Regional District of
Kootenay Boundary

REGIONAL DISTRICT OF KOOTENAY BOUNDARY

ELECTRIC VEHICLE AND INFRASTRUCTURE STUDY

Date: November 30, 2020

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FCM Project Completion Report

GMF number	16869
Name of lead applicant (municipality or other partner)	Regional District of Kootenay Boundary
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Date of the report	November 30, 2020

1. Introduction

a) Who was involved in doing the Feasibility Study, and what are their affiliations? Please include name, title and contact information. Those involved could include municipal staff, engineers and other consultants, a representative from a non-governmental organization, and others.

The following individuals were involved in the production of the Regional District of Kootenay Boundary Electric Vehicle and Infrastructure Study.

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2. The Feasibility Study

a) Describe the process that you undertook to make this feasibility study a reality, from concept, to council approval, to RFP, to final deliverable.

- The RDKB Fleet Vehicle Replacement policy recognizes the role the Regional District can play in reducing greenhouse gas emission from its fleet. The policy states the RDKB shall utilize a green vehicle purchasing strategy wherever possible in the replacement of light or passenger vehicles. The aim is to support the RDKB's corporate goal to be carbon neutral.
- The current RDKB Board approved the 2019 RDKB Corporate Greenhouse Gas Reduction Action Plan where the RDBK fleet was identified as area of focus for greenhouse gas reduction.
- Electric Vehicle Awareness and Test Drive Session - On the October 29th 2019, an electric vehicle awareness session was held at the RDKB Trail Office. This involved an introduction to EV presentation and the opportunity to test drive a battery electric vehicle. Around 20 staff participated in the awareness session and / or the test drive.
- Following this session, the RDKB explored the opportunity of purchasing a battery electric vehicle as part of the fleet replacement schedule. This included review of different electric vehicles vs RDKB requirements, the operating and maintenance costs of BEV compared to existing fleet vehicles and potential greenhouse gas savings.
- The RDKB Board approved funding for the installation of level 2 charger and the allocation of additional funds toward the purchase of the RDKB first fleet electric vehicle.
- An Electric Vehicle induction was introduced to creating driver awareness and orientation to new RDKB electric vehicles.

The RDKB created EV infrastructure study project

- An internal project steering group was established for the project.
- The RDKB Board approved the funding for the EV infrastructure study and the submission of the FCM grant application.
- The RDKB prepared a Request for Proposal (RFP) for the EV infrastructure study (study). The RFP outlined a phased implementation approach of EV charger for each site based on an initial EV roll out schedule.
- The steering group evaluated the proposals and conducted reference checks. AES Engineering was selected to undertake the study.
- AES Engineering team undertook an initial study and concept design that included sites visits, analysis of the charging requirements and each site's electrical capacity, developed concept design options and undertook a cost comparison for the options.
- Once the initial study was completed, the steering group selected the preferred option for each site recognizing the charging requirements and capacity were different for the two sites.
- AES Engineering undertook detailed design based on the preferred option for each site and a phased implementation approach.

Low Carbon Fleet Management Plan

- In parallel a Low Carbon Fleet Management Plan was developed that looked at RDKB fleet, existing and emerging vehicle technologies, technology maturity and timeframes. This assisted in the development of the passenger and light duty trucks EV roll out plan at each office and phasing EV infrastructure installations.
- Lunchtime learning session on Low Carbon Fleet Management Plan and emerging transport technologies was held.

An employee survey was conducted to understand know more about employees experience using the RDKB Electric Vehicles and EVs outside of work.

The RDKB has recently purchased two additional electric vehicles.

b) What were the objectives of the Feasibility Study (what was it seeking to determine)?

The key objective of this study was to examine how the RDKB could install electric vehicle charging infrastructure in a cost effective manner, enabling the expansion of electric vehicles in the RDKB fleet and reduce its fleet greenhouse gas emissions. The study included the cost optimization of infrastructure for rural travel distances, which can be shared with other local governments and organizations.

In summary, the study:

- Determined charging requirements for range of different user profiles across light duty fleet including regular rural trips;
- Determined upgrade and infrastructure requirements at key site that can then inform roll out at other facilities;
- Examined the charging load management and load sharing systems option to optimize infrastructure costs.

c) What approach (or methodology) was used in the Feasibility Study to meet these objectives?

The RDKB engaged AES Engineering to undertake the infrastructure optimization study and design. The approach taken by AES was to:

- Review the RDKB's existing electrical infrastructure at the Trail and Grand Forks offices. This included site visits to both offices;
- Analyze charging requirements including trip analysis and vehicle usage;
- Evaluate each office's electrical capacity and potential EV infrastructure demand;
- Develop a number of high level design EV charging options and associated electrical upgrades to meet trip profiles, future charging requirements, fleet parking layout and electric infrastructure requirements;
- Undertake a cost comparison of the options with included different combinations of load sharing and dedicated EV charging.

d) Please describe any public consultations conducted as part of the Feasibility Study and their impact on the Study.

The RDKB undertook a staff survey to understand more about people's experience using the RDKB Electric Vehicles and EVs outside of work. It asked about their driving experience in an EV, what they saw as the benefits and the barrier and if they would purchase one in the future.

The RDKB had 19 responses with 95% saying they would purchase an EV in the future. Most had driven a battery electric or hybrid electric vehicle including the RDKB fleet EVs. The main items that surprised people when they drove the EVs was the car's handling, acceleration and power. Next was how far the car could travel however charging and running out of power were the key concerns.

The key benefits identified were:

- Environmental and a reduction in greenhouse gas emissions
- Reduction in fuel costs and maintenance costs
- Eco-brand and demonstrating leadership

The key concern was charging and drive range on the vehicle including running out of power and longer roads trips requiring some pre-trip planning. The other barriers and concerns raised were:

- Purchase price of electric vehicles and re-sale value;
- Limited all wheel drive and 4x4 options especially when driving through snowy mountain passes;
- How EVs operate in cold conditions;
- Battery replacement and disposal.

No other consultations were conducted as part of the Study.

3. Feasibility Study Findings and Recommendations

a) What were the environmental findings related to the options explored in the Feasibility Study? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

The electrification of the RDKB fleet vehicles will reduce greenhouse gas emissions, displace gasoline consumption with electricity consumption and reduce air contaminant emissions from the combustion of fossil fuel.

The RDKB anticipates the replacement of five general and building inspection fleet vehicles with battery electric vehicles will reduce greenhouse gas emissions by around 17.3 tCO2 each year and reduce gasoline consumption by 8,190 litres per year.

Emissions savings over (kgCO2)	Hyundai Kona Electric[1] 2020	Ford Escape SE 2020	Ford 150 2020
Fuel efficiency (L/100km)		8.19	12.57
7 year life (kgCO2)	2,114	26,354	40,456
Gasoline consumption - 7 year life (litres)		11,466	17,598

Assumption: Vehicle life 7 year and 20,000 km per year

It is anticipated that the replacement of 5 fleet vehicles that travel 20,000 km per year over a 7 year would reduce:

- Greenhouse gas emissions by 121 tCO2

[1] CAA Driving Costs Calculator https://carcosts.caa.ca/

- Gasoline consumption by 57,330 litres.

b) What were the financial findings related to the options explored in the Feasibility Study (for example, results of a cost-benefit analysis, financial savings identified, and so on)? Please provide quantitative results and summary tables of these results (or the page numbers from the Feasibility Study report).

The below tables outline the EV infrastructure conceptual design options and associated electrical upgrade for the Trail and Grand Forks office.

	Dedicated	2-Share	3-Share	4-Share	No. Circuits
Trail Office (plus 6 E-bike 120V chargers)					
Option 1 - 18 Stalls, 34kVA	0	2	2	14	6
Option 2 - 22 Stalls, 45kVA	0	4	4	14	8
Option 3 - 22 Stalls, 117kVA	22	0	0	0	22
Option 4 - 38 Stalls, 177kVA	38	0	0	0	38
Preferred Option - 16 Stalls, 67kVA	0	8	0	8	6
Grand Forks Office					
Option 1 - 7 Stalls, 18 kVA	0	2	1	4	3
Option 2 - 10 Stalls, 28 kVA	0	6	0	4	4
Option 3 - 13 stalls, 80kVA	13	0	0	0	13
Preferred Option - 6 stalls, 27 kVA	2	4	0	0	4

Following are indicative cost estimates for the conceptual design options outlined:

Options	Cost		
	Electrical	Chargers	Total
Trail Office			
Option 1 – 18 Stalls	31,754	81,000	112,754
Option 2 - 22 Stalls	35,061	99,000	134,061
Option 3 - 22 Stalls	70,081	99,000	169,801
Option 4 - 38 Stalls	102,699	171,000	273,699
Grand Forks Office			
Option 1 - 7 Stalls	23,038	31,500	54,538
Option 2 - 10 Stalls	25,495	45,000	70,495
Option 3 - 13 Stalls	41,880	58,500	100,380

The costs indicated represent supply and installation of electrical infrastructure for the various options. The cost values do not include escalation or GST and are valid for 2020 and are in Canadian dollars.

Dedicated circuits require significant electrical system infrastructure accommodate the electrical load and dedicated wiring to each electric vehicle supply equipment (EVSE). As noted above, this increases the electrical upgrade and installation costs. Performance is typically higher than other configurations, as there is no impact from other EVSE.

Multiple EVSE on an electrical circuit i.e. 2-share (or 4-share) means there are two (or four) chargers on one electrical circuit. The use of share circuits and associated load management systems reduces the electrical infrastructure costs and reduced electrical demand and associated utility demand charges. This is applicable at the Trail office however not at Grand Forks office.

Refer to page 19 of the Study for further details on the options analyzed and the associated infrastructure costs.

c) Based on the environmental and financial findings above, what does the Feasibility Study recommend?

There are two elements of the infrastructure installation which impact on initial and overall costs are:

- Electrical infrastructure – this can be installed either 1) in phases, however increases the overall costs and complexity of the installation, and disrupts building users for a longer duration; or 2) at once, reducing cost and complexity.
- EV Supply Equipment (EVSE) - Coordinating the EVSE installation to charging infrastructure demand levels will decrease initial costs.

Refer to page 22 of the study

The study recognized that the charging requirements at the two sites were different. The fleet vehicles based at the Grand Forks office travel longer distances e.g. 100-400 km daily, and more frequently to provide services across the Boundary area within RDKB region.

The Trail office has a greater number of fleet vehicles based at the office. These vehicles have an average daily trip length of between 10 – 100 kms with about 24% of general fleet vehicles trips from Trail to Grand Forks.

Trail office – it was recommended to install electrical infrastructure and EVSE for 14 fleet parking stalls, 2 employee stalls, and 2 visitor stalls. Charging performance analysis indicates that a 4-share (4 chargers on a 40A circuit) would prove sufficient for the fleet vehicles.

The electrical infrastructure costs were estimated to be $31,754 and the EVSE costs at $45,416, although it would not be necessary to purchase all chargers initially. The EVSE installations can be coordination with the delivery dates for the EVs.

Grand Forks office – it was recommended to install electrical infrastructure and EVSE for 4 fleet parking stalls and 2 employee / staff stalls. Due to limited information on fleet

trip distance on consecutive days and the need to upgrade the electrical service combinations of 2 dedicated chargers for fleet and 2-share for the others.

The electrical infrastructure costs were estimated to be $23,038 and the EVSE costs at $31,500. The EVSE installations can be coordination with the delivery dates for the EVs.

4. Lead Applicant's Next Steps

a) Taking the Feasibility Study's recommendations into account, what next steps do you as the municipality plan to take? What potential benefits or internal municipal improvements would result from these next steps?

The RDKB now has a clear roadmap of electrification of its passenger and light duty fleet vehicles, and the electrical infrastructure and EVSE required deliver that roadmap. The purchase of Electric Vehicles as part of the fleet replacement cycle and installation of electrical infrastructure upgrades and EVSE is being integrated into the RDKB planning and budgeting process.

The RDKB has recently purchased two new electrical vehicles including one vehicle for the Grand Forks building inspection team.

The electrical infrastructure upgrades and an EV charger installation are underway at the Grand Forks office.

The RDKB has installed a 2 share EV charger at the Trail office. It is currently exploring funding opportunities for the installation of electrical infrastructure upgrade and phase 1 of the EVSE. After Phase 1, the installation of the EVSE will be coordinated with the roll out of electric vehicles.

5. Lessons Learned

In answering the questions in this section, please consider all aspects of undertaking the Study — from the initial planning through each essential task until the Final Study was prepared.

a) What would you recommend to other municipalities interested in doing a similar Feasibility Study? What would you do differently if you were to do this again?

In preparation for undertaking a similar study, we would recommend other local governments:

- Gather data and information on vehicle daily usage (i.e. time of travel, mileage etc) on all fleet vehicles to understand their charging needs. The RDKB uses trip log sheets in their general fleet vehicles. This information was available for the last 2 years and was an important in understanding our charging requirements. The information on other fleet vehicle usage was limited and not available in sufficient granularity.

- Review the electrical documentation on existing buildings and facilities where the EV charging infrastructure will be located. Determine if further information is required to

allow the study and detailed design to be completed. If not, include in the consultants scope of work.

- Build staff awareness of EVs and engage them in the discussions on electrifying fleet vehicles. The RDKB ran an EV information and test drive EV session for staff. This helped build understanding and acceptance of EVs. In addition, the RDKB introduced an EV induction process to familiarize staff with the vehicle and charging, and also discuss any concerns.

b) What barriers or challenges (if any) did you encounter in doing this Feasibility Study? How did you overcome them?

The Grand Forks office is an older building that required electrical infrastructure upgrade and increase electrical capacity to meet the EV charging requirements. There was little documentation on existing infrastructure so a more detailed review was required.

The RDKB undertook an audit of the existing infrastructure and loads, which were provided to the consultant.

6. Knowledge Sharing

a) Is there a website where more information about the Feasibility Study can be found? If so, please provide the relevant URL.

The RDKB is currently developing a new website. In the New Year an article will be included on the EV infrastructure study with a link to the study. Please refer to the Climate Actions page. https://rdkb.com/Environment/Climate-Energy/Climate-Actions

b) In addition to the Feasibility Study results, has your Feasibility Study led to other activities that could be of interest to another municipality (for example, a new policy for sustainable community development, a series of model by-laws, the design of a new operating practice, a manual on public consultation or a measurement tool to assess progress in moving toward greater sustainability)? If so, please list these outcomes, and include copies of the relevant documents (or website links).

Please refer to the RDKB website for further updates on RDKB Climate Action initiatives including Corporate Climate Mitigation Targets and Project, Climate Adaptation and Resilience Activities. https://rdkb.com/Environment/Climate-Energy/Climate-Actions