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REC-overing Body Heat: How Awarding Renewable Energy Credits to Crematoria Can Encourage the Development of Renewable Electricity

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Note

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Despite the current political climate, enterprising developers have been driving the renewable energy market in the United States for decades now. But even though solar-, wind-, and hydro-power developments have been efficient alternatives to coal power plants and helped foster a cleaner environment, even the most agile renewable energy technologies can fail, hindered by their technical requirements. With wind and solar farms showing characteristics of being inefficient and unreliable, there is a pressing need for increased reliance on novel, even shocking, sources of energy. Because types of materials that can be combusted are abundant, if not unlimited, greater focus on the reuse of materials past their life cycle could contribute to a decrease in the amount of waste and dependency on finite fossil fuels. After decades of moderate success with recycling, more recently, scientists began looking into technologies that could recapture energy from organic matter.

As it turns out, the answer may be right in front of us—or perhaps more accurately, inside of us. This Note discusses the gruesome proposal of utilizing crematoria to produce electricity from the burning of human corpses. But before jumping into the topic, this Note first examines federal energy policy and the state policies of California, Connecticut, and Oregon for their approaches to energy recovered from organic matter, i.e., biomass. It asserts that current policies do not give enough attention to biomass as a source of energy and proposes a series of regulatory changes to promote the use of this form of electricity generation. To make a point, this Note accentuates not only environmental benefits, but also a variety of economic incentives. In the final section, this Note applies the federal energy regulatory framework and the Renewable Portfolio Standards from three states to the economic analysis of crematoria-generated electricity for the purposes of Renewable Energy Credits.

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INTRODUCTION

Climate change experts predict that fossil fuel reserves will deplete in less than one hundred years.[1] However, they fear that given current consumption levels, some resources might run out within the next several decades.[2] This timeframe will greatly depend on the world population's economic needs and the political security of resources. Based on these projections, scientists share concern that conservation of fossil fuels alone will not guarantee the security of electricity supply. Instead, the future of the energy market will greatly rely on the hunt for new, efficient sources of electricity.

This gloomy view of the future coincides with the observation that the 85-plus age bracket is the fastest-growing population in America.[3] Despite the increase in life expectancy, people are not necessarily living healthier lives.[4] As people live longer, the time they are exposed to pollutants—some of them byproducts of the combustion of fossil fuels—is extended. This creates more time for environmental health hazards to

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[1] *See, e.g.*, INT'L ENERGY AGENCY, RESOURCES TO RESERVES 2013: OIL, GAS AND COAL TECHNOLOGIES FOR THE ENERGY MARKETS OF THE FUTURE 18 (2013) (positing that proven reserves of conventional oil, based on current consumption levels, will last another forty to forty-five years) [hereinafter RESOURCES TO RESERVES 2013]; BRITISH PETROLEUM, BP STATISTICAL REVIEW OF WORLD ENERGY JUNE 2017 13, 27, 37 (2017), https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review-2017/bp-statistical-review-of-world-energy-2017-full-report.pdf [https://perma.cc/5BKE-Q36G] (providing statistics that support a contention that global oil and gas reserves can last for over 50 years at current global production levels, and global coal reserves can last for more than 150 years).

[2] *See* RESOURCES TO RESERVES 2013, *supra* note 1, at 18 (suggesting that conventional oil, based on current consumption levels, will last another forty to forty-five years).

[3] Jacqueline A. Olexy, *Aging in Today's Environment: Is It a Healthy Proposition?*, 14 PENN. ST. ENVTL. L. REV. 131, 135 (2005).

[4] *Id.* at 140 (describing how air pollution has taken its toll on the exacerbation of some chronic respiratory and cardiovascular diseases).

manifest.[5] Researchers have shown that environmental pollutants accelerate the aging process,[6] and this means that, with no significant change in birth rates, the American age pyramid will continue to be narrowed at the bottom.

This Note examines the morbid topic of the use of the human body past its expiration date. Specifically, it explores whether crematoria could be used as a clean-energy solution to the dependency on fossil fuels. Part I frames the discussion around the pros and cons of bioenergy—energy that comes from the burning of organic matter—and discusses different materials that are burned for the production of electricity, including solid waste, organic matter, and animal waste. Part II lays the groundwork for a discussion of crematoria by providing an overview of the history of burials and regulation in the death-care industry. Part III then poses the question of whether the burning of human corpses could qualify under the federal framework and states' Renewable Portfolio Standards. It provides a legal analysis of the energy market in three states—California, Connecticut, and Oregon—and explores the scope of states' definitions of "biomass." The Conclusion argues that crematoria-generated electricity might become a viable solution if proposed to investors with the right incentive. It argues for the availability of renewable energy credits and discusses ownership of the credits in light of property, ethical, and environmental considerations.

I. ENERGY RECOVERY FROM THE COMBUSTION OF DIFFERENT MATERIALS

Before going into detail, it is important to establish what we burn. Part I analyzes current forms of energy production from the burning of different materials, such as solid waste, organic matter, and animal waste. Incinerator plants that process these materials offer an alternative to the combustion of fossil fuels—the most popular form of electricity generation in the United States—which creates 67% of the world's greenhouse gas emissions.[7]

A. *Phasing Out Fossil Fuels Through International Action: the Kyoto Protocol and Paris Agreement*

Traditional energy sources, such as coal, oil, and natural gas, continue to be a global environmental concern, not only because fossil fuels are the principal factor in climate change, but also because their supplies are finite

[5] *Id.*

[6] *Id.* at 138.

[7] *See* Michael B. Gerrard, *Introduction and Overview*, *in* THE LAW OF CLEAN ENERGY: EFFICIENCY AND RENEWABLES 1 (Michael B. Gerrard, ed. 2011).

and often located in unstable or hostile nations.[8] In past decades, at last, the majority of countries around the globe have acknowledged that fossil fuels have a negative impact on the environment. As a consequence, people across the world began a dialogue that resulted in major international successes—agreements signed in Kyoto and Paris targeted at decreasing the growing dependency on fossil fuels.[9]

The Kyoto and Paris agreements outlined two ways to deal with climate change: (1) a reduction in the amount of consumer energy, and (2) an increase in the share of non-fossil energy.[10] The Kyoto Protocol, the first international agreement of its kind, committed its signatories to take action to fight climate change "by setting internationally binding emission reduction targets."[11] To do so, the Kyoto Protocol designated two commitment periods during which parties to the agreement committed to reduce greenhouse gas emissions to below 1990 levels through both national measures and international market-based mechanisms.[12] The Paris Agreement built upon the success of the Kyoto Protocol. Bringing all member states of the United Nations together in the effort to combat climate change, the Paris Agreement's central aim was to keep global temperature rise less than two degrees Celsius above preindustrial levels.[13] To emphasize the need for collective action and mutual involvement, the Paris Agreement set requirements for transparency in implementation efforts and reductions in greenhouse gas emissions through reporting on "nationally determined contributions."[14] Today, one opportunity to meet the goals of the Kyoto and Paris agreements is phasing out fossil fuels through the wider use of non-fossil sources of combustible energy, such as solid waste, organic matter, and animal waste.

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[8] *Coal and Other Fossil Fuels: The Use of Fossil Fuels has Significant Consequences*, UNION OF CONCERNED SCIENTISTS, http://www.ucsusa.org/clean-energy/coal-and-other-fossil-fuels [https://perma.cc/6677-9G9Z] (last visited Oct. 16, 2017); George W. Bush, President of the United States, State of the Union Address (Jan. 31, 2006) ("Keeping America competitive requires affordable energy. And here we have a serious problem: America is addicted to oil, which is often imported from unstable parts of the world.").

[9] Kyoto Protocol to the United Nations Framework Convention on Climate Change art. 2, Dec. 11, 1997, 37 I.L.M. 22 (2005) [hereinafter Kyoto Protocol]; Paris Agreement Under the United Nations Framework Convention on Climate Change art. 4, Apr. 22, 2016, 55 I.L.M. 740 (2016) [hereinafter Paris Agreement].

[10] Kyoto Protocol, *supra* note 9, art. 2(1)(a)(iv); Paris Agreement, *supra* note 9, art. 4.

[11] *KP Introduction*, UNITED NATIONS CLIMATE CHANGE, http://unfccc.int/kyoto_protocol/items/2830.php [https://perma.cc/42KA-WWJG] (last visited Oct. 25, 2017).

[12] *Id.*

[13] Paris Agreement, *supra* note 9, art. 2(1)(a).

[14] *The Paris Agreement*, UNITED NATIONS CLIMATE CHANGE, http://unfccc.int/paris_agreement/items/9485.php [https://perma.cc/NV4X-3KA7] (last visited Oct. 25, 2017).

B. *Municipal Solid Waste: Dealing with the Cities' Stinky Problem*

One of the most familiar sources of energy production is solid waste. Historians have discovered that, even 2000 years ago, the Mayan Indians of Central America burned their trash.[15] The long history of rubbish only reiterates that mankind has always been wasteful with its resources. As a nation, Americans generate more municipal solid waste per capita than any other country in the world.[16] New York state, with the biggest city in the United States—New York City—addressed this waste problem as early as the late nineteenth century. In 1885, the governor of New York built the first garbage incinerator in the country.[17] Today, the New York problem is replicated in other states, where landfills are overflowing with trash that well exceeds their capacities.[18] States and municipalities nationwide have been debating whether they should divert their resources from landfills and instead double the resources they put into waste management plans to increase the capacity of municipal solid waste incinerators.[19]

The question arises: why are New York City and other cities still struggling to get this problem under control? Environmentalists suggest that the effectiveness of a waste management program depends on three criteria: "(1) its environmental cost; (2) its economic cost; and (3) its

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[15] MICHELLE MULDER, TRASH TALK: MOVING TOWARD A ZERO-WASTE WORLD 9 (2015).

[16] Thomas F. Irwin, *Slowing the Rush to Burn: The Need to Revise Federal Municipal Solid Waste Policy to Prioritize Recycling Over Incineration*, 19 VT. L. REV. 891, 891 (1995).

[17] Douglas Martin, *City's Last Waste Incinerator Is Torn Down*, N.Y. TIMES, May 6, 1999, http://www.nytimes.com/1999/05/06/nyregion/city-s-last-waste-incinerator-is-torn-down.html [https://perma.cc/746Q-8MEA]. Sadly, only 20% of New York's garbage ends up at an incinerator plant, where solid waste is converted into energy. Max Galka, *What Does New York Do With All Its Trash? One City's Waste – In Numbers*, THE GUARDIAN (Oct. 27, 2016, 8:38 AM), https://www.theguardian.com/cities/2016/oct/27/new-york-rubbish-all-that-trash-city-waste-in-numbers [https://perma.cc/J7AC-ECFA].

[18] *See* Galka, *supra* note 17 ("New York generates more than 14 million tonnes of trash each year."); William Weir, *Solid Waste Disposal More than Doubles EPA Estimates*, YALE NEWS (Sept. 21, 2015) (showing that landfills across the country are taking in more than twice as much solid waste as the government estimates (citing John T. Powell et al., *Estimates of Solid Waste Disposal Rates and Reduction Targets for Landfill Gas Emissions*, 6 NATURE CLIMATE CHANGE 162, 162 (2016))).

[19] *See, e.g.*, Nate Seltenrich, *Incineration Versus Recycling: In Europe, A Debate Over Trash*, YALE ENV'T 360 (Aug. 28, 2013), https://e360.yale.edu/features/incineration_versus_recycling__in_europe_a_debate_over_trash [https://perma.cc/AH57-G9UD] (noting that United States is following Europe's lead in considering new strategies for managing waste); Kerri Barsh, *The Debate Over Florida's First Commercial Waste-to-Energy Incinerator in 2 Decades*, GREENBERG TRAURIG E2 L. BLOG (Jan. 28, 2015), https://www.gtlaw-environmentalandenergy.com/2015/01/articles/biofuels/the-debate-over-floridas-first-commercial-waste-to-energy-incinerator-in-2-decades/ [https://perma.cc/2U5G-LB2Q] (presenting both sides of the argument); Tim Faulkner, *Central Landfill Keeps R.I. Incinerator Debate Alive*, ECORI NEWS (March 4, 2015), https://www.ecori.org/composting/2015/3/4/central-landfill-continues-to-keep-ri-incinerator-debate-alive [https://perma.cc/URZ2-HAMZ] (presenting arguments in the debate over whether to build a waste incinerator in Rhode Island).

ability to reduce waste."[20] While mega-capacity incinerators certainly have great potential to satisfy the third criterion, advocates of waste management still have largely failed to convince legislators that they are a better alternative to recycling. This is because critics of municipal solid waste incineration (MSWI) argue that the process of rendering hazardous materials safe is too complex and the operation of incineration plants too costly and inefficient.[21]

Solid waste management is regulated on the federal level by the Environmental Protection Agency, which derives its authority from the Resource Conservation and Recovery Act (RCRA).[22] This Act provides for regulation at every step of MSWI project development: "generation, transportation, treatment, storage, and disposal."[23] Although RCRA foresees the burning of municipal solid waste, it limits the ability to reap the full benefits of such incineration. This is because RCRA's framework is largely based on recycling, incentivized by setting national goals for the reduction of waste by conversion into reusable material.[24] Because incineration puts an end to the life cycle of a material, its goals are adverse to the goals of recycling. As a result of recycling, the material is not only reduced, but also returned to the previous stage in a material's life cycle, increasing the demand for "manufacturing the same materials from virgin sources."[25]

This obvious challenge to the development of large-scale MSWI is problematic because the burning of solid waste might be a relatively safe alternative to storage in landfills. First, there seems to be a never-ending list of items that cannot be recycled or can only be recycled with the use of advanced processes.[26] Second, current technologies do not allow for processing of some unrecyclable materials into new forms, so some items usually end up in a landfill anyway.[27] Even some otherwise recyclable

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[20] Irwin, *supra* note 16, at 908.

[21] *Id.* at 893–94.

[22] Research Conservation and Recovery Act of 1976, 42 U.S.C. § 6901 (2012).

[23] U.S. ENVTL. PROTECTION AGENCY, RESOURCE CONSERVATION AND RECOVERY ACT (RCRA) AND FEDERAL FACILITIES, https://www.epa.gov/enforcement/resource-conservation-and-recovery-act-rcra-and-federal-facilities [https://perma.cc/5PPJ-PZ96] (last visited Feb. 2, 2018).

[24] *See* 42 U.S.C. § 6902(a)(6) (2012) (listing as one of the Act's objectives: "minimizing the generation of hazardous waste and the land disposal of hazardous waste by encouraging process substitution, materials recovery, properly conducted recycling and reuse, and treatment").

[25] Irwin, *supra* note 16*,* at 892.

[26] *See* Nick Douglas, *What You Can and Can't Recycle*, LIFE HACKER (Aug. 7, 2017, 2:45 PM), https://lifehacker.com/what-you-can-and-cant-recycle-1797603814 [https://perma.cc/BAH9-H8LR] (providing advice on what can and cannot be recycled and what items ought to be recycled in particular way).

[27] *See Single-Stream Recycling*, SCI. AM., https://www.scientificamerican.com/article/single-stream-recycling/ [https://perma.cc/294Q-N5YC] (last visited Apr. 3, 2018) (noting that not all items placed in recycling bins are recyclable, and that these items—the residuals—usually get sent to landfills).

materials, despite landing in a recycling bin, might not make it through the rendition process because they were manually sorted at the processing facility due to concerns of contamination by other types of waste.[28] Third, many recycling problems arise simply because the whole idea of waste segregation cannot exist without the involvement of people.[29] Without environmentally responsible citizens who are aware of what their trash consists of and who are willing to sort their household waste into separate bins, recycling does not exist. And where recycling does not exist, most of the waste ends up in a landfill. MSWI offers a solution to this problem because its success does not depend on average-citizen engagement.

Having addressed the economic and efficiency concerns regarding waste management programs, Part I.B turns to environmental concerns regarding the burning of hazardous materials. The Environmental Protection Agency warns against the burning of some hazardous materials, such as particular types of plastic or rubber, providing evidence that the toxic residue produced during combustion might pose a great risk to the public health.[30] This concern becomes particularly important in light of the decision in *Chicago v. Environmental Defense Fund*,[31] in which the U.S. Supreme Court held that although the burning of hazardous material generated nonhazardous combustion ash residue, the residue should nevertheless be strictly regulated as hazardous waste under Subtitle C of the RCRA.[32] This decision effectively means that for the energy industry,

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[28] Sarah Laskow, *Single-Stream Recycling Is Easier for Consumers, but Is it Better?*, ATLANTIC Sept. 18, 2014, https://www.theatlantic.com/technology/archive/2014/09/single-stream-recycling-is-easier-for-consumers-but-is-it-better/380368/ [https://perma.cc/B7QT-6BXM].

[29] *See* Erin Schumaker, *The Psychology Behind Why People Don't Recycle*, HUFFINGTON POST (Aug. 3, 2016, 8:14 AM), https://www.huffingtonpost.com/entry/psychology-of-why-people-dont-recycle_us_57697a7be4b087b70be605b3 [https://perma.cc/PK26-H5UC] (giving reasons for why people do not want to recycle and arguing that citizens' participation is necessary for the success of recycling efforts).

[30] *See* U.S. ENVTL. PROTECTION AGENCY, DIOXINS PRODUCED BY BACKYARD BURNING, https://www.epa.gov/dioxin/dioxins-produced-backyard-burning [https://perma.cc/CG2E-KTTK] (last visited Oct. 25, 2017) (describing the danger to human health from the inhalation of dioxins and other toxic pollutants, which are produced in the process of combustion of household solid waste); U.S. ENVTL. PROTECTION AGENCY, BURN WISE BEST BURN PRACTICES, https://www.epa.gov/burnwise/burn-wise-best-burn-practices [https://perma.cc/7QXZ-HESL] (last visited Oct. 25, 2017) (cautioning against burning materials such as plastic and rubber, which release toxic or harmful chemicals when burned).

[31] 511 U.S. 328 (1994).

[32] *Id.* at 339; Resource Conservation and Recovery Act of 1976, 42 U.S.C. § 6901 (2012); *see* U.S. ENVTL. PROTECTION AGENCY, INSTRUCTIONS AND FORM FOR HAZARDOUS WASTE GENERATORS, TRANSPORTERS AND TREATMENT, STORAGE AND DISPOSAL FACILITIES TO OBTAIN AN EPA IDENTIFICATION NUMBER (EPA FORM 8700-12/SITE IDENTIFICATION FORM), https://www.epa.gov/hwgenerators/instructions-and-form-hazardous-waste-generators-transporters-and-treatment-storage-and [https://perma.cc/9ZVR-GT5E] (last visited Jan. 30, 2018) (describing the federal scheme of RCRA Subtitle C, which regulates "hazardous waste generators, transporters and treatment, storage and disposal facilities").

there is now a wider range of materials for which processing is discouraged by the stringent requirements of Subtitle C.

The material used in tires is an example of a hazardous material that has been subject to a long debate on use past its life cycle.[33] Until October 2013, Connecticut operated a tire-to-energy facility with the capacity to produce electricity levels similar to those of a coal plant.[34] The plant generated about 205,000 megawatt hours of electricity per year and offered a solution to Connecticut's inability to store or dispose of tires in a more environmentally sustainable way.[35] However, tire incineration was deemed nonviable because tires consist of some substances, such as heavy metals and chloride, the burning of which may result in the release of diverse and complex combustion products.[36] Today, Connecticut has three reduction facilities which handle tires in the process of recycling.[37] The rest of the unprocessed tires remain in storage with tire retailers—effectively kept away from the landfills, yet ineffectively disposed of.[38]

Aside from the concerns with the burning of hazardous materials, incineration of regular solid waste involves a whole range of climate-relevant emissions. Waste-to-energy plants emit, for example, the following greenhouse gases: CO_2, N_2O, NOx, and NH_3, of which CO_2 "constitutes the chief climate-relevant emission."[39] Researchers estimate that "[t]he incineration of 1 Mg of municipal waste in MSWIs is associated with the production/release of about 0.7 to 1.2 Mg of carbon dioxide CO_2."[40] The CO_2 emissions produced in the process come from a heterogeneous mixture of waste and include both fossil- and biogenic-origin carbon.[41] Whereas the fossil-origin CO_2 emissions have been considered negative for the environment, biogenic CO_2 emissions relate to

[33] *Tire Recycling*, RECYCLINGTOWN, http://www.recyclingtown.com/tire-recycling/ [https://perma.cc/67SZ-QVXM] (last visited Oct. 25, 2017).

[34] CONN. DEP'T OF ENERGY & ENVTL. PROTECTION, RECYCLING AND DISPOSAL OF SCRAP TIRES, http://www.ct.gov/deep/cwp/view.asp?a=2714&depNav_GID=1639&q=324902 [https://perma.cc/2D76-54ZF] (last updated Dec. 2016).

[35] John Penney, *ReEnergy: 'Many Inquiries' About Sterling Tire-Burning Site*, NORWICH BULL. (Sept. 14, 2016, 4:43 PM), http://www.norwichbulletin.com/article/20150914/news/150919750 [https://perma.cc/ALK4-N9D2].

[36] Letter from Greenpeace Toxics Research & Info. Unit, to Environmental Activists, GREENPEACE, http://www.energyjustice.net/files/tires/files/greenpeaceletter.html [https://perma.cc/XAV2-YWN9].

[37] CONN. DEP'T OF ENERGY & ENVTL. PROTECTION, *supra* note 34.

[38] *Id.*

[39] Bernt Johnke, *Emissions from Waste Incineration*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE [IPCC] 463 (2000), http://www.ipcc-nggip.iges.or.jp/public/gp/bgp/5_3_Waste_Incineration.pdf [https://perma.cc/XM3F-4AWC].

[40] *Id.* at 459.

[41] *Id.* at 457.

the natural carbon cycle and are neutral for the environment.[42] With this distinction drawn, "the proportion of CO_2 assumed to be of fossil origin . . . is given as 33 to 50 percent."[43] Therefore, depending on the energy efficiency of a particular solid waste incinerator, the carbon footprint might be proportionately small and, in fact, carbon-neutral due to other advantages that incinerator plants provide. Moreover, despite the common image of piles and piles of waste, most materials in landfills exist in a finite quantity in the environment and need to be constantly reused to meet the demands of consumer society.[44] Repeated recycling of the same materials, in so-called "open-loop" recycling, may also cause the materials to deteriorate until they become waste.[45] Eventual destruction of such materials is inevitable, and thus at some point in time, it will become necessary to burn the solid waste.

Despite a number of environmental concerns related to the operation of MSWIs, solid waste management projects arguably remain a viable alternative to landfills. Not only can they last a lifetime,[46] offering a mass-scale and reliable solution to the reduction of huge volumes of trash, incinerators may also recover energy in the process and operate as municipal heating systems—something that cannot be achieved by recycling.[47] Finally, incinerators can be strategically placed close to big cities, which often lack grid connections to other renewable sources of energy, such as wind or solar power.[48] This problem will be discussed

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[42] *Biogenic CO2 Emissions*, SGS, http://www.sgs.com/en/environment/climate-change/biogenic-co2-emissions [https://perma.cc/N3YN-CCRA] (last visited Apr. 3, 2018).

[43] Johnke*, supra* note 39, at 459.

[44] *See* Conor Gaffey, *Earth Overshoot Day 2017: Human Beings Have Already Used Up the Planet's Natural Resources for the Year*, NEWSWEEK (Aug. 2, 2017, 5:56 AM), http://www.newsweek.com/earth-overshoot-day-2017-climate-change-645296 [https://perma.cc/MSY5-PUUJ] ("As of August 2, [2017] human beings have used up [their] allowance of resources such as water, clean air, and soil for 2017, according to environmental groups the Global Footprint Network and the World Wildlife Foundation (WWF).").

[45] Mark Fedkin, *5.2. Recycling: Open-Loop Versus Closed-Loop Thinking*, PENNSTATE C. OF EARTH & MIN. SCI., https://www.e-education.psu.edu/eme807/node/624 [https://perma.cc/HA3A-AA4L] (last visited Apr. 3, 2018).

[46] *See* Jeffrey Morris & Nickolas J. Themelis, *Does Burning Garbage for Electricity Make Sense?*, WALL ST. J., Nov. 15, 2015, https://www.wsj.com/articles/does-burning-garbage-for-electricity-make-sense-1447643515 [https://perma.cc/6LQG-EGPB] (describing pros and cons of burning waste for energy).

[47] U.S. ENVTL. PROTECTION AGENCY, ENERGY RECOVERY FROM THE COMBUSTION OF MUNICIPAL SOLID WASTE (MSW), https://www.epa.gov/smm/energy-recovery-combustion-municipal-solid-waste-msw [https://perma.cc/AP7A-ZUVN] (last visited Apr. 3, 2018).

[48] *See* Morris & Themelis, *supra* note 46 ("A waste-to-energy plant of one million tons capacity can be built on 20 acres and over a lifetime of 40 years or more help avoid conversion of 1,000 acres to landfills."); Nate Seltenrich, *Waste Incineration Plants a Hard Cell for Cities*, FUTURESTRUCTURE (Apr. 4, 2014), http://www.govtech.com/fs/news/Waste-Incineration-Plants-a-Tough-Sell-for-Cities.html [https://perma.cc/B7QV-V7EL] (noting that although waste incineration appeals to cities struggling with garbage problems, the public is skeptical about the idea).

again in Part III's analysis of waste management solutions in the context of crematoria-based power plants.

C. *Organic Matter: Returning to the Roots*

Another source of energy used widely today is organic matter. Moving away from the discussion of consumer commodities to agricultural goods, Part I.C begins by providing a universal definition of biomass, followed by a discussion of the benefits and disadvantages of the combustion of organic matter, including its uses in biofuels and bioelectricity.

Biomass is described generally as "any form of organic matter . . . encompass[ing] a variety of materials, all of which are renewable at some rate."[49] Biomass differs from solid waste in several ways. First, unlike solid waste, organic matter is renewable, and therefore encompasses materials that are not at the end of their life-cycle, for example, by-products such as the agricultural residue formed from farm practices.[50] Solid waste, on the other hand, encompasses the final form of a good past its life cycle, once the item has lost its consumption value.[51] Second, organic matter is not toxic, except for the dangerous methane it emits in the process of decomposition.[52] On the other hand, solid waste can be hazardous or nonhazardous, and its toxicity essentially depends on the chemical composition of the material being burnt.[53] Finally, unlike solid waste, which is made of a variety of materials, organic waste contains mostly water, which makes it difficult to transport and store due to its weight.[54]

Conversion of organic matter into biomass confers multiple benefits on the environment. First, the process prevents organic waste from

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[49] Brent J. Hartman, *Defining "Biomass": An Examination of State Renewable Energy Standards*, 19 TEX. WESLEYAN L. REV. 1, 3 (2012).

[50] *See* Renee Cho, *Is Biomass Really Renewable?*, COL. UNIV., EARTH INST., STATE OF THE PLANET (Aug. 18, 2011), https://blogs.ei.columbia.edu/2011/08/18/is-biomass-really-renewable/ [https://perma.cc/BBB8-483Z] (explaining why biomass is considered a renewable energy resource, and listing the types of organic matter that form it).

[51] *See supra* notes 44–45 and accompanying text (describing how materials are repeatedly recycled until they deteriorate to the point that they are no longer useful).

[52] Emily K. Geoghegan et al., *Decomposition and Methane Production in Anaerobic Environments: A Case Study in a Methanogenic Bioreactor,* U. CHI. MARINE BIOLOGICAL LABORATORY, http://www.mbl.edu/ses/files/2016/02/EmilyGeoghegan.pdf [https://perma.cc/6UR3-22R3] (last visited Apr. 19, 2018).

[53] U.S. ENVTL. PROTECTION AGENCY, LEARN THE BASICS OF HAZARDOUS WASTE, https://www.epa.gov/hw/learn-basics-hazardous-waste [https://perma.cc/D2HL-WW6Y] (last visited Apr. 3, 2018).

[54] *See Organic Waste Management*, U. MASS. AMHERST CTR. FOR AGRIC., FOOD, AND THE ENV'T, https://ag.umass.edu/greenhouse-floriculture/greenhouse-best-management-practices-bmp-manual/organic-waste-management [https://perma.cc/Y4FW-Y3HT] (last visited Feb. 15, 2017) ("The volume of the finished compost is smaller than the volume of raw materials because of the breakdown of organic matter and the evaporation of water.").

decomposing in landfills where it may generate methane gas, which is dangerous to humans.[55] In fact, some municipalities have banned organic matter from their landfills, and instead have mandated its conversion to bioenergy.[56] Second, modern technologies allow for two ways of utilizing biomass beyond decomposition: (1) production of biofuel; and (2) production of bioelectricity.[57] These two sources of energy are renewable, sustainable, and offer an alternative to fossil fuels, which continue to be ubiquitous in electricity production and transportation.

Despite the recent rise of the electric car, the combustion engine vehicle has long been central to American life.[58] This has contributed to widespread increases in greenhouse gas pollution to the point that smog is prevalent and visible in some of the larger cities in the United States and worldwide.[59] The hope is that in reaction to the visible effects of motor vehicle pollution, people will develop a keener sense of environmental awareness, which may accelerate the conversion to renewable sources of energy in the near future.

A trending topic today, in part due to the popularity of electric car manufacturer Tesla, is the future of biofuels.[60] Traditionally, households generated bioenergy in only two ways: (1) burning wood for heat; and (2) cooking with animal fats. Today, scientists estimate that 2.4 billion people globally, most of them in developing countries, still collect wood and animal waste for fuel.[61] Although not the most technologically agile or fascinating clean-energy solution, biomass provides approximately 35% of

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[55] *Organic Waste*, ENV'T VICTORIA (June 16, 2016), https://environmentvictoria.org.au/resource/organic-waste/ [https://perma.cc/7RXF-C9VX].

[56] *Which Communities Have Compost Facilities and Ban Foodwaste in Landfill?*, PAC. NW. POLLUTION PREVENTION RESOURCE CTR., http://pprc.org/index.php/2014/p2-rapid/which-communities-have-compost-facilities/ [https://perma.cc/879N-XJMV] (last visited Apr. 3, 2018); *see State Landfill Banks on Organics – February, 2014*, U.S. COMPOSTING COUNCIL, Landfill Ban Map 2-2014, https://compostingcouncil.org/landfill-bans-on-organics/landfill-ban-map-2-2014-2/ [https://perma.cc/HL2H-AD3T] (last visited Apr. 3, 2018) (indicating permissibility of organics in landfills by state).

[57] Ellen Moyer, *Biomass, Biofuel, Biopower, and Bioenergy: Sound So Cool But Wreck the Climate and Rip Us Off*, HUFFINGTON POST (Dec. 2, 2015, 11:51 AM), https://www.huffingtonpost.com/ellen-moyer-phd/biomass-biofuel-biopower-_b_8680774.html [https://perma.cc/J4EK-A3PM].

[58] Edward Humes, *The Absurd Primacy of the Automobile in American Life*, ATLANTIC, Apr. 12, 2016, https://www.theatlantic.com/business/archive/2016/04/absurd-primacy-of-the-car-in-american-life/476346/ [https://perma.cc/MDF8-XVFP].

[59] *See id.* (describing the environmental, health, and economic costs of burning large amounts of fossil fuels).

[60] William T. Coyle, *The Future of Biofuels: A Global Perspective*, U.S. DEP'T OF AGRIC., ECON. RES. SERV. (Nov. 1, 2007), https://www.ers.usda.gov/amber-waves/2007/november/the-future-of-biofuels-a-global-perspective/ [https://perma.cc/V3TC-X4T9].

[61] DEPARTMENT OF TRADE AND INDUSTRY, MEETING THE ENERGY CHALLENGE: A WHITE PAPER ON ENERGY, 2007, Cm. 7124, at 45 (UK).

the energy used in developing countries, as compared to 11% globally.[62] It also contributes to about 90% of the global share of renewable energy.[63] Biofuel in its forms today can be divided into two types: ethanol and biodiesel.[64] Ethanol is made from sugar or starch crops, such as corn.[65] Biodiesel, on the other hand, is made from vegetable oils, including soybean oil and/or animal fats.[66] Because both are used today as fuel in vehicles, it is possible that they could also be used in the combustion engines in incineration plants.[67] This use of biomass, however, is greatly inefficient because of the light weight of dry (water-evaporated) biomass, and also because only a limited number of agricultural products can be processed into ethanol at all.[68]

But biomass has more than one application. It can also be converted into electricity through combustion.[69] Bioelectricity offers a great alternative to the more popular sources of renewable energy—like wind or solar power—because it is less expensive to produce and available at all times, regardless of weather conditions. There are two main types of organic matter that can be made into biomass and converted into bioelectricity: energy crops and agricultural residue. Energy crops include some types of agricultural produce, such as corn or switchgrass, as well as other types of agricultural waste.[70] Proponents of converting organic matter into bioelectricity argue that in addition to clean energy, bioelectricity also helps to reduce greenhouse gases in the atmosphere.[71] Critics, however, try to undermine the efficiency of this solution by showing that energy crops are land-intensive and require more land than any other form of electricity source, both renewable and nonrenewable.[72] But energy crops, unlike the traditional staple crops, are more resilient and environmentally friendly,

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[62] Erik Bluemel, *Biomass Energy: Ensuring Sustainability Through Conditioned Economic Incentives*, 19 GEO. INT'L ENVTL. L. REV 673, 675–76 (2007).

[63] From this number, about 66% is produced from wood, and 24% is produced from solid waste. *Id.* at 676.

[64] OFF. OF ENERGY EFFICIENCY & RENEWABLE ENERGY, BIOFUELS BASICS, http://www.energy.gov/eere/bioenergy/biofuels-basics [https://perma.cc/DYU9-EP8H] (last visited Oct. 25, 2017).

[65] *Id.*

[66] *Id.*

[67] *See infra* Part III for discussion of the use of biofuels in the combustion engines in crematoria.

[68] *See Organic Waste Management supra* note 54 (explaining that organic matter is composed in part of water); *see also infra* notes 69–74 and accompanying text (discussing the different uses of energy crops).

[69] *Biomass Energy*, NAT'L GEOGRAPHIC, http://www.nationalgeographic.org/encyclopedia/biomass-energy/ [https://perma.cc/GAE4-9GQS] (last visited Oct. 25, 2017).

[70] U.S. DEP'T OF AGRIC., NCRS, PLANT MATERIALS PROGRAM, PLANTING AND MANAGING SWITCHGRASS AS A BIOMASS ENERGY CROP 1, TECHNICAL NOTE NO. 3 (Sept. 2009).

[71] Bluemel, *supra* note 62, at 673–74.

[72] *Id.* at 683.

and also require fewer fertilizers.[73] Moreover, some energy crops, such as corn, can be also used for the dual purpose of providing food as well as energy.[74] As a result, even with the concerns of taking up great acreage on the farm, the benefits of energy crops in terms of their sustainable growth for the dual use of human consumption and electricity production far outweigh the potential drawbacks.

The other form of biomass, made from agricultural and forestry residues, also can be converted into clean energy.[75] Rather than burning the residues directly, organic matter is first processed into pellets and then combusted.[76] Although scientists are divided, the whole process is regarded as somewhat environmentally friendly because it produces no more carbon dioxide than the process of burning fossil fuels.[77] Critics of this solution, however, argue that excessive reliance on forestry residue may incentivize greater demand for food, which will in turn lead to deforestation.[78] To prevent this from happening, some states have implemented laws that specifically forbid cutting down trees for the purpose of burning them for energy.[79]

In light of Part I.B's discussion of municipal solid waste incinerators, their environmental and economic costs, and their ability to reduce waste,

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[73] *Id.* at 684.

[74] Lois Yoksoulian, *Corn Better Used as Food Than Biofuel, Study Finds*, UNIV. OF ILL, ILL. NEWS BUREAU (June 20, 2017, 9:00 AM), https://news.illinois.edu/view/6367/520569 [https://perma.cc/CSR9-ATG2].

[75] Jessica Ebert, *Agricultural Versus Industrial Waste for Energy*, BIOMASS MAG., http://biomassmagazine.com/articles/1430/agricultural-versus-industrial-waste-for-energy [https://perma.cc/J5US-KTRB] (last visited Oct. 28, 2017).

[76] *Id.*

[77] *Carbon Neutrality of Biomass*, AM. FOREST & PAPER ASS'N, http://www.afandpa.org/issues/issues-group/carbon-neutrality-of-biomass [https://perma.cc/F2BZ-RATJ] (last visited Oct. 28, 2017). For example, bioenergy based on forest biomass is a leading source of renewable energy in the European Union; *see, e.g.,* European Commission Memo 13/803, EU Forest-Based Industries: A Blueprint to Unleash Their Economic and Societal Potential (Sept. 20, 2013 (announcing a plan to expand the European Union's already "significant forest-based industries"). *But see* Warren Cornwall, *Is Wood a Green Source of Energy? Scientists Are Divided*, SCIENCE (Jan. 5, 2017, 9:00 AM), http://www.sciencemag.org/news/2017/01/wood-green-source-energy-scientists-are-divided [https://perma.cc/XDU9-PA5K] ("Unlike coal or natural gas, they argue, wood is a low-carbon fuel. The carbon released when trees are cut down and burned is taken up again when new trees grow in their place, limiting its impact on climate."); Roger Drouin, *Wood Pellets: Green Energy or New Source of CO2 Emissions?*, YALE ENV'T 360 (Jan. 22, 2015), http://e360.yale.edu/features/wood_pellets_green_energy_or_new_source_of_co2_emissions [https://perma.cc/U84W-86N6] ("Burning wood pellets releases as much or even more carbon dioxide per unit than burning coal.").

[78] J. Popp et al., *The Effect of Bioenergy Expansion: Food, Energy, and Environment*, 32 RENEWABLE & SUSTAINABLE ENERGY REVIEWS 559, 562 (2014).

[79] *E.g.,* David Abel, *Burning Trees for Fuel May Soon Qualify for State Subsidies*, BOS. GLOBE (Aug. 7, 2017), http://www.bostonglobe.com/metro/2017/08/06/burning-trees-for-fuel-may-soon-qualify-form-renewable-energy-massachusetts/qnnsEPd8YucYHP4WODvenI/story.html [https://perma.cc/GSF6-G9RU].

it follows that biomass might have an inherently greater potential to generate electricity than solid waste. Mega-capacity biomass incinerators—unrestricted in the types of organic material they can use, significantly less regulated than MSWI, and located just outside the big cities—could provide huge volumes of electricity to the grid.[80] Although the upfront capital costs to build such facilities might be significant,[81] Lazard's levelized cost of energy analysis provides that biomass is still cheaper than, or comparable in price to, the dirty sources of energy (such as natural gas, diesel, or coal), and cheaper than some forms of solar energy.[82] Furthermore, because organic matter is a more environmentally-friendly material than solid waste, biomass incinerators would receive less criticism for two reasons: (1) burning organic matter does not contradict the notion of recycling because organic matter, by its nature, cannot be restored to a new form and instead has to be reduced to residue; and (2) organic matter does not produce toxic residue and additionally reduces the methane emissions it would have otherwise created if left to decompose in a landfill.

For these reasons, burning organic matter presents an innovative and efficient solution that may become even more desirable in the future as other forms of renewable energy fail to increase their share of the energy market.

D. *Animal Waste: Heating Homes with "Poo Power"*

The last, and perhaps least known, method of combustible energy production is animal waste. Having assessed organic waste incineration as a viable form of clean energy, Part I.D will take a step forward into the future to discuss whether burning animal waste has the potential to provide a reliable source of energy. This Section will explore the ways animal waste can be disposed of, discussing both the traditional and modern methods of waste utilization. It will provide an overview of international case studies from three countries where scientists have developed a process to convert animal waste into bioenergy China, Sweden, and the United Kingdom.

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[80] *Biomass for Power Generation and CHP*, INT'L ENERGY AGENCY 1, 4 (Jan. 2007), https://www.iea.org/publications/freepublications/publication/essentials3.pdf [https://perma.cc/5JBM-348U].

[81] *See Lazard's Levelized Cost of Energy Analysis—Version 10.0*, LAZARD 2 (Dec. 2016), https://www.lazard.com/media/438038/levelized-cost-of-energy-v100.pdf [https://perma.cc/898H-5EYT] (comparing unsubsidized levelized cost of alternative and conventional energy sources).

[82] *See id.* at 11 (comparing capital cost of alternative and conventional energy sources).

Traditionally, and even still today, animals served a twofold purpose: (1) to provide a source of meat[83] and (2) to provide a source of dairy.[84] Conventionally, animals were killed in slaughterhouses, where their meat was processed, then produced for sale, and the waste disposed of in a container outside.[85] Slaughterhouses, however, are a source of pathogens and disease, and scientists have come to understand that storing organic waste outside produces dangerous methane in the decomposition process.[86] More recently, scientists have developed ways to collect methane released from decomposition, which can then be converted to biofuel.[87] Recaptured methane, also called biogas, has become popular on pig farms in China, Southeast Asia, and some parts of Latin America.[88] Today, scientists are testing means of re-capturing methane from cattle to use as bioenergy.[89] The ensuing case studies from different regions of the world focus on creative solutions to handling animal waste. The studies originated out of concerns regarding the contamination of water and food from improperly-disposed-of animal waste.

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[83] *See* U.S. DEP'T OF AGRIC., ANIMAL PRODUCTION, http://www.usda.gov/topics/animals/animal-production [https://perma.cc/C856-HFGL] (last visited Oct. 28, 2017) (describing beef, poultry, and pork production in the United States).

[84] *See id.* (describing dairy production in the United States).

[85] Sue Cross, *Slaughterhouse Waste - It All Has to Be Dealt With: A Case for the Vegan Option Continued*, HUFFINGTON POST (Feb. 14, 2013, 17:35 GMT), https://www.huffingtonpost.co.uk/sue-cross/horse-meat-slaugtherhorse-veganism_b_2684502.html [https://perma.cc/4HTL-LBWF].

[86] *See* Ian MacLachlan, *Humanitarian Reform, Slaughter Technology, and Butcher Resistance in Nineteenth-Century Britain*, *in* MEAT, MODERNITY, AND THE RISE OF THE SLAUGHTERHOUSE 128 (Paula Young Lee ed., 2008) (providing an example of Victorian Great Britain as an overview of changes to traditional slaughter methods as a result of humanitarian reform efforts).

[87] *See, e.g.*, Joel. K. Bourne, Jr., *Harnessing the Power of Poo: Pig Waste Becomes Electricity*, NAT'L GEOGRAPHIC (July 13, 2016), https://www.nationalgeographic.com/people-and-culture/food/the-plate/2016/07/pig-waste-energy-north-carolina.html [https://perma.cc/CK4V-M48Q] (describing how North Carolina transforms pig waste into methane gas, which is then harnessed for energy).

[88] Eliza Barclay, *China Turns to Biogas to Ease Impact of Factory Farms*, YALE ENV'T 360 (Nov. 11, 2010), http://e360.yale.edu/features/china_turns_to_ecological_biogas_production_to_ease_impact_of_factory_livestock_farms [https://perma.cc/QCV2-KT6Y]; Ploy Chitsomboon & Pisit Changplayngam, *Pig Manure Sweet Money for Thai Farmer*, REUTERS (Oct. 9, 2007, 8:39 PM), https://www.reuters.com/article/us-thailand-biofuel/pig-manure-sweet-money-for-thai-farmer-idUSBKK670620071010 [https://perma.cc/ZLV4-E4UD]; *Methane Capture and Combustion from Swine Manure Treatment for Pocillas and La Estrella*, UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, https://offset.climateneutralnow.org/methane-capture-and-combustion-from-swine-manure-treatment-for-pocillas-and-la-estrella-33- [https://perma.cc/8MNW-QWRT] (last visited Oct. 28, 2017); *Philippines Pig Farms Earn Carbon Credits for Capturing Methane from Manure*, WORLD BANK (Aug. 7, 2012), http://www.worldbank.org/en/news/feature/2012/08/07/Philippines-pig-farms-earn-carbon-credits-capturing-methane-from-manure [https://perma.cc/2YBD-JFH8].

[89] *See* Teodora Zareva, *This is How You Turn Cow Fart Gas Into Energy*, BIG THINK, http://bigthink.com/design-for-good/this-is-how-you-turn-cow-fart-gas-into-energy [https://perma.cc/76KZ-L6ZV] (last visited Apr. 3, 2018) (explaining a novel approach to the problem of bovine methane release).

In China, "over 16,000 dead pigs were dumped into one of Shanghai's primary drinking water sources" in 2013.[90] In particular, Zhejiang Province has been experiencing an increasing volume of animal waste resulting from agricultural production and slaughterhouse processing; the volume currently oscillates around one million pig carcasses per year.[91] Although worthless and burdensome to dispose of as waste, the carcasses are worth $56 per ton when converted to biofuel.[92] Scientists have invented an efficient way to discard the waste. First, pig carcasses are cooked in a pressure cooker for six hours.[93] Next, pig fat is extracted from the water and converted to biodiesel.[94] The process helps the environment by reducing the impact animal waste has on the quality of water, and also by providing a clean form of energy with a small or nonexistent environmental footprint.

Within the European Union, 16 million tons of animal byproducts are produced annually.[95] This huge mass of animal waste produced in slaughterhouses across Europe is concerning, particularly because of the potential return of mad cow disease.[96] Scientists estimate that it would cost more than one billion euro ($1,250,000,000) to dispose of all the animal waste.[97] Instead, Swedish scientists have come up with a simple process in which animal waste is crushed, ground together, and then burned with wood chips or peat to produce "biomal"—a type of biofuel which can be used for the household supply of heat and electricity.[98] The process is environmentally friendly and cost-efficient and has already received international attention.

In the United Kingdom, one energy company owns three plants that use "poultry litter, including excreta, feathers, spilled feed, substrate, soil,

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[90] Emil Morhardt, *Biofuel from Waste Pig Carcasses*, ENERGY VULTURE (Jan. 3, 2015), https://energyvulture.com/2015/01/03/biofuel-from-used-pig-carcasses/ [https://perma.cc/MWM2-K9PS].

[91] *Id.*; *see also* Zhiliang Zhang & Jianbing Ji, *Waste Pig Carcasses as a Renewable Resource for Production of Biofuels*, 3 ACS SUSTAINABLE CHEMISTRY & ENGINEERING 204, 204, 207 (2015) (noting that a "significant volume of animal carcasses" is an "inevitable consequence" of livestock farming).

[92] Morhardt, *supra* note 90.

[93] *Id.*

[94] *Id.*

[95] Stephen L. Woodgate & Johan T. van der Veen, *Fats and Oils – Animal Based*, *in* FOOD PROCESSING: PRINCIPLES AND APPLICATIONS (Stephanie Clark et al. eds., 2014).

[96] *See* CENTERS FOR DISEASE CONTROL AND PREVENTION, ABOUT BSE, https://www.cdc.gov/prions/bse/about.html [https://perma.cc/ZUG5-WGGV] (last updated Aug. 9, 2017) (noting the decrease in cases of the BSE epizootic in the United Kingdom from 1995 to 2015).

[97] Patrick A. Messerlin, *"Mad Cow" Disease, France and Europe*, BROOKINGS (Mar. 1, 2002), https://www.brookings.edu/articles/mad-cow-disease-france-and-europe/ [https://perma.cc/H8QP-UK4F].

[98] A.K. Streeter, *Where's the Beef? It's Heating Swedish Homes*, TREE HUGGER (May 20, 2010), https://www.treehugger.com/renewable-energy/wheres-the-beef-its-heating-swedish-homes.html [https://perma.cc/3TKN-2V9L].

and dead birds" to supply electricity to the grid, which is then distributed to some 150,000 homes.[99] The waste is combusted at 1500 degrees Fahrenheit to heat up water which then "drives a [steam] turbine and generator to produce electricity."[100]

These creative solutions are receiving a lot of support and financial backing from regulators in the European Union.[101] European law even acknowledges the use of animal waste for electricity production, listing it as a potential source of renewable energy under the Renewable Energy Directive.[102] Another regulation, the Industrial Emissions Directive, specifically provides standards for the treatment of animal waste in incineration plants.[103] What the regulations do not yet account for, however, is that the conversion of animal waste, such as poultry litter in the United Kingdom, might necessitate the use of fossil fuels to heat up water—a process which could also be achieved with the use of biofuels.

Continuous support for the development of novel sources of renewable energy is vital, particularly when it comes to the animal waste problem. China and Sweden have offered solutions to that problem. Because burning animal waste reduces the amount of methane in the atmosphere,[104] it is an important control mechanism for overgrazing and can yield some additional benefits, such as the control of animal diseases.[105] But these incentives may bring calamity. The demand for this additional energy supply might lead to the excessive killing of animals—some of which are not only sources of meat, but also dairy—along with others who exist in the ecosystem to eradicate pests and maintain ecological balance. Although not perfect, these solutions are innovative and offer important points for the discussion of crematoria-generated electricity in Part III.

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[99] HUMANE SOC'Y OF THE U.S., AN HSUS REPORT: THE IMPLICATIONS OF FARM ANIMAL-BASED BIOENERGY PRODUCTION 3 (2009), http://animalstudiesrepository.org/hsus_reps_environment_and_human_health/1/ [https://perma.cc/VPA9-HWFJ].

[100] *Id.*

[101] *See* Didier Bourguignon, *Biomass for Electricity and Heating: Opportunities and Challenges,* EUR. PARL. RES. SERV., 2–4 (2015), http://www.europarl.europa.eu/RegData/etudes/BRIE/2015/568329/EPRS_BRI(2015)568329_EN.pdf [https://perma.cc/L4DB-YUUB] (explaining that the EU provides "incentives" to use biomass as a form of renewable energy).

[102] *See* Council Directive 2009/28, 2009 O.J. (L 140) 17 (EC) ("The use of agricultural material such as manure, slurry and other animal and organic waste for biogas production has, in view of the high greenhouse gas emission saving potential, significant environmental advantages in terms of heat and power production and its use as biofuel.").

[103] *See* Council Directive 2010/75, 2010 O.J. (L 334) 20–21, 35 (EU) (setting European Union wide emission limit values for selected pollutants in large combustion plants).

[104] *See supra* Section I.C.

[105] *See* Lynn M. Boris, *The Food-Borne Ultimatum: Proposing Federal Legislation to Create Humane Living Conditions for Animals Raised for Food in Order to Improve Human Health*, 24 J.L. & HEALTH 285, 288, 290 (2011) (footnote omitted) ("Cattle arrive at the slaughterhouse covered with feces that contain E. coli thereby increasing the chance of contamination and human illness.").

II. HISTORY OF BURIALS AND REGULATION IN THE DEATH CARE INDUSTRY

Having discussed the main sources of combustible energy, Part II will now provide the groundwork for a discussion of a novel, though controversial, approach to clean energy: burning dead bodies. In order to better understand Part III's discussion of the environmental, property, and ethical concerns pertaining to crematoria-generated electricity, this Section discusses the clash between traditional burials and a more recent approach: cremation.

When life ends, we bid the dead farewell. Traditionally, the dead were buried in cemeteries, which have long been highly regulated on the municipal and, later, state level.[106] States first acquired power to regulate cemeteries for moral reasons. Burying a dead body was seen as "an important factor in the savage world in preventing the return of the spirit and in assuaging its evil intent."[107] Later, states came to control cemeteries for reasons of sanitation. Today, it is no longer disputed that improper disposition of bodies results in health hazards to the living.[108]

From an environmental perspective, traditional ground burials are problematic for two reasons. First, traditional funerals are resource-intensive. The typical ten-acre piece of land where a cemetery lies "contains enough coffin wood to construct more than 40 homes," not to mention hundreds of tons of steel and tens of thousands of tons of concrete.[109] In addition, the same cemetery ground contains "a volume of embalming fluid sufficient to fill a small . . . swimming pool" in a home's backyard.[110] Second, toxic chemicals used in the burial process contaminate soil and groundwater. For example, the first funeral directors were known to use arsenic until it was banned in 1910 and replaced with formaldehyde—a human carcinogen.[111] These chemical compounds, used as embalming fluids, would travel until they reached groundwater, from which the toxins would spread to other waters, including drinking water reservoirs, in the neighborhood.[112]

Cremation remediates many of these problems as it requires no acreage of land or wood and uses no embalming fluids. The whole process, using the example of California's definition, is composed of three steps:

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[106] PERCIVAL E. JACKSON, THE LAW OF CADAVERS AND OF BURIAL AND BURIAL PLACES 187 (2d ed. 1950).

[107] *Id.*

[108] *Id.* at 189.

[109] Mark Harris, *Arsenic Contamination in Graveyards: How the Dead Are Hurting the Environment*, UTNE READER (June 2013), http://www.utne.com/environment/arsenic-contamination-ze0z1306zpit [https://perma.cc/DNZ3-5PXF].

[110] *Id.*

[111] *Id.*

[112] *Id.*

> (a) The reduction of the body of a deceased human to its essential elements by incineration. (b) The repositioning or moving of the body or remains during incineration to facilitate the process. (c) The processing of the remains after removal from the cremation chamber . . . .[113]

The viability of cremation is further reinforced by a general trend in the death care industry, which pays increasing attention to catering to the needs of those who care about the environment. For example, the National Funeral Directors Association has recently started to market "green funerals," which can include: embalming with formaldehyde-free products; no embalming; the use of other sustainable materials, such as biodegradable clothing, shrouds, or burial containers; recycled paper products; and locally-grown organic flowers or food.[114] However, funeral directors decline to classify cremation as a "green funeral" because of the use of nonrenewable fossil fuels in the operation of combustion engines.[115] This concern can be overcome through the use of biofuel in the place of fossil fuels.

III. THE PROPOSAL: CREMATORIA-GENERATED ELECTRICITY

As has been foreshadowed in previous sections, this Note proposes using crematoria to produce electricity from the burning of human corpses. For this idea to work, however, a state must classify a human corpse as a material eligible under the Renewable Portfolio Standard (RPS). Because federal law provides that the human body is not a solid waste,[116] Part III.A will only explore the classification of human body as biomass in three states: California, Connecticut, and Oregon. Part III.B will discuss the viability of this proposal from the perspective of renewable energy credits as an incentive for developers to invest in cremation. Part III.C will discuss environmental, property, and ethical concerns regarding the burning of bodies, as posed in the debate on the future of renewable resources.

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[113] CAL. HEALTH & SAFETY CODE § 7010 (West 2018).

[114] *What It Means to Be Green,* NAT'L FUNERAL DIRECTORS ASS'N, http://www.nfda.org/resources/business-technical/green-funeral-practices/what-it-means-to-be-green [https://perma.cc/6DBC-YWW3] (last visited Apr. 19, 2018).

[115] *Id.*

[116] The Clean Air Act does not currently classify the human body as solid waste. 42 U.S.C. § 7429. This decision came after the Environmental Protection Agency's ruling on mercury in 2005, in which the agency decided that crematoria could not be regulated as solid waste incinerators under section 129 of the Act. Standards of Performance for New Stationary Sources and Emission Guidelines for Existing Sources: Other Solid Waste Incineration Units, 70 Fed. Reg. 74,881 (Dec. 16, 2005).

A. *Renewable Portfolio Standards: Classifying Human Bodies as Biomass*

Biomass is defined under the Energy Security Act of 1980 as "any organic matter[,] which is available on a renewable basis, including agricultural crops and agricultural wastes and residues, wood and wood wastes and residues, animal wastes, municipal wastes, and aquatic plants."[117]

In Part I.D, this Note discussed the emerging trend of burning animal carcasses for energy. Since biomass is a qualifying energy source in all the states that have adopted an RPS or other energy goal,[118] Part III.A takes a step forward and discusses whether human bodies could be classified as biomass under the RPS in three different states: California, Connecticut, and Oregon.

RPSs are obligations that states put on their regulated utilities to procure a certain share of generated energy from renewable sources.[119] A common feature of RPSs is that utilities can meet their nonfossil energy obligations through the purchase of energy from a renewable source power generator.[120] This mechanism is called a renewable energy credit and is further discussed in Part III.B.

California's RPS does not restrict the types of biomass materials that may be used to produce bioelectricity,[121] but it does emphasize the importance of the use of materials that have an impact on improving air quality.[122] Based on this simple definition, it appears that the human body can be classified as biomass, with the caveat that such use of biomass improves air quality. While the burning of dead bodies emits an amount of mercury, whether this amount is negligible would be subject to the regulator's determination.

Under Connecticut's RPS, eligible "renewable energy" includes electricity produced from "low emission advanced biomass conversion technologies," and may include other fuels derived from *agricultural produce* that the state determines "provide net reductions in greenhouse gas emissions and fossil fuel consumption."[123] Biomass facilities are only

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[117] Energy Security Act of 1980, 42 U.S.C. § 8802(2)(A).

[118] Hartman, *supra* note 49, at 8.

[119] Joshua P. Fershee, *Renewables Mandates and Goals*, *in* THE LAW OF CLEAN ENERGY: EFFICIENCY AND RENEWABLES 77 (Michael B. Gerrard ed., 2011).

[120] *Id.*

[121] *See* CAL. PUB. UTIL. CODE § 399.12 (West 2018) ("'Eligible renewable energy resource' means an electrical generating facility that meets the definition of a 'renewable electrical generation facility' in Section 25741 of the Public Resources Code."); CAL. PUB. RES. CODE § 25741 (West 2018) (stating that a facility that uses biomass qualifies as a "renewable electrical generation facility").

[122] *See* CAL. PUB. UTIL. CODE § 399.11(b)(3) (West 2018) (stating that the legislature seeks to "reduc[e] air pollution, particularly criteria pollutant emissions and toxic air contaminants, in the state").

[123] CONN. GEN. STAT. § 16-245n(a) (2016).

eligible for "Class I" status if the emissions of nitrogen oxides are below a certain threshold and the biomass fuel comes from material that is cultivated and harvested in a sustainable manner.[124] More specifically, sustainable biomass excludes construction and demolition waste, finished biomass products from lumber or paper mills, and biomass from old-growth timber stands.[125] Otherwise, biomass facilities qualify for "Class II" status if nitrogen oxide emissions exceed the threshold level, regardless of the type of biomass fuel used.[126] Although burning the human body would positively contribute to reductions in greenhouse gas emissions, the body may not be classified under Connecticut's definition of biomass for two reasons. First, crematoria currently use fossil fuels to run their combustion engines. If the greenhouse gas emissions reductions exceed the fossil fuel consumption, then this might not be an issue. However, Connecticut also expressly provides that biomass be derived from agricultural produce, which the human body definitely is not.

In Oregon, the RPS simply provides that electricity generated from biomass, including woody biomass and animal manure, is considered a form of renewable energy if it is not generated by burning wood treated with chemical preservatives or municipal solid waste.[127] Oregon encourages the use of other renewable energy projects, which may include small-scale combined heat and power facilities using biomass.[128] Oregon's definition of biomass, which appears rather all-inclusive, would likely include the human body, since it is neither wood nor solid waste.

For all three states, the classification of the human body as biomass is a novel issue and would be subject to a first impression decision by the regulator who may choose to either include or exclude the human body as a source of energy eligible under the RPSs.

B. *Incentive: Renewable Energy Credits*

As observed throughout this Note, laws that exist on the federal level and the state level in California, Connecticut, and Oregon do not focus on the development of waste-origin sources of renewable energy. Although these laws do not expressly prevent the use of cremation-generated electricity, there is little or no incentive to construct and operate such a novel source of electricity production, as opposed to investing money in more developed solar or wind energy production. However, the success of

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[124] *Id.* § 16-1(a)(20)(A)(xi).

[125] *Id.* § 16-1(a)(39).

[126] *Id.* §§ 16-1(a)(20)–(21).

[127] OR. REV. STAT. §§ 469A.025(2)–(3) (2007).

[128] *Renewable Portfolio Standard*, N.C. ST. U. N.C. CLEAN ENERGY TECH. CTR., http://programs.dsireusa.org/system/program/detail/2594 [https://perma.cc/9ZZ9-LNKN] (last updated June 7, 2016).

the previously discussed case studies and support by the European Union create at least some reason for excitement. For these reasons, this Section will apply the Renewable Energy Credits (RECs) mechanism to crematoria to explore the viability of this clean energy solution.

RECs, a state-level energy policy supplemental to the RPS, require utilities to hold a number of renewable energy credits proportionate to the amount of retail energy they sell. These credits can be either self-generated or purchased from other qualified renewable energy retailers.[129] The development of such a tradeable energy market marks an important moment for utilities. Through the RPSs, states require an annual increase in the percentage of electricity generated from renewable sources. Many utilities, bound by their substantial long-term investments in traditional power plants, are sometimes incapable of making a quick transition to begin generating electricity from renewable sources. Although largely successful, the RECs mechanism has its flaws too. Some states act leniently in pursuing their own goals and rarely enforce these provisions, while others set ambitious renewable energy policies and exceed expectations. Part III.B provides an overview of three states' RPS goals, which will help put into perspective the important role RECs play in the energy market.

California's RPS is probably the most ambitious state-level renewable energy policy in the nation.[130] California requires all electric utilities "to increase procurement from eligible renewable energy resources to [50%] of total procurement by 2030."[131] In November 2017, California achieved 30% progress, closing in on the 2020 goal over two years in advance, mostly with the use of solar, wind, and geothermal energy.[132] California is excelling in meeting its RPS goals and it is a great success story for renewables. California's fast-growing renewable energy market is good for business and the economy—it is a source of more than 500,000 jobs and nearly $10 billion in clean-tech investment.[133] Part of the success in renewables in California is owed to tradable renewable energy credits;[134] specifically, limiting their use initially to 25% and currently to 10% of

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[129] Fershee, *supra* note 119, at 79.

[130] CAL. PUB. UTIL. COMMISSION, CAL. RENEWABLES PORTFOLIO STANDARD (RPS), http://www.cpuc.ca.gov/RPS_Homepage/ [https://perma.cc/8VU5-SBZM] (last visited May 10, 2017).

[131] *See* CAL. ENERGY COMMISSION, TRACKING PROGRESS: RENEWABLE ENERGY OVERVIEW 2 (DEC. 2017) (presenting the progress toward meeting California's renewable energy goals in 2017).

[132] *Id*. at fig. 2.

[133] Mary Leslie, *SoCal Economy Will Benefit from 100 Percent Renewable Energy*, DAILY NEWS, Sept. 12, 2017, https://www.dailynews.com/2017/09/12/socal-economy-will-benefit-from-100-percent-renewable-energy/ [https://perma.cc/3UK9-U2BM].

[134] Tradable renewable energy credits (TRECs) are "renewable energy credits that are unbundled from the associated renewable energy used to produce the attribute." Fershee, *supra* note 119, at 81.

California's three largest utilities' annual RPS requirements.[135] Under the California Energy Commission's current guidelines, "credits or payments associated with the reduction of solid waste" also qualify for the credits.[136]

Connecticut's Renewable Energy Portfolio (REP) assumes that by 2020, Connecticut will produce 27% of energy from renewable sources within its three classes, deriving most of its total output from Class I.[137] Connecticut's three Classes are composed of the following: Class I includes "classic" renewable sources of energy, such as solar or wind power, but also some types of biomass facilities; Class II includes solid waste facilities; and Class III includes waste heat-recovery systems.[138] Connecticut offers a lot of potential for waste-to-energy facilities to generate a considerable share of the state's REP obligations. Under Connecticut's RECs mechanism, the owner of an electricity-generating project in Connecticut may choose to either contract to sell its energy "'bundled' with the accompanying attribute value directly to an electricity provider (usually at a premium above the wholesale electricity price)," or separate the REC and energy and sell them in the regional wholesale market.[139] Although RECs generated by waste-to-energy facilities in Connecticut have historically sold at a lower price than those generated by solar or wind power,[140] recently signed Public Act 17-144 aims to address this problem by increasing the number of waste-to-energy RECs utilities must purchase.[141] This measure has already drawn criticism from some

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135 *Id.* at 81; *California*, SREC TRADE, http://www.srectrade.com/srec_markets/california [https://perma.cc/X4N2-9PTQ] (last visited Jan. 24, 2018).

136 CAL. PUB. UTIL. CODE § 399.12(h)(2) (West 2018).

137 CONN. DEP'T ENERGY & ENVTL. PROTECTION, CONN. RENEWABLE PORTFOLIO STANDARD, http://www.ct.gov/pura/cwp/view.asp?a=3354&q=415186 [https://perma.cc/45VR-FVHH] (last updated December 2017).

138 CONN. GEN. STAT. §§ 16-1(a)(20)–(21), (38). Note, however, that since 2015, REC values for Class I biomass and landfill methane gas have been decreasing. *Renewable Portfolio Standard*, N.C. ST. U. N.C. CLEAN ENERGY TECH. CTR., http://programs.dsireusa.org/system/program/detail/195 [https://perma.cc/9X6Q-6XKF] (last updated Nov. 2, 2017).

139 CONNECTICUT RENEWABLE PORTFOLIO STANDARD, CT DEEP (2016), http://www.ct.gov/pura/cwp/view.asp?a=3354&q=415186 [https://perma.cc/JD6D-PFBF].

140 *See* Matt Pilon, *CT Throws a Lifeline to Fuel Cells, Waste to Energy*, HARTFORD BUS.COM (July 10, 2017), http://www.hartfordbusiness.com/article/20170710/PRINTEDITION/307069972 [https://perma.cc/3VD5-EC7R] (explaining that waste-to-energy facilities faced the problem with supply of credits outpacing demand).

141 *See* Pub. Act No. 17-144 (providing that in 2018, 2019, and 2020 "an additional four percent of the total output or services shall be from Class I or Class II renewable energy sources," and imposing penalties if the wholesale supplier fails to comply with this Renewable Portfolio Standard requirement); *see also* Judy Benson, *Source: The Day: Bill Would Add Premium Price to Power from Burning Trash*, CITIZENS CAMPAIGN (March 3, 2012), https://www.citizenscampaign.org/news/story.asp?id=509 [https://perma.cc/APM2-RCYF] (reporting that in 2012 the state legislature considered a bill that would impose the same premium rates for electricity generated by trash incinerators as electricity generated by more popular sources of renewable energy, effectively treating waste-to-energy facilities as Class I renewable energy sources).

environmental groups who argue that promoting waste incineration will not only provide an incentive to produce more trash, but also contradicts the goals of the state's Zero Emission and Low Emission RECs program.[142]

Oregon's RPS requires that 50% of the electricity Oregonians use come from renewable resources by 2040.[143] RECs in Oregon can be bundled with, or purchased separately from, electricity contracts, but the unbundled RECs can only meet 20% of a large utility's and 50% of a large consumer-owned utility's RPS obligation.[144] However, only eleven megawatts of municipal solid waste can count towards the RSP goals each year.[145] This limited framework leaves a lot of room for improvement, but the most worrisome characteristic of Oregon's RPS is that it does not incentivize the use of waste incinerators.

Extending the REC framework to include crematoria would incentivize energy developers to pursue novel sources of renewable energy for investment. Because two of the three states discussed—California and Oregon—would arguably classify human bodies as biomass under their RPS definitions, perhaps crematoria-generated electricity could become eligible to receive RECs. In Connecticut, where the state has a well-established framework for MSWIs, legislators could create a separate classification for human bodies beyond the already-existing noninclusive biomass.

A REC mechanism for crematoria would work similar to wind farms. First, crematoria would generate electricity to be distributed to the grid.[146] In exchange for the supply of electricity, crematoria would receive from the utility both the price under the power purchase agreement and a certificate. The utility would then transmit the electricity to customers.

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[142] CONNECTICUT COALITION FOR ENVIRONMENTAL JUSTICE, COMMENTS ON DEEP RESOURCE REDISCOVERY RFP PHASE II ON MODERNIZING THE CONNECTICUT SOLID WASTE SYSTEM PROJECT 2 (Nov. 2017) ("Trash incineration . . . is highly polluting, is dirtier than coal burning by most measures, and is NOT preferable to directly landfilling waste. Trash incineration is the most expensive and polluting way to manage waste or to produce energy."). Under this program, utilities have an obligation to enter into long-term contracts for Low Emission RECs from Class I facilities up to two MW, and Zero Emission RECs from Class I facilities up to one MW. *Renewable Energy Credits*, EVERSOURCE, https://www.eversource.com/content/ct-c/residential/save-money-energy/explore-alternatives/renewable-energy-credits [https://perma.cc/J9B9-YLHJ] (last visited Jan. 24, 2017).

[143] *Renewable Portfolio Standard*, OREGON DEP'T OF ENERGY, https://www.oregon.gov/energy/energy-oregon/Pages/Renewable-Portfolio-Standard.aspx [https://perma.cc/S2ES-V73K] (last visited May 10, 2017).

[144] *Renewable Portfolio Standard: Program Overview*, DATABASE OF ST. INCENTIVES FOR RENEWABLES & ENERGY, http://programs.dsireusa.org/system/program/detail/2594 [https://perma.cc/2FL8-FMVK] (last visited Jan. 24, 2017).

[145] AMERICAN COUNCIL ON RENEWABLE ENERGY (ACORE), RENEWABLE ENERGY IN THE 50 STATES: WESTERN REGION 26 (Sept. 2014).

[146] *Renewable Energy Certificates (RECs)*, ENVTL. PROT. AGENCY, https://www.epa.gov/greenpower/renewable-energy-certificates-recs [https://perma.cc/GKF5-HC8C] (last visited Feb. 1, 2018).

Crematoria would sell the certificate on the open market, which might be purchased, for example, by an end-use customer or utility. This would promote further development of renewable energy, possibly drawing Congress' attention towards creating a uniform, "nationwide REC market[, where] . . . obligated parties place renewable generation capacity in places where the technology will be economically feasible."[147]

C. *Challenges and Solutions*

This preceding discussion raises a question—who will ultimately get ownership of the certificate? Part III.C attempts to answer this question by looking to property laws in California, Connecticut, and Oregon. It also explores pertinent environmental risks and ethical concerns.

1. *Property Concerns: Right of Disposal*

Who owns the certificate? On the one hand, the incentive of the REC mechanism would seem to provide that the owner of the renewable energy generating facility be issued the certificate. Because crematoria owners are in actual possession of the human body (the biomass) and it is their work that generates the electricity in the process, perhaps they should receive it. On the other hand, the decedent's family members have property rights to dispose of the body. In the absence of a will, or while carrying out the wishes of the decedent, they are the ones who make a decision to transport and surrender the corpse to the crematorium for it to be disposed of and converted into renewable energy.

Traditionally, dead bodies were not considered property, although courts have considered them in a quasi-property context. The right to the remains of the deceased for the purpose of providing proper burial, known as the right of sepulcher, has long been recognized at common law as a legal right.[148] However, "there [has been] no legally recognized property right in a dead body, and modern laws in the United States regarding the treatment of dead bodies derive from the government's police powers to guard public health."[149] Today, when a right to a burial is recognized both in the sphere of ethics as well as at common law, there is still no universal rule that would determine to whom the right of burial is granted. In some jurisdictions, a spouse or other relative of the deceased ordinarily has the right to possession of a corpse for the purpose of burial.[150] Nonetheless,

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[147] Hartman, *supra* note 49, at 20.

[148] *See* Correa v. Maimonides Med. Ctr., 165 Misc. 2d 614, 617 (N.Y.S. 1995) ("This right, characterized as the right of sepulcher under common law, continues to be recognized by the courts notwithstanding the passage of many hundreds of years.").

[149] JACKSON, *supra* note 106, at 14.

[150] *See* Sherman v. Sherman, 750 A.2d 229, 235 (N.J. Super. Ct. Ch. Div. 1999) ("[C]ourts generally concluded that the surviving spouse's desires had priority over other relatives, including

even when the decedent leaves a will behind, courts will often refuse to honor the decedent's wishes because "a dead body [cannot] be viewed as property belonging to the estate."[151] When the decedent's wishes are unknown, however, a court may ask the spouse or the surviving kin to indicate how they would like the body to be disposed of, so long as these wishes are reasonable and not contrary to public policy.[152] The property right to a dead body may be limited by concerns regarding public health, safety, and welfare.[153]

In California, there are designated classes of persons who have a right to dispose of the body of a deceased person, including: (1) an agent under a power of attorney for health care, (2) a competent surviving spouse, and (3) next of kin.[154] California law does not require the family of the deceased to use a funeral director.[155]

Connecticut residents have the right to declare their own wishes for the disposition of their bodies, or to appoint an agent to fulfill their wishes after death.[156] In the absence of such declaration, however, the following classes of persons, in priority order, have the right to custody and disposition of a body: (1) a spouse, (2) adult children, (3) parents, (4) siblings, (5) next of kin, or (6) a designee of the probate court.[157]

Oregon too has a personal preference law, and in the absence of disposition directions, the following classes of persons may assume the right to control dispositions of remains: (1) a spouse, (2) adult children, (3) parents, (4) adult siblings, (5) a guardian, (6) next of kin, (7) a personal representative of the estate of the decedent, (8) a person nominated in the decedent's last will, or (9) a public health officer.[158]

Except for the last class of persons, which often includes a public health officer or a designee of the probate court, the law in all three states

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children of the decedent."); Felipe v. Vega, 570 A.2d 1028, 1031 (N.J. Super. Ct. Ch. Div. 1989) (holding that the deceased's former companion's request to disinter companion's body and to move it to a cemetery within walking distance of her home showed good cause to overcome the presumption against right of removal); Fidelity Union Trust Co. v. Heller, 84 A.2d 485, 487 (N.J. Super. Ct. Ch. Div. 1951) (holding that even though the testator had expressed a wish to be buried in a mausoleum erected on a designated plot, but the testator during his lifetime purchased a plot in another cemetery, the executors would be relieved from having to carry out the express directions of a will).

[151] *Sherman*, 750 A.2d at 234.

[152] Lubin v. Sydenham Hosp., Inc., 181 Misc. 870, 871 (N.Y.S. 1943).

[153] *See* Wolf v. Rose Hill Cemetery Ass'n, 832 P.2d 1007, 1009 (Colo. App. 1991) (holding that in making a decision whether the body should be disinterred, the following equitable considerations are weighted: length of time interred, the practicality of disinterment, impact of disinterment on others (citing Hoppe v. Cathedral Cemetery, No. 2525, 1915 WL 3349, at *5 (Pa. Ct. Com. Pl. March 22, 1915))).

[154] CAL. HEALTH & SAFETY CODE § 7100 (West 2018).

[155] *Id.*

[156] CONN. GEN. STAT. § 45a-318 (2018).

[157] *Id.*

[158] OR. REV. STAT. § 97.130 (2018).

prioritizes the rights of the decedent's family and grants no such rights to the funeral director or crematorium owner.

The next Section supplements this discussion with a different perspective. It offers an argument for awarding the certificate to the crematorium owner based on ethical and financial considerations.

2. *Ethical Concerns: Traditions and Finances*

Modern ways of disposing of dead bodies are not universally accepted across different groups. Death practices vary and are deeply embedded within the cultural and religious traditions of different people. For example, Orthodox Judaism forbids cremation[159] and the Catholic Church did not approve of cremation until recently.[160] In some cultures, which believe in the importance of the last farewell, families want to see the body before it is buried in the ground.[161] In most instances, customs mandate that the deceased body be buried in the ground; however, sometimes the family also asks to open the casket before the ceremony. While cremation disregards some of these traditions altogether, it is unfortunately true that money often plays a role. Awarding a REC to the family of the deceased may lead to bad public policy outcomes, encouraging some families to abandon their religious traditions in lieu of a tradeable commodity.

Another argument for awarding the certificate to the crematorium owner involves the incentives, or the lack of incentives, funeral directors have to promote cremation. Cremations offer a cheaper alternative to the traditional funeral, mostly because they utilize fewer resources than conventional burials. This, in turn, means that funeral directors or crematoria owners receive less compensation from the process than they would have received had the family chosen a traditional burial.[162] This predicament poses ethical questions. Scholars in this area speculate that one of the reasons why cremations have not yet reached the peak of their popularity is because funeral directors are not incentivized to promote cremation and instead choose to induce customers to opt for a traditional burial over cremation.[163] Funeral directors have long been known to use deceptive techniques, such as grief counseling, to trick customers into

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[159] *Jewish Views on Cremation*, MY JEWISH LEARNING, http://www.myjewishlearning.com/article/judaism-on-cremation/ [https://perma.cc/Q5MD-XMWW] (last visited Oct. 28, 2017).

[160] Marshall Connolly, *Catholic Church Issues New Guidelines for Cremation. Here's What You Need to Know*, CATHOLIC ONLINE (Oct. 25, 2016), http://www.catholic.org/news/hf/faith/story.php?id=71581 [https://perma.cc/UWL8-5M3D].

[161] *See supra* notes 159 & 160.

[162] David E. Harrington & Kathy J. Krynski, *The Effect of State Funeral Regulations on Cremation Rates: Testing for Demand Inducement in Funeral Markets*, 45 J.L. & ECON. 199, 200 (2002).

[163] *Id.*

buying a more expensive service.[164] Awarding a REC to the funeral director would offer a positive financial incentive to those who, without such an incentive, might encourage families to undertake traditional burials for the sake of turning a greater profit. This would also help families save money in the burial process.

Further ethical questions remain. The Code of Ethics of the International Cremation Federation simply states that "[t]he products or residue of a cremation shall not be used for any commercial purpose."[165] It may be the case that the age-old funeral profession is just not ready for the novelty of this proposal.

3. *Environmental Risks: Emissions and Odors*

Finally, this Section offers closure to this Note's discussion on the use of crematoria for clean energy production with an analysis of the three major environmental risks associated with cremation: (1) the use of fossil fuels to start the combustion engine, (2) mercury emissions, and (3) emissions of chemical compounds like nitrogen oxide. To ultimately answer the question of whether it is economically and environmentally feasible to burn human bodies as biomass, this Section will explore the problems associated with each of the above hazards and offer available solutions to remedy the problem.

First, it appears that even though burning dead bodies in a crematorium is by itself a clean energy solution, the process of combustion still requires the use of fossil fuels. With current technology, crematoria run on combustion engines fueled by natural gas, which means that they emit carbon dioxide into the atmosphere.[166] In order for crematoria to be classified as a source of renewable energy and subject to the REC program, a question must be answered: will the amount of clean energy produced by crematoria offset the amount of dirty energy produced to operate the combustion engines?[167] One way to remedy this potential problem is to replace the natural gas that is currently used with biofuel, as discussed in Part I.C.

Second, burning dead bodies may contribute to emissions of mercury —called "cremercury" in scientific literature[168]—present in dental

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[164] *Id.* at 201, 221.

[165] EUROPEAN STANDARD (EN): FUNERAL SERVICES – REQUIREMENTS, No. 15017, ICS 03.080.30, (Annex B), art. 8 at 28 (EUR. COMM. FOR STANDARDIZATION 2005).

[166] Clint Williams, *No, We Can't Burn People for Electricity*, MOTHER NATURE NETWORK (June 7, 2013, 3:41 PM), http://www.mnn.com/earth-matters/energy/stories/no-we-cant-burn-people-for-electricity [https://perma.cc/LE98-KLH8].

[167] *Id.*

[168] *See, e.g.*, Philip Donald Batchelder, Comment, *Dust in the Wind? The Bell Tolls for Crematory Mercury*, 2 GOLDEN GATE U. ENVTL. L.J. 118, 123 n.35 (2008) ("The cremation industry coined the

amalgam fillings in tooth cavities.[169] In the process of incineration, these fillings undergo volatilization which, in turn, releases mercury—an element "rank[ed] as the second most poisonous compound on earth . . . ."[170] The Food and Drug Administration cautions that "[h]igh levels of mercury vapor exposure are associated with adverse effects in the brain and the kidneys."[171] However, since cremation on average emits only two to three grams of mercury,[172] the emissions have been considered too low to merit regulation in the United States.[173] Scientists expect that cremercury emissions will continue to increase until 2020—when they will have grown by two-thirds since the 2000s—before decreasing back to the level of emissions of the 2000s around 2055.[174] These estimates are based on the observance of two related trends. First, the majority of people who will be pronounced dead in the next few decades include the large baby boomer population, which is the largest group of people who have mercury amalgam dental fillings.[175] Since 2000, when around 175,000 dentists in the United States installed some 100 million amalgams in patients' teeth each year,[176] the practice has gradually become obsolete.[177] Second, with the increase in the number of people who choose cremation over traditional funeral services, the number of people with mercury amalgam dental fillings who undergo the cremation process will be the greatest in the next few decades. For example, by 2030, scientists anticipate that more than half of all United States residents will opt for cremation, which is a pool of people with an aggregate reservoir of as much as 1,000 tons of mercury in fillings.[178] In Oregon alone the estimated amount of cremercury produced

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term 'cremains' from 'cremated ashes.' This Comment follows suit with 'cremercury.'" (citing JESSICA MITFORD, THE AMERICAN WAY OF DEATH REVISITED 17 (2d ed. 1996))).

[169] *Id.* at 120; *see also* Kimberly M. Baga, *Taking a Bite out of the Harmful Effects of Mercury in Dental Fillings: Advocating for National Legislation for Mercury Amalgams*, 20 J.L. & HEALTH 169, 179 (2007) (discussing both sides of the mercury amalgam debate, with "anti-amalgamists calling for the complete removal of mercury in dental fillings"); Paul Rahill, *Mercury & Cremation Issues Revisited*, CREMATION ASS'N OF N. AM., http://www.cremationassociation.org/?MercuryAndCremation [https://perma.cc/QT84-A5PL] (last visited Feb. 16, 2018) (describing how the presence of mercury in amalgam dental fillings results in the presence of the element in crematory emissions).

[170] Batchelder, *supra* note 168, at 120.

[171] *About Dental Amalgam Fillings*, U.S. FOOD & DRUG ADMIN., https://www.fda.gov/MedicalDevices/ProductsandMedicalProcedures/DentalProducts/DentalAmalgam/ucm171094.htm [https://perma.cc/4YM4-Y3VL] (last updated Dec. 5, 2017).

[172] Batchelder, *supra* note 168, at 124.

[173] *See id.* at 131 (positing that cremercury is not regulated by the federal government because crematories do not emit significant amount of mercury pollution).

[174] *Id.* at 125.

[175] *Id.*

[176] *Id.* at 124.

[177] *See id.* at 145 (predicting that "mercury will likely be phased out of dentistry altogether" in the coming decades).

[178] *Id.*

is 43 pounds per year, which, in theory, could contaminate 19,500 lakes, poisoning the food chains within.[179] Although 43 pounds makes up only 3% of Oregon's total emissions, this illustrates the extent of the cremercury problem.[180] With cremation becoming more popular, it is likely that states will soon think of drafting policies targeting cremercury emissions. This Note provides two ways of addressing this problem.

One of the possible solutions is to install filtration technologies to capture the toxin. However, the technology is very costly[181] and the process results in large volumes of contaminated water discharge waste.[182] Another, cheaper solution is to mandate that all dental amalgam fillings be removed from a body prior to cremation. The removal process could follow the organ-donor model: the living consent to their teeth being removed upon death (as organ donors consent to having their organs removed).[183] This approach would have at least three distinct benefits: (1) it would allow the living donor to make an informed decision, taking the burden of responsibility away from either the funeral director or the mourning family of the deceased; (2) it would inform the funeral and crematory workers of the presence and location of amalgam fillings, reducing the time spent on preparing the body for incineration; and (3) it would prevent funeral directors from "stealing" dental fillings, which often include valuable materials like silver or gold.[184] Overall, this solution would also help to preserve the sanctity of the funeral process.

The third environmental risk associated with cremation is that burning dead bodies releases a magnitude of chemical compounds into the atmosphere, including "carbon dioxide, carbon monoxide, nitrogen oxide, [sulfur] dioxide, hydrogen chloride gas, hydrogen fluoride, and mercury [vapor]."[185] In addition to these compounds, which contribute to greenhouse gas emissions, crematoria also produce some organic carcinogenic compounds.[186] There is currently no regulation for the toxic metals present in the dead body, although funeral directors customarily remove jewelry and metal joints before cremation.[187] In a study sponsored by the Cremation Association of North America, scientists found that

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[179] *Id.* at 122–23.

[180] *Id.* at 123.

[181] Filtration equipment costs as much as $690,000. *Id.* at 144–45.

[182] *Id.* at 145.

[183] *Id.* at 153.

[184] *Id.* at 153–54.

[185] *More About Cremation and Its Impact on the Environment*, CALGARY COOPERATIVE MEMORIAL SOC'Y, http://www.calgarymemorial.com/effect-of-cremation-on-environment.html [https://perma.cc/D3BW-R7S3] (last visited May 10, 2017).

[186] Megan Love Huffman, *Metals in Medicine and the Environment: Cremation Waste and Toxins*, http://faculty.virginia.edu/metals/cases/huffman1.html [https://perma.cc/ZY2A-V58D] (last modified Aug. 5, 2009).

[187] *Id.*

although filtration methods are not very successful in reducing the amount of toxins released during cremation, the yearly toxin release from crematoria worldwide is only a small fraction of greenhouse gases globally.[188]

In the discussion of environmental risks associated with the cremation process, important consideration should be given not only to the concerns of the scientists, but also to those of the public. It is not surprising that the public often perceives crematoria to be notorious for visible emissions and odors.[189] Even with the best technologies reducing the amount of cremercury emitted in the process, crematoria will remain a dirty business, releasing into the air a variety of exhausts and odors. Whether or not crematoria-source odors are a greater nuisance than odors coming from cemeteries is a separate question.[190] But what this Note attempted to prove in Part II is that crematoria offer an alternative to cemeteries, which have become resource- and land-intensive. Crematoria not only take up less space than cemeteries, but are also strategically placed in locations where the process of cremation—with or without the odors emitted—is of the least nuisance to the neighborhood residents.

CONCLUSION

Given the depleting reservoirs of fossil fuels, developing novel sources of renewable energy is not optional anymore—it is necessary. While different cultures across the world stay focused on the search for separate solutions to the waste problem and the energy supply problem, they miss the potential benefit of a combined solution. Learning from the experience of solid waste and biomass incinerators, crematoria might become a leading and innovative source of combustible energy. This solution is particularly viable today, when traditional burials—rituals celebrating the afterlife—are becoming obsolete due to public health and spatial concerns.

T.S. Eliot wrote in his famous poem, "The Waste Land": "That corpse you planted last year in your garden/Has it begun to sprout? Will it bloom this year?"[191] It might just happen that with the development of crematoria, energy will become more readily available in cities or even our backyards. And with the right incentives, such as renewable energy credits, the energy market can be transformed. Although this solution is far from perfect and

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[188] *Id.*

[189] *See, e.g.*, Union Cemetery Co. v. Harrison, 101 So. 517, 519 (Ala. Ct. App. 1924) (holding that a cemetery is a nuisance where "noxious, deleterious, and disagreeable odors" exist); *see also* CALGARY COOPERATIVE MEMORIAL SOC'Y, *supra* note 185 (discussing the processes by which emissions are controlled and the relatively miniscule contribution crematoria have to total greenhouse gas emissions).

[190] JACKSON, *supra* note 106, at 209.

[191] T.S. ELIOT, THE WASTE LAND 7 (Michael North ed., W.W. Norton & Co. 2001) (1922).

skeptics of crematoria-generated electricity have plenty of environmental and ethical concerns, we do know this: while modern technology will not make a person immortal, it might just keep the Earth sustained.