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Testimony of Professor Marco J. Castaldi, Ph.D.[1]
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SUPPORT WITH AMENDMENTS – Senate Bill 516 – Clean Energy Jobs
OPPOSE – Senate Bill 548 – Renewable Energy Portfolio Standard - Eligible Sources

I am writing to provide testimony and support to allow Waste-to-Energy to remain eligible as a Tier 1 renewable source in Maryland. Specifically this is in response to Senate Bill 516 and Senate Bill 548.

Maryland is producing energy from Waste-to-Energy (WTE) with lower carbon emissions compared to coal fired power plants. The WTE facilities in Maryland State have also decreased their CO_2 intensity by 45% from 2009 to 2014. In fact, nation-wide use of the WTE technology can become one of the big contributors to America's carbon dioxide reductions, accounting for as much as 325 million tons of CO_2 or 6.3% of the total U.S. emissions in 2016. Importantly, the EPA concluded WTE produces electricity with less environmental impact than almost any other source (Horinko and Holmstead, 2003). Furthermore EPA and a 2013 report by the Department of Energy's National Renewable Energy Laboratory (NREL) conclude that WTE is the best for GHG emissions reductions compared to other power generating systems including landfill gas to energy (Funk et al. 2013). Even the California Air Resources Board (CARB) concluded that the MSW disposed of in the three California WTE facilities results in net negative GHG emissions, ranging between -0.16 and -0.45 MT CO_{2e} per ton of waste disposed. Figure 1 provides the individual savings for each WTE facility that was operating in California in 2014.

WTE facilities have been demonstrated to reduce CO_2 emissions. It has been proven through scientific carbon-14 methods (ASTM D6866 protocol) that typical MSW WTE stack emissions, that routinely meet the Maximum Achievable Control Technology (MACT) standards, contains up to 65% biogenic CO_2, i.e. renewable bio-carbon. This scientifically proves that nearly 2/3 of the CO_2 emissions from a WTE facility are from renewable sources. If the GHG savings from recycling 50 pounds of metal from every ton of MSW processed in a WTE facility are included it is evident that every ton of MSW processed in a WTE facility avoids a ton of CO_2 equivalent emissions(Brunner and Rechberger, 2004, 2015). When compared to the energy recovered using methane from landfills, it must be recognized that ½ of the carbon from the biomass fraction is released as CO_2 without any energy recovery. This same consideration must be given to fuel cells as well. Finally regarding sustainable waste management, a consensus was reached on a number of items but one stands

[1] I am a Professor of Chemical Engineering and the Director of the Earth System Science & Environmental Programs at The City College of City University of New York. I have been appointed as a Fulbright Global Fellow for two years for the research involved in transforming waste materials, such as municipal solid waste to energy and am a Fellow of the American Institute for Chemical Engineers. I have also been appointed by The National Academy of Engineering Frontiers of Engineering Education for the 2012-2013 academic year based on the work related to waste to energy. I have authored two books related to waste conversion technologies and over 90 peer reviewed journal articles related to waste prevention and reduction, waste to energy and utilization of waste materials for energy or materials production. It is through these experiences that I offer my comments respectfully.

out. It was “*On an overall LCA basis, WTE is environmentally preferable to landfilling*.” Europe has long recognized the greenhouse gas mitigation achieved by WTE as well as many other respected organizations such as the IPCC, the Clean Development Mechanism under Kyoto Protocol and U.S. EPA. This is because WTE facilities have been demonstrated to reduce CO_2 emissions.

Table 5: ARB Staff Preliminary Estimates of Net GHG Emissions from California MSW Thermal Facilities*

(MTCO2e/Short Ton Waste)

Facility	Waste (TPD)	Non-biogenic MT CO2E Emissions	Energy Credit MT CO2E[1]	Metal Recycled (Tons)	Metal Recycling Credit MT CO2E[2]	Avoided Landfill Methane Emissions MTCO2e[3]	Net MT CO2E per Ton Waste
Covanta Stanislaus	800	79,590	-49,740	5,690	-10,240	-70,080 to -154,760	-0.17 to -0.46
Commerce Refuse to Energy	360	53,760	-26,000	920	-1,660	-31,540 to -69,640	-0.04 to -0.33
Long Beach SERRF	1380	115,790	-81,390	6,500	-11,700	-120,890 to -266,960	-0.19 to -0.48
Total	2,540	249,150	-153,740	13,110	-23,600	-222,500 to -491,360	-0.16 to -0.45

1 Uses 2009-2010 average CA grid emission factor of 668 lb. CO2e per MWh, and assumes facilities produce 85% of rated power capacity per Table 1.
2 Uses a metal recycling credit of 1.8 MT CO2e per short ton of ferrous metal.
3 Estimated avoided landfill methane emission 0.24 to 0.53 MTCO2e/MT

Figure 1. *CARB's analysis showing specific WTE facilities' ability to reduce GHG emissions*((CARB), 2013)

Importantly a recent UNEP report “District Energy in Cities: Unlocking the Potential of Energy Efficiency and Renewable Energy” states that Paris currently meets 50% of its heating needs using three WTE plants that results in avoidance of 800,000 tons of CO_2 emissions each year. These savings arise from electricity produced from the WTEs that offset electricity production from facilities that rely on fossil fuels.

WTE facilities also recover metals that are recycled. WTE plants recover nearly 700,000 tons of ferrous metal for recycling. That avoids CO_2 emissions and saves energy compared to the mining of virgin materials for manufacturing new metals. One under-appreciated aspect of the residual ash produced by WTE is the large amount of concentrated metals that can be recovered and put back into the material cycle. These metals range from common iron, aluminum and copper yet are in large amounts. For example in one MSW combustion facility there is approximately 6300 tons of aluminum, 3400 tons of iron and 440 tons of copper. Multiply this by the 76 plants currently operating in the US and it is obvious there is a significant driver to incorporate this into the recycling industry. Furthermore, the ash contains a significant amount of rare and critical materials such as silver (0.98 tons/year), rubidium (1.5 tons/yr), yttrium (1.4 tons/yr), neodymium (1.3 tons/yr), and gallium (0.40 tons/yr).

Therefore, it is clear that WTE makes a positive contribution toward GHG reduction (gaseous emissions and associated material recovery) and should be encouraged. It is shameful that the US has lagged so far behind Europe, and now China, in deploying WTE facilities to manage its waste. It is obvious that WTE should maintain its Tier 1 status for renewable energy and should be placed above other GHG friendly power generating technologies because it also manages the vast amounts of waste that citizens of the U.S. create every day.

Respectfully Submitted,

/mjc

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