Friends of the Earth United States

SRAP

Making a Bad Situation Worse

Manure Digesters at Mega Dairies in Wisconsin

Acknowledgments

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Executive Summary

Once a quaint, pastoral community, Kewaunee County, Wisconsin, is now dominated by industrial dairy operations. The county holds the highest density of cows per acre in the state, with cows outnumbering people nearly 5-to-1.[1] The consolidation and expansion of concentrated animal feeding operations (CAFOs) and the overwhelming volume of waste they generate have created significant environmental and public health concerns in Kewaunee County, including contaminated local drinking water. For decades, county residents have demanded increased oversight of industrial livestock operations and stronger enforcement of existing regulations to no avail. Instead, multiple anaerobic digesters—a technology that captures methane emissions from animal waste to produce manure biogas, also known as factory farm gas—have been built and are now operating in the county.

Kewaunee County residents, who continue to suffer the environmental and public health impacts of CAFOs, have made it clear that digesters do not solve their problems. In fact, the digesters in their community have made a bad situation even worse. In addition to continued pollution from the CAFOs themselves, the proliferation of digesters has led to dangerous spills, damage to local infrastructure, increased ammonia emissions, and more concentrated waste application on the land. Additionally, all CAFOs with digesters in Kewaunee County have increased their herd sizes, creating more pollution and enteric methane emissions.

This case study, based on research, public records, and interviews with residents, highlights the harmful community impacts of factory farm gas in Kewaunee County. While the case study tells just one locality's story, it reflects many concerns with the buildout of manure biogas in Wisconsin as well as across the United States.

Not only do factory farm gas systems fail to resolve the negative environmental and public health impacts of CAFOs, but they exacerbate pollution and safety risks to communities living near industrial livestock operations and biogas plants.[2] They also entrench the current, inherently unsustainable system of factory farms—all for overstated and inadequate methane reduction benefits.[3] Under the deceptive banner of "renewable natural gas," anaerobic digesters are portrayed as a technology that can substantially reduce the emission of methane, a potent greenhouse gas. However, our research demonstrates that anaerobic digesters yield a much lower reduction in methane emissions than estimated by the U.S. government, and that these reductions are highly variable and uncertain due to a lack of monitoring.[4]

An anaerobic digester, a closed, oxygen-free environment, is employed to capture methane released from livestock manure and turn it into biogas. During anaerobic digestion, bacteria break down organic material (in this case, animal waste) in the digester.5 What is left behind from bacteria "eating" the waste is a combination of gases, primarily methane and carbon dioxide, as well as solid and liquid material (also called "digestate" or "effluent").6 Biogas can be burned for heat or electricity or processed and injected into natural gas pipelines or used as vehicle fuel.

Mega-Dairies Cause Mega-Pollution in Kewaunee County

In Kewaunee County, water quality has been severely degraded due to consolidation and growth of large, industrial dairy operations and the vast quantity of waste these facilities produce. **Over the last 30 years, the number of dairy cows in Kewaunee County increased by 88%, while the number of dairy farms decreased by 82%.**[7] When asked about his primary concern about the exponential growth in the number of cows per farm, Dick Swanson, a twelve-year resident of Kewaunee County told us, "Two words: liquid manure."

The increase in both the animals and their waste has been particularly disastrous for a community in which 70% of the population relies on private wells for drinking water.[8] Decades of research documents water contamination tied to manure from the county's dairy farms, and residents' observations bolster those reports. **One study found over 60% of the private wells sampled in Kewaunee County contained fecal microbes tied to the vast quantity of waste that dairy operations produce, which is spread on the land and runs off into ground and surface waters.**[9] **A 2021 study determined that the main risk factor in the county for well contamination by coliform bacteria was the well's proximity to a manure storage pit.**[10] Water contaminated by pathogens is making the people of Kewaunee County sick: Additional research indicates that **the primary cause of acute gastrointestinal illness in the county is cow manure**.[11]

Keith Bancroft, a 48-year resident of Kewaunee County, identified outdated and inadequately enforced nutrient management plans (NMPs), which outline a farm's planned fertilizer and manure application schedule, as an enduring problem in addressing county water quality.[12] **A 2022 report by Environmental Working Group and Midwest Environmental Advocates found regular overapplication of fertilizer and animal manure in nine Wisconsin counties, including Kewaunee, which led to contaminated waterways**.[13] Unfortunately, the cost of addressing pollution from CAFOs falls to county residents, and costs are often high and unaffordable for most families.

Despite persistent advocacy by community members, little has been done by the state or federal government to increase oversight of CAFOs or properly enforce existing environmental laws in Kewaunee. Instead, the county—like many Wisconsin localities—is experiencing an uptick in manure biogas production. **In Kewaunee County, 28% (5/18) of the CAFOs now use anaerobic digesters to produce factory farm gas, including one of the largest CAFOs in Wisconsin, Kinnard Farms.**

Manure biogas systems are typically only feasible at the largest CAFOs,[14] and rely on the existence and perpetuation of these operations using the most hazardous, methane-generating manure management practices. This is the case in Kewaunee County as well: **All livestock operations in Kewaunee County supplying the digesters are large, with herd sizes ranging from 1,600 to over 9,000 cows.** These facilities are also located near residential areas and services, including schools, a day care center, and health centers. **Nearly all Kewaunee County residents live within ten miles of a digester**.[15]

Anaerobic Digesters Exacerbate Environmental and Public Health Concerns

In addition to continued pollution from the CAFOs themselves, we found that anaerobic digesters have not resolved any of Kewaunee County's pollution challenges. **Water contamination remains a major issue for Kewaunee County, with a 2024 water quality testing report showing elevated levels of nitrate in water supplies throughout the community.**

Unfortunately, government policies that support the manure biogas market, including the federal Renewable Fuel Standard and California's Low Carbon Fuel Standard (LCFS), create perverse incentives for livestock operations to maximize methane yield by increasing animal herd sizes, either by displacing animals from smaller farms, adding new animals, or both. **In Kewaunee County, our research shows that on average, herd sizes at CAFOs with a digester grew by 58%. This represents an astonishing annual year-over-year herd size increase of 5.2% and reflects national trends.** Recent research by Friends of the Earth and Socially Responsible Agriculture Project found that across the country, herd sizes at dairies with digesters grew 3.7% year-over-year, which is 24 times the growth rate for overall dairy herd sizes in the states included in the analysis.[16] Larger herd sizes not only create more air and water pollution due to the increased volume of waste, but also generate more enteric methane emissions from the cows themselves.[17] Thus, the primary cause of Kewaunee County's contamination problem, excess manure,[18] is increasing due to the growing herd sizes that follow installation of anaerobic digesters. Furthermore, policies promoting manure biogas production are incentivizing dairies to employ the most hazardous—and methane-generating—manure management practices: liquid or slurry manure maintained in lagoons or ponds.

The CAFOs that supply the anaerobic digesters in the county are taking advantage of the lucrative payouts from the factory farm gas market: **All Kewaunee County manure digester operations participate in either the Renewable Fuel Standard, the Low-Carbon Fuel Standard, or both and receive payments through these programs for the biogas they create.**

Accidents, Environmental Violations, and Infrastructure Damage Accompany Digesters

Proponents of digesters claim the technology helps livestock operations improve manure management and reduce risk of nutrient runoff.[19] **Yet, all five Kewaunee County CAFOs with digesters have experienced at least one spill since digester installation**, including one operation that reported 23 spills since installing a digester in 2009. **All five Kewaunee County CAFOS with digesters have been issued one or more citations for a nutrient management plan implementation violation after installing a digester.** Additionally, **all five CAFOs were cited at least once for improper land application of waste after they installed a digester.**

Kewaunee County does not have a pipeline injection site for biogas produced by manure digesters, **so most dairies truck the methane gas to neighboring localities, resulting in air pollution and damage to local infrastructure across the county due to increased truck traffic.**

Policy Recommendations

The Kewaunee County residents we spoke with see anaerobic digesters as a perpetuation of the problem rather than a solution. Instead of more digesters, they want stronger enforcement of environmental protection laws, more support for sustainable, regenerative agriculture and truly renewable energy, and an end to incentives for producing manure biogas. Rather than investing in manure biogas, public resources should be redirected to more effective methane reduction solutions that do not exacerbate environmental injustice and industry consolidation. While policies must shift at the federal level, state policymakers and agencies can take several measures to better protect people and the environment from the harms of manure biogas and CAFOs.

Specifically, we recommend the following policies:

1. Do not fund or incentivize manure biogas.
2. Prohibit installation of new liquid manure handling systems, such as waste lagoons, in Wisconsin.
3. Prohibit construction of new large CAFOs and expansion of those currently operating in Wisconsin.
4. Regulate waste from CAFOs and digesters, including treatment and application of digestate.
5. Strengthen and enforce nutrient management plan violations to ensure compliance through the Wisconsin Pollutant Discharge Elimination System (WPDES) program. Impose meaningful penalties on repeat offenders, including suspension of permits.
6. Protect and support meaningful local control over anaerobic digester operations by Wisconsin localities to address issues related to road damage, fires, explosions, and biosecurity.
7. Require CAFO operators to provide "real-time" reporting on water usage and locations of manure-hauling trucks.
8. Prohibit more than one CAFO from sharing land application sites.
9. Incentivize farmers to adopt regenerative agricultural practices that decrease farmers' input costs, reduce erosion, improve soil health, produce more nutrient-dense foods and mitigate climate change.
10. Put conditions on CAFO permits to reduce public health and environmental harms, including by limiting herd sizes.
11. Require and improve methane monitoring and reporting from livestock operations.
12. Pursue methane reduction strategies that support environmental justice and fair markets for producers, including regulating methane emissions from industrial livestock facilities, leveraging statewide food procurement toward plant-forward menus, reducing food waste, and prioritizing conservation funding for pasture-based livestock production.
13. Require disclosure of basic data from CAFOs and digester operators. Fund and conduct research to assess the impact of manure biogas policies on methane emissions, industry consolidation, and rural communities.

I. Introduction

In Kewaunee County, Wisconsin, cattle outnumber people nearly 5-to-1.[20] Concentrated animal feeding operations (CAFOs), also known as factory farms, dominate the landscape. CAFOs confine thousands of animals and produce enormous amounts of waste—as much as one billion tons per year across the United States, more than three times as much waste as humans.[21] These facilities are major sources of air and water pollution for rural communities, primarily due to the waste produced. This waste is often stored in giant manure pits and periodically overapplied to spray fields, causing contaminants to leech into aquifers, affecting nearby homes and drinking water sources.[22] Animal agriculture is also a major driver of the climate crisis, accounting for nearly 60% of emissions from the global food system.[23] Animal agriculture is the largest source of U.S. methane emissions, accounting for 36% of total U.S. methane emissions, which primarily stem from the digestive system of the animals themselves (known as "enteric fermentation"), and the management of the vast quantity of animal waste produced by industrial livestock operations.[24]

The environmental effects of extreme concentration of industrial animal agriculture are acutely felt by residents of Kewaunee County, whose health and quality of life have been severely impacted by polluted drinking water, primarily from animal waste.[25] But CAFO regulations have not improved. Instead, Kewaunee County residents have witnessed the proliferation of anaerobic digesters, technology employed on large-scale livestock operations to reduce methane emissions by capturing the gas released from animal waste and creating manure biogas, or factory farm gas, which can then be used for heat and electricity or refined into pipeline-quality gas that can be used as transportation fuel.

Kewaunee County residents, who continue to suffer the environmental and public health impacts of CAFOs, have made it clear that digesters do not solve their problems. In fact, digesters in their communities have made a bad situation even worse. In addition to continued pollution from the CAFOs themselves, dangerous spills, exponential herd-size growth, and damage to local infrastructure have all accompanied the proliferation of anaerobic digesters.

This case study is based on research as well as interviews with Kewaunee County residents. It details community members' struggles with access to clean water due to CAFO pollution and the failure of Wisconsin state agencies to enforce environmental protections against manure contamination. It also explores how the harmful impacts of factory farm gas expansion—supported by government policies like the federal Renewable Fuel Standard and California's Low Carbon Fuel Standard (LCFS)—have exacerbated these toxic conditions.

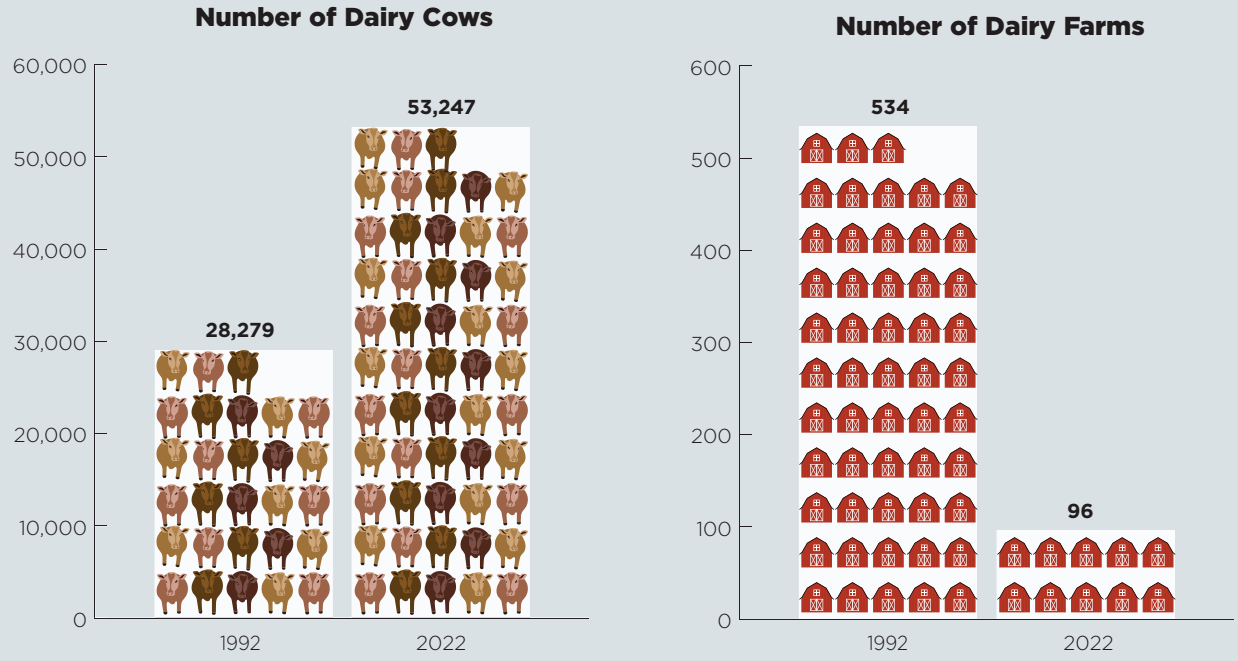
II. The Industrialization of Kewaunee County's Dairy Industry

Kewaunee County is a rural, agriculture-intensive community 20 miles east of Green Bay, Wisconsin. Twelve-year resident Dick Swanson moved to Kewaunee County with his wife to be closer to family but "would have probably thought differently [about moving] if [we] understood what CAFOs were." The Wisconsin Department of Natural Resources (WI-DNR) defines a dairy CAFO as a farming operation with 1,000 or more animal units (the equivalent of approximately 714 mature dairy cows).[26] Kewaunee County is home to 18 dairy CAFOs spread over 342.5 square miles of land.[27]

However, this is not always what the county looked like. Keith Bancroft, a 48-year resident of Kewaunee County, noted that when he moved to the community, most traffic was "tractors...a few farm trucks," but that over the years, it gradually changed. "It [was] more and more big equipment and manure tankers and big feed trucks." Keith noted that small farms around him were "gobbled up" by bigger farms, some of which "continued to get bigger or were sold off to an even bigger farm." The industrialization and consolidation of dairy farms in Kewaunee County is not anecdotal: Over the last 30 years, there has been an 88% increase in the number of dairy cows, but an 82% decrease in the number of dairy farms.[28] Historical census data show that in 1992, there were 534 dairy farms in Kewaunee County and 28,279 cows;[29] in 2022, there were just 96 dairy farms in the county but with 53,247 dairy cows.[30]

When asked about his primary concern with the exponential growth in the number of cows per farm, Dick said, "Two words: liquid manure."

Figure 1. Over the last 30 years, there has been an 88% increase in the number of dairy cows in Kewaunee County, but an 82% decrease in the number of dairy farms.



Mega-Dairies Cause Mega-Pollution in Kewaunee County

One of Kewaunee County's greatest challenges is water pollution from industrial-scale livestock operations. Decades of research documents water contamination tied to waste from the county's dairy farms, and residents' observations bolster those reports.

In Kewaunee County, 70% of the population relies on private well water for drinking.[31] One study found that over 60% of private wells sampled contained fecal microbes tied to the large quantities of waste that dairy farms spread on the land, which causes pollutants to leach into ground and surface waters.[32] Researchers from this study speculate that if wells were regularly tested, the number of contaminated wells would likely exceed 90%.[33] Pathogens, including E. coli, Salmonella, Giardia, and Cryptosporidium, have all been found in private water supplies.[34] These pathogens can cause diarrhea and increased risk of sickness or death in children, pregnant people, immunocompromised people, and others.[35] A pair of 2021 studies confirmed this: One revealed that the main risk factor in the county for well contamination by coliform bacteria was its proximity to a manure storage pit,[36] while the other found that the primary cause of acute gastrointestinal illness in the county is cow manure.[37]

Keith Bancroft identified outdated and inadequately enforced nutrient management plans (NMPs) as an enduring problem in addressing water quality in the county. An NMP outlines a farm's planned fertilizer and manure application volume and schedule throughout a given year.[38] The U.S. Environmental Protection Agency (EPA) requires all CAFOs to have a National Pollution Discharge Elimination System (NPDES) permit, and to receive this permit, the CAFO must have an NMP.[39] Wisconsin also requires an NMP for CAFOs and additionally limits wastewater discharges via the Wisconsin Pollutant Discharge Elimination System (WPDES) program.[40]

While the goal of an NMP is to prevent overapplication of fertilizer, the plans are ultimately calculated to maximize the allotted application of nitrogen, phosphorus, and potassium.[41] Further, penalties for NMP violations, which by their nature are also WPDES violations, are not always enforced and can be inconsequential. For example, violating an NMP can result in just a WI-DNR citation and a $10 per day fine.[42] A 2022 report from Environmental Working Group and Midwest Environmental Advocates found regular overapplication of fertilizer and animal manure in nine Wisconsin counties, including Kewaunee, leading to contaminated waterways.[43] They noted that in Kewaunee County, "manure phosphorus [application] alone exceeded total crop phosphorus removal in the county by 23 percent."[44] Even in rare cases when violations are referred to the Department of Justice for civil forfeiture, the penalties are a fraction of the CAFO's profits and the damage is often already done.[45]

Wisconsin wisely restricts manure land application during winter months due to increased risk of ground and surface water pollution that results from putting manure on wet or frozen ground and ground that lacks crops.[46] Specifically, from February 1 to March 31, liquid waste may not be applied to any field that contains snow or is frozen.[47] Additionally, liquid manure cannot be applied to frozen land at any time, unless it's an emergency and WI-DNR verbally approves its application.[48] However, like the enforcement of NMPs, this prohibition is laxly enforced by the agency, primarily because it relies on CAFOs' self-reporting or community members reporting violations to WI-DNR.[49] A 2022 study that used satellite imagery and machine learning to identify potential instances of manure spreading during the winter predicted that the state's 330 CAFOs illegally land-applied waste 951 times during February and March.[50] In 2023, the researchers worked with WI-DNR to confirm the accuracy of their predictive model and found that it correctly spotted winter manure spreading in about half of the 121 cases the agency investigated.[51] WI-DNR admitted that they "definitely did find more noncompliant winter spreading than a normal or an average year," indicating that illegal manure spreading is likely regularly occurring in Wisconsin.[52]

One 2022 study that used satellite imagery and machine learning to identify potential instances of manure spreading during the winter predicted that the state's 330 CAFOs illegally land-applied waste 951 times during February and March.

Tom Cretney, who lived in Kewaunee County for two decades, told us that many of these farms "dump a lot of truckloads [of waste] on this land." He and other concerned residents have tried to monitor CAFO pollution, but the CAFO operators have prevented them from doing so. As Tom sees it, "They don't want us to know because this is a widespread contamination throughout the county. It's a nasty business and a lot of chemicals are poured on the land." Dick Swanson gave a similar perspective stating, "It's a chemical assault and it's not ending."

The costs of removing water contaminants are high and unaffordable for most families. Reverse osmosis systems to remove pathogens can cost $17,000 per home.[53] One Kewaunee County resident reported spending $10,000 to dig a new well to access pathogen-free water, but within months the new well was contaminated too.[54]

The costs of removing water contaminants are high and unaffordable for most families. Reverse osmosis systems to remove pathogens can cost $17,000. One Kewaunee County resident spent $10,000 to dig a new well to access pathogen-free water, but within months the new well was contaminated too.

Kewaunee Residents Call for More Oversight of Factory Farms

Given the widespread contamination of the county's drinking water, advocates have spent years pushing for greater oversight and accountability of factory farms. Community groups like Kewaunee CARES advocate against the CAFO model as well as track and litigate environmental violations tied to dairy production.[55] In 2014, the group joined a statewide coalition to file a petition with EPA to use its emergency authority to investigate dairy pollution in the county.[56] In response, WI-DNR created the Groundwater Collaboration Workgroup, which published formal recommendations in 2016 that mostly centered on improving compliance with existing regulations.[57]

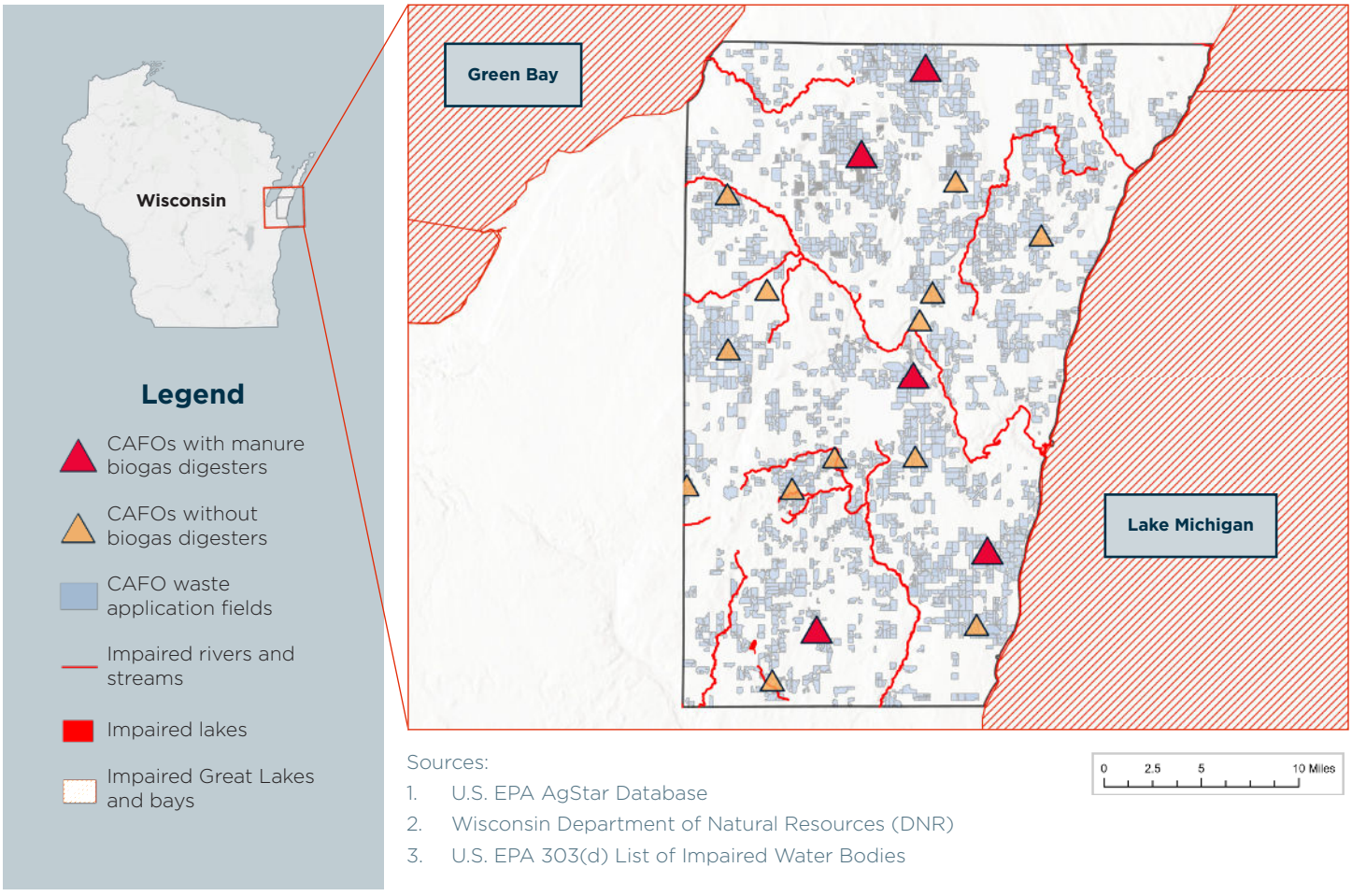
Two positive steps occurred after the workgroup concluded: First, Kewaunee County passed a Public Health and Ground Water Protection Ordinance, which prohibits the application of waste on soils with less than 20 feet of topsoil January 1 through April 15, unless a written exemption is provided by the Land and Water Conservation Committee.[58] Second, WI-DNR revised the rules governing manure spreading on vulnerable karst topography found in localities like Kewaunee County.[59] The rule change developed a targeted performance standard for nitrates, which means that if normal regulatory performance standards are not met, "additional management practices need to be implemented in order to better achieve water quality standards."[60] However, many felt it did not go far enough as it did not establish stronger requirements for actual manure spreading.[61] Moreover, both the regulatory change and the Public Health and Ground Water Protection Ordinance require local enforcement, which remains lax, and residents, including those we spoke with, find lacking.[62]

Recently, a major lawsuit further acknowledged the harm.[63] In July 2021, the Wisconsin Supreme Court resolved a decade of litigation between Clean Wisconsin, an environmental advocacy organization, and Kinnard Farms, the largest CAFO in the county and one of the CAFOs with a digester.[64] The court found that WI-DNR failed to properly regulate Kinnard Farms when it allowed the operation to expand and add 3,000 cows, despite its frequent manure spills and improper manure spreading, which contaminated local drinking water and exposed the surrounding area to pathogens.[65] However, as Clean Wisconsin notes, the lawsuit "only settled that DNR has the authority to include conditions," such as herd size limits and regular groundwater testing, when issuing wastewater permits.[66] Subsequently, after years of Kinnard Farms improperly spreading waste in the county, WI-DNR reissued the CAFO's WPDES permit in 2023 with conditions. The agency limited the operation's herd size to just over 11,000 cows and required it to cease spreading liquid manure within four years, or else it would be required to regularly monitor nearby groundwater.[67]

Despite the modest legislative and regulatory changes, water quality remains an issue in Kewaunee County. A water quality testing report from January 2024 revealed elevated levels of nitrate in water supplies throughout Kewaunee.[68] Dick Swanson just wants to know, "Why do the people of Kewaunee County need lawyers for clean water when they [CAFO operators] know exactly what they need to do?"

Yet rather than factory farms taking accountability for the damage their pollution has caused, Kewaunee County residents are instead witnessing the proliferation of anaerobic digesters.

Figure 2. Manure Biogas Digesters and CAFOs in Kewaunee County, Wisconsin



Sources:

1. U.S. EPA AgStar Database
2. Wisconsin Department of Natural Resources (DNR)
3. U.S. EPA 303(d) List of Impaired Water Bodies

III. Digester Growth in Kewaunee County: Making a Bad Situation Worse

An anaerobic digester is a closed, oxygen-free environment that captures the methane released from livestock manure and turns it into biogas. During anaerobic digestion, bacteria break down organic material (in this case, animal waste) in the digester.[69] What is left behind from bacteria "eating" the waste is a combination of gases, primarily methane and carbon dioxide, as well as solid and liquid material (also called "digestate" or "effluent").[70] The digestate, commonly used as fertilizer, is a highly concentrated, nutrient-rich byproduct that must be carefully managed to prevent increased nutrient pollution.[71] The gas can be used to generate heat or electricity on-site or electricity sold to the electric grid. It can also be processed into so-called "Renewable Natural Gas," or it can be converted to Compressed Natural Gas (CNG) or Liquefied Natural Gas (LNG) and used as vehicle fuel. Labeling this gas as "renewable" is industry greenwashing; manure biogas is inseparable from the highly polluting factory farming industry. Because "Factory farm gas" better reflects the true nature of this form of dirty energy, these terms are used interchangeably throughout this case study.

Five dairy CAFOs in Kewaunee County currently have digesters: Dairy Dreams, Deer Run Dairy, Kinnard Farms, Pagel's Ponderosa Dairy, and Wakker Dairy.[72] Pagel's Ponderosa constructed the first digester in the county in 2009, followed by digesters installed in rapid succession at three neighboring CAFOs. Kinnard Farms installed four additional digesters in 2020.[73]

Under the deceptive banner of "renewable natural gas," anaerobic digesters are portrayed as a technology that can substantially reduce methane emissions, a powerful greenhouse gas. However, evidence shows that anaerobic digesters yield a much lower reduction in methane emissions than estimated by the U.S. government, and that these reductions are highly variable and uncertain due to a lack of monitoring.[74] For example, anaerobic digestion and storage of the leftover digestate releases additional greenhouse gases, such as nitrous oxide, undercutting a portion of the methane emission reductions.[75] Research also shows that biogas supply chains leak more than EPA estimates, releasing additional methane into the atmosphere.[76] Additionally, manure biogas production relies on the existence and perpetuation of CAFOs using on the most hazardous—and methane-generating—manure management practices, like liquid or slurry manure maintained in lagoons or ponds.

An analysis of EPA data by Friends of the Earth and Socially Responsible Agriculture Project indicates that the staggering amount of state and federal government incentives and subsidies supporting manure biogas production, perversely, may be encouraging livestock operations to consolidate and grow their herd sizes to produce more manure to maximize methane production.[77] Larger herd sizes not only create more air and water pollution from the larger amounts of manure but also more enteric methane from the cows themselves.[78]

Unfortunately, factory farm gas production is not only an inadequate approach to the climate crisis, but these systems further entrench factory farms and fail to address their existing harms to rural communities, workers, farmed animals, and the environment. Even worse, manure biogas production generates additional environmental, public health, and safety concerns for communities living near factory farms and biogas plants.

Factory Farm Gas Further Entrenches Industrial Animal Agriculture

Anaerobic digesters are typically only feasible at the largest CAFOs, further increasing the competitive advantage for large-scale producers.[79] Unsurprisingly, all CAFOs in Kewaunee County supplying the digesters are large, with herd sizes ranging from 1,600 to over 9,000 cows.

Table 1. Size of CAFOs Supplying Anaerobic Digesters

CAFO name	Year of digester installation[80]	Number of cows (as of 2022)
Pagel's Ponderosa	2009	8,543[81]
Dairy Dreams	2010	6,188[82]
Deer Run Dairy	2012	1,612[83]
Wakker Dairy	2012	3,050[84]
Kinnard Farms	2020	9,300[85]

In Kewaunee County, these industrial operations are located near residential areas and services, including schools, a day care center, and health centers. For example, within five miles of Wakker Dairy's digester is Kewaunee Elementary school, a day care, and a hospital.[86] Of the county's 9,267 households, nearly all live within 10 miles of a digester.[87]

As it stands, the CAFOs with digesters in Kewaunee County collectively produce over 304 million gallons of waste every year.[88] That's more than 1,000 times the amount of human waste produced annually by all of Kewaunee County.[89] With the proliferation of digesters, that amount is likely to grow: As we explore later in this case study, producing manure biogas via anaerobic digestion is lucrative for CAFOs, so they are incentivized to use the most methane-generating manure management systems and produce even more manure either through further consolidation of farms, herd size expansions, or both.

Deer Run Dairy's digester exemplifies these perverse incentives. In order to generate more methane, Deer Run Dairy allows other farms to truck their manure to the site and offload it in a mixing tank.[90] This indirectly incentivizes smaller farms in the area to transition to the highly polluting lagoon manure management system in order to utilize the digester to discard their waste. It also creates additional truck traffic and safety risks.[91]

Factory Farm Gas Production Increases Environmental and Public Health Harms

The installation of anaerobic digesters fails to address many of the harms from factory farming. Digesters do nothing to curb the use of antibiotics administered to livestock, a driver of antibiotic resistance in humans, or prevent the next pandemic from originating in a factory farm and spreading.[92] They also don't address the issue of farmers locked in unfair contracts or protect workers on farms and in slaughterhouses. Finally, digesters fail to minimize the suffering of the more than nine billion animals raised for food in intolerably cruel conditions.

Even worse, factory farm gas production adds to existing environmental and public health burdens for communities living near CAFOs. This is distressing for a community like Kewaunee County that already struggles with these issues due to manure runoff pollution. Studies have shown that anaerobic digestion increases emissions of ammonia, an air pollutant associated with respiratory illness and irritation of the eyes, nose, and throat.[93] One study published in the journal Agriculture, Ecosystems, & Environment estimates that digestion increases cumulative ammonia emissions from manure by 81%.[94] Several other studies substantiate the claim that facilities with digesters emit more ammonia than conventional hog or dairy operations, creating risks for those living and working nearby.[95,96]

Digestate Threatens to Make Water Pollution in Kewaunee County Worse

Biogas digesters have not only failed to address the current contamination of water from CAFOs but they have potentially made it worse. Keith Bancroft pointed out that, "The trucks still run up and down the road because there is still liquid that comes out of that digester." Specifically, the byproduct of biogas, digestate can exacerbate water quality problems.

Digestate is a byproduct of anaerobic digestion that is commonly land applied as fertilizer and must be carefully managed to prevent pollution.[97] Nitrogen and phosphorus are more concentrated in digestate compared to fresh or composted manure, so digestate can cause nitrogen leaching; nitrous oxide emissions; residual methane, ammonia, and hydrogen sulfide emissions; and odorous gasses when applied in excess or without proper application protocols.[98] Moreover, while some manure digesters reach high temperatures that can kill certain pathogens (e.g., E. coli) in animal waste that can contaminate drinking water,[99] this does not address the high concentration of nutrients from digestate (or all pathogens). As noted above, in areas with intensive livestock production, there is often an oversupply of these nutrients relative to the land available for digestate application.[100] As a result, applying digestate to the land—compared with fresh manure—may have a higher risk for both ground and surface water quality problems.[101] This is alarming considering that Kewaunee County already faces overapplication of nutrients on its land as well as a failure to enforce nutrient management plans.[102]

Keith is rightfully frustrated by the support of digesters in a community already struggling with access to clean water, primarily due to waste from dairy CAFOs. He told us, "When we build a digester and take millions of gallons of clean water and mix it with manure...it's a huge waste of clean water. But then it also puts it in an environment where they're going to anaerobically process that and create a nasty gas...it's insane."

Herd Size Expansion Generates More Pollution, More Methane

As explored in greater detail below, federal and state programs encourage construction of anaerobic digesters and reward production of biogas with lucrative subsidies and incentives. To receive these payouts, CAFOs and biogas companies are incentivized to produce more factory farm gas by increasing animal herd sizes, either by displacing animals from smaller farms, adding new animals, or both. New research by Friends of the Earth and Socially Responsible Agriculture Project found that herd sizes at dairy CAFOs with digesters s grew 3.7% year-over-year, which is 24 times the growth rate for overall dairy herd sizes in the states included in the analysis.[103]

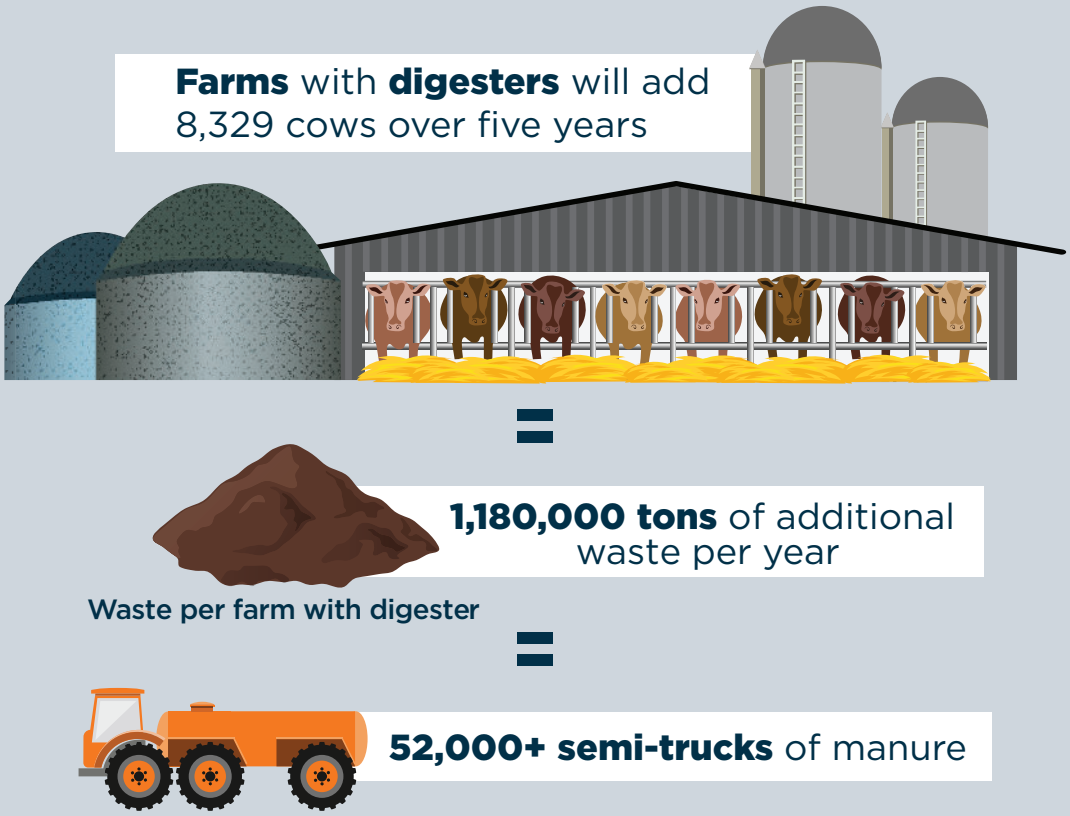
This national trend is reflected in Kewaunee County, where digester installations are correlated with significant growth in herd sizes. **On average, herd sizes of CAFOs with anaerobic digesters in Kewaunee County grew by 58%. This represents an astonishing annual year-over-year herd size increase of 5.2%.** All five CAFOs, which were large to start, increased herd sizes after installing digesters. For instance, in 2019, the year before its digester was installed, Kinnard Farms housed 7,591 cows; in 2022, that number grew to 9,300 cows, a herd size increase of 23% in just 3 years.[104] WI-DNR permitted Kinnard Farms to expand even as it underwent litigation surrounding improper manure spreading.[105] Wakker Dairy, which installed its digester in 2012, experienced one of the largest herd increases, expanding from 1,600 cows in 2012 to over 3,000 cows in 2022—nearly doubling its herd size.[106] Overall, dairies with digesters in Kewaunee County added over 9,500 dairy cows between the year of digester installation and 2022. Previous research found that across Wisconsin, CAFOs with digesters grew by 2.4% year-over-year, while industrial livestock operations in the state without a digester had an annual year-over-year herd size increase of just 0.1%.[107]

Table 2. Herd Size Increases at Dairy CAFOs With Digesters

CAFO name	Year of digester installation[108]	Number of cows (as of year closest to digester installation)[109]	Number of cows (2022)	Herd size increase	Year-over-year herd size increase
Pagel's Ponderosa	2009	4,600 (2009)[110]	8,543[111]	**85.7%**	**4.9%**
Dairy Dreams	2010	4,300 (2012)[112]	6,188[113]	**43.9%**	**3.7%**
Deer Run Dairy	2012	1,100 (2012)[114]	1,612[115]	**46.5%**	**3.9%**
Wakker Dairy	2012	1,600 (2012)[116]	3,050[117]	**90.6%**	**6.7%**
Kinnard Farms	2020	7,591 (2019)[118]	9,300[119]	**22.5%**	**7.0%**
AVERAGE				**57.9%**	**5.2%**

Although these results do not prove a causal link between digesters and herd sizes, this finding supports the notion that digesters—in combination with policies that reward biogas production—incentivize increased herd sizes.

Figure 3. Herd Size Growth at Dairies With Digesters in Kewaunee County Will Generate Massive Volumes of Waste



- Farms with digesters will add 8,329 cows over five years.[1]
- This will add 1.18 million tons of additional waste over five years.[2]
- Farms with digesters in Kewaunee County = 52,000 semi-trucks of manure.[3]

1 Calculated using total end population and average YOY increase.

2 On average, dairy cows produce .078 tons of waste per day. Natural Resources Conservation Service. (n.d.). ***Agricultural Waste Management Field Handbook***. U.S. Department of Agriculture. https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=31475.wba. .078 x 365 x 5 = 142 tons of waste over 5 years. 142 x 8,329 cows = 1.18 million tons of waste over 5-years.

3 An 18-wheeler can carry up to 22.5 tons. Tarradell, M. (2020, June 22).***A Guide to Truck Weight, Classification, and Uses***. TCS Fuel. https://www.tcsfuel.com/blog/truck-weight-classification/

More cows due to the installation of anaerobic digesters means even more manure—the primary source of Kewaunee County's water pollution.[120] As Kewaunee County continues to struggle with chronic water contamination, more liquid manure is an unwelcome development.[121] "There's not enough land for what they're producing," said Dick Swanson. And more land is unlikely to appear.

Manure Biogas Production Damages Infrastructure

Biogas from digesters is often upgraded and injected into a pipeline and transported to its final point of usage. Kewaunee County does not have an injection site. Instead, most dairies truck methane gas to Newton, WI, or Hilbert, WI. Trucking gas between counties requires heavy trucks to travel hundreds of miles, continually traversing state and town roads in suburban and rural areas, damaging the environment, local infrastructure, public health, and quality of life for those living nearby.

Tom Cretney confirmed this, telling us that because of the hauling of waste and gas regularly on the road as part of these operations, "you're going to have damage on the roads, and you can see that across Kewaunee."

Accidents and Environmental Violations Accompany Manure Digesters

Digesters increase the risk of accidents, including spills and explosions. For example, in 2020, Pagel's Ponderosa Dairy's methane digester building caught on fire.[122] Meanwhile, at a manure digester in nearby Dane County, Wisconsin, pipelines transporting manure from surrounding farms spilled more than 400,000 gallons of waste in 3 separate incidents over a 3-year period.[123] All five CAFOs with digesters in Kewaunee County have caused at least one spill since digester installation, but it's impossible to know the total number of spills because WI-DNR allows CAFOs to self-report.[124] Even with Wisconsin's lax enforcement system, Pagel's Ponderosa Dairy reported an astounding 23 spills since its digester was installed in 2009.[125]

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Proponents claim that digesters help livestock operations improve manure management and reduce the risk of nutrient runoff.[126] However, in Kewaunee County, all CAFOs with digesters have received one or more citations for NMP implementation violations after installing a digester, indicating that they failed to adhere to nutrient management standards set by WI-DNR. Further, all farms were cited at least once for improper land application after installing a digester. For example, Wakker Dairy incurred a $225,000 penalty in 2022 after the Wisconsin Attorney General found the farm violated multiple provisions of its wastewater discharge permit, including 20 occasions where manure was spread or ran off through subsurface drains.[127] The frequency of these instances refutes the contention that digesters help dairies refrain from excess or untimely manure spreading events.

IV. Government Policies Drive Anaerobic Digester Growth

Digester Infrastructure Relies on Costly Taxpayer Subsidies and wwIncentives

Anaerobic digester infrastructure is expensive to build and maintain.[128] Between 2015 and 2021, the cost of constructing a digester averaged $4.3 million for large dairies,[129] not including the cost of ongoing maintenance to operate the system and machinery.[130] While CAFOs can use private capital to finance anaerobic digesters (e.g., Kinnard Farms' digester is a product of a partnership with Kewaunee Renewables, a subsidiary of a transnational energy corporation, DTE Vantage), in most cases, constructing an anaerobic digester is not viable without public subsidies.

The federal government provides significant subsidies for digester installation through United States Department of Agriculture (USDA) grant and loan programs, such as the Environmental Quality Incentives Program (EQIP) and the Rural Energy for America Program (REAP).[131] The Inflation Reduction Act and Bipartisan Infrastructure Act directed additional money to programs like these, as well as creating new tax breaks for producing manure biogas.[132] Despite the extensive amount of tax dollars provided, none of these programs include any conditions or exclusions to reduce public health and environmental harms or increase transparency. Some states, including Wisconsin, also use tax incentives to offset the cost of constructing and operationalizing anaerobic digesters.[133] Wisconsin's tax code specifically notes that there is a sales and use tax exemption for "the sales price from the sale of and the storage, use, or other consumption of a product whose power source is…gas generated from anaerobic digestion of animal manure."[134]

In Kewaunee County, three CAFOs, Dairy Dreams, Deer Run Dairy, and Pagel's Ponderosa Dairy, received federal dollars to install digesters.[135] Keith Bancroft finds this outrageous, noting that he knows local farmers "who raise beef cattle on grass pasture and hay fields…they do it the right way, and they don't kill the land and they put carbon back in the ground, and they get nothing. And yet someone out there who is creating all this pollution gets government subsidies." Or as Tom Cretney put it, "Digesters are just a waste of wealth. There is so much more we could be doing."

Broadly however, the lack of transparency into digester operations makes it challenging to identify all of their funding sources. For example, the EPA AgSTAR database, the main federal source for tracking digesters, only provides a "yes/no" column for USDA funding, does not report more granular funding or profit sources, and does not include all digesters.[136] On the whole, there is a shocking lack of mandated disclosure and reporting, despite the provision of significant public tax dollars.

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Government Policies Incentivize Factory Farm Gas Production

In addition to subsidizing the costs of building anaerobic digesters, government programs incentivize the sale of biogas, creating perverse incentives for CAFOs to produce as much methane as possible to receive lucrative payouts for manure biogas. On the federal level, the Renewable Fuel Standard (RFS) requires that a certain volume of renewable fuels, including biomass-based diesel like factory farm gas, is mixed in with traditional petroleum-based fuel, creating a guaranteed market for the biofuel industry.[138]

On the state level, California is the largest national demand-side driver of the factory farm gas market through its Low Carbon Fuel Standard (LCFS), a program to decrease the carbon intensity of the state's transportation fuels.[139] Each year, the California Air Resources Board (CARB) sets carbon intensity (CI) standards for transportation fuels. Fuels below the CI standard receive credits while fuels above the CI benchmark receive deficits.[140] Transportation fuel providers must show they meet LCFS CI standards and can do so by acquiring (trading) or earning more credits than deficits.[141] CAFOs throughout the U.S. can earn credits by installing and operating digesters to produce manure biogas. Currently, manure biogas has an extremely large negative CI score because CARB gives participating CAFOs credit for both reducing methane emissions from manure (under the false assumption that wet, methane-generating manure is an unavoidable byproduct of livestock production), and for replacing fossil fuels with higher CI scores.[142] As a result, LCFS distorts the market for transportation fuels, boosting manure biogas above truly renewable sources, and incentivizes CAFOs to generate as much methane—and therefore as much manure—as possible to capitalize on the hefty subsidies.

In Kewaunee County, Wakker Dairy, Kinnard Farms, Deer Run Dairy, Pagel's Ponderosa Dairy, and Dairy Dream all participate in either RFS, LCFS or both through partnerships with energy companies, including Kewaunee Renewables, DTE Vantage, Clean Energy Renewable Fuels, and U.S. Venture, Inc.[143]

Kewaunee Renewables, partnered with Kinnard Farms, is registered with the RFS as a renewable fuel producer and LCFS.[144] DTE Vantage, Kewaunee Renewables parent company, is registered with both LCFS and RFS.[145] In a 2019 press release, DTE Vantage announced it was working with Dairy Dreams and Pagel's Ponderosa Dairy, among other farms in Wisconsin, to process and pipe biogas from digesters.[146] Dairy Dreams and Pagel's Ponderosa Dairy have both partnered with Clean Energy Renewable Fuels LLC as well to provide biogas for injection at the Calumet-Maple Leaf/ Grotegut facility in Wisconsin.[147] Deer Run Dairy, which upgrades fuel at the Deer Run RNG Project facility, is also a registered renewable fuel producer within RFS and LCFS. U.S. Venture, Inc. partners with the farm to provide services like transport and biogas injection.[148] Wakker Dairy applied to LCFS through its own company, Wakker Biogas, LLC.[149]

As registered renewable fuel producers, these Kewaunee County livestock operations and their business partners receive payments for biogas they provide. As of April 2024, a CAFO can earn $3.09 per gallon of factory farm gas through RFS[150] and between $65 and $67 per metric ton through the LCFS.[151]

There is, however, a lack of transparency around the effectiveness of the digesters—both as a source of energy and as a technology to reduce greenhouse gases (as noted above). Keith Bancroft shared that Pagel's Ponderosa claimed its digester would "power up Kewaunee County with clean, renewable energy and reduce the amount of liquid manure that went back into land." Indeed, the company's website states, "with the electricity generated from the digester, Pagel's Ponderosa can almost power the entire neighboring city of Kewaunee…".[152] It also claims that its digester "substantially reduces greenhouse gas emissions."[153] However, Pagel's Ponderosa does not provide any other information about the energy produced or its greenhouse gas reductions from employing the digester. From Keith's perspective, its claims are "all pretty much BS." Tom Cretney echoed Keith's concerns about the lack of transparency: "[We] want to know more about the outputs and inputs…the information is difficult to source…we want to see receipts of the energy produced."

The skepticism around industry claims is justified. Despite extensive public investments in and support for manure biogas, the U.S. government is not monitoring or reporting on methane emissions from CAFOs with digesters or collecting basic information in ways necessary to understand whether these investments yield substantial greenhouse gas reductions.

V. Conclusion and Policy Recommendations

Kewaunee County's systemic pollution will not be resolved through manure biogas production. These systems rely on industrial livestock operations growing larger, while toxic manure management—via lagoons and spray fields—continues. As Dick Swanson correctly put it, anaerobic digesters "are not a magic pill." Keith Bancroft agreed: "[There is an] unending list of things I think that CAFOs and digesters do not fix."

As this case study shows, the installation of anaerobic digesters has not stemmed any of the other negative side effects of factory farms in Kewaunee County: The largest CAFOs continue to grow, CAFO waste continues to be overapplied on the land, residents continue to struggle to access to clean water, large tanker trucks continue to crush county roadways, and thousands of cows continue to be kept in intolerably cruel conditions.

In fact, as this case study has shown, the digesters in their community have made this bad situation even worse. In addition to the continued pollution from the CAFOs themselves, the proliferation of anaerobic digesters has led to dangerous spills and damage to local infrastructure, as well as increased ammonia emissions and more concentrated waste application on the land from digestate. Additionally, all of the CAFOs with digesters in Kewaunee County have increased their herd sizes significantly, creating more pollution and enteric methane emissions.

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Rather than investing in anaerobic digesters, public resources supporting manure biogas should be redirected to more cost-effective methane reduction solutions that do not exacerbate pollution and environmental injustice. Instead, policies should support a just transition away from factory farming to regenerative agriculture, and away from fossil fuels to truly renewable energy. While policies must shift at the federal level, there are many measures that state policymakers and agencies can take to better protect people and the environment from the harms of manure biogas and CAFOs. These include:

1. Do not fund or incentivize manure biogas.
2. Prohibit installation of new liquid manure handling systems, such as waste lagoons, in Wisconsin.
3. Prohibit construction of new large CAFOs and expansion of those currently operating in Wisconsin.
4. Regulate waste from CAFOs and digesters, including treatment and application of digestate.
5. Strengthen and enforce nutrient management plan violations to ensure compliance through the Wisconsin Pollutant Discharge Elimination System (WPDES) program. Impose meaningful penalties on repeat offenders, including suspension of permits.
6. Protect and support meaningful local control over anaerobic digester operations by Wisconsin localities to address issues related to road damage, fires, explosions, and biosecurity.
7. Require CAFO operators to provide "real-time" reporting on water usage and locations of manure-hauling trucks.
8. Prohibit more than one CAFO from sharing land application sites.
9. Incentivize farmers to adopt regenerative agricultural practices that decrease farmers' input costs, reduce erosion, improve soil health, produce more nutrient-dense foods and mitigate climate change.
10. Put conditions on CAFO permits to reduce public health and environmental harms, including by limiting herd sizes.
11. Require and improve methane monitoring and reporting from livestock operations.
12. Pursue methane reduction strategies that support environmental justice and fair markets for producers, including regulating methane emissions from industrial livestock facilities, leveraging statewide food procurement toward plant-forward menus, reducing food waste, and prioritizing conservation funding for pasture-based livestock production.
13. Require disclosure of basic data from CAFOs and digester operators. Fund and conduct research to assess the impact of manure biogas policies on methane emissions, industry consolidation, and rural communities.

The residents we spoke with had a variety of opinions on what the government should incentivize instead of manure biogas production. Keith Bancroft said, "Someone who never kills the land and has grassland for pasture and hayfields should just automatically receive some compensation by the acreage from one of those USDA [conservation] programs." He added that the government should pay farmers to adopt regenerative agriculture practices: "Regenerative agriculture changes the traditional farming focus from what we see growing above ground to understanding what nature is providing below ground." Tom Cretney said that both federal and state governments should support truly renewable energy projects. In addition to lax enforcement of existing laws, Dick Swanson sees the new marketplace for manure biogas as a major problem: "As we all know now, liquid manure is making more money than the milk." He said, "We're going to get more CAFOs. The money's too big now." Resoundingly, none of the county residents we spoke with felt that anaerobic digesters were the solution.

Manure biogas has failed to solve the problems caused by large dairy CAFOs in Kewaunee County. As residents have observed, the proliferation of anaerobic digesters in their community has neither improved water quality nor resulted in meaningful changes to the way manure is managed. Instead, community members witness millions of taxpayer dollars being poured into factory farm gas production, rewarding the very same industrial polluters who are actively destroying their community's environment.

To accept manure biogas as the best approach to managing methane emissions means accepting the current, toxic polluting factory farm system that hurts rural communities like Kewaunee County, fuels the climate crisis with emissions from animal feed and enteric fermentation, and raises billions of animals in intolerably cruel conditions that threaten public health year after year. That is not something we can accept. Instead, policymakers must prioritize solutions that effectively reduce emissions while centering the communities harmed by factory farm pollution and support a just transition to the healthy, fair, and sustainable food system we desperately need.

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