Electric Vehicle Feasibility Study Requirements

The following requirements detail the outline and mandatory content of a Feasibility Study for the Electric Vehicles for Municipalities (EVM) program.

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MCCAC
Municipal Climate Change Action Centre

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1.0 Introduction

1.1 Purpose

As a component of the Electric Vehicles for Municipalities (EVM) program, municipalities can receive financial support to conduct a Feasibility Study of incorporating electric vehicles (EVs) into their fleets. This EVM Feasibility Study Requirements document provides guidance on the requirements for a Feasibility Study to ensure municipalities receive high-quality reports that help to inform fleet electrification decisions. Please note that the provisions in this document outline the minimum level of rigor required.

The purpose of performing a Feasibility Study with quantified greenhouse gas emissions reductions and energy savings is to provide the Municipality accurate estimates of the cost, energy savings, and greenhouse gas reductions needed to inform their decision-making related to transitioning to an electric vehicle fleet.

1.2 Definitions

Baseline: the "baseline" case describes the utilization, energy, and cost characteristics of the vehicle fleet in its current state. The baseline should be a fair representation of norming operating conditions for each vehicle.

Electric Vehicle (EV): a vehicle that is powered entirely or partially by an electric powertrain with a battery that can be recharged by plugging into the grid.

Battery Electric Vehicle (BEV): an EV that is entirely powered by an electric powertrain with a battery that is recharged by plugging into the grid and has no combustion engine.

Plug-in Hybrid Electric Vehicle (PHEV): an EV that is partially powered by a battery that is recharged by plugging into the grid and that also has a combustion engine that can provide additional electrical or mechanical power.

Hybrid Electric Vehicle (HEV): a vehicle that is powered by a combustion engine that is combined with an electric motor and battery but that cannot be recharged by plugging into the grid. Liquid fuel is the only source of energy for this type of vehicle. Hybrid electric vehicles are **considered out-of-scope for this program and should not be included within a Feasibility Study.**

Electric Vehicle Charging Stations (EVCS): electrical equipment that is used to provide electrical power to an EV to charge the vehicle's battery.

2.0 General Requirements

2.1 Pre-Qualified Consultants

In order for a Municipality to receive a rebate, their Feasibility Study must be completed by a pre-qualified Consultant who appears on the MCCAC's Pre-Qualified Consultants list. Pre-Qualified Consultants have been approved by MCCAC to offer services through the EVM program. Pre-Qualified Consultants must be qualified professionals, such as a Professional Engineer (P. Eng), a Certified Energy Manager (CEM), or a Certified Energy Auditor (CEA).

Consultants interested in pre-qualifying to offer Feasibility Studies through EVM may review the Pre-Qualified Consultant Requirements and send a submission to contact@mccac.ca for review.

2.2 Feasibility Study Scope

The scope of the Feasibility Study should be clearly defined and agreed upon with the participating Municipality prior to the Feasibility Study commencing. Pre-Qualified Consultants work with the Municipality to ensure the Feasibility Study satisfies the Municipality's needs, requirements, and expectations. The Feasibility Study scope must include, but is not limited to, the focus area within the Municipal fleet, the types of vehicles, the number of baseline vehicles to be included, the EV Charging Station requirements (Level 1, 2, 3, or other), and the goals of the Municipality, and the available Municipal budget to incorporate EVs into the fleet.

2.3 Assumptions

Fuel and Electricity Costs

A Feasibility Study should base fuel cost estimates on the average fuel price (either diesel or gas as appropriate for any given vehicle) over the past 12 months based on Statistics Canada Table 18-10-0001-01. Reasonable adjustments may be made to this price to account for such factors as geography, provided assumptions are clearly stated and justified. Electricity costs should be provided based on the fleet's actual electricity rate schedule, accounting for costs attributable to incremental energy consumption and incremental peak load.

EV Model GHG Analysis

For light-duty passenger vehicles, the EV ratings should be based on the most recent version of the NRCan EV Information Guide. For establishing baseline consumption data, consumption ratings should be based on the most recent version of the NRCan Fuel Consumption Guide.

For vehicles that are not included in either guide, Consultants should leverage the best consumption data available. This may include, but is not limited to, reviewing existing case studies or manufacturer claims for a given vehicle, applying judgment to the appropriateness of the information, and whether adjustments are warranted to predict real-world performance in a given application.

Any other assumptions, data, and calculation methodology used in the Feasibility Study, beyond what is listed here, must be clearly explained and sourced.

2.4 Emissions Factors

To ensure a consistent approach to evaluating greenhouse gas (GHG) emissions savings, Consultants must use the following emissions factors (EF) for each fuel/energy type:

Fuel/Energy Type	Emissions Factor
Gasoline	2.3×10^{-3} tonnes CO_2eq/L
Diesel	2.7×10^{-3} tonnes CO_2eq/L
Propane	1.5×10^{-6} tonnes CO_2eq/L
Natural Gas	1.9×10^{-6} tonnes CO_2eq/L
Electricity (generated in Alberta)	6.4×10^{-4} tonnes CO_2eq/kWh

For any other applicable emissions factors or global warming potentials emission factors, please refer to the Carbon Offset Emission Factors Handbook.

3.0 Establish Baselines

3.1 Baseline of Existing Fleet

The Feasibility Study should begin with an assessment of the Municipality's existing vehicle fleet. This is essential to determine the best opportunities for replacement with electric vehicles. The Feasibility Study should identify the greatest impact in terms of emissions and cost savings while still meeting the operational requirements of the fleet.

The Feasibility Study does not need to cover every vehicle in the fleet. The study can focus on a subset of the fleet identified as potentially suitable for replacement with electric vehicles. The study may include consideration for vehicle replacement cycles or other logistical considerations. The Feasibility Study should clearly state why certain vehicles within a fleet were excluded from the study.

The baseline assessment should capture the following details for each vehicle:

- Vehicle make, model, and year
- Vehicle type (e.g. passenger car, pickup truck, refuse truck)
- Engine displacement and fuel type
- Vehicle age (years)
- Vehicle odometer reading (lifetime distance driven)
- Annual distance driven (km)
- Annual fuel consumption (L)
- Annual fuel cost ($)
- Annual maintenance costs ($)
- Usage profile (a description of typical driving conditions such as highway, city, stop & go driving, significant amount of idling, requirements for towing, or other)

4.0 Estimating EV Costs and Savings

A key result of the Feasibility Study will be an estimation of the likely costs and savings involved with incorporating EVs into the Municipality's fleet and a comparison of the findings to the baseline. An estimated timeline identifying all the required tasks to complete the project should be clearly outlined.

4.1 EV Model Options and Costs

The Feasibility Study will identify available models of vehicles that may be suitable for deployment in the Municipality's fleet. For each identified model, the following details should be provided:

- Vehicle make, model, and year
- Vehicle type (e.g. passenger car, pickup truck, refuse truck)
- Vehicle powertrain type (e.g. BEV or PHEV)
- Charging requirements
- Vehicle cost
- For BEVs:
    - Battery energy capacity (kWh)
    - Electric motor output power (kW)
    - Rated energy consumption (kWh/100km)
    - Rated driving range (km)

- For PHEVs:
    - Battery energy capacity (kWh)
    - Electric motor output power (kW)
    - Combustion engine displacement and fuel type
    - Rated electrical energy consumption (kWh/100km)
    - Rated electric driving range (km)
    - Rated fuel consumption (L/100km)[1]

4.2 EV Charging Infrastructure

The Feasibility Study should include a high-level logistical analysis and description of the proposed approach for installing new EV charging infrastructure. This should include a general description of the parking areas targeted for installation and the proposed type(s) and models of EVCSs to be deployed. The study should also include a high-level assessment of the available on-site electrical capacity and whether the site will require capacity upgrades and/or an EV charging load management system given the increase in electrical demand and electricity costs.

[1] Given the variability in PHEV operating modes

4.3 EV Operational Costs and Emissions Savings Requirements

The Feasibility Study should provide an estimate of the potential cost and emissions savings for the EVs proposed for adoption into the Municipality's fleet. These calculations should be based on the consumption ratings of the proposed EVs and the actual consumption of the baseline vehicles.

For each proposed replacement, the Feasibility Study should highlight:

- **Annual fuel savings and cost:** This will be a comparison between the fuel consumption of the baseline vehicle and any fuel consumption of a proposed replacement vehicle in the case of PHEVs (based on an estimate of the percentage of electric versus fuel-mode driving).
- **Annual Electricity Consumption and Cost**: This will be based on the electrical energy consumption of the proposed EV (including an estimate of the percentage of electric versus fuel-mode driving for PHEVs) accounting for both energy and demand charges.
- **Maintenance Savings:** At minimum, this should account for any reduction in brake maintenance and a reduction (PHEVs) or elimination (BEVs) of oil changes.
- **Usage Profile:** Account for any factors that may impact savings estimates, such as the operation of the vehicles included in the baseline assessment and how these may affect the estimated consumption ratings of the proposed EVs.
- **Lifetime Cost Savings**: This will be based on the incremental cost of the proposed EV compared to the baseline vehicle, the net annual cost savings, and a reasonable estimate of the useful life of the vehicle. Cost savings should be calculated both with and without the financial support provided by this program.
- **Payback Period**: Calculate the number of years of annual cost savings required to recover the initial incremental cost of the EV, both with and without the support of the incentive provided by this program.
- **Net GHG savings**: Based on the emissions factors for electricity and fuel types in Section 2.4, the Feasibility Study should provide a net GHG savings analysis on both an annual and a vehicle lifetime basis.

5.0 Final Recommendation

The Feasibility Study should end with a final recommendation summarizing recommendations for changes to the municipal fleet and existing infrastructure for charging EVs. A statement regarding the scope of the project and comparison to the baseline fleet should be provided along with the rationale behind the recommendations for EV vehicles and the vehicles to be replaced. The study should summarize all costs and cost savings measures, GHG emissions savings, and energy efficiency improvements mentioned above and interpret the most optimal approach for fleet electrification based on a municipally-tailored usage profile.

6.0 Summary of Required Feasibility Study Contents

The following table provides a reference guide outlining the core sections and subsections of a Feasibility Study and the key information that must be included in each section. Additional information, figures, and tables can be included as required.

Note: The Feasibility Study must also include all data and calculations as described in the sections above that may not be summarized in this table.

Section	Report Content
Executive Summary	• Brief description of report and analysis Summary tables • Energy Savings and GHG Reductions Summary Table • Financial Analysis Summary Table
Background	Quantification team: • Team members and qualifications • Date of study and site visit(s), if completed Scope definition: • Identifies the Municipality's needs, requirements, budget constraints, and electrification goals • Must be agreed upon with the participating Municipality prior to the Feasibility Study commencing Description of the EV site and municipal fleet: • Physical description including: number of vehicles identified for replacement, vehicle type, parking lot zones targeted for installing EV Charging infrastructure, proposed type(s) and models of EVCSs to be deployed, available on-site electrical capacity, and whether electrical infrastructure upgrades are needed
Baseline Analysis	Measure baseline: • Include baseline vehicle list of details from section 3.1
EV Project Summary	*For each individual EV include:* EV description: • Description of each EV: specifications, efficiency, expected service lifetime, cost, and charging station required to operate vehicle (see section 4.1) • Description of any changes to operational usage parameters or electrical load profiles due to EV replacement and EV charging station installation Energy and GHG performance: • Baseline vehicle's average annual fuel consumption (L)

Section	Report Content
	• EV annual energy use (kWh) • Annual energy savings after upgrading baseline vehicle (kWh or GJ) • Annual emission reductions (tonne CO_2e) • EV simple payback (years)
Project Energy Savings Summary	EV summary: • A table summarizing the annual energy use and energy and cost savings for each baseline vehicle and EV from the section above (for quick comparison) • A table summarizing the project-lifetime energy and cost savings for all EV replacements Project totals • Total annual energy and cost savings • Total energy savings and costs over EV life (7 years)
Project GHG Emission Reduction Summary	EV summary: • Table summarizing the annual and project lifetime GHG emission reductions for each EV replacement Project totals: • Total annual GHG emission reductions • Total GHG emission reductions over project lifetime (7 years)
Financial Analysis Summary	Project cost-effectiveness totals: • The simple payback life-cycle cost for the project Project capital cost: • Total estimated capital cost for each EV and all accompanying EV Charging Stations (including equipment and installation) • Total capital cost for the project • Requested funding for the project under EVM
Final Recommendation	Recommendations including: • A comparison to the baseline fleet with rationale behind EV replacement choices and vehicles to be replaced • A summary of all costs and cost savings measures, GHG emissions savings, and energy efficiency improvements • An interpretation of the most optimal approach for fleet electrification based on a municipally-tailored usage profile

Contact Us

Questions about the EVM program may be directed to:

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