



The Regional Municipality of Durham Report

To: The Committee of the Whole
From: Commissioner of Works, Commissioner of Finance, and Commissioner of Corporate Services
Report: #2019-COW-17
Date: June 12, 2019

Subject:

Organics Management Next Steps and Updated Preliminary Business Case.

Recommendations:

That the Committee of the Whole recommends to Regional Council:

- A) That approval be granted for the Region to proceed with Council's preferred long-term organics' management technology solution, with the capital project to include both a mixed waste transfer and pre-sort facility and an anaerobic digestion (AD) organics management processing facility with the specific financing to be approved at time of Request for Proposal (RFP) issuance and confirmed at the time of RFP award;
- B) That wet anaerobic digestion be approved as the Region's technology for processing organic materials, to maximize diversion, including Green Bin organics and the organic fraction of mixed garbage wastes;
- C) That the Region's service delivery approach for implementing the Region's long-term organics management solution include public ownership of the transfer/pre-sort facility and AD organics management processing facility with a long-term (15-25 year) single contract to be obtained from the private sector to design, build, operate and maintain (DBOM) the facilities;
- D) That procurement follow a two-step Request for Proposal Qualifications (RFPQ) and Request for Proposal (RFP) process, in which:
 - a. The RFPQ shall include appropriate requirements for financial capacity (construction, bonding, operations) together with technical requirements, to be issued with the list of recommended prequalified companies (to participate in the subsequent RFP) to be presented to Regional Council for approval in fall 2019; and

- b. The subsequent RFP process shall be issued together with the design-build-operate-maintain contract to reduce the need for protracted negotiations prior to financial close.
- E) That Regional staff be authorized to retain GHD Limited (GHD) to act as the owner's engineer, at a cost not to exceed \$800,000 to be funded from the existing capital project funds, for the following scope of work:
 - a. Development of a detailed project implementation schedule setting out key activities and milestones for the execution of the project;
 - b. Undertake the siting evaluation and environmental compliance approvals and permitting application for transfer/mixed waste pre-sort and AD facilities within Durham Region; and
 - c. Support both the RFPQ and RFP processes, including development of technical documentation and evaluations.
- F) That the updated 2019 preliminary business case for the Region's recommended transfer/mixed waste pre-sort and AD facilities be received for information, recognizing that an update will be provided as part of the recommendation to Regional Council to proceed with RFP issuance once uncertainties around key parameters are resolved (e.g. siting and haulage implications, project implementation timing and site specifications, energy and other by-product preferences, available connections, revenues, costs and implications due to evolving regulatory requirements);
- G) That an independent third-party fairness monitor be retained at a total cost not to exceed \$100,000 to oversee subsequent procurement processes as approved by Regional Council to protect the Regional Municipality of Durham and to ensure fairness and transparency on behalf of vendors and other stakeholders, and that the selection of the fairness monitor be made at the discretion of the Chief Administrative Officer and Commissioner of Finance;
- H) That external legal counsel be retained at a cost not to exceed \$125,000 to provide advice for the next steps of the long-term organics management solution and assist in the procurement process and contractual arrangements; and
- I) That Regional staff report back to Regional Council on the results of the following to seek further direction:
 - a. The feasibility of a potential partnership/joint venture with the preferred proponent identified through the Expression of Interest (EOI-1152-2018 to solicit interest in a partnership to procure, finance and share the net costs arising from the development and implementation of the Region's long-term organics waste management solution project), and whether negotiations to establish this partnership/joint venture should commence;

- b. The evaluation of siting (i.e. location) and environmental compliance approvals and permitting application requirements for the transfer/mixed waste pre-sort and AD facilities within Durham Region;
 - c. A detailed project implementation schedule, including key activities and milestones, to progress the implementation of the Region's long-term organic's management solution; and
 - d. Recommended timing and approval to initiate the RFP, based on resolution of uncertainties around key parameters (e.g. siting and haulage implications, project implementation timing and site specifications, energy and other by-product preferences, available connections, revenues, costs and implications due to evolving regulatory requirements).
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Report:

1. Purpose

- 1.1 The purpose of this report is to seek approval of the next steps for the long-term organics management solution, including proceeding with a mixed waste transfer and pre-sort facility and anaerobic digestion (AD) (utilizing a wet technology) under a design, build, operate and maintain (DBOM) service delivery approach.
- 1.2 This report also provides an update and next steps to solicit a business partnership for the Region's long-term organics management solution pursuant to EOI 1152-2018 (EOI). Additional technical and procurement expertise is also required to assist the Region in subsequent procurement processes anticipated in 2019. This report provides the updated preliminary business case results as well as the investigation of the beneficial uses of the by-products from an AD facility.

2. Background

- 2.1 In June 2018, Regional Council approved Report #2018-COW-146, which directed staff to report back on the following, which are addressed in this report:
 - a. That anaerobic digestion with a mixed waste transfer and pre-sort facility be approved as the preferred technologies for the Regional Municipality of Durham's long-term organics management strategy;
 - b. That the development of a Phased Project Implementation Plan be authorized to consider the merits of a first phase with a transfer station capable of accommodating pre-sort capabilities;
 - c. That future business analysis of a mixed waste pre-sort, and organics processing service delivery approach for a potential long-term organics management solution, be limited to either i) a private sector service contract or ii) a design-build-operate and maintain public-private partnership (P3) contract;

- d. That staff be directed to explore options, including confidential non-binding and procedurally fair discussions with interested partners including Request for Information Respondents, regarding partnerships, joint ventures, public-private partnership, co-ownership, or other forms of participation in order to bring available market and other financial information forward for consideration by Regional Council regarding a potential relationship as part of the long term Organics Management Strategy, and more specifically an anaerobic digestion facility; and
 - e. That an investigation of the benefits from Regional use of the potential energy and other by-products and environmental attributes be undertaken and compared to those benefits that may be realized through potential business partnerships.
- 2.2 On May 15, 2019, Committee of the Whole (Report #2019-COW-8) received an update along with specific recommendations for additional technical and financial expertise to assist Regional staff in progressing to the next steps.
- 2.3 Based upon Regional Council approval, Regional staff retained Deloitte LLP who have provided peer review of the preliminary business case update.
- 2.4 Regional Council deferred the following two recommendations from Report # 2019-COW-8, which are in this report for Regional Council approval:
- That procurement expertise and advice be retained at a total cost not to exceed \$100,000 to engage an independent third-party fairness monitor to oversee subsequent procurement processes as approved by Regional Council to protect the Regional Municipality of Durham and to ensure fairness and transparency on behalf of vendors and other stakeholders with the procurement process to be determined by the Chief Administrative Officer and Commissioner of Finance; and
 - That external legal counsel be retained at a cost not to exceed \$125,000 to provide advice for the next steps of the long-term organics management solution to assist in the procurement process and contract arrangements.
- 3. Recommended AD Facility with a Mixed Waste Transfer and Pre-Sort Facility**
- 3.1 In the analysis of potential phasing, it has been determined that the development of a phased implementation plan was not in the Region's best interest.
- 3.2 A transfer/pre-sort facility accepts all the residual garbage from single family residences and multi residential properties and then separates out the recyclables and organics from the garbage. The recyclables will be sent to market while the sorted organics will be processed by the AD along with Green Bin organics and converted into energy and fertilizer. The remaining residue waste will be processed at the Durham York Energy Centre (DYEC).

3.3 Significant advantages can result from co-location, including:

- Minimizing haulage and transportation costs and logistical efficiencies and cost savings;
- Reduced odour and greenhouse gas (GHG) emissions; and
- Increased operational efficiencies and flexibility and reduced risk.

3.4 In consultation with GHD, it was determined that the transfer/pre-sort facility and AD should be operated by the same entity to reduce Regional risk. It was also determined that siting and implementation should be conducted together to avoid capital and operational inefficiencies.

3.5 While co-location requires a larger site, opportunities and challenges of potential sites will be identified, reviewed and addressed with the assistance of GHD (i.e. to complete their original 2016 Part 3 consulting proposal) at a cost not to exceed the original Owner's engineer contract of \$800,000. It is recommended that approval be granted to proceed to implement together a mixed waste transfer/pre-sort facility with AD facility, as the Region's project for the long-term-organics management solution.

3.6 Currently, the organic and recyclables in the mixed waste are all combusted in the DYEC. In terms of mixed waste pre-sort and organics processing systems, there are a wide range of technologies available throughout the world. Mixed waste pre-sort systems are not common in Canada. There are two facilities in operation, at a scale approaching the requirements of the Region, located in Edmonton and Halifax.

3.7 A mixed waste pre-sort and transfer station, with AD facility can achieve increased waste diversion, green energy production, and resource recovery of non-combustibles such as ferrous and non-ferrous metals, inert items like glass and grit.

3.8 The implementation of a Provincial organics ban, as identified in the Ontario Organics Action Plan, along with the planning of the mixed waste pre-sort system would ensure the Region is in full compliance with any organics ban regulation.

3.9 It is recommended that the Region proceed, at the same time, with the full mixed waste transfer pre-sort and organics management processing system to mitigate risk. Developing the pre-sort, transfer and AD facility together, and having the same company complete the design, build, operate and maintain ensures the Region can significantly mitigate the input and output quality risks and key project deliverables of increased diversion and green energy production.

3.10 The advantages of co-location of the transfer station pre-sort, transfer station with the anaerobic digestion facility are:

- Minimize double handling of waste materials;
- Provide a better opportunity for greater recovery of higher quality organics and recyclables;
- Minimize haulage between the sites;
- Reduce potential odour issues and combined operations reduces the need for multiple odour control systems;
- Operational efficiencies for staffing and equipment; and
- Business continuity planning and ability to react to unexpected operational upsets.

4. Recommended Organics Management Technology-Wet AD

- 4.1 The selection of an AD technology, either dry or wet, is key to the overall operating success of the facility and is important in providing vendors with additional certainty up-front as they decide whether to participate in the Region's recommended RFPQ-RFP process.
- 4.2 The AD technologies were reviewed as part of the GHD report "Background Research, Technical and Options Analysis" date June 21, 2017. The differences in wet anaerobic digestion and dry anaerobic digestion are that in wet AD, the feedstock is pumped, heated and stirred (5-15 percent solids) and in dry AD it can be stacked (over 15 percent solids) with inoculant (bacteria seed) sprayed over the top of it which percolates through the material, breaking it down over a longer retention time. Wet systems have a successful track record in treating low solid materials such as municipal wastewater and food waste.
- 4.3 The composition of the incoming feedstock is an important consideration when assessing AD technologies. Since the organic fraction recovered from the mixed waste pre-sort facility has a higher contamination rate, the wet AD technology will be better suited to recover the bio-fuel and produce marketable by-products from the digestate. The wet AD technology would also have a:
- reduced footprint;
 - increased feedstock characteristics;
 - reduced retention time;
 - better energy balance;
 - more flexible digestate management; and
 - better economic performance.

- 4.4 The decision to proceed with a wet AD technology allows the range of business case analysis of capital, operating and maintenance costs to be narrowed.
- 4.5 Therefore, it is recommended that wet anaerobic digestion be approved as the technology for processing the Region's organic materials.

5. Recommendation to Proceed with Siting Investigations

- 5.1 The RFPQ will indicate to the prospective bidders that the Region is undertaking a site selection exercise that will consider transportation logistics, compatible land uses, potential synergies with existing facilities and the available utilities and grid proximity. In addition, a commitment by the Region to site the project enhances bidder confidence in the process, results in an expanded vendor pool and can significantly reduce longer-term implementation costs.
- 5.2 The results of the site investigation review and recommended site(s) will be presented to Regional Council prior to the issuance of the RFP.
- 5.3 It is recommended that Regional staff retain GHD to proceed with the detailed project implementation schedule development and complete a siting evaluation. An examination by GHD will be undertaken related to environmental compliance approvals and permitting application requirements, given their expertise and experience in the field of anaerobic digestion. GHD would be the owner's engineer to provide support to RFPQ and RFP development and evaluations.

6. Recommended Service Delivery Approach: Design, Build, Operate and Maintain (DBOM)

- 6.1 On June 13, 2018, Regional Council approved Report #2018-COW-146 implementing the long-term organics management solution either through a private sector service contract or a public-private-partnership approach (P3), based on a design, build, operate and maintain (DBOM) contract as follows:

"C) That future business analysis of a mixed waste pre-sort, and organics processing service delivery approach for a potential long-term organics management solution be limited to either i) a private sector service contract or ii) a design-build-operate and maintain public private partnership (P3) contract"

- 6.2 Under the DBOM model, the design, construction, operation and maintenance related to the asset(s) would be procured under a single long-term contract with a private sector partner. Under this model, the Region would either own and finance construction of any new capital assets or could partner with a business or government entity for both the investment and the procurement and implementation process. A private sector consortium would be responsible for design, construction, operation and maintenance of the facility, secured separately through the RFPQ-RFP process.
- 6.3 In contrast, the private ownership model would involve contracting services from a

private sector waste service provider utilizing a facility or facilities fully owned and operated by the private sector. The Region would enter into a service provision contract, for mixed-waste transfer/pre-sort and organic waste processing. Under a service contract the Region would deliver waste from curbside collection programs to the private sector facility(ies) and would be charged a processing fee by the merchant/private sector partner in addition to payment for all costs related to the haulage and transportation of both mixed garbage wastes and organics to the private sector facility/facilities.

- 6.4 As part of the identified next steps (Report # 2019-COW-8), additional analysis of the two service delivery options shortlisted by Regional Council was completed. Analyses of the service delivery approaches focused on assessing criteria related to three broad categories:
- a. The level of Regional ownership and control;
 - b. The degree of risk transfer to the private sector; and
 - c. Business/financial considerations.

Ownership and Control

- 6.5 A DBOM model will provide the Region with greater control over its long-term organics management system than a private sector model. It is in the Region's best interest to maintain a level of control over this project to sustain a long-term solution for the Region that can react to both community and environmental needs in a fiscally responsible manner. Under a private sector model, the Region is relinquishing much of that control to a third party.
- 6.6 Control is the greatest where there is Regional ownership of a local site and facilities, since this allows the Region to react to its waste management requirements with the least amount of outside influence.
- 6.7 Under the private sector option, haulage and transportation costs are also less certain and operational risks are increased, with potential impacts to Regional, as well as Oshawa and Whitby collection costs. Under a DBOM model, haulage and transportation costs, including collection cost impacts, can be minimized, since siting under this option would ensure facilities are located within Durham and that co-location benefits are maximized to the extent possible, considering siting and all requirements for waste collection, transfer haulage and residue management.

Regional Risk Mitigation

- 6.8 It is important to note that the elimination of all risks related to a large and complex infrastructure project is not possible. However, risks can be mitigated through service delivery and contract development to ensure that each identified potential risk is managed by the party best able to control or manage it.

- 6.9 Both the DBOM and private sector service models provide for significant risk transfer to the private sector. However, the analysis determined that the DBOM model transfers the greatest risk away from the Region and ensures adequate Regional oversight over the long-term organics management. Under a DBOM contract, most risks can be either transferred to the private sector or mitigated through contractual performance specifications and securities.
- 6.10 As previously reported, GHD Limited and Ernst and Young Orenda Corporate Finance Inc. (E&Y) consultants completed and reported on a detailed risk assessment completed for the Region, including assessment of 20 identified risks, their potential impacts and the probability of occurrence under various potential service delivery models (e.g. potential for regulatory changes, environmental impacts, cost escalation etc.). The consultants investigated the level of risk retained by the Region under each service delivery model and concluded that DBOM is a preferred approach.
- 6.11 While the Region would be expected under either model to retain risks that are beyond the control of any private sector entity (e.g. regulatory changes, Regional scope changes or changes in strategic direction etc.), the private sector DBOM contractor would accept responsibility for any risk related to their technology, design, construction or operational impacts (e.g. environmental impacts, failure to meet performance standards, or failure to ensure by-product/energy outputs can meet market requirements).
- 6.12 The Region conducted market sounding with Request for Information (RFI 1158-2017) and a majority of the 19 responses from the private sector indicated that a DBOM service delivery would be most appropriate. DBOM reflects recent experience in North America. DBOM contracts allow for the setting of project performance and levying securities to ensure appropriate operational quality, monitoring, reporting and environmental standards. Furthermore, contractual arrangements link the performance of private sector operations to the facility design build, ensuring that technical and operational risks are transferred to the private sector partner. The level of performance control is reduced under a private sector contract with facility ownership by the private sector.
- 6.13 As identified in June 2018 (Report 2018-COW-146), recently both the City of Toronto and the Region of Peel completed a procurement process for organic food waste processing capacity through a service contract but received very limited responses. Both municipalities determined the best option from an economic and environmental point of view was to proceed with a Regional ownership model utilizing DBOM.
- 6.14 Market risk has been identified with the merchant capacity option (i.e. private sector service contract) including those related to the currently under-developed organics processing market available to utilize AD technology for both Green Bin and mixed waste organics diversion. While the preliminary business case anticipates comparable costing across both service delivery models under

consideration, the private service tipping fee assumption is more subjective, given there are limited facilities available in the current market to provide an adequate market sounding.

Business/Financial Considerations

- 6.15 This category recognizes the importance of ensuring affordable and managed costs and cost predictability over the life of the long-term organics management solution, including planning and development costs, financing and funding costs and project costs for design, construction, operations and life-cycle management.
- 6.16 The DBOM model is more beneficial in terms of minimizing Regional risks of cost escalation over the long-term contract and transfers the greatest operational risk to the contractor as compared to the private sector service contract model.
- 6.17 A key mitigation factor in this regard is the ability through DBOM to bundle the design-build and operate-maintain components of the project into a single contract. Not only does this incent the private sector to complete design-construction on time to begin collecting operations fees as soon as possible, any risk of failure to meet performance standards and targets is fully transferred to the private sector who also designed and constructed the project and faces potential significant penalties in the unlikely event of non-performance.
- 6.18 Cost escalation over the long-term contract is mitigated during construction by having the performance payments tied to pre-defined construction performance milestones and fixed escalation benchmarks for construction (set at notice to proceed) as part of the DBOM contract. Operational cost risk is minimized as fees are tied to pre-determined price indices over a potential 20-year term and include capital life-cycle costs and requirements for the good state of repair of facilities as part of the operating fee and private sector responsibility.
- 6.19 It is recommended that DBOM be approved as the Region's service delivery approach for implementing the Region's long-term organics management solution. While both short-listed service delivery options could provide long-term organics management solutions and harness private sector specialized technologies and innovation, DBOM:
- a. Provides enhanced ownership and control along with significant risk transfer;
 - b. Reduces operational and technology risk; and
 - c. Allows provision of a full infrastructure solution with a lowered risk of cost escalation or other potential impacts to the Region's integrated waste management system.

7. Procurement Considerations

- 7.1 It should be noted that DBOM service delivery is a more rigorous procurement

process than a merchant capacity contract and includes more significant professional services requirements ahead of RFP issuance. This up-front due diligence however often results in faster project implementation once a preferred vendor is selected. Project management and retention of professional services experience/expertise can range upwards of 7 to 12 per cent of project costs. This professional specialized expertise for project development will reduce both overall project costs and risks over implementation and long-term operations over the life cycle of the project. This strategy is considered a prudent up-front investment.

- 7.2 Release of the RFP is generally contingent on the Region's efforts in siting and initial permitting, and the commitment to ensure off-site services. Furthermore, bidders need enough time once the RFPQ is issued to establish a suitable consortium adequate to provide a full infrastructure solution which would meet Durham's long-term 15-25 year requirements.
- 7.3 The draft contract, generally refined based on RFPQ technologies, can be released with the RFP to the pre-qualified consortia, to reduce the need for protracted negotiations between RFP award and notice to proceed.
- 7.4 All efforts up-front during specification and contract development and procurement will reduce schedule delays and uncertainties later in the project implementation process.
- 7.5 Uncertainties even at the RFPQ stage can lengthen the procurement process and lower vendor confidence, thereby potentially reducing the competitive vendor pool. It is prudent that the RFPQ identify service delivery methodology as well as provide for general commitments by the Region (e.g. commitments to provide a future site, site servicing and financing to the project as well as mass balance (tonnage) projections, commitment to put-or-pay and technology identification). The bid cost for potential vendors is high and they will judge the Region's commitment up-front, as well as determine the project's required partners/resources in determining whether they will participate. It is in the Region's interest to maximize competition and attract the highest quality bidders by maximizing the flow of information to the bidders which will ensure the greatest understanding of requirements.
- 7.6 Approved financial and business advisory services will be utilized to ensure development of appropriate financial capacity requirements related to the recommended RFPQ. Looking forward to potential Council approval of a subsequent RFP issuance, external expertise will also be utilized to develop appropriate risk balance parameters to inform the ongoing project development.

8. Expression of Interest Update

- 8.1 As outlined in 2019-COW-8, the Region released a non-binding Expression of Interest on October 23, 2018 (EOI-1152-2018) to solicit interest in a partnership to procure, finance and share the net costs arising from the development and implementation of the Region's long-term organics management solution project.

The Region released the EOI as a precursor to a service delivery RFPQ and RFP on the project.

- 8.2 The EOI involved two phases. Phase 1 was a written response and Phase 2 was in person presentation. The EOI evaluation team, comprised of staff from Works, Finance and Legal Services (“EOI Evaluation Team”), evaluated the responses and presentations in accordance with the following core principles outlined in the EOI:
- a. Will the Region benefit from the Company’s proposed type and level of investment in the project?
 - b. What net benefits, financial or otherwise, can the Region expect from a partnership with the Company after considering the Company’s expected share of any environmental attributes, beneficial by-products and/or potential net revenues arising from the project?
 - c. How will the Company contribute to the Region, including the Region’s overall economic development?
 - d. Did the Company present any conditions to a Business Partnership that will impede or substantively constrain the project?
- 8.3 On November 12, 2018, the Region received nine submissions in response to phase 1 of the EOI. Of the nine, seven of the submissions appeared to be proposals relating to service delivery on the project. Pursuant to the express terms of the EOI, these submissions were not considered. As such, only two companies, Epcor and Meridiam, were asked to participate in the Phase 2 presentation stage.
- 8.4 Epcor is a corporation that is wholly owned by the City of Edmonton, however their Board of Directors remains independent from the City. Epcor is a for-profit commercial entity that invests in power, water and natural gas projects throughout Canada and the United States. Epcor has \$500 million available for investment in Ontario.
- 8.5 Meridiam is a global investment company with 71 ongoing projects worldwide. Meridiam is a for-profit commercial entity that invests in energy, works and health related projects. While Meridiam does not have substantive roots in the Canadian market, they do have a North American investment fund of \$1.2 billion and are keenly interested in entering into the Canadian market.
- 8.6 During the Phase 2 presentation, the EOI evaluation team determined that both companies met the EOI evaluation thresholds and did not present any significant conditions or restraints that would impede or substantively constrain the project. As such, the EOI Evaluation Team recommended that senior management interview both respondents to determine whether a business partnership/joint venture is viable with either entity.
- 8.7 On May 28, 2019, both respondents sent representatives to meet with the Region’s

CAO, Commissioner of Finance, Commissioner of Works and Director of Legal Services. Senior management reached a consensus on the preferred respondent pending background due diligence.

8.8 As such, the EOI evaluation team will proceed with industry due diligence and verification of financial viability for the preferred proponent. Once that process is complete, staff will return to Council with the appropriate recommendations seeking Regional Council direction. Specifically, staff will return to Regional Council to provide recommendations and seek direction on whether a partnership/joint venture with the preferred proponent is viable and whether negotiations to establish this partnership/joint venture should commence.

9. Updated Preliminary Business Case

9.1 Additional information has allowed staff to update some of the preliminary business case assumptions and scenarios:

- Actual household and tonnage values for 2018 and updated projections for household growth and tonnage through to 2041, inclusive;
- Updated recoverable organics from mixed waste and other divertible materials based on the results of the recently-completed waste composition study;
- Updated contract rates, escalations and assumptions for transfer, organics and leaf and yard waste processing, landfill and recoverable materials revenues;
- Consideration of the pre-sort and transfer function assuming a service-contract delivery with processing assumed on a contracted cost per tonne basis (modified from the June 2018 assumption of a Regional upfront capital infrastructure cost for transfer/pre-sort facility);
- Alternative costing for varied organics processing capacity sizing assumptions given the uncertainties around future household, tonnage and waste generation rates; and
- Consideration around potential net financial benefits from alternate biogas utilization opportunities available to the Region.

9.2 The cost analysis will continue to remain preliminary and will be refined as project scope, sizing and technology becomes better defined and details around siting, permitting, ancillary costs and potential by-products (including energy) and net financial benefits become known.

9.3 As the Region is planning for significant growth over the coming decades, waste diversion opportunities are available through both single family and multi-residential sector waste streams. Table 1 outlines base scenario estimates for projected

mixed waste which would work through the pre-sort, processing, and disposal process.

Table 1: Residual Mixed Waste Projections (tonnes per year)

Year	2018	2022	2026	2031	2036	2041
Single Family (SF)	80,900	88,000	99,300	115,300	124,100	132,900
Multi Residential (MR)	14,000	15,100	16,900	19,600	21,400	23,200
Total	94,900	103,100	116,200	134,900	145,500	156,100

Note: Assumes constant tonnage per household per year over 2020 to 2041 period.

9.4 Through the updated waste composition study, the mass balance assessment for projected recoverable organics potentially available through the pre-sort process under the base growth scenario is outlined in Table 2.

Table 2: Total Projected Recoverable Organic Material (tonnes per year)

Year	2018	2022	2026	2031	2036	2041
Organic Fraction Mixed Waste	32,300	35,100	39,600	46,000	49,500	53,200
Source Separated Organics*	28,500	31,000	35,000	40,900	44,100	47,100
Total	60,800	66,100	74,600	86,900	93,600	100,300

Notes:

1. Assumes constant tonnage per household over 2020-2041 period.
2. Estimates do not include any additional sources of organics other than what is collected in the Region's current systems.
3. Organics Fraction Mixed Waste (OFMW) total includes projected recoverable amount of fibres, pet and sanitary waste. Totals are prior to AD pre-processing.

9.5 With recoverable organics removed from the mixed waste stream, additional products such as metals, aluminum, fibres, different grades of plastics, and glass are recovered and sent to their respective recyclables' markets for reuse. Ferrous and non-ferrous metals that are currently recovered at the DYEC would be recovered upstream at the pre-sort process. The mixed waste transfer and pre-sort system would divert materials currently processed at the DYEC and create capacity necessary to accommodate the increase in waste garbage created by projected population growth while working towards the Region's 70 per cent diversion rate.

9.6 Updated preliminary cost estimates for the recommended AD organics processing facility, including a facility for transfer and pre-sort of mixed waste, are as follows:

- With the support of technical consultant GHD, base unit costs for both capital and operating have been revisited and show to still be within the cost range when compared to similar facilities/projects. The up-front capital costs for transfer/pre-sort and organics processing are estimated at approximately \$164 million under the base costing scenario, including land, with \$42.3 million attributed to pre-sort/transfer, \$116.3 million for AD facility and \$4.8 million for land (not including biogas upgrading and injection facility). Sensitivity analysis suggests that capital costs could range from \$125 million to \$204 million;

Table 3: Organics Management Solution: Updated Preliminary Capital Cost Estimate

Land	\$ millions
Pre-Sort/Transfer Facility	2.4
Anaerobic Digestion Processing Facility	2.4
Land Sub-Total	<u>4.8</u>
Capital	
Pre-Sort/Transfer Facility	42.3
Anaerobic Digestion Processing Facility	116.3
Capital Sub-Total	<u>158.7</u>
Total Estimated Capital Cost	<u><u>163.5</u></u>

- The AD and pre-sort and transfer facility operating and maintenance costs during the first year of operations are estimated at \$19.3 million using base cost assumptions (including annual lifecycle costs and other recycling revenues). Costs could increase by an additional \$15 million to \$26 million per year for debenture financing costs as necessary to finance the initial capital investment (not including biogas capital) based on low and high capital design cost per tonne ranges. The estimated debt financing costs for the base cost is \$20.5 million. These financing implications could be affected by a potential EOI partnership to be determined.
 - In contrast, the service contract cost option which yields the same net present value over the assumed 20-year operating period shows total first year operating costs of just over \$25.7 million, with no assumed ownership of pre-sort/transfer and organic processing facilities.
- 9.7 Table 4 provides an overview of potential first year operating expenditures for the Status Quo scenario versus the AD option and a service contract scenario for pre-

sort/transfer and AD organics processing which yields the same net present value over an assumed 20-year operating period.

Table 4: Status Quo Compared to Expanded Organics Processing – Annual Preliminary Cost for Assumed Full First Year of Operations (Nominal Dollars)

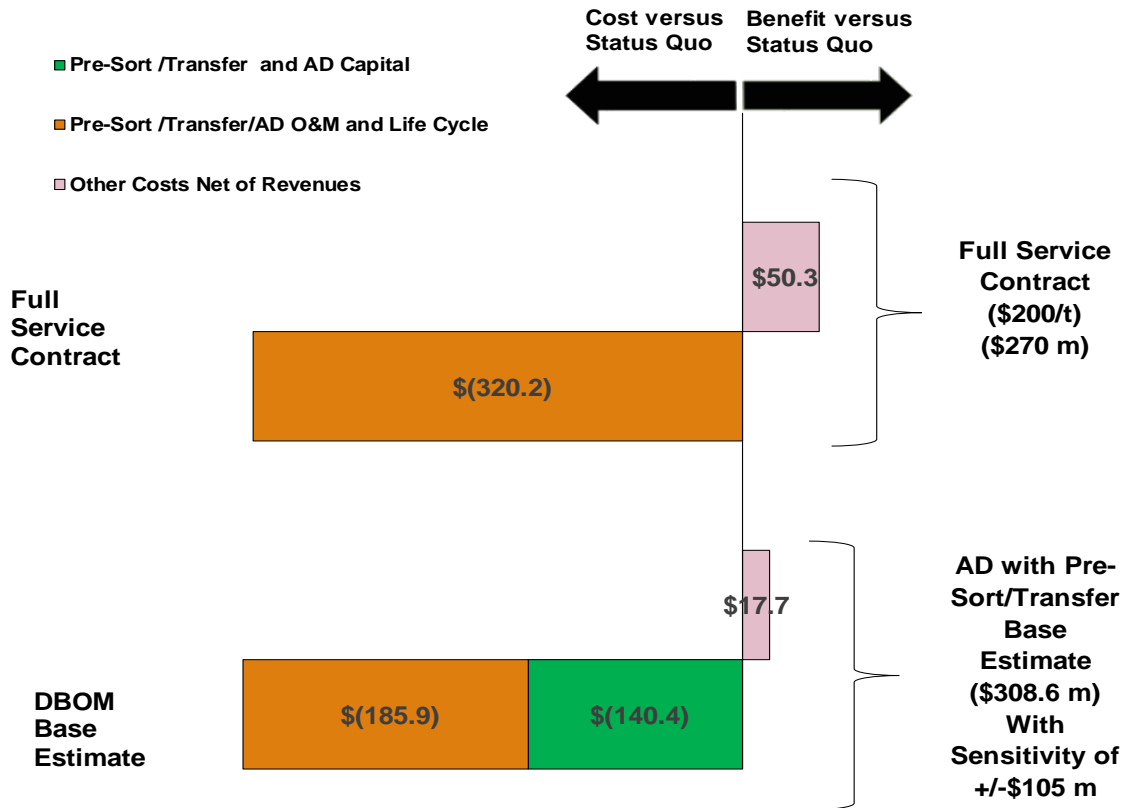
	Status Quo	Council-Directed Options	
		AD DBOM	AD Service Contract (\$200/t)
	(31,000 tonnes)	(66,100 tonnes)	(66,100 tonnes)
	\$ millions	\$ millions	\$ millions
<u>Pre-Sort/Transfer Costs:</u>			
Annual Pre-Sort Transfer Costs	-	9.7	12.1
Less: Recycling and EPR Revenues	(0.5)	(1.6)	(1.6)
Total Pre-Sort/Transfer Operations	(0.5)	8.1	10.5
<u>Organics Processing Costs:</u>			
Annual Processing Costs	6.4	8.8	14.2
Other Costs (by-product management, disposal)	2.1	2.4	1.0
Total Pre-Sort/Transfer Operations	8.5	11.2	15.2
Debt Service Payment	-	20.5	-
Net Operating Cost	8.0	39.9	25.7

Notes:

1. Assumes no biogas system capital or operating costs as well as no revenues included for biogas. Also assumes no excess capacity sales and no leaf and yard waste processing costs.
 2. Projected organics tonnages are for the first year of assumed operations of 2022 and timing will be determined as project progresses. Debenture based on cost sensitivities outlined, could result in annual debt servicing cost upwards of \$26 million assuming total capital upwards of \$200 million. Debt service payment under the base cost scenario would be \$20.5 million based on the capital cost of \$163.5 million.
 3. Includes transfer of residuals for disposal at DYEC and/or landfill, where applicable. AD DBOM includes cost for disposal of produced digestate.
- 9.8 Table 5, adjusted for recyclable revenues, demonstrates that overall net present value cost for AD with pre-sort and transfer versus the status quo to be within a similar range to the preliminary findings of Report 2018-COW-146. Comparisons are made to the base AD cost scenario excluding other disposal costs (assuming

avoided disposal cost in digestate assuming marketable opportunity) as well as the low and high cost scenarios in addition to service contract option assuming organics processing at \$200/tonne.

Table 5: Net Present Value (2019 Dollars) – Preliminary Service Contract and AD Cost Scenarios and Sensitivity Analysis



Notes:

1. Net present values do not include revenues for excess capacity sales, biogas or other by-products. Haulage costs are not included.
2. Capital cost, operating and lifecycle cost for biogas upgrading not included.
3. Service contract option assumptions have been revised to assume pre-processing residuals are responsibility of contractor, which would lower residuals for disposal and landfill costs.
4. Capital and operating costs remain as the primary cost drivers for the project. Based on the preliminary nature of project information, a +/-25 per cent change to the capital construction cost-per-tonne to pre-sort/transfer and organics processing infrastructure has a total incremental impact of +/-

\$45 million (2019 dollars, not including biogas upgrading capital) on the base net present value of \$308.6 million. Similarly, a +/-25 per cent change to operating costs for pre-sort/transfer and organics processing has an incremental facility operating impact of +/- \$60 million (2019 dollars) on the base net present value of \$308.6 million.

- 9.9 While the service contract option at \$200/tonne still shows as slightly more cost effective versus the base AD costing scenario, the low and high cost sensitivities presented indicate the potential for an AD DBOM scenario to be lower than a service contract option. Further opportunities for cost offset may exist where disposal costs for by-products (digestate) are avoided and/or revenues realized, and where net financial benefits are made possible through resultant biogas production. Furthermore, the implications of haulage, which have been excluded, can be significant, especially if comparing potential costs for centrally-sited organics processing under DBOM service delivery versus externally sited organics processing under service contract.
- 9.10 As indicated previously in this report, based on the recent experiences of both the City of Toronto and the Region of Peel, there is limited merchant capacity in Ontario.
- 9.11 Costs can also be impacted by numerous other factors including, but not limited to, variations in technology options, pre-sorting and/or processing capabilities and requirements (i.e. odor control, storage for by-products), capacity sizing, inflationary factors and siting requirements including potential servicing. Given the cost ranges presented, more refined costing estimates will be developed as AD and pre-sort and transfer detailed design specifications and costing become scoped.

10. Facility Sizing, Capacity, and Utilization Sensitivity Analysis

- 10.1 Consistent with the 2017 and 2018 preliminary business case updates, this updated analysis assumes 110,000 tonnes of organics processing capacity for the AD facility and 160,000 tonnes of capacity for the pre-sort/transfer facility. However, as facility sizing from prior preliminary business case updates assumed organics processing capacity to address 20-year requirements, revised tonnage projections and changes in waste composition and recoverable organics amount suggest potential capacity sizing for organics processing of 5,000 to 10,000 tonnes less. An AD facility reduced to 100,000 tonnes of organics processing capacity would result in potential costs being approximately \$12 million (2019 dollars) less due to reduced capital and life cycle costs.
- 10.2 As noted above, a key risk to overall costs are attempting to project tonnages and waste compositions 20 years into the future, driven in part by uncertain household growth projections. A lower growth scenario (closer to recent average household growth rates) would impact the updated preliminary business case in a number of ways:

- Decline in projected incoming SSO and OFMW with absolute tonnages in 2041 declining by approximately 15 per cent from the base projection;
- Resultant decline in potential biogas output by approximately 25 to 30 million cumulative cubic metres (m³) over a 20-year operating period;
- Decline in total cumulative digestate/compost tonnage output of approximately 10 to 13 per cent with potential foregone revenues where marketable opportunities exist; and
- Associated cumulative decline in overall pre-sort/transfer and organics processing operating costs of approximately 12 per cent, or \$26.5 million (NPV). However, assuming sizing of 110,000 tonnes of processing capacity, unutilized capacity at the end of the 20-year operating would increase from 9 per cent of design capacity to 23 per cent. While revenue opportunities for assumed sales of excess capacity may be considered (acceptance of tonnages from other municipalities and private sector), if securing additional volumes becomes a challenge, the risks and cost implications related to oversizing and carrying underutilized capacity will need to be further assessed during project development.

10.3 Quality of incoming organics, the ability to recover, and the composition of mixed waste (OFMW) are also imperative since facility sizing will consider incoming organics that requires processing. Diversion benefits and residuals requiring disposal at DYEC will be impacted in part by contamination levels. While base assumptions have contamination levels of approximately 20 per cent for OFMW, an increase to 40 per cent would increase total cumulative pre-processing residuals requiring disposal by over 170,000 tonnes over the 20 year operating period.

11. Risk Considerations, Opportunities and Potential Cost Impacts

11.1 Consideration and assessment of potential risks, opportunities, impacts and mitigation options are important at the pre-approval stage of any project. Given the scale, scope and complexity of an AD organics management processing system with pre-sort and transfer, as with prior updates, potential risks and opportunities continue to include:

- Capital construction, lifecycle and operating cost ranges (described above);
- Facility location, scale, sizing and feedstock supply volumes related to household growth and tonnage forecasts;
- Feedstock composition, including the quality or mixture of waste organics, which impacts processing, potential marketable by-product opportunities, and operating costs;
- Haulage;

- Potential implications to DYEC operations due to put-or-pay obligations, electricity generation revenues and compliance obligations; and
- Emerging or evolving markets for by-products and environmental attributes, including:
 - Recyclable materials recovered through the pre-sorting processing;
 - Biogas as created through the AD process and its possible end-uses;
 - Digestate or compost created through organics processing; and
 - Creation of compliance-based and/or marketable carbon credits recognizing GHG emission reductions.

12. Haulage and Siting Considerations

12.1 Given the potential locations for any future facility are unknown at this time, no haulage costs for organics were considered as part of the base analysis (only transfer of residual wastes to DYEC and/or disposal to landfill, where applicable). Any future siting considerations for pre-sort/transfer or organics processing will require additional consideration of resultant cost and operational aspects in relation to collection (i.e. Regional collection routes and benefits of centralized location) and disposal of waste (i.e. proximity of organics processing solution being situated near point of disposal for residual wastes).

12.2 The recommended review of potential locations for the preferred pre-sort/transfer/AD system will include the identification of suitable locations for the required organics management, site servicing, and connecting infrastructure. Staff will assess potential implications to overall haulage/transportation costs based on siting and co-location for transfer and pre-sort and AD processing facilities in the context of current and projected contract rates, projected tonnage flows over the proposed operating period for the processing facility and relative logistical savings due to proximity to waste collection, processing and disposal areas.

13. Potential Beneficial Uses of the By-Products of an AD facility

Energy By-Products

13.1 A review of energy by-products has considered the potential of biogas production from the AD process. The following options were examined:

- Use of renewable natural gas (RNG) at Regional facilities;
- Use of compressed natural gas (CNG)/RNG for fueling of Regional fleet;
- Direct sale of RNG within and/or outside the Enbridge franchise area;

- Combined heat-and-power (CHP) to generate both electricity and heat;
- Direct sale of raw biogas; and
- Other biogas utilization options.

13.2 Generally, the AD facility technology, scope and sizing including tonnage throughput, composition and quality and facility run-times, will impact biogas yield and option viability. Further, a detailed distribution system impact assessment would be required to determine takeaway capacity and distribution system reinforcements and costs, if applicable.

13.3 For this report, biogas utilization options were assessed without consideration of service delivery model, potential partnership opportunities and/or grants. Possible sharing and/or transfer of rights to energy by-product, revenues and related environmental benefits may still exist under a DBOM service delivery model. Furthermore, partnerships may still exist outside the arrangements made under a DBOM service delivery model. Attachment 1 further outlines options and potential estimated net financial benefits for quantifiable options.

13.4 Ultimately, the preferred biogas utilization option(s) will consider corporate priorities and/or other strategic directions (i.e. revenue maximization, corporate and GHG emission reductions, facility energy self-reliance) along with technical and financial considerations once AD project scope is better understood.

Other By-Products

13.5 As a result of the anaerobic processing, much of the carbon is removed from the waste, and turned into a bio-fuel. Most of the nutrients and organic matter that were in the original organic wastes are left behind, and are a by-product that is a rich, commercial organic fertilizer. There is a limited Regional use for the digestate byproducts of liquid fertilizer or soil augmentation solids. However, as demonstrated in other jurisdictions, the digestate by-products could have significant value to the agricultural community and would eliminate the disposal costs for this material if this beneficial use is realized.

13.6 There are current Ontario examples of the fertilizers that are produced being licensed by the Canadian Food Inspection Agency and can be used in certified organic farming. In addition to the fertilizers and soil augmentation, the biomass could be further processed into bio-char for use as a cleaning media for bio-fuels.

14. Update on Senior Government Grant Funding Opportunities

14.1 Regional staff continue to investigate funding opportunities for both due diligence studies and capital project implementation. The GHD Part 1 and 2 studies received a \$175,000 study grant from the Federation of Canadian Municipalities (FCM) Green Municipal Fund (GMF).

- 14.2 Capital grant applications tend to require additional project details including environmental specifications, implementation schedules and budget plans. A number of program funding streams continue to be reviewed by staff including funding through the Integrated Bilateral Agreement (IBA) between Canada and Province of Ontario which will provide \$11.8 billion in federal funding and \$10 billion in provincial funding for infrastructure projects under the Investing in Canada Infrastructure Program (ICIP) over the next ten years.
- 14.3 Among these allocations are Green Infrastructure funds where funding would be cost-shared with federal, provincial and municipal governments to target climate resilience and mitigation initiatives which reduce GHG emissions. While the Rural and Northern stream of ICIP funding has been released for application, staff consultation with the Ontario Ministry of Infrastructure has indicated anticipated launch for Green Infrastructure funds later in 2019. Details around business case and funding submission requirements are still to be determined.
- 14.4 Other opportunities continue to be reviewed including, but not limited to, opportunities available through the Canada Infrastructure Bank (CIB) as well as FCM GMF.
- 14.5 Staff continue to monitor available opportunities as work continues to further define the project magnitude and scope.

15. Next Steps

Public Consultation

- 15.1 The implementation of the Project will not trigger the requirement to undertake an Environmental Assessment. Regional staff will however, initiate a communication plan that will invite consultation at various stages of the project. Communications with the public is also a requirement of the Environmental Compliance or Renewable Energy Approval processes (ECA/REA).

Professional Services

- 15.2 Professional expertise will be required to support the subsequent procurement processes as the project moves forward. This includes overseeing the procurement processes, technology and specifications, vendor evaluations, and assessment of vendors/proprietary technologies to ensure adequate information to vendors over each stage and prudent contract development, including commercial terms and appropriate risk sharing and potential for project design and construction. Therefore, it is recommended that:
- That an independent third party fairness monitor be retained at a total cost not to exceed \$100,000 to oversee subsequent procurement processes as approved by Regional Council to protect the Regional Municipality of Durham and to ensure fairness and transparency on behalf of vendors and other stakeholders, and that the selection of the fairness monitor be made at

the discretion of the Chief Administrative Officer and Commissioner of Finance; and

- That external legal counsel be retained at a cost not to exceed \$125,000 to provide advice for the next steps of the long-term organics management solution to assist in the procurement process and contract arrangements.

16. Conclusions

- 16.1 To move forward with the Region's long-term organics management solution, Regional staff are recommending the approval to proceed with an Anaerobic Digestion facility (using a wet technology) with a mixed waste transfer and pre-sort facility utilizing a DBOM service delivery approach.
- 16.2 Regional staff will explore the viability of a potential partnership and will report back to Regional Council.
- 16.3 Additional technical and procurement expertise is also required to assist the Region in subsequent procurement processes anticipated in late 2019.
- 16.4 This report provides the updated preliminary business case results as well as the investigation of the beneficial uses of the by-products from an AD facility.
- 16.5 Approval of this report will allow the Region to proceed with the recommended long-term organics management solution presented here within this report

Respectfully submitted,

Original Signed By John Presta For

Susan Siopis, P.Eng.
Commissioner of Works

Original Signed By

Nancy Taylor, BBA, CPA, CA
Commissioner of Finance

Original Signed By

Don Beaton, BCom, M.P.A.
Commissioner of Corporate Services

Recommended for Presentation to Committee

Original Signed By

Elaine C. Baxter-Trahair
Chief Administrative Officer

Attachment #1: Potential Beneficial Uses of the By-Products of an AD facility**Overview of RNG Production**

1. Production of RNG requires upgrading and injection infrastructure where preliminary cost estimates for capital, operating and life-cycle costs over a 20-year operating period are \$26 to \$30 million (2019 dollars), excluding pipeline costs. Actual costs will also be impacted by facility and tie-in location, injection pressure, production date and quality, surrounding distribution system load growth, service size, main extension requirements, land and on-site gas storage. Consideration around mandatory (injection) and/or optional (upgrading) biogas upgrading services through Enbridge or other entities is also required.

Use of RNG for Regional Facilities

2. The Region consumes 8 to 10 million m³ of natural gas annually across all corporate functions. Use of RNG would displace conventional supply and the contractual framework could be expected to function similarly to the Region's existing gas purchase agreements, allowing the Region to nominate and manage its own self-supplied RNG. Cost offset would be realized on the commodity portion and distribution charges would still apply. Option viability is largely dependent on prevailing conventional natural gas market prices (and carbon pricing) versus RNG production costs. Given only natural gas commodity cost are avoided, net financial benefits under this scenario may be difficult to achieve, even under a higher natural gas market pricing scenario.

Fueling of Fleet Vehicles

3. RNG can be used interchangeably for natural gas once injected and wheeled to fueling stations. CNG/RNG fueling could offset a large portion of Regional fleet fuel usage (Transit is about 75 per cent of total annual fuel litres consumed). Considerations for CNG/RNG fueling include, but are not limited to:
 - CNG/RNG is a cleaner option than conventional fuels, burns cleaner than diesel for all priority pollutants and generally best-suited for heavy duty fleet applications and short haul, return-to-base fleets (i.e. refuse trucks, buses);
 - While CNG/RNG vehicle costs are generally higher than conventional vehicles, refuelling times and operating ranges are comparable to conventional fuel types, although CNG fuel generally shows a life-cycle cost advantage and as a transportation fuel is not subject to road/fuel taxes;

- Requirement for suppliers/vendors to handle/manage CNG/RNG vehicles and staff training to manage new fuel-type. Ensuring appropriate backup generators and storage to ensure business continuity. Requirement for continued availability of conventional fuel for shared facilities; and
 - Upfront fuelling infrastructure and facility upgrade costs are significant. Costs for upgrading all Works and Transit maintenance facilities is upwards of \$22 million, excluding natural gas and/or electrical distribution system upgrades.
4. Preliminary review indicates potential to realize notable net financial and environmental benefits of CNG and/or RNG fueling versus conventional fuel use. Requires further evaluation versus other technologies such as electric vehicles.

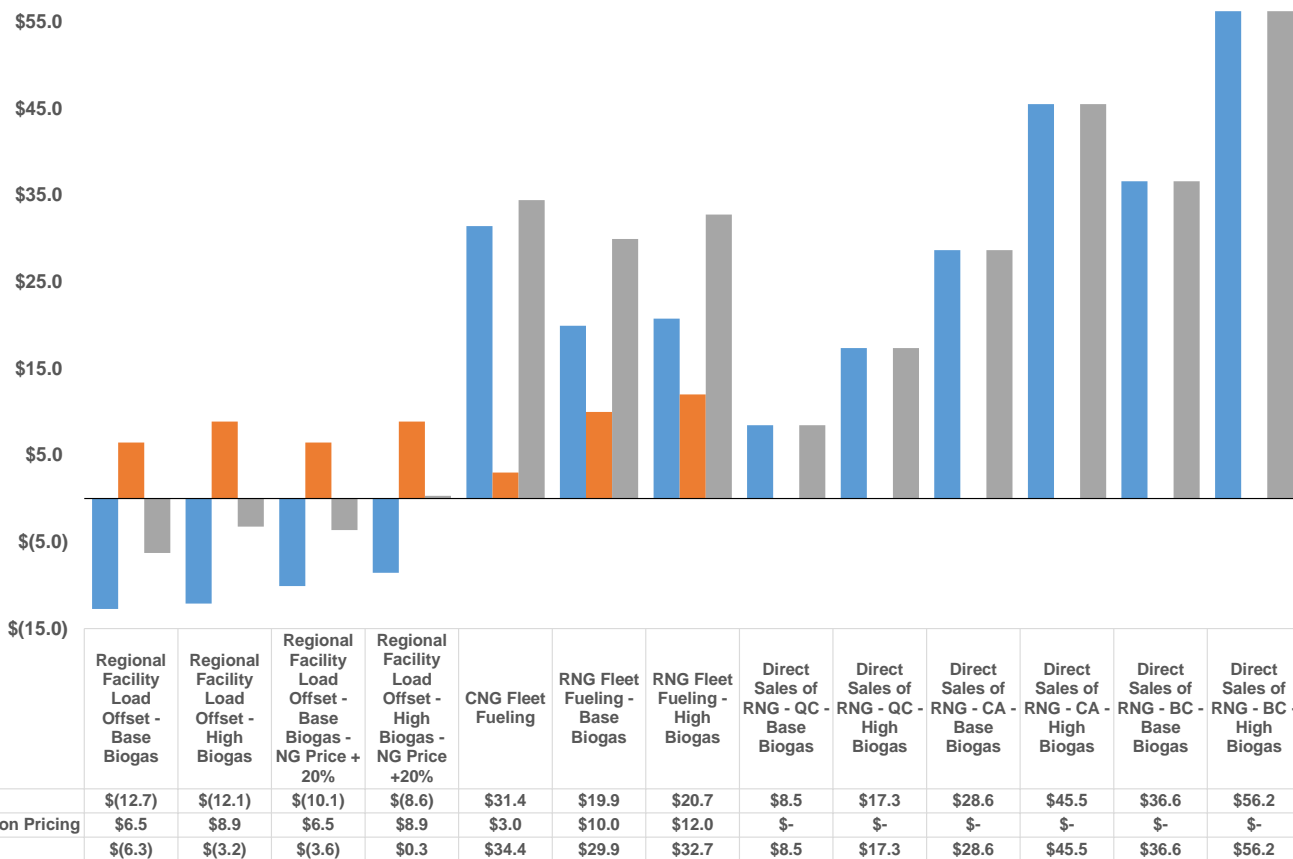
Direct Sales

5. There exist several RNG supply programs in other jurisdictions outside Ontario, and use of a marketer/broker can help facilitate the sale/transfer of RNG volumes to entities where nominations would be supported through exchange and injection services agreements. All tolls, transportation and marketing/broker fees are shipper/producer responsibility and additional accounting/monitoring requirements may apply (volume/quality validation).
6. Programs offering long term purchase contracts (upwards of \$30/GJ or more) may provide long-term revenue certainty for produced RNG. Experience exists for sales across North America including producers shipping to British Columbia, California and Quebec. While not for direct Regional use and will usually involve giving up all environmental attributes (contracts often require regulatory approval), direct RNG sales may yield the highest net revenue benefits.

Estimated Net Financial Benefits

7. Staff reviewed several biogas utilization options which could yield net financial and/or environmental benefits to the Region (quantifiable options summarized in Figure 1). Considering annual estimated biogas yield over a 20 year operating period from base production rates and high yield scenarios based on sales of excess organics processing capacity, as well as stakeholder feedback around available program opportunities and contractual parameters, the following scenarios were presented around use of RNG for Regional facilities, CNG/RNG fueling of fleet, as well as direct sales options.

**Figure 1: Net Financial Benefits for Various Biogas Utilization Options
(2019 to 2041, in millions of 2019 dollars)**



Notes: see Attachment 2 for additional information around scenario assumptions.

- Additional opportunities may be available but are project dependent and so costs and net benefits cannot be quantified at this time (i.e. CHP, direct sale of raw biogas, other partnerships). Project economics across options will also be impacted by relative pricing between competing commodities over time including future status of the regulatory landscape and any future carbon pricing regime.

Combined Heat-and-Power (CHP)

- Potential exists for use of Combined Heat-and-Power (CHP) technology to simultaneously generate electricity and produce heat for other process or heating requirements. Type of CHP engine and energy recovery potential would be verified during detailed design stages and through consultations with both electrical and natural gas distributors. While the Province has moved away from standardized supply contracts, net metering remains an option. Economics of CHP will be influenced by AD technology and size plus factors such as wastewater treatment processes given impacts to facility energy requirements.

Sale of Raw Biogas

10. Potential may exist for direct sale of raw biogas to an entity that would then design, supply, install, own and operate an RNG upgrading and injection system on or near the producing site (supported by land leased under separate agreement with provision of site access, piping of supply, wastewater discharge, and other rights as needed for operation/servicing). While direct sale of biogas may transfer risks to an outside entity, given the market for RNG in other jurisdictions, there may be ability to negotiate revenue uplift mechanisms should the outside entity successfully secure end markets for the finished RNG product.

Other Biogas Utilization Options

11. Other options and opportunities should be examined once project specific information is better known, including but not limited to, direct sale of biogas for use by adjacent industries/customers, district systems where option could be to send biogas and/or hot water to adjacent industries/customers for heating; and/or biogas to other Regional facilities (i.e. WPCPs, DYEC). Opportunities may consist of exchanges and/or sharing of biogas and related upgrading and/or fueling infrastructure for uses across multiple Regional facilities.

Environmental Attributes

12. Carbon offsets are credits generated through initiatives which reduce emissions in non-regulated sectors. With the cancellation of the cap and trade program and related regulations, there is no regulatory framework for compliance-based carbon offset creation in Ontario. While potential exists for voluntary offset creation, such instruments are generally viewed as lower quality and less marketable. While there exists potential for the development of federal offset protocols, in absence of such a framework, preference may lie with selling RNG to jurisdictions willing to pay a premium for related environmental benefits.
13. Other instruments may include Renewable Energy Certificates (RECs), which are tradable instruments representing the attributes of renewable energy projects and may be sold together or separately from electricity produced. Generally, the REC market is mainly RPS compliance-driven, where Canada has no compliance-based RPS frameworks and a limited voluntary market. Renewable energy projects providing electricity to grid would also require a Renewable Energy Approval (REA) and need to substantiate electricity demand.

Attachment #2: Summary of Key Preliminary Business Case Update Assumptions

Description	Assumption
Base waste tonnage	<ul style="list-style-type: none"> Region of Durham actual waste values for SSO (Green Bin), mixed waste for single family and multi-residential and Regional waste management facilities (WMF) for 2018
Household and tonnage growth projections	<ul style="list-style-type: none"> Planning Report #2018-INFO-149 and converging to Regional Official Plan (ROP) values to 2031. Projections for 2032 and beyond based on Hemson Consulting Ltd. GGH Growth Forecasts to 2041. Tonnage per household per year based on 2018 values.
Low household growth scenario	<ul style="list-style-type: none"> Average annual household growth approximately 30 per cent less than assumed under base case. Tonnage per household per year based on 2018 values.
Waste composition for mixed waste	<ul style="list-style-type: none"> 2019 Region of Durham Waste Composition Study Results OFMW for single family: 41.5 per cent plus recoverable fibres OFMW for multi-residential: 42.6 per cent plus recoverable fibres 80 per cent recovery of organics at pre-sort OFMW include pet and sanitary waste
Contamination rates of organics	<ul style="list-style-type: none"> 3 per cent for SSO (Green Bin organics) 20 per cent for OFMW in base case Sensitivity of 40 per cent contamination for OFMW
Capital costs for Pre-sort/Transfer facility	<ul style="list-style-type: none"> Sizing of 160,000 tonnes of mixed waste processing capacity \$250 per design tonne in base case Sensitivity of +/-25 per cent of base unit cost
Capital costs for AD Processing facility	<ul style="list-style-type: none"> Assumed sizing of 110,000 tonnes of processing capacity in base case Sensitivity of 100,000 tonnes of processing capacity \$1000 per design tonne in base case Sensitivity of +/-25 per cent of base unit cost
Debenture assumptions	<ul style="list-style-type: none"> 5 per cent interest rate over 10 years
Operating costs for Pre-sort/Transfer	<ul style="list-style-type: none"> \$80 per processed tonne in base case Sensitivity of +/-25 per cent of base unit cost

Description	Assumption																		
Operating costs for AD Processing facility	<ul style="list-style-type: none"> \$90 per processed tonne in base case Sensitivity of +/-25 per cent of base unit cost 																		
Digestate disposal cost	<ul style="list-style-type: none"> \$88 per tonne of output (unchanged from 2018 update) 																		
Land acquisition cost	<ul style="list-style-type: none"> \$545,000/hectare. Assumed approximately 8 hectares for pre-sort/transfer and AD processing (based on RFI feedback) 																		
Life cycle costing	<ul style="list-style-type: none"> 2 per cent of initial capital outlay annually over 20 years 																		
Service contract cost per tonne	<ul style="list-style-type: none"> \$200/tonne for processing of SSO (Green Bin) and OFMW tonnage \$109/tonne for mixed waste pre-sort/transfer 																		
Biogas upgrading facility (included for RNG for Regional facilities, CNG/RNG fuelling, and Direct RNG sales)	<ul style="list-style-type: none"> Biomethane upgrading and injection capital and minor conveyance of \$8.9 million. Operating costs per m3 based on biogas produced Provision for life cycle costs based on 0.5 per cent of initial capital outlay plus mid-life membrane replacement Assumed 20 year operating period commencing 2022 																		
Facility and Fueling Upgrades (for CNG/RNG Fueling Option)	<table border="0"> <thead> <tr> <th data-bbox="513 999 813 1031" style="text-align: center;"><u>Location</u></th> <th data-bbox="1040 999 1430 1031" style="text-align: center;"><u>Facility/Fueling Upgrades</u></th> </tr> </thead> <tbody> <tr> <td data-bbox="513 1052 813 1083">DRT Westney</td> <td data-bbox="1146 1052 1325 1083" style="text-align: right;">\$6.26 million</td> </tr> <tr> <td data-bbox="513 1104 813 1136">DRT Farewell / Raleigh</td> <td data-bbox="1146 1104 1325 1136" style="text-align: right;">\$7.76 million</td> </tr> <tr> <td data-bbox="513 1157 943 1188">Oshawa / Whitby Works Depot</td> <td data-bbox="1146 1157 1325 1188" style="text-align: right;">\$2.69 million</td> </tr> <tr> <td data-bbox="513 1209 935 1241">Ajax / Pickering Works Depot</td> <td data-bbox="1146 1209 1325 1241" style="text-align: right;">\$1.62 million</td> </tr> <tr> <td data-bbox="513 1262 805 1293">Orono Works Depot</td> <td data-bbox="1146 1262 1325 1293" style="text-align: right;">\$1.35 million</td> </tr> <tr> <td data-bbox="513 1314 821 1346">Scugog Works Depot</td> <td data-bbox="1146 1314 1325 1346" style="text-align: right;">\$0.93 million</td> </tr> <tr> <td data-bbox="513 1367 878 1398">Sunderland Works Depot</td> <td data-bbox="1146 1367 1325 1398" style="text-align: right;">\$1.02 million</td> </tr> <tr> <td colspan="2" data-bbox="513 1419 1455 1493"> <ul style="list-style-type: none"> Preliminary costing from Region's CNG/RNG Fleet and Facility Feasibility Assessment undertaken by WSP/Change Energy </td> </tr> </tbody> </table>	<u>Location</u>	<u>Facility/Fueling Upgrades</u>	DRT Westney	\$6.26 million	DRT Farewell / Raleigh	\$7.76 million	Oshawa / Whitby Works Depot	\$2.69 million	Ajax / Pickering Works Depot	\$1.62 million	Orono Works Depot	\$1.35 million	Scugog Works Depot	\$0.93 million	Sunderland Works Depot	\$1.02 million	<ul style="list-style-type: none"> Preliminary costing from Region's CNG/RNG Fleet and Facility Feasibility Assessment undertaken by WSP/Change Energy 	
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Vehicle cost premiums (for CNG/RNG Fueling Option)	<ul style="list-style-type: none"> By Gross Vehicle Weight Rating: Class 1-3, 6, 8-11 vehicle: up to \$21,000; Class 4 vehicle: \$40,000, Class 7 vehicle: \$60,000 Preliminary costing from Region's CNG/RNG Fleet and Facility Feasibility Assessment undertaken by WSP/Change Energy 																		
Direct RNG Sales Rates (for RNG Direct Sales Option)	<ul style="list-style-type: none"> \$30/GJ for California and British Columbia and \$15/GJ for Quebec 																		