Chapter 8

Energy from Sewage

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**Abstract**

The organic material in wastewater is a valuable source of energy that is currently mostly wasted. It produces both carbon dioxide and methane, which is an even more powerful greenhouse gas.

Anaerobic digestion is a proven technology to produce and capture methane from such organic material. This biogas, following clean-up, can be burned for on-site heating or combined heat and power, used as a fuel for fleets, or injected into the local natural gas utility pipelines as renewable natural gas.

Most Ontario wastewater treatment plants do not use anaerobic digestion. Of those that do, the majority flare (and thus waste) at least some of the energy. To achieve Ontario’s goal of reducing greenhouse gas emissions, anaerobic digestion and energy recovery should become standard at wastewater treatment plants whenever practical. Even better, treatment plants could become “energy centres” that also produce and capture methane from a wide range of supplemental organic wastes. Keeping organic wastes out of landfills is essential to Ontario’s circular economy strategy, and capturing the methane from such wastes is important for meeting climate targets.

This opportunity will be challenging to realize, but it offers so many benefits that it deserves focused government attention and support.
8.1 What is Biogas and How is it Produced?

Sewage contains organic material, including human body waste, food waste, soaps, etc. Much of this material is eventually broken down by bacteria into the two most common greenhouse gases (GHGs), methane and/or carbon dioxide. Generally speaking, aerobic conditions produce carbon dioxide and anaerobic environments produce methane.

At the wastewater treatment plant (WWTP), some of the organic matter in sewage is converted to carbon dioxide as part of secondary (aerobic) wastewater treatment. However, the majority of the organic matter is separated from the wastewater stream into a semi-solid sludge that requires further treatment.

At this stage, anaerobic digestion (AD) can be used to treat the sludge. Anaerobic digestion occurs in a closed vessel that excludes oxygen. It converts 50% - 60% of the biodegradable organic material to biogas, and creates a smaller volume of residual sludge.\(^1\) The primary purpose of AD has traditionally been to reduce the volume of treated sludge produced, and therefore the cost of disposal.\(^2\)

However, AD also opens up possibilities for energy recovery. The biogas it produces typically contains 55%-75% methane and 24% - 44% carbon dioxide, with 1% or less of other gases.\(^3\) Biogas typically has an energy content of about 22 megajoules per cubic metre,\(^4\) essentially all of it from methane.

Ontario wastewater plants with AD often flare this gas (burn it without energy recovery). This is better from an emissions perspective than releasing unburned biogas to the air, but is still a waste of potentially useful energy. In a circular economy, biogas could displace fossil fuels, e.g., for on-site heating, electricity generation, injection into the natural gas pipelines, or in natural gas vehicles (see Figure 8.1).

Additional processing is required for some of these applications. For example, prior to injection into natural gas pipelines (an option for plants adjacent to the natural gas system), impurities such as siloxanes, carbon dioxide, water and hydrogen sulphide must be removed. This cleaned gas, which meets pipeline quality specifications, is often referred to as “renewable natural gas” (RNG) or “green gas”.\(^5\)

In a circular economy, biogas could displace fossil fuels.
Only a minority of Ontario municipal wastewater treatment plants currently use anaerobic digestion for their sludge (about 30% from the ECO survey). If anaerobic digestion is not used, the organic material in sludge will eventually break down into carbon dioxide or, worse, methane, producing greenhouse gas emissions without any useful energy recovery. This can occur on-site or off-site, e.g., at landfills.

8.2 How Much Biogas Potential is There in Ontario?

The amount of usable methane generated by a WWTP will vary with the amount of biodegradable organic material it processes. Wastewater contains roughly three times the energy required to treat it (depending on the sewage source and the required level of treatment) although not all of this energy can be recovered. In some European countries, biogas from wastewater plants has become an important energy source. Biogas production from WWTPs contributes approximately 20% of all biogas used for energy in Denmark, and as high as 40% in Sweden.

Research by the Canadian Biogas Association suggests an Ontario potential of approximately 0.0336 m$^3$ methane per cubic metre of wastewater. A report by Alberta Innovates for Enbridge Gas Distribution and Union Gas estimates that Ontario treats about 2 billion m$^3$ of municipal sewage per year, giving an estimate of 68 million m$^3$/year as the potential for Ontario municipal sewage to produce RNG through anaerobic digestion. The report also estimates that an additional 69 million m$^3$/year of methane potential exists from gasification of the residual bio-solids, although this is likely not feasible in the near-term.
Anaerobic digestion of other organic wastes could provide much larger amounts of RNG. Alberta Innovates estimates a near-term Ontario potential of 1,372 million m$^3$/year (20 times the volume from WWTP alone), from livestock manure, crop residues, organics in municipal solid waste, WWTPs and landfill gas. This is roughly 6% of the total volume of natural gas supplied to Ontario customers, and could reduce GHG emissions by about 2.7 Mt/year carbon dioxide equivalent (CO$_2$eq), roughly 2% of provincial emissions. Some of these biogas sources, particularly crop residues and organics in municipal solid waste, are potentially well-suited to co-digestion at WWTPs, as discussed below.

The potential contribution of RNG in Ontario from all sources is shown in Figure 8.2 below.

**Figure 8.2. Ontario potential for renewable natural gas production (by feedstock) compared to 2010 natural gas distribution**

Note: Excludes longer-term potential for additional renewable natural gas production from gasification technology, including gasification of bio-solids remaining after anaerobic digestion.

8.3 Energy Recovery in Ontario Wastewater Plants

In Ontario, there are some 750 WWTPs, all of which have some potential to generate biogas. However, according to the ECO’s Water-Energy Efficiency Survey (2017) (see Textbox 1.4.1 and Appendix A), few municipalities recover biogas for energy production from wastewater.

About 30% of respondents (28 in total) indicated that they use anaerobic digestion as part of their wastewater treatment processes. These municipalities use the biogas for the following uses (multiple uses are possible, so the totals do not add to 100%):

- 68% flare at least some of the methane produced, with only two municipalities flaring all of it.
- 54% use the methane for on-site heating (either space heating or process heating, often to heat the digester itself), reducing the use of natural gas. This is the quickest, easiest and cheapest way for a WWTP to use methane. However, in the summer there is typically little on-site need for space or process heating, so the excess gas is often flared.
- 25% co-generate heat and electricity. The heat will be used as described above. For the electricity production, some municipalities have generation contracts, selling the electricity at a fixed price to the Independent Electricity System Operator, while others are “behind-the-meter”, reducing their consumption of purchased electricity.

In total, Ontario municipalities are using only a fraction of the potential biogas from their wastewater. Encouragingly, a further seventeen municipalities in the ECO’s water-energy efficiency survey (see Appendix A) are looking at various options to utilize biogas from their WWTP facilities more effectively.

Table 8.1 lists the main plants that currently capture and use their biogas for co-generation of heat and electricity, based on information from the Canadian Biogas Association, supplemented by the ECO’s survey and additional research.14

Table 8.1. Anaerobic Digesters at Ontario Wastewater Treatment Plants Used for Co-generation

<table>
<thead>
<tr>
<th>Municipality</th>
<th>Electrical Co-generation Capacity (kilowatts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Barrie</td>
<td>500</td>
</tr>
<tr>
<td>Chatham-Kent15</td>
<td>250</td>
</tr>
<tr>
<td>Collingwood16 (in development)</td>
<td>65</td>
</tr>
<tr>
<td>Guelph</td>
<td>500</td>
</tr>
<tr>
<td>Hamilton</td>
<td>1600</td>
</tr>
<tr>
<td>Kingston17</td>
<td>370</td>
</tr>
<tr>
<td>Mississauga – Clarkson (in development)</td>
<td>1400</td>
</tr>
<tr>
<td>Ottawa</td>
<td>2400</td>
</tr>
<tr>
<td>Peterborough18</td>
<td>380</td>
</tr>
<tr>
<td>Thunder Bay</td>
<td>600</td>
</tr>
<tr>
<td>Toronto - Ashbridge’s Bay (in development)</td>
<td>10,000</td>
</tr>
<tr>
<td>Toronto - Humber</td>
<td>4700</td>
</tr>
<tr>
<td>Waterloo Region (in development, three different wastewater plants – Galt, Kitchener, Waterloo)19</td>
<td>1200 (3 plants combined)</td>
</tr>
</tbody>
</table>

Source: Canadian Biogas Association (2013).20
Hamilton is currently unique in that in addition to co-generation, it converts some biogas into RNG and injects it into the natural gas pipeline system. Some of the RNG is then used to for Hamilton’s natural gas fuelled buses. Hamilton, however, does not advertise this on its buses as the bio-bus in Bristol, England did.
8.4 Barriers to Energy Recovery at Wastewater Treatment Plants

Why don’t more Ontario wastewater plants recover energy from sewage? Three of the main barriers include:

- a burdensome environmental approvals process;
- uncertainty about financial benefits; and
- insufficient economies of scale.

Some additional barriers (not discussed in this report) include lack of human resources and technical knowledge among municipal staff to manage a biogas project; a focus on compliance with sewage works approvals as the plant’s core business; and, limited space on-site (e.g., London, Ontario), as AD requires more land area than incineration (although less than composting). An additional barrier could be the costs associated with the conversion of old legacy aerobic digestion systems to anaerobic systems.

8.4.1 Environmental Approvals

For a municipality to install or alter an AD at its WWTP, it must apply for an amendment to the WWTP’s Environmental Compliance Approval (ECA) under section 53 of the Ontario Water Resources Act. In addition, a municipality will either need to apply for or amend their section 9 ECA for air emissions under the Environmental Protection Act. This is not a decision to be taken lightly. In addition, local municipal zoning and site plan approvals will be required. Such applications involve a considerable amount of time, effort, expense and uncertainty, and expose municipalities to the possibility that the Ministry of the Environment and Climate Change (MOECC) will require changes to other elements of the ECAs. Long approvals delays are common, and can materially drive up project costs.

The approval process is even more challenging if the municipality wants to use the biogas to generate electricity (often through a combined heat and power unit). No matter how small, this requires a Renewable Energy Approval (REA) under O. Reg. 359/09 of the Environmental Protection Act, irrespective of whether the electricity is to be sold into the grid. Appendix 1 of the technical guide to obtaining an REA provides the details of what is required to secure this approval. Requirements for obtaining a REA include extensive plans and reports (e.g., noise and odour assessments; a heritage assessment) as well as public consultation. Preparing the application can take well over a year, and cost a significant amount plus the municipality must pay the MOECC as much as $27,000 to review the application, a considerable expense for most municipalities. Over and above this cost, are the costs for the engineering and design studies required to secure the approvals, which can be significant and be as much as $1 million.

The Climate Change Action Plan committed Ontario to establish a low-carbon content requirement for natural gas.

It is not yet clear what, if any, additional approvals would be required to supply renewable natural gas into natural gas pipelines.

8.4.2 Uncertainty about Cost Savings

Energy recovery from biogas production requires a large initial financial investment, particularly if the wastewater plant does not already have AD.

AD projects face the same issues with access to capital as energy efficiency projects (discussed in Chapter 4). Funds are scarce and there is intense competition with other possible projects, including those perceived as more closely associated with the plant’s core business. In this competition, energy recovery projects have been hampered by uncertainty about the future market value of, and demand for, biogas.

These issues should become clearer in the near future.
Ontario can make energy recovery cost-effective by enabling WWTPs to digest appropriate local food/organic wastes.

The June 2016 Climate Change Action Plan committed Ontario to establish a low-carbon content requirement for natural gas. In its September 2016 *Regulatory Framework for the Assessment of Costs of Natural Gas Utilities’ Cap and Trade Activities*, the Ontario Energy Board identified RNG as a potential GHG abatement measure that gas utilities can undertake to meet their compliance obligations under cap and trade, (i.e., the *Climate Change Mitigation and Low Carbon Economy Act, 2016*). The three rate-regulated gas utilities have now filed their first compliance plans under that framework. The two main gas utilities, Enbridge and Union, both indicated their intention to move toward the integration of RNG into their gas supply over the longer term but not as part of their 2017 compliance options. However, they anticipate the renewable content of natural gas from RNG development will play an increasing role in future compliance plans, and in Union’s case this could be as early as 2018.

In December 2016, the Minister of Energy wrote to the Ontario Energy Board:

> We intend to consider how RNG will help meet Ontario’s future energy needs during the development of the next Long-Term Energy Plan… I encourage the OEB to move forward in a timely manner to include RNG as a potential fuel that could help reduce GHG emissions as a part of the gas utilities’ supply portfolios.

In response, the OEB announced that by the end of 2017, it will develop a new framework for the Assessment of Distributor Gas Supply Plans. The framework “will set out the OEB’s expectations and approach to issues related to including RNG within the distributors’ gas supply portfolios.” In April 2017, the OEB established a technical working group to assist with this task.

Current indications are that gas utilities are having difficulty identifying enough potential sources of biogas to meet anticipated demand, even though the OEB’s Framework is likely to permit them to charge more for RNG than they do for fossil natural gas. This suggests that WWTPs should be able to sell any RNG that they can generate, at a predictable price and on long-term contracts, if they have ready access to a natural gas pipeline. In addition, there is the potential for biogas to be used for electricity generation behind the meter, particularly in cases where there is not ready access to a natural gas pipeline.

**8.4.3 Economies of Scale**

Even once there is certainty about the financial value of biogas, smaller WWTPs may not produce enough biogas to make energy recovery worthwhile. The United States Environmental Protection Agency estimates that energy recovery (at least for co-generation) is only feasible at plants that treat at least 4,000-19,000 m³ of wastewater per day, roughly the amount generated by 10,000-50,000 households. The International Energy Agency estimates a minimum of about 5,000 m³ of wastewater per day, about 12,500 households.

Many Ontario WWTPs receive less wastewater than that. However, Ontario can facilitate its proposed diversion of organics from landfill, while making energy recovery cost-effective at more WWTPs, by enabling WWTPs to digest appropriate local food/organic wastes. In addition, these sites could also be designed to receive other biomass material, such as silvergrass or switchgrass. Food waste has up to three times as much energy potential as sewage sludge on a comparable dry matter basis. Technologies can enable existing WWTP anaerobic digesters to co-digest food waste and significantly increase biogas production without a physical expansion to the AD, reducing capital cost.
Co-digestion – the digestion of wastewater sludge combined with other organics transported to the WWTP – is not currently undertaken in Ontario, but there are examples elsewhere. In 2015, a wastewater facility in Gresham, Oregon achieved net-zero energy status, in part by producing 92% of its power from on-site biogas. The high production of biogas was possible due to organic inputs, such as fats, oils and grease from local restaurants.

8.4.4 Saint-Hyacinthe, Quebec - A Wastewater Plant as Biogas Hub

The vision of WWTPs as energy centres is demonstrated by the City of Saint-Hyacinthe, Quebec – the 2016 Federation of Canadian Municipalities (FCM) Sustainable Communities Award winner in the waste program. This project is expected to become operational by mid-2017.

At the Saint-Hyacinthe WWTP, organic and sewage wastes are combined and converted in an anaerobic digester to high quality bio-solids and pipeline quality biogas. This biogas is first used to run municipal vehicles and to heat and cool municipal buildings (including City Hall). Any excess is then injected into the local gas grid operated by Gaz Métro. The supplemental organics come from organic waste (brown bins in Quebec) collected from 23 participating municipalities, and other local sources such as greenhouses and farms. The federal government, the Quebec government and the City each covered one-third of the costs. In using its WWTP as a local energy hub for the community, this project – a first in Quebec and one of the first in North America – may provide a useful example for smaller Ontario communities, and allow Ontario to make greater use of potential biogas resources.

Of direct importance to Ontario is that this system plans to divert 100% of the collected organic waste (25,000 tonnes/year) - waste that otherwise would have gone to landfill. The AD technology with the added organics also reduced the volume of sewage sludge going to landfill by about 50%. GHG emissions from transporting sludge to landfill were reduced by about 15% due to reduced volume of landfilled solids.

This project demonstrated the need to work together to secure the volume of organics needed to make it a viable energy option. This will be particularly important for Ontario’s smaller municipalities. The involvement of businesses such as greenhouses, food stores and farms who can provide a local source of organics should be encouraged. Local farms who have ADs on site also need to be at the table to avoid potential “organic supply” conflicts.

Here in Ontario, the City of Stratford has announced a similar energy recovery project. Organic waste from both Stratford and surrounding areas will go into an existing wastewater plant anaerobic digester to generate renewable natural gas for Union Gas.
On March 1, 2017, Ontario announced its Strategy for a Waste-Free Ontario: Building the Circular Economy. Part of this strategy is to reduce the volume of food and organic waste going to landfill, including from the industrial, commercial, and institutional (ICI) sector as mentioned above. MOECC estimates that increasing Ontario’s organic diversion rate by 10% would reduce Ontario’s GHG emissions by 275 kilotonnes. A ban of organics from landfill is under consideration, such as the ban that has been in place in Nova Scotia since 1998.

In addition to waste reduction at the source, there are two main alternatives to landfill for organic waste:

a) compost  
b) anaerobic digestion

AD of organic waste is well known. There are several examples in Ontario (e.g., Disco Road Toronto, Toronto Zoo Biogas (in development), Grimsby Biogas, Woolwich Bio-En Inc.), but Ontario’s existing compost/AD capacity falls far short of the current volume of organic waste. Most of the on-farm anaerobic digesters in Ontario also receive some food-based organic waste to blend with their agricultural inputs. If organics are banned from landfill, WWTPs could provide much needed capacity to handle organic waste (e.g., from residential food waste, or commercial sources of fats, oils, and greases). Other potential organic sources may be less obvious - Waterloo has recently announced a pilot program to collect bagged dog excrement in public places, and transport it for anaerobic digestion with other organic wastes to create biogas.

However, it can be challenging to store and transport organic wastes cost-effectively and with acceptable odour levels. If the transportation is fuelled by petroleum products (e.g., diesel), the GHG reduction benefit can be partially eroded irrespective of whether the waste is going to landfill or an AD.

Quebec has already adopted a 60% organics diversion target, and plans a total ban of all organics from landfills by 2020. Companies and municipalities in Quebec are therefore investigating options for managing organic waste commercially. For example, municipalities near Varennes, Quebec have invested with local industry in a joint venture to divert their organics from landfill to feed a new large scale AD currently under construction. The biogas from this digester will be sold next door to a joint venture partner – GreenField Ethanol of Quebec Inc. – to displace a portion of the large volumes of natural gas currently used to dry their wet distillers grain.

8.4.5 Garburators – A Quick Way to get Food Waste to the WWTP?

Garburators (in-sink disposal units) are designed to pulverize organics (food wastes) into a pulp that is flushed down the sanitary drain. The resulting organic-rich pulp ends up in WWTPs.

Garburators can enrich the energy content (and biogas potential) of wastewater. However, municipalities generally prefer separation of organics at source (directed towards composting or AD). Garburator pulp can clog sewers, consume water flushing the material down the drain, and increase energy and chemical usage at the WWTP to handle the increased biological oxygen demand. In cities with combined storm and sanitary sewers, an additional concern is direct discharge of the food waste to waterbodies during overflow events. For this reason, Toronto prohibits garburators in older areas with combined sewers, but allows them in newer areas with separated sewer systems. Still, garburator technology has not been widely adopted in Ontario.
Another potential energy source for AD is hauled sewage – sludge pumped from septic tanks, portable toilets and holding tanks. The MOECC has estimated that Ontario generates 1.2-1.75 million m$^3$ of hauled sewage annually, but the true amount may be higher.43 While much hauled sewage is already disposed of at WWTPs, Ontario still allows land application, i.e., spreading untreated sewage on agricultural land. The MOECC is considering whether to reduce or eliminate such land application.44 If so, hauled sewage disposal at local WWTPs may become mandatory. In 2011, the Township of Georgian Bluffs implemented an anaerobic digester in Owen Sound purpose-built for digestion and co-generation of hauled sewage.45

Ontario’s Strategy for a Waste-Free Ontario will need to consider the wider use of AD technology in the context of the province’s organic waste diversion targets. A vision of what a zero organic waste future might look like was presented at an FCM Sustainability Conference, with AD at the core:

![Diagram](image)

**Figure 8.3. The role of anaerobic digestion in a zero-waste economy.**

Source: Adapted from: Anaergia (2013).46
However, not all organic waste is necessarily appropriate for AD (e.g., yard waste and leaf litter are generally more suited to composting). The MOECC needs to ensure the right balance for treatment of organic waste is found, between composting facilities, on-farm biogas systems, anaerobic digesters at WWTPs and other end uses.

### 8.5 ECO Recommendations

To achieve GHG reduction targets, the Ontario government should help wastewater treatment sites to produce low-carbon energy from wastewater, from organics diverted from landfill, and from agricultural biomass.

Both the provincial and federal levels of government have recognized that infrastructure investments are needed in the municipal wastewater sector. Substantial funding will likely be provided through federal-provincial bilateral agreements on green infrastructure funding, including water and wastewater systems. While upgrading WWTPs to meet compliance and other operational requirements, there is a singular opportunity to also position these facilities to keep organics out of landfill and generate renewable energy. This could make these facilities a fundamental contributor to the energy profile of Ontario municipalities and help support Ontario’s leadership position in the water/wastewater sector.

**Recommendation:** The Ministry of Infrastructure should make anaerobic digestion and energy recovery technology eligible for water/wastewater infrastructure funding.

Three specific barriers were identified:

**Approvals:** Given that biogas energy projects at WWTPs are built in working industrial sites, the current approvals process requiring a full REA for all projects that include electricity generation may be a lot of work for very little result in terms of environmental or natural heritage protection. The cost and effort can be prohibitive for small municipalities, relative to the amount of energy (and financial benefits) that biogas utilization can provide. A simplified approvals process has been put in place for some similar small-scale energy projects. On-farm ADs which are used to generate electricity require either an REA with simplified approval requirements, or no REA at all (although they do need to meet certain requirements under the *Nutrient Management Act, 2002*), and are much more widespread in Ontario as energy production hosts than WWTPs. Small-scale electricity generation from non-renewable energy sources at other facilities also follows a simpler approvals path, requiring an ECA.

The MOECC has an approvals modernization program to reduce regulatory burdens without reducing environmental protection. AD with energy recovery at WWTPs should be a candidate for a simpler, faster, more predictable approval process.

**Recommendation:** The Ministry of the Environment and Climate Change should, without reducing environmental protection, simplify the regulatory approvals process for energy recovery systems associated with anaerobic digestion at wastewater treatment plants, including systems that co-digest off-site organics.

The Ontario government should help wastewater treatment sites to produce low-carbon energy from wastewater, from organics diverted from landfill, and from agricultural biomass.
**Financial Certainty:** It appears unlikely that many more wastewater plants will make a major investment in AD and energy recovery if they must assume all the risk related to the future economic value of biogas for energy production. This is particularly the case with regards to the future economic value associated with carbon reductions. In the ECO’s view, the OEB’s new framework for distributor gas supply plans should set an RNG content requirement and set cost recovery criteria for the utilities. These criteria should allow gas utilities to enter into renewable gas supply contracts, for a term long enough to encourage new projects.

**Recommendation:** The Ontario Energy Board should set a renewable natural gas content requirement and cost recovery criteria for gas utilities.

**Co-digestion:** AD, including co-digestion at WWTPs, can play a substantial role in Ontario’s plan to increase the organics diversion rate through the Strategy for a Waste-Free Ontario. At the same time, co-digestion can also allow AD with energy recovery at smaller WWTPs.

Smaller municipalities should be encouraged to work together, perhaps by collectively selecting one WWTP to host an anaerobic digester that could provide benefits to all participants. Saint-Hyacinthe, Quebec, provides an example of how such a collaborative effort could work.

In addition to organic waste diverted from landfill, there may be opportunities to utilize local, purpose-grown biomass.

It would be useful for the Ministry of the Environment and Climate Change and the Ministry of Agriculture, Food and Rural Affairs to examine the potential and the policy barriers for wastewater treatment plants to serve as “biogas hubs” using anaerobic digestion with energy recovery, including co-digestion of off-site organic material, such as material diverted from landfill and agricultural biomass.
Endnotes


2. Enbridge Gas Distribution, EB-2011-0242, Application and Evidence, EB-2011-0242, Enbridge Gas Distribution, Renewable Natural Gas Application (9 September 2011) at Exhibit B, Tab 1, Appendix 4, section 2.1.4, online: <www.rds.ontarioenergyboard.ca/webdrawer/webdrawer.dll/webdrawer/rec/299468/view/EGDI_APPL_RNG_20110930.PDF>.


10. Ibid at 16.

11. Ibid at 22.

12. Ibid at 24 and 26. The study also assumes additional emissions reductions (not included in this estimate) will occur from reduced methane leakage from landfills and animal manure.

13. Ibid at Table 10 and Figure 7.


21. Ibid at 53.

22. Ibid at 73-74.


25. Ibid at 214.


29. Enbridge Gas Distribution, Natural Resource Gas Limited, Union Gas Limited


34. Stakeholder communication, March 2017.


39. Ibid at 6.


46. Anaergia, “Food Waste Diversion from Landfill” (presentation to FCM Sustainability Conference, February 2013) at slide 2.

47. O Reg 267/03.