Beach

Hallandale Beach

PROGRESS. INNOVATION. OPPORTUNITY.

EV Fleet
In-House Operation and Maintenance

December 2021

BACKGROUND

The City of Hallandale Beach was awarded a State of Florida Department of Transportation (FDOT) Grant in the amount of $2.5 million to implement an Electric Bus Fleet. The City propose to purchase nine (9) EV to have two buses per route reducing headways and to use electric buses that will help to meet the City's sustainability Action Plan (SAP) goal to "displace 90% of gasoline/diesel fuels efficiency or alternatives fuels" by 2040. In addition to the City's SAP, the intergovernmental Panel on Climate Change has set the goal of cutting emissions by 45% by 2030 and 100% by 2055.

On March 17, 2021, the City Commission adopted Resolution No. 2021-025 approving the utilization of the State of Georgia contract awarded through RFP 99999-001-SPD0000152 with BYD Motors LLC previously known as BYD Motors Inc. for a total amount not to exceed five million dollars ($5,000,000) for the purchase of nine (9) electric buses and related equipment and authorize the City Manager to execute any and all related documents.

The City Manager's Office requested a Community Shuttle in-house operation and maintenance analysis to determine the feasibility of developing an in-house organization that can provide services in the most efficient and effective way to all COHB residents and visitors by the time the new EV Transit Bus Fleet will be in place to start public operations.

ANALYSIS

The following in-house Operation and Maintenance was completed with consideration to various other EV fleet operations, namely Pinellas County PSTA, City of Tallahassee StarMetro. Assistance from FDOT, Parson's and Sage Energy Consulting, and the previously mentioned Transit Authorities.

Pinellas County Suncoast Transportation Authority operates a fleet of BYY 35' K9M Transit Buses. PSTA now has a total of six electric buses that are battery powered and produce no emissions. The agency also has 88 hybrid buses. In 2013 Tallahassee StarMetro Transit Authority deployed five all-electric, zero-emission, fast-charging buses into its StarMetro bus fleet. At the time, this was the largest all-electric bus fleet in the southeast. In 2018, StarMetro's all-electric buses began servicing FSU campus, making FSU one of the first universities in the nation to use all-electric buses to transport students, staff, and teachers on campus and between the campus and popular off campus housing locations. In 2019 StarMetro added 15 additional all-electric buses.

The following cost breakdown includes personnel to manage, operate and maintain a fleet of 9 EV Buses and 2 Propane Spare Buses, tires, parts & components for the maintenance program, energy consumption costs, technology package associated yearly costs, external services, consulting, and liability insurance costs.

The 2 propane buses will be a lease from the County through Section 3.1 LEASE of the Interlocal Agreement Between Broward County And City Of Hallandale Beach For Community Shuttle Services

1. Table 1 contains the total in-house annual Management, Operation and Maintenance cost.

2. Table 2 contains the in-house annual Personnel cost breakdown associated to the management, administration, operation and maintenance of the nine (9) EV 30' K7M Transit Bus vehicle fleet, and two (2) spare propane fueled cutaway vehicles, to service the four City routes.
3. Table 3 contains the in-house annual and total maintenance cost associated to tires, parts, and components required for the 12-year maintenance program provided by BYD for the K7M EV Transit Bus.
4. Table 4 contains the annual in-house energy consumption cost associated to the annual operation of nine (9) EV K7M buses provided by Sage Energy Consultants.
5. Table 5 contains the annual in-house cost for the provision and operation of the on-board Technology Pack including the telecom services for GPS/Bus tracking, Camera & DVR, Bus Stop announcing, Passenger Counters, Pass phone App, Bus Wi-Fi services.

Other costs included in the analysis were expenses associated to general building maintenance, technical services, training, testing services, consulting services, and general and vehicle fleet liability insurance that will be adjusted as the City gathers more detailed information from the City Risk Manager.

The resulting total cost for the management, operation and maintenance generates an Hourly Rate of $69.60.

Table 1. COHB EV Pilot Project Operation & Maintenance in-house Total Annual Cost.					
	Item	**Total Yearly O&M Costs**	**Total Miles**	**Total Cost/Mile**	%
2	Personnel	$2,130,505.41	317,122	$ 6.72	89%
3	BYD Maintenance tires, parts & components	$ 50,711.43	317,122	$ 0.16	2%
4	Energy EV Source from City Grid	$ 60,000.00	317,122	$ 0.19	2%
5	Technology Package **	$ 42,822.72	317,122	$ 0.14	2%
6	Building Maintenance	$ 21,000.00	317,122	$ 0.07	1%
7	Technical Services, Training, Testing	$ 25,000.00	317,122	$ 0.08	1%
8	External services and Consulting	$ 20,000.00	317,122	$ 0.06	1%
9	General & Auto Liability; Physical Damage*	$ 52,000.00	317,122	$ 0.16	2%
	Total Cost of Ownership	**$ 2,402,039.56**	**317,122**	**7.57**	**100%**
	Total Revenue Hours	**34,512**			
	Hourly Rate	**$ 69.60**			

* Information provided from City of Miramar

** Technology Package Telecom Services City of Doral

Table2. COHB EV Pilot Project Operation & Maintenance in-house Annual Payroll											
Personnel	**QTY**	**Job Description**	**Full Time/ Part Time**	**Total Hours per week**	**Total Hours per year per employee**	**Management/ Supervisory**	**Hourly Rate**	**Average Yearly Salary**	**Hourly Rate with Benefits**	**Average Yearly Salary with Benefits**	**Yearly Salary**
Operation & Maintenance Foreman (High Level EV Technician)	1		FT	40	2080	Management		$ 80,000.00	$ 56.00	$ 116,476.12	$116,476.12
Staff Management Support (Clerical administration + inventory control)	1	Inventory Control	FT	40	2080			$ 41,000.00	$ 33.50	$ 69,680.02	$69,680.02
Operations 10 HOURS SHIFTS											
Regular Bus Operators (7 AM to 7 PM Monday to Friday 10 hr max)	9	Bus Operator	FT	50	2600			$ 55,000.00	$ 43.12	$ 89,696.12	$807,265.08
Week-end Drivers (12 hours Saturday)	9	Bus Operator	PT	12	624		$ 27.00	$ 16,848.00	$ 33.59	$ 20,960.56	$188,645.04
Spare Bus Operators (8 AM to 4 PM Monday to Friday)	2	Bus Operator	FT	40	2080			$ 55,000.00	$ 43.12	$ 89,696.12	$179,392.24
Week-end Drivers (12 hours Sunday)	1	Bus Operator	PT	12	624		$ 27.00	$ 16,848.00	$ 33.59	$ 20,960.56	$20,960.56
Spare Driver on Call	1	Bus Operator	PT	24	1248		$ 27.00	$ 33,696.00	$ 33.51	$ 41,825.13	$41,825.13
Route Supervisor Monday to Friday (Could drive if required)	1	Transportation Supervisor	FT	40	2080	Supervisory		$ 63,000.00	$ 46.19	$ 96,077.82	$96,077.82
Route Supervisor weekends (Could drive if required)	1	Transportation Supervisor	PT	24	1248	Supervisory	$ 29.00	$ 36,192.00	$ 34.58	$ 43,160.86	$43,160.86
Operation Dispatcher Monday-Friday (8 hours/day)	2	Dispatcher	FT	40	2080			$ 45,000.00	$ 35.81	$ 74,479.62	$148,959.24
Operation Dispatcher weekends (12 hour/day Saturday and Sunday)	1	Dispatcher	PT	24	1248		$ 35.00	$ 43,680.00	$ 41.72	$ 52,070.83	$52,070.83
Maintenance											
High Level Electric Bus Technician (8 AM to 4 PM Monday to Friday)	1	Master Mechanics	FT	40	2080			$ 70,000.00	$ 50.71	$ 105,477.12	$105,477.12
General Level Electric Bus Technician (8 AM to 4 PM Monday to Friday)	2	Journeyman Mechanics	FT	40	2080			$ 53,000.00	$ 40.42	$ 84,078.82	$168,157.64
EV Maintenance Technician Weekends on Call	1	Journeyman Mechanics	PT	24	1248		$ 32.00	$ 39,936.00	$ 38.15	$ 47,615.85	$47,615.85
Bus Cleaning & facility maintenance Monday to Saturday (from 6:30 pm to 10:30 pm)	2	Service attendant	PT	24	1248		$ 15.00	$ 18,720.00	$ 17.93	$ 22,370.93	$44,741.86
Totals	**33**									W/Benefits	**$2,130,505.41**
Total estimated serviced miles per year	**317,122**									estimated	**$ 6.72**
2019 Yearly Passengers expanded in 30%	**369,447**									estimated	**$ 5.77**
Per Hour Cost (Total Serviced Hours Per Year)	**34,512**										**$ 61.73**

Total weeks per year = 52

11 vehicle maitenenance fleet

9 EV Transit Buses + 2 Gasoline/propane spare vehicles)

Nine(9) BYD K7M-30 FT. 500,000 MILES MATERIAL COST ESTIMATE FOR MAINTENANCE

YEAR	TOTAL MILEAGE (miles)	FOB TOTAL MATERIAL COST ESTIMATE FOR MAINTENANCE (US$)
12	500,000	$608,537.14

The interval depends on whichever comes first(time & mileage)					Replacement Times in 12 Years	Material Price	Qty. for Once in Metric Unit	Qty. for Once	Unit	Qty. Vehicle	Total Material Price
Mileage(×1,000miles)	First Maintenance <3000 Miles(first 3 months)	9	18	36							
/		Every 3 months	Every 6 months	Every 12 months							
Overall inspection	I	I	I	I	56	0	1	1	/	9	/
Lubricate vehicle lubricating points (non-maintenance-free and no centralized lubrication)	/	R	R	R	55	$ 0.39	300g	10.60	OZ	9	$ 2,046.33
Clean the air conditioner inlet filter	/	C	C	C	55	$ -	1	1	PCS	9	$ -
Clean the condenser of brake system	/	/	C	/	27	$ -	1	1	PCS	9	$ -
Replace the wiper blade	/	/	R	R	27	$ 20.36	2	2	PCS	9	$ 9,892.53
Replace the gear oil	R	/	R	R	28	$ 19.99	6.8L	1.80	GAL	9	$ 9,067.46
Replace the drive motor oil	/	/	R	R	27	$ 8.07	4.6L	4.86	QT	9	$ 9,530.51
Replace the drive motor oil filter	/	/	R	R	27	$ 22.02	2	2	PCS	9	$ 10,701.72
Replace air dryer filter	/	/	/	R	13	$ 111.08	1	1	PCS	9	$ 12,996.83
Replace and check the air filter	/	/	/	R	13	$ 50.98	1	1	PCS	9	$ 5,964.66
Check and replace oil-gas separator of air compressor	/	/	/	R	13	$ 359.52	1	1	PCS	9	$ 42,063.84
Replace the air compressor oil	/	/	/	R	13	$ 53.17	1.45L	0.39	GAL	9	$ 2,426.33
Clean fresh air filter and condenser and evaporator filter	/	/	/	C	13	$ -	1	1	PCS	9	$ -
Replace the tire	/	50K or 12 months			9	$ 663.00	6	6	PCS	9	$ 322,218.00
Replace the brake pads	/	50K or 12 months			9	$ 518.19	2	2	PCS	9	$ 83,946.78
Replace the 24-V battery	/	75K or 24 months			6	$ 430.53	2	2	PCS	9	$ 46,497.24
Replace the steering oil filter	/	75K or 24 months			6	$ 33.70	1	1	PCS	9	$ 1,819.80
Replace the steering oil	/	75K or 24 months			6	$ 20.44	8.0L	8.45	QT	9	$ 9,326.77
Replace the coolant of chassis	/	75K or 24 months			6	$ 17.99	24.0L	6.34	GAL	9	$ 6,159.06
Replace the coolant of power battery	/	75K or 24 months			6	$ 17.99	39.16L	10.34	GAL	9	$ 10,044.90
Brake rotor(Rear)	/	150K or 36 months			3	$ 205.62	2	2	PCS	9	$ 11,103.48
Brake rotor(Front)	/	200K or 48 months			2	$ 352.05	2	2	PCS	9	$ 12,673.80
Grease the ZF front axle wheel hub bearing and wheel hub chamber.	/	For 12H series, perform inspection and maintenance every 310,000mile or 48 months.			1	$ 0.90	200g	7.05	OZ	9	$ 57.11
									Total Material Cost Estimate For Maintenance		$ 608,537.14

Note
I=Inspect R=Replace C=Clean

Year	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	11st	12nd
Total Material Cost Estimate For Maintenance (US$)	**$ 8,232.70**	**$ 65,383.45**	**$ 53,038.28**	**$ 70,524.18**	**$ 59,412.39**	**$ 20,216.82**	**$ 59,395.95**	**$ 69,141.71**	**$ 53,038.28**	**$ 73,159.92**	**$ 69,047.40**	**$ 7,946.07**

The costs herein are based on operating range (unit: mile) calculation.

Average Per Year	**$ 50,711.43**

Table 4. Per Year energy associated cost

215 kWh Buses (GSD -1 tariff)					
Profile	**Control type**	**Total annual bill**	**Annual serviced miles**	**Average cost per mile ($/mile)**	**Average cost per bus ($/bus/year)**
Typical Use (60% occupancy - 1.33 kWh/mi)	Timer based charging	$ 96,000	322,398	$ 0.30	$ 10,667
	CMS charging	$ 55,000	322,398	$ 0.17	$ 6,111
Worstcase Use (100% occupancy - 1.46 kWh/mi)	Timer based charging	$ 98,000	322,398	$ 0.30	$ 10,889
	CMS charging	$ 60,000	322,398	$ 0.19	$ 6,667

Timer based charging is where all buses start charging during off-peak times to avoid high utility costs from on-peak and part-peak tariffs.
CMS charging is where an after-market charge management software shapes the load (and keeps it flat) to mitigate high demand costs.
The mileage of 1.33 kWh/mi and 1.46 kWh/mi are averaged across all 4 routes.

Sage Consulting Contacted FPL for EV charging tariff analysis

Financial Modeling		
Particulars	**EV**	**Diesel**
Estimated fuel per mile cost ($/mi)	$0.17	$0.59
Maintenance Cost ($/mi)	$0.55	$1.53
Total operation cost ($/mi)	$0.72	$2.12
Cost Savings Calculation		
Operational savings between Electric vs Diesel bus ($/mi)	$1.40	
Mileage for FY2019 per bus (miles/yr)	35,344	
Mileage for FY2019 for 9 buses (miles/yr)	318,096	
Operational savings for the 9 bus EV fleet	$445,145	
Operational cost savings for the 9 bus fleet over 10 year period	$4,451,447	

Parson's Sage Consulting Energy Consumption Analysis

Technology Package taken from City of Doral Contract	Total Equipment	First 24 months	After 24 months
Tracking, Camera & DVR, Stops announcing, Pass Counters, Pass App, Wi-Fi. Purchase plan 2 years 24 months)	$ 11,965.00	$ 498.54	$ -
Service Plan		$ 229.84	$ 229.84
Total per Month per vehicle		$ 728.38	$ 229.84
Total per Month 5 Vehicles		$ 3,641.91	$ 1,149.20
Total Cost per Year per Fleet 5 vehicles		**$ 18,209.54**	**$ 5,746.00**
Automatic voice information System per year		$ 10,200.00	$ 10,200.00
Yearly Total for a Fleet of 5 Vehicles		**$ 28,409.54**	**$ 15,946.00**

Total per Month 9 Vehicles		$ 6,555.44	$ 2,068.56
Total Cost per Year per Fleet 9 vehicles		**$ 78,665.22**	**$ 24,822.72**
Automatic voice information System per year		$ 18,000.00	$ 18,000.00
Yearly Total for a Fleet of 9 Vehicles		**$ 96,665.22**	**$ 42,822.72**