TORONTO

STAFF REPORT
ACTION REQUIRED

Utilization of the Biogas from the new Source Separated Organic Material Processing Facilities and Landfill Gas from the Green Lane Landfill

Date:	October 19, 2009
To:	Public Works and Infrastructure Committee
From:	General Manager, Solid Waste Management Services
Wards:	All
Reference Number:	p:/2009/swms/Nov./022PW

SUMMARY

The purpose of this report is to convey the results of the biogas and landfill gas utilization study undertaken by Solid Waste Management Services (SWMS) (the 'Study'). The objective of the Study was to comparatively assess options to utilize the biogas to be produced at the City's new Source Separated Organic (SSO) Material processing facilities to be constructed at the Disco Transfer Station and Dufferin Waste Management Facility sites (the 'SSO Facilities'), and the landfill gas collected from the Green Lane Landfill.

Based upon the results of the Study, SWMS proposes that the biogas to be produced at the SSO Facilities be refined to pipeline gas quality and supplied to the local gas distribution system for eventual use by the City as fuel for compressed natural gas (CNG) solid waste collection vehicles and to offset consumption of natural gas in City facilities. This report seeks the authority, subject to execution of an agreement to develop the new SSO processing facility at the Disco Transfer Station site, to undertake Request for Expressions of Interest (REOI) and Request for Proposals (RFP) processes to procure a contract to design, build, own and operate the pipeline gas refining systems at the SSO Facilities.

Based upon the results of the Study, SWMS proposes that the landfill gas generated by the Green Lane Landfill be utilized in the cogeneration system proposed by Toronto Hydro Energy Services Inc. (THESI) on behalf of the partnership between THESI and Ontario Plants Propagation Ltd. (the 'Partnership'). The report requests authority to negotiate with the Partnership on a sole-source basis for a contract to design, build, own and operate a

new cogeneration system to utilize the landfill gas from the Green Lane Landfill and to subsequently report the outcome of the negotiations to City Council.

RECOMMENDATIONS

The General Manager, Solid Waste Management Services recommends that:

1. City Council authorize and direct the General Manager, Solid Waste Management Services, to enter into sole source negotiations with Toronto Hydro Energy Services Inc. and Ontario Plants Propagation Ltd., in partnership, for a contract to design, build, own and operate a new cogeneration system to utilize the landfill gas from the Green Lane Landfill.

2. The General Manager, Solid Waste Management Services, report back to City Council on the results of the negotiation.

3. Subject to the execution of an agreement for the design, construction and operation of the new SSO processing facility at the Disco Transfer Station site, the General Manager Solid Waste Management Services and the Director Purchasing and Materials Management Divisions be directed to:

    a. issue a Request for Expressions of Interest to pre-qualify proponents to design, build, own and operate biogas refining systems at the SSO Facilities; and,

    b. issue a Request for Proposals to pre-qualified proponents for a contract to design, build, own and operate biogas refining projects at the SSO Facilities; and,

4. Subject to the execution of an agreement for the design, construction and operation of the new SSO processing facility at the Disco Transfer Station site, the General Manager Solid Waste Management Services and the Deputy City Manager and Chief Financial Officer be directed to investigate options for funding the cost of biogas refining through cost savings resulting from displacing natural gas with refined biogas or some other means.

Financial Impact

The recommendations presented in this report have no financial implications.

The Deputy City Manager and Chief Financial Officer has reviewed this report and agrees with the financial impact information.

DECISION HISTORY

As its May 17, 18 and 19, 2005 meeting, City Council adopted the recommendation from the Policy and Finance Committee authorizing staff to negotiate agreement with THESI to undertake cogeneration projects at Dufferin Transfer Station, Ashbridges Bay Treatment Plant, Thackeray Road Landfill and Highland Creek Treatment plant. The City

The City Council Decision document can be viewed at Page 20, Item 27 "Proposal by Toronto Hydro Energy Services Inc. to Develop Renewable Energy Cogeneration Projects at Selected City Sites":
http://www.toronto.ca/legdocs/2005/agendas/council/cc050517/cofa.pdf

As its March 3, 4 and 5, 2008 meeting, Council City approved Motion M17.8 "Toronto Hydro Renewable Energy Products within City Facilities" which reaffirmed the original motion but substituted the Thackeray Landfill with the GLL. This motion also refers to THESI agreeing to compensate the City by sharing any revenues, payments or other subsidies to be generated through the development and operation of projects of this nature. Any funds to be received through the development and operation of the cogeneration project are to be first applied to ensuring that there is no increase in City divisional Operating or Capital costs and second, towards other Council-approved initiatives that would reduce air pollution and greenhouse gas emissions.

The City Council Decision document can be viewed at (relevant pages from 111 to 112):
http://www.toronto.ca/legdocs/mmis/2008/cc/decisions/2008-03-03-cc17-dd.pdf

The City has adopted three Green House Gas (GHG) and Smog Pollutant (Criteria Air Contaminants – CACs) emission reduction targets culminating in a significant 80% reduction by 2050 target which is in keeping with other authorities such as the Province of Ontario who have the identical target.

More information is available to the staff report titled "Climate Change, Clean Air and Sustainable Energy Action Plan: Move from Framework to Action" dated June 13, 2007 to Executive Committee:
http://www.toronto.ca/legdocs/mmis/2007/pe/bgrd/backgroundfile-4982.pdf

It is the City's objective that emission reduction credits, for reducing emissions of GHGs and CACs, resulting from City projects, including the projects which are the subject of this Study, are to be retained by the City and eventually retired.

More information is available to the staff report titled "Contract Language to be Included in Contracts with Potential Carbon Credits" dated August 31, 2006 to Policy and Finance Committee:
http://www.toronto.ca/legdocs/2006/agendas/committees/pof/pof060918/it036.pdf

ISSUE BACKGROUND

SWMS and THESI have been discussing the development of biogas cogeneration projects at the proposed new SSO processing facilities proposed for the Disco Transfer Station and Dufferin Waste Management Facility sites since the fall of 2008. In June 2009, THESI submitted a proposal to develop the biogas cogeneration projects on an essentially design, build, own and operate basis.

SWMS and the proposed limited partnership of THESI and OPPL (the 'Partnership') have been discussing the development of landfill gas cogeneration project at the Green Lane Landfill and the OPPL site since the fall of 2008. In June 2009, THESI submitted a proposal on behalf of the Partnership to develop the landfill gas cogeneration project on an essentially design, build, own and operate basis.

Fleet Services division in cooperation with Solid Waste Management Services has purchased a CNG refuse truck that will be built with the Cummins Westport ISL natural gas engine. The ISL model matches horsepower and torque ratings for comparable diesel engines and as an original equipment manufacturer (OEM) design is approved for using biomethane fuels derived from landfill projects. Another advantage of the ISL engine is that it already meets the 2010 emission standards mandated by the US EPA well ahead of the regulation using a much simpler engine design than the clean diesel alternatives. Toronto's new CNG refuse truck is expected to arrive later in 2009.

CNG engines are one of several platforms being considered for Toronto's heavy-duty truck fleet in 2009 as part of a TAF-sponsored project known as the Green Vehicle Evaluation and Selection Tool (GVEST). The GVEST tool is currently being developed by Fleet Services in conjunction with its partners to look at the various engine platforms and compare them on cost, operability and emissions. As part of Fleet's Green Fleet Plan, 2008 – 2011 approved by Council, heavy-duty trucks are the next candidates to be transitioned to cleaner and lower emission vehicles as was done with the light-duty fleet.

COMMENTS

Biogas and Landfill Gas Production

The SSO Facilities will employ anaerobic digestion to convert the organic fraction of the SSO material stream into digester solids, which will subsequently be converted into compost at a secondary processing site, and biogas which is a combustible mixture of methane and carbon dioxide. Based on the past performance of the existing organics processing facility at the Dufferin Waste Management Facility, each tonne of SSO processed produces approximately 120 cubic metres of biogas containing 60 percent methane. Processing SSO at the combined capacity proposed for the SSO Facilities of 110,000 tonnes per year will result in the production of approximately 13.6 million cubic meters of biogas annually, equivalent to a rate of 920 cubic feet per minute.

When processing SSO at 110,000 tonnes per year, the forecasted annual quantity of biogas from the SSO Facilities:

- is equivalent to approximately 8 million cubic meters of natural gas, which could satisfy the heating and hot water requirement of approximately 2,700 homes;

- contains sufficient energy to support approximately 3.6 MW of electricity production producing 28 million kWh of electricity annually which could satisfy the electricity requirement of approximately 2,800 homes; or,

- contains the energy equivalent of approximately 7 million litres of diesel fuel which is in excess of the approximately 4.4 million litres of diesel fuel consumed annually by the solid waste collection fleet.

Decomposition of the organic fraction of solid waste in a landfill produces landfill gas, which is a combustible mixture of methane, carbon dioxide and lesser amounts of other gasses such as oxygen and nitrogen. Landfill gas typically also contains other compounds of significance such as hydrogen sulphide and siloxane, which must be removed to make the gas suitable for most applications.

The Green Lane Landfill has an existing system to collect and flare landfill gas from closed landfill cells. This system is being expanded to improve the gas capture efficiency and thereby reduce off-site odours. In the future, the landfill gas collection system will be expanded to service active and planned new landfill cells. Currently landfill gas is collected at a rate of approximately 950 cubic feet per minute, equivalent to approximately 14 million cubic metres of landfill gas annually. The concentration of methane in the landfill gas is typically 50 percent by volume.

Golder Associates were engaged by SWMS in June 2009 to forecast future quantities of landfill gas to be captured from the Green Lane Landfill based on the forecasted types and quantities of waste to be interred. According to forecasts, approximately 34 million cubic meters (equivalent to 2,300 cubic feet per minute) of landfill gas will be captured in 2012. At peak production in 2023, the forecast predicts capture of 59 million cubic metres (equivalent to 4,000 cubic feet per minute) of landfill gas.

At peak production, the forecasted quantity of landfill gas from the Green Lane Landfill:

- is equivalent to approximately 29.5 million cubic meters of natural gas, which could satisfy the heating and hot water requirement of approximately 9,800 homes;

- contains sufficient energy to support approximately 16 MW of electricity production producing 126 million kWh of electricity annually which could satisfy the electricity requirement for approximately 12,600 homes; or,

- contains the energy equivalent of approximately 25 million litres of diesel fuel which is in excess of the approximately 4.4 million litres of diesel fuel consumed annually by the solid waste collection fleet.

Environmental Considerations

Landfill gas contains methane and carbon dioxide both of which are greenhouse gases (GHGs) but methane has a Global Warming Potential (GWP) 21 times that of the carbon dioxide. Collecting methane and flaring it not only reduces the odour but also reduces the GWP of the gas released because burning of methane turns it into carbon dioxide which has a GWP of only 1. Flaring reduces odour and reduces the release of GHGs.

Biogas also contains methane and, as for landfill gas, flaring can reduce odour and can reduce the associated GHG emissions.

However, utilizing the biogas or landfill gas to either generate electricity and thermal energy, as in cogeneration, or as an alternate fuel supply, as with refining the biogas or landfill gas to pipeline gas quality and subsequently utilizing the gas for CNG vehicles, not only reduces the GHG emissions to zero but also offsets the fuels that would otherwise create the electricity or heat a facility or power a vehicle.

Collecting and flaring biogas or landfill gas, or using them as a combustion source, as well as offsetting the emissions from electricity generation or offsetting diesel vehicle emissions, could all be used to establish carbon credits. These have potential monetary value which, depending on many inherent market rules and provisions, and which in turn vary between the regulatory and voluntary market situations, are a potential source of redeemable costs. However, the market rules effectively limit or disallow such potential value by excluding projects that are governed by regulation, such as odour reduction regulations, or are lacking in "additionality", meaning lacking in initiatives to reduce GHG or other carbon releases that would not otherwise be done for other reasons.

The City also has a policy to register and retire its carbon credits, making the consideration of carbon credits as a monetary benefit irrelevant.

However, a potential conflict with City policy exists in the case where the biogas or landfill gas is converted into electricity through a cogeneration project. In order to qualify for the premium rates paid for electricity from renewable sources offered under the Ontario Power Authority's Fee-in Tariff (FIT) program, the OPA requires that all rights to the GHG reduction credits that OPA requires pass to the OPA. Qualifying for the FIT program would mean that GHG reductions achieved through the use of the biogas or landfill gas in cogeneration could not be counted towards the City's GHG reduction targets.

The OPA's policy and specific contractual language respecting "environmental attributes" being transferred to the OPA as a condition of contracts with City will be explored by the

City's Carbon Credit Working Group with the aim of limiting, as much as possible, the transfer of any City environmental attributes to the OPA.

Currently no program similar to the OPA's FIT program exists which would be applicable to the other biogas and landfill gas utilization options considered in the Study. Emission reductions achieved by implementing utilization options other than cogeneration could be retained by the City.

Bio/Landfill Gas Utilization Study

In April 2009, SWMS engaged the services of FVB Energy Inc. (via RFP #9121-09-3034) to undertake the Study and to report the results of a comparative assessment of utilization options for the biogas to be generated by the SSO Facilities and for the landfill gas collected from the Green Lane Landfill. The following options to utilize the biogas and landfill gas were assessed:

1. cogeneration based on the proposals submitted by THESI where THESI, in the case of the SSO Facilities or the Partnership in the case of the Green Lane Landfill, would design, build, own and operate a system to convert the biogas or landfill gas into electricity, to be supplied to the local grid and sold to the OPA under the FIT program, and heat to be used on site to satisfy building or process heating requirements;

2. production of pipeline gas where a contractor would be engaged to design, build, own and operate a system to refine the biogas to meet quality requirements of the local natural gas distribution system, and where the resulting pipeline gas would be conveyed through the existing natural gas distribution system to displace a portion of the approximately 40 million cubic meters of natural gas consumed by City facilities annually; and,

3. production of pipeline gas, as above, with a corresponding plan to transition the solid waste collection vehicle fleet from diesel to compressed natural gas (CNG) fuel and thereby displace the approximately 4.4 million litres of diesel fuel consumed annually by solid waste collection vehicles.

Comparative Assessment of Biogas and Landfill Gas Utilization Options

The 20-years contract term of the FIT program was adopted as the Study planning period to provide an equitable basis of comparison for all options. Utilization options were compared on the basis of financial, environmental and risk criteria as described in the following paragraphs.

The financial aspects of the utilization options were compared on the basis of estimated incremental capital and operating costs to be incurred by, and revenues and cost savings to accrue to, the City. The Study calculated the net present value of all cost, revenue and

savings streams over the planning period based on capital borrowing costs and discount and inflation rates suggested by the City's Finance Division.

The environmental aspects of the biogas utilization options were compared on the basis of the reductions of greenhouse gas emissions and the reductions of smog forming emissions, as Criteria Air Contaminants, in keeping with the City's policies and adopted targets. Emissions reductions from offsetting electricity, natural gas, and diesel fuel by replacing them with biogas were also included. The standard landfill and waste related inventory protocols of counting carbon crediting and the City's adopted policies respecting retiring credits were also used in the comparison.

The utilization options were compared on the basis of the following risks:

- financial risk: the risk that the actual costs, revenues or savings differ from Study estimates due to errors in cost estimation or errors in forecasting future energy prices;

- technical risk: the risk that the technology may not operate as predicted due to poor reliability or performance;

- project execution risk: the risk that the execution of the project may be frustrated due to an inability to contract for necessary services on acceptable terms;

- contract management and administration risk: the risk that the City may not fully realize project benefits due to management or administrative issues between contracting parties.

The quantitative Study results of the financial and environmental aspects of the utilization options for biogas and landfill gas are summarized in Tables 1 and 2 respectively found in the Attachment to this Report.

Results: SSO Facilities - Cogeneration

Description

The cogeneration system proposed to be designed, built, owned and operated by THESI at each SSO Facility would include either a single 1.6 MW_e unit or two 1.06 MW_e units as required to utilize the maximum quantity of biogas.

The cogeneration system will produce electricity, which will be sold to the OPA under the FIT program, and the heat will be recovered and supplied to the SSO Facilities in the form of hot water to satisfy building and process heat requirements.

Financial aspects

THESI would design, build, own and operate the cogeneration system and therefore there would be no direct costs to the City.

In exchange for the biogas and space provided by the City, THESI offers a revenue stream consisting of a fixed payment for the site and access, and a variable payment which will be a percentage of the gross electricity revenue. The percentage of the gross electricity revenue will vary depending on the quantity of biogas supplied and over time as THESI's capital investment is recovered.

Environmental Aspects

Biogas that is used in a cogeneration system to produce both electricity and thermal energy can also be regarded, as by standard protocols, to be a non-GHG polluting fuel source (despite its release of carbon dioxide when combusted) that offsets other polluting fuel sources. This produces a higher benefit than simple flaring.

However, these benefits do not accrue to the City under current arrangements with the OPA nor could they be counted towards the City's GHG reduction targets.

Though in reality, a benefit clearly exists to the world at large, it cannot be counted as an environmental benefit or accomplishment by the City.

This option will result in a reduction of 256,000 tonnes of GHG being released into the environment.

Risk Aspects

This option is considered to have low financial risk to the City since costs will be borne by THESI who provided the financial information used in the Study. The FIT program provides a guaranteed purchase price for the electricity over the Study planning period which minimizes risk of forecasting future energy prices.

This option is considered to have low technical risk as the large number of biogas cogeneration projects attests to the reliability and performance of cogeneration systems in this application.

THESI's proposal confirms the City's ability to secure a contract to design, build, own and operate the cogeneration system. Since the City would be required to enter into only one agreement with THESI, and the form of the agreement can be based on existing models, the risk of managing the contract is considered to be minimal. Similarly, since the settlement of the variable portion of the payment to the City will be based on gross electricity revenue paid by a third party, i.e., the OPA, the risk of administering the contract is considered to be minimal.

Results: SSO Facilities - Pipeline Gas

Description

The pipeline gas option as considered in the Study consists of the following components at each SSO facility:

- a new system to refine the biogas by removing constituents other than methane, and to compress the refined pipeline gas for supply to Enbridge Gas' distribution grid; and,

- monitoring and control systems at the connection points to ensure that only pipeline gas, meeting Enbridge Gas' quality specifications, is accepted into the distribution grid.

The quantities of biogas forecasted at the combined capacity proposed for the two SSO facilities of 110,000 tonnes per year will produce approximately 13.6 million cubic meters and could be converted into approximately 8 million cubic metres of pipeline gas quality annually. From the SSO facilities, the pipeline gas would be connected to Enbridge Gas distribution system and would thereafter be available for consumption by the City. The City would retain ownership of the pipeline gas from production to consumption.

Financial aspects

In order to create an equitable basis for comparison with the cogeneration options, the Study assumed that the new system to refine and compress biogas would be designed, built, owned and operated by a contractor acting on a 20-year contract with the City. The contractor would be compensated for the capital and operating costs and risk through a variable payment based on the quantity of pipeline gas produced over the term of the operating phase of the contract (see Table 1 in the attachment to this report).

Environmental aspects

If appropriate contractual agreements are put in place to clarify and confirm that such SSO biogas when transported elsewhere to unknown consumers, is by protocol a fuel source that does not produce GHG emissions (even when combusted) and that ownership of the offsetting credits remains with the City, such gas can be both valued and counted fully toward the City's GHG reduction targets.

This option will result in a reduction of 223,000 tonnes of GHG being released into the environment, but which can be counted toward the City's reduction target.

Risk aspects

Biogas refining costs were estimated in the absence of information from operating facilities and therefore the risk exists that actual costs may exceed estimates.

The estimate of future cost savings from displacing natural gas with pipeline gas are considered to be conservative as they assume annual cost increases over the planning period at or slightly above CPI. Future natural gas costs are most likely to be higher than future costs used in the Study.

This option is considered to have low technical risk as the large number of biogas refining projects in North America and elsewhere are sufficient to attest to the reliability and performance of gas refining systems in this application.

In terms of the contract risk, this option would require the City to enter into multiple agreements covering the biogas refining operation, connection to Enbridge Gas' system, and for managing the transportation of the gas through the distribution system. No contractual model currently exists for the biogas refining system. Also the methods by which the payments required by the various contracts would be determined may rely upon multiple measurements by the contracting parties, creating the potential for settlement disputes.

Results: Green Lane Landfill – Cogeneration

Description

The cogeneration system proposed to be designed, built, owned and operated by the Partnership would have the following components:

- new systems to treat and compress the landfill gas to be installed at the Green Lane Landfill and connected to the landfill gas collection system;
- a new 7 km pipeline to convey the landfill gas to OPPL's site;
- a cogeneration system to be located at OPPL's site with capacity to be increased from 5 MW_e to a maximum of 10 MW_e over time as warranted by increasing quantities of landfill gas.

The cogeneration system will produce electricity, which will be sold to the OPA under the FIT program, and the heat will be used in OPPL's greenhouses.

This option benefits a local employer (OPPL) and therefore has strong support in the community.

Should future landfill gas quantities exceed the quantity required to support the 10 MW_e cogeneration system at OPPL's site, THESI proposes to utilize the excess landfill gas in a new electricity generating facility with a capacity of up to 6 MW_e to be located at the Green Lane Landfill.

Financial aspects

The Partnership would design, build, own and operate the cogeneration system and therefore there would be no direct costs to the City.

In exchange for the landfill gas and space provided by the City, the Partnership offers a revenue stream consisting of a fixed payment for the site and access, and a variable payment which will be a percentage of the gross electricity revenue. The percentage of the gross electricity revenue will vary depending on the quantity of landfill gas supplied and over time as the Partnership's capital investment is recovered.

At THESI's suggestion, the Study assumed that revenue from the up to 6 MW_e generation facility which may be constructed at the Green Lane Landfill site if warranted by landfill gas volumes will be based on the same percentage of gross electricity revenues as for the cogeneration system located at OPPL's site.

Environmental Aspects

Landfill gas that is used in a cogeneration system to produce both electricity and thermal energy can also be regarded, as by standard protocols, to be a non-GHG polluting fuel source (despite its release of carbon dioxide when combusted) that offsets other polluting fuel sources. This produces a higher benefit than simple flaring.

However, these benefits do not accrue to the City under current arrangements with the OPA nor could they be counted towards the City's GHG reduction targets.

Though in reality, a benefit clearly exists to the world at large, it cannot be counted as an environmental benefit or accomplishment by the City.

This option will result in a reduction of 1,226,000 tonnes of GHG being released into the environment, but which cannot be counted toward the City's reduction target.

Risk Aspects

This option is considered to have low financial risk to the City since costs will be borne by the Partnership and the financial information used by the Study was provided by THESI. The FIT program provides a guaranteed purchase price for the electricity over the Study planning period which minimizes risk of forecasting future energy prices.

This option is considered to have low technical risk as the large number of landfill gas cogeneration projects attests to the reliability and performance of cogeneration systems in this application.

The proposal from the Partnership confirms the City's ability to secure a contract to design, build, own and operate the cogeneration system. Since the City would be required to enter into only one agreement with the Partnership, and the form of the agreement can be based on existing models, the risk of managing the contract is considered to be minimal. Similarly, since the settlement of the variable portion of the payment to the City will be based on gross electricity revenue paid by a third party, i.e. the OPA, the risk of administering the contract is considered to be minimal.

Results Green Lane Landfill – Pipeline Gas

Description

The pipeline gas option as considered in the Study has the following components:

- a new system to refine the landfill gas by removing constituents other than methane, and to compress the refined pipeline gas for supply to Union Gas' distribution grid, would be constructed at the Green Lane Landfill site and connected to the landfill gas collection system;

- a new 15 km pipeline to convey the pipeline gas from the Green Lane Landfill site to the nearest suitable connection point on the Union Gas distribution system; and,

- monitoring and control systems at the connection points to ensure that only pipeline gas meeting Union Gas' quality specifications is accepted into the distribution grid.

The quantities of landfill gas forecasted for 2012, and the peak landfill gas production year of 2023, could be converted into approximately 17 million and 29 million cubic metres of pipeline gas respectively. From the Green Lane Landfill, the pipeline gas would be wheeled through Union Gas' and subsequently Enbridge Gas' distribution systems and would thereafter be available for consumption by the City. The City would retain ownership of the pipeline gas from production to consumption.

Financial aspects

In order to create an equitable basis for comparison with the cogeneration options, the Study assumed that the new system to refine and compress landfill gas would be designed, built, owned and operated by a contractor acting on a 20-year contract with the City. The contractor would be compensated for the capital and operating costs and risk through a variable payment based on the quantity of pipeline gas produced over the term of the operating phase of the contract.

Environmental aspects

If appropriate contractual agreements are put in place to clarify and confirm that such landfill biogas when transported elsewhere to unknown consumers, is by protocol a fuel source that does not produce GHG emissions (even when combusted) and that ownership of the offsetting credits remains with the City, such gas can be both valued and counted fully toward the City's GHG reduction targets.

There are no environmental differences between pipeline gas being supplied from biogas or from Landfill biogas, assuming similar standards of biogas cleansing, other than those that derive from the greater quantities delivered by pipeline from Green Lane.

This option will result in a reduction of 1,113,000 tonnes of GHG being released into the environment, but which can be counted toward the City's reduction target.

Risk aspects

Landfill refining costs were estimated in the absence of information from operating facilities and therefore the risk exists that actual costs may exceed estimates.

The estimate of future cost savings from displacing natural gas with pipeline gas are considered to be conservative as they assume annual cost increases over the planning period at or slightly above CPI. Future natural gas costs are most likely to be higher than future costs used in the Study.

Refining large quantities of landfill gas to supply pipeline gas to a natural gas distribution system is known to be undertaken at only two projects in North America; a private landfill in Ohio and the closed Fresh Kills landfill in New York. Available information on the reliability and performance of the existing large-scale landfill gas refining systems is limited and the system's ability to meet local pipeline gas quality requirements when subjected to variations in the quantity and composition of the landfill gas has not been confirmed. The limited North American experience with landfill gas refining is not sufficient to consider the technical risk of this option to be minimal.

In terms of the contract risk, this option would require the City to enter into multiple agreements covering the biogas refining operation, connection to Union Gas' system, and for managing the transportation of the gas through Union Gas' and Enbridge Gas' distribution systems. No contractual model currently exists for the biogas refining system. Also the methods by which the payments required by the various contracts would be determined may rely upon multiple measurements by the contracting parties, creating the potential for settlement disputes.

Results: CNG SWMS Collection Fleet

Description

This option complements the pipeline gas options of either the SSO facilities or the Green Lane Landfill by transitioning the Solid Waste collection vehicle fleet from diesel to compressed natural gas fuel. The Solid Waste collection fleet consumes approximately 4.4 million litres of diesel fuel annually. A similar CNG fuelled Solid Waste collection fleet would require approximately 5.3 million cubic metres of natural gas, which is less than the quantity of pipeline gas to be produced by the two SSO facilities processing at full capacity.

The plan to transition the Solid Waste collection vehicle fleet to CNG fuel includes the following components:

- replacing existing diesel vehicles at the end of their service life with new CNG fuelled vehicles;

- constructing new City-owned CNG fuelling stations at the City's Bermondsey, Ingram and Ellesmere Yards and contracting for regular inspection and maintenance services; and,

- training fleet maintenance staff and upgrading existing fleet maintenance facilities to accommodate CNG vehicles.

Financial aspects

The City would incur the following incremental capital costs to transition the Solid Waste collection fleet to CNG fuel:

- the incremental cost of CNG fuelled collection vehicles over similar model diesel vehicles; and,

- the cost of constructing new City-owned CNG fuelling stations, including compressors and gas storage and distribution piping, at the Bermondsey, Ingram and Ellesmere Yards.

The Study assumed an incremental cost for the maintenance of CNG collection vehicles relative to diesel vehicles limited to the cost of once or twice annual replacement of spark plugs. Additional incremental operating costs would result from the operation of the CNG fuelling stations, primarily from the electricity consumed by the gas compressors, and from the contracted regular maintenance service.

Savings would accrue to the City from displacing the approximate 4.4 million litres of diesel fuel consumed annually with pipeline gas. The pipeline gas in excess of the

quantity required to fuel a CNG waste collection fleet would displace the consumption of natural gas by City facilities and thereby accrue additional savings.

Environmental aspects

Displacing diesel fuel with pipeline gas will result in a significant reduction in local smog causing emissions. Smog is most commonly identified in Toronto by the excessive presence of ozone, or fine particular matter. Their presence in the atmosphere relates closely to the amount of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) released to air in the presence of sunlight. These are referred to as the smog causing pollutants. Criteria Air Contaminants (CACs) includes these gasses plus others such as sulphur dioxide (SO_2).

In this report "CAC emissions" of NO_x and SO_2 are taken as a surrogate equivalent for smog forming emissions as NO_x is a major contributor and control on the presence of ozone, and SO_2 contributes to fine particulate matter concentrations though diesel fuel consumption.

Replacing diesel fuel with biogas to power tucks is a considerable environmental improvement and all benefits and offsets would fully accrue to the City and be fully countable towards the City's GHG reduction and CAC reduction targets.

As a complement to the pipeline gas option for either biogas or landfill gas, transitioning the solid waste collection fleet to CNG will create additional GHG reductions, which can be counted toward the City's reduction target, and additional CAC reduction which can also count as a benefit to the City's targets. The additional emission reductions are summarized in the table below.

Table: Additional Emission Reductions Achieved by SWMS Collection Fleet Transition to CNG Fuel

As a complement to the pipeline gas option for:	GHG Reduction CO_2e (tonne)	CAC reduction	
		NO_x (tonne)	SO_2 (tonne)
Biogas	45,000	7,000	1,900
Landfill Gas	45,000	7,000	1,900

Risk aspects

This option is considered to have low risk of underestimating incremental capital and operating costs because the largest incremental cost item, the incremental cost of CNG vehicles, is based on recent tender results and future incremental costs are most likely to be below estimates.

The estimate of future cost savings from displacing diesel and natural gas with pipeline gas are considered to be conservative as they assume annual cost increases over the planning period at or slightly above CPI. Future diesel and natural gas costs are most likely to be higher than future costs used in the Study.

Only two municipalities in north-eastern North America are known to operate CNG fuelled solid waste collection vehicles and their operating history is limited. Therefore, due to the lack of information on the performance and reliability of CNG solid waste collection vehicles this option is considered to have some technical risk.

In Summary

In light of the Study results, it is staff opinion that cogeneration is the preferred utilization option for the landfill gas from the Green Lane Landfill. For a project of this scale, the technical risks of the pipeline gas refining are considered to outweigh the potential financial benefit relative to the cogeneration option. Therefore, staff recommend that the General Manager Solid Waste Management Services be authorized to negotiate with the Partnership on a sole-source basis for a contract to design, build, own and operate a new cogeneration system to utilize the landfill gas from the Green Lane Landfill and to subsequently report the outcome of the negotiations to City Council. This recommendation is consistent with previous Council direction on the implementation of renewable projects with Toronto Hydro (see Decision History for March 3, 4 and 5 2008).

In light of the Study results, it is staff opinion that the pipeline gas option, with the complementary plan to transition the solid waste collection fleet to CNG fuel, is the preferred utilization option for the biogas from the SSO Facilities. Relative to the cogeneration option, the additional financial and environmental benefits of the pipeline gas option for the biogas, with the complementary plan to transition the solid waste collection fleet to CNG fuel, outweigh the technical risk for a project of this scale. Therefore, staff recommend that, subject to execution of an agreement to develop the new SSO processing facility at the Disco Transfer Station site, the City issue a Request for Expressions of Interest (REOI) and Request for Proposals (RFP) processes to procure a contract to design, build, own and operate the pipeline gas refining systems at the SSO Facilities.

The Toronto Environment Office assisted with the preparation of this report.

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SIGNATURE

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ATTACHMENTS

Table 1: Financial and Environmental Assessment of SSO Biogas Utilization Options
Table 2: Financial and Environmental Assessment of Landfill Gas Options