Methane Digesters and Biogas Recovery—Masking the Environmental Consequences of Industrial Concentrated Livestock Production

*Nicole G. Di Camillo**

* J.D., UCLA School of Law, 2011; B.S., B.A., Indiana University, 2006. I would like to thank Sean B. Hecht, UCLA School of Law, for his guidance and mentorship. I would also like to thank Michael S. Cagle and Andreas Rechtsteiner for their support, proof-reading, and invaluable feedback.

I.
INTRODUCTION

As climate change becomes a prominent focus in environmental protection policy, the agriculture sector's role in greenhouse gas emissions is gaining attention. It has become clear that agriculture, and livestock production in particular, are major worldwide contributors to greenhouse gas emissions, and government agencies are seeking solutions to deal with these emissions. Methane digesters ("digesters"), alternatively referred to as "dairy digesters" or "anaerobic digesters," are being promoted by the U.S. Environmental Protection Agency ("EPA") and the U.S. Department of Agriculture ("USDA") as a way to reduce greenhouse gas emissions from intensive livestock and dairy operations; the accompanying biogas recovery systems are promoted as an auspicious source of renewable energy production from such facilities. Digesters, marketed as an alternative waste management technology, ostensibly mitigate methane emissions caused by the high concentration of livestock manure stored on such facilities. They capture the methane that is released as a result of anaerobic bacterial digestion of manure, which can subsequently be burned as an alternative biogas fuel source, potentially providing economic and environmental benefits. The EPA, USDA and U.S. Department of Energy ("DOE") jointly coordinate the AgStar program, which provides financial subsidies and educational guidance for developing digester systems, and many states provide additional subsidies or tax credits for encouraging the implementation of digesters.

The benefits of digesters are not, however, unequivocal. First, there are serious questions about the efficiency of digesters—they are very expensive, often prohibitively so without subsidies. The biogas recovery process itself creates emissions of other air pollutants, which in turn can contribute to global warming. In addition, digesters do not in fact reduce the actual quantity or nutrient load of manure, which are among the major problems associated with large-scale livestock production; in other words, at the end of the digestion process, large-scale facilities still have a large manure problem on their hands.

Second, it is important to recognize the context in which most digesters tend to be cost-effective and profitable. Digesters are profitable, arguably only with the help of subsidies, at industrial-scale concentrated livestock facilities, often referred to as Concentrated Animal Feeding Operations ("CAFOs").[1] These facilities contribute to a host of environmental problems aside from methane emissions. Notwithstanding the benefits derived from methane digestion and biogas recovery systems extolled by the EPA and USDA, industrial livestock production in its entirety is still a major contributor to greenhouse gas emissions. Methane emissions from manure management are responsible for only a fraction of the system-wide greenhouse gas emissions associated with such production and only a small percentage—approximately seven percent—of overall methane emissions in the United States. Beyond greenhouse gas emissions, industrial livestock production contributes to "traditional" air and water pollution problems, and raises important public health concerns. Although CAFOs are a significant source of air and water pollution, their regulation under U.S. environmental laws has been inconsistent or sometimes non-existent.[2] CAFOs emit air and water pollutants[3] and water quality is consistently threatened by the large quantity and high concentration of manure stored on such facilities,[4] problems which digesters do nothing to address.

The purported benefits of digesters must, thus, be assessed within the context of these issues so that they do not have the effect of "greenwashing" the environmental practices of large industrial livestock operations—making it seem that those who implement digesters are part of a solution instead of a major contributor to the problem. I argue in this comment that, in light of the major pollution problems associated with CAFOs, the benefits conferred by digester systems are minimal, and moreover, that the government should not offer obligation-free subsidies and resources to CAFOs to implement such systems. These systems can potentially confer economic benefits to such opera-

1. "CAFO" is the EPA's term of art for "Medium" and "Large" Animal Feeding Operations ("AFOs"), statutorily defined at 40 CFR § 122.23 (2010). *See infra* Part I.C.iii for further discussion of the nature of CAFOs. CAFOs are in essence, large-scale, industrial-style livestock facilities where animals are confined and fed, rather than being allowed to pasture.

2. *See generally* Nicolai V. Kuminoff, *Public Policy Solutions to Environmental Externalities From Agriculture, in* The 2007 Farm Bill and Beyond 115, 119 tbl.1 (Bruce L. Gardner & Daniel A. Sumner eds., 2007), *available at* http://www.aei.org/docLib/20070516_Summary.pdf.

3. Viney P. Aneja, *Effects of Agriculture upon the Air Quality and Climate: Research, Policy, and Regulations*, 43 ENVTL. SCI. TECH. 4234, 4234–4240 (2009).

4. Kate Celender, *The Impact of Feedlot Waste on Water Pollution Under the National Pollutant Discharge Elimination System (NPDES)*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 947, 949 (2009).

tions while the operators continue to practice in the same environmentally unsound manner, apart from some reduction in methane emissions. Subsidies for digester systems are an inefficient and dangerous distraction from the real environmental problems posed by CAFOs, which should be the focus of agriculture-related environmental protection efforts.

Instead of promoting digesters, which provide only minimal environmental benefits, I argue that the government should be increasing regulation of CAFOs under existing environmental laws. CAFOs should be required to internalize the environmental costs of their method of livestock production, not subsidized to continue to produce livestock in a largely unsustainable manner. I ultimately conclude that the government should focus attention and resources not on such arguably dubious technologies as a way to address the environmental problems associated with industrial livestock production, but instead on ways of promoting more comprehensive, sustainable, long-term solutions to developing livestock and agricultural production systems which are protective of the environment and public health.

Part I will discuss the recent attention that digesters have received from government agencies, describe the AgStar program, and explain how digester systems work. This section will also discuss some of the critiques that have been made of digester systems—in particular, criticisms that digesters contribute to other forms of air pollution, and are only feasible for industrial-scale, concentrated livestock facilities. Part II will discuss the contribution of industrial livestock operations to climate change more broadly. The focus will be on how, when viewed in the context of the entire industrial livestock commodity chain, methane from manure accounts for only a small fraction of the sector's greenhouse gas emissions. Part III will discuss how, beyond greenhouse gas emissions, industrial livestock production contributes to "traditional" pollution problems and raises significant public health concerns. This part will also review the inadequacy of current regulation of CAFOs and suggest increasing regulation. This part will conclude with the argument that, given the substantial environmental impact of CAFOs, the cost of digesters (if implemented) should be borne by CAFO operators themselves, not supported with scant public resources.

II. METHANE DIGESTERS AND BIOGAS RECOVERY— IN THE SPOTLIGHT

A. *Digesters Have Received Attention for Their Potential to Mitigate Greenhouse Gas Emissions from Livestock Production Facilities*

As climate change begins to take center stage in the environmental protection dialogue, dairy and livestock facilities, as well as agriculture more broadly, are beginning to garner attention.[5] Agriculture is a major international contributor of greenhouse gas emissions (GHGs) — "about one-third of the total human-induced warming effect due to GHGs comes from agriculture and land-use change."[6] In the United States, agricultural emissions constitute approximately 8% of total U.S. GHG emissions.[7] Worldwide, it is estimated that the livestock sector alone (beef and dairy cattle, swine, and poultry) accounts for 18% of GHGs, more than the transportation sector.[8] Agricultural operations release carbon dioxide, methane and nitrous oxides and "increasing evidence shows that the greater size and intensity of farms and concentrated animal-feeding operations (CAFOs) increase the emissions of odorous compounds (e.g., organic acids) and trace gases (e.g., carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), nitrogen oxides (NO_x), ammonia (NH_3) and reduced sulfur compounds."[9] The livestock sector is responsible for "65% of anthropogenic nitrous oxide, 37% of anthropogenic

5. As just one recent example, *see* Press Release, USDA, 0075.11, USDA Requests Public Comment on the Development of Tools and Guidance for Estimating Greenhouse Gases (Feb. 18, 2011), http://www.usda.gov/wps/portal/usda/usdahome?contentid=2011/02/0075.xml&navid=NEWS_RELEASE&navtype=RT&parentnav=LATEST_RELEASES&edeployment_action=retrievecontent (discussing the USDA seeking public comment on a new project geared at developing tools for estimating greenhouse gas emissions from farm, ranch and forest land owners). *See also* Notice of Development of Technical Guidelines and Scientific Methods for Quantifying GHG Emissions and Carbon Sequestration for Agricultural and Forestry Activities, 76 Fed. Reg. 34 (Feb. 18, 2011).

6. KEITH PAUSTIAN ET AL., PEW CTR. ON GLOBAL CLIMATE CHANGE, AGRICULTURE'S ROLE IN GREENHOUSE GAS at iii (2006), *available at* http://www.pewclimate.org/docUploads/Agriculture%27s%20Role%20in%20GHG%20Mitigation.pdf.

7. *Id.* at 4.

8. HENNING STEINFELD ET AL., FOOD & AGRIC. ORG. OF THE U.N., LIVESTOCK'S LONG SHADOW: ENVIRONMENTAL ISSUES AND OPTIONS, at xxi, 112 (2006), *available at* ftp://ftp.fao.org/docrep/fao/010/a0701e/a0701e.pdf.

9. Aneja, *supra* note 3, at 4235.

methane, and 64% of anthropogenic ammonia."[10] Livestock and dairy operations in particular are large releasers of methane,[11] particularly salient to climate change as methane is over 20 times as effective at trapping heat as carbon dioxide.[12]

At the 2009 Climate Summit in Copenhagen, U.S. Secretary of Agriculture Tom Vilsack announced a Memorandum of Understanding between the USDA and The Innovation Center for U.S. Dairy with the goal of combating the dairy industry's contribution to greenhouse gas emissions. The major thrust of the agreement was to "[a]ccelerate and streamline the process for adopting anaerobic digesters by the United States dairy farm operators through various USDA programs" with a goal of reducing the dairy industry's greenhouse gas emissions by 25% over the next decade.[13] More recently, the EPA and USDA "announced a new interagency agreement promoting renewable energy generation and slashing greenhouse gas emissions from livestock operations. The agreement expands the work of the AgStar program, a joint EPA-USDA effort that helps livestock producers reduce methane emissions from their operations."[14] The EPA, USDA and DOE jointly coordinate the AgStar Program, which functions as "an outreach program designed to reduce methane emissions from livestock waste management operations by promoting the use of biogas recovery systems. . . . at confined livestock facilities that handle manure as liquids and slurries, typically swine and dairy farms."[15] The new collaboration will allocate "up to $3.9 million over the next five years to help the farms overcome obstacles preventing them from recovering and using biogas"[16] and as Vilsack pointed out, "the part-

10. *Id.*

11. Methane is released at concentrated animal production facilities via manure storage and ruminant digestion emissions from the animals themselves. Manure stored in anaerobic conditions, such as in the covered lagoons or holding tanks present at most CAFOs, produces methane as a result of anaerobic bacterial digestion of the manure. *See infra* Part II.A (discussing how methane emissions from ruminant digestion largely trump emissions from manure storage).

12. *Methane*, ENVTL. PROT. AGENCY, (May 5, 2010), http://epa.gov/methane/.

13. *Dairy Industry Aims to Cut GHG 25% by 2020*, 111 DAIRY FOODS 1 (Jan. 1, 2010).

14. *See* Press Release, U.S. Dept. of Agric., EPA Administrator and Agriculture Secretary Team Up to Promote Farm Energy Generation Agreement Will Help Cut Greenhouse Gas Emissions (May 3, 2010), http://www.epa.gov/aging/press/epanews/2010/2010_0503_1.htm [hereinafter EPA-USDA Press Release].

15. *AgStar – About Us*, ENVTL. PROT. AGENCY, http://www.epa.gov/agstar/about-us/index.html (last updated June 2, 2011).

16. EPA-USDA Press Release, *supra* note 14.

nership . . . will not only help generate renewable energy, but provide new income opportunities for farmers and ranchers."[17]

Most of the federal funding for digester systems comes from the Food, Conservation, and Energy Act of 2008 (i.e. the Farm Bill), specifically through the Rural Energy for America Program ("REAP"). The funding for REAP recently increased from $155 million to $255 million, with which the USDA plans to continue to provide "grant and loan funds for construction of proven anaerobic digester systems" as well as provide "technical assistance and feasibility studies."[18] Since 2003, the USDA Rural Development program has "awarded more than $40 million for anaerobic digestion systems."[19] The Farm Bill itself also establishes loans and grant programs "to help farmers purchase renewable energy systems, including methane digesters."[20] State agencies and programs, such as the California Energy Commission and Wisconsin Focus on Renewable Energy Program, have also coordinated with AgStar to facilitate the development of digesters.[21] Various state tax incentives and credits also foster the development of digester systems as sources of renewable energy—for example, the state of Michigan exempts agricultural methane digesters from property taxes.[22]

B. *How Digesters Work—Their Potential for Environmental Benefits and Renewable Energy Production*

One source of methane emissions from CAFOs is from manure stored in concentrated liquid, anaerobic (i.e. oxygen-free) conditions, such as in lagoons or holding tanks. The oxy-

17. *Id.*

18. *AgStar – Frequent Questions*, ENVTL. PROT. AGENCY (Apr. 29, 2009), http://www.epa.gov/agstar/faq.html.

19. DEP'T OF AGRIC. – AGSTAR, FUNDING PROGRAMS FOR DEVELOPING ANAEROBIC DIGESTION SYSTEMS (Apr. 2011), *available at* http://www.epa.gov/agstar/documents/agstar_federal_incentives.pdf.

20. Deanne M. Camara Ferreira, *Global Warming and Agribusiness: Could Methane Gas From Dairy Cows Spark the Next California Gold Rush?*, 15 WIDENER L. REV. 541, 550 (2010).

21. Envtl. Prot. Agency, *AgStar Digesters Continue Accelerating in the U.S. Livestock Market,* AGSTAR DIGEST, Winter 2006, at 1, 2, *available at* http://www.epa.gov/agstar/news-events/digest/2006digest.pdf.

22. MICH. COMP. LAWS § 211.9 (1979), *available at* http://legislature.mi.gov/doc.aspx?mcl-211-9; *see also AgStar Funding On-Farm Biogas Recovery Systems: A Guide to Federal and State Resources*, ENVTL. PROT. AGENCY, *available at* http://www.epa.gov/agstar/tools/funding/index.html (last updated May 26, 2011). *See generally* Ferreira, *supra* note 20, at 542 (describing numerous Federal, State and private sector incentive systems for developing digesters).

gen-free atmosphere allows bacterial breakdown, or digestion, of the manure. This digestion results in the release of approximately 60% methane and 40% carbon dioxide gases.[23] Manure management from livestock operations in 2009 accounted for 49.5 $TgCO_2$ equivalents, or approximately 7.2% of U.S. human-related methane emissions.[24] Digesters work by capturing and combusting the gases that are created through the digestion process to produce electricity, heat or hot water.[25] The EPA indicates that biogas recovery can be profitable for facilities in four main ways: 1) reducing their reliance on purchased electricity, 2) the ability to sell excess energy generated back into the utility system, 3) through heat recovery systems that harness the heat produced in the digestion process for on-site water and space heating, and 4) the sale of carbon credits in places with greenhouse gas markets.[26] Digesters are also purported to provide environmental benefits by improving odor control, providing better control of ammonia emissions from manure, and potentially protecting local water quality.[27]

According to the EPA, there are currently an estimated 162 operational digester systems in the U.S. In 2010, the EPA estimated that biogas capture "directly reduced methane emissions by 51,000 metric tons or 1.1 million metric tons carbon dioxide equivalent (CO_2e), and avoided 264,000 metric tons of CO_2e by displacing fossil fuels with captured methane."[28] The EPA estimated that nationally, "swine and dairy operations could generate 6.3 million MWh of electricity each year."[29] Based on this estimate, the EPA concludes that, "swine and dairy operations

23. ETHAN ELKIND, ROOM TO GROW – HOW CALIFORNIA AGRICULTURE CAN HELP REDUCE GREENHOUSE GAS EMISSIONS 8 (2010), *available at* www.law.berkeley.edu/files/Room_to_Grow_March_2010.pdf.

24. ENVTL. PROT. AGENCY, *supra* note 12.

25. ENVTL. PROT. AGENCY, EPA-430-F-02-004, MANAGING MANURE WITH BIOGAS RECOVERY SYSTEMS IMPROVED PERFORMANCE AT COMPETITIVE COSTS 3 (2002), *available at* http://www.epa.gov/agstar/documents/manage.pdf [hereinafter MANAGING MANURE WITH BIOGAS].

26. U.S. ENVTL. PROT. AGENCY, EPA-430-8-06-004, MARKET OPPORTUNITIES FOR BIOGAS RECOVERY SYSTEMS: A GUIDE TO IDENTIFYING CANDIDATES FOR ON-FARM AND CENTRALIZED SYSTEMS 4, *available at* http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1008VEI.txt [hereinafter MARKET OPPORTUNITIES FOR BIOGAS]; *see* Ferreira, *supra* note 20, at 552.

27. MANAGING MANURE WITH BIOGAS, *supra* note 25, at 7.

28. ENVTL. PROT. AGENCY, ANAEROBIC DIGESTERS CONTINUE TO GROW IN THE U.S. LIVESTOCK MARKET (May 2010), *available at* http://www.epa.gov/agstar/documents/2010_digester_update.pdf.

29. MARKET OPPORTUNITIES FOR BIOGAS, *supra* note 26, at 4.

collectively could potentially generate electricity worth more than $500 million annually."[30]

C. *Critiques of Digesters—Pollution Problems and Applicability Limited to Large CAFO-Style Facilities*

Concern about greenhouse gas emissions and climate change certainly must encompass a cognizance that emissions from agricultural operations are significant, and must be addressed. Digesters might potentially provide some benefits in terms of methane reductions, but the benefits are not unequivocal. The following sections outline the major challenges associated with digesters.

1. Digesters Release "Traditional" Air Pollutants

The methane digestion and biogas burning process, while capturing methane, produces other air pollutants— "on-site renewable energy production from biogas burned in internal combustion engines creates emission byproducts that include nitrogen oxide, sulfur oxide, volatile organic compounds (VOCs), particulate matter, and carbon monoxide."[31] States must regulate these pollutants pursuant to the Clean Air Act, and regulatory conflicts have arisen when digesters would release too many of these air pollutants. For example, the Air Resources Board of California has refused to permit some digesters in the San Joaquin Valley due to violations the Clean Air Act's National Ambient Air Quality Standards for nitrogen oxides (NO_x) in the region.[32] The release of nitrogen oxides in particular is problematic, as they are major players in the creation of ground-level ozone, which can create serious health problems.[33] The equipment and ongoing maintenance needed to fix these problems is often prohibitively expensive, causing some farmers to simply shut down their digesters, even after having made significant capital investments.[34]

30. *Id.*

31. ELKIND, *supra* note 23, at 8.

32. P.J. Huffstutter, *A Stink in Central California Over Converting Cow Manure to Electricity*, L.A. TIMES, Mar. 1, 2010, http://articles.latimes.com/2010/mar/01/business/la-fi-cow-power1-2010mar01.

33. *See Nitrogen Dioxide*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/air/nitrogenoxides (last updated Aug. 17, 2011); *Ground-Level Ozone*, ENVTL. PROT. AGENCY, http://www.epa.gov/glo/health.html (last updated July. 6, 2011).

34. *See* Huffstutter, *supra* note 32.

2. Digesters Do Not Address the Large Quantities of Manure Generated by Large-Scale Livestock Production

While the digestion process may reduce some of the methane emissions resulting from the storage of manure, it does not appreciably reduce the amount or the nutrient content of manure.[35] Thus, large-scale concentrated livestock facilities must still find an ultimate destination for the manure. This is one of the major problems with large, industrial scale livestock production facilities—because they are typically not "mixed-use," meaning they do not have crops as well as livestock, they cannot use the manure themselves and have to spread it over other agricultural land. Such facilities typically produce much more manure than can be readily used on nearby agricultural lands, often resulting in over-application and nutrient overloads.[36] In addition, the digestion process does not remove heavy metals or antibiotics present in the manure, passed through by dosed animals.[37] Although some pathogen reduction is accomplished in the digestion process, research indicates that re-growth of pathogens occurs once post digestion solid manure is re-stored.[38]

3. Digesters are Expensive to Install and are Typically Only Cost-Effective for Large, CAFO-Scale Facilities

Despite their purported benefits, many small-scale farming advocates and environmental groups have criticized digesters—claiming that digesters are not economical without large subsidies, and that those subsidies only support large, CAFO-scale facilities, at the expense of smaller, more sustainable farms.[39] Digesters are indeed very expensive to install, "often costing as much as three million dollars,"[40] and additional costs are re-

35. John Paul, *Anaerobic Digestion A Feel Good Strategy or a Sustainable Manure Management Solution?*, TRANSFORM COMPOST SYSTEMS LTD. 2 (Jan. 2008), http://www.transformcompostsystems.com/articles/Is%20Anaerobic%20digestion%20a%20good%20idea%20Dec%2008.pdf.

36. See *infra* Part III-A-i for a discussion of the damage caused by the over-application of manure.

37. SIERRA CLUB, SIERRA CLUB GUIDANCE: METHANE DIGESTERS AND CONCENTRATED ANIMAL FEEDING OPERATION (CAFO) WASTE 2 (2004), http://www.sierraclub.org/policy/conservation/methane_digesters.pdf.

38. *Id.*

39. *See, e.g.*, John Kinsman, *Taxpayer Subsidized Manure Digesters Stimulate Factory Farm Pollution*, CAPITAL TIMES, Mar. 14, 2010, http://host.madison.com/ct/news/opinion/column/article_c83be70c-62aa-59e8-91f7-04db55a0377e.html.

40. ELKIND, *supra* note 23, at 8.

quired to sell the biogas product back into the utility grid, given the costly "extra technology required to remove the impurities in the biogas in order to convert it to utility-grade natural gas."[41] Given the large expense associated with digester set-up, large, well-endowed livestock production facilities maintain a financial advantage over smaller facilities. Only large facilities are able to shoulder the cost of digester systems—in addition to which, digester systems are really only effective at very large scale livestock operations, given the need for large quantities of manure. The AgStar program's own documentation for identifying profitable candidates for digester and biogas recovery systems indicates that the profitable systems are, "the *larger operations* that use liquid or slurry manure handling systems and collect manure from *animal confinement areas* frequently."[42] The documentation continues, "[t]he potential for a positive financial return appears to be most likely at dairy operations with milking herds of more than 500 cows and swine operations with more than 2,000 head of confinement capacity."[43] These numbers both fall within the EPA's numeric standard for a "Medium CAFO,"[44] and are close to the level of "Large CAFO."[45]

As an illustration, Wisconsin is the state with the largest number of operational digesters, twenty-six.[46] In this case, the small-

41. *Id.*

42. MARKET OPPORTUNITIES FOR BIOGAS, *supra* note 26, at 3 (emphasis added); *see also* MARK A. MOSER, RESOURCE POTENTIAL AND BARRIERS FACING THE DEVELOPMENT OF ANAEROBIC DIGESTION OF ANIMAL WASTE IN CALIFORNIA 2 (Dec. 1997), *available at* http://agrienvarchive.ca/bioenergy/download/resource_potent_A.D.pdf (indicating that in determining profitability of a digester system, the "size of the farm is the most important factor, because larger facilities take advantage of significant economies of scale").

43. MARKET OPPORTUNITIES FOR BIOGAS, *supra* note 26, at 3.

44. A facility with 200-699 mature dairy cattle or 750-2499 swine (each weighing over 55 pounds) would constitute a Medium CAFO. 40 C.F.R. § 122.23(b)(6)(i) (2010). A Medium CAFO must obtain a Clean Water Act National Pollutant Discharge Elimination System (NPDES) permit if it discharges or proposes to discharge pollutants. *Id.* § 122.23(d)(1). In addition, such facilities must discharge pollutants in one of two specified "methods of discharge." *Id.* § 122.23(b)(6)(ii). A medium-sized facility may also be designated a CAFO if it is "found to be a significant contributor of pollutants," regardless of its method of discharge. OFFICE OF WASTEWATER MGMT., ENVTL. PROT. AGENCY, REGULATORY DEFINITIONS OF LARGE CAFOs, MEDIUM CAFO, AND SMALL CAFOs, *available at www.epa.gov/npdes/pubs/sector_table.pdf.*

45. A facility with 700 or more mature dairy cattle or 2500 or more swine (each weighing over 55 pounds) constitutes a "Large CAFO." 40 C.F.R. § 122.23(b)(4).

46. Envtl. Prot. Agency, *Operating Anaerobic Digester Projects*, AGSTAR, http://www.epa.gov/agstar/projects/index.html (last updated July 14, 2011).

est farm has 810 cows[47], making it a "Large CAFO."[48] The average number of cows is much higher—2115 per farm.[49] The fact that every single farm with a digester in Wisconsin has enough cattle to be designated a "Large CAFO" is striking—under the Clean Water Act, Large CAFOs are by definition point sources of pollution, and are subject to effluent pollutant limitations under the Act, through the NPDES permitting system.[50]

The fact that most digester systems are feasible only for large CAFOs is one of the most important factors to consider when assessing their potential benefits. As discussed below in Parts II and III, CAFOs create a host of environmental problems outside of manure-associated methane emissions. Some might argue that viewed in this context, digesters are a positive development: if large, polluting facilities reduce even some of their pollution, this is a step in the right direction. Critics, however, find that the overwhelming environmental problems associated with CAFOs,[51] and the basic unsustainability of the CAFO farming system, do not warrant the use of publicly funded subsidies for the minimal improvements associated with digesters.[52] The Sierra Club for example, maintains that, "the potential for methane digesters to partially mitigate some of the extensive and pervasive damage caused by CAFOs does not justify the use of this

47. The smallest is Sunrise Dairy, with 810 cows. ENVTL. PROT. AGENCY, *Sunrise Dairy*, AGSTAR, http://www.epa.gov/agstar/projects/profiles/sunrisedairyformerlysuringcommunityd.html (last updated July 14, 2011).

48. *See* 40 C.F.R. § 122.23(b)(4) (2010). Large CAFOs also meet the underlying definition of an Animal Feeding Operation ("AFO"). An AFO is "a lot or facility where . . . animals . . . are stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period, and [c]rops [and] vegetation . . . are not sustained in the normal growing season over any portion of the lot of facility." *Id.* § 122.23(b)(1).

49. Envtl. Prot. Agency, *Anaerobic Digester Database*, AGSTAR, http://www.epa.gov/agstar/projects/index.html#database (last updated July 14, 2011).

50. Effluent limitations for pollutants are required for "categories and classes of *point sources*." 33 U.S.C. § 1311(b)(2)(A) (2006) (emphasis added). A point source is "any discernible, confined and discrete conveyance, including but not limited to any . . . *concentrated animal feeding operation* . . . from which pollutants are or may be discharged." 33 U.S.C. § 1362(14) (2006) (emphasis added).

51. *See* discussion *infra* Part III.A.

52. *See, e.g*, Kinsman, *supra* note 39 (describing a $6.6 million state tax credit for the construction of two community manure digesters in Dane County, Wisconsin, which the author claims only help a "handful of mega-dairies."). *See* SIERRA CLUB, *supra* note 37, at 3; *Anaerobic Digesters*, ENERGY JUST. NETWORK, http://www.energyjustice.net/digesters/ (last visited Apr. 5, 2011) (stating digesters are "marginally effective" and are a "Trojan horse that pretends to solve a waste management problem while enabling factory farms to invade the community.").

technology as a basis to support the development of new CAFOs."[53] Their position is that while "[e]xisting CAFOs may reduce the problems they are currently causing by use of methane digesters . . . they should be installed at the cost of the CAFO owner and not from public subsidy."[54]

III.
EVEN BEYOND MANURE-ASSOCIATED METHANE EMISSIONS, INDUSTRIAL LIVESTOCK OPERATIONS ARE MAJOR CONTRIBUTORS TO GREENHOUSE GAS EMISSIONS

A. *Methane from Manure Accounts for a Relatively Small Portion of Livestock-Associated Methane Emissions*

While the recent EPA and USDA announcement of an interagency agreement to cut greenhouse gas emissions from livestock operations claims that digester technology can slash greenhouse gas emissions by better manure management, the reality is less dramatic.[55] In fact, the majority of methane emissions associated with livestock production stems from enteric digestion from the animals themselves, and not from manure.[56] The amount of U.S. emissions from enteric digestion far exceeds methane emissions from manure storage—in 2008, enteric fermentation accounted for 140.8 $TgCO_2$ equivalents (24.8% of total U.S. methane emissions), the largest single source of methane emissions in the United States, while manure management accounted for only 45 $TgCO_2$ (7.93% of total U.S. methane emissions).[57] Beef cattle are the largest contributor of methane emissions via enteric fermentation—they create 72% of the methane emissions associated with enteric fermentation; dairy cattle account for 23%. In 2009, enteric fermentation from beef cattle operations released 99.6 $TgCO_2$ equivalents of methane, accounting for 17.5% of total U.S. methane emissions.[58]

---

53. SIERRA CLUB, *supra* note 37, at 2.

54. *Id.*

55. EPA-USDA Press Release, *supra* note 14.

56. *See Methane*, ENVTL. PROT. AGENCY, tbl.1, http://www.epa.gov/methane/sources.html (last updated Apr. 18, 2011) (showing that U.S. methane emissions from enteric fermentation have consistently far exceeded emissions from manure). Enteric fermentation is a process that occurs in the fore-stomachs, or rumen, of ruminants like cattle, sheep and goats. *Id.* This fermentation process aids the ruminants in digestion and produces methane as a byproduct. *Id.* The methane is then exhaled by the animal. *Id.*

57. ENVTL. PROT. AGENCY, *supra* note 12.

58. *See* ENVTL. PROT. AGENCY, EPA-430-R-11-005, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2008 at 6-2 tbl.6-3 (2010) [hereinafter EPA

Thus, the livestock industry's largest contribution to methane emissions remains unaddressed by digester systems. In addition, while beef cattle themselves account for such a significant percentage of methane emissions, beef cattle facilities are not generally considered suitable for digester systems. Cattle are kept and fed on "dry lots," where manure is not collected and remains in solid form. Digesters however, require "daily manure feed to produce a consistent level of biogas,"[59] making swine and dairy cattle facilities more appropriate, since the manure there is collected by flushing or "slurrying" into liquid holding tanks or lagoons.[60]

It has been argued that digesters are increasingly beneficial as methane emissions from manure have increased dramatically since 1990, much from increases in the quantity of swine and dairy cow manure. The EPA cites the shift to large dairy and swine facilities as the cause of the increase — "the shift toward larger facilities is translated into an increasing use of liquid manure management systems, which have higher potential CH_4 [methane] emissions than dry systems."[61] Despite the increased use of liquid manure handling systems, the EPA acknowledges that nonetheless, "the majority of manure in the United States is handled as a solid, producing little CH_4."[62] So, even while methane from manure management has increased over the past twenty years, it is still a relatively minor contributor to the sector's overall methane emissions compared with the emissions stemming from ruminant digestion in livestock animals themselves. This raises significant uncertainty about the ability of digesters to "slash" the livestock industry's contribution to greenhouse gas emissions. Moreover, it appears that digesters are a quite expensive fix to a problem caused largely by the recent ill-considered increase in concentrated swine and dairy operations, and their subsequent manure management techniques. This lends credence to a digester critic's argument that "[t]he real tragedy is that manure digesters actually make global warming worse while "solving" a manure problem that would not even

---

U.S. GHG INVENTORY REPORT], *available at* http://epa.gov/climatechange/emissions/usinventoryreport.html.

59. MOSER, *supra* note 42, at 8.

60. *See* MANAGING MANURE WITH BIOGAS, *supra* note 25, at 5 fig.2.

61. EPA U.S. GHG INVENTORY REPORT, *supra* note 58, at 6-7.

62. *Id.*

exist if cows were allowed to graze on pasture rather than being confined indoors."[63]

B. *An Analysis of The Livestock Industry's Entire "Chain of Supply" Reveals Enormous Contributions to Greenhouse Gas Emissions*

While digesters may to an extent mitigate the greenhouse gas emissions generated by liquid manure,[64] it is important to consider the industry's overall substantial contribution to greenhouse gas emissions, lest digesters be seen as a panacea for the industry's contribution to those emissions. When assessing the livestock industry's contribution to greenhouse gas emissions on a system-wide basis, it is clear that methane emissions—even from enteric fermentation, which makes up the lion's share of overall methane emissions—constitute only one of many sources of emissions associated with the livestock production chain.[65] While this does not mean that methane emissions are not significant, nor that mitigation measures such as digesters are completely futile, it does mean that there are other, larger sources of emissions that remain unaddressed by the technology.

Livestock production is estimated to contribute a net addition of 4.5 to 6.5 billion tons of carbon into the atmosphere each year through numerous channels—"burning fossil fuel to produce mineral fertilizers used in feed production; methane release from the breakdown of fertilizers and from animal manure; land-use changes for feed production and for grazing; land degradation; fossil fuel use during feed and animal production; and fossil fuel use in production and transport of processed and refrigerated animal products."[66] Some of these emissions come from direct emissions, as is the case with methane released from manure storage, and also indirectly, through for instance, the CO_2 released as a result of burning fossil fuels for production of feed crops.[67] Fossil fuel burning and "land-use changes, which destroy organic carbon in the soil" are the major causes of the net increase in carbon releases.[68] The sections below will highlight

63. Kinsman, *supra* note 39.
64. *See* MARKET OPPORTUNITIES FOR BIOGAS, *supra* note 26, at 3; *see* discussion *supra*, part I.B.
65. STEINFELD ET AL., *supra* note 8, at 85-86.
66. *Id.*
67. *See id.* at 79.
68. *Id.* at 85.

some of the major ways in which the livestock industry contributes to greenhouse gas emissions, aside from methane emissions from manure management and storage.

1. Feed Crop Production

Since livestock production has become increasingly concentrated and industrialized, most livestock animals are no longer pastured, grazing on grasses in fields, but instead are confined and fed in feedlots.[69] Feed crops of corn and grains are used to feed the vast quantities of animals reared in such CAFOs, and their production utilizes approximately one-third of all arable land in the world.[70] Worldwide, the demand for feed crops has increased, as 80% of growth in the livestock sector stems from industrial-scale, confined animal production facilities.[71] Feed crop production is a highly energy intensive process—the ancillary fertilizers, synthetic chemicals and fossil fuels used to create such large crop yields make livestock production a particularly energy consuming venture. Not even accounting for the substantial energy required to process and transport the end product, feedlot beef production requires 35 kcal of energy to produce 1 kcal of food energy.[72] The high energy demands of feed crop production lead to significant greenhouse gas emissions—in particular through the burning of fossil fuels in the manufacture of fertilizers and the energy used for crop production itself.[73]

The manufacturing of nitrogen-based fertilizers used on feed crops requires a large amount of fossil fuel inputs—natural gas, oil or coal is used in the development process.[74] These "[c]hemical fertilizers circumvent the naturally occurring process of 'fixing' nitrogen to the soil by combining nitrogen and hydrogen gases under immense heat and pressure," a process that re-

69. Leo Horrigan et al., *How Sustainable Agriculture Can Address the Environmental and Human Health Harms of Industrial Agriculture*, 110 ENVTL. HEALTH PERSP. 445, 448-49 (May, 2002) (discussing the trend towards intensive concentration of livestock and animal production). *See* discussion *infra* Part III.A for a discussion of the other serious environmental consequences of such confinement operations.

70. STEINFELD ET AL., *supra* note 8, at 45.

71. *Id.* at 278. As an example of the intensification in concentration of animal production, in the U.S., "[t]he largest 3% of farms (all with at least 1,000 hogs each) now produce 60% of U.S. hogs" and for beef, "more than 40% of all production comes from 2% of the feedlots." Horrigan et al., *supra* note 69, at 449.

72. Horrigan et al., *supra* note 69, at 448.

73. *See* STEINFELD ET AL., *supra* note 8, at 86.

74. *See id.*

quires large amounts of energy from fossil fuels to complete.[75] Nitrogen-based fertilizer is largely used to produce corn (maize)[76]—and subsequently, a staggering 66% of all corn produced in the U.S. is fed to animals in CAFOs.[77] Based on the amount of energy required to produce nitrogen based fertilizers, and the amount of those fertilizers used for feed crop production, it is estimated that this stage of livestock production produces approximately 41 million tons of CO_2 emissions worldwide each year.[78]

Beyond the production of the fertilizers themselves, the on-farm energy costs of producing feed crops are high, likely even larger than those associated with fertilizer production. Energy spent on "seed, herbicides/pesticides, diesel for machinery (for land preparation, harvesting, transport) and electricity (irrigation pumps, drying, heating, etc.)" results in an estimated 90 million tons of CO_2 emissions worldwide per year.[79] Fertilizer use on feed crops is also a major contributor of N_2O (nitrous oxide) emissions, a greenhouse gas 310 times more heat trapping than CO_2.[80] Soil naturally releases N_2O through "microbial processes of denitrication and nitrication" but such releases are greatly increased through the application of synthetic fertilizers.[81] Agricultural soil management accounts for the majority of N_2O emissions in the United States (67.9%)[82] and global emissions are expected to increase 50% by 2020, largely due to increased use of synthetic fertilizers and increased production of animal manure.[83] It is estimated that the use of fertilizers for livestock

75. Jodi S. Windham, *Putting Your Money Where Your Mouth is: Perverse Food Subsidies, Social Responsibility & America's 2007 Farm Bill*, 31 ENVIRONS ENVTL. L. & POL'Y J. 1, 8 (2007).

76. *See* STEINFELD ET AL., *supra* note 8, at 87.

77. William S. Eubanks II, *A Rotten System: Subsidizing Environmental Degradation and Poor Public Health with our Nation's Tax Dollars*, 28 STAN. ENVTL. L.J. 213, 259 (2009).

78. *See* STEINFELD ET AL., *supra* note 8, at 88 tbl.3.4.

79. *Id.* at 88.

80. Aneja, *supra* note 3, at 4236.

81. *Id.*

82. EPA U.S. GHG INVENTORY REPORT, *supra* note 58, at 6-1.

83. INTERGOV'T PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2007: MITIGATION OF CLIMATE CHANGE 503 (Bert Metz, et al. eds., 2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter8.pdf. It is thus noteworthy that manure is not only a source of methane emissions, but also N_2O (nitrous oxide) emissions. Manure stored in aerobic conditions and manure spread on land both release N_2O. Because manure stored (or spread) aerobically is not suitable for digestion, digester technology is unable to mitigate manure-generated N_2O emissions. *See* KELSI BRACMORT, CONG. RESEARCH SERV., R40667, ANAEROBIC DIGESTION:

feed crop production results in 0.2 million tons of nitrous oxide emissions annually.[84] Overall, global feed crop production is estimated to cause in excess of 0.7 million tons of nitrous oxide emissions annually.[85]

2. Land Use Changes Associated with Feed Crop Production Contribute to Greenhouse Gas Emissions

Increased production of feed crops also requires cultivation of land, resulting in increased CO_2 emissions through soil carbon losses.[86] Livestock-induced CO_2 emissions from cultivation of land for feed crops are estimated to be around 28 million tons per year.[87] The modification of land for ranching operations also increases greenhouse gas emissions. Land clearing and deforestation for conversion to feed crop and ranching lands, particularly problematic in Latin America, are estimated to result in worldwide emissions of approximately 2.4 billion tons of CO_2.[88] Through both cutting (or worse, burning) of trees and loss of trees as future "carbon sinks," deforestation is thus a major contributor to CO_2 emissions. While deforestation in Latin America has historically been driven by ranching operations, demand for land for feed-crop production is increasing, driven by the increasing number of confined livestock production facilities,[89] and, resulting in larger and faster conversion of Amazon forests.[90]

GREENHOUSE GAS EMISSION REDUCTION AND ENERGY GENERATION 6 n.18 (May 4, 2010), *available at* http://www.nationalaglawcenter.org/assets/crs/R40667.pdf ("Manure that is not managed (e.g., manure deposited in a pasture from livestock grazing) has low methane emissions, but relatively high nitrous oxide emissions. The greenhouse gas nitrous oxide is 310 times more effective at trapping heat in the atmosphere than carbon dioxide over a 100-year timeframe.").

84. STEINFELD ET AL., *supra* note 8, at 105. See discussion *infra* Part III.A.ii on the environmental consequences of the use of fertilizer.

85. STEINFELD ET AL., *supra* note 8, at 105.

86. *See id.* at 92.

87. *Id.*

88. *Id.* at 91.

89. *Id.* at 91.

90. Douglas C. Morton et al., *Cropland Expansion Changes Deforestation Dynamics in the Southern Brazilian Amazon*, 103 PROC. NAT'L ACAD. OF SCIS. 39, 14637, 14638–39 (2006).

3. The Final Stages—Fossil Fuel Use in Processing, Storing and Transport of Feed and Consumer Products Results in the Release of Greenhouse Gas Emissions

When animals are concentrated and fed, as is the case on CAFOs, significant energy is required to process and ship feed to such facilities. The development of CAFOs has in fact relied on relatively low shipping costs—the high nutritional value to weight ratio of grains like corn make their long-range shipment feasible. For instance, "the ability to ship grain at low cost to the Mid-Atlantic, which lies outside major corn- and soybean-growing regions, has facilitated the dramatic growth of CAFOs in North Carolina—now the second largest hog-producing state and fourth largest producer of broilers."[91] However, processing and shipment of feed, as well as processing, storage and shipment of the ultimate animal products derived from CAFOs, are all activities that require energy and result in the release of CO_2.[92] It is estimated that transport of livestock products (including transport of feed for livestock rearing) results in CO_2 emissions exceeding 0.8 million tons worldwide per year.[93]

C. *Subsidies for Digesters Distract from the Broad Range of Greenhouse Gas Emissions Associated with Industrial Livestock Production*

When looking at industrial livestock production's overall contribution to greenhouse gas emissions, it is clear that methane emissions from manure storage are only a minor component of the sector's weighty contribution to greenhouse gas emissions. Digesters, which address only this small component of the sector's greenhouse gas emissions, can not address the wide-ranging emissions from CAFOs. While digestion technology is a way to reduce some of the emissions associated with the livestock industry, a more comprehensive approach must be taken to drastically

---

91. UNION OF CONCERNED SCIENTISTS, CAFOS UNCOVERED THE UNTOLD COSTS OF CONFINED ANIMAL FEEDING OPERATIONS 17 (Doug Gurian-Sherman ed., 2008) [hereinafter CAFOS UNCOVERED], *available at* http://www.ucsusa.org/food_and_agriculture/science_and_impacts/impacts_industrial_agriculture/cafos-uncovered.html.

92. *See* STEINFELD ET AL., *supra* note 8, at 99–100.

93. *Id.* at 100.

reduce its overall emissions, and to encourage a more sustainable approach to livestock production.[94]

Some might argue that this is a complicated issue and not likely to be solved simply, or in the near future. Therefore, digester technology should be seen as a stepping stone, a small part of the solution to addressing the greenhouse gas emission problems of large, industrial-style livestock facilities—an as "good as it gets for now" argument. I argue to the contrary, at least in the context of public subsidies. The fact that digesters do so little to address the overall emissions of CAFOs makes them a distraction from the bigger environmental and climate change problems stemming from industrial-scale livestock production. Such a distraction should not be funded with ever-dwindling public resources. Public subsidies should not be spent praising entities for accomplishing a very small reduction in greenhouse gas emissions, while their overall model of production continues to create massive emissions of greenhouse gases. As one environmental writer stated, referring to methane digesters and other "technological fixes" for addressing greenhouse gas emissions associated with livestock production:

> [G]overnment subsidies for these so-called fixes actually incentivize CAFOs, when the truly sustainable solution requires shifting away from this production system entirely. . . . while one or more of these technological responses might somewhat reduce livestock emissions, we already know that we need a drastic reduction from the sector even to maintain emissions at current levels. This level of reduction simply cannot be achieved with mere tinkering.[95]

94. *See* INTERGOV'T PANEL ON CLIMATE CHANGE, *supra* note 83, at 510–11 (explaining that methane mitigation techniques, including digestion technology, can have varying effects on N_2O and CH_4 (methane) emissions. The report concluded that worldwide there is likely *limited opportunity* for mitigation of methane and other GHG emissions through manure *management, treatment or storage*, concluding that all methane mitigation techniques "require further study from the perspective of their impact on whole life-cycle GHG emissions.").

95. ANNA LAPPÉ, *Diet for a Hot Planet Livestock and Climate Change in* THE CAFO READER THE TRAGEDY OF INDUSTRIAL ANIMAL FACTORIES 245 (Daniel Imhoff Ed., 2010).

IV.
THE INDUSTRIAL LIVESTOCK INDUSTRY'S CONTRIBUTION TO "TRADITIONAL POLLUTANTS" AND REGULATION UNDER EXISTING ENVIRONMENTAL LAWS

As discussed in Part II, digesters are hardly a universal remedy for the livestock industry's contribution to greenhouse gas emissions. Digesters likewise largely fail to address the traditional pollutant problems and environmental damage caused by CAFO-scaled industrial livestock production. While digesters can provide tangible benefits in the form of reduced methane emissions, potentially reduced odors from manure, and possible biogas recovery, most of the negative environmental consequences of industrial scale, concentrated animal feeding operations, discussed in this section, remain.

Although digesters are clearly not designed to address the majority of environmental consequences of industrial livestock production, offering subsidies to environmentally unsound facilities for implementation of technology that could help them garner significant economic benefits, while not requiring any additional improvement in their underlying environmental practices, is inappropriate. Instead, I propose that the government should address the underlying pollution problems caused by CAFOs directly, by increasing their regulation under existing environmental laws.

A. *The Environmental Consequences of Industrial Livestock Production*

1. Environmental Consequences of Manure

The manure-affiliated environmental consequences of intensive livestock operations are well known, and the costs of dealing with these consequences are largely externalized by the industry.[96] Industrial scale livestock production directly creates significant air and water pollution problems, largely stemming from the large quantity and high concentration of manure stored at

96. PEW COMM'N ON INDUS. FARM ANIMAL PROD., PUTTING MEAT ON THE TABLE: INDUSTRIAL FARM ANIMAL PRODUCTION IN AMERICA 29 (APR. 2008) [hereinafter PUTTING MEAT ON THE TABLE], *available at* http://www.pewtrusts.org/uploadedFiles/wwwpewtrustsorg/Reports/Industrial_Agriculture/PCIFAP_FINAL.pdf (concluding that the "expanding array of deleterious environmental effects on local and regional water, air, and soil resources" is largely externalized by the meat production industry and not accurately reflected in the consumer purchase price of such items).

CAFOs. The sheer quantity of animals housed on such facilities creates a major manure management problem—the USDA estimates that confined livestock and poultry operations produce around 500 million tons of manure annually—approximately three times as much as the entire U.S. human population.[97] Under more traditional methods of farming, which involved mixed crop and low-density animal production (meaning less overall manure), manure can successfully be utilized as fertilizer on croplands, helping sustain long-term fertility in the soil.[98]

Over the past few decades this farming paradigm has shifted towards a concentration of animal production, and separation of animal and crop production—"the number of animals on small to medium-sized farms decreased substantially between 1982 and 1997, while animals on CAFOs increased by 88 percent."[99] Under the current dominant system, given the immense quantities of manure produced by CAFOs, when manure is applied to croplands it is often being over-applied—more manure is applied than the soil can handle—resulting in nitrogen and phosphorous runoff problems.[100] Also, given the fact that CAFOs are increasingly regionally concentrated, often at a distance from croplands, appropriate cropland application of manure is often infeasible.[101] This results in manure being stored on-site, as previously discussed, in lagoons and storage tanks, where it results in emission of air pollutants—nitrous oxide, hydrogen sulfide, ammonia, volatile organic compounds, and particulate matter are the major emissions stemming from the break down of manure.[102] Further, lagoon and storage tank leaks can lead to ground and surface water contamination.[103]

2. Other Environmental and Health Consequences Stemming from CAFOs

The concentrated food animal production industry, by relying on feed crops for its existence, is also instrumental in the overuse

---

97. *Id.* at 23.

98. *Id.*

99. CAFOs UNCOVERED, *supra* note 91, at 10. *See also* Horrigan et al., *supra* note 69, at 448.

100. *See* PUTTING MEAT ON THE TABLE, *supra* note 96, at 25 ("Animal farming is also estimated to account for . . . more than 30% of the nitrogen and phosphorus loading in the nation's drinking water.").

101. CAFOs UNCOVERED, *supra* note 91, at 57.

102. Aneja, *supra* note 3, at 4235.

103. *See* CAFOs UNCOVERED, *supra* note 91, at 51–52; Celender, *supra* note 4, at 960.

of pesticides and fertilizers[104] which can result in water and soil pollution, as well as potential human health problems.[105] Crops typically only absorb one-third to one-half of the nitrogen fertilizer applied to them, and the remainder becomes runoff, which can lead to increased algal growth in water bodies.[106] This increased growth depletes the oxygen in the water and has led to dead zones, where aquatic life can no longer survive.[107] The reliance on monoculture feed crops also contributes to soil degradation and water depletion,[108] as well as declines in biodiversity, which in turn leads to a vicious cycle of increased use of pesticides and herbicides.[109]

CAFO practices are also implicated in public health concerns. Growing evidence indicates that the overuse of antibiotics at CAFOs—a result of both the ease of disease spreading among high concentrations of animals, and their non-medicinal use as growth enhancers—may be contributing to the development of antibiotic resistant pathogens[110] and to antibiotic resistance in humans.[111] In addition, "the most prevalent foodborne pathogens are overwhelmingly associated with animal products, most of which come from factory farms and high-speed processing facilities."[112] The air pollutants stemming from manure-saturated CAFOs have been linked to higher asthma rates in populations living close to CAFOs,[113] and CAFO workers exposed to high levels of hydrogen sulfide and other gases from decomposing manure and urine have been found to have "temporary or chronic respiratory irritation . . . acute and chronic bronchitis, nonallergic asthma-like syndrome, mucous membrane irritation, and noninfectious sinusitis."[114]

104. *See* discussion *supra* Part II.B.1 for a discussion of the greenhouse gas implications of fertilizer production.

105. Horrigan et al., *supra* note 69, at 450.

106. *Id.* at 446.

107. *Id.*

108. *Id.* at 448.

109. *Id.*

110. *Id. at* 451-52.

111. *Id.* at 445.

112. *Id.*

113. *See* PUTTING MEAT ON THE TABLE, *supra* note 96, at 17.

114. *Id.* at 16.

B. *Traditional Pollution Control Laws—Regulation of CAFOs Should be Secured and Expanded Under the Clean Air Act and Clean Water Act*

1. Air Pollution—CAFOs' Contribution to Air Pollution Warrant Regulation Under the Clean Air Act

Given the fact that industrial scale animal feeding operations are major emitters of air pollutants, they should be regulated under the Clean Air Act. The Clean Water Act, cognizant of the water pollution problems stemming from CAFOs, regulates large CAFOs under the National Pollutant Discharge Elimination System ("NPDES") permitting program, under which they are subject to pollutant discharge limitations. The Clean Air Act meanwhile has no such express provision for regulating CAFOs, despite the fact that they release emissions that have been shown to "cause and contribute significantly to air pollution that is reasonably anticipated to endanger public health and welfare."[115] The Act, in fact contains specific exemptions for some agriculture-related pollution, such as the Administrator's "authority to 'establish a greater threshold quantity for, or to exempt entirely [from regulation under the Hazardous Air Pollutants—Prevention of Accidental Releases section], any substance that is a nutrient used in agriculture when held by a farmer."[116] The Act also "prohibits states from enforcing standards or other emissions-controlling requirements for engines used in farm equipment."[117]

These exemptions, and the current non-regulation of animal feeding operations under the Clean Air Act, stem from the fact that when the Act was drafted, livestock production was largely different than today—facilities were smaller in scale, and often livestock rearing was part of family-run, mixed-crop and animal-production farms,[118] where lower quantities of manure did not

115. The Humane Society of the U.S., et al., Petition to List Concentrated Animal Feeding Operations under Clean Air Act Section 111(B)(1)(A) of the Clean Air Act, and to Promulgate Standards of Performance under Clean Air Act Sections 111(B)(1)(B) and 111(D) (2009) [hereinafter Humane Soc'y EPA Petition], *available at* http://www.foe.org/sites/default/files/HSUS_et_al_v_EPA_CAFO_CAA_Petition.pdf.

116. Sarah C. Wilson, *Hogwash! Why Industrial Animal Agriculture is Not Beyond the Scope of Clean Air Act Regulation*, 24 PACE ENVTL. L. REV. 439, 448 (2007).

117. *Id.*

118. *See* FOUND. FOR DEEP ECOLOGY, FATAL HARVEST THE TRAGEDY OF INDUSTRIAL AGRICULTURE 55 (Andrew Kimbrell ed., 2002) ("Between 1987 and 1992,

pose as much of a pollution risk. In fact, protection of agriculture and livestock *from* air pollution is highlighted in the Act's Findings and Purposes—the Act states that "the growth in the amount and complexity of air pollution brought about by urbanization, industrial development, and the increasing use of motor vehicles, has resulted in mounting dangers to the public health and welfare, *including injury to agricultural crops and livestock*."[119] Farming systems have changed dramatically since then, towards a system of highly concentrated animal feeding facilities that are much more like industrial factories in their ability to release air pollutants. Concentrated livestock facilities are now themselves a major source of air pollution, from which the environment and public health need protection.

Recognizing this shift in livestock operations and their subsequent contribution to air pollution, the EPA itself required the state of California to remove a longstanding Health and Safety Code exemption for agricultural operations from air pollution laws. The EPA found that California's State Implementation Plan—the state plan that implements the Federally-set ambient air quality standards—was inadequate due to the state's agricultural exemption. The EPA found that the exemption "unduly restricts the local districts' ability to adequately administer and enforce their title V programs" and it required California to amend its law, "to eliminate the permitting exemption as it pertains to major agricultural sources of air pollution."[120]

The EPA should follow its own lead from this situation, and recognize that CAFOs, as significant sources of air pollution, should be regulated under the Clean Air Act. The Humane Society of the United States ("HSUS") recently submitted a petition to the EPA requesting that the EPA do just that. The HSUS requested that CAFOs be designated as stationary sources of pollution under Section 111 of the Act because their emissions "constitute air pollution that endangers health and welfare."[121] The HSUS also requested that new source performance standards for CAFOs be set—"new source performance standards will create a strong incentive for new CAFOs to use production methods that protect public health and welfare and will allow en-

America lost an average of 32,500 farms per year, about 80 percent of which were family-run.").

119. 42 U.S.C. § 7401(a)(2) (2009) (emphasis added).

120. Wilson, *supra* note 116, at 461-62.

121. Humane Soc'y EPA Petition, *supra* note 115, at 4.

forcement by the government or private citizens when factory farms violate those emissions limits."[122] This is particularly important given the increasing number of CAFOs—setting such standards will at least ensure "that harms to public health and welfare from CAFOs will not increase."[123]

In sum, regulation of CAFOs under the Clean Air Act would provide a robust way of protecting the environment and public health from the deleterious air pollutant emissions released by CAFOs. Unlike digesters, which address only one emission from CAFOs, Clean Air Act regulation is more comprehensive—it would require CAFOs to comply with air quality standards for *all* of their air pollutant emissions, a result that would be more protective of the environment and public health and which would appropriately place the burden of compliance on CAFO operators.

2. Water Pollution—CAFOs' Contributions to Water Pollution and Contamination Warrant More Stringent Regulation Under the Clean Water Act

As mentioned previously, certain CAFOs are currently regulated under the Clean Water Act's NPDES permitting program.[124] NPDES permits are required for CAFOs that qualify as "point sources" of pollution. Permits require development of "best management practices," including, for instance, nutrient management plans "to dispose of waste in an efficient way while minimizing risk to the environment."[125] However, there are aspects of the permitting system that reduce the effectiveness of the Act's regulation of CAFOs. For instance, effluent limitations—the limitations set for the amount of a pollutant that may be discharged from a point source—only apply to *large* CAFOs. For small and medium CAFOs the state "permitting body uses its best professional judgment to set discretionary requirements."[126] In addition, small CAFOs, unlike medium and large CAFOs, are not by default considered "point sources" even though they can substantially contribute to water pollution.[127] This means that

122. *Id.* at 3.
123. *Id.* at 67.
124. *See* discussion *supra* Part I.C.3.
125. Celender, *supra* note 4, at 948.
126. *Id.* at 955.
127. *Id.* at 962.

small CAFOs are only required to obtain NPDES permits as decided by the state permitting authority.[128]

The major problem with these permitting-authority-dependent designations is the lack of uniformity—the current system leads to a patchwork of regulation and can lead to "hotspots" of water pollution risk where the regulation of small and medium CAFOs is less stringent. States could "use their discretion in this area to advantage the CAFOs rather than to make more stringent environmental permitting decisions."[129] The EPA should thus develop a uniform system of regulation for *all* CAFOs, so that more CAFOs are subject to regulation, and their contribution to water pollution can be more closely monitored and mitigated.

C. *Digesters and Other "Technological Fixes" Can Dovetail with Increased Regulation of CAFOs, but Should Not "Greenwash" CAFOs' Environmental Practices*

The emphasis of this note, on increased regulation of CAFOs under existing laws, is not meant to imply that digester and biogas recovery technology could not be used synergistically with heightened Clean Air Act and Clean Water Act standards. Digesters may provide additional greenhouse gas mitigating benefits by reducing methane emissions, given that the Clean Air Act does not currently regulate methane emissions. Even without subsidies, there may be incentives for CAFOs to adopt digester technology. The economic benefits provided by biogas recovery—reduced energy costs and financial gains from excess energy being sold back to utility companies—could be used by CAFO operators to offset the costs of implementing the technology required to meet the air quality standards set by the Clean Air Act.

Likewise, digester technology may be able to synergistically work with improved and increased regulation of CAFOs under the Clean Water Act. Anaerobic treatment can, under certain circumstances (e.g. high temperatures and particular pH levels), reduce the phosphorous content and heavy metal content of manure, thus reducing the exposure of groundwater to these

128. *See Id.* (discussing how small CAFOs must only obtain NPDES permits "if the appropriate permitting authority so determines, after an on-site inspection and consideration of certain factors. These factors include the size of the CAFO, the location relative to nearby waterbodies, the amount of waste entering the water . . . and 'other factors affecting the likelihood or frequency of discharge of animal wastes manure.'") (quoting 40 C.F.R §122.23 (2007)).

129. *Id.* at 963.

materials when the manure is subsequently spread on fields.[130] Also, the synthetic liners of anaerobic digester tanks are often stronger than in conventional lagoons, decreasing the risk of manure spills,[131] thus reducing the burden on CAFOs for compliance with their NPDES permits.

The fact that digesters, like other "technological fixes" such as "methane-suppressing feed additives" introduced into cattle feed,[132] might result in some reduction in methane or other pollutants does not automatically warrant support for their implementation with public subsidies. While technological advances and research and development in the agriculture sector should be examined, we should be wary of investing large amounts of public subsidies in technologies that might make a small difference, but leave the underlying status quo of CAFOs in place. As one researcher stated in the context of environmental issues and agriculture:

> [N]ew agricultural technologies . . . are a necessary condition for further improvements in the environmental performance of agriculture. But they are by no means sufficient. Without more stringent environmental regulation, there is little hope of substantial additional progress.[133]

V.
CONCLUSION

Digesters *alone* are not the solution to the environmental problems stemming from industrial scale, confined animal feeding operations. Although efforts to curb greenhouse gas emissions from agriculture through digestion systems are laudable, they should not obscure the system-wide environmental problems resulting from industrial-scale livestock operations. The livestock industry is a major contributor to greenhouse gas emissions and traditional pollution problems, most of which cannot be addressed by digester technology. Digesters, like any "technological" fix for the industry's environmental problems, fail to address the underlying unsustainability of the current concentrated livestock production industry.

---

130. MANAGING MANURE WITH BIOGAS, *supra* note 25, at 7.

131. *Id.*

132. *See*, PAUSTIAN, *supra* note 6, at 24 (discussing various technological fixes designed to reduce greenhouse gas emissions from the agriculture sector).

133. Erik Lichtenberg, *Some Hard Truths About Agriculture and the Environment*, 33 AGRIC. & RESOURCE ECON. REV. 24, 28 (Apr. 2004), *available at* http://purl.umn.edu/31372.

Instead of treating such fixes as long-term solutions, policymakers should begin to assess the livestock industry in its entirety—they should engage in an honest assessment of the immense impacts, both locally and globally, that modern industrial livestock production has on the environment, human health, rural communities and animal welfare. For instance, while the USDA touts digesters as a way to dramatically reduce greenhouse gas emissions from the livestock sector, it continues to support subsidies for commodity feed crops—on which the industrial livestock industry relies for its "efficiency"—despite the fact that feed crop production demands large amounts of fossil fuel energy, and creates significant greenhouse gas emissions.[134]

In order to make real progress towards reducing the agriculture and livestock production sectors' contribution to greenhouse gas emissions, the USDA should pursue an overhaul of its subsidies program. Subsidies should support farmers when costs of production are high, rather than creating a system that artificially lowers the price of commodity crops to below the actual cost of production, which in turn facilitates the growth of CAFOs. The USDA should also be actively involved in researching and promoting effective alternatives to feed crop use for livestock rising—for instance, responsible pasturing and grazing techniques. Further, the USDA should more closely monitor and regulate antibiotic and hormone use in concentrated livestock facilities in order to prevent antibiotic resistance and other negative public health impacts.

Likewise, the EPA promotes digesters as a way to "slash" greenhouse gas emissions from livestock operations, while its own data demonstrate that manure management is a relatively minor contributor to methane emissions, compared with the emissions from enteric fermentation.[135] While manure management, relatively speaking, is a minor contributor to greenhouse gas emissions, it still poses great air and water quality pollution problems that remain unaddressed by the Clean Air Act and Clean Water Act. The EPA should thus expand its regulation of CAFOs and their manure management systems under existing environmental laws in order to adequately address their traditional pollution problems.

134. *See* discussion *supra* Part II.B. *See generally* Jodi S. Windham, *Putting Your Money Where Your Mouth Is: Perverse Food Subsidies, Social Responsibility & America's 2007 Farm Bill*, 31 ENVIRONS ENVTL. L. & POL'Y J. 1, 8 (2007).

135. *See* discussion *supra* Part II.A.