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Introductory Memorandum
Biogas Use, Reduction, and Repurposing Model Law for Wastewater Treatment Facilities

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I. Summary of the Model Law

The Biogas Use, Reduction, and Repurposing Model Law for Wastewater Treatment Facilities requires wastewater treatment facilities (WWTF) with a wastewater flow rate of 5 million gallons per day (MGD) or more to cut almost all methane emissions and harness biogas as a renewable energy source. These regulated facilities are identified herein as Large WWTFs.

The model law applies only to Large WWTFs, which are those having a wastewater flow rate of 5MGD. Under the model law, a Large WWTF must capture, to the maximum extent practicable as determined by the Permitting Authority, biogas generated from the anaerobic digestion portion of its water treatment process to prevent methane (a component of the biogas) from being vented (released) or flared (burned). A combined heat and power (CHP) system must then be used to convert the captured biogas into electricity, which, in turn, would be used to power the facility. The requirements are phased in across five years from the date of the law's enactment for Large WWTFs already in operation and apply on the date of exactment for Large WWTFs that have not yet begun construction.

Any surplus biogas or electricity generated that is not used to power the Large WWTF must be routed to systems that process it for other consistent uses, such as selling to third parties (industrial users, electric power producers, or as vehicle fuel).

A state tax credit is proposed for WWTFs that apply the technology, as federal tax credits for methane capture under the Inflation Reduction Act (IRA) do not apply to WWTFs.

Further, owners or operators must conduct routine inspections (audio, visual, and olfactory) as required by the Permitting Authority to ensure that equipment functions properly without leaks or waste.

Releases of methane that violate the law are considered violations of the state's clean air regulations. Exceptions are made in cases of emergencies or maintenance of the gas control system.

II. The Need to Minimize Methane Emissions and Utilize Biogas in the Wastewater Treatment Sector

Addressing methane emissions from WWTFs is crucial due to methane's high climate impact and the largely untapped opportunity to repurpose biogas as a renewable energy source. In the United States, municipal WWTFs use microorganisms to break down "sewage sludge" into biosolids during the anaerobic digestion process, producing a byproduct called biogas.[1] This biogas typically contains 50-70% methane (CH_4) and 30-50% carbon dioxide (CO_2).[2] At present, many WWTFs vent or flare biogas, releasing methane and carbon dioxide into the atmosphere and wasting a renewable resource.[3] A 2023 study extrapolated that methane emissions from municipal WWTFs may be 1.9 times higher than reported by the U.S. Environmental Protection Agency or Intergovernmental Panel on Climate Change.[4] It is estimated that U.S. WWTFs emit 18.4 million metric tons of carbon dioxide equivalents ($MMTCO_2e$),[5] and the proportion of methane emissions from WWTFs has increased over the past 20 years.[6]

To address these emissions, WWTFs can shift away from venting or flaring biogas and instead install or upgrade combined heat and power (CHP) systems[7] to efficiently convert the biogas into renewable electricity, fuel, and thermal energy.[8] The electricity produced can, in turn, be used to meet the WWTF's energy needs, often at a cost lower than the retail rate.[9] Additionally, the recovered heat can be used to heat the anaerobic digesters, provide hot water, or meet other heating demands within the facility. This integrated approach not only benefits the environment but also results in cost savings and increased resilience for WWTFs by reducing reliance on external electricity and heat sources.[10]

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[1] Mohammed Khaleel Jameel et al., *Biogas: Production, Properties, Applications, Economic and Challenges: A Review*, 7 Results in Chemistry 101549 (2024), https://doi.org/10.1016/j.rechem.2024.101549 (https://www.sciencedirect.com/science/article/pii/S2211715624002455)

[2] *Id.*

[3] Maile Lono-Batura et al., *Biogas Production and Potential from U.S. Wastewater Treatment*, 53 Biocycle (Dec. 2012) https://www.biocycle.net/biogas-production-and-potential-from-u-s-wastewater-treatment/#:~:text=Nearly%20two%2Dthirds%20of%20the,of%20these%20operate%20anaerobic%20digesters

[4] Culhong Song, et al., *Methane Emissions from Municipal Wastewater Collection and Treatment Systems*, 57 Envtl. Sci & Tech (Feb. 3, 2023), https://pubs.acs.org/doi/10.1021/acs.est.2c04388

[5] *See* Jonathan Ramseur, *Inflation Reduction Act Methane Emissions Charge: In Brief*, CRS R47206, p. 3 (Aug. 29, 2022) (using 2019 data) https://crsreports.congress.gov/product/pdf/R/R47206

[6] Daniel P. Moore et al., *Underestimation of Sector-Wide Methane Emissions from United States Wastewater Treatment*, 57 Envtl. Sci. & Tech (Feb. 27, 2023), https://pubs.acs.org/doi/10.1021/acs.est.2c05373

[7] EPA describes the systems as follows: CHP is the simultaneous production of electricity and heat from a single fuel source, such as natural gas, biomass, biogas, coal, or oil. CHP is an energy system that can be modified depending on the needs of the energy end user. Several individual components are configured into an integrated CHP system, including the prime mover, generator, heat recovery equipment, and electrical interconnection. The prime mover which drives the overall system typically identifies the CHP system. Prime movers can include reciprocating engines, combustion turbines, steam turbines, microturbines, and fuel cells. U.S. EPA, *Opportunities for Combined Heat and Power at Wastewater Treatment Facilities: Market Analysis and Lessons from the Field*, https://www.epa.gov/sites/default/files/2016-07/documents/opportunities_for_combined_heat_and_power_at_wastewater_treatment_facilities_market_analysis_and_lessons_from_the_field.pdf

[8] *Id.*

[9] According to EPA, the cost to generate electricity using a CHP system ranges from 1.1 to 8.3 cents per kWh, depending on the prime mover and other factors. The cost generally is less than current retail electric rates of 3.9 to over 21 cents per kWh. *Id.*

[10] *Id.*

Despite the known benefits of anaerobic digestion and CHP systems, nearly two-thirds of the United States' 3,200 WWTFs treating more than 1 MGD do not employ anaerobic digestion.[11] Of those that do, one-third have yet to beneficially use the biogas for energy or fuel production, and over 870 facilities flare at least some of their biogas.[12] Flaring biogas converts methane into carbon dioxide, a greenhouse gas.[13] Moreover, studies estimate that incomplete flaring and equipment leaks could be significant sources of methane emissions at WWTFs.[14]

Currently, WWTF methane emissions are not the primary focus of federal or state legislation aimed at reducing greenhouse gases, although states with climate legislation might address these releases. The United States' legislative efforts to reduce methane, which include the IRA, primarily target methane emissions in the oil and natural gas sector.[15] The IRA also offers tax credits for installing renewable energy systems and producing biogas. However, those credits are limited to farms and landfills.[16]

This model law seeks to close a legislative gap in the capture and management of methane emissions from wastewater treatment facilities. It aims to minimize methane emissions from these facilities (meaning reducing to the smallest possible amount), mandate the use of biogas as a renewable energy or fuel source, and lower reliance on externally sourced electricity, particularly electricity generated from non-renewable sources.

III. The Benefits of Methane Capture at Large Wastewater Treatment Facilities

If all WWTFs with a wastewater flow rate of 5 MGD with existing anaerobic digestion systems installed CHP systems for energy recovery and regularly monitored these systems to check for leaks and efficiency, the United States could reduce greenhouse gas emissions by 2.3 million metric tons (CO_2e) annually – the equivalent to the annual emissions from 430,000 passenger

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[11] Maile Lono-Batura et al., *Biogas Production and Potential from U.S. Wastewater Treatment*, 53 Biocycle (Dec. 2012) https://www.biocycle.net/biogas-production-and-potential-from-u-s-wastewater-treatment/#:~:text=Nearly%20two%2Dthirds%20of%20the,of%20these%20operate%20anaerobic%20digesters

[12] *Id.*

[13] *Biogas Energy* (n.d.), bloomenergy.com. https://www.bloomenergy.com/biogas-energy/#:~:text=Addressing%20methane%20emissions%20from%20waste,still%20contributes%20to%20CO2%20emissions

[14] Colton Poore, *Wastewater Sector Emits Nearly Twice as Much Methane as Previously Thought*, Princeton Engineering (Feb. 2023) https://engineering.princeton.edu/news/2023/02/28/wastewater-sector-emits-nearly-twice-much-methane-previously-thought#:~:text=But%20when%20anaerobic%20digesters%20operate,cause%20many%20of%20the%20problems.%E2%80%9D

[15] For example, the IRA funded $1.55 billion toward the Methane Emissions Reduction Program administered by the EPA, focusing on methane as a byproduct of oil and gas production. Similarly, state law incentives do not include WWTFs. No state tax incentives for methane capture at WWTFs were found in a review of a database maintained by N.C. State University. *See* https://programs.dsireusa.org/system/program.

[16] *See* https://programs.dsireusa.org/system/program. The database shows some states' tax incentives apply to anaerobic digesters used on farms, which use waste to produce electricity (*see, e.g.* Mich, Minn.). Iowa and Kansas each offer a tax incentive for collecting methane and other gases from decomposing wastes, but the incentives are limited to production from landfills. Notably, funding for methane emission reduction was rescinded under Pub. L. 119-21, *see, e.g.* §§ 60012, 60013.

vehicles.[17] Moreover, using the heat and electricity produced by the CHP systems to sustain the facility would result in cost savings for the facility, which are often publicly owned treatment works that are owned or operated by a municipal government.[18]

Many municipalities in the United States have successfully implemented CHP technology and are reaping the environmental and economic benefits.[19] For example, Tri-City Water Resource Recovery Facility in Clackamas County, Oregon, which processes over 11 MGD for more than 190,000 people, upgraded its facility by adding a new anaerobic digester to improve capacity and efficiency, and replacing an aging CHP engine with a 600-kW lean-burn engine. These upgrades, completed in July 2021, were expected to generate around 4,300 megawatt-hours of electricity annually, offsetting nearly half of the facility's energy needs and saving an estimated $619,000 on power and $191,000 on heating annually.

Smaller facilities have also seen benefits.[20] Delhi Charter Township, south of Lansing, Michigan, upgraded its WWTF, originally built in 1962, to increase capacity for its 25,000 residents. The upgraded facility, which treats up to 4 MGD, includes new digesters and a CHP system that significantly reduced the facility's natural gas and electricity demands, saving approximately $60,000 annually by reducing the facility's purchased electricity by over 40%.

By installing more efficient biogas conversion systems, WWTFs can also expand their capacity to accept and process additional organic waste from local sources - such as fats, oils, and grease from restaurants, or agricultural waste from nearby farms. [21] This not only increases renewable energy generation but also helps divert methane-producing materials from landfills and unmanaged decomposition.

IV. Economic Feasibility of Methane Capture at Wastewater Treatment Facilities

The proposed legislation aims to make methane capture at WWTFs economically viable by applying only to those WWTFs with a wastewater flow rate of at least 5 MGD. Wastewater flow rates of 5 MGD or higher are typically necessary to generate enough biogas for economically

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[17] Environmental and Energy Study Institute (EESI) *Fact Sheet: Biogas: Converting Waste to Energy* (2017), https://www.eesi.org/papers/view/fact-sheet-biogasconverting-waste-to-energy#:~:text=Wastewater%20Treatment&text=If%20all%20the%20facilities%20that,emissions%20from%20430%2C000%20passenger%20vehicles

[18] U.S. EPA, *Opportunities for Combined Heat and Power at Wastewater Treatment Facilities: Market Analysis and Lessons from the Field*, https://www.epa.gov/sites/default/files/2016-07/documents/opportunities_for_combined_heat_and_power_at_wastewater_treatment_facilities_market_analysis_and_lessons_from_the_field.pdf

[19] David Moldal, *Wastewater Treatment, Powered by Biogas*, WaterWorld (Dec. 16, 2021) https://www.waterworld.com/wastewater-treatment/article/14214366/2112wwcas

[20] U.S. EPA, *Financing CHP Projects at Wastewater Treatment Facilities with Clean Water State Revolving Funds* (2014) https://www.epa.gov/sites/default/files/2015-7/documents/financing_chp_projects_at_wastewater_treatment_facilities_with_clean_water_state_revolving_funds.pdf

[21] One example of this is in Gresham, Oregon. Its wastewater treatment plant became the first facility in the Pacific Northwest to achieve net-zero energy consumption after installing two 395-kW CHP engines. The facility increased its biogas production through the co-digestion of fats, oils, and grease from local restaurants. David Moldal, *Wastewater Treatment, Powered by Biogas*, WaterWorld (Dec. 16, 2021), https://www.waterworld.com/wastewater-treatment/article/14214366/2112wwcas

viable CHP systems.[22] However, smaller WWTFs (*i.e.,* between 1 and 5 MGD) could produce sufficient biogas if biosolid loadings were high enough, or if the facilities supplemented their digestion process by adding fats, oils, and greases collected from local restaurants, for example, to boost the biogas generation rate of the anaerobic digesters.[23]

The use of biogas as a renewable energy source can lead to significant savings, which can help offset the costs of installing new technologies, including CHP systems. Additionally, any surplus biogas or electricity beyond the facility's needs can be sold or repurposed, providing further economic opportunities or cost savings for municipalities and other owners or operators. For example, biogas can be sold to industrial users, electric power producers, or used as vehicle fuel.[24]

To further incentivize biogas export, the proposed legislation includes a tax credit for the sale of biogas from Large WWTFs.

With an estimated $600 billion investment gap over the next 20 years to upgrade the United States' aging water infrastructure, this moment presents a key opportunity to leverage the environmental and economic benefits of anaerobic digestion and CHP technology at Large WWTFs.[25]

V. Community Involvement

To support these goals and ensure that implementation reflects local priorities, the memorandum also recommends that the relevant Permitting Authority establish a Community Advisory Committee composed of diverse local stakeholders, specifically including representatives of residential users, commercial utility users, local businesses, and relevant local government entities. The Committee could recommend the disposition of surplus biogas or electricity, for example, helping to align energy use decisions with community needs and environmental priorities.

To maximize the community and environmental benefits of these upgrades, facilities implementing CHP systems may also develop and implement a plan to identify opportunities to align infrastructure improvements with local environmental priorities, such as installing air quality monitoring stations or taking other actions to enhance environmental conditions in their area. [26]

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[22] U.S. EPA, *Opportunities for Combined Heat and Power at Wastewater Treatment Facilities: Market Analysis and Lessons from the Field* (2011), https://www.epa.gov/sites/default/files/2016-07/documents/opportunities_for_combined_heat_and_power_at_wastewater_treatment_facilities_market_analysis_and_lessons_from_the_field.pdf

[23] *Id.*

[24] *Id.*

[25] Matt Hale, *Maximizing the opportunities of anaerobic digestion from wastewater*, Wastewater Technology (Dec. 6, 2018), https://www.watertechonline.com/wastewater/article/15550717/maximizing-opportunities-of-anaerobic-digestion-from-wastewater

[26] Examples of community-centered co-benefits integrated into wastewater and energy infrastructure projects include the San Francisco Public Utilities Commission's Southeast Treatment Plant upgrades, which incorporated

Also, to the extent that some facilities may lack funding, states are encouraged to offer technical assistance and financial resources for WWTF conversions, based on a community's socio-economic vulnerability, including such factors as median household income, existing environmental exposures, and public health indicators.

air quality monitoring and urban greening programs (https://www.sfpuc.gov/); and Los Angeles's Hyperion Water Reclamation Plant, which produces recycled water used for landscape and industrial purposes as well as supplement the LA River to support the local habitat (https://sanitation.lacity.gov/).