Annual Emissions Report - 2025

Environmental Sustainability Committee
Revision 0
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Contents

1 EXECUTIVE SUMMARY

Emissions from 2024-25 fiscal year operations were 158.8 metric tonnes of CO2e, down 4% from the previous season. The reduction arises predominantly from a more detailed analysis of staff shifts from the previous season, which showed a drop in staff commuting emissions compared with previous assumptions.

SLNC continues to make progress on long-term electrification of operations, where gasoline fueled equipment is replaced with electricity-based equipment. In 2024, SLNC installed several programmable thermostats, implemented new volunteer-developed seasonal shutdown / startup electrical procedures, electrical upgrades, and installed movable electrical receptacles to allow race teams to plug irons and rotor brushes into electrical outlets (thereby permanently eliminating use of a gasoline generator).

Presently, SLNC harvests, splits, and stores firewood in the fall. An assessment showed that if firewood was managed in a way to allow it to dry, less than half of the current amount of firewood would be needed to satisfy present heating requirements. In addition, more modern woodstoves, and a more airtight and insulated building envelope would reduce heat loss (and by inference reduce the amount of firewood needed). These latter opportunities will likely arise as a result of the lodge renewal project now underway.

In 2024, SLNC secured arrangements with the City of Vernon for weekend carpool parking, and also conducted a carpool awareness contest. Data from the contest showed that at least 67 round trips were avoided by carpooling in one month. Prorating for a full season, such carpool participation could eliminate burning of ~1,364L of gasoline (which represents 64% of SLNC's gasoline consumption).

2 INTRODUCTION

This report provides an update to past emissions reports produced by the Sovereign Lake Nordic Club (SLNC) Environmental Sustainability Committee ("Committee") [1,2], and provides our best estimates for emissions for the latest fiscal year (2024 June to 2025 May). Consistent with last year, SLNC emission levels show reductions in emissions arising from (a) overall operational improvements, and (b) more detailed analysis that refines assumptions. An assessment of these factors is included in this document.

3 OPERATIONAL OVERVIEW

As documented in the initial benchmark report [1], Sovereign Lake Nordic Club (SLNC) emissions arise from (1) diesel consumption in grooming, (2) burning of wood for heat, (3) car emissions from staff and supplier commuting, (4) gasoline consumption to operate a snowmobile, a quad, fleet vehicles, and work-related vehicle trips, brush saws, and generators, (5) production of garbage from operations and visitors, and (6) electricity consumption. Our analysis also separately reports on estimated emissions from visitors.

Measures of consumption are regularly quantified for diesel and electricity; however gasoline consumption is not recorded on a Litre basis, and firewood use, garbage and recycling volumes are not regularly recorded.

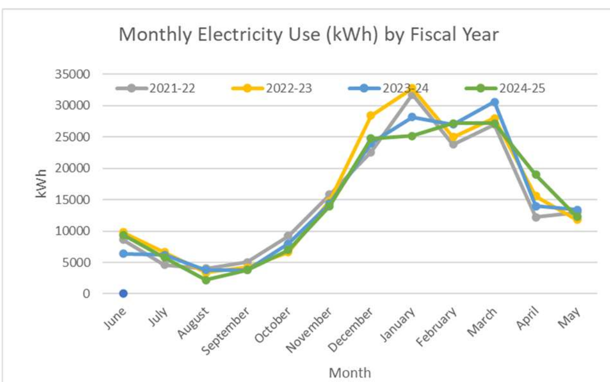
4 ANNUAL CONSUMPTION DATA AND ANALYSIS

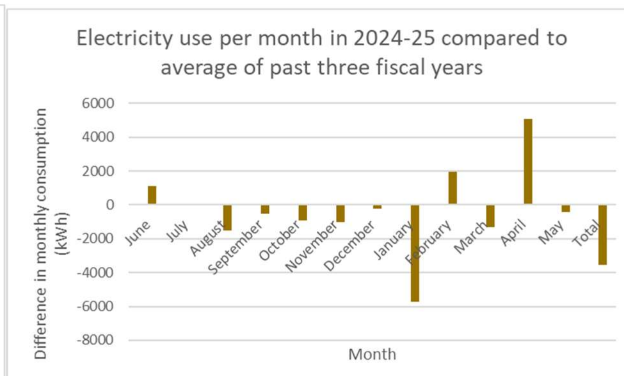
4.1 Electricity

SLNC continues to make progress on long-term electrification of operations, where gasoline fueled equipment is replaced with electricity-based equipment. It is SLNC's aim to electrify operations while reducing annual operating costs. This can be achieved by operational improvements and system upgrades that reduce annual electricity consumption in excess of the added electricity demand from new electrical-based equipment.

In fiscal 2024-25, electrical upgrades were centered around heating controls and more efficient operating procedures. Experienced volunteers conducted a walkdown of SLNC's entire operations and produced a detailed set of electrical upgrade recommendations along with seasonal shutdown/startup procedures all aimed at reducing electricity consumption. Programmable thermostats were installed in the shed (containing our PistenBullys) and in the office space in the main lodge.

Consumption of electricity is invoiced on a monthly basis and this creates a clear record of use. The first figure below illustrates monthly electricity use in kWh for fiscal years 2021-22 to 2024-2025 (earlier years had reduced consumption due to COVID-related shutdown are not comparable). The second figure shows the change in electricity consumption in fiscal 2024-25 compared to the average of the previous three fiscal years.





For fiscal 2024-25, average monthly use was 14,825 kWh[1] which was 1% lower than last year, and 2% lower than the 15,122 kWh per month average over fiscal 2021-24. Reducing consumption from last year is a good achievement, as last year's electricity use was 3.8% below the previous year (helped by a warm early season). Total energy reduction was 3,567 kWh compared to the past three years.

In August, the electrical shutdown procedure resulted in electricity usage down by over 40% for the month. This procedure alongside hardware upgrades led to monthly reductions in consumption over most of the year. Early season reductions were offset somewhat by a jump in electricity consumption in the late season, believed to be related to a large increase in visitors and more grooming due to high

[1] BC Hydro invoiced based on an estimated reading for May 2025. They subsequently revised to a lower estimate on the June invoice and provided a credit. The numbers reported here are based on downloads of raw consumption data from BC Hydro's website and represent the true usage up to the standard May invoice period.

snowfalls in the month (which led to large heat losses from open doors in the lodge and shed). When adjusting for BC Hydro affordability credits and increases in year-over-year electricity rates, the modifications produced a savings of about $2,300 in fiscal 2024-25.

4.1.1 Energy Usage Intensity

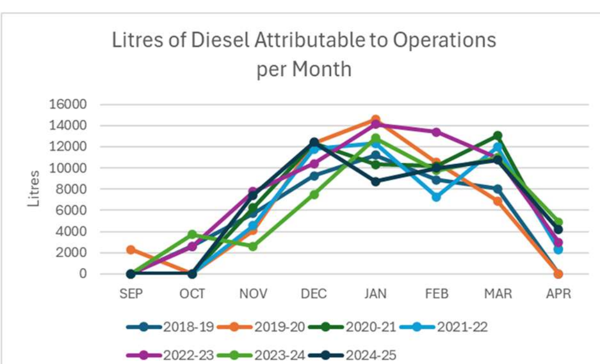
Reference [3] recommends reporting energy use per square foot of space, referred to as Energy Usage Intensity (EUI), to allow comparison against industry benchmarks. From Reference [3], we can calculate that the applicable square footage is 11,609 square feet (sf). For 2024-25, 177,900 kWh of electricity use therefore converts into 15.32 kWh/sf. This value, while improved marginally from past years, is higher than the 12 kWh/sf observed at typical ski clubs in Ontario (which have similar climates) [3], suggesting continued significant opportunity for energy efficiency improvements.

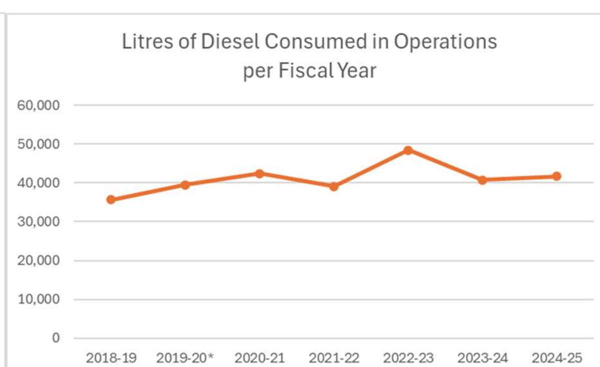
4.2 Diesel

Diesel fuel is used by the PistenBully groomers as part of daily operations. SLNC receives regular deliveries of diesel between October and April, and sells about 26% of this diesel to a local supplier that provides snow clearing services using diesel-fueled equipment. It is estimated that 15% of the diesel sold to the local supplier is used to clear SLNC parking lots and is attributable to SLNC operations. With clear records available, the volumes of diesel used to support operations can be closely calculated.

The Figures below show the net consumption of diesel attributable to SLNC operations for the past seven seasons on a monthly and annual basis. Diesel usage for 2024-25 was 41,674L, which is marginally higher than the 7 year average of 41,063L.

Overall total snowfall was similar over the past two seasons at about 5.5 metres during the season. Diesel use for operations was within 2.5% of last year, despite factors that were expected to reduce diesel consumption (namely, the unexpected departure of certain grooming staff, and use of “tactical grooming” whereby the groomers could make decisions that reduced the consumption of fuel (e.g., decision to not groom certain trails if they were still in acceptable condition following the previous day’s grooming, or if it was snowing heavily during grooming and therefore grooming would be wasted)). Analysis over the last several years shows that diesel use is essentially completely corelated to the amount of snowfall. Only a move towards more efficient models of groomers is expected to materially reduce consumption and emissions from diesel in the future.





4.3 Gasoline Used in Direct Operations

Gasoline purchase volumes are not tracked at SLNC, although the invoices for gasoline are categorized separately. Gasoline purchases between June 2024 and May 2025 totaled $3,525 for use in fleet cars (including the team van used to carpool athletes to race venues), a snow machine, a quad bike, portable generators and handheld equipment (e.g., brushsaws). In 2024-25, modifications were made to the power panel that allowed power receptacles to be available to race teams to use waxing irons and rotor brushes. This change resulted in eliminating the use of gasoline powered generators to power such equipment.

Assuming an average purchase price of $1.65/L, gasoline volume consumed throughout the fiscal year is 2,136L, which is down a further 32% from last year. This reduction reflects the benefits of focusing on limiting gasoline use and systematically eliminating gas-burning equipment from operations.

4.4 Water

Water is drawn from a well and consumed in the day lodge, tech building, and shop. Unfortunately, there is no meter to measure site water consumption. While the true volume of water consumption on site cannot be quantified, the committee has recommended that a water meter be installed as part of the lodge renewal project to provide benchmark data for future use.

4.5 Firewood

No new calculations were made in the last year regarding the use of firewood. Consequently, the site is still estimated to still burn between 11 to 14 metric tons of firewood per year[2] as described in Reference [1]. However, an assessment of the future of firewood use at SLNC was conducted by the committee as a design consideration for lodge renewal. This assessment is summarized below.

The assessment looked at whether firewood should continue to be used at SLNC and, if so, how consumption might be reduced going forward. It was concluded that firewood itself is in a closed natural cycle where carbon is absorbed during tree growth and released after tree death; such a cycle has been in place for millions of years and does not add to global carbon levels (unlike greenhouse gas emissions from one-time burning of fossil fuels). From this standpoint, use of firewood in the future is acceptable from an environmental perspective. It is noted that, from an operational perspective, firewood is essentially free fuel (notwithstanding the costs of gathering, splitting, and stacking the wood) and keeps operational costs down.

Opportunities to reduce the amount of firewood burned were identified. At present, wood is collected, split and stored in the fall, and is believed to have little opportunity to dry. Firewood that is optimally split in size and fully dried is expected to produce 50% more heat and fewer emissions. Looking at this another way, SLNC could meet the same heating needs with 50% less wood, if splitting was optimized and firewood inventory managed such that it is dried thoroughly and the driest wood is burned first. In addition, more modern woodstoves can reduce wood consumption and emissions, and a more airtight and insulated building envelope would reduce heat loss (and by inference reduce the amount of firewood needed). These latter opportunities will likely arise as a result of the lodge renewal project

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[2] 10 cords*430kg/m3*3.625 m3/cord*0.72wood/cord = 11,223 kg, 12 cords*430 kg/m3*3.625 m3/cord*0.72 wood/cord = 13,467.6 kg. [3,4]

now underway. Combined, it is expected that firewood consumption at SLNC can be reduced by at least half.

4.6 Waste

No updates were made in the last year regarding waste and recycling. Consequently, the total estimated garbage produced (using data from the 2021 study [2]) over a 150-day operating season is about 865 kg of garbage and 165 kg of recycling per season as described in Reference [3].

5 ESTIMATED EMISSIONS FROM TRAVELLING TO SLNC

5.1 Visitor Emissions

No updates were made in the last year regarding calculation of visitor travel emissions. The total emissions from visitors, as shown in last year's emissions report [2], are reproduced in the table below.

Tonnes CO_2e Emissions Attributable to Visitor Travel	
Local driving	379.9
Non-local driving	108.3
Non-local flying	618.6
Total	1,106.8

5.2 Driving Emissions from Staff and Suppliers

In the original report [1], it was estimated that there were a combined 13 trips to site per day between staff and suppliers. Over 150 operating days this produced an estimated 1950 round trips and 19.83 metric tons of CO2e per year.   A more detailed assessment was performed this year, and is described below.

A detailed review of 2023-24 staffing schedules showed that 747 staff shifts took place. About 5% of these trips are believed to be carpooled with another staff member.   Assuming an average 50km round trip and using the weighted average of 10.18L/100km [1] of gasoline per kilometer and 2.3 kg CO2e /L [1], staff commuting emissions are calculated to be 8.53 metric tons CO2e per year.

About 116 supplier trips from the Vernon area are estimated to be taken over the operating year (for such things as diesel delivery, garbage pick, etc). Delivery trucks are usually larger and use diesel fuel, resulting in higher levels of commuting emissions per kilometre than passenger vehicles. Using representative emissions data for delivery vehicles [4], and assuming trips are made directly to SLNC (i.e., they are not shared with other deliveries to Silver Star), supplier emissions are calculated to be 4.09 metric tons CO2e per year.

Thus, following a more detailed assessment, staff and supplier combined commuting emissions are calculated to be 12.62 metric tons CO2e per year.

5.3 Initiatives to Reduce Visitor Emissions

5.3.1 Carpooling

SLNC was pleased to be supported by the City of Vernon, which provided parking for carpool participants on weekends and holidays. To promote awareness, the Committee ran a carpooling contest from January 17th to February 17th. Over a month, 135 entries were received confirming that they were involved in a carpool (as either a driver or passenger). Overall, 60 different people were involved. While we don't know how many people were in each car, if we conservatively assume there was one driver and one passenger, then for 135 entries, half or 67 round trips would be avoided (note that this is the most conservative arrangement as assuming a car with one driver and 3 passengers, actually saves three round trips per drive (or 135*3/4 = 101 trips). Using a 40km round trip from the carpool lot, and gas consumption and emission factors used elsewhere in this report, in a month 0.62 metric tons of CO2e emissions were avoided by contest participants through not burning 273 Litres of fuel. Extrapolated over 5 months, this becomes 1,364 Litres of gasoline and 3.16 metric tons of CO2e emissions avoided. For context this represents 64% of SLNC's 2024-25 gasoline use (and related emissions).

5.3.2 Anti-idling signs

Two committee members donated funds to purchase four large anti-idling signs. These signs are displayed daily at the entrance to the parking lot and entrance to the lodge. While it is impossible to quantify how much idling has reduced, the instalment has boosted awareness and resulted in positive feedback.

6 2024-25 ESTIMATED EMISSIONS FROM OPERATIONS

Based on the analysis above, emissions attributable to direct operations at SLNC are summarized below (in order of decreasing contributions).

Category	Annual Consumption	Conversion Factor to CO_2e	Metric Tons CO_2e emitted per year	% of Total Operations Emissions
Diesel	41,674 L	2.7 kg CO_2e/L	112.52	71
Firewood[3]	13,500 kg	1.8 kg CO_2/kg	24.30	15
Staff & Suppliers[4]	--	--	12.62	8
Gasoline	2,136 L	2.3 kg CO_2e/L	4.91	3
Waste[5]	865 kg	2.89 tonnes CO_2/ton garbage	2.76	2
Electricity	175,000 kWh	9.9 tonnes CO_2e/GWh[6]	1.76	1
Total	-	-	158.8	100.0

[3] No new data available, so assumed the same as in previous year.
[4] Calculations now reflect differing fuels and emission rates between passenger and delivery vehicles, thus single data for consumption and conversion factors is no longer representative.
[5] No new data available, so assumed the same as in previous year.

Estimated emissions from visitors [2] are reproduced below, and account for seven times the emissions from operations.

Category	Metric Tonnes CO_2e emitted per year	% of Total Operations Emissions
Visitors	1,106.8	697%

7 PUBLIC IMPACTS ON SLNC EMISSIONS

7.1 Impact of BC Hydro Grid Electricity Green House Gas Emission Intensity Factors

SLNC draws all its power from the BC Hydro grid. BC Hydro reports its grid emission factors on an annual basis [5]. Using these emission factors and the electricity consumption at SLNC, we can calculate the annual emissions from electricity consumption. The calculated emissions are shown in the Table below for the past 3 years (note that to simplify calculation we multiplied the annual (calendar) emission factor by the fiscal year consumption at SLNC).

Year	Grid emission factor (tCO2e/GWh)	SLNC fiscal year annual consumption (kWh)	SLNC GHG emissions (tCO2e)
2022	11.5	187,000	2.15
2023	11.3	179,800	2.03
2024	9.9	177,900	1.76

7.2 Visitor Car Choices

SLNC continues to track the car choices of visitors, and the related changes in average emission profiles. An inventory of vehicle types in the two SLNC parking lots was taken on one Saturday each year over the past three years. The data are summarized in the table below.

	Count			Percent of Vehicles		
Vehicle Category	Sat 18 Feb 2023 [snowy	Sat 17 Feb 2024 [sunny]	Sat 8 Mar 2025 [overcast]	2023	2024	2025
Regular car, SUV, or Truck[7]	151	207	147	91	87	88
Hybrid	7	13	6	4	5.5	4
Plug-in Hybrid	1	4	2	1	2	1
Battery electric	7	13	12	4	5.5	7
Total	166	237	167	100	100	100
Weighted average fuel consumption (L/100 km)	10.18	9.93	9.85			

The data show that the combined number of visitors with cars that were hybrid, plug-in hybrid or battery electric, was similar to last year, although the uptrend in use of battery electric cars continues.

[7] All pickup trucks were categorized as gasoline for ease of calculation.

Using the same fuel efficiency values per vehicle type as shown in Reference [5], the slight increase in the prevalence of battery electric cars lowered average visitor fuel consumption per 100 km driven from 9.93 to 9.85 (or less than 1%). When this reduction is applied to car commuters, this change in visitor car fleet make-up represents a decrease of about 15.9 metric tons of CO2e since the first year of the study and 3.7 metric tons of CO2e since last year.

8 SUMMARY OF 2024-25 IMPROVEMENTS AIMED AT REDUCING EMISSIONS

As outlined above, SLNC completed four projects to reduce resource consumption and emissions:

1. installation of programable baseboard heater thermostats,
2. introduction of shutdown/startup procedures to reduce electricity consumption,
3. installation of power receptacles for race team use to eliminate gasoline generator, and
4. a more detailed analysis of staff and supplier trips and emissions.

Performing a more detailed analysis of staff shifts reduced the conservatism in the original estimates and produced a more accurate understanding of emissions from staff and supplier commuting. It was understood that reducing electrical consumption would have a negligible impact on emissions due to the clean sources of electricity used by BC Hydro, however such measures reduce long-term operating costs and provide capacity for electrification of operations in the future. Lastly, by eliminating the use of a gasoline generator for races, SLNC has made the next step in its plan to eliminate use of all gasoline-based trail equipment.

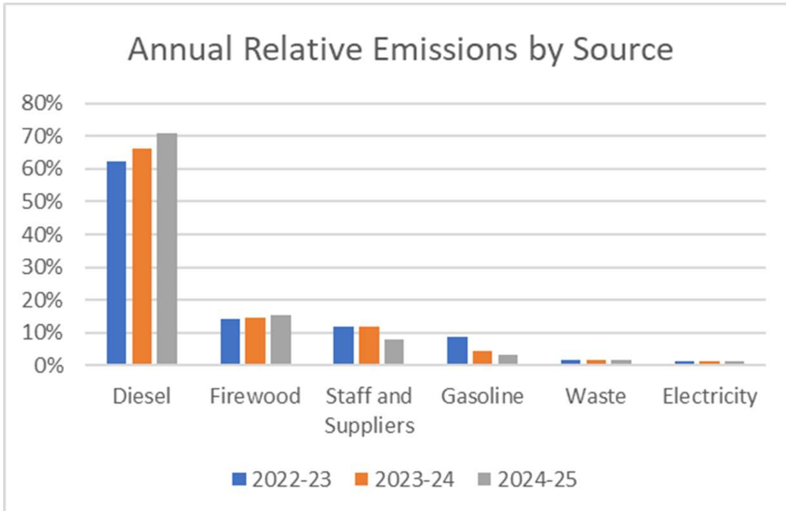
9 ANNUAL CHANGES IN SLNC EMISSIONS

Estimated emissions for the past three fiscal years are summarized by the emission source category below. Emissions are estimated to have dropped by 4% over the past year. This is primarily due to reductions in emissions attributable to staff and suppliers (by performing a more detailed analysis of staff shifts and eliminating original conservative assumptions). Emission reductions from the continued decline in gasoline consumption were fully offset by a slight increase in diesel consumption.

Category	2022-23 Metric Tons CO_2e emitted per year	2023-24 Metric Tons CO_2e emitted per year	2024-25 Metric Tons CO_2e emitted per year	Change from Last Year (%)
Diesel	130.72	109.94	112.52	+2.3
Firewood*	24.30	24.30	24.30	0.0*
Staff & Suppliers	19.83	19.83	12.62	-36.6
Gasoline	14.95	7.24	4.91	-32.0
Waste*	2.76	2.76	2.76	0.0*
Electricity	2.15	2.03	1.76	-12.9
Total	194.7	166.1	158.8	-4.4

* Not re-assessed in 2024-25

As conservative assumptions have been eliminated from calculations, it shows that diesel use related to grooming is becoming increasingly the dominating factor in SLNC's operations (see Figure below). Grooming has been identified by members as one of the most important aspects of SLNC's success and is unlikely to diminish. Total operating emissions will therefore only materially decrease with the replacement of the current 2019-era PistenBullys with newer high efficiency or electric models of groomers.



10 SUMMARY

This report compiles consumption data from SLNC operations for the past fiscal year, and compares this to past years. The following key observations have been made:

- Emissions from operations are 158.8 metric tonnes of CO2e and are down by 4% compared to 2023-24. This reduction is predominantly due to performing more detailed calculations using the number of shifts worked last season and reducing conservatism on calculated staff and supplier emissions.
- Diesel consumption was shown to be highly corelated to snowfall and is increasingly the highest source of operating emissions.
- The use of a gasoline generator to power race team equipment during major events was eliminated by installing new moveable electrical receptacles.
- Initiatives to reduce electricity use included implementation of seasonal shutdown/startup procedures and installing programmable baseboard heater thermostats. Electricity use remained comparable to last year, despite not having the same warm weather early season conditions, that have been shown to make a significant impact on consumption [2].
- There are opportunities to reduce the amount of firewood required through implementation of improved splitting and drying practices.

11 REFERENCES

[1] Sovereign Lake Nordic Centre, “Initial Benchmark Report – 2023”, April 20, 2023, Revision 0.

[2] Sovereign Lake Nordic Centre, “Annual Emissions Report - 2024”, June 17, 2024, Revision 0

[3] “Sovereign Lake Nordic Club Eco Efficiency Report”, GreenStep Solutions Inc., January 26, 2021.

[4] https://afdc.energy.gov/data 103 10

[5] Electricity Emission Intensity Factors for grid-connected entities, Province of British Columbia, Grid Factors for Integrated grid. https://www2.gov.bc.ca/gov/content/environment/climate-change/industry/reporting/quantify/electricity