Subject: Email - Communication - Sherry Tarasoff - Saskatoon Transit Battery Electric Bus Trial Performance Results - CK 1402-1
Attachments: electric_bus_questions.pdf

From: Web NoReply <web-noreply@Saskatoon.ca>
Sent: Monday, March 7, 2022 7:49 AM
To: City Council <City.Council@Saskatoon.ca>
Subject: Email - Communication - Sherry Tarasoff - Saskatoon Transit Battery Electric Bus Trial Performance Results - CK 1402-1

--- Replies to this email will go to [redacted] ---

Submitted on Monday, March 7, 2022 - 07:49

Submitted by user: Anonymous

Submitted values are:

Date Monday, March 07, 2022
To His Worship the Mayor and Members of City Council
First Name Sherry
Last Name Tarasoff
Phone Number
Email [redacted]
Address [redacted] Peterson Cres
City Saskatoon
Province Saskatchewan
Postal Code S7L[redacted]
Name of the organization or agency you are representing (if applicable)
Subject Agenda item 7.1.1 Saskatoon Transit Battery Electric Bus Trial Performance Results
Meeting (if known) SPC on Transportation
Comments
I have some questions re: agenda item 7.1.1 Saskatoon Transit Battery Electric Bus Trial Performance Results. See the attached document for details.
Thank you,
Sherry Tarasoff
Attachments
electric_bus_questions.pdf
Will you be submitting a video to be vetted prior to council meeting? No

I have some questions re: agenda item 7.1.1 Saskatoon Transit Battery Electric Bus Trial Performance Results.

INFORMATION REPORT

Saskatoon Transit Battery Electric Bus Trial Performance Results

ISSUE

Key drivers for research to be conducted into the feasibility of alternate propulsion systems for the Saskatoon Transit fleet were: 1) the City of Saskatoon Low Emissions Community plan to phase in a transit electric fleet starting in 2022 to meet environmental sustainability goals and, 2) the operating impacts of extreme cold weather events on emission control systems on the current Saskatoon Transit diesel bus fleet. What is the feasibility and business case of transitioning the Saskatoon Transit diesel bus fleet to Battery Electric Buses?

BACKGROUND

In early 2019, Saskatoon Transit was approached by the Saskatchewan Research Council (SRC) with the idea of conducting a Battery Electric Bus (BEB) feasibility study. Saskatoon Transit was exploring bus electrification, and this seemed to be a timely and good opportunity to begin a partnership. In March of 2019, SRC presented their feasibility study to Transit management.

Jansen, R. (2019). Electric Bus Feasibility Study for Saskatoon Transit, Saskatchewan Research Council confidential report, publication number 14506-2E19.

Why was this report considered confidential? Why is it not part of the public record?

Effective Range

The BYD bus has a 330 kWh battery, and this equated to a 470 km effective range, approximately the distance of the longest run that a current diesel bus goes before coming back to the garage for refueling. The highest energy consumption was in February when temperatures of -40 Celsius were seen for a few weeks. During this time, a peak average usage of 2.2 kWh/km was observed, which results in a maximum effective range of 150 km.

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7. The effective range of the battery was between 175 and 361 km throughout the test months of the demonstration period. The effective range is related to the total energy consumption of the bus. Thus, in the coldest months, the effective range of the bus was lowest. The effective range is the amount the bus can be driven from 100% to 0% state of charge (SOC).

Why was the effective range of the BYD trial bus so much less than expected?

Table 3 - Energy consumption data for the electric bus

Month	Year	Monthly travel distance (km)	Avg driving Speed (km/h)	Grid energy supplied to bus (kWh)	Net energy used by motor (kWh)	Min temp during a driving session (°C)	Total bus energy consumption (kWh/km)	Energy consumption of motor (kWh/km)
Nov	2020	907	30	1870	645	-15.6	2.1	0.71
Dec	2020	740	36	1509	566	-21.8	2.0	0.76
Jan	2021	1868	33	3610	1394	-35.0	1.9	0.75
Feb	2021	1768	32	3914	1370	-39.0	2.2	0.78
Mar	2021	301	35	490	217	-12.1	1.6	0.72
Apr	2021	327	31	470	230	-3.0	1.4	0.70
May	2021	2534	34	1781	1640	-2.4	0.7	0.65
June	2021	243	33	407	149	12.4	1.7	0.61
July	2021	2744	36	3165	1758	11.2	1.2	0.64
Aug	2021	3759	37	3614	2306	4.0	1.0	0.61
Sept	2021	307	34	431	227	2.0	1.4	0.74
Oct	2021	0	--	--	--	--	--	---
Totals/ Average		**15497**	**34**	**21262**	**10502**	**-9.0**	**1.4**	**0.68**

Why was there such a fluctuation in driving distance throughout the trial period? Why was it not used consistently everyday? (I understand that the low monthly usage for March and April was due to problems with the fire suppression system which was accidentally activated and required recharging.) A diesel bus has an annual transit distance of 50,000 km/year (137 km/day). This electric trial bus only travelled 15,497 kms in 11 months. Is this enough for an accurate assessment?

4. FINANCIAL ANALYSIS

4.1 Total Cost of Ownership

Table 6 compares the total cost of ownership of an electric BYD to a diesel bus. Although the cost of the electric BYD bus is almost double that of the diesel bus, BEBs typically have much lower maintenance and energy costs. In addition, the capital cost of BEBs is likely to decrease going forward. Saskatoon Transit provided the current pricing of a diesel and an electric bus at $660,000 and $1,200,000, respectively [Bracken, 2021a]. The current cost of diesel fuel for Saskatoon Transit is $1.21/L and the average fuel consumption of their diesel bus fleet is 48.2 L / 100 km (0.482 L / km) based on 2020 data [Bracken, 2021c]. Carbon tax is now added to diesel, and it is reasonable to anticipate further increases to the cost of diesel to account for the cost of carbon over the next several decades.

As per the Electric Bus Feasibility Study completed by the Saskatchewan Research Council for Saskatoon Transit, a typical Saskatoon Transit bus has an annual travel distance of 50,000 km and a lifetime of 18 years; the feasibility study also estimates the maintenance costs of a diesel and an electric bus at $0.86/km and $0.18/km, respectively [Jansen, 2019]. Inflation has not been incorporated into the total cost of ownership analysis in Table 6, and thus all values are represented in 2021 Canadian dollars. The 2019 feasibility study estimated that the energy economy of a BEB would be approximately 1.0 kWh / km [Jansen, 2019]. As a result of the higher HVAC energy demand, the BYD bus tested by Saskatoon Transit this past year, has an average energy economy of 1.4 kWh/km from the grid (the total energy supplied to bus from the grid divided by total distance travelled during demonstration test).

Table 1 summarizes the time spent in each session mode during the test period. Idling includes pauses in between routes, maintenance periods, or parked in the Saskatoon Civic Operations Center garage overnight after charging was complete. The electric bus was typically operated on routes during peak hours in the morning and peak hours in the afternoon [Bracken, 2021a]. The data recorded indicates that the bus had the highest utilization in May, July, August, and September. The low monthly usage for March and April was due to problems with the fire suppression system which was accidently activated and required recharging [Bracken, 2021a]. Data indicates that the bus was not driven from Sept 1st to 24th and was only driven 0.2 hours in October 2021. There was a high amount of charging hours for the month of July, because of an unexplained inconsistency in the data; there were several sessions in July recorded as charging sessions even though the state of charge of the battery was 100% at the start of these sessions. These additional charging sessions should have been recorded as idling sessions.

Why was the bus not driven September 1-24 and only 0.2 hours in October?

Electric bus

Fleet Electrification

With the plan to electrify the fleet in the future, the funding requirements will change considerably. The estimate for a new electric 40-foot low-floor bus and charger is around $1.2 million, in order to purchase ten of those per year annual funding would need to be approximately $12 million.

The advantage of the electric bus is the expected reduction in operational costs, namely in the fuel usage and parts to maintain the bus. The total cost of ownership is expected to start showing savings after year ten or eleven. Over the life of the bus, an expected total cost of ownership savings of $500,000 per bus is expected to be realized, equating to $69.5 million over the life of the entire fleet, or an estimated $3.86 million annually.

At the time of writing, Saskatoon Transit is in the middle of its electric bus trial with very positive results. Being a leased bus, it wasn't exactly the bus Transit wanted, however in the first seven months of usage, an issue with the ramp was the only required maintenance on the bus. Even through the cold months of winter, the typical after-treatment issues seen on a diesel bus were non-existent, and the bus saw regular and reliable service.

According to the 2021 Corporate Asset Management Plan for Saskatoon Transit, there was an issue with the ramp that required maintenance. When did that happen and how long was it out of service for repairs?

I have no experience running a municipal transit system. I do, however, have experience researching what other municipalities have learned from their BEB fleets. Like the Edmonton Study says "electric buses…will require thorough planning, training, and resources to ensure the City of Edmonton derives the full benefits of their use." There is more to the service than just acquiring the buses.

Electric Bus Feasibility Study for the City of Edmonton

Halifax Electric Bus Feasibility Study

Zero Emission Bus Feasibility Study for the Alexandria Transit Company