Michael E. Van Brunt, P.E.
Manager, Sustainability

Covanta Energy Corporation
40 Lane Road
Fairfield, NJ 07004
Telephone: (973) 882-2768
Facsimile: (973) 882-4167

Via Electronic Mail to: lcfs@nescaum.org

November 10, 2009

Northeast States for Coordinated Air Use Management
89 South Street, Suite 602
Boston, MA 02111

Re: Northeast/Mid-Atlantic Low Carbon Fuel Standard

To Whom it May Concern:

We are pleased to offer comments on the Northeast and Mid-Atlantic Low Carbon Fuel Standard (LCFS). Efforts to reduce the emissions of transportation fuels, such as the LCFS, are crucial to overall efforts to reduce emissions of greenhouse gases (GHGs) and mitigate the future impacts of climate change.

Covanta is committed to employing technologies that reduce our nation's GHG emissions while generating renewable energy. Covanta is an internationally recognized owner and operator of energy from waste (EfW) facilities, which convert municipal solid waste (MSW) into steam and/or electrical energy. Our company owns and/or operates 42 EfW facilities in the U.S., including 23 in the states participating in the LCFS, and owns and/or operates other renewable energy sources, including biomass to energy (BtE) and landfill gas to energy (LFGTE) operations. Using national averages, EfW facilities reduce GHG emissions by 1 ton of carbon dioxide equivalents for every ton of waste processed on a life cycle basis.[1] Electricity generated from EfW can be an important source of a low carbon transportation fuel in electric and hybrid electric vehicles.

The benefits of EfW as a net GHG reducing source of renewable energy are widely recognized by the World Economic Forum Davos Report, the Nobel prize winning Intergovernmental Panel on Climate Change (IPCC), the United Nations Framework Convention on Climate Change (UNFCCC), the European Union and the European Environmental Agency, the Global Roundtable on Climate Change (GROCC) convened by Columbia University's Earth Institute, and the U.S. Conference of Mayors.

Actively involved in international climate change efforts, Covanta is a founding reporter of The Climate Registry (TCR) and has been reporting its California emissions to the California Climate Action Registry since 2005. Covanta personnel also recently served on the TCR Electric Power Sector Protocol Workgroup and are currently working on the World Resources Institute / World Business Council for Sustainable Development GHG Protocol's workgroups to develop a Scope 3 GHG Emission Inventory Protocol.

---

[1] B. Bahor, M. Van Brunt, K. Weitz, A. Szurgot, "Life Cycle Assessment of Waste Management Greenhouse Gas Emissions Using Municipal Waste Combustor Data" *Journal of Environmental Engineering*, in press (available at http://dx.doi.org/10.1061/(ASCE)EE.1943-7870.0000189).

We are also pursuing exciting emerging technologies that convert waste into renewable diesel. Covanta has begun construction of an innovative waste-to-diesel demonstration project at one of our existing facilities in New England. Once operational, the waste-to-diesel process will generate non-ester renewable diesel fuel through catalytic depolymerization of a variety of different waste feedstocks, including MSW.

After recycling, recovering energy from waste is preferred over landfilling by the US EPA Office of Resource Conservation and Recovery and the European Union in accordance with established waste hierarchies. A plentiful and renewable feedstock, over 260 million tons of which is currently disposed in U.S. landfills, MSW does not compete with food production, does not result in land-use change emissions either directly or indirectly, and can serve as a feedstock for renewable transportation fuels, including electricity.

MSW is an indigenous source of energy which can help to reduce our reliance on foreign fossil fuels and even foreign biomass fuels. In evaluating options for the LCFS, the Northeast States Center for a Clean Air Future (NESCCAF) identified that "waste is by far the region's most significant resource" for the production of advanced biofuels.[2] A recent consensus policy statement authored by eleven Berkeley, Dartmouth, MIT, Princeton, and University of Minnesota scientists in the journal *Science* identified MSW as one of five key biofuel feedstocks with lower life-cycle GHG emissions than fossil fuels and little or no competition with food production.[3] The 2008 New Jersey Energy Master Plan states that "almost 75% of New Jersey's biomass resources are produced directly by the State's population, a majority of which is solid waste." New Jersey advocates pursuit of waste to energy to meet 2020 Renewable Portfolio Standard (RPS) goals.

Accordingly, we support the inclusion of MSW as an eligible feedstock in the LCFS. As shown in our attached detailed comments, post-recycled MSW including both fossil and biogenic components results in net reductions in GHG emissions primarily by reducing our dependence on landfills, the 2nd leading source of anthropogenic methane in the United States. Furthermore, we fully support the proposed approach to evaluate all technologies equally, based solely on their proven ability to generate sustainable low carbon transportation fuels or electricity.

Thank you again for the opportunity to submit comments and please do not hesitate to contact me if you have any questions or if you would like to review the results of our life cycle assessments presented in more detail.

Sincerely,

Michael E. Van Brunt

Michael E. Van Brunt, PE
Manager, Sustainability

Att.

---

[2] Northeast States Center for a Clean Air Future. *Introducing a Low Carbon Fuel Standard in the Northeast: Technical and Policy Considerations*. July 2009.
[3] Tilman, D., R. Socolow, J. A. Foley, J. Hill, E. Larson, L. Lynd, S. Pacala, J. Reilly, T. Searchinger, C. Somerville, R. Williams. "Beneficial Biofuels – The Food, Energy, and Environment Trilemma." *Science* v325. July 17, 2009.

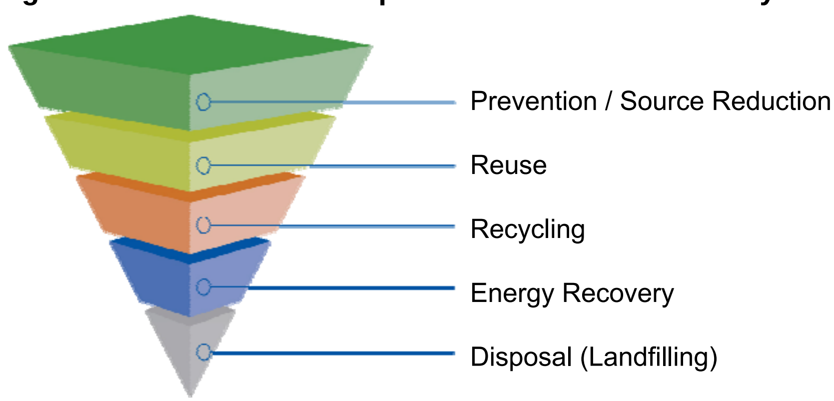
Municipal Solid Waste as an Eligible LCFS Feedstock

Municipal Solid Waste is a plentiful domestic resource and its use as a renewable fuel feedstock does not compete with the food supply and results in no direct or indirect land-use change emissions. Furthermore, use of MSW as a feedstock for renewable diesel fuel avoids methane, a potent GHG, emissions from landfills. Life cycle GHG emissions for MSW-based renewable diesel and electricity are well below their respective baselines. These benefits, coupled with the ample available resource in New England and Mid-Atlantic states and EfW's existing technology, position MSW as an excellent feedstock for the LCFS.

MSW as a Resource

Increasingly, waste is being viewed as a resource and an opportunity for reducing GHG emissions. The former US EPA Office of Solid Waste is now the Office of Resource Conservation and Recovery, reflecting a new emphasis on sustainability and recovering value from former waste materials. Both the European Union (EU) and the U.S. EPA have developed waste hierarchies which give preference to recycling and energy recovery over waste disposal in landfills (Figure 1).[4, 5] A recent paper coauthored by U.S. EPA and North Carolina State researchers demonstrated the value of EfW over landfilling from a GHG, energy and emissions perspective.[6] The GHG reductions achievable are significant: extending the European waste management model globally can achieve a GHG reduction of 1 Gigatonne carbon equivalents (GtCE) per year by 2054.[7]

Figure 1. US EPA and European Union Waste Hierarchy



Unfortunately, MSW management in the United States, including the New England and Mid-Atlantic states, is currently heavily weighted to the bottom of this hierarchy. Currently, over 260 million tons of MSW are landfilled annually in the United States, over 64% of the waste we

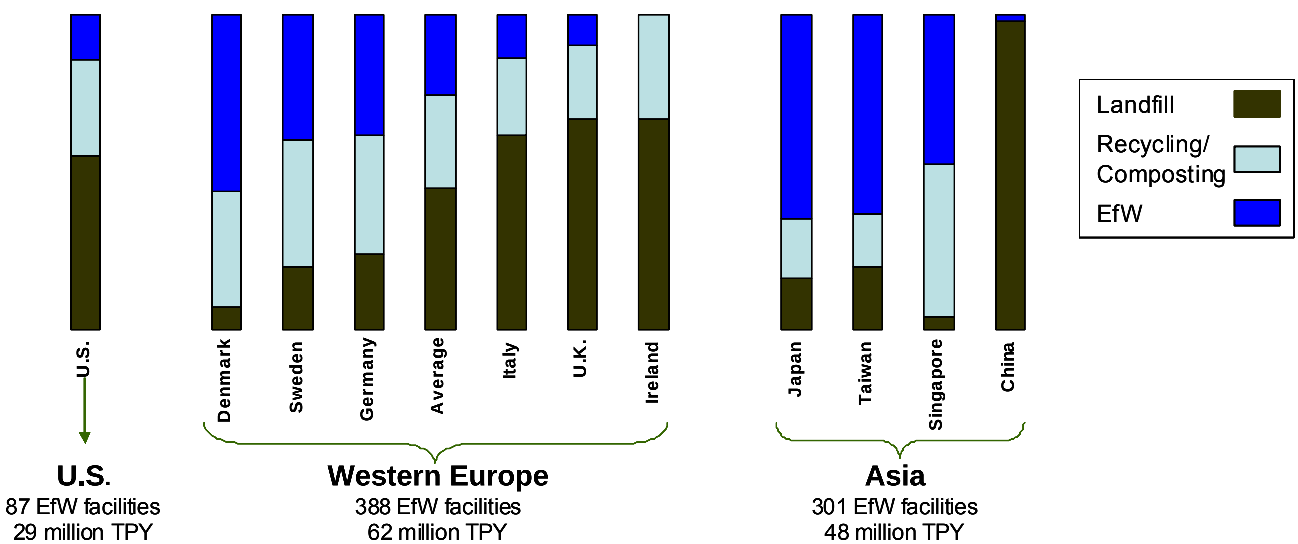
---

[4] U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response. *Opportunities to Reduce Greenhouse Gas Emissions through Materials and Land Management Practices*. Washington, DC. September 2009.
[5] European Union, EU (2008) Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives. *Official Journal of the European Union*. L312, **51**, 3-30
[6] Kaplan, P.O, J. DeCarolis, and S. Thorneloe, 2009, "Is it better to burn or bury waste for clean electricity generation?" *Environ. Sci. Technology* 43 (6) pp1711-1717
[7] B. Bahor, M. Van Brunt, J. Stovall, K. Blue, Waste Manag Res. in press (available at http://wmr.sagepub.com/cgi/rapidpdf/0734242X09350485v1.pdf).

generate. Nationally, we recycle and compost only 29% and recover energy from only about 7% of our waste.[8]

This contrasts sharply to the experience with EfW in other industrialized nations with more aggressive recycling and waste management policies. As can be seen from the following figure, the countries with the highest national recycling rates also exhibit the greatest use of EfW. U.S. renewable policies need to embrace the lessons learned from other industrialized nations which have achieved higher national recycling rates in conjunction with resource recovery. Failure to do this promotes the status quo, resulting in more landfilling and the increased GHG emissions associated with this practice.

Figure 2. International Use of Energy from Waste



Current practices leave a tremendous unused resource. The July 2009 NESCCAF report identified that over 20 million dry tons of MSW are likely available in the six New England states, New York, New Jersey, and Pennsylvania. MSW is available 365 days a year in the areas of highest demand. This is a distinct advantage over other forms of biofuels, including biofuel crops such as corn or switchgrass based ethanol, which are available only during the growing season and must be stored and generally require significant transportation to bring the fuels to the areas of greatest need. As noted in the EPA's Notice of Proposed Rulemaking (NOPR) for the Renewable Fuel Standard Program (RFS2), "a significant advantage of MSW over other cellulosic biomass is that it can be generated year-round in many parts of the U.S."[9]

MSW is Renewable

MSW is being continuously replenished. The exact characteristics of MSW, including the biomass and fossil fractions, will vary as recycle programs evolve and will vary from community

[8] Arsova, L., R. van Haaren, N. Goldstein, S. Kaufman, N. Themelis. "The State of Garbage in America: 16th Nationwide Survey of MSW Management in the U.S." *BioCycle*. December 2008. **47** (4), 26-43
[9] NOPR, Federal Register v74 n99 May 26, 2009. p25075

to community; however in each instance, MSW is a separated material that can be beneficially managed as an energy resource. The recovery of energy potential from both fossil and biomass materials in MSW remaining after recycling is an advantage to the United States reaching its RFS goals.

There is significant precedent for the inclusion of MSW as a renewable resource. Already, 24 states, the District of Columbia, and the U.S. Department of Energy consider EfW to be a renewable source of Energy.[10, 11] The World Economic Forum at their recent meeting in Davos, Switzerland, identifies EfW as one of eight renewable technologies likely to make a meaningful contribution to a future low-carbon energy system.[12]

No Land Use Change from Use of MSW

Renewable fuels generated from waste biomass, including the biogenic fraction of MSW, do not lead to land use change. A recent paper co-authored by researchers from The Nature Conservancy and the University of Minnesota found that biofuels from waste streams "would minimize habitat destruction, competition with food production, and carbon debts, all of which are associated with direct and indirect land cleaning for biofuels production."[13] The World Wildlife Federation (WWF) recommends that the use of waste and by-products be promoted to reduce emissions associated with food crop displacement.[14] The RFS2 NOPR recognizes that biodiesel derived from waste grease does not have land use impacts in its assessment of waste grease biodiesel. The NOPR also recognizes that corn oil that is not food grade would have no land use impacts.[15] We believe that the same analysis applies equally to renewable diesel produced from MSW, since the waste stream is a byproduct of land use decisions made for reasons other than to serve as a feedstock for renewable fuel. Including MSW in the LCFS will have no impact on the land use decisions underlying the generation of the waste stream in the first instance.

Avoidance of Landfill Gas

Every ton of waste diverted from landfills and used for renewable fuels or electricity prevents GHG emissions from landfills, which emit methane for 100 years or more. In the U.S., less than ⅔ of waste landfilled is managed in landfills with landfill gas (LFG) collection.[16] For those landfills that collect LFG, reported collection efficiencies vary widely, with little information or consensus on either short term or integrated life cycle default values. In the emission factor database, AP-42, the USEPA uses a default value of 75%. The IPCC cites default values as low as 20% with reference to measurements between 10% and 85% at active gas recovery

---

[10] Integrated Waste Services Association. Fact Sheet: Waste-to-Energy and State Renewable Statutes. http://www.wte.org/docs/FactSheetState.pdf;

[11] Letter from David K. Garman, Assistant Secretary Energy Efficiency and Renewable Energy, U.S. Department of Energy to Maria Zanes, President, Integrated Waste Services Association. April 23, 2003. http://www.wte.org/docs/EEREletter.pdf.

[12] World Economic Forum. *Green Investing: Towards a Clean Energy Infrastructure.* January 2009. http://www.weforum.org/pdf/climate/Green.pdf

[13] Fargione, J., J. Hill, D. TIlman, S. Polasky, P. Hawthorne. "Land Clearing and the Biofuel Carbon Debt" *Science* Published online February 7, 2008; 10.1126/science.1152747.

[14] WWF. "WWF Position Paper on Bioenergy – June 2008." http://assets.panda.org/downloads/wwf_position_paper_on_bioenergy_291107.pdf

[15] NOPR, Federal Register v74 n99 May 26, 2009. p25052.

[16]USEPA. *Solid Waste Management and Greenhouse Gases: A Life Cycle Assessment of Emissions and Sinks*, 3rd Edition. September 2006. http://www.epa.gov/climatechange/wycd/waste/SWMGHGreport.html

projects and 10% and 80% at closed landfills.[17] The Massachusetts Department of Environment Protection (MA DEP) recommended a collection efficiency of 40% to the EPA.[18] While these reported efficiencies represent short term collection efficiencies, an integrated life cycle efficiency that takes into account changes in LFG collection over time is necessary to conduct a life cycle assessment (LCA), the most suitable mechanism for evaluating and comparing impacts that occur over different time frames. An integrated landfill gas collection efficiency of approximately 50% over 100 years and 10% soil oxidation in landfill cover soils yields a 55% collection / destruction efficiency.

Recovering energy from the waste remaining after recycling is recognized as a preferred management approach in EPA's solid waste management hierarchy. Reducing our dependence on landfilling also helps reduce the potential for groundwater impacts associated with landfill leachate.

Life Cycle Assessment Results

As detailed below, the recovery of energy from post-recycled MSW by both generating renewable electricity and liquid transportation fuels results in net reductions in GHG emissions, predominately from avoided landfill methane emissions. Based on these results, post-recycled MSW, including both the biogenic and fossil based components, should be included as an eligible feedstock in the LCFS.

LCA of MSW in EfW Process

EfW facilities convert post-recycled MSW into useable electricity and/or steam through a controlled combustion process incorporating modern emission control equipment meeting strict federal and state limits. When electricity is generated from EfW, there is a net avoidance of GHG emissions. This avoidance is based on the following processes:

1. Anthropogenic, or fossil CO_2, GHG emissions from combustion of waste components (plastics, textiles, etc.) made from fossil fuels such as oil and natural gas;
2. Avoidance of landfill methane emissions from waste, including factoring-in methane capture, that would have been landfilled in the absence of the EfW facility (described above); and
3. Avoidance of extraction and manufacturing GHG emissions due to ferrous metal recovery and recycling at EfW facilities.

Figure 3 compares the LCA results of using EfW-generated electricity as a low carbon transportation fuel with the emissions intensity of the gasoline baseline and the carbon intensities of electricity used as a transportation fuel from figure 3-11 of the July 2009 NESCCAF report. An energy economy ratio (EER) of 2.4 corresponding to a plug-in hybrid electric vehicle (PHEV) was used for the results depicted. Owing to the avoidance of landfill

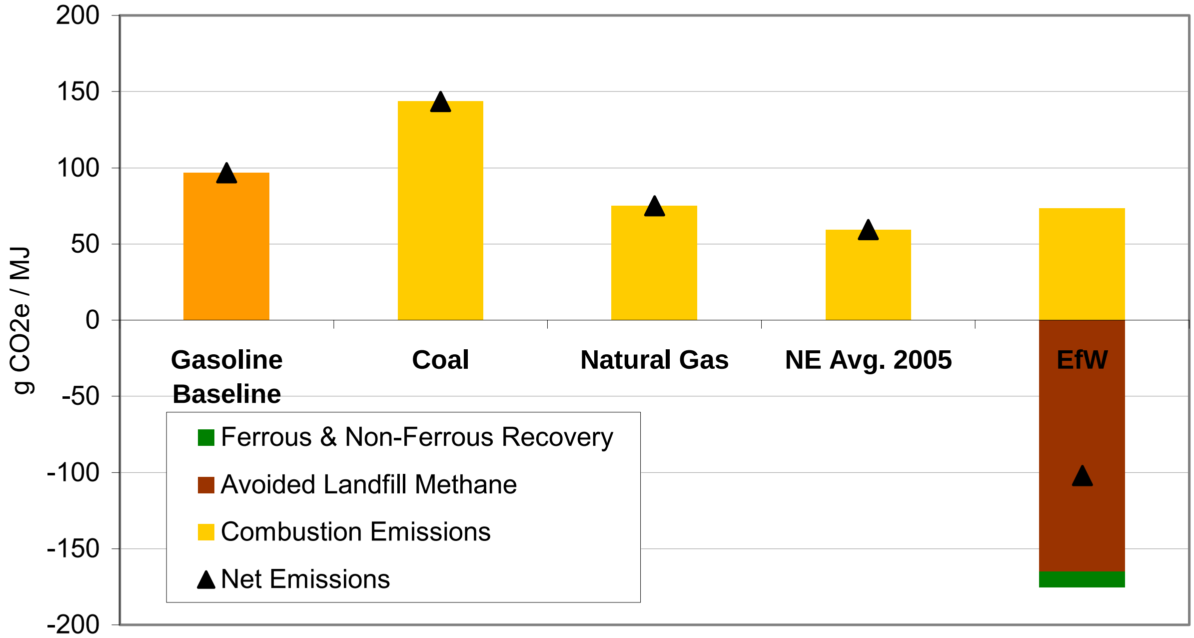
---

[17] Intergovernmental Panel on Climate Change. 2006 IPCC Guidelines for National Greenhouse Gas Inventory, Eggleston, S., Buendia, L., Miwa, K., Ngara, T., & Tanabe, K. (Eds), IGES, Hayama, Japan. http://www.ipcc-nggip.iges.or.jp/public/2006gl/ (September 4, 2009).

[18] Letter from Laurie Burt, Commissioner MA DEP to US EPA dated June 10, 2009, Re: Docket ID No. EPA-HQ-OAR-2008-0508 ("Mandatory Reporting of Greenhouse Gases," Vol. 74, No. 68 *Federal Register* 16448, April 10, 2009

methane emissions, only electricity from EfW results in a net reduction in GHG emissions, even when GHG emissions from the fossil components of MSW are included.

Figure 3. Life Cycle Carbon Intensity of EfW Electricity as a Transportation Fuel



LCA of MSW in Waste-to-Diesel Process

Covanta has begun construction of an innovative waste-to-diesel demonstration project at one of our existing facilities. Once operational, the process will produce renewable diesel fuel from a variety of different waste feedstocks, including, but not limited to, MSW.

Covanta's waste-to-diesel process is a catalytic depolymerization process that can be applied to a variety of feedstocks, including post-recycled MSW, plastic wastes, biomass, hydrocarbon sludges, and tires. Prior to reaction, feedstocks are processed for size to less than 2 inches and metals and glass are separated. The catalytic depolymerization process is simpler than many competing processes, relying on a patented "friction turbine" which provides necessary heat in the process while creating turbulent mixing needed for the catalytic reactions. By-products are predominately CO_2 and H_2O with a small amount of volatile organic compounds (VOCs). Exhaust gases from the demonstration project are routed to the existing energy from waste (EfW) boilers and air pollution control to ensure destruction of any VOC emissions from the process.

A life cycle analysis (LCA) performed reveals that, for a wide range of biogenic fractions of MSW, the process generates a fuel with significantly lower GHG emissions than the diesel baseline (Figure 4).

Figure 4. Life Cycle Carbon Intensity of Waste to Diesel Process