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Let's Talk About Biogas ... Even If We Think It Stinks

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Executive Summary

State support for anaerobic digester technology is growing rapidly. This technology, which is rarely profitable without government support, promises to reduce greenhouse gas emissions from intensive livestock agriculture, and reduce some associated public health and environmental damages. However, state support of this technology risks entrenching intensive livestock production, which could exacerbate harms such as animal cruelty, workers' rights abuses and environmental damages.

There are a number of tools that policymakers can use to mitigate the negative impacts of anaerobic digester legislation, so that the public health and environmental benefits of the technology are not offset by an expansion of intensive livestock production. State support of anaerobic digester technology also provides an opportunity to support more sustainable methods of farming and greenhouse gas emission reduction. These tools include comprehensive permitting that safeguards against the potential harms of intensive livestock agriculture, conditions on eligibility for state support to mitigate negative impacts of anaerobic digester adoption, and support for cooperative digesters in order to prevent the benefits from state support of anaerobic digester technology from solely going towards the largest operations.

Framing the Debate

As state governments take the lead on climate action in the United States, policymakers are increasingly expanding from a narrow focus on power plant and vehicle emissions to include emissions from agriculture and land use. Direct emissions from agriculture constitute about 9% of U.S. greenhouse gas emissions[1], while animal agriculture produces 36% percent of the country's methane[2] – a greenhouse gas that is significantly more potent than carbon dioxide. Acknowledging the urgent need to reduce emissions of methane and other short-lived climate pollutants, many states have begun enacting policies promoting farms' adoption of anaerobic digesters (ADs), which capture methane from livestock manure to be used as a source of energy.

Efforts to reduce the climate impact of animal agriculture are certainly laudatory. However, ADs are primarily adopted on confined animal feeding operations (CAFOs) which pose a number of well-documented threats to public health and the environment besides methane emissions. These include pollution of waterways and groundwater with pathogens, heavy metals and excess nutrients via manure lagoon overflow and seepage or field application of liquid manure; airborne emissions of ammonia, hydrogen sulfide, and particulate matter; health risks to farm workers and local communities; and cruelty to animals kept in confined spaces[3].

Anaerobic digesters have the potential to alleviate some of the environmental and health problems associated with CAFOs, but fail to address these other justice issues. Social justice and animal welfare advocates argue that the promotion of ADs will not only increase CAFOs' social license to operate, but will divert resources from more sustainable methods of emissions reduction and, through investment in infrastructure, lock in future reliance on this harmful form of animal production[4,5]. In their view, ADs are nothing but greenwashing and should be opposed.

We recognize CAFOs generate harm to the environment, workers, animals, and public health, but acknowledge that they represent a major part of the agricultural economy of the U.S. which is unlikely to change in the near future. Thus, we seek a middle path which policymakers can emulate when promoting anaerobic digesters. Our approach insists that a truly sustainable solution must consider public health, environmental effects, food security, workers' rights, animal welfare and climate change. Acknowledging that anaerobic digesters can serve as a productive solution to some of the harms of animal agriculture, we propose a set of policy pathways that can maximize their potential while ensuring they are deployed appropriately in ways that enhance or, do not detract from, other areas of justice.

Background on Anaerobic Digesters

Manure-Related Pollution and Barriers to Treatment

Manure is a significant unregulated source of air and water pollution, with waste managed on a small dairy equivalent to that generated by a human population of 3000 to 10,000 people. Livestock manure is a source of zoonotic pathogens, drug residues, hormones and heavy metals, all of which can have negative impacts on human and animal health[6].

Concentration of CAFO operations means there is not enough land for safe land application of manure – over fertilization results in runoff and contamination. Large CAFOs produce most excess nitrogen and phosphorous contamination (more than 50% nitrogen and 67% phosphorous comes from 5% of operations[7]). These nutrients can have devastating effects on aqueous environments, particularly through eutrophication.

Manure from both monogastric (such as swine) and ruminant (such as cattle) livestock emits methane and storing manure produces nitrous oxide. Both are powerful greenhouse gasses multiple times stronger than CO_2.

Anaerobic Digester Technology

Biogas generation uses the biological process of anaerobic digestion (AD), performed by bacteria, to process waste products. Animal manure, human waste, food waste and organic waste from food processing are all viable feedstocks for AD. AD converts organic compounds in manure to methane while retaining inorganic nutrients (nitrogen and phosphorus), achieving 50-60% solids reduction (although it does not reduce the overall volume of waste)[8,9]. The AD process also inactivates between 87-100% of pathogens as well as weed seeds[10]. This results in a solid low odor, high nutrient product suitable for land application, composting and conversion into potting soil and cattle bedding. The liquid from the AD process can be used as fertilizer, and is also high in nutrients, and low in pathogens and weed seeds compared to untreated waste. While the high nutrient content of the AD products makes them valuable as fertilizer, it also does not address nutrient runoff problems.

Biogas is typically made up of 65 percent methane and 35 percent carbon dioxide, with trace amounts of other compounds. Strategies that remove impurities such as hydrogen sulfide (H2S)[11] and CO_2[12] improve the gas's suitability for electricity generation and use as an alternative transport fuel, but require further investment in equipment.

	Methane Production of Manure (ft3/animal/day)	Energy Value (BTU/animal/day)
Dairy Cattle	17	16000
Beef Cattle	13	12000
Swine	18	17000

Source: Sharvelle and Loetscher (2011). Anaerobic Digestion of Animal Wastes in Colorado. Colorado State University Extension.

Anaerobic digestion requires that feedstock material be of low solids content, less than 15% solids by weight. Typically, manure collected on a dry lot has a much higher solids content than 15%. This means that dry lot manure management using anaerobic digestors may not be desirable unless there is a source of wastewater nearby to dilute the manure with. The efficiency and positive outputs of AD are usually greater at higher temperatures[13,14].

Maintenance costs and sludge transport systems are critical factors in ensuring efficient AD operation. Improper maintenance leads to leaks of methane, which would contribute to a larger GHG footprint[15]. It is estimated that as 40% of digesters operating in rural China, for example, have leaks[16].

Transport of biogas from production sites to the user is a major consideration and can significantly impact the economic viability of AD. A regional biogas grid with pipelines can minimize transport costs per volumetric unit of biogas by connecting several digesters to a central point[17]. Equally, on site use of biogas can eliminate the transport costs.

Economic Viability

Due to a lack of comprehensive data, a lot is uncertain about the economic viability of AD technology in the US[18]. The profitability of AD technology depends on many factors that vary across farms such as electricity prices, manure management practices, capital costs, heating requirements and access to off-site waste[19,20,21].

In spite of these uncertainties, there are some stylized facts about the economic viability of AD technology that appear to be backed by the literature. First, the electricity benefits of AD technology, whether for on-site use or for off-site sales, tend not to be enough to make investments in this technology economically viable[22]. Where AD technology is economically successful, either in theory or in practice, it is generally due to cost sharing with the government[23] and the availability of tipping fees[24].

Second, investments in AD technology are largely hindered by uncertainties about output value, output prices, operating costs, and the expected life of the technology. In particular, electricity prices are potentially highly volatile. Further, the capital used for AD technology suffers from asset specificity, which refers to that in the event of low returns on investment – the costs sunk into the AD technology cannot be recovered through alternative uses of the capital[25].

What is certain is that AD technology entails significant economies of scale. This is because AD digesters require high upfront fixed costs. In order for these fixed costs to be worthwhile, the operation needs to produce enough waste that the cost per animal is not too high. Further, legal standards for electricity re-sale tend to favor larger operations[26]. For example, one study of Idaho dairy farms found that AD technology was only economically viable for farms with at least 3000 cows[27]. Another study put the number at 5000[28]. A study of swine farms in Idaho found that herds had to have at least 1800 animals for AD technology to be economically viable[29].

The extent of the economies of scale depends on what sorts of revenue streams are available. Studies have found that the availability of electricity resale, government loan support, tipping fees, and bedding offsets, can all mitigate the economies of scale of AD technology, making these revenue streams particularly important for policymakers to consider[30].

Cooperative Digesters

One potential means of making AD technology economically accessible to smaller farms is through the use of cooperative digesters. A cooperative digester serves many, typically small, farms.[31] The cooperative digester spreads the fixed costs among multiple smaller farms, decreasing the cost per animal for each farm. Cooperative digesters are economically feasible with government support and high energy prices, factors that have sustained their implementation in some European countries.[32] However, the implementation of cooperative digesters faces many obstacles in US markets. According to one survey, obstacles include uncertainty about transportation costs, mixing different types of manures, and receiving commitments from other farmers.[33] The transportation costs associated with hauling manure between farms and the digester could interfere with the ability of farms to diminish capital costs through the use of such digesters.[34]

Policy Discussion

The legal framework surrounding anaerobic digestion and biofuels consists of laws and regulations governing agriculture, land use, energy production, energy transmission, and environmental protection. This framework is carried out by agencies and regulators at the federal, state, and local levels. Accordingly, there is tremendous variation among states and, in some cases, individual localities.

In several areas, federal law provides a backdrop for biogas development in several areas. The Federal Power Act and Public Utility Regulatory Policies Act (PURPA), for example, govern the interstate movement and wholesale pricing of energy. The Clean Water Act and National Environmental Protection Act (NEPA) set minimum environmental standards that apply to many animal agriculture operations. The USDA and the FTC develop and enforce some labelling standards for agricultural products. States, however, are the primary regulators of fuel production and of intensive animal farming more generally.

Specifically, within the federal structure, states have primary authority in the following areas:

- The production and distribution of energy within state borders
- Property permitting and taxation
- Public portfolio standards and procurement requirements
- Local environmental, health, and welfare standards.

Thus, while the federal government has some capacity to proactively support research and development through the federal tax code and other financing programs, the relevant incentives and regulations for biogas are largely a product of state regimes. <u>Those hoping to influence the development of biogas should, therefore, look to state legislatures and state regulatory bodies.</u>

The following sections survey the elements of state legal regimes that are most often relevant for biogas development. It should be noted, however, that the style, structure, and statutory terminology varies across state codes. For example, different states use the terms “biogas,” “biomethane” and “renewable natural gas,” interchangeably. The relevant titles of each state code should, therefore, be reviewed individually.

State Support

Integration into State Energy Systems

Many states are driving adoption of agricultural biogas through their broader renewable energy incentive structures. At least twenty-two states classify biogas as a renewable energy source under their state Renewable Portfolio Standards (see Appendix 4). Renewable Portfolio Standards (RPS) mandate that energy suppliers (usually investor-owned utility companies, but some states include municipal or cooperative utilities) provide a set proportion of electricity from renewable sources. RPS legislation often also includes carve-outs and renewable energy credit multipliers to promote certain renewable energy technologies.

Both of the major carbon cap-and-trade systems in the U.S., California and the Regional Greenhouse Gas Initiative, allow farms to generate carbon offset credits by installing anaerobic digesters. California's carbon cap-and-trade system allows the sale of carbon offset credits (California Compliance Offsets) from the development and operation of new or expanded methane digester facilities on dairy cattle and swine farms. These offset projects are required to meet certain additionality requirements (set by section 95973(a)(2) of the Cap-and-Trade Regulation) and must go through an annual verification process conducted by an independent, ARB-accredited verification body[35]. So far, CARB has issued over 4.9 million offset credits - with each credit representing an emissions reduction of 1 tonne CO_2e - under the livestock protocol to over 100 projects[36]. Following Assembly Bill 398, the Compliance Offsets Protocol Task Force has begun the process of helping CARB establish new offset protocols for 2021-2030[37].

In the Regional Greenhouse Gas Initiative (RGGI), the carbon cap-and-trade market covering ten states in New England and the Mid-Atlantic, anaerobic digesters which capture and destroy methane from either animal manure or organic food waste qualify as one of five categories of projects eligible for CO_2 offset allowances (except in Massachusetts, Rhode Island, and New Hampshire, which do not issue offset allowances[38]). These allowances can then be sold as offsets to emission sources regulated under RGGI. However, at time of writing, there were no registered offset projects falling under this project category listed on RGGI's public database[39].

Direct Financial Assistance Programs

Biogas adoption is also directly subsidized through public grants, loans, and pilot programs for anaerobic digester installation. Biogas projects qualify for federal grants of up to $20,000 under the USDA's Rural Energy for America Program[40], and many states also operate their own subsidy programs.

For example, the California Climate Investments program uses cap-and-trade revenue to fund several grant programs aimed at supporting anaerobic digesters and other methane-reducing manure management projects. The California Department of Food and Agriculture's Dairy Digester Research & Development Program has designated up to $24.5 million for grants covering up to 50% of the total project cost for the installation of dairy digesters in California. The program has funded over 60 projects since its introduction in 2015[41]. However, the state also acknowledges that anaerobic digestion is not the only method of methane reduction in animal agriculture. CDFA also offers grants of up to $750,000 through its Alternative Manure Management Program for implementation of non-digester manure management practices such as composting, advanced solids separation, dry scraping and pasture-based management[42]. The program has funded 58 projects through 2018.

Other state-level programs include the Maryland Department of Agriculture's Animal Waste Technology Fund[43] and Minnesota's Methane Digester Loan Program[44].

Tax Incentives

States can incentivize the construction and operation of anaerobic digester technology through the tax code. Tax incentives can work through two channels. First, tax credits or deductions can be used to offset the cost of construction. Second, tax credits or deductions can supplement revenue from the energy production of the farm's digester. Most states in the US implement tax incentives that encourage farms to adopt AD technology[45].

In many cases, the state will exempt the farm (as well as other types of operations) from property taxes. For example, in Iowa, certain properties (depending on the time of construction), as well as improvements to those properties, are exempt from taxes if they generate methane from waste; this covers anaerobic digesters[46]. Some states, such as Wisconsin and Colorado, subsidize the sale of products used to construct and operationalize AD technology through sales tax exemptions[47]. Finally, there are states, such as South Carolina, that allow tax credits, which can be used to offset income taxes, for costs incurred in the operation of AD technology[48].

It is of note that property tax exemptions exacerbate economies of scale involved with anaerobic digester construction and operations. This is because property taxes, as well as sales taxes, are levied on the worth of a given property; the more valuable the property, the greater is the gain that can be derived from a tax exemption. To the extent that anaerobic digesters are more valuable when operated on larger operations, property tax exemptions will favor those larger operations. In addition, when tax credits are non-refundable (as in the case of South Carolina), they are only valuable to the extent that the corporation claiming them has income taxes to offset. If larger operations pay more in income taxes, they will benefit more from these credits.

In contrast, states may implement tax incentives that depend on the extent of the AD technology's production, measured either through its inputs or its outputs. Utah provides a production tax credit to biomass systems of .35 cents per kWh generated[49]. Maryland offers one worth .85 cents per kWh generated[50]. This type of tax program incentivizes not only the construction and maintenance of AD technology, but also the use of this technology to produce greater amounts of energy. This means both that any given operator of AD technology is motivated to produce more energy on the margin, which could mean generating a greater quantity of inputs (i.e. animal waste), as well as that operators of larger facilities are rewarded to a greater extent, due to their ability to generate greater amounts of energy.

Policy Applications and Interventions

In order to limit the negative impacts of legislation that encourage AD deployment, states may want to mandate stricter permitting to reduce the environmental, health and social impacts of intensive livestock farming; restrict eligibility for state support to operations that meet stricter standards or conditions; and offset the economies of scale that benefit large CAFOs by supporting cooperative digesters.

Comprehensive Permitting

Enhanced permitting is one way in which AD implementation can be safeguarded against the perpetuation of harmful practices, and could be used to improve conditions on CAFOs. ADs are required to comply with local, state and federal regulatory and permitting requirements for air, solid waste and water. Permits are issued by different agencies and levels of government and the permitting process is complex, costly, and time-intensive; for example, permitting regulations range from municipal zoning to state solid waste to federal stationary emissions sources. In addition, requirements vary by location and change frequently[51]. Due to the complexity of the process, regulatory bodies and agencies can lack coordination and enforcement of permits. General permits are one way to streamline the permitting application process by combining permitting requirements enforced by different regulatory bodies and agencies. States with a consolidated or general permit process include California, Massachusetts, Nebraska, and Pennsylvania. In exchange for coordinated environmental permitting, states can include language to strengthen enforcement of pollution controls and improved standards for workers, animals, and public health.

See Appendix 1 for model language.

Conditions on Eligibility

Limiting the eligibility for state support to operations that meet requirements covering areas of concern can mitigate the negative impacts of AD support, and could lead to better practices being implemented when coupled with the financial incentives for adopting both AD technology and best practices included in the legislation. Areas of concern/best practices could include farm size, antibiotic use, animal welfare, worker's rights and infrastructure investment.

Legal definitions can be important tools in the implementation of conditions on eligibility, and carefully defined terms in legislation can ensure that AD technology is supported in the most sustainable fashion, limiting the negative impacts of the technology.

See Appendix 2 for model language.

Support for Cooperative Digesters

The economics of AD adoption entail significant economies of scale, which benefit the largest CAFOs. One mechanism to offset this market distortion is to support cooperative digesters which can increase the scale of inputs and deliver economic feasibility by pooling the feedstocks from multiple farms and other organic waste producers. This model has been successful in a number of European countries.

See Appendix 3 for model language.

Many states exempt manure-only anaerobic digesters from solid waste permitting requirements, while requiring additional permits for co-digestion. States could instead include all farm digester systems in solid waste permitting schemes (or exempt both manure-only as well as co-digestion, but this would be an additional barrier to adequate solid waste management).

See Appendix 1.B. for model language.

Summary of State Support Mechanisms

Tools at the state level can shape state support for ADs in three main ways: (1) constraints on biogas use, (2) support for small operations or co-digestion, and (3) tighter standards for labor, animals, and environmental management. Renewable Portfolio Standards and Direct Financial Assistance can constrain eligibility to operations that meet certain standards. Tax incentives can prioritize smaller farms in their benefits structures. Permitting can tighten environmental, worker, and animal welfare standards and enforcement. We categorize these tools as follows:

Tool	Potential Constraints	Potential Supports	Purpose
Energy System Policies	Infrastructure limitations, i.e. requiring on-site electricity generation and net metering instead of gas pipelines Additionality requirements	Carve-outs, Cap-and-trade offset credits	Constraints on biogas adoption; Tighter standards for labor, animals, and environmental management
Direct Financial Assistance Programs	Prioritize alternative manure management practices Limit to operations with fair labor practices and animal welfare standards Limit eligibility to operations below a certain size	Public grants, loans, pilot programs	Constraints on biogas adoption; Tighter standards for labor, animals, and environmental management
Tax Incentives	Limit to digesters that intake waste from smaller operations or engage in cooperative digestion	Tax credits/deductions for construction and operating costs	Financial support for smaller operations' use of AD technology
Environmental Permitting	Limit nitrogen runoff from manure and liquid wastewater land applications Limit to operations with fair labor practices and animal welfare standards Limit to operations with enforceable nutrient management plan	Incentivize environmental practices through streamlined permitting and subsidy eligibility	Tighter standards for labor, animals, and environmental management; Regulatory support for smaller operations' use of AD technology

Appendix 1: Comprehensive Permit

General Permit Requirements for Composting or Aerobically or Anaerobically Digesting Organic Materials [See Massachusetts general permit process].

(A) The owner and operator of an operation that composts or aerobically or anaerobically digests organic materials shall:

(1) take all necessary steps to ensure the operation and its products do not result in an unpermitted discharge of pollutants to air, water or other natural resources of [state], create a public nuisance, or present a significant threat to public health, safety or the environment, including but not limited to:

(a) ensuring that the operation is located at least [distance] from any existing water supply well in use at the time the operation commences

(b) conducting nutrient monitoring of surrounding surface and ground waters within [distance] of the anaerobic digester

(c) establishing a watershed-level nutrient TMDL where levels of nitrogen exceeding [limit] and phosphorous exceeding [limit] are detected

(d) ensuring that all the Dischargers shall be considered in assessing compliance with the waste-load allocations in the TMDLs [Such as those established in California Order No. R8-2013-0001, NPDES No. CAG018001; Dairy General Permit]

(2) ensure that the operation incorporates best management practices, including but not limited to:

(a) employing an appropriate number of properly trained personnel for the size and type of the operation [Include additional worker protections such as those stipulated by New York Senate Bill 6578, The Farm Laborers Fair Labor Practices Act (June 16, 2019)]

(b) compliance with animal welfare standards [Such as the California Ballot Measure on Farm Animal Cruelty]

(c) compliance with adequate nutrient management as enforceable by routine inspections by a nutrient manager certified under a nutrient management training and certification program [Such as that stipulated in Virginia § 62.1-44.15 voluntary nutrient management training and certification program]

(3) take all necessary steps to ensure that the organic material and products are not contaminated by toxic substances at levels which may pose a significant threat to public health, safety or the environment, including but not limited to:

   (a) implementing a toxics control plan that ensures that the final products resulting from the operation do not pose a significant threat to public health, safety or the environment

   (b) surrendering eligibility for subsidies should toxics be detected in the final products at levels that pose a significant threat to public health, safety or the environment for any likely use of the product [include time constraint or contingency plan]

(B) Authorization: This general permit authorizes both the digestion of animal manure as well as the processing (mixing or blending) of (i) animal manure, (ii) grease trap waste (collected from restaurants, grocery stores, and/or facility preparing cleaning up from food service), (iii) pre-consumer food scraps from food markets, grocery stores, food banks, food distribution centers, school cafeterias and (iv) wastewater from a dairy parlour/farm, hereinafter referred to as a “co-digestion” [Reference Pennsylvania General Permit WMGM042 (August 17, 2011)]. Digestion of animal manure and co-digestion are authorized for beneficial use as follows:

(1) The liquid wastewater and solid waste removed from the digester may be beneficially used as a soil additive for agricultural purposes if the wastewater and solid waste does not exceed [limit] of fats, oil and grease, [antibiotic limit], [nitrogen and phosphorous limit], and [limited frequency of application and seasonality of application].

(2) The solid waste in field applications complies with an enforceable nutrient management plan.

(C) Recordkeeping: The permittee shall maintain accurate records to demonstrate compliance and submit a report to the [department] annually to demonstrate that the liquid wastewater and solid waste removed from the digester met the requirements as specified in the general permit.

Appendix 2: Conditions on Eligibility

(1) The [state regulatory body] shall ensure that biomethane, and the infrastructure required to produce biomethane, sourced from animal feeding operations [cite to state ag law or licensing scheme for def] eligible for [state support] meets [one or more] of the following conditions:

(A) Is an animal feeding operation with a capacity of less than 2000 animal units.
(B) Is an animal feeding operation that complies with the following standards:
   (i) Antibiotic use clause [Such as the 2019 Illinois General Assembly Bill SB3429]
   (ii) Confinement conditions clause [Such as the California Ballot Measure on Farm Animal Cruelty]
   (iii) Worker protections [Such as those stipulated by New York Senate Bill 6578, The Farm Laborers Fair Labor Practices Act (June 16, 2019)]
(C) Does not market products as 'sustainable' or 'responsible' as a result of biomethane generation activities.
(D) Biomethane is not injected into a common carrier pipeline.

(2) Sources are subject to [time period] inspection to confirm eligibility

[Alternatively] Condition Eligibility by Defining *Eligible Source*

For the purposes of [state support program], eligible source means:

(A) Water resource recovery [wastewater] facility
(B) Municipal solid waste facility [landfill]
(C) [Non animal] Food production and processing facility
(D) Food retailer
(E) An animal feeding operation that:
   (i) Has capacity less than [2000] animal units; and
   (ii) Meets conditions on antibiotic use, animal confinement conditions, worker protection.
(F) Community or cooperative digestion point [example definition: that takes waste from multiple eligible sources exclusively]

Conditions on Use (and interconnection)

(1) [State support] is available for

   (a) Onsite electricity generation ("electrical interconnection of onsite electrical generation facilities.")
   (b) Onsite heat generation

(c) Hard-to electrify sectors
(d) Vehicle fuels

Definitions:

Biomethane — gas created by the anaerobic digestion of organic materials

Common carrier pipeline — a gas conveyance pipeline that is owned or operated by a utility or gas corporation, excluding a dedicated pipeline.

Appendix 3: Support for Cooperative Digesters

A taxpayer may claim a tax credit equal to X% of the reasonable operating costs of its commercial biomass system if

(i) At least 50% of the material converted by the system into biomass originates in farms with fewer than [2000] livestock animals; and

(ii) Each of the farms that provide material to the system for conversion is reasonably compensated for the provision of such material. Reasonable compensation should reflect the value to the owner(s) of the system of receiving the material, as well as the costs of transportation of the material.

If agreed to by all parties, compensation to a farm may be in the form of energy generated by the commercial biomass system.

Appendix 4: States Recognizing Biogas in Renewable Portfolio Standards (RPS)

State RPS policies vary widely on several elements including RPS targets, the entities they include, the resources eligible to meet requirements and cost caps. In many state bills the percentage of renewable energy required to meet the RPS increases regularly. RPS bills define different classes of renewable energy, which have different requirements under the legislation, and include carve-outs and renewable energy credit multipliers to promote certain renewable energy technologies, as well as time limits within which certain technologies can be counted towards the state RPS.

State RPS that include manure digesters (non-exhaustive list)

- Arizona Ariz. Admin. Code §14-2-1801 et seq.
- California
- Colorado Senate Bill 263
- Connecticut Conn. Gen. Stat. §16-1
- Delaware Del. Code Ann. 26 §351 et seq.
- Hawaii Hawaii Rev. Stat. §269-91 et seq.
- Maine Senate File 457
- Massachusets Mass. Gen. Laws Ann. ch. 25A §11F
- Michigan Senate Bill 438
- Minnesota Minn. Stat. §216B.1691
- Montana Mont. Code Ann. §69-3-2001 et seq.
- Nevada Senate Bill 358
- New Hampshire N.H. Rev. Stat. Ann. §362-F
- New York Senate Bill 6599 (for localized use, as an offset)
- North Carolina N.C. Gen. Stat. §62-133.8
- North Dakota N.D. Cent. Code §49-02-24 et seq.
- Oregon Or. Rev. Stat. §469a
- Rhode Island R.I. Gen. Laws §39-26-1 et seq.
- Texas Tex. Utilities Code Ann. §39.904
- Vermont Standard: House Bill 40
- Virginia Va. Code §56-585.2
- Washington Senate Bill 5116 (loosely defined - includes all animal wastes energy)

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This report was researched and written in spring 2020 by a team of Yale graduate and professional school students in the **Climate, Animal, Food & Environmental Law & Policy Lab ("CAFE Lab")**, an initiative of the **Law, Ethics & Animals Program at Yale Law School**.

The CAFE Lab's mission is to develop novel strategies to compel industrial food producers to pay the currently uncounted, externalized costs of industrial agriculture for people, animals, and the environment. For more information about the Program and the CAFE Lab and to access its publications, please visit: law.yale.edu/animals.

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