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Testimony of Professor Marco J. Castaldi, Ph.D.
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I am writing to provide testimony to allow Waste-to-Energy to remain eligible as a Tier 1 renewable source in Maryland. Specifically this is in opposition to House Bill 332: Renewable Energy Portfolio Standard - Eligible Sources.

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. 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 am also a Fellow of the American Institute of Chemical Engineers (AIChE) and American Society of Mechanical Engineers (ASME). I have authored two books related to waste conversion technologies and over 100 peer reviewed journal articles related to waste prevention and reduction, waste to energy and utilization of waste materials for energy or materials production.

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, contain between 40-65% biogenic CO_2, i.e. renewable bio-carbon. This scientifically proves that nearly ½ 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).

A large body of literature employs life cycle assessments (LCA) to calculate the potential GHG savings when using WTE versus other MSW management options. This is also widely recognized by the scientific and engineering communities as well as numerous state legislatures and non-profit organizations. Some examples include the Intergovernmental Panel on Climate Change ("IPCC"), the World Economic Forum (Liebreich *et al.*, 2009), and the Center for American Progress as well as the various states, including Pennsylvania(Pennsylvania Environmental Protection Department, 2019), New York(Solid Waste Advisory Group, 2010), Maine(Maine Department of Environmental Protection; Joint Standing Committee on Natural Resources of the Maine Legislature, 2004) and Florida (Florida Climate Action Team, 2008). Using WTE in conjunction with source separation recycling/composting systems can achieve virtually zero waste-to-landfills. WTE plants currently recover nearly 700,000 tons of ferrous metal for recycling annually, which avoids CO_2 emissions and saves energy compared to the mining of virgin materials for manufacturing new metals.

The state of Maryland is producing energy from 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.

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*(California Air Resources Board, 2013)

Finally 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 by three WTE plant that results in avoidance of 800,000 tons of CO_2 emissions each year. These savings arise from electricity produced from the WTE that offset electricity production from facilities that rely on fossil fuels.

Therefore it is clear that WTE makes a positive contribution toward GHG reduction 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. Since WTE also sustainably manages MSW that is produced by citizens every day at the rate of nearly 4 pounds per person per day, it must remain as a Tier 1 renewable source and should be preferred compared to other GHG friendly energy technologies.

Respectfully,

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