REPORT TO THE RESOURCES RECOVERY TASK FORCE FROM THE SUBCOMMITTEE ON RENEWABLE ENERGY CERTIFICATES (RECS)

December 12, 2013

The REC subcommittee was charged with reviewing what changes need to be made to the REC market to stabilize the business model for WTE and what impacts would changes to the REC market have on Renewable market in general.

Background

Financial Challenges

The PURPA based PPAs for the six WTE facilities in Connecticut are expired or will be expiring soon. This, combined with current and projected low energy prices resulting primarily from natural gas, has placed financial burdens on the state's WTE infrastructure.

WTE is in Class 2 in Connecticut's RPS. Currently, the Class 2 RECs have little value, as they are currently trading around 55 cents per REC. This is in contrast to Class 1 RECs which are trading around $55 per REC. Many of the Class 2 RECs remain unsold because of the low value.

Table 1: Approximate Class 2 REC Revenues For In-State WTE Facilities

Facility	Net MWH	Current Class 2 Revenue ($0.55)*
Bridgeport	478,410	$ 263,125.50
SECONN	131,500	$ 72,325.00
Bristol	106,622	$ 58,642.10
Mid-CT	417,000	$ 229,350.00
Wallingford	57,979	$ 31,888.45
Lisbon	111,542	$ 61,348.10
TOTAL	1,276,479	$ 716,679.15
*Assumes RECs are sold		

The value of the RECs is driven down because the supply of Class II RECs far exceeds the demand. Additionally, over 50% of Class 2 RECs are earned from out-of state locations.

Solid Waste Policy

State solid waste policy indicates a clear preference of WTE over landfilling. This policy has made Connecticut a national and international leader in sustainable solid waste management.

However, in direct contradiction to this policy, landfill gas systems are in Class 1 in the state's RPS. It is not that methane should not be collected from landfills, the problem is that the state's RPS is subsidizing landfilling while doing nothing to stabilize WTE, which completely eliminates any methane emissions.

Further, WTE facilities in Connecticut pay a $1.50 per ton fee to the state, which originally was used to reimburse WTE facilities for state mandated environmental testing. Recently, the law was changed and the facilities are no longer reimbursed, and are now picking up the entire costs of these test. The state raises approximately $3 million per year from these fees. Landfills do not pay the $1.50 fee.

Table 2: Comparison of WTE and Landfills in Connecticut

	REC Value	Solid Waste Fee
WTE	$0.55	$1.50 per ton
Landfills	$55.00	0

Future Outlook

The state needs to ensure its energy and solid waste policies are consistent. The subcommittee's recommendation will ensure that the state makes a positive step in that direction. As the state works toward its long term solid waste goals, a necessary additional component of the subcommittee's recommendation is the acknowledgement that as DEEP begins development of the next SWMP, it needs to identify the future solid waste management needs of the state. This should include an overall review of the solid waste management system to ensure the state remains a national leader and that the state does not slip back and begin long haul landfilling. The state should continue to incorporate the solid waste hierarchy elements including goals for WTE capacity over a multi-decade period, as well as other detailed diversion targets and implementation strategies. Just as important and parallel with this effort, the state needs to continue to more closely align its solid waste and energy policies by assessing what the state sees as an acceptable mix of in state vs. out of state and baseload vs. intermittent renewable energy production. Consistent with this exercise, the state should incorporate the true value of the benefits achieved by each technology by applying the social cost of carbon to the net lifecycle greenhouse gas mitigation achieved by each technology in the context of both its solid waste and energy policies, as this is another area where the two policies intersect.

This will help the DEEP and other stakeholders consider what is needed for solid waste capacity and renewable energy over the next 10, 20 and even 30 years, and ensuring that its energy and solid waste policies are working in harmony.

Reports

The Subcommittee believes it is important to note several reports which address issues relating to WTE and the Class II market in Connecticut.

DEEP's *Restructuring Connecticut's Renewable Portfolio Standard* report, dated April 26, 2013, discusses the financial challenges facing in state WTE facilities because of the expiring PPAs. It also mentions a restructuring of the Class II RECs as a possible solution.

In the *Report of the Modernizing Recycling Working Group*, dated December 27, 2012, one of the recommendations of the report is to "assure the sustainability of the state's waste to energy infrastructure to manage non-recyclable wastes". The report also mentions several ways to address the financial challenges, including bi-lateral contracts and a change in the Class II structure.

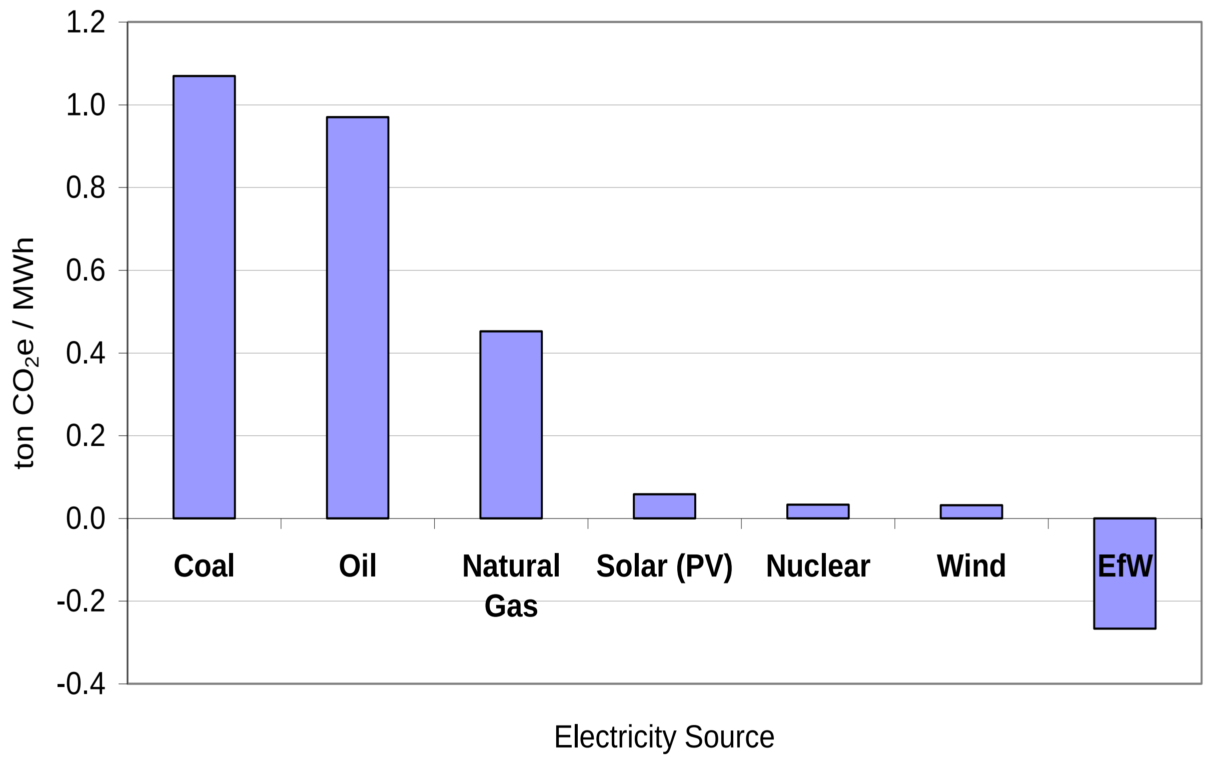
Finally, a report titled *Statewide Economic Impacts of Connecticut's waste To Energy Sector*, dated February 2013 and authored by Dr. Eileen Berenyi, estimated that the total statewide economic impact of the waste to energy sector in the state amounts to over $428 million. The direct labor earnings are approximately $33 million, with another $27 million in indirect wages.

<u>Waste-to-Energy A Climate Mitigation Technology</u>

Waste-to-Energy has long been recognized internationally as a GHG mitigation technology by the Intergovernmental Panel on Climate Change (IPCC), the World Economic Forum and European Union and been able to sell carbon offsets through the Clean Development Mechanism (CDM) of the Kyoto Protocol. In the United States, the recent expansions of the Lee County Resource Recovery Facility and Hillsborough County Resource Recovery Facility in Florida are both generating carbon offset credits under the Voluntary Carbon Standard. In the European Union, the waste sector through reducing waste to landfills and increasing the use of waste- to-energy has achieved the highest relative reductions of greenhouse gases of any sector in the economy at 34%. Attachment A includes a description of various reports which highlight the GHG mitigation benefits of WTE. It's important that Connecticut continue to reap the benefits that WTE can provide by reducing methane from landfills, offsetting baseload coal with baseload renewable energy and being able to recycle metals that would otherwise to lost forever in a landfill.

WTE offers tremendous GHG mitigation benefits. It is the only source of electricity that actually reduces GHG emissions. As mentioned, WTE has been acknowledged by scientist worldwide as a key GHG mitigation technology. For every ton of waste processed in an WTE facility, on a national average, a ton of greenhouse gas is mitigated, primarily because WTE prevents the generation of methane that would otherwise have been generated when that trash is instead landfilled. Landfills (again, in Class 1) are one of the largest sources of manmade methane emissions.

Table 3: Comparison of GHG Emissions



Sources: WARM v10, U.S. EPA (2006), Hondo, Hiroki, 2005, Life cycle GHG emission analysis of power generation systems: Japanese case

Increased Focus on Methane

The President's Climate Action Plan states, "Curbing emissions of methane is critical to our overall effort to address global climate change." In the United States, landfills are the third largest source on methane emissions. The recently released IPPC report updated the 100 year global warming potential of methane to 34 times as potent as CO2 when climate-carbon feedbacks are included and 84 times more potent over 20 years. This is a 36% increase over the last report, and a 62% increase over the methane GPW value of 21 that is still widely used. Overall, the climate impact of methane is much larger than previously reported. The latest data on methane's contribution is over 75% higher than previously reported. **Methane now represents over 40% of the total net drivers of climate change.** With the increased focus of the potency of methane, Connecticut needs to stabilize its waste-to-energy infrastructure to avoid resorting to landfills and the corresponding methane that would be released.

<u>Estimated Value of WTE Electricity in Connecticut Based on U.S. Social Cost of Carbon</u>

Background on the Social Cost of Carbon

Earlier this year, the Interagency Working Group on Social Cost of Carbon, comprised of 13 agencies including the U.S. EPA, Department of Energy, and Department of Commerce, updated the social cost of carbon (SCC) used to estimate, in economic terms, the climate benefits of federal rulemakings.[i] For example, since 2010, the SCC has been used in nine EPA rulemakings. According to the U.S. EPA:

"The SCC is an estimate of the economic damages associated with a small increase in carbon dioxide (CO_2) emissions, conventionally one metric ton, in a given year. This dollar figure also represents the value of damages avoided for a small emission reduction (i.e. the benefit of a CO_2 reduction)."[ii]

Greenhouse Gas Benefits of Energy-from-Waste

WTE is widely recognized as a tool to reduce GHG emissions from waste management, including by the U.S. EPA[iii], U.S. EPA scientists,[iv] the Intergovernmental Panel on Climate Change ("IPCC"),[v] the World Economic Forum,[vi] the European Union,[vii,viii] CalRecycle, and both mandatory and voluntary carbon offset markets.[ix]

The U.S. EPA has found that WTE facilities avoid, on average, one ton of GHG emissions as carbon dioxide equivalents for every ton of waste processed when evaluated on a lifecycle basis.[x] Accounting for the lower carbon intensity of the New England power grid and that Connecticut's MSW would be more likely to wind up in a landfill equipped with a flare or energy recovery than the national average if it were not processed in an WTE facility, each ton of MSW processed at a Connecticut WTE facility is estimated to save 0.6 tons of greenhouse gases as carbon dioxide equivalents (CO_2e).

Applying the SCC to WTE

As described above, the SCC can be used to determine the economic value associated an emission reduction, such as that achieved annually by Connecticut's WTE facilities. Average 2013 SCC values are presented for three discount rates, 2.5%, 3%, and 5%, reflective of a range of values used to determine the present value associated with the future cost of climate change. In recognition of criticisms that an average SCC may not properly reflect future climate impacts, an additional set of SCC values were presented representing the 95^{th} percentile value assuming a 3% discount rate (Table 4).

Using the average SCC values presented at the 2.5% and 3% discount rates as a range, electricity generated by WTE facilities in 2015 provides an economic benefit of $45 – 69 / MWh in 2011 dollars (Table 5), reflecting the value of damages avoided associated with climate change.

Table 4. Social Cost of Carbon

	Discount Rate and SCC Statistic			
	5%	3%	2.5%	3%
Year	Average	Average	Average	95th percentile
2015	$12	$40	$62	$117
2020	$13	$46	$69	$137
2025	$15	$51	$75	$154
2030	$17	$56	$81	$170
2035	$20	$61	$87	$187
2040	$23	$66	$93	$205

Table 5. Value of EfW Power

Avg. Benefit of EfW Power GHG Reductions* ($ / MWh)	
3% D.R.	2.5% D.R.
$45	$69
$51	$77
$57	$84
$63	$90
$68	$97
$74	$104

* Assumes 550 kWh (net) / ton MSW

Recommendation

Thanks to its six WTE facilities, Connecticut is in a unique position in that there are no active MSW landfills in the state, meaning that Connecticut is avoiding the release of a significant amount of methane into the atmosphere. As these facilities face economic challenges due to current and projected low energy prices, it is critical that a solution is developed that will ensure that these facilities remain in operation. It is also important to recognize that one of the main purposes of the state's RPS is to incentivize new development and ensure the viability of existing renewable energy facilities so that their environmental benefits can be realized. RPS structures are used throughout the county to assist the private sector in developing renewable energy sources and assist existing owners in continuing to operate.

A comprehensive solution should 1) recognize the GHG mitigation benefits of WTE, and 2) establish a value for that mitigation and 3) fairly compensate the WTE facilities for this mitigation.

1. Recognition of GHG Mitigation Benefits

The GHG mitigation benefits of WTE have been discussed previously in this report, and do not need to be repeated in full here. The benefits are real and significant, as based on national averages WTE mitigates 1 ton of GHG emissions for every ton of MSW sent to a WTE as opposed to a landfill.

2. Establish A value for GHG Mitigation

Using the EPA's SCC to monetize this benefit gives a range of $45 - $69 per MWh. This would put the compensation close to or above a Class I REC (approximately $55). The subcommittee did not want to propose a solution that was equal to or exceeded the Class I REC value but still created enough compensation to keep the facilities viable. Using a percentage of the value of Class I would maintain a separation between the Class I REC value and the value attributed to in state GHG mitigation, but still compensate the plants for their methane mitigation enough to maintain the viability of the plants.

3. Fair Compensation

The subcommittee's recommended solution would be to modify Class II to specify that a Class II eligible renewable energy generator that meets certain conditions will receive a REC valued at 50% of the market price for Class I REC. To be eligible for the enhanced REC pricing, the Class II renewable energy generator must prevent the generation of methane from Connecticut generated trash and reduce GHG emissions.

Table 6: Recommended Solution

Facility	Net MWH	Approximate Revenue Loss from Expired PPAs	Class II GHG REC*
Bridgeport	478,410	$ 18,000,000.00	$ 13,156,275.00
Mid-CT	417,000	$ 16,000,000.00	$ 11,467,500.00
Wallingford	57,979	$ 2,300,000.00	$ 1,594,422.50
TOTAL	953,389	$ 36,300,000.00	$ 26,218,197.50
*Assumes Class 1 REC at approximately $55			

This solution would help stabilize the in state WTE facilities so that the state can ensure that out of state landfills do not become the only options available to municipalities in the state.

Attachment A

Is It Better To Burn or Bury Waste for Clean Electricity Generation?—P. Ozge Kaplan, Joseph DeCarolis, and Susan Thorneloe— ***Environ. Sci. Technol.*****, Article: 10 February 2009**
http://pubs.acs.org/doi/pdf/10.1021/es802395e
Page 7 States:
"Discarded MSW is a viable energy source for electricity generation in a carbon constrained world. One notable difference between LFGTE and WTE is that the latter is capable of producing an order of magnitude more electricity from the same mass of waste. In addition, as demonstrated in this paper, there are significant differences in emissions on a mass per unit energy basis from LFGTE and WTE. On the basis of the assumptions in this paper, WTE appears to be a better option than LFGTE. If the goal is greenhouse gas reduction, then WTE should be considered as an option under U.S. renewable energy policies. In addition, all LFTGE scenarios tested had on the average higher NO_x, SO_x, and PM emissions than WTE."

EEA Briefing—European Environment Agency—"Better management of municipal waste will reduce greenhouse gas emissions"— Jan 31, 2008
http://www.eea.europa.eu/publications/briefing_2008_1
Page 1 States:

- "Increased recovery of waste, and diverting waste away from landfill play a key role in tackling the environmental impacts of increasing waste volumes.
- As recycling and incineration with energy recovery are increasingly used, net greenhouse gas emissions from municipal waste management are expected to drop considerably by 2020."

Global Roundtable on Climate Change – February 20, 20017
http://grocc.ei.columbia.edu/sitefiles/file/GROCC_statement_2-27_1%20(3).pdf
Page 9 States:
"Efforts to reduce global emissions of methane from landfills should be expanded, including increased use of waste-to-energy facilities where appropriate and cost-effective."

Kyoto Protocol To The United Nations Framework Convention On Climate Change - 1998
http://unfccc.int/resource/docs/convkp/kpeng.pdf
Page 2 States:
"Implement and/or further elaborate policies and measures in accordance with its national circumstances, such as:…Limitation and/or reduction of methane emissions through recovery and use in waste management, as well as in the production, transport and distribution of energy;"

[i] Interagency Working Group on Social Cost of Carbon, United States Government, 2013, *Technical Support Document: -Technical Update of the Social Cost of Carbon for Regulatory Impact Analysis – Under Executive Order 12866* http://www.whitehouse.gov/sites/default/files/omb/inforeg/social_cost_of_carbon_for_ria_2013_update.pdf

[ii] USEPA, 2013, *Fact Sheet: Social Cost of Carbon*, http://www.epa.gov/climatechange/Downloads/EPAactivities/scc-fact-sheet.pdf

[iii] USEPA, Air Emissions from MSW Combustion Facilities webpage, accessed October, 2013 http://www.epa.gov/epawaste/nonhaz/municipal/EfW/airem.htm#6

[iv] 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. Available at: http://pubs.acs.org/doi/abs/10.1021/es802395e

[v] EfW identified as a “key mitigation measure” in IPCC, “Climate Change 2007: Synthesis Report. Contribution of Work Groups I, II, and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change” [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp. Available at: http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_synthesis_report.htm

[vi] EfW identified as a key technology for a future low carbon energy system in World Economic Forum. *Green Investing: Towards a Clean Energy Infrastructure.* January 2009. Available at: http://www.weforum.org/pdf/climate/Green.pdf

[vii] EU policies promoting EfW as part of an integrated waste management strategy have been an overwhelming success, reducing GHG emissions over 72 million metric tonnes per year, see European Environment Agency, *Greenhouse gas emission trends and projections in Europe 2009: Tracking progress towards Kyoto targets* *http://www.eea.europa.eu/publications/eea_report_2009_9*

[viii] European Environmental Agency (2008) Better management of municipal waste will reduce greenhouse gas emissions. Available at: http://www.eea.europa.eu/publications/briefing_2008_1/EN_Briefing_01-2008.pdf

[ix] Clean Development Mechanism Executive Board: “Approved baseline and monitoring methodology AM0025: Avoided emissions from organic waste through alternative waste treatment processes.” Available at: http://www.cdm.unfcc.int/methodologies/DB/3STKBX3UY84WXOQWIO9W7J1B40FMD

[x] U.S. EPA, Air Emissions from MSW Combustion Facilities webpage, accessed November 1, 2012. http://www.epa.gov/epawaste/nonhaz/municipal/EfW/airem.htm#6