CITY OF HAMILTON
PUBLIC WORKS DEPARTMENT
Energy, Fleet and Facilities Management Division

TO:	Chair and Members Public Works Committee
COMMITTEE DATE:	January 10, 2022
SUBJECT/REPORT NO:	Natural Gas Waste Collection Trucks (PW22003) (City Wide)
WARD(S) AFFECTED:	City Wide
PREPARED BY:	Tom Kagianis (905) 546-2424 Ext. 5105
SUBMITTED BY: **SIGNATURE:**	Rom D'Angelo, C.E.T.; CFM Director, Energy, Fleet and Facilities Management Public Works Department 

RECOMMENDATIONS

(a) That the following appendices attached to Report PW22003 be received:

(i) City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Study Report as identified in Appendix “A” attached to Report PW22003;
(ii) City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study Report as identified in Appendix “B” attached to Report PW22003;
(iii) City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling 2nd Supplemental Study Report as identified in Appendix “C” attached to Report PW22003;

(b) That Council approve funding to support the cost premium of 10 CNG waste collection trucks and related facility ancillary requirements in the amount of $700,000 to the Fleet Project ID 4942151100 from:

(i) Unallocated Capital Reserve (#108020) in the amount of $200,000;
(ii) Appropriate from Capital Project 5121855137 Waste Management R&D Program in the amount of $10,000;
(iii) Internal Loan from the Energy Conservation Initiatives Reserve 112272 in the amount of $490,000 amortized over 7 years;

(c) That the estimated fuel savings of $70,000 per year from the new CNG vehicles funded in Recommendation (b) be used to repay the funds borrowed, plus applicable interest, to the Energy Conservation Initiatives Reserve (112272) as indicated in Appendix “D” attached to Report PW22003 from the Public Works Waste Division Dept ID 512560;

(d) That a new Capital Project be set up with a budget of $490,000 funded from the Energy Conservation Initiatives Reserve #112272 to fund future incremental costs from Fleet and Facilities for projects and/or purchases which qualify according to the Corporate Energy and Sustainability Policy as determined by the Manager, Energy Initiatives;

(e) That the Goods and Services be procured through a Purchase Order, a formal Contract or any other process as approved by the Director of Financial Services and Corporate Controller and that the General Manager of Public Works, or their designate, be authorized to negotiate and enter into a single source procurement and execute the completion of all associated documents with Envoy Energy Fuels Inc. for the supply, installation and management of CNG mobile refuelling equipment, commodity and operational requirements for the life of the 10 CNG vehicles to be procured, in a form satisfactory to the City Solicitor.

EXECUTIVE SUMMARY

The purpose of this report is to recommend the purchase of 10 Compressed Natural Gas (CNG) powered waste collection trucks that will align to the Motion adopted by City of Hamilton (City) Council on March 27th, 2019 (Item 3 of the Board of Health Report 19-003, March 18th, 2019) an Accelerating and Prioritizing Climate Action in Response to the Climate Emergency as well as endorsing a clear direction from the Bay Area Climate Change Summit that allows Hamilton to meet climate change targets, notably, “that all diesel vehicles be decommissioned by 2030 and all vehicles electrified by 2050.”

The City’s Waste Collections Section currently operates 37 diesel powered trucks. The 10 vehicles in this recommendation are scheduled for replacement in 2023 and represents 27% of the waste collection fleet.

In July 2019 Marathon Technical services was contracted to perform a CNG Packer Truck Fuelling Study in consideration of replacing all City owned waste collection trucks from diesel powered to CNG powered as they became due for replacement.

The recommended solution will result in a net reduction of GHG emissions of approximately 99 tonnes annually and is not expected to have any negative operational impacts.

Envoy Energy Fuels Inc. is the only known company in Canada that offers this combination of equipment for a CNG mobile refuelling solution. The recommended single source procurement for the mobile CNG fuelling station required to fuel all 10 (new) CNG vehicles is estimated to be $190,000 annually, which is based on a historical annual average fuel consumption rate, this figure can fluctuate due to operations and fuel usage. There are no budget impacts as the fuel cost to operate the waste management fleet is pre-established as part of the base budget. The expected life of a CNG waste packer truck is 7 years.

Replacement approval for the 10 CNG vehicles identified in this report is scheduled for replacement in 2023 and has been submitted in the 2022 Fleet Replacement Capital Budget for council approval. This will allow for enough time to issue the appropriate procurement documents and schedule build of vehicles and installation of refuelling infrastructure in a timely fashion for the delivery of new CNG waster packers in 2023.

Alternatives for Consideration – See Page 9

FINANCIAL – STAFFING – LEGAL IMPLICATIONS

Financial: The cost premium (estimated 20%- 25%) to purchase a natural gas-powered chassis compared to the same diesel-powered chassis is $60,000 each. Capital cost for ancillary requirements (lighting, parking and impact protection) is estimated at a one-time cost of $100,000 for a total cost of premium including the trucks of $700,000.

The estimated expenditure to purchase 10 CNG waste packers is $4.1M (plus $100,000 one-time expenses).

- $3.0M will be drawn from the Fleet Reserve (previously approved through the capital budget process);
- $0.5M Waste's Capital Project (previously approved through the capital budget process);
- $0.7M incremental cost will be funded as follows and transferred into to Fleet Project # 4942151100:
    - the Energy Conservation Initiatives Reserve (112272) in the amount of $490,000. These funds will be repaid over seven (7) years plus applicable interest. The payback schedule to the

- Energy Conservation Initiatives Reserve is outlined in Appendix "D" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Funding Repayment;
- An additional $200,000 will be transferred from the Unallocated Capital Reserve (#108020). The request is being made based on the recent Waste Management WIP closure of Capital Project 5122194029 SWMMP – Alternative Disposal Facility which was closed on the June 30th, 2021;
- The balance of $10,000 of the incremental costs will be appropriated from Capital Project 5121855137 Waste Management R&D to the Fleet Project ID 4942151100.

Based on the increased replacement cost, waste collections annual contributions to reserve will increase approximately $68,500 for all 10 new trucks. This is based on the estimated purchase cost of the trucks and will change based on the actual contract price realized after tender.

The recommended single source procurement for the mobile CNG fuelling station required to fuel the new CNG vehicles is estimated to be $190,000 annually, which is based on a historical annual average fuel consumption rate, this figure can fluctuate due to operations and fuel usage. There are no budget impacts as the fuel cost to operate the waste management fleet is pre-established as part of the base operating budget.

Staffing: The slow fill CNG station will result in less time to refuel vehicles. Typically, Waste Collection staff would use a City owned fuel station on their collection route. In some instances, staff would modify their route to get to a City fuel site. The refuelling process, including travel could take 15 minutes or more. However, by locating the fuel site at 1579 Burlington St., staff will forgo the current time to refuel and simply attach a fuel nozzle to the vehicle at the end of their shift. The refilling process will happen overnight during low peak energy consumption applicable rates.

Legal: Fleet/Energy staff will work with legal to draft an agreement in a form satisfactory to the City Solicitor.

HISTORICAL BACKGROUND

The Waste Collection Section of the Waste Management Division operates 37 diesel powered waste collection trucks in the following configurations to accommodate specific operational requirements.

Quantity of Vehicles	Body Configuration	Scheduled Replacement Year	Estimated Annual Diesel Fuel Use (Litres)
16	Rear Load	2021	232,137
10	Side Load	2023	211,450
2	Mini Rear Load	2023	12,610
9	60/40 split Rear Load	2025	140,382

Fleet Services sets the replacement schedule of waste collection trucks based on several factors which include maintenance, mileage, new vehicle lead time and operating impacts. In 2021 Fleet Service reduced the expected life of waste collection trucks from 8 years to 7 years. This was based on an analysis that showed spiking maintenance costs in years 6-8.

CNG powered waste collection trucks have been in the industry for many years and are available in many styles and configurations to meet specific operational requirements. The City currently has one CNG fuel site located at 2200 Upper James. This location is used to refuel transit buses. A previous site at 330 Wentworth Street N., was installed in the mid 1990’s with a Pro Logic Controller and compressors that were no longer supported by the manufacturer for parts supply therefore the site was decommissioned.

Over the last few years development of hybrid and fully electric powered chassis have shown a stronger presence in the market. Several cities throughout the United States are working with manufacturers to test operational requirements. The City has contacted industry representatives to stay current on availability in our market and have asked to be notified when demonstration models are available.

The Battery Electric Vehicle options currently available in the industry for the 10 Side Load vehicles are not available in configurations that would meet waste collections operating requirements in Hamilton.

Fleet Services keeps current on options for vehicle replacements by attending various waste expo's, Fleet equipment trade shows and through public and private industry contacts.

POLICY IMPLICATIONS AND LEGISLATED REQUIREMENTS

- Procurement Policy By-law: Policy 11- Non-Competitive Procurements
- Corporate Energy and Sustainability Policy

RELEVANT CONSULTATION

The following departments provided input into the development of this report:

- Corporate Services Department, Financial Planning Division;
- Corporate Services Department, Procurement Division**. (**Provided information only with respect to adherence to the Procurement Policy);
- Public Works Department, Waste Management Division;
- Public Works Department, Corporate Asset Management Division;
- Healthy & Safe Communities Public Health Services; (Air Quality & Climate Change)
- Public Works Department, Energy Fleet and Facilities Management Division.

External consultation included:

Marathon Technical Services provided Compressed Natural Gas Packer Truck Fueling Studies attached hereto as:

- Appendix "A" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fueling Study Report;
- Appendix "B" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study;
- Appendix "C" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study.

Marathon has over 35 years of full-time experience in the CNG market providing professional consulting technical and financial analysis and support services for the CNG infrastructure market. Marathon provides professional services from project conceptual analysis, through the design and construction phases to the development of maintenance and support programs and has no affiliation with any equipment supplier

but has extensive experience with a wide variety of CNG equipment suppliers, installers and other service providers.

In the initial report, Marathon evaluated a total of five scenarios. A cost analysis of replacing the City's waste collection fleet vehicles from diesel powered to CNG powered as they became due for replacement was conducted.

Subsequently the City asked Marathon to conduct a further analysis on a few additional options that recently were identified. The additional options presented flexibility to reduce the typical long-term commitment to a traditional life cycle of a CNG refuelling station and offset the substantial capital cost required. This would also allow the City to quickly pivot and take advantage of developing new technologies of electric or other power options that could become available in the near future and further assist in the reduction of GHG emissions.

ANALYSIS AND RATIONALE FOR RECOMMENDATION

The trucks are either currently not available in an electric option that will suit the operating departments requirements or are cost prohibitive. In the meantime, the short-term option of purchasing 10 CNG powered waste collection trucks will bridge the gap and continue the City on the path towards reducing Green House Gasses (GHG's).

The recommended solution in this report will result in a net reduction of GHG emissions of 99 tonnes annually and is not expected to have any negative operational impacts.

The recommended option provided by Envoy Energy Fuels Inc. is the lowest cost for a short-term solution and allows flexibility to expand if the vehicles scheduled for replacement in 2025 don't offer an electric alternative.

A complete analysis of short term CNG options are provided in the attached consultants report (Appendix "B" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study) and (Appendix "C" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study).

The analysis included evaluation of several CNG refueling option scenarios, a cost analysis, estimated reduction of GHG's and some commentary of other chassis power options that are currently available in the industry.

The result of the study provided five scenario's that ranged in a Net Present Value (NPV) cost from between $(1.2M) and $1.3M. The option that provided the highest NPV was contingent on other factors that presented significant operational risks and are not recommended. An additional concern of all options was the long-term commitment to CNG refuelling infrastructure when electric options appear to be making a strong surge in this vehicle class.

Fleet Services then requested Marathon Technical Services to review the CNG refuelling options on two smaller scale scenarios (Appendix "B" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study) and (Appendix "C" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study) that included only a portion of the fleet vehicles and for a shorter term. The additional refuelling options, until recently, have not been traditional options available in the market. These additional options allow for shorter term CNG refuelling solutions and alleviates the City from the substantial capital investment that is typically associated with a natural gas compressor station installation (Est. $4M).

The recommended option supplied by Envoy Energy Fuels Inc. consists of a trailer mounted compressor and gas storage dispensed to 10 vehicles, time fill manifold refuelling stations (Appendix "C" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study Table 4--Company A--Trailer Concept using Contractor Fuel):

The contractor assumes:

- All the equipment and installation capital costs;
- All the operation and maintenance costs;
- All repair costs;
- All station licensing and permitting costs;
- All trucking of gas to site;
- The commodity and utility gas cost.

All costs identified above will be charged by the vendor at a cost per m^3 of gas used and will be expensed to Waste Collections operating budget.

The Energy Conservation Initiatives Reserve (112272) is used in part to fund incremental costs according to the previously approved Corporate Energy and Sustainability Policy (PW14050(a)). Eligible capital costs are targeted towards

incremental costs that relate to the purchase of high efficiency, low emission equipment that will move the City of Hamilton towards its long-term targets that relate to the reduction of energy intensity and lowering emissions / Greenhouse Gases (GHG's). These costs are typically outlined in a lifecycle analysis that depicts a base line or standard equipment purchase compared to the high efficiency or low emission alternative. This was clearly outlined in the waste collection truck analysis that shows the lower GHG's and lower fuel costs that accompany the CNG option compared to the diesel option.

ALTERNATIVES FOR CONSIDERATION

1. Convert All Waste Collection Vehicles to CNG

   The option to convert the entire waste collection fleet to CNG was the primary focus of the initial consultation with Marathon. This analysis considered 5 different refuelling station options.

   Marathon assembled capital cost and operating cost data from its own sources and from the City. Where possible, City data and HSR data, rather than general industry data. A conservative mix of costs was used for analysis over a 21-year life cycle based on truck replacement at 7-year increments as discussed in the report. The 21-year period corresponds to the normal expected life of the CNG station. Two of the scenarios have a positive NPV and all achieve payback within the project period.

   This option would require a 21-year commitment to replace waste collection vehicles with natural gas to realize the cost savings and reductions in GHG's.

   The fleet industry is moving towards battery electric vehicles which will offer a greater reduction in GHG within the 21-year window. Therefore, Fleet does not recommend investing in an option with a 21-year commitment.

   Switching from diesel to natural gas reduces GHG's by 17%.

   Financial: A complete financial analysis of CNG options are provided in the attached consultants report (Appendix "A" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fueling Study Report).

   Staffing: N/A

   Legal: N/A

2. Short Term Agreement with Traditional CNG Equipment

   Marathon Technical Services was contracted to conduct further analysis after their initial consultation to investigate options. A complete analysis of CNG short term options are provided in the attached consultants supplemental reports (Appendix B attached to Report PW22003- City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study) and (Appendix "C" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study).
   Financial: N/A

   Staffing: N/A
   Legal: N/A

3. Upgrade of 330 Wentworth Street CNG Fuel Site

   This option was considered in the initial consultant's report and would be cost prohibitive as little if any of the current equipment could be used. This option also conflicts with future development of these lands.

   Financial: A complete financial analysis of CNG options are provided in the attached consultants report (Appendix "A" attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fueling Study Report).

   Staffing: N/A

   Legal: N/A

4. Biodiesel

   Biodiesel is a renewable fuel made from vegetable oil and waste cooking oil, animal fats such as beef tallow and fish oil, and even algae oil. Biodiesel can be blended in a variety of ratios with conventional diesel fuel. B10 – A blend of 10% biodiesel and 90% fossil diesel. An annualized blend of B20 (used during summer months) and B5 (used during winter and shoulder months).

   Biodiesel can be used not only for waste collection vehicles but for all diesel-powered City vehicles. Cost of Biodiesel blends up to 20% are at parity to that of conventional diesel fuel.

   Biodiesel presents some concerns with cold weather operations and long-term storage stability. Some precautions must be taken before making the switch to

biodiesel, including using a lower blend due to viscosity issues at cold temperatures.

Additives also may be needed to improve storage conditions and allow for the use of biodiesel fuel in a wider range of ambient temperatures.

Biodiesel fuel is an excellent medium for microbial growth. Since water accelerates microbial growth and is naturally more prevalent in biodiesel fuels than in petroleum-based diesel fuels, care must be taken to remove water from fuel tanks.

Biodiesel results in reductions of GHG's but not to the extent of CNG. Possible cold weather concerns are further heightened as waste collection vehicles are parked outdoors.

Average annual blend of B12.5 biodiesel can reduce GHG's by 10-12%

Financial: N/A

Staffing: N/A

Legal: N/A

5. Electric Powered

   Fleet has contacted many potential providers including LION, Mack, Volvo and BYD however there are currently no electric powered vehicle configurations that could meet the operational requirement of the waste collections group for semi automated side loading.

   Financial: N/A

   Staffing: N/A

   Legal: N/A

6. Fuel new CNG trucks at the 2200 Upper James HSR location

   The round-trip distance from 1579 Burlington St to 2200 Upper James is 46km and 42 minutes drive time

Financial: Additional cost of approximately $430,000 annually to drive to this location. A complete financial analysis of CNG options are provided in the attached consultants report (Appendix “A” attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fueling Study Report).

Staffing: This option adds 42 minutes of unproductive staff time each operating day

Legal: N/A

ALIGNMENT TO THE 2016 – 2025 STRATEGIC PLAN

Healthy and Safe Communities
Hamilton is a safe and supportive City where people are active, healthy, and have a high quality of life.

Clean and Green
Hamilton is environmentally sustainable with a healthy balance of natural and urban spaces.

Built Environment and Infrastructure
Hamilton is supported by state-of-the-art infrastructure, transportation options, buildings and public spaces that create a dynamic City.

Our People and Performance
Hamiltonians have a high level of trust and confidence in their City government.

APPENDICES AND SCHEDULES ATTACHED

Appendix “A” attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Study Report

Appendix “B” attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study

Appendix “C” attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Fuelling Supplemental Study

Appendix “D” attached to Report PW22003 - City of Hamilton Compressed Natural Gas (CNG) Packer Truck Funding Repayment