Background Notes
EcoLogo™ Program Standard Review (Round 1)

CCD-003 Electricity-Renewable Low-Impact

(B) BIOGAS-FUELLED ELECTRICITY

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May 14, 2009

1. Introduction

Biogas-powered electricity is currently considered in the EcoLogo™ renewable low-impact electricity standard (CCD-003), and five biogas-powered generating facilities amounting to a total capacity of 21 MW have already been third-party certified by the EcoLogo™ Program.

During a preliminary research period, the EcoLogo™ Program engaged with stakeholders to narrow down the scope of environmental criteria categories needing revision or to be added to the standard to continue to define environmental leadership. As such, the EcoLogo™ Program was able to narrow down its criteria scope. This scope will be presented in this document. Moreover, the EcoLogo™ Program will propose environmental leadership criteria for further stakeholder review as well as outline unresolved questions for further consideration by stakeholders.

2. New Criteria Statements to the Current Active Standard

Following preliminary research and a discussion with stakeholders, the EcoLogo™ Program will address the following environmental impact categories and related stressors by proposing to add new criteria statements to the current active standard. Each proposed criteria statement is followed by a rationale explaining why we are proposing the addition to the standard. Only those topics that were discussed with stakeholders will be presented below.

2.1. Re-Usability of Equipment

[Addition]:

6. To meet the requirements of this standard, biogas-fuelled electricity must be generated in such a manner that:

(c) for landfill gas to energy systems

50% of functional equipment at the end of the emitting life of a landfill must be re-used.

Rationale:

Following a discussion with stakeholders, it is clear that parts of landfill gas equipment used to produce energy can be re-used, including tanks, vessels and cogen units (between 0-100% of parts). Some electrical controls can also be re-used. It was mentioned that the lifespan of cogen units have been known to operate for 10-15 years in biogas applications, and some systems can combust landfill gas for over 20 years. In general, landfill gas will peak at 5 to 7 years, but small quantities may continue to be emitted from a landfill for 50 or more years (Agency for Toxic Substances & Disease Registry, n.d.). Because only certain landfill gas to energy equipment parts can be reused at the end of the life of a biogas producing landfill, and also because only certain parts will remain functional at the end of the life of a biogas producing landfill, to save material and energy, the EcoLogo™ Program will encourage the re-use of 50% of functional landfill gas generating systems at the end of the emitting life of landfills.

2.2. Reducing Acidification and Eutrophication from the Anaerobic Digestion of Manure

2.2.1. Re-Use of Phosphorus and Nitrogen Nutrients

[Addition]:

6. To meet the requirements of this standard, biogas-fuelled electricity must be generated in such a manner that:

(b) for farm and food-based biogas systems

ii) the highest performance and nutrient management planning standards must be followed;

iii) 75% of phosphorus and nitrogen (by mass) from the systems must be returned to the land while following best nutrient management practices, or used in another agronomic or horticultural application (such as producing a compost-like byproduct, pots, bedding);

Rationale:

Following consultations, stakeholders suggested it was important for biogas energy systems to follow the highest standard of nutrient management planning and performance standards. Good nutrient management planning will assist in determining how much, if any, additional nutrients are needed to "top-up" to meet the cropping agronomic requirements. Having a high concentration of nutrients in the digestate makes it easier to use the material as a nutrient source. This results in the avoidance of the use of natural-gas based nitrogen fertilizer, or of phosphorous fertilizer which must be trucked in from afar.

Some suggestions included:

- A Nutrient Management Strategy developed by a person certified under Nutrient Management Regulation (O.Reg.267/03 as amended) (Ontario Government, 2008).
- The U.S. AgSTAR, USDA and ASERTTI (2007) Protocol for Quantifying and Reporting the Performance of Anaerobic Digestion Systems for Livestock Manures

This is why the EcoLogo™ Program is mandating that the highest performance and nutrient management planning standards must be followed.

Also, stakeholders suggested that not all digestate can and should be returned to the land, especially low nutrient digestate from cities because there is no known cost-effective way to do so. The EcoLogo™ Program therefore decided that at least 75% of phosphorus and nitrogen nutrients should be re-used in CCD-003.

3. Unchanged Criteria Statements in the Current Active Standard

Following preliminary research and a discussion with stakeholders, the EcoLogo™ Program proposes to keep certain criteria statements intact. Only those criteria statements that were discussed with

stakeholders will be presented below. A rationale explaining why we are proposing to keep statements unchanged is provided for those.

3.1. Greenhouse Gas Emissions

Rationale:

See *General Considerations* Background Notes presented elsewhere for the review of CCD-003.

4. Considerations Withdrawn from Review

Following preliminary research consultations, the EcoLogo™ Program has withdrawn the following environmental considerations from this review. Below, we provide a rationale explaining why we have decided not to address these considerations further during this review. Only those topics that were discussed with stakeholders will be presented below.

4.1. Low-Impact and Renewable Nature of Landfill Gas to Energy

Rationale:

Although the EcoLogo™ Program does not generally support the landfilling of waste, we understand the environmental value of using landfill gas for energy. For instance, some benefits include the reduction of greenhouse gas emissions and hazardous air pollutants, mercury, and NOx and SOx emissions. The EcoLogo™ Program does not support, however, the proliferation of landfills for the purpose of energy production. We instead, encourage a transition away from landfilling organic matter as have been done in countries like Sweden who have already put a ban on the landfilling of organic waste. We believe that landfill gas to energy should only be a temporary measure to mitigate emissions of noxious gases like methane and non-methane organic compounds (NMOCs). This is because, for example, as a stakeholder pointed out, "recycling, composting, and waste reduction are by far the best strategies for methane reduction."

4.2. H_2S Emissions

Rationale:

Following preliminary research and a discussion with stakeholders, the EcoLogo™ Program has decided it was not necessary to require a threshold level concentration of H_2S within CCD-003. This is mostly because most H_2S is converted into SOx which are already addressed in CCD-003.

4.3. Mercury Emissions

Rationale:

According to Chen, C. & Greene, N. (2003), the addition of an energy system to a landfill generally reduces mercury emissions. Moreover, according to EPA (1997)'s Mercury Study Report to Congress, landfills contributed less than 0.1 percent of the total mercury released from all man-made sources in the United States in 1994. When compared on an annual basis, mercury emissions from landfill gas are significantly less than mercury emissions generated by small oil-fired boilers used in homes and apartments.

4.4. Non-Methane Organic Compounds Emissions

Rationale:

The EcoLogo™ Program does not think NMOC emissions must be addressed in CCD-003. This is because landfill gas combustion actually reduces NMOC emissions to the environment.

In fact, according to the EPA (2007),

> *Concentrations of NMOC in uncontrolled landfill gas can vary depending on several factors, including the type of waste discarded in the landfill, the climate surrounding the landfill, and the physical properties of the individual organic compound. A default concentration of 595 parts per million by volume (ppmv) of NMOC is presented in EPA's* Compilation of Air Pollutant Emission Factors (AP-42). *Of this total NMOC, 110 ppmv are considered HAP compounds, according to default concentrations in* AP-42. *Therefore, total uncontrolled concentrations of organic HAP at landfills are typically less than 0.02 percent of the total landfill gas. The* Standards of Performance for New Stationary Sources *(NSPS) and* National Emission Standards for Hazardous Air Pollutants *(NESHAP) regulations require combustion of NMOC, a surrogate for organic HAP, at a destruction efficiency of 98 percent, or to an outlet concentration of 20 ppmv NMOC. The process of combustion destroys organic compounds, including methane and NMOC. During combustion, these organic compounds chemically react with oxygen in the presence of heat, breaking apart to form water vapor, carbon dioxide, and other less volatile compounds. Combusting the gas in a reciprocating engine, gas turbine, or boiler to generate energy also reduces pollution associated with the extraction and use of fossil fuels to produce the same amount of energy.*

4.5. Low-Impact Nature of the Anaerobic Digestion of Manure

Rationale:

During a discussion with stakeholders, all agreed the use of manure in anaerobic digesters in agriculture represents environmental leadership. Some of the environmental benefits highlighted by stakeholders pertaining to the anaerobic digestion of manure include:

- Manure is a critical base substrate for every stable anaerobic digestion process and can be used as a 'buffer' for other substrates with different organic characteristics;
- Biogas technologies demonstrate how additional value and societal benefit can be captured from a difficult-to-handle, existing waste streams;
- Anaerobic digesters produce high quality fertilizer by largely converting organic nitrogen in manure to ammonium. Ammonium is then readily available and utilized by plants;
- When using the digestate material as a fertilizer, availability of nitrogen to the crop is more predictable, meaning less nitrogen needs to be applied to achieve the same crop results. The net application of nutrients can subsequently be reduced;
- Digesting food or vegetable byproducts with manure in a digester reduces GHG emissions;

- The use of digesters significantly reduces pathogens;
- The use of digesters reduces odour because the volatile organic acids which cause odour are consumed by biogas producing bacteria;
- Properly applied digester effluent decreases the likelihood of surface or groundwater pollution by significantly reducing Biochemical Oxygen Demand (BOD);
- The use of digesters could offset the use of fossil fuels; and
- Biogas recovery can improve profitability while improving environmental quality and create jobs related to the design, operation, and manufacture of biogas energy recovery systems.

4.6. Reducing Acidification and Eutrophication from the Anaerobic Digestion of Manure

4.6.1. Reducing P and N Emissions from Anaerobic Digesters

Rationale:

During a discussion with stakeholders, it was stated that "on-going research at present is aimed at ways to technically and cost-effectively reduce nitrogen and phosphorus levels from anaerobic digestion systems. No such methods have yet been proven." Therefore, the EcoLogo™ Program will not mandate threshold levels of N and P emissions from anaerobic digesters at this time.

4.6.2. Separating P and N nutrients

Rationale:

During a discussion with stakeholders, it was mentioned that although feasible, nutrient separation of P and N is not a necessary component of digestate management to demonstrate environmental leadership. While there can be advantages to undertaking this separation, in most applications of farm-based biogas systems there is no need for this since all of the nutrients are needed close-by. Due to the fact it is not always necessary to separate nutrients, the EcoLogo™ Program does not think it should mandate its' separation. Separating nutrients should only be done when it is the best nutrient management technique available. This is therefore indirectly addressed in point 2.2.1 above.

4.6.3. Differentiating between Crop Types

Rationale:

Stakeholders generally think that digesters should not only use the by-products of crops that demonstrate lower eutrophication and acidification potential than petrol. A reason for this was that such a requirement could compete with the necessity of crop rotation systems for soil preservation. Also, it was mentioned that "Anaerobic digestion promotes sustainable agricultural practices. It is already competitive enough in the organics market, limiting the products that come only from crops that demonstrate lower levels of eutrophication and acidification than petrol will not foster biogas development. It would also be difficult to separate multiple streams of organic by-products at food

processing zones." Because of these reasons, the EcoLogo™ Program will not mandate the use of particular crop by-products for digestion within CCD-003.

4.7. Dioxins and Furans

Rationale:
Based on preliminary research, it appears as though the risks posed by dioxins and furans are currently being reassessed by both the U.S. and Canadian governments. Due to the fact that both governments are working to control these emissions, the EcoLogo™ Program will not further address this issue within CCD-003.

5. Unresolved Issues

Following preliminary research and a discussion with stakeholders, the EcoLogo™ Program has not been capable of resolving certain issues. Indeed, no clear direction could be found indicating how EcoLogo™ should address these issues, although in certain cases, several proposals were brought forward. The goal of the EcoLogo™ Program is to determine whether these issues can be resolved and what criteria statement could be included in the standard. Only those topics that were discussed with stakeholders will be presented below.

5.1. Criteria Air Emissions (CO, NOx, SOx and PM)

Rationale:

See *General Considerations* Background Notes presented elsewhere for the review of CCD-003.

5.2. Animal Renderings

[Proposal A]:

The EcoLogo™ Program should allow the use of animal renderings for electricity in CCD-003.

[Proposal B]:

The EcoLogo™ should not allow the use of animal renderings for electricity in CCD-003.

Pros:

All stakeholders who submitted comments during the consultation were of the opinion that the use of animal renderings for energy represents significant environmental leadership and as such should be considered by the EcoLogo™ Program.

Some of the benefits presented by stakeholders include:

- Anaerobic digestion of animal renderings is the most advanced and technically controlled way to handle animal by-product materials while deriving energy. Since these animal by-product waste streams are already produced, they need to be managed;

- When managed properly, digestion of animal by-products can reduce odour;

- When managed properly, digestion of animal by-products can reduce pathogens;

- Since landfill gas for energy is included in CCD-003 and therefore organics of animal by-products are indirectly included this way, they should also be allowed when energy is produced outside of landfills by anaerobic digestors;

- The digestion of animal renderings can stabilize the nutrients for reintroduction into the environment;

- This form of energy production offsets our dependence on fossil fuels and related environmental impacts

<u>Cons:</u>

It remains controversial whether or not animal-based products should be considered for environmental leadership simply because, by their inherent nature, they could be considered unsustainable. Some stipulate that meat production and all of the meat industry derived environmental impacts are unnecessary when populations could be fed on vegetable-based diets which have a much lower environmental footprint. Here is a list of environmental impacts generally associated to the meat and dairy industry outlined in Vasil (2007):

- *Meat production is 10 to 20 times more energy intensive per edible ton than grain production.*

- *One-fifth of the planet's land surface is used for grazing animals, double what goes to growing crops.*

- *An area larger than New York State is estimated to be destroyed every year for grazing land.*

- *If no controls are in place, meat production can lead to ammonia, particulate matter, sulfur oxide, hydrogen sulfide or reduced sulfide air emissions.*

- *If untreated, dissolved solids and nitrate might contaminate waterways.*

- *Animal abuse.*

- *An increase in greenhouse gas emissions. Gassy livestock accounts for 18% of the world's greenhouse gases.*

- *Animal protein swallows 8 times more fossil fuels than beans or vegetable protein.*

- *Release of antibiotics (if not grown organically).*

- *Release of hormones.*

- *Over 90% of our exposure to dioxins comes from food, especially animal fats.*

- *Aesthetic impacts due to odors and suspended solids.*

- *Oil and grease discharges may cause problems to infrastructure like sewers.*

6. References

Agency for Toxic Substances & Disease Registry. (n.d.). *Landfill Gas Primer - An Overview for Environmental Health Professionals*. Retrieved May 11, 2009, from http://www.atsdr.cdc.gov/hac/landfill/html/ch2.html

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