeast Regina; 10 MW Pesâkâstêw Solar Power Project, located near Weyburn; and 10 MW Awasis Solar Power Project, located near Regina. Each of these projects are built, owned, and operated by independent power producers, and in some cases in partnership with Indigenous groups or businesses.



## LEC Action 31: Increase landfill gas capture from the Saskatoon Landfill

Landfill gas is produced from waste that has been buried for many years and does not depend on future waste disposal, ensuring no conflict with waste reduction goals. Sites are limited for development of any higher purpose (e.g., green infrastructure, neighbourhoods), making it ideal for a power generation site.

90% of Environmental Awareness survey respondents were somewhat or very supportive of producing power from waste and biomass.

### Status

In 2013, the Landfill Gas (LFG) Collection System was commissioned. It's comprised of vertical wells, interconnected piping, a compression and treatment facility, and an enclosed flare to collect and destroy landfill gas. In 2014, two 815 kW gas engine generators were commissioned for the LFG-Power Generation Facility. The LFG collection and power generation system captures an average of 51,000 tonnes $CO_2e$ of emissions annually. The captured methane is either flared or converted to electricity which is sold to SaskPower and used in a local electricity generation facility. Since 2014, the LFG-Power Generation facility has generated 8–12 GWh annually. The LFG-Collection System has reduced Landfill GHG emissions by approximately 35% since commissioning in 2014. Recent upgrades to the system include the construction of 12 additional vertical wells that will increase the overall uptime of the generator.

### LEC Target

- Increase methane capture and destruction from the landfill to 50%, by 2026.
- Reduce a total of 1,891,000 tonnes $CO_2e$ between 2020–2050.

### Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 31: Increase landfill gas capture from the Saskatoon Landfill** | | Increase methane capture and destruction from the landfill to 50%, by 2026. | | | | |
| **31.1** | **Landfill gas expansion** | | | | | |
| **a.** | Expansion to complete the perimeter header and connect the existing horizontal collectors to the Landfill Gas Collection Facility. Complete looping of landfill. | **P3** | | | | WWO |
| **b.** | Operations of the expansion | | **P4** | | | WWO |

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **31.2** Landfill gas Plant upgrade | | | | | | |
| **a.** | Feasibility assessment of upgrading the Landfill Gas Plant | **P2** | | | | |
| **b.** | If feasible, upgrade the Landfill Gas Plant | **P3** | | | | |
| **c.** | Operations of the Landfill Gas Plant upgrades | **P4** | | | | |
| **31.3** New engine addition | | | | | | |
| **a.** | New engine addition feasibility study | **P2** | | | | SL&P |
| **b.** | If feasible, begin implementation of the new engine addition | **P3** | | **P4** | | WWO |
| **31.4** | **Additional expansion and/or upgrades to meet remaining targets** | | | | | |
| **a.** | Review performance and determine if additional expansion or upgrades are required to meet remaining gaps for Action 31. If required, develop business case to request funding to initiate the additional expansion or upgrades | **P1** | | | | WWO |
| **b.** | If required, begin development of additional expansion or upgrades.<br>• The landfill gas collection system could be expanded through drilling more wells into the landfill for increased methane capture. | **P2** | | **P3** | | WWO |
| **31.5** | **Next steps beyond 2034 agreement expiration** | | | | | |
| **a.** | Begin considerations for Landfill Gas Facility opportunities beyond power purchase agreement (ending in 2034) | **P1** | | | | WWO |

## Benefits

- System with planned improvements projected to reduce 1,120,200 tonnes $CO_2e$ over 20-year contract to sell energy generated to SaskPower (2014–2034)
- Beyond 2034, GHG emission reduction will remain possible as the Landfill Gas Collection Facility has enough flaring capacity to continue destroying gas from the landfill (up to 69,000 tonnes $CO_2e$ annually by 2034)
- Enables higher purpose for waste materials previously landfilled
- Co-located on landfill site

## Cost

- LEC Action 31: ($16)/t$CO_2e$
- Based on costs and revenues from 2014–2034 provided in Landfill Gas Project Proforma[13], ($6)/t$CO_2e$

13 Appendix 1- Landfill Gas Project Proforma: https://pubsaskatoon.escribemeetings.com/filestream.ashx?DocumentId=159399

## LEC Action 35: Install a CHP facility at St. Paul's Hospital

Combined heat and power (CHP) systems are efficient producers of thermal and electric energy. They typically use natural gas or biomass, which can be replaced with renewable natural gas. The systems' thermal energy can meet a facility's heating requirements, and the electric energy is either used by the facility or sent to the utility's electrical distribution system.

CHP projects are relatively expensive and are becoming less impactful on overall GHG reductions as the electricity grid's emission intensity is reduced through increasing its renewable energy sources. The natural gas that powers the units must be renewable to benefit from the same emission reductions as powering from a cleaner electric grid.

### Status

In 2015, the City installed combined heat and power (CHP) systems at Shaw and Lakewood Civic Centres. The systems are energy efficient and reduce GHG emissions for the buildings.

The St. Paul's Project was cancelled by the Saskatchewan Health Authority, citing risk and reliability issues.

### LEC Target

- Install two 540 kW CHP units at St. Paul's Hospital.
- Reduce a total of 40,000 tonnes $CO_2e$ between 2020 and 2050.

### Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 35: Install a CHP facility at St. Paul's Hospital** | | Install two 540 kW CHP units at St. Paul's Hospital | | | | |
| **35.1** | **White paper on installing CHP units at a facility to meet targets** | | | | | |
| **a.** | Researching and developing a white paper to determine the feasibility of installing two CHP units at a facility comparable to St. Paul's Hospital to meet the target for Action 35. | **P1/P2** | | | | SUST |
| **35.2** | **Alternatives to meet GHG targets** | | | | | |
| **a.** | If CHP is not feasible, develop business case to explore alternatives to meet equivalent GHG targets. | | **P1** | **P2** | **P3** | *TBD* |

### Benefits

- Lakewood and Shaw Civic Centre systems are estimated to reduce 6,500 tonnes $CO_2e$ over 20-years (2015–2035)
- Energy resiliency through decentralizing electricity sources

### Cost

- LEC Action 35: ($780)/t$CO_2e$
- Estimates of Lakewood and Shaw Civic Centre systems: $835/t$CO_2e$

## LEC Action 36: Implement district energy systems in the downtown and north downtown areas

District energy systems can be an efficient way to produce and distribute thermal energy to clusters of buildings. When built with the possibility of expansion and flexible fuel use, district energy systems can change with energy demand and energy technologies. These systems work best at a larger scale, such as a group of larger buildings, or a neighbourhood – the implementation could provide that area a sense of pride in their leadership for climate action.

85% of Environmental Awareness survey respondents were somewhat or very supportive of producing and using heat and power at the neighbourhood facility level through district energy.

### Status

No current work is being done at the City.

The University of Saskatchewan is planning a district energy study that will identify medium- and long-term options and opportunities to decarbonize their heating and cooling systems while also considering what role electrification may play in supporting this. The results from this study, which are expected by the end of 2022, will inform decision making around the overall institutional plan and capital requirements to reduce emissions by 45% of 2010 levels by 2030.

The University recognizes that many aspects of these plans have direct links with the City of Saskatoon and will be sharing relevant useful information from their study where possible.

### LEC Target

Create district energy systems to serve the downtown and north downtown areas. The systems will add these components over time:

- 2026: 37 MW RNG boiler
- 2034: 37 MW RNG boiler and CHP unit (9.6 MW thermal, 10.5 MW electricity outputs)
- 2042: CHP unit (6.4 MW thermal, 7 MW electricity outputs)

Reduce a total of 1,079,000 tonnes $CO_2e$ between 2020 and 2050.

## Initiatives

| INITIATIVE AND PHASE | | Phase 2022–23 | Phase 2024–25 | Phase 2026–27 | Phase 2028+ | Respon-sible |
|---|---|---|---|---|---|---|
| **LEC 36: Implement District Energy Systems in the Downtown and North Downtown Areas** | Create district energy systems to serve the downtown and north downtown areas. The systems will add these components over time:<br>• 2026: 37 MW RNG boiler<br>• 2034: 37 MW RNG boiler and CHP unit (9.6 MW thermal, 10.5 MW electricity outputs)<br>• 2042: CHP unit (6.4 MW thermal, 7 MW electricity outputs) | | | | | |
| **36.1** | **District Energy opportunities to meet targets** | | | | | |
| **a.** | Business Case to request funding for a feasibility study of District Energy opportunities | | **P1** | | | SUST |
| **b.** | Assess the feasibility of meeting Action 36 and identify recommended way forward with possible opportunities, including:<br>• Developing policy for new or expanding neighbourhoods to ensure new buildings are district energy ready. Policy development would require an understanding of impacts to land development and servicing costs prior to implementation.<br>• Partnering with Saskatoon Land or local developers for system creation, starting with a Pilot. Investment in district energy at a neighbourhood scale requires a better understanding of long-term benefits for developers and home purchasers. | | **P2** | | | *SUST* |
| **c.** | If recommended, implement Policy for District Energy development | | | **P3** | **P4** | *SUST* |
| **d.** | If recommended, implement a District Energy System Pilot | | | **P3** | **P4** | *LAND* |
| **36.2** | **Alternatives to meet GHG targets** | | | | | |
| **a.** | If District Energy is not feasible, develop business case to explore alternatives to meet equivalent GHG targets | | | **P1** | **P2** | *TBD* |

## Benefits

- Emission reductions: TBD
- Energy resiliency through decentralizing electricity sources
- Sense of local neighbourhood pride in participating in a low-emissions technology

## Cost

- LEC Action 36: ($77)/$tCO_2e$

## LEC Action 37: Construct a hydropower plant at the weir

The South Saskatchewan River provides potential for hydropower projects. A hydropower system at the existing weir could have 5.5–6.1 MW capacity. In considering co-benefits, the weir project could improve safety, wildlife habitation, recreational use, and could create partnership opportunities with local and indigenous organizations.

89% of Environmental Awareness survey respondents were somewhat or very supportive of Hydropower at the Saskatoon Weir.

### Status

A pre-feasibility study was conducted for the hydropower project at the weir. The study found that it is not financially economical at this time.

### LEC Target

- Complete installation of a 6 MW hydropower project at the weir, with an operational efficiency of 55% or greater by 2027.
- Reduce a total of 218,000 tonnes $CO_2e$ between 2020 and 2050.

### Next Steps

A condition assessment of the weir, full feasibility and environmental impact studies must be completed to further progress this initiative.

## Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 37: Construct a hydropower plant at the weir** | | Complete installation of a 6 MW hydropower project at the weir, with an operational efficiency of 55% or greater by 2027. | | | | |
| **37.1** | **Install Hydropower at the weir to meet targets** | | | | | |
| **a.** | Business Case to request funding for a feasibility study of hydropower at the weir study | | | **P1** | | SL&P |
| **b.** | Assess the feasibility of meeting Action 37 through a weir condition assessment, full feasibility, and environmental impact of hydropower | | | | **P2** | SL&P |
| **37.2** | **Alternatives to meet GHG targets** | | | | | |
| **a.** | If Hydropower is not feasible, develop business case to explore alternatives to meet equivalent GHG targets | | | | **P1** | *TBD* |

## Benefits

- If built by 2027, a 6 MW system at 55% efficiency could reduce 119,300 tonnes $CO_2e$ by 2050.
- Safety improvements
- Wildlife habitation improvements
- Recreational use
- Potential partnerships with First Nations Power Authority and the University of Saskatchewan
- Energy resiliency through decentralizing electricity sources

## Cost

- LEC Action 37: \$14/t$CO_2e$

## LEC Action 38: Install renewable energy storage over time

Renewable energy can be stored for use when needed, using systems such as battery electric storage or pumped hydro storage. Stored renewable energy can be deployed when needed, bridging the temporal gap between when energy is produced (i.e., when it's sunny) and when it is needed (i.e., at night and during peak demand periods). Releasing stored energy decreases reliance on fossil fuel-based peaking plants that operate during peak demand hours (mornings and evenings). The current cost of battery electric storage is high, but prices are decreasing quickly as battery technologies become increasingly inexpensive to produce. It is a promising technology experiencing increased adoption across North America.

### Status

The Dundonald Ave Solar Farm feasibility study considered the implementation of a battery storage system. However, it was determined that a battery system would have nearly doubled the capital expenditure of the project, and that there was a lack of vendor/product certainty and standardization.

As the project becomes operational, and as battery storage costs decrease, SL&P will re-evaluate the option of incorporating battery storage at the site.

83.8% of engagement survey respondents somewhat or strongly supported renewable energy storage, while 8.6% were unsure, and 7.7% did not support it.

### LEC Target

- 50 MW of grid-tied electricity storage is added gradually between 2025 and 2050. Reduce a total of 3,435,000 tonnes $CO_2e$ between 2025 and 2050.

## Initiatives

| INITIATIVE AND PHASE | Phase | | | | Respon-sible |
|---|---|---|---|---|---|
| | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 38:** Install renewable energy storage over time | 50 MW of grid-tied electricity storage is added gradually between 2025 and 2050 | | | | |
| **38.1** Install renewable energy storage over time to meet targets | | | | | |
| **a.** Business Case to request funding for a feasibility study for renewable energy storage | | **P1** | | | SL&P |
| **b.** Feasibility study for meeting Action 38 through an analysis of technology to date and a phased strategy with identified opportunities, including a protocol to include battery storage as a consideration for all future City-led large-scale renewable energy generating projects, as well as a reconsideration at regular intervals for any operational generating systems. | | | **P2** | | SL&P |
| **38.2** Alternatives to meet GHG targets | | | | | |
| **a.** Develop business case to explore alternatives to meet equivalent GHG targets if above initiatives are not sufficient is not feasible. | | | **P1** | **P2** | *TBD* |

## Benefits

- Every 1 MW of solar PV energy generation capacity could reduce 7,200 tonnes $CO_2e$ over 30-year life of system
- Energy resiliency through decentralizing electricity sources
- Better management of renewable energy generation and use onsite

## Cost

- LEC Action 38: ($3)/$tCO_2e$
- Based on a simple estimate provided in the feasibility study for the Dundonald Avenue Solar Farm, assuming 1 MW generating capacity and a 4 MWh battery energy storage system: $296/$tCO_2e$

## Examples

The Town of Lumsden has installed a 616 kW solar PV system, with 500 kW battery storage, for their wastewater treatment plant. The solar energy generated would be enough to power 66% of the wastewater treatment plant's energy needs. The battery would charge at peak production/low usage (midday) and then be used nightly. No electricity from the panels will be exported to the grid. The system began operations in spring 2022.

## LEC Action 39: Procure renewable electricity from third party producers

It is anticipated that Saskatoon's target of 80% emissions reductions by 2050 will not be achieved without purchasing renewable energy that is generated outside of city limits. This energy could be procured from third party producers, from additional energy projects undertaken by the City, or from energy projects that are partnerships between the City and private, not for profit, or cooperative energy outfit. The required amount of renewable energy procured to meet the LEC goals will be dependent on the success of other actions, as well as SaskPower's effectiveness at meeting/exceeding its own renewable energy targets.

While the energy produced would be outside city limits, the City would prioritize nearby production facilities to support the regional development of renewable energy projects. Collaboration with the municipality that has jurisdiction of the sited land for renewable energy generation would be included to unsure all parties benefit from the development.

One possible alternative to directly procuring electricity would be purchasing Renewable Energy Certificates (RECs). RECs are a specific form of carbon offset credit that generates renewable energy to offset emissions (vs. other methods, such as planting trees). A REC represents renewable "attributes" or "benefits" associated with renewable energy generation – which can be ambiguous to define and account for.

A local example of RECs is SaskPower's Renewable Partnership Offering (RPO). This partnership would support SaskPower in the development of a new 100 MW (Megawatt) solar facility (estimated to be completed in 2025).

Participating RPO customers would continue to pay SaskPower for the electricity they consume at established rates. In addition, participants would pay a premium for renewable energy generated by their agreed-upon capacity to account for grid

access and solar production costs. For example, if a customer agrees to supporting 50 MW generating capacity, they will pay an additional $/MWh premium for however much 50 MW is generated during the billing period. In return, participating customers will receive an energy credit based on the output of the solar facility allocated to the customer, a credit for carbon tax paid based on the output of the solar facility, as well as the RECs based on the generation provided that is related to their portion of the output.

Engagement survey respondents expressed the need to diversify our forms of energy generation; it was suggested that depending only on solar and wind generation could make the city more susceptible to environmental emergencies (e.g., blizzards, inclement weather, etc.)

There was mixed support for the City pursuing Renewable Energy Credits – 58.7% of respondents somewhat or strongly supported the initiative, while 19.8% were unsure, and 21.5% did not support it.

Respondents felt that the impacts of average residents/business adopting renewable energy generation is marginal relative to the need for changes to provincial/municipal and energy production/delivery policies

### Status

Saskatoon Light & Power is always looking for opportunities for utility-scale generation, and frequently meets with companies that are interested in generating.

The City of Saskatoon has submitted an Expression of Interest to be allocated 66 MW of generating capacity for a 10-year term to the RPO.

The City does not currently have any Renewable Portfolio Standards[14], so the City can only purchase voluntary market RECs and in exchange receive an environmental benefit. These voluntary RECs are supplied by solar or wind farms or hydroelectric generators typically outside of the purchaser's direct grid supply. Voluntary market RECs are typically registered with an NGO program (e.g., Green-e) and may be registered with regional certificate tracking systems.[15]

### LEC Target

- Procure electricity from 1,600 MW of renewable energy capacity installed outside of Saskatoon.
- Reduce a total of 54,119,000 tonnes $CO_2e$ between 2020 and 2050.

14 Renewable Portfolio Standard is a policy that requires electric utilities to source a portion of their energy needs from renewable energy resource, often including a REC trading system to minimize the cost of compliance.

15 RECs, PPAs, Allowances and EECs: https://www.offsetguide.org/understanding-carbon-offsets/other-instruments-for-claiming-emission-reductions/renewable-energy/1387-2/

## Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 39: Procure renewable electricity from a third-party producer** | | Procure electricity from 1,600 MW of renewable energy capacity installed outside of Saskatoon. | | | | |
| **39.1** | **Procure renewable energy over time to meet targets** | | | | | |
| **a.** | Business Case for the feasibility study of meeting Action 39 | **P1** | | | | SUST |
| **b.** | Feasibility study of meeting Action 39 through an investigation of opportunities to purchase utility-scale low-emissions energy generation outside of Saskatoon. Including RECs, and their emission reductions implications | | **P2** | | | SUST |
| **c.** | Develop an administrative process for energy generation partnerships and renewable energy credit purchasing, ensuring viable options are brought to City Council. Protocol to consider:<br>• Selection criteria (e.g., prioritize RECs that support the regional development of renewable energy projects)<br>• How to verify certification and regulation of RECs currently available within its consideration for their purchase.<br>• How to track the credit and ensure no benefits are counted more than once | | | **P3** | | SL&P |
| **d.** | Operations of renewable energy purchasing protocols | | | | **P4** | SL&P |
| **39.2** | **RPO opportunity with SaskPower** | | | | | |
| **a.** | Submit an expression of interest to SaskPower to explore and evaluate the RPO opportunity, and to | **P1** | | | | SL&P |
| **b.** | If successful with expression of interest, determine a funding strategy to begin RPO partnership with SaskPower | | **P2** | | | SL&P |
| **c.** | Contract development with SaskPower for RPO | | **P3** | | | SL&P |
| **d.** | Implement contract with SaskPower for RPO | | | **P4** | | SL&P |
| **39.3** | **Alternatives to meet GHG targets** | | | | | |
| **a.** | Develop business case to explore alternatives to meet equivalent GHG targets if above initiatives are not sufficient is not feasible | | | | **P1** | *TBD* |

### Benefits

- 66 MW capacity could reduce 245,000 tonnes $CO_2e$ over the proposed 10-year RPO contract
- Supporting larger Saskatchewan region / Canadian region
- Enables larger projects that benefit from economies of scale

### Cost

- None provided in LEC Action 39
- Based on the estimated costs for the proposed 10-year RPO contract: \$66 to \$122/$tCO_2e$

## LEC Action 40: Procure Renewable Natural Gas from third party producers

Thermal and electrical energy production that currently relies on natural gas can be shifted to renewable natural gas. Renewable natural gas is produced from decomposing organic materials like food, agricultural waste, wastewater, and manure. Methane capture from landfills can be upgraded to renewable natural gas, and organic materials can be processed in anaerobic digestion facilities to provide gas to upgrade to renewable natural gas. Once upgraded, renewable natural gas can be used exactly like natural gas. Biogas can potentially also be used to generate electricity

### Status

There are no actions currently underway to procure renewable natural gas from third party producers and SaskEnergy currently has no program that allows for the purchase or selling of renewable natural gas. A demonstrated demand for renewable natural gas may be required before any external (third party) investment might occur.

Saskatoon's Wastewater Treatment Plant produces biogas as part of the treatment process that can be captured and used for heating on-site buildings and digesters. The facility began using their biogas for heating in 2021, with estimated annual savings of approximately $300,000 in heating costs.

89.8% of respondents somewhat or strongly supported biogas use at the Wastewater Treatment Plant, while 9.8% were unsure, and 0.4% did not support it.

### LEC Target

- Import Renewable Natural Gas to displace 50% of natural gas demand.
- Reduce a total of 40,607,000 tonnes $CO_2e$ between 2020 and 2050.

## Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 40: Procure renewable natural gas from third party producers** | | Import renewable natural gas to displace 50% of natural gas demand. | | | | |
| **40.1** | **Wastewater Treatment Plant biogas use opportunities** | | | | | |
| **a.** | Explore opportunities to further use biogas and biomass generated from the City's Water and Wastewater Treatment Plants, including power generation and use in civic operations outside of the facility. | **P2** | | | | SW |
| **b.** | Implement viable opportunities for biogas use from the wastewater treatment facility. | | **P3** | | | SW |
| **c.** | Operations for viable usage of biogas. | | | **P4** | | SW |
| **40.2** | **Procure renewable natural gas to meet targets** | | | | | |
| **a.** | Business Case for the feasibility study of meeting Action 40. | | **P1** | | | SUST |
| **b.** | Feasibility study of meeting Action 40 through investigating and market forecasting of opportunities to purchase renewable natural gas. | | | **P2** | | SUST |
| **c.** | If feasible, develop an administrative process for purchasing and switching to the use of renewable natural gas. | | | | **P3** | SUST |
| **40.3** | **Alternatives to meet GHG targets** | | | | | |
| **a.** | Develop business case to explore alternatives to meet equivalent GHG targets if above initiatives are not sufficient is not feasible. | | | | **P1** | *TBD* |

### Benefits

- Emission reductions: TBD
  - In 2021, biogas use at the wastewater treatment plant replaced ~ 238,638 $m^3$ of natural gas, reducing ~465 tonnes of $CO_2e$
- Wastewater biogas enables higher purpose for waste materials
- Biogas production co-located on wastewater treatment facility site

### Cost

- None provided in LEC Action 40

### Examples

Biogas is collected from the Glenmore landfill in Kelowna, BC, the Salmon Arm, BC Landfill, the City of Surrey's municipal organic waste, food waste and industrial, commercial, and institutional waste, and the Greater Vancouver Regional District's Lulu Island Wastewater Treatment plant. This biogas is treated and purified to produce renewable natural gas.[16]

16 https://www.fortisbc.com/services/sustainable-energy-options/renewable-natural-gas/meet-our-renewable-natural-gas-suppliers

## Known Marginal Abatement Costs

For the above listed Implementor Initiatives, several have progressed sufficiently to provide insight on current anticipated costs per tonne of greenhouse gas emissions reduced. The below figure shows the costs for seven initiatives, including grants where they have been identified and applied for, as indicated by the "low range". In the case of initiative 30.1, the project has secured grant funding, so the "high range" is purely hypothetical for insight into future projects of similar scale. For 39.2, the low and high ranges are not dependent on grant funding, but on the agreed-upon bulk rate costs of electricity purchased.

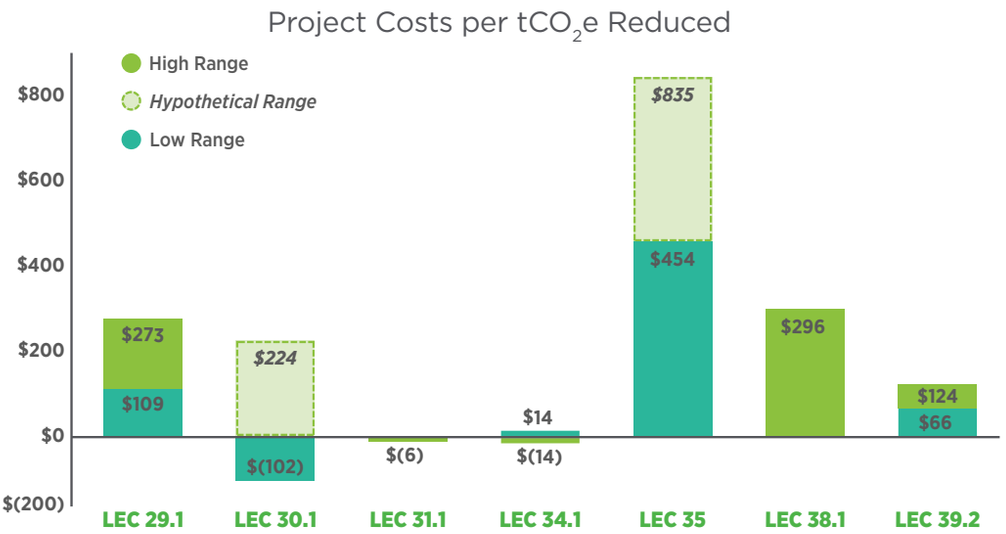



*Figure 7: Known Marginal Abatement Costs for Implementor Initiatives*

***29.1*** *Install 1–1.5 MW generation capacity of solar PV on up to 10 municipal rooftops*

***30.1*** *Install 2.2 MW generation capacity of ground-mount solar PV at Dundonald Solar Farm*

***31.1*** *Landfill gas expansion*

***34.1*** *Install ~1 MW generation capacity of ground-mount solar PV at the Wastewater Treatment Plant*

***35*** *(related) CHP facility at Shaw & Lakewood*

***38.1*** *Install renewable energy storage over time to meet targets (Dundonald example)*

***39.2*** *RPO opportunity with SaskPower*

## Investor, Regulator, and Encourager Initiatives

The following initiatives describe where the City's role would be to invest, regulate, and encourage renewable and low-emission energy in the community, thus aiding in the progression of the following LEC Actions:

- **LEC 32** - Encourage existing residential building owners and mandate new buildings to install solar PV systems; and
- **LEC 33** – Encourage existing ICI building owners and mandate new ICI buildings to install solar PV systems

The initiatives listed have multiple considerations outside of the costs borne by the City. For example, if the City provides a $5,000 rebate, there is no certainty on who will be funding the remaining amounts to implement the renewable energy projects, or what those additional costs may be for the project to be successful.

Given the uncertainty around the scope of these initiatives, costs still need to be determined and will depend on the scale and uptake. With this in consideration, only costs for the City have been included and are described in general terms. GHG emissions reductions from these initiatives are also uncertain for the same reasons.

Considering that the average at-home solar panel system has a generating capacity of 7 kW, while the potential City-led initiatives have a generating capacity of approximately 100–66,000 kW, 43.7% of engagement respondents preferred the City to prioritize larger, City-led initiatives, 8.4% preferred the City to support self-generation in the community, while 38.6% wanted the City to support both, equally.

## LEC Action 32: Encourage existing residential building owners and mandate new buildings to install solar PV system through programming and bylaw

### LEC Target

- Install 10 MW of residential solar capacity by 2030, 50 MW by 2050.
- Reduce a total of 195,000 tonnes $CO_2e$ between 2020 and 2050.

### Marginal Abatement Cost

- LEC Action 32: ($344)/$tCO_2e$

The average 7.6 kW residential solar PV system will have upfront capital costs of $2.92/W,[17] and operation and maintenance costs of up $0.05/kWh generated. Half of the energy generated is typically assumed to be used in real time, while the remainder is net metered through SaskPower or Saskatoon Light & Power's net metering rates.

Investing in, regulating, and encouraging the community's residents to generate their own renewable energy can be done through numerous initiatives. The following presents the City's initiatives according to these roles.

### Considerations: Investor

#### HELP & Rebates

Homeowners may not own their properties long enough to fully realize the benefits or pay-off from installing rooftop solar. Pay-off will be primarily influenced by the upfront costs of installing a system, and the savings generated from energy production.

Many engagement respondents found the costs for installation and maintenance are too high; the return on investments and incentives are not properly marketed/advertised to the community; and that there are few grants or loans currently available to help cover capital costs.

*"How do I justify thousands and thousands of dollars for solar power...? If you can show us, the retired, working poor and middle class people how to do that then I am a supporter."*

17 Based on data from Home Energy Loan Participants installing Solar PVs on the rooftops in Saskatoon.

### Community Solar

There are many residents who typically cannot or would not self-generate at home. This includes residents over 65, renters, income-qualified households, or those with site-specific limitations such as shading, home orientation, and rooftop structure, as Solar PVs require direct solar access to generate power.

Renters identified that condo associations and property managers will often not allow for anything that is not aesthetically pleasing to be installed; it can be difficult for one tenant to convince the entire building of renewable energy opportunities; most multi-unit housing and condos are not equipped for electric vehicle charging

Some engagement respondents expressed that the long-term pay-off is more difficult to justify and envision for residents over 65 who may not fully realize the benefits within their lifetime:

*"Age + Fixed Income — It seems too costly for us to retrofit our home given our age, cost of investment, and anticipated time of remaining in our own home. If we were younger we would make the investment."*

Community solar is where an organization builds a solar project and community members can participate it in its financing to receive benefits. Community solar can provide access to customers who would otherwise not participate in self-generation. Community scale solar also benefits from a larger pool of investors which enables larger-scale projects or purchasing agreements.

Various models exist for community solar, and in some cases require virtual net metering policies. Virtual net metering (VNM) allows customers to buy into renewable energy systems on- or off-site. The power generated would not be used by the customer directly but, rather, the power generated will go back to the grid and the utility organization would then distribute the credits produced to individual accounts. Participants may receive the virtual use of the production of the power from the specific panels they have purchased, or they may be charged a levelized cost of solar energy on a monthly basis, or another method may be employed to ensure the participants are receiving benefits for investing in renewable energy.

Virtual Net Metering imposes similar risk as Net Metering programs to utilities, where participating customers may not adequately contribute towards the maintenance of the electrical power grid.

### Smart Grid Initiatives

As distributed energy resources evolve, so must the power grid. Examples of smart grid initiatives that support integration of distributed energy and energy conservation include smart metering technology, system automation, battery storage technology, demand-side management strategies, and micro-grids. A micro-grid is a local electrical grid with defined electrical boundaries, acting as a single and controllable entity. It is able to operate in connection to a larger utility grid or standalone (in island mode).

Some engagement respondents doubted whether the grid would be able to incorporate the different forms of energy generation and associated higher demands:

*"Either put a real modern power grid in place powered by truly sustainable energy sources… or accept that we will be burning gasoline until there is nothing left."*

## Status: Investor

### HELP & Rebates

The Home Energy Loan Program (HELP) provides Saskatoon homeowners with low interest loans to cover the upfront cost of larger home upgrades, including rooftop solar PV panels and solar hot water systems. Loans between $1,000 and $60,000 are available and are then repaid through property taxes over 5-, 10-, or 20-year terms. HELP was launched in September 2021 and as of October 2022, 242 (19 income-qualified) applicants have been approved to participate in the program with an average loan request of $30,500. 73 projects are currently under construction. 20 projects have been completed with an estimated savings of 897 GJ/year and emissions reductions of 60 $tCO_2e$/year.

Currently, the program is being offered through a grant and loan from the Federation of Canadian Municipalities as well as internal City funds and is projected to have sufficient financing for up to four years.

Through HELP, income-qualified households (calculated at 2.5 times Statistics Canada Low Income Cut-Off) are also eligible for a $3,500 rebate in addition to the low interest loan available for the total cost of the retrofit. The program administration fee is also waived for income-qualified residents. These rebates are only available for the approximately 260–300 Saskatoon households participating in the program.

Other rebates and incentives include the Canada Greener Homes Grant (up to $5,000 in rebates), the Canada Greener Homes Loan, (interest-free 10-year loans of $5,000-$40,000), and the provincial tax credit (10.5% rebate).

At SaskPower net metering rates ($0.075/kWh) over a 30-year lifetime, the estimated marginal abatement cost for a residential owner of a 7.6 kW solar generation system would be $54/$tCO_2e$. Including the Canada Greener Homes Grant, and the provincial tax credit ($7,300 total), the marginal abatement cost would be ($118)/$tCO_2e$.

Natural Resources Canada has created an online inventory of programs to promote the efficient use or conservation of energy at the end-use level and/or the use of alternative energy in Canada. It covers programs offered by the Government of Canada, provincial and territorial governments, major Canadian municipalities and major electric and gas utilities and companies. Any incentives that may apply to Saskatoon residents producing their own solar will be available there.[18]

18 Main Directory of Energy Efficiency and Alternative Energy Programs in Canada | Natural Resources Canada (nrcan.gc.ca)

Considering the rebates currently available, 51.8% of engagement respondents felt they would require additional rebates to invest in renewable energy generation for their home or business, while 28.5% were unsure, and 19.7% did not require additional rebates.

### Community Solar

In Saskatoon, the Saskatchewan Environmental Society (SES) Solar Co-op has developed several community solar projects including the Solar Power Demonstration Site in partnership with the City of Saskatoon. Located at the City's Landfill Gas Power Generation Facility, the demonstration site was installed in 2016 and consists of four ground-mount arrays, with a total of 92 solar panels and 30.7 kilowatts of generation capacity. The installation includes two solar tracker systems on loan from Saskatoon Polytechnic that rotate to follow the sun throughout the day. Under the 25-year agreement, the City will purchase the electricity generated by the solar panels and will use the electricity to help operate the Landfill Gas Generating Station.

In 2020, SL&P completed a pilot demonstration of Virtual Net Metering (VNM) in collaboration with the Saskatchewan Environmental Society (SES), SES Solar Co-operative, Saskatoon Car Share Co-operative, Sun Country Highway and Saskatchewan Research Council (SRC). The Renewable Rides project demonstrated an offsite solar array capable of supplying the energy needs of five electric vehicle chargers virtually across the power grid. The pilot project identified regulatory, utility and customer considerations that restrict further implementation of a VNM program.

80.4% of engagement respondents somewhat or strongly supported the City supporting community solar projects, while 9.1% were neutral, and 10.5% did not support it.

### Smart Grid Initiatives

SL&P has completed deployment of smart meters or automated metering infrastructure (AMI).

## Initiatives: Investor

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 32:** Encourage existing residential building owners and mandate new buildings to install solar PV system through programming and bylaw. | | Install 10 MW of residential solar capacity by 2030, 50 MW by 2050. | | | | |
| **32.1** | **HELP program** | | | | | |
| **a.** | Monitor HELP program uptake and provide an update to the Standing Policy Committee on Environment, Utilities and Corporate Services by early 2023 to determine next steps for the program. | **P4** | | | | SUST |
| **b.** | Implement next steps for HELP program | **P3** | | | | SUST |
| **c.** | HELP program sustainment (including next steps) | | **P4** | | | SUST |
| **32.2** | **Smart grid initiatives** | | | | | |
| **a.** | Develop business case for implementing smart grids and develop a smart grid roadmap to leverage the AMI system. | **P1** | | | | SL&P |
| **b.** | Partner with the University of Saskatchewan through a research junction project to explore the viability of urban micro-grids. | **P1** | | | | SL&P |
| **c.** | If feasible, begin implementation of smart grids | | **P2** | **P3** | **P4** | SL&P |
| **d.** | If viable, begin planning for urban micro-grids | | **P2** | **P3** | **P4** | SL&P |
| **32.3** | **Residential rebates for renewable energy generation** | | | | | |
| **a.** | Business Case to request funding for investigating Residential rebates for renewable energy generation | **P1** | | | | SUST |
| **b.** | Investigate the use of additional rebates as incentives for residential renewable energy self-generation | | **P2** | | | SUST |
| **c.** | If feasible, implement the use of additional rebates as incentives for residential renewable energy self-generation | | | **P3** | **P4** | SUST |

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **32.4** | **Incentivizing community solar** | | | | | |
| **a.** | Business Case to request funding for investigating community solar incentives | **P1** | | | | SUST |
| **b.** | Explore opportunities for incentivizing and implementing community solar PV projects, including rebates, and leasing vacant, undevelopable City-owned land at reduced or no cost to participating solar companies or co-operatives:<br>• Review and identification of potential parcels would include consideration of approved Sector Plans and Neighbourhood Concept Plans, as well as other long-term goals, to accommodate the typical minimum 25-year lifecycle of solar projects. As with City-led projects, the sites would consider best purposes for the land and would incorporate co-benefits where possible.<br>• In partnership with Saskatoon Land and Planning and Development. | | **P2** | | | SUST |
| **c.** | Begin development for community solar incentives | | | **P3** | **P4** | *TBD* |
| **32.5** | **Additional investor programming to meet GHG targets** | | | | | |
| **a.** | Develop business case to explore additional investor programming to meet equivalent GHG targets if above initiatives are not sufficient to support Action 32 | | | | **P1** | SUST |

### Benefits: Investor

- Emission reductions: TBD
- HELP:
  - Provides energy audit data for future planning
  - Better quality of living for participants through home improvements
- Municipal rebates:
  - Improves equity of program participation (regardless of utility provider)
- Community solar incentives:
  - Improves equity of participating in a renewable energy transition
  - Any land sites offered by City would be selected and/or optimized for best use
- Smart grid initiatives
  - improve energy efficiency & resiliency

### Costs: Investor

- HELP:
  - Administrative time (1 FTE at for the duration of program)
  - Programming is currently grant-funded
- Rebates:
  - Administrative time (1 FTE at part-time for 1–2 years)
  - Rebates TBD
- Community solar incentives:
  - Administrative time (1 FTE at part-time for 1–2 years)
  - Rebate costs TBD
  - Land lease opportunity costs TBD
- Smart grid initiatives:
  - Administrative time (1 FTE at part-time for 1–3 years to explore opportunities)
- If the energy is generated within SL&P's district, then there would be a revenue loss of $1,150/year for the average 7.6 kW system.

## Consideration: Regulator

### Net Metering and Power Producer Update

Customers can self-generate electricity for their own use and send excess electricity to the grid for future credit on their power bill through Net Metering Program. Customers with larger installations can also sell excess electricity onto the grid through the Small Power Producers Program. The credit or purchasing rate will determine the savings or income received though power generation returned to the grid.

### Solar Access and Orientation Review

Solar PVs require direct solar access to generate power. In many urban areas, direct solar access is limited by street and lot orientation, shading from adjacent buildings and/or trees, building orientation, and rooftop design.

### Solar Administration

To comply with the National Building Code, rooftop structures with solar panels must be able to accommodate the additional weight of the panels and snow, rain and wind loads.[19] This requires analysis and plans prepared by a Professional Engineer. New buildings and structural alterations to existing buildings require a development permit and a building permit. Preliminary feedback from the public suggests that the plan review and permitting process should be as streamlined as possible.

## Status: Regulator

### Net Metering and Power Producer Update

Net Metering programs are offered by all utilities in the province. SL&P's Net Metering program currently incentivize self-generation as they credit energy at the retail rate (Table 3). However, the energy credit and purchase rates do not accurately reflect the costs required to maintain the grid and are more costly than the bulk energy that SL&P purchases from SaskPower.

In Q4 2019, SaskPower reduced their Net Metering rate to equal the average cost of energy on the grid (previously retail rate), as shown in Table 3. The rate was changed to ensure adequate costs are recovered from participating customers to maintain the grid, and thereby reduce cross subsidization of customers. SaskPower does not intend to change their Net Metering Program until March 31, 2026 at the earliest.

With a 7 kW residential system, the anticipated payback period varies between programs as shown in Table 3.

*Table 3: Net metering rates and estimated payback periods*

| | Excess Energy Credit Rate | Estimated Payback Period |
|---|---|---|
| **SaskPower and Swift Current Light & Power** | $0.075 per kWh (fixed at average cost of energy in 2019) | 21–23 years |
| Saskatoon Light & Power | $0.1565 per kWh (variable at retail rate) | 16–18 years |

19 As of 2019. Climate Action Plan. Progress Report 2020.

Through SL&P's Small Power Producer Program, electricity is purchased by SL&P at a fixed rate of $0.114846 (2020 rates) per kilowatt hour ($/kWh). SaskPower discontinued its Small Power Producer Program in 2018. Small Power Producer Program participation rates have been low as it results in a longer payback period when compared with the Net Metering Program in most circumstances.

Net Metering Program participation rates (per total customers) have remained similar across the province between November of 2019 and May of 2022, with SaskPower accepting 475 participants, while SL&P has accepted 53 participants over the same period. Self-generation from residents and businesses in the SL&P franchise area currently amounts to approximately 3.36 MW of solar capacity.

### Solar Access Regulation

The City has a number of bylaws, plans and guidelines that encourage the use of renewable energy including solar. The *Official Community Plan – Bylaw No. 9700*, adopted in 2020, encourages increasing energy generation from renewable sources, and raising energy efficiency standards for new and renovated buildings.

The OCP designates Corridor Growth Areas that will provide significant infill development opportunities along the city's major corridors. The *Corridor Transformation Plan*, which provides further guidance for achieving these opportunities, contains land use principles that include encouraging the use of renewable energy sources. The *Neighbourhood-Level Infill Development Strategy*, which addresses infill development on individual lots in established neighbourhoods, includes design guidelines encouraging passive solar design and energy efficiency.

The OCP requires Sector Plans and Neighbourhood Concept Plans to comprehensively guide urban growth in new development areas, neighbourhoods and employment areas. When designing new neighbourhoods, developers including Saskatoon Land consider street and lot layouts that will facilitate the use of solar energy.

The *Zoning Bylaw No. 8770* permits the installation and operation of solar panels in all zoning districts.

### Solar Administration

The City has recently launched a new ePermitting system that will let people apply for permits, track the progress of the application and even request inspections all digitally, reducing the need for in person visits to City Hall and increasing transparency around the permitting process.

## Initiatives: Regulator

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **32.6** | **Net metering and power producer updates** | | | | | |
| **a.** | Explore changes to the Net Metering and Small Power Producer Programs and present recommendations to Council. Changes will consider:<br>• rate parity with provincial programs<br>• long-term financial sustainment of the programs<br>• participation rate<br>• Grandfathering participants with approved applications as of a certain cutoff date when changes are made to go-forward rates<br>• Impacts to rates for non-participating income-qualified residents<br>• Virtual net metering programming | **P1** | | | | SL&P |
| **b.** | Implement recommended changes to Net Metering and Small Power Producer Programs | | **P3** | | | SL&P |
| **c.** | Operations of updated Net Metering and Small Power Producer Programs | | | **P4** | | SL&P |
| **32.7** | **Solar access and orientation guidelines** | | | | | |
| **a.** | Business case to request funding to research the potential for the City's land use plans, bylaws, policies and procedures to provide greater support for the use of renewable energy such as rooftop solar installations. Identify major opportunities that could make meaningful progress towards the City's renewable energy targets, including the creation and promotion of guidelines for solar orientation. For example, street and lot layouts, building orientation and roof design. | **P1** | | | | P&D/ SUST |
| **b.** | Develop options for enhancing solar access and the use of renewable energy in the context of the City's land use planning framework. Engage with key stakeholders including the land development and building industries. | | **P2** | | | P&D/ SUST |
| **c.** | Present recommended options to City Council. Proceed with any necessary amendments to plans, bylaws, policies and procedures, as well as development of any guidelines for neighbourhoods and for buildings, to implement Council's direction. | | | **P3** | | P&D/ SUST |
| **d.** | Finalize and promote amendments and guidelines for solar access and orientation.<br>• Incorporate any relevant content into educational programming | | | | **P4** | P&D/ SUST |

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **32.8** | **Solar administration review and update** | | | | | |
| **a.** | Review the permitting and plan review process for solar panels and explore any opportunities for a simplified and outcomes-based process.<br>• In collaboration with internal stakeholders, including Building Standards and Planning and Development. | **P2** | | | | SUST |
| **b.** | Draft any changes to the permitting and plan review process for solar panels. | | **P3** | | | SUST |
| **c.** | Finalize and implement any changes to the permitting and plan review process for solar panels. | | | **P4** | | *TBD* |
| **32.9** | **Include renewable energy in park development standards** | | | | | |
| **a.** | Update Park guidelines to recommend renewable energy be incorporated into parks where feasible. | **P3** | **P4** | | | PARK |
| **32.10** | **Additional regulator programming to meet GHG targets** | | | | | |
| **a.** | Develop business case to explore additional regulator programming to meet equivalent GHG targets if above initiatives are not sufficient to support Action 32. | | | | **P1** | SUST |

## Benefits: Regulator

- Emission reductions: TBD
- Net metering and power producer programing update:
  - Improves program sustainment.
  - Reduces inequitable impact on residents who cannot participate.
- Ensures renewable energy is addressed holistically in the City's land use planning framework.
- Solar administration improves equity of application process.

## Costs: Regulator

- TBD
- Net metering and power producer programing update:
  - Administrative time (1 FTE at part-time for one year).
- Solar access and orientation review:
  - To be determined through preparation of a business case.
- Solar administration review and update:
  - Administrative time (1 FTE at part-time for 1–2 years).
- If the energy is generated within SL&P's district, then there would be a revenue loss of $1,150/year for the average 7.6 kW system.

## Consideration: Encourager

### Educational Programs

Many respondents stated they were exploring renewable energy systems for their home/business but are waiting for the right time (e.g., reduced costs, moving, building, etc.). Many respondents were uncertain what was possible on their property, and what the return on investment could be for renewable energy production. The community has many questions regarding renewable energy that are not being answered in plain language; individuals considering renewable energy are not sure where to begin.

### Renewable Energy Waste Recycling

The adoption of renewable energy, especially solar PV panels and battery storage, also raise concerns for their eventual end-of-life disposal (25+ years from installation).

> *"How long must the equipment be in use for in order to offset the material use, its construction, and also its disposal after it is spent?"*

## Status: Encourager

### Educational Programs

FCM grant funding in association with HELP has been secured to expand Residential Energy Efficiency & Energy Generation Education including energy coaching, training for industry/realtors, communications and education campaigns, and self-service online tools and maps to determine if their home is a good fit for solar PV, or see options available for reducing energy through home upgrades.

### Renewable Energy Waste Recycling

While recycling facilities in the United States are preparing to begin accepting solar modules for recycling, there are no known options for Saskatoon to recycle solar panels locally. Recovery Park, a one-stop waste drop-off location for residents with multiple waste diversion options, is expected to open in 2023, and could be used as a transfer station for renewable energy waste recycling.

## Initiatives: Encourager

| INITIATIVE AND PHASE | | Phase 2022–23 | Phase 2024–25 | Phase 2026–27 | Phase 2028+ | Responsible |
|---|---|---|---|---|---|---|
| **32.11** | **Educational programming for energy efficiency and renewable energy generation** | | | | | |
| **a.** | Develop education programs for the Residential Energy Efficiency & Energy Generation Program, including:<br>• Addressing known concerns for energy generation and further encouragement of energy improvements.<br>• Offering opportunities for dialogue to address questions that may not be as typical or anticipated.<br>**Programming to consider:**<br>• In-person education through informative posters at civic facilities and libraries, info sessions, and facility tours.<br>• Reaching additional participants outside of HELP, especially underserved groups such as renters, income-qualified participants, and those with language barriers.<br>• Prioritizing community champions in the coaching program that we may not typically associate with renewables but would better reflect the community. | **P2** | | | | SUST |
| **b.** | Implement education programs for the Residential Energy Efficiency & Energy Generation Program. | | **P3** | | | SUST |
| **c.** | Education programs for the Residential Energy Efficiency & Energy Generation Program sustainment.<br>• Incorporate guidelines for solar access and orientation when finalized. | | | **P4** | | SUST |
| **32.12** | **Renewable energy waste recycling** | | | | | |
| **a.** | Develop business case to encourage renewable energy waste recycling and sustainable end-of-life management | **P1** | | | | SUST |
| **b.** | Implement education programs for the Residential Energy Efficiency & Energy Generation Program | | **P2** | | | SUST/ WWO |
| **c.** | If a reliable recycler is found, begin accepting renewable energy waste, like unusable solar PV panels in the next phase of Recovery Park development | | | **P3** | | SUST/ WWO |
| **d.** | Renewable energy waste recycling program sustainment | | | | **P4** | *TBD* |
| **32.13** | **Additional encourager programming to meet GHG targets** | | | | | |
| **a.** | Develop business case to explore additional encourager programming to meet equivalent GHG targets if above initiatives are not sufficient to support Action 32 | | | | **P1** | SUST |

### Benefits: Encourager

- Emission reductions: TBD
- Educational programs:
  - Improves equity of available information on energy in Saskatoon through easy-to-understand inclusions such as infographics on basic topics that are also easy to translate.
  - Local job opportunities.
- Renewable energy waste recycling:
  - Local business development.
  - Job opportunities.
  - Revenue generation from the materials recycled (depending on their market values).
  - Co-located with numerous other material recycling drop-off options (if accepted at Recovery Park).

### Cost: Encourager

- Educational programs:
  - Administrative time (1 FTE at part-time for the duration of program)
  - Communications and education programs (service providers)
- Renewable energy waste recycling:
  - Administrative time (included in Recovery Park project)

## LEC Action 33: Encourage existing ICI building owners and mandate new buildings to install solar PV systems through programming and bylaw

ICI and multi-unit residential buildings can often have large rooftops with considerable solar generating capacity potential, without the need for additional land, and the ability to use power onsite.

### LEC Target

- Install 20 MW of ICI solar capacity by 2030, 200 MW by 2050.
- Reduce a total of 1,147,000 tonnes $CO_2e$ between 2020 and 2050.

### Marginal Abatement Cost

- LEC Action 33: ($562)/$tCO_2e$

### Status

ICI customers can use the net metering of small power producer programs to generate their own electricity. There is currently no additional incentive programming targeted at this sector.

82.7% of engagement respondents somewhat or strongly supported Industrial, Commercial and Institutional, while 11.8% were neutral, and 5.5% did not support it.

27% of Environmental Awareness survey respondents identified not having control over decisions (e.g., don't own home) as the biggest barrier towards having solar panels on their homes.

## Initiatives

| INITIATIVE AND PHASE | | Phase | | | | Respon-sible |
|---|---|---|---|---|---|---|
| | | 2022–23 | 2024–25 | 2026–27 | 2028+ | |
| **LEC 33:** | **Encourage existing ICI building owners and mandate new buildings to install solar PV systems through programming and bylaw** | Install 20 MW of ICI solar capacity by 2030, 200 MW by 2050 | | | | |
| **33.1** | **Industrial, Commercial and Institutional Energy Efficiency program** | | | | | |
| **a.** | Explore options for an Industrial, Commercial and Institutional Energy Efficiency program including:<br>• education and networking opportunities<br>• rebates and incentives, and<br>• potential financing for energy efficiency and renewable energy.<br><br>The program would target larger properties and consider stakeholders who do not qualify for traditional customer self-generation programs, such as renters/tenants, income-qualified households, and local businesses not eligible under the traditional net-metering program. | **P2** | | | | SUST |
| **b.** | Implement Industrial, Commercial and Institutional Energy Efficiency programming | | **P3** | | | SUST |
| **c.** | Education programs for the Residential Energy Efficiency & Energy Generation Program sustainment | | | **P4** | | SUST |
| **33.2** | **Additional programming to meet GHG targets** | | | | | |
| **a.** | Develop business case to explore additional programming to meet equivalent GHG targets if above initiatives are not sufficient to support Action 33. | | | | **P1** | SUST |

### Benefits

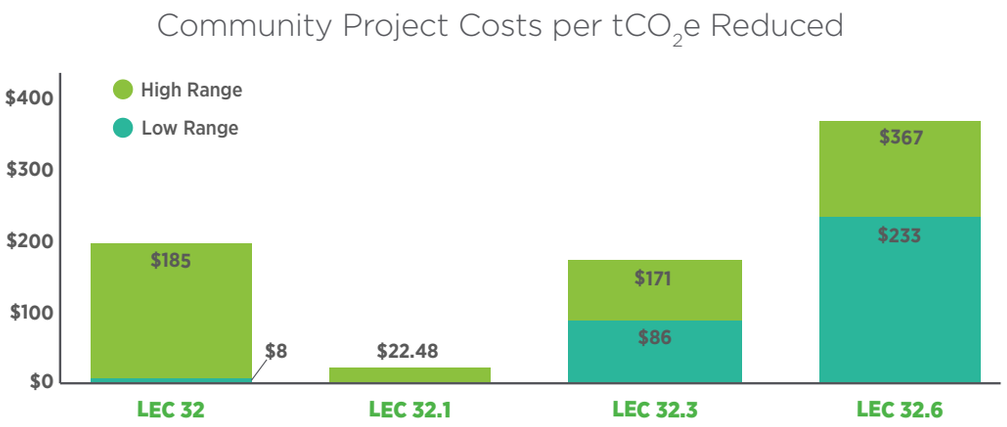
- Improves equity of participating in a renewable energy transition.
- Large ICI rooftops allow for solar access without additional land.

### Cost

- Administrative time (1 FTE at part-time for the duration of program).

## Known Marginal Abatement Costs

For the above listed Investor, Regulator, and Encourager Initiatives, the below figure shows the costs for the resident to install rooftop solar PV, with and without currently available grants as indicated by the low and high ranges, respectively. Additionally, the costs to the City per tonne of greenhouse gas emissions reduced have been estimated for three initiatives. HELP is estimated to require four years of administrative time to enable 420 participants improve their homes and reduce emissions by 1,232 $tCO_2e$ per year, for 29 years. The rebate costs were estimated assuming a range of $0.50–$1.00/W installed. For SL&P net metering rate changes, the loss of utility revenue ranges from the $0.075/kW to the current 1:1 rate, and assumes only half of the community's projects would be installed in SL&P's district.




***32*** *Install residential solar capacity (Costs to resident)*

***32.1*** *Home Energy Loan Program (HELP) (costs to City)*

***32.3*** *Residential rebates for renewable energy generation*

***32.6*** *Net metering and power producer updates (SL&P revenue loss)*

*Figure 8: Known Marginal Abatement Costs for Implementor Initiatives*

# MOVING FORWARD

Alternative Currents outlines a path forward. Through continued engagement with residents, businesses, institutions, and experts, the City will refine the initiatives in this implementation plan and seek to phase-in a coherent set of energy initiatives in the 2022–2030 period.

The initiatives outlined in this implementation plan will be pursued based on their level of readiness and overall alignment with corporate values and goals. The development of future initiatives recommended through this implementation plan will be considered holistically, ensuring:

- Siting of renewable energy projects considers potential impacts on wildlife, storm water, and micro-climate.
- Siting considers existing and proposed adjacent land uses within its assessment.
- Vacant land that is not better suited to urban development is prioritized for use in energy generation projects over developing undisturbed natural areas, farming lands, or lands with historical and cultural significance.
- Projects that include co-benefits are given due merit in decision-making.
- Procurement of renewable energy technology considers the ethics of the materials sourced as well as the availability for re-use, repurposing, or recycling at its end of life.
- All projects consider ways to address poverty and/or resolve income disparities.
- Affordable renewable energy opportunities for income-qualified housing and renters are explored once energy efficiency is addressed.
- Public engagement, both general and targeted, will be included in all major program design and planning.

## Reporting and Monitoring Progress

Progress towards the initiatives within Alternative Currents will be implemented and monitored through the Climate Action Plan program and reported to City Council through the Climate Action Plan annual Progress Report. Alternative Currents will be updated following updates to the LEC Plan. Some of the identified initiatives will extend beyond 2030, so updates to this implementation plan will reflect extended timelines and any new initiatives that are identified.

## Conclusions

As the City continues its journey in reducing energy usage through improved efficiency and better building insulation, the switch to renewable and low-emitting technology will become increasingly important for greater emissions reductions. Saskatoon has great opportunities for generating, and supporting the generation, of renewable and low-emissions electricity. Many proven technologies are continuing to improve for larger adoption.

# APPENDIX A: Renewable and Low-Emission Energy Project Comparison Tool

A tool has been developed internally to help contextualize and compare multiple renewable and low-emission energy opportunities. This tool calculates total project costs and their payback period, as well as the potential emissions savings over the project's lifetime. Calculations are based on the following assumptions:

- The financial analysis is a nominal analysis, with inflation included in the escalation rates.
- Total investment cost and operations expenses are provided in dollars for the intended first year of construction. (e.g., if the construction year is 2023, the expenses will be given in 2023 dollars, and all cash flows are discounted to 2023).
- Output is converted to present value (PV) dollars as well as expected levels of cash flows in any given year.
- Any additional funding, such as grants, is included in a project's evaluation. A range of costs with or without funding is provided if the funding is not yet secured..
- Any projects that intend to export energy to the grid will be considered at anticipated rates for both SaskPower and Saskatoon Light & Power, specific to the project's size and location (e.g., a large rooftop solar project on a municipal building within Saskatoon Light & Power's district will use the rates for Commercial Loads greater than 75 kVA).
- Project life, unless otherwise determined, will be given as the assets warranty lifetime (i.e., for solar PV systems, 30 years)
- Grid emission intensity is based off of SaskPower's forecasted intensities from 2022–2030. Grid Emissions intensity decreases 1% after 2030. *Note: with this assumption, the grid's emissions intensity does not reach 0% by 2050.*
- For city-led initiatives, capital costs on project estimations include an additional 10% for design, costs for a project manager during construction, and 20% for contingency
- If not determined at the specific site, operation and maintenance costs, including asset replacement, will be estimated as:
  - $0.01/kWh generated for ground-mount solar PV systems (based on Dundonald feasibility study).
  - $0.03/kWh generated for rooftop solar PV systems (based on 9 representative municipal solar rooftop assessments).
  - $0.05/kWh generated for residential rooftop solar PV systems.
- Interest rates used will be based on the average historical 30-year rates (3.25–3.5%).
- The carbon tax on electricity is calculated by SaskPower based on the specific mix of their power supply for the year. Carbon tax used in the tool is forecasted from previous years' tax rates and the federal governments carbon tax escalation schedule, reaching a maximum in 2030.
- No potential emissions from the installations of the systems have been included.

# ACKNOWLEDGEMENTS

Saskatoon has a diverse population with many different perspectives on renewable and low-emissions energy's role in their lives, homes and workplaces. As such, it was important to consult a variety of technical experts, internal stakeholders, and community members to ensure the Implementation Plan reflects a broad vision for renewable and low-emissions energy. The City would like to thank everyone who took the time to provide feedback and expertise.

## Project Team

**Pam Groat**
*Project Manager*

**Adir Glikson**
*Temporary Project Manager*

**Amber Weckworth**
*Project Supervisor*

**Kathryn Theede**
*Energy and Sustainability Engineering Manager*

**Gabriella James**
*Accounting Coordination*

**Kenton Lysak**
*Public Engagement Consultant*

**Megan Evans**
*Marketing Consultant*

**Megan Quintal**
*Marketing Consultant*

## Steering Committee

**Angela Gardiner**
*Utilities & Environment General Manager*
Project Sponsor

**Lesley Anderson**
*Planning and Development Department Director*

**Trevor Bell**
*Saskatoon Light & Power Department Director*

**Troy LaFreniere**
*Facilities Management Department Director*

**Russ Munro**
*Saskatoon Water Department Director*

**Jeanna South**
*Sustainability Department Director*

## Civic Subject Matter Expertise and Support

Riwaj Adhikari
Erin Akins
Michael Beal
Tyson Bull
Katie Burns
Hilary Carlson
José Cheruvallath
Kelsea Doll
Foued Dridi
Ross Elliott
Kara Fagnou
Keith Folkersen
Terry Fusco
Trista Gartner
Mallory Gellner
Sheldon Goertzen
Pam Hamoline
Laura Hartney
Sadiq Ibrahim
Warren Isbister-Bear
Melanie Laine
Cassandra Marchuk
Scott McCaig
Amanda Moffatt
Md Mohoshin
Brad Murray
Oreva Oboghor
Bibian Rajakumar
Matthew Regier
Chris Richards
Genevieve Russell
Geraldine Sadia
Mike Sadowski
Jeremy Sibley
Courtney Smith
Derek Thompson
Michelle Tomasiewicz

## Individuals from other organizations and the community

Thank you to all individuals from renewable and low-emissions energy-related organizations and businesses, and the public who took time to share their expertise and feedback.

City of Saskatoon