RECYCLING COUNCIL OF BRITISH COLUMBIA

RCBC Background Paper:

Energy Recovery Policy Positions

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1.0 BACKGROUND

In 2008, the Recycling Council of B.C. (RCBC) adopted a policy related to the development of new waste-to-energy (WTE) facilities in British Columbia. The policy reads as follows:

"RCBC adopts a position that 1) is opposed to the development of new waste-to-energy disposal facilities –including bioreactors and incinerators (mass-burn, pyrolysis, plasma, gasification and any other conversion technology) as they inhibit/prevent/restrict the development of Zero Waste programs and facilities aimed at the reduction, reuse, recycling and composting of discarded products and materials and 2) asserts mixed municipal solid waste should not be considered a "clean," "renewable" or "carbon-neutral" source of energy."

This policy was adopted in response to Metro Vancouver's interest in building new WTE facilities in the region to process mixed Municipal Solid Waste (MSW). Since this policy was approved, RCBC has received numerous inquiries related to our position on a variety of forms of waste-to-energy. The term waste-to-energy has expanded over time to encapsulate an assortment of energy recovery systems and material types, and it was determined that RCBC's current policy is not comprehensive enough to address this variety of technologies.

While RCBC is opposed to the processing of MSW in WTE facilities, the organization does not have a position on other forms of energy recovery that may or may not be more environmentally appropriate. This document is a first step in providing the RCBC Policy Committee and Board of Directors with the information required to adopt a more comprehensive set of policies related to energy recovery from waste in B.C.

There is a wide variety of energy recovery technologies and processes in operation around the globe. This industry is in a constant flux, with new technologies continuously being developed, adapted, and improved. To overcome the informational hurdles presented by this wide range of technologies, the following document is organized roughly around material types. In general, RCBC is interested in determining which types of wastes (i.e.: materials) are and are not appropriate sources for energy recovery.

2.0 MIXED MUNICIPAL SOLID WASTE (MSW)

As outlined above, RCBC's original WTE policy position was designed to articulate the organization's position on the processing of mixed municipal solid waste in WTE facilities. Despite the environmental claims of many WTE companies, RCBC does not feel the need to revisit this policy. Mixed MSW is comprised of a wide variety of material types, including paper, metal and plastic, which should be recycled. The environmental savings of a zero waste approach, which focuses on waste reduction and diversion, far outweigh the environmental benefits of energy recovery from MSW. These issues are discussed in much more detail in RCBC's report entitled Examining the Waste to Energy Option.

Policy Position:

RCBC reiterates its opposition to the processing of mixed municipal solid waste in waste-to-energy facilities of all forms, including incinerators and bioreactors. The conversion of mixed municipal solid waste into energy should not be considered a clean, green or renewable source of energy.

It is worth noting the continuing debate, particularly in Metro Vancouver, of the environmental and economic benefits of landfills versus WTE facilities. Two recent reports released by AECOM and Belkorp Environmental Services have been at the forefront of this debate. Given RCBC's commitment to zero waste, it is not believed that RCBC needs to be drawn into this debate. RCBC should continue to promote a zero waste strategy and not promote one residual management scenario over the other.

3.0 TIRE DERIVED FUELS

Scrap tires can be used as a fuel source, either to replace coal or natural gas in cement kilns and pulp and paper mills, or as a feedstock in WTE facilities. Tires are a desirable fuel source for industry as they typically contain about the same quantity of embedded energy as oil and about 25 percent more energy than coal. Tires are often a cheaper fuel source than other fossil fuels, which continues to drive demand in British Columbia for Tire Derived Fuel (TDF) in the cement industry.

Tire Stewardship BC (TSBC) is responsible for the collection and management of used tires in British Columbia. In 2008, about 400,000 tons of scrap tires were collected under their program. According to TSBC's 2008 Annual Report, about 70 percent of these tires were recycled into tire derived products (TPDs). Tires are typically converted into crumb rubber, which is used in products such as athletic tracks, synthetic turf fields, flooring and mats for industrial and agricultural use, asphalt rubber and non slip pavers for patios, walkways and playgrounds. Large tires from highway trucks are also made into mats in the construction industry. The remaining 30 percent of collected tires were used as a fuel supplement in the cement and pulp and paper industries.

Lehigh Northwest Cement, which operates a large cement kiln in Delta, is the primary recipient of scrap tires that are not recycled into products in B.C. The plant's fuel source is comprised of roughly 92 percent coal and eight percent tires. As such, tires that are used as a fuel source can be seen as offsetting the use of coal.

The environmental impact of replacing coal with TDF in cement kilns and pulp and paper mills is widely debated. As a whole, air emissions of various pollutants are generally thought to be similar in either scenario. Both the U.S. Environmental Protection Agency and the U.K. Health Protection Agency, for example, concluded that while some pollutants are reduced if coal is replaced with TDF, other pollutants are increased. As such, the net effect of using tires instead of coal is considered neutral. For a review of various lifecycle analyses on the issue, see a recent study released by the government of Nova Scotia.

The greenhouse gas (GHG) impact of replacing coal with TDF in cement kilns is also roughly neutral, despite the claims of some TDF proponents. ICF Consulting's report on the life cycle GHG emission factors of scrap tires and coal, for example, found tires to be an extremely slight improvement over coal. Other reports, such as Belkorp's recent study on waste management strategies in Metro Vancouver, found the GHG impacts of tires and coal to be equal. Regardless, it is clear that replacing coal with scrap tires does not represent a significant reduction in GHG emissions.

Tire Stewardship BC has a performance target to achieve a ratio of tire derived products (TDP) to tire derived fuel (TDF) at 80 percent to 20 percent. This ratio was achieved in 2007 but, as previously mentioned, the 2008 calendar year saw a ratio of 70 percent TDP to 30 percent TDF. This represents an increase in the portion of scrap tires used as a fuel source instead of being recycled, between the years 2007 and 2008. Information is not yet available for 2009.

As part of the recently approved RCBC EPR Framework Principles, RCBC passed a policy position related to the waste reduction hierarchy in EPR programs. The policy reads as follows:

Waste Reduction Hierarchy - Programs must illustrate a commitment to following the 3R waste reduction hierarchy and to achieving the highest, best use for collected materials through demonstrated continuous environmental improvement.

Given the lack of tangible environmental benefits of replacing coal with scrap tires as a fuel source, RCBC's position on tire derived fuel should stress the importance of the waste reduction hierarchy.

Policy Position:

The management of scrap tires collected in British Columbia should adhere to the waste reduction hierarchy. Wherever possible, source reduction and recycling should be encouraged over the use of tires as a fuel source. The proportion of tires converted into tire derived fuel should be low and constantly declining, with a significantly higher proportion of tires converted into tire derived products.

4.0 LANDFILL GAS

Landfill gas (LFG) is generated by the decomposition of MSW in landfills. Organic materials such as food waste, yard waste, paper and cardboard decompose to create methane, carbon dioxide and a small amount of trace pollutants such as Volatile Organic Compounds (VOCs). The release of methane is particularly important from a climate change perspective, as its climate change impact is over twenty times that of carbon dioxide.

LFG can be captured and utilized to recover its energy value. If the size or location of the landfill does not warrant the use of captured LFG, the gas is often simply flared off. In appropriate locations, however, LFG can be used for a variety of purposes, including heating greenhouses, running turbines or producing electricity. Captured methane can also be purified and sold directly to natural gas utilities or converted to compressed natural gas and used as a fuel source in vehicles.

In January of 2009, the B.C. government passed the Landfill Gas Management Regulation, which requires that all MSW landfills in B.C. above a certain threshold undertake an assessment of landfill gas generation. The ultimate goal of the regulation is to implement LFG collection and utilization procedures at all large-scale MSW landfills in the province.

Both the Delta and Cache Creek landfills employ LFG capture systems. The Delta Landfill includes a LFG collection and utilization project that involves the production of electricity sold onto the grid and the utilization of thermal heat in a local greenhouse by Maxim Power Corp. Wastech has proposed an ambitious plan to convert LFG collected at the Cache Creek landfill into liquefied natural gas to fuel the vehicles that transport waste from Metro Vancouver to the landfill. In January, 2010 the Minister of Environment announced his decision to approve an expansion of the Cache Creek landfill, with the assumption that this LFG proposal would be further explored. For information on the projections of various LFG scenarios at the Cache Creek landfill, see here.

The percentage of LFG that can be captured by modern collection systems remains controversial. A wide range of estimates have been proposed for the average efficiency of collection systems. The U.S. Environmental Protection agency in a 2006 report, for example, assumes a capture rate efficiency of about 75 percent. Other reports by reputable sources suggest that average capture rates of over 90 percent are possible. The level of assumed capture efficiency will lead to large differences in the estimated GHG reductions associated with LFG projects. Regardless of the capture rate, however, it is clear that even the most modern of LFG collection systems allow a significant proportion of methane, a potent GHG, to escape from landfills.

The diversion of organic waste into composting and/or biogas programs is the most effective way to reduce greenhouse gases at their source. It does not make sense to continue to place organic waste in landfills only to attempt to later capture the gases associated with their decomposition. Given the percentage of methane that evades landfill gas collection systems, the focus should be on ensuring organic materials are diverted from the waste stream before reaching the landfill.

The net greenhouse gas emissions associated with organic waste would be lower in such a front-end approach that emphasizes diversion, and would cost less over the long run. Recent attempts to monetize the environmental benefits of various organics management strategies, for example, have shown that composting provides a greater benefit at a lower cost than LFG recovery systems. Life cycle assessments of various organics management strategies have come to the same conclusion.

LFG collection and utilization systems should be seen as a way of reducing the environmental impacts associated with past practices that involved the needless landfilling of compostable organics. They should not, however, be considered an effective strategy to manage organics into the future.

Policy Position:

Landfill gas (LFG) collection and utilization systems can play an important role in reducing the GHG emissions associated with historically active areas of landfills, but should not be prioritized as a management strategy into the future. The overwhelming priority related to the management of organics, at both the provincial and local level, should be placed on the diversion of organics from landfills into composting programs.

5.0 CONSTRUCTION AND DEMOLITION WASTE

Note that this portion of the waste stream is often referred to as demolition, land clearing and construction waste (DLC). For the purposes of this document, only construction and demolition waste is being considered.

Construction and demolition wood waste is generated from the construction, renovation, repair, and demolition of houses and other building structures. Most of this wood is considered "clean" in that it is untreated and unpainted. Construction and demolition wood waste comprises a major portion of the waste stream in British Columbia. As such, many regional districts are developing new strategies to increase wood waste diversion in their jurisdictions. Metro Vancouver's new Draft Solid Waste Management Plan, for example, proposes banning wood waste from disposal by 2012.

C&D wood waste diverted from landfills in British Columbia is typically used as a fuel source in industrial processes. In Metro Vancouver, diverted C&D wood waste is converted into process engineered fuel (PEF) by Urban Wood Waste Recyclers and used in Lafarge's Richmond cement plant to displace coal as a fuel source. This market is very strong in B.C., with demand for wood waste as a fuel source continuing to outstrip supply.

A variety of other technologies and processes are possible to convert C&D wood waste into energy, including direct combustion and conversion into cellulosic ethanol. The Dockside Green development in Victoria, for example, includes a biomass heat generation plant that generates heat and hot water from the conversion of wood waste (including C&D wood waste) into synthetic gas (syngas).

Diverting C&D wood waste from landfills into energy recovery systems can represent a significant environmental improvement. Dr. Jeffrey Morris has authored the most comprehensive report on the issue, but unfortunately it is not available online. A discussion on the findings of this report is available in Appendix D of Belkorp's aforementioned report on Metro Vancouver's waste options. See here for a review of a similar life cycle analysis which includes wood waste.

Dr. Morris concludes that each tonne of clean wood waste used as a fuel source to replace natural gas (as in Dockside Green) offsets about one tonne of eCO2. Each tonne of clean wood waste used as a fuel source to replace coal (as in Lafarge's cement plant) offsets about two tonnes of eCO2. For this reason, the Dockside Green project is expected to offset over 3,000 tonnes of eCO2 annually while the Lafarge plant is expected to offset 300-1,000 tonnes a year at its present rate of coal substitution.

There are, of course, a variety of other higher value uses for clean C&D wood waste besides energy recovery. The reuse of structurally sound timber is underutilized in British Columbia as it necessitates novel demolition and deconstruction practices. Potential markets for clean C&D wood waste include finger-jointed wood, reconstituted panel and particle board, animal and pet bedding, mulch and paper pulp.

While research into the environmental savings associated with these products is not well developed, initial research (1, 2) implies that recycled wood waste products can be more favorable from an environmental perspective than energy recovery. Dr. Morris, for example, estimates that each tonne of clean wood waste recycled into paper pulp offsets 2.7 tonnes of eCO_2, significantly more than if it had displaced natural gas or coal. Significant barriers to the further market adoption of these products and processes exist, however, including low levels of demand, few business opportunities, low prices for virgin materials and the overpowering demand of fuel markets.

Policy Position:

In keeping with the waste reduction hierarchy, further opportunities to reuse and recycle construction and demolition wood waste into new products should be aggressively explored and pursued in British Columbia. The recovery of energy from construction and demolition wood waste is understood to be environmentally advantageous, particularly when it offsets the use of fossil fuels, but should be seen as secondary to higher value uses such as reuse and recycling.

6.0 WASTE HEAT

Waste heat recovery refers to the capture and reuse of thermal energy that would otherwise be released into the environment. Waste heat recovery comes in a variety of forms, including exhaust air heat recovery in buildings, combustion heat recovery in boiler plants, heat recovery from refrigeration systems and wastewater heat recovery. Captured heat is typically used for space or water heating in nearby homes and buildings.

While waste heat is fairly underutilized as an energy source in British Columbia, prominent examples have increased the exposure of this energy option. Both the Whistler Sliding Centre and the Richmond Olympic Oval, for example, capture waste heat from their refrigeration systems and reuse the thermal energy for water and space heating purposes on site. The Life Sciences Centre at the University of British Columbia and the Abbotsford Regional Hospital and Cancer Centre include exhaust air heat recovery systems that capture and reuse waste heat.

Wastewater heat recovery, or sewer heat recovery, in particular has been receiving increased exposure in British Columbia of late. After the release of an influential report that studied various energy alternatives in the Greater Vancouver area, the new False Creek development in Vancouver established a sewage heat recovery system. Thermal energy from warm sewage is recovered and used for heating residential space and domestic hot water. Wastewater heat recovery systems are also used at Okanagan College and the Whistler Athletes' Village.

The environmental benefits of waste heat recovery are well established. Waste heat systems capture energy that would otherwise be wasted and that has no other beneficial use. Recovered heat directly displaces other sources of thermal energy such as natural gas, reducing societal dependence on fossil fuels. Sewage heat is estimated to reduce greenhouse gas emissions by 50 percent in projects in British Columbia and is associated with significantly lower levels of air pollution than other established forms of energy. Okanagan College's project, for example, is expected to offset 800 tonnes of GHG emissions a year. The challenges in establishing heat recovery systems are typically economic in nature, given the up-front capital costs of such systems, but their environmental benefits are clearly demonstrated.

Policy Position:

RCBC considers waste heat recovery to be an environmentally beneficial and appropriate source of energy. Waste heat recovery systems displace other more GHG-intensive sources of thermal energy, and make use of energy that would otherwise be wasted.

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