

Alternate Fuel Collection Vehicles

Technology Review and Sample Contract Incentive Clauses

Prepared By: The Emerald Group

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This report is provided as opinion for discussion only and is **not** designed to replace qualified engineering, architectural or legal advice in any way. Municipalities are cautioned to obtain qualified advice and certified/approved drawings and plans prior to undertaking or adopting any recommendations that may affect their programs or facilities.

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Executive Summary

Currently four types of AF vehicles are available for recycling collection. Pros and cons along with current cost estimates are listed below.

Estimated fuel burn improvements with all systems are between 10% to 30%.

Estimated return on investment, contingent on relative price of diesel, is 7 to 15 years. This puts the payback period beyond most 3-5 yr. recycling collection contracts.

Estimated full cost to incentivize this technology is \$30,000 to \$50,000 per unit

Two methods of including this technology in collection contracts:

1. Municipality proposes/advises bidders of incentive amounts,
2. Municipality asks for proposals with preference given to AF vehicles and an agreement to negotiate a mutually satisfactory incentive with the successful bidder.

Method 2. is the recommended option as it will permit a municipality to evaluate the options submitted under the tender process, select a preferred AF or no AF option and subsequently negotiate the monetary incentive to be paid to the contractor either at the onset of the contract or as a cost per tonne increase.

Technology Review

Four currently available technologies were reviewed for this project and their pros and cons set out below.

Hydrogen AF vehicles were not reviewed in this study as the fuel availability and engine/fuel cell technology were not deemed mature enough to consider as a viable option in Ontario at this time.

1. Compressed Natural Gas (CNG)

Pros:

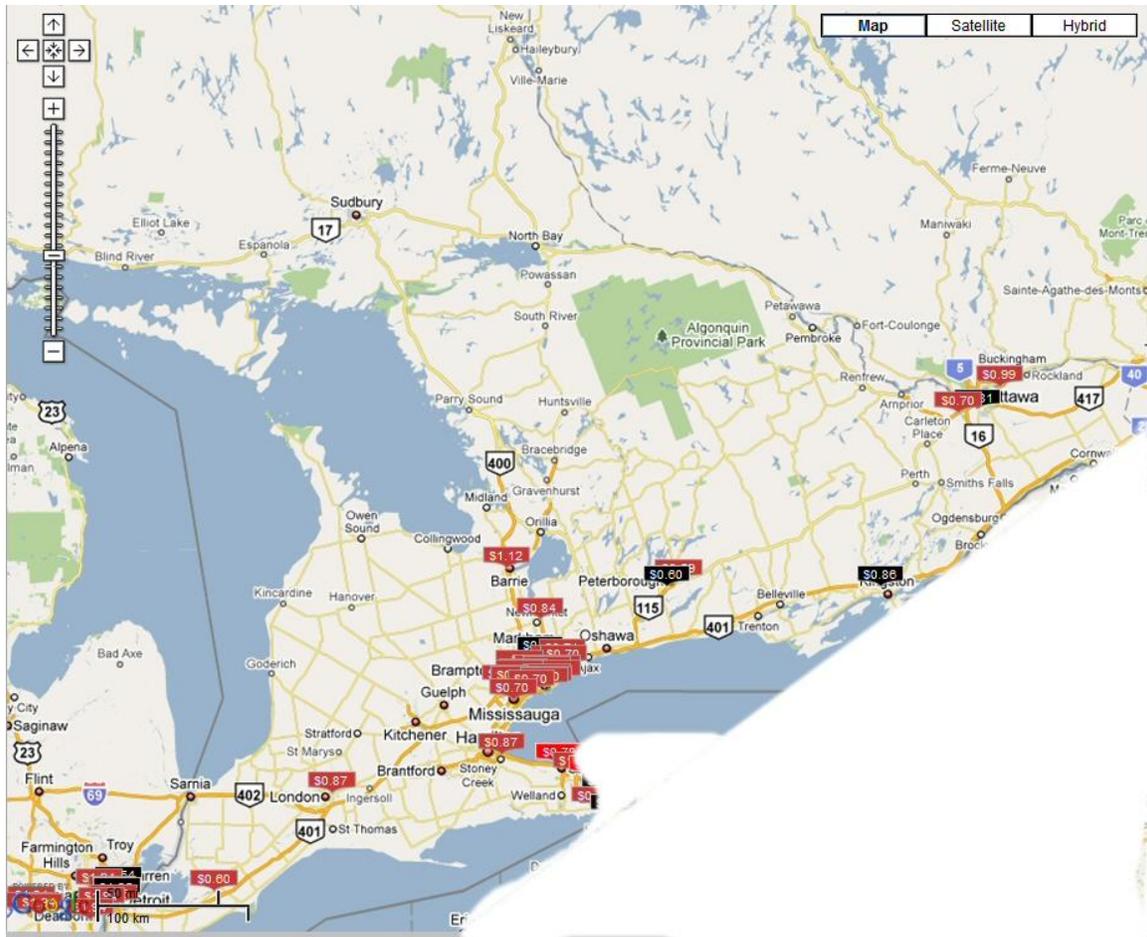
- Currently available through companies like Peterbilt, Cummins, Caterpillar, Westport engines.
- Lower emissions, quieter operation
- Proven engine designs
- Some American municipalities using them (Seattle, Boise)
- Some Provincial/Federal funding incentives may be available

Cons:

- Existing filling stations limited to Toronto, Ottawa, Hamilton and Niagara areas. (station location map below)
- High cost to open a fast fill station (750,000 – 1,000,000) out of reach for small/rural municipalities.
- Slow fill stations cheaper but require many hours to refill tanks
- Limited range unless very large tanks installed
- Potential fire/explosion/rocket hazard with high-pressure large tanks.
- Reduced engine performance vs. diesel
- Some additional maintenance costs
- Price of fuel variable unless long term contracts locked in.

Cost:

- 30,000 – 50,000 per unit.



CNG filling stations in Ontario
Current fuel prices vary from 0.70 to 1.12

2. BioDiesel (B20)

Pros:

- No engine modification needed up to 20% mixture
- Permits local refining and diversion of biomass waste.
- Cleaner emissions
- Some Federal/Provincial funding incentives may be available
<http://oee.nrcan.gc.ca/transportation/personal/news-releases.cfm?attr=8> and
<http://www.rev.gov.on.ca/en/refund/vpaf>
- Municipalities can refine their own if raw material supply is available

Cons:

- Existing suppliers limited

- Supplies and quality variable
- Consistency and cleanliness of B20 an issue
- Additional filters may be needed
- Potential fuel line clogs
- Organic slime can grow in B20 fuel tanks
- Cold weather congealing is an issue, may need tank heaters
- Some additional maintenance costs

Cost:

- 3,000-5,000 per unit. (fuel filters and preheaters)

3. Electric Hybrid (EH) Launch Assist

Pros:

- No engine modification needed, parallel drive system installed
- True “Hybrid” system good for public relations
- Battery can power automated collection arms
- No special handling or filling stations required
- Some Provincial funding incentives may be available

Cons:

- Batteries in Toronto EH busses reported lasting only 18 months vs. 5 yrs. claimed in supplier info.
- Not much fuel savings if stop/start cycle too frequent like urban recycling trucks at each house vs. bus stops every few blocks (batteries need time to recharge between stops).
- Increased maintenance costs
- Batteries lose capacity over time
- Potential Hazardous Waste disposal issues
- Battery weight and space reduces cargo capacity
- Cold weather reduces battery efficiency
- Potential fire hazard with onboard lithium

Cost:

- 30,000 – 50,000 per unit.

4. Hydraulic Launch Assist

Pros:

- No engine modification needed, parallel drive system installed
- Conventional technology in hydraulic tanks, motors, pumps and valves
- High pressure hydraulics can power automated collection arms
- No special handling or filling stations required
- Regenerative braking powers system and works well with frequent stop and go cycles.
- Powerful, dependable system (in use by Denver *, Fort Worth, Phoenix)

Cons:

- Hydraulic components heavy, est. 1,000 lb./system reduces cargo weight capacity
- Not much fuel savings if stop/start cycle too infrequent like rural recycling trucks travelling down country roads. (Bluewater reports 10-17% fuel savings)
- Increased maintenance costs
- Potential Hazardous Waste disposal issues with hydraulic fluid
- Cold weather reduces efficiency until fluid warms up.
- Complex valve controls required

Cost:

- 30,000 – 40,000 per unit.

** As a typical Denver refuse truck, the Peterbilt Model 320 vehicle equipped with the HLA system supplied to the city averages 8400 miles per year of difficult, stop-and-go driving. City officials report that it has averaged 2.875 mpg, a 25% improvement over the 2.3 mpg average of the city's conventional trucks.*

Although that may not sound like much, it adds up to about 1600 gal of bio-diesel fuel saved per year. It also means that 1600 gal worth of NOX, particulates, and COX were not injected into Denver's air.

<http://www.hydraulicspneumatics.com/200/Issue/Article/False/84207/Issue>

Conclusions

One size AF solution does not fit all for recycling collection applications. There are clearly defined “sweet” spots for each technology.

- Hydraulic Launch Assist has best application in dense urban settings.
- CNG has best application near existing filling stations.
- Hybrid Battery Launch Assist has best application in dense rural settings.
- B20 has best application near existing suppliers and warmer climates
- Return on investment can be expected to exceed 7 years based on current diesel pricing and current fuel burn savings.
- Incentives between 30-50,000 will be necessary to encourage uptake of the technology.
- Some Federal and/or Provincial funding may be available to help offset the costs.

Sample Collection Contract AFV Clauses

The following sample tender/RFP clauses are included as examples of methods for permitting a municipality to obtain pricing for AF collection vehicles. These clauses may need further modification depending on the local circumstances of the municipality and/or their purchasing/legal departments.

Under the “equipment” sections of the Tender RFP, the following clauses may be added.

1. Preference will be given to bids/proposals based on collection equipment that operates with higher fuel efficiency and fewer emissions. Bidders are instructed to specify the make, type and average fuel efficiency and emissions of the vehicles they propose to use for this collection contract in diesel equivalent km/l. and the type of fuel and/or hybrid system powering the vehicles.

The weight of the preference can be adjusted in the evaluation section of the contract. The suggested weighting factor is 10% of the evaluation assigned to the best fuel efficiency and lowest emissions submitted by a proponent. The remaining proponents submissions may be reduced proportionally all the way to 0% for the worst fuel efficiency and highest emissions proposed.

If you wish to financially incentivize AFV collection equipment over and above the evaluation preference then clause 2 below may be added.

2. Additionally, the municipality will negotiate with the selected proponent for the payment of an equipment allowance (*a specified amount may be inserted here if the CIF deems appropriate e.g...* up to 40,000 per unit) to offset the initial cost of the installation/conversion of collection vehicle drive components to operate on alternate fuels or hybrid power systems. Proponents are advised that fuel cost savings are expected to be demonstrated in the cost per tonne collection pricing submitted as compared to standard diesel powered collection equipment. Proponents must also submit prices based on standard diesel collection vehicles for comparison.

Alternate clause:

3. Additionally, the municipality will negotiate with the selected proponent for the payment of up to \$???.00 per tonne to offset the initial cost of the installation/conversion of collection vehicles to operate on alternate fuels or hybrid power systems. Proponents are advised that fuel cost savings are expected to be demonstrated in the collection cost per tonne pricing submitted as compared to standard diesel powered collection

equipment. Proponents must also submit prices based on standard diesel collection vehicles for comparison.

If the highest priority of incentivizing AF collection vehicles is the reduction of air pollution, then the following clause may be inserted:

The contractor shall co-operate with the Municipality's efforts to reduce the air pollution impacts of recycling collection. The contractor shall work to replace the current collection fleet with a fleet using compressed natural gas (CNG), high mileage diesel, vehicle launch assist or reduced emission engines. Until the fleet is replaced with approved alternative vehicles, the contractor shall use a blend of ultra low-sulfur diesel fuel and at least a 10% blend of bio-diesel.

An additional recommendation is that collection proponents should be allowed to submit open proposals for AF solutions rather than municipalities writing tight specifications for this equipment. Individual contractors may have access to additional alternatives and/or experimental equipment not contemplated by the municipality or generally available as public knowledge as of this date. Municipalities can opt out of approving AF collection equipment if they deem costs are prohibitive.

The final recommendation is that it is preferable for a municipality to pay for AF conversions through a cost per tonne increase rather than an up front incentive payment. (Clause 3 above) This is anticipated to reduce municipal and/or CIF up front funding commitments and should also provide an incentive to increase collection tonnage over the life of the contract.

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