

Selwyn Township: PHEV Final Report

PHEV Final Report: April 01 – July 31, 2021 (3 months)

Background

The Township received a grant from FCM’s Green Municipal Fund to cover 80% of total project costs involved in leasing a Mitsubishi Outlander plug-in hybrid electric vehicle (PHEV) for the Building and Planning Department and the installation of an electric vehicle charging station at the Township office.



The charging station was used each day to charge the PHEV during both on-peak and off-peak hours. The charging station was available for free public use however, recommended for public to use during off-peak hours.

This Final Report covers April – July, 2021 (3 months). Comparisons between the half-ton truck and the PHEV to evaluate the fuel efficiency and cost savings.

Fuel

Projected Costs & Savings

Description	Half-Ton Truck	Mitsubishi PHEV
Mileage	Average kilometers driven per year: 26,000km (Building & Planning drives up to 100km/day/vehicle = 26,000km/year)	
Average Fuel Consumption & Cost	\$1,945/year (3,890 litres). Based on Township’s 2016, 2017 and 2018 data.	If driving up to 100km per day with a 40km electric range (source: vehicle manual), the Township will use 40% less fuel on a yearly basis. 60% of \$1,945= \$1,167
Fuel Efficiency (litres per 100km)	12.8L/100km	3.2L/100km PHEV is 75% more fuel efficient than the half-tons (3.2L/100 km vs. 12.8L/100km). \$1,167/0.25= \$292
Conclusions	The Township is projected to spend about 75% less on fuel per month	

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	with the PHEV, totalling \$292 per year on fuel.
	Projected fuel savings for one year = \$1,653 (\$1,945-\$292)

Actuals: April 01– July 31, 2021

Description	Half-Ton Truck	Mitsubishi PHEV
Mileage (km)	<p>Mileage (April – July 2021) = 7,218 km</p> <p>Previous Mileage: Sept – Dec 2020 = 3191 km Dec 2020 – Mar 2021 = 3406 km</p> <p>Total Mileage = 13,815 km</p>	<p>Mileage (April – July 2021) = 4,762 km</p> <p>Previous Mileage: Sept – Dec 2020 = 6671 km Dec 2020 – Mar 2021 = 5450 km</p> <p>Total Mileage = 16,883 km The PHEV used electricity to power the vehicle approximately 30% of the time, driving 12,121km using electricity and 4,762km using fuel.</p>
Fuel Consumption (L) & Cost (\$)	<p>Fuel Consumption (April – July 2021) = 527.60L</p> <p>Fuel Cost (April – July 2021) = \$564.68.</p> <p>Previous Fuel Consumption: Sept – Dec 2020 = 243L Jan – Mar 2021 = 375L</p> <p>Total Fuel Consumption = 1,146L</p>	<p>Fuel Consumption (April-July 2021) = 108L</p> <p>Fuel Cost (April – July 2021)= \$115.59</p> <p>Previous Fuel Consumption: Sept – Dec 2020 = 245L Jan - Mar 2021 = 98L</p> <p>Total Fuel Consumption = 451L</p>
Fuel Efficiency (L/100km)	<p>Half-Ton consumed a total of 528L of fuel to drive 7,218km, performing at a fuel efficiency of approximately 7.3L/100km. However, this is lower than the ideal fuel efficiency for a truck and therefore we will use 12.8L/100km for comparisons.</p>	<p>PHEV consumed a total of 108L of fuel to drive 4,762 km, performing at a fuel efficiency of approximately 2.2L/100km. However, this is lower than the ideal fuel efficiency for a truck and therefore we will use 3.2L/100km for comparisons</p>
Conclusions	<p>Fuel Efficiency: The PHEV is more fuel efficient than driving a half-ton truck. If the half-ton truck was only fleet vehicle, the additional 4,762 km (driven by the PHEV from April to July 2021), would have increased the</p>	

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	amount of fuel consumption to approximately 610L (4762km/100km x 12.8L/100km). This would have increased the cost to \$549. Therefore, since September 2020 the Township has saved approximately \$433.41 in fuel by driving the PHEV.
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Vehicle Maintenance Costs

Projected Costs & Savings

Description	Half-Ton Truck	PHEV
Maintenance	The typical annual maintenance costs for a half-ton vehicle are est. to be \$630.50 (based on 2016, 2017 and 2018 data for one vehicle).	The average maintenance cost of a Mitsubishi PHEV in its first year is \$225 (3 oil changes). The first is subsidized by Peterborough Mitsubishi subsidized the first oil change and after that oil changes cost \$75/each, totalling \$150 for the year. Peterborough Mitsubishi also covers tire rotation.
Conclusions	Projected maintenance savings for one year = \$405.50	

Actuals- April 01–July 31, 2021

Description	Half-Ton Truck	PHEV
Maintenance	Average maintenance cost (2021)= \$89.71 Previous Maintenance Costs: 2020 = \$353 Total maintenance cost = \$1,160.42	Oil change (July 2021) = \$78.83 Safety inspection (July 2021) = \$98.00 Total maintenance cost (April – July 2021) = 176.83 Previous Costs: Oil change (completed September 2020) = \$81.20 Total maintenance cost = \$258.03
Conclusions	Cost Savings = \$89.70 (maintenance cost for half ton truck) – \$176.83 (maintenance for PHEV) = \$630.59 cost savings in maintenance fees with the PHEV	

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Results Summary

The PHEV resulted in fuel savings as it consumed less fuel compared to the half-ton truck. The fuel efficiency for the PHEV is also better; getting approximately 3.2L/100km. The PHEV is 75% more fuel efficient than the half-ton truck based on the ideal fuel efficiency for the PHEV and the half-ton truck. The maintenance costs for the PHEV (\$176.83) are higher than the maintenance cost for half-ton truck (\$89.71), however, this included a safety inspection for the PHEV which was not required for the half-ton truck. Overall, staff like driving the PHEV and it represents Selwyn Township's commitment to the climate action plan to support a green fleet.

Charging Station Usage & Costs

Summary

From April 01, 2021 – July 31, 2021 the total kilowatt hour usage for the Township Office Charging Station was **612.12 kWh**. On average, each charging session for the PHEV consumes **6.9 kWh** of electricity.

Approximately a total of **1691.45 kWh** has been consumed through charging the PHEV and public vehicles from September 2020-July 2021.

Charging Station Installation

Projected cost: **\$4,900**

Actual Cost: **\$5,883.76**

(\$3,612.48 for the charger + \$2,271.28 for installation)

Over budget: **\$983.76**

Additional Expenses

EV charging station sign= \$33.90

Vehicle decals =\$103.96

Total additional expenses = **\$137.86**

PHEV Charging Methodology

Using its timed-charging function, the Mitsubishi Outlander PHEV was programmed to only charge during off-peak hours between 7pm and 7am (8.5 cents/kWh). Staff would connect the vehicle to the charger at the end of the day and it would follow the time-charging schedule. Hydro One charges 11.9 cents/kWh during mid-peak hours and 17 cents/kWh during on-peak hours.

The public used the EV charger once from April – July, 2021 costing approximately \$10.00 (5.93 kWh x 0.017).

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Staff anticipates public charging will increase as more electric vehicles become a viable option for passenger vehicles.

Public Education

As part of the public education component of this pilot, content was developed for the Township website on the benefits of electric transportation and to promote the FCM-funded PHEV pilot and free charging station at the Township office. As well, the PHEV was showcased at the EV Society's Event on August 29, 2021 at the Isabella Morris Park in Lakefield, ON.

For more details visit: [Electric Vehicle Public Education](#) on the Selwyn Township website.

User Observations

Seasonal Driving Range

Warmer months: approximately 35km

Colder months: approximately 25km

Average Range: approximately 30km

Cold weather driving

- 1) **Diminished Electric Range:** During the summer/fall a full charge would indicate an electric range of 40km. Utilization of the air conditioning system did not indicate any change to the electric range. Thus far winter use has shown a reduced electric charge range to approx. 30-35km with a full charge.
- 2) **Effects of Heating System:** The need to run the heating system automatically reduces the electric range by 10km. This translates to a full electric charge range of between 20-25km after a full charge.
- 3) **Charge Port:** By design the charging port is susceptible to the elements (as they're not in a covered environment). As such there are times where the charging cable has been covered in ice and frozen in place to the port. It has also meant a build-up of ice in the charging bay which has resulted in the charging port cover/door not being able to close properly.



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Optimizing Use of the PHEV

The following strategies are utilized by Township staff to optimize use of the PHEV, reducing costs and environmental impact.

Seat and steering wheel warming functions: these functions use less power than heating the whole vehicle cavity if there is just one occupant. However, this did not provide for sufficient comfort on very cold days.

Regenerative braking: to capture energy and recharge the battery, a function especially effective when driving downhill.

Eco Mode. reduces power allocated to heating and cooling units and the driver reviewed how effectively they utilized Eco Mode at the end of each trip.

Battery save mode: reserves the use of remaining power for more appropriate conditions, and **battery charge mode** allows the driver to boost battery capacity for long inclines and tough conditions.

Mitsubishi Outlander PHEV App: Building and Planning staff downloaded an app with allowed them remote control over the vehicle. Using the app they started the vehicle a few minutes before driving it so that the ice and snow would melt from the charging port making it easier to disconnect.

Design Flaws

The driver side door seal is not the best. As such, water makes its way through the door and collecting/solidifying as ice at the base of the door in the winter months. This frequent ice buildup makes it quite difficult to open the door or open the door far enough to get in.



The driver-side door is slightly dented at the base near the front that catches the frame of the vehicle when the door is opened and closed. At times this limits how wide the door can open making it difficult to get in and out of the vehicle.



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Conclusions & Recommendations

Township staff have consulted with professionals and EV enthusiasts as well as conducted their own research on possible EV options for the Building and Planning Department.

The Mitsubishi Outlander PHEV was a suitable choice for the department when the pilot began, due to its all-wheel drive capabilities and range of dashboard features. However, the vehicle has exhibited some design flaws, has a lower-than-expected electric range in the winter months, and is a larger vehicle than is necessary for the department.

FCM extended the funding agreement until August 1st, 2021 when the PHEV lease with Peterborough Mitsubishi is over.

Township Electric Vehicle Strategy

Buy-out the Mitsubishi Outlander PHEV for \$28,000.00 plus HST, safety certificate, admin, and licence transfer. Staff feel this represents very good value and would accomplish the primary goal of the Corporate Green Fleet Strategy in the Township's Climate Change Action Plan, to begin transitioning the municipal fleet to electric.

The next vehicle purchase in 2022 could be a fully electric vehicle plus an additional charging station. At this time, it is likely there will be more electric vehicles available in the Canadian market as well as funding and incentive programs for electric vehicles and EV infrastructure.

Recommended Strategy for Continuing to Transition the Township Fleet to Electric

If the Township wants to promote the viability of fully electric vehicles, consideration should be given to purchase a fully electric vehicle for the next vehicle purchase (dependant on department vehicle requirements).

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