To: Michigan Public Services Commission
From: Louise Gorenflo, lgorenflo@gmail.com
Michigan Food for All and the Earth Partners
Case No: U-21170
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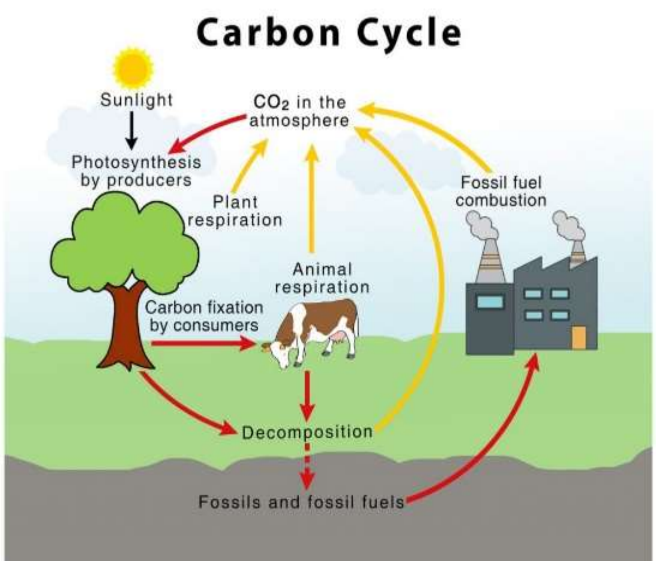
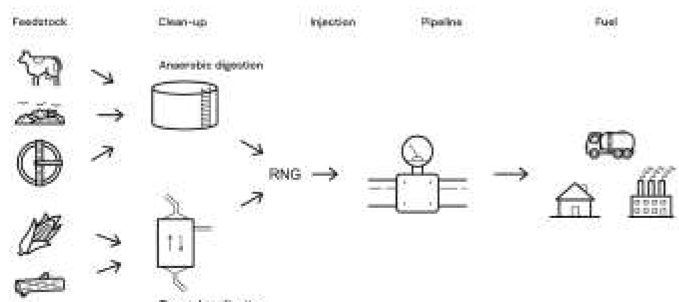
The ICF study concludes with the premise that RNG is a cost-effective greenhouse gas reduction strategy. These comments do not accept the unquestioning adoption of the Combustion Approach to GHG accounting and claim for carbon neutrality of biogas, the basis for ICF's conclusion.



When the biosphere is involved, the claim of carbon neutrality must be analyzed in terms of carbon stocks and flows. The carbon cycle involves plants taking up carbon dioxide from the air for photosynthesis which allows for new plant growth. The carbon locked into sugars, the product of photosynthesis, is then released as carbon dioxide through respiration, decay, or combustion. This cycle has not been in equilibrium since humans began appropriating plants (trees, grasslands, crops) at large scales many generations ago. Using plants for bioenergy to reduce atmospheric CO_2 buildup is itself a dynamic perturbation of the existing stocks and flows.

For biogas to be carbon neutral, it would require that when the biogas is burned, it emits no additional carbon dioxide than would be taken up by new plant growth. Yet, the ICF study boundary begins with the cow, not the corn. For ICF to claim that burning biogas is carbon neutral would require it to specify where the new plant growth would occur. If pushed, ICF would likely identify the next corn crop as the new growth that would uptake carbon dioxide to meet the claim of carbon neutrality. In that case, ICF's boundary needs to include corn as the bioenergy crop necessary both for the manure and its claim of carbon neutrality.



In the case of manure-derived biogas, corn is the primary feedstock for biogas. The cow is simply the initial biodigester, who produces a digestate that is then liquefied and further processed by the built biodigester.

The primary use of the US corn harvest is to feed CAFO livestock, which generates manure for biogas. Livestock feed crops do not keep carbon away from the atmosphere for long periods of time because they are consumed by livestock, which return almost all of the crop's carbon to the atmosphere as respiration and manure.

Claim of Carbon Neutrality

Many policies consider biomass combustion as 'carbon-neutral,' regardless of the source of the biomass. Although these policies may acknowledge the carbon emissions from using fossil fuels to produce and refine biomass, as well as trace-gases, they omit the carbon dioxide (CO_2) released by the burning of the biomass itself. They do so either by omitting these emissions when accounting for emissions from bioenergy or by simply endorsing all bioenergy on the assumption that it emits no net carbon dioxide, as ICF has done. Such policies and regulations thus treat biomass as an inherently 'carbon neutral' energy source. This is not correct.

Correctly addressing the climate implications of bioenergy is critical because governments and bio-industries contemplate using large quantities of plant-derived material and make the claim that bioenergy is carbon neutral. This claim is based on the unexamined assertion that the carbon dioxide released in the burning of plant material is "naturally" absorbed by the growth of new plants, becoming part of nature's carbon cycle.

The bioenergy industry's view of the carbon cycle is the basis of the claim that bioenergy mitigates GHG emissions. For GHG accounting purposes, when compared with the GHG emissions released when fossil gas is burned, the burning of biogas would emit zero emissions.

Correcting Carbon Neutrality

The assumption that bioenergy is inherently carbon-neutral is a major error. It is quite a sweeping claim: It asserts that a carbon flow into the atmosphere at one place and time (from bioenergy combustion) is automatically and fully offset by carbon uptake at another place and time (on ecologically productive land).

A first-order stock-and-flow analysis of the key carbon flows clarifies the situation. Combustion chemistry dictates that replacing a fossil fuel with bioenergy does not reduce the rate at which carbon flows into the atmosphere. Beyond reducing the combustion of chemically carbon-based fuels or capturing and sequestering CO_2 from their combustion, mitigation requires increasing the rate at which CO_2 is removed from the atmosphere.

Therefore, for bioenergy to be potentially beneficial, it is not enough for its carbon merely to be biogenic; it is necessary that it be obtained in a way that increases the rate of net carbon uptake by the biosphere. For an increase in net ecosystem production to be directly credited to bioenergy, it must be evaluated locally on the land from which the biomass feedstock is obtained. In ICF's study, this uptake cannot be credited to the manure. It can only be credited to the feedstock that cows eat. This real world understanding of carbon neutrality firmly places corn production within the ICF frame.

Simplifying the steps in this story, the decision to use the land for bioenergy results in more carbon being stored underground in fossil fuels, but this benefit comes at the expense of less carbon being stored by plants and soils. Bioenergy reduces CO_2 emissions only to the extent the first effect outweighs the second.

The combustion of manure-derived biogas does not by itself result in additional plant growth, offset the emissions from energy use, or justify failing to account for the carbon emitted from burning biogas. If the carbon from crops used for bioenergy are replaced by plant production elsewhere, then the carbon emission consequences of biogas depend on how this is done. If more land is converted to crops, then the calculation must include the lost carbon storage or sequestration due to changing land-use.

It is important to be precise where and how physical changes occur in the absorption or emission of carbon in the use of bioenergy. Because bioenergy does not physically reduce emissions from combustion, it mitigates GHG emissions only if, and to the extent that land and plants are managed to grow additional biomass and take up additional CO_2 beyond what they would absorb without conversion into bioenergy.

To reiterate: only biomass grown in excess of that which would have grown anyway is 'additional biomass' containing 'additional carbon,' and has the potential to reduce carbon emissions when used for energy. The basic error in the carbon neutrality of biomass assumption is the failure to count the production and use of biomass that land would generate if not used for bioenergy.

ICF claims that IPCC guidelines state that CO2 emissions from biogenic fuel sources (e.g., biogas or biomass based RNG) should not be included when accounting for emissions in combustion – only CH4 and N2O are included. This is to avoid any upstream "double counting" of CO2 emissions that occur in the agricultural or land use sectors per IPCC guidance (p. 71).

This premise that all biomass is carbon-neutral results from a misapplication of the original guidance provided for the national-level carbon accounting under the United Nations Framework Convention on Climate Change (UNFCC). Under the UNFCCC accounting rules, countries report their emissions from energy use and from land-use change separately. For example, if an acre of forest is cleared and the wood used for bioenergy, the carbon lost from the forest is counted as a land-use emission. To avoid double-counting, the rules therefore allow countries to ignore the same carbon when it is released after combustion. This accounting principle does not assume that biomass is carbon-neutral, but rather that emissions can be reported in the land-use sector. This accounting system is complete and accurate because emissions are reported from both land and energy sectors worldwide.

The accounting rule under the Kyoto Protocol is different: it caps emissions from energy use but does not apply worldwide and it applies only incompletely to land use even in the industrialized countries. By excluding biogenic emissions from the energy system, the Protocol erred because this practice means that those emissions are in many cases never accounted for at all. Similarly, many national and European policies and, as well as many lifecycle and other analyses, mistakenly ignore biogenic emissions from energy use by not including changes in land-based carbon.

For example, when wood is harvested for bioenergy, it takes a century, on average, for the carbon dioxide emissions from burned wood to be reabsorbed in a growing forest, during which time the released carbon dioxide is contributing to global warming. Burning wood to generate electricity also releases more carbon dioxide than fossil fuels to produce the same amount of energy. Under European Union rules, emissions from biomass are not counted toward the bloc's pledges to reduce greenhouse gasses.

Burning trees harvested from the southeastern forests of the U.S. has boomed into a $10-billion-a-year industry, and now produces around 60 percent of what the European Union considers renewable energy. More than one million acres of American forest have been cut for biomass, amplifying climate risks like flooding and landslides. The EU used the combustion approach for GHG accounting, claiming that burning the trees for electricity is carbon neutral, completely ignoring the land use changes caused by clearcutting the more than one million acres and the transport of the trees to Europe. Scientists globally have pushed back hard on this assumption, and the EU has proposed new accounting rules which would likely shutter much of this biomass industry.

The Waste Argument

Manure is not a waste:

The bioenergy industry claims that cow manure is carbon neutral. Because methane has a greater global warming potential than carbon dioxide, proponents of bioenergy argue that it is better from a greenhouse gas perspective to burn this material and emit the carbon as carbon dioxide rather than let it decompose as liquefied manure and emit methane.

Within a complex natural system, very little waste escapes. Whatever one species no long wants, another species benefits from it. This interrelatedness and interdependency marks a mature ecologic community. New species evolve around waste streams. So little waste escapes from an old growth forest that we can drink from the streams running them. Such natural systems have a circular flow of materials and energy with minimal waste escaping from it.

Manure only becomes a waste in a CAFO. The CAFO livestock is industrial, not natural. It has a linear flow of materials from feedstock to product. Because it is not meaningfully regulated by environmental regulations, it freely externalizes whatever it does not want into the air, water, land, harming public health and destroying natural systems, such as driving the high alga blooms in Lake Erie.

Manure is not a waste within natural systems and in sustainable agriculture as it serves as an important natural fertilizer and soil conditioner. Many species feed on the manure, decomposing and returning it to the next step within the natural circular economy. No methane escapes and much of the carbon dioxide is recaptured in new plant and animal growth.

The U.S. CAFO industry produces three times the fecal matter than the entire U.S. population. The CAFO industry have a manure problem that creates an enormous public health and ecologic hazards. Liquefying manure is a business decision and not based on any concern other than profit. Now the opportunities of carbon offsets and government subsidies arise to make more money off the misbegotten animals through capturing and selling the methane to the gas utilities.

The digestate coming out of the biodigester gets returned to a lagoon where more methane escapes and ultimately gets applied to land at volumes impossible for the soil and biota to process the manure. The levels of nitrogen and phosphorus in the digestate are the same as the liquefied manure going into biodigester. The next big rain comes, and the nitrogen and phosphorus get washed into the streams or into the groundwater, and people downstream have to spend millions of dollars to remove the algal toxins from their water.

Methane is not released from pastured cow manure. The methane released by dairy CAFOs is due to a business decision to maximize profit. CAFO owners have externalized the cost of manure management. In turn, government has under-regulated the CAFO industry manure management, which has led to unchecked environmental degradation of our air, water, and land. Rather than the public picking up the tab in the form of subsidies and incentives to dairy CAFOs, it would maximize pubic benefit for the industrial practice of liquefying CAFO manure to be eliminated.

Note: ICF makes no mention of how the biodigester's digestate is managed within its study. There is no cost line item for digestate management.

Trees are not a waste:
ICF states in its Michigan biomass inventory forestry and forest products residue:

> Biomass generated from logging, forest and fire management activities, and milling. Inclusive of logging residues, forest thinnings, and mill residues. Also materials from public forestlands, but not specially designated forests (e.g., roadless areas, national parks, wilderness areas). (p. 19.)

This is boilerplate language that most biomass proposals include to mislead decision-makers into believing that only "forestry wastes" will be used. Forestry residues are extremely limited relative to fuel demand, and many biomass projects claiming that burning whole trees would only be a last resort quickly pivot to harvesting whole trees for fuel.

Biomass fuel is often portrayed as being derived from "waste" materials, such as tree branches, sawdust and agricultural crop residues. Because these materials are expected to decay eventually, emitting carbon dioxide in the process, it is argued that burning them to generate energy will emit the same amount of carbon as if they were left to decompose.

This claim only works if the time element is ignored. It takes years and even decades for trees tops and branches to decompose on the forest floor, and during that process, a portion of that decomposing carbon is incorporated into new soil carbon.

Burning trees and tree "waste" pumps its stored carbon into the atmosphere instantaneously. There is a difference of many years, and even decades, between the immediate emissions from burning residues, and slow natural decomposition. Biomass cannot be considered carbon neutral unless critical factors like time are ignored. A 50 megawatt biomass power plant burns more than a ton of wood a minute. It takes seconds to burn a tree, and many decades to grow it back.

The bioenergy industry claims that biomass energy is carbon neutral as new plant growth recaptures, or "resequesters" an amount of carbon equivalent to that released to the atmosphere by burning biomass fuels, and therefore net carbon emissions are zero. When trees are used for fuel, it is obviously not possible for the system to be "carbon neutral" in a timeframe meaningful to addressing climate change.

Agricultural residue is not waste
Included in ICF's inventory is ag residue. ICF says that

> "available (ag residue) biomass is constrained to not exceed the tolerable soil loss limit of the USDA Natural Resources Conservation Service and to not allow long-term reduction of soil organic carbon…Not all agricultural residues are made available, as crop residues often provide important environmental benefits, such as protection from wind and water erosion, maintenance of soil organic carbon, and soil nutrient recycling" (pp. 32-33).

In an ideal world, that sound great. In the real world, no regulatory constraints exist to ensure such practices will occur. Industrial agriculture has a poor track record in soil conservation. If the price is right, industrial producers with the lowest concerns for land stewardship will strip the fields clean.

Recommendation: Prior to any approval of the use of "biomass waste" for bioenergy, the MPSC should require a full environmental impact statement with ample public participation for each of the biomass sources: manure, forestry, and cropland residue.

Climate Change and CAFO Manure Supply

The ICF study only presents the Business as Usual (BAU) scenario. Absent is the impacts that climate change will have on the supply of all biomass as agriculture is the most sensitive to change in temperature and precipitation than any other industries. Researchers have identified that climate change is on course to hit the U.S. Corn Belt early and hard. The climate regimes will push the cultivation geographies north of the border.

The Mid-West is under the current threat of expanding drought and higher temperatures. One failed feedstock crop will create turmoil in the livestock market. Successive crop failures will put an end to the livestock industry. Even though ICF fails to make the connection between corn and manure supply in the study, without corn there will be no manure.

Another climate-related scenario that would affect the manure supply is a rapid global phase-out of animal agriculture, which has the potential to stabilize greenhouse gas levels for 30 years and offset 68% of carbon dioxide (and methane) emissions this century. CAFOs especially significantly contribute to global warming through ongoing emissions of methane and nitrous oxides and land use conversion to support the livestock. The world becomes more desperate to act on reducing climate dangers, and the rapid reduction of industrial livestock production would not only achieve significant climate goals but would move toward other non-climate priorities: soil conservation, biodiversity protection, and public health crisis of metabolic diseases caused by overconsumption of meat.

Recommendation: the MPSC needs to consider the impacts of climate change on the supply of manure as a biogas feedstock.

Transition of U.S. agricultural production from feedstock to food

Increasing world hunger, driven by climate change and conflict, has brought into the forefront the food justice call that we increase the amount of food for people and reduce growing feedstock for livestock and bioenergy. Worldwide demand for crops is increasing rapidly due to global population growth, increased biofuel production, and feedstock for the livestock production industry. Currently 36% of the calories produced by the world's crops are being used for animal feed and only 12% of those feed calories contribute to the human diet as meat and other animal products. Even small shifts in our allocation of crops for feed and fuel to food for people could significantly increase global food availability.

Recommendation: the MPSC needs to consider a declining dedication of U.S. crops to feed for livestock to meet the challenges of an increasingly hungry world. This is an immediate challenge. Less feed would result in less manure.

Bioenergy Industry Claims of No Land Use Changes

The ICF study claims (page 33):

> In the simulations no land use change is assumed to occur, except within the agricultural sector (i.e. forested land is not converted to agricultural land for agricultural residue or energy crop purposes).

Many international and government projections imply at least doubling the total human harvest of world plant material for bioenergy. For example, the IPCC Special Report on Renewable Energy suggests that the global bioenergy potential could be as high as 500 EJ/year, comparable to current fossil energy use. By contrast, the total annual global biomass harvest for food, feed, fiber, wood products, and traditional wood use for cooking and heat amounts to approximately 230 EJ of chemical energy value.

An increase in the use of bioenergy of this magnitude would create substantial adverse impacts on natural ecosystems, compete with food production, and undermine other goals to reduce present impacts of agricultural production on the environment, and improve the well-being of farm animals.

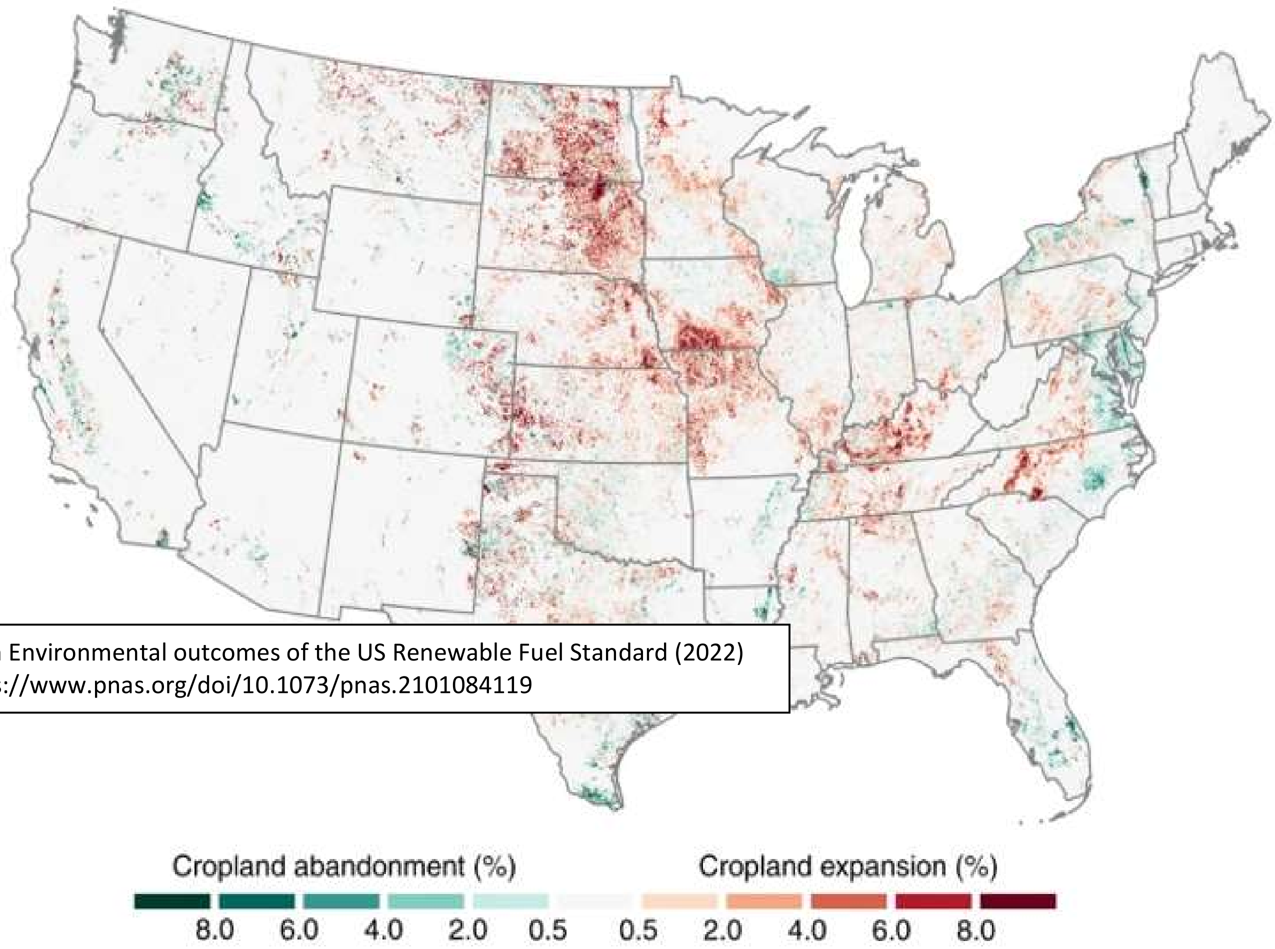
Generating food, fiber and other biomass-based products that people currently consume utilizes roughly 75% of the world's vegetated land. Agricultural and forestry practices have not, on balance, increased the total quantity of biomass production: they have merely transformed natural ecosystems to produce goods and services for human consumption.

As human uses of land have already reached troubling levels, and as large additional demands exist for food, bioenergy crops, and timber, the challenges that would result from a doubling of global human biomass harvest for bioenergy (or even higher increases) should not be underestimated, and the full greenhouse gas emissions that would result from such an increase in bioenergy production are uncertain.

Further, dedicating land to the production of tree, crops, and grasses specifically as bioenergy. ICF states:

> Energy crops are largely grown on idle or available pasture lands, particularly at lower farmgate prices. Similar to agricultural residues, in the simulations no land use change is assumed to occur, except within the agricultural sector (i.e., forested land is not converted to agricultural land for agricultural residue or energy crop purposes) pp. 34-35.

Fig. 1: Net cropland conversion 2008–16.

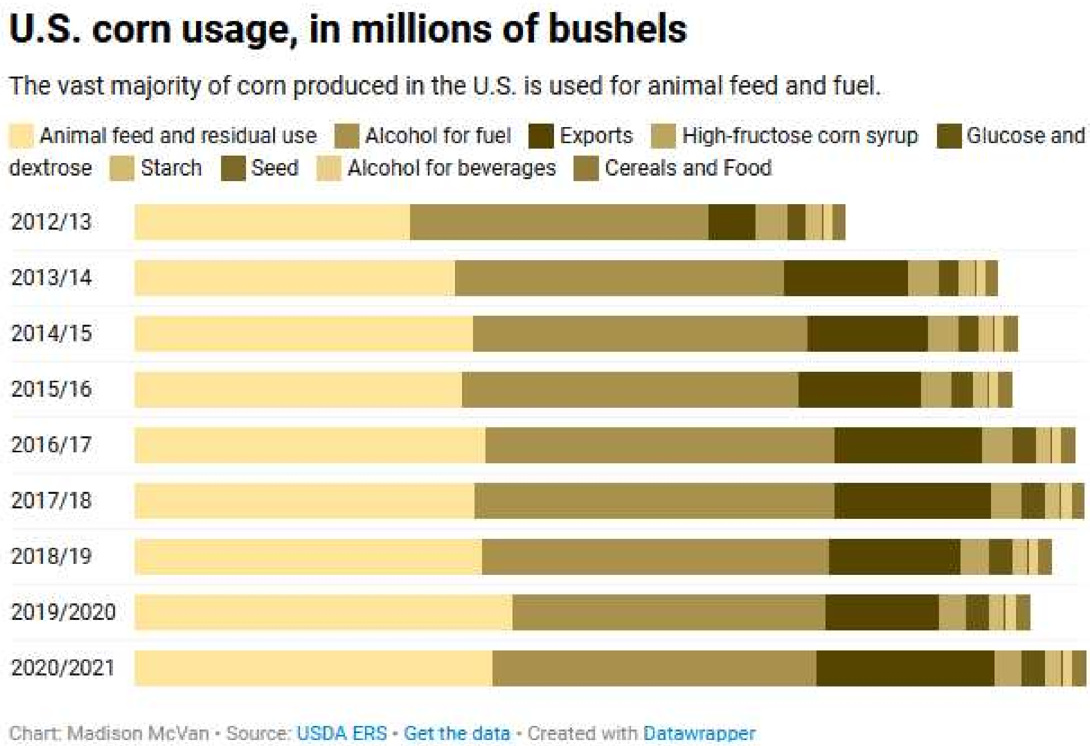


Rates of net conversion calculated as gross cropland expansion minus gross cropland abandonment and displayed as a percentage of total land area within non-overlapping 3 km × 3 km blocks. Net conversion was most concentrated in the eastern halves of North and South Dakota, southern Iowa, and western portions of Kansas, Kentucky, and North Carolina.

From Environmental outcomes of the US Renewable Fuel Standard (2022)
https://www.pnas.org/doi/10.1073/pnas.2101084119

More land has been converted to cropland to grow more corn as feedstock. Conversion of natural lands to cropland to feed CAFO livestock drives the enormous climate and habitat loss not only globally but in Michigan as well.

The below graph shows that corn production continues to increase, which means land conversion to corn production is ongoing.



Growing energy crops on "idle land or available pasture lands" is land use conversion as idle land and pasture land are carbon sinks.

Bioenergy use at scales needed to significantly replace fossil fuels requires large areas of land. Further demands for productive land, whether forest or cropland, amplify the many factors that drive land-use change globally. Bioenergy displaces land from prior uses, resulting in both direct and indirect land-use change. This leads to the difficult conundrum of carbon debt, i.e., the time it takes for the release of carbon stocks linked to bioenergy expansion to be paid back through future carbon uptake, which can be decades.

Moreover, the realities of bioenergy production exacerbate the effects of industrial-scale agriculture on soil health, water quality, biodiversity, and other ecosystem services. The result is a dissonance between positive views of bioenergy based on prospective modeling and negative views based on assessing its real-world impacts in light of the limitations of land-use governance and available technology.

Industrialized agriculture and livestock production continues to convert natural and semi-natural ecosystems and to use unsustainable agricultural practices. This results in environmental threats to biodiversity like algae blooms in Lake Erie that kills fish. Humans benefit from biodiversity as diverse species and their habitats provide us many ecosystem services upon which we depend for clean water, air, and land.

While ICF's simulations may have been constrained to model no land use change, the bioenergy and livestock feed industries have not constrained their land use changes. Globally, the major forests of the world, both the Amazon and in SE Asia, are being decimated to accommodate the production of more corn, soybeans, and palm oil. Within the U.S., undeveloped land is being converted to corn as the market for feedstock for CAFOs and corn ethanol continues to grow.

Recommendation: MPSC does not make a decision about the feasibility of CAFO derived manure for RNG until it has an adequate GHG life-cycle analysis for livestock manure biogas (from corn production to end use, including the management of biodigester waste products). A number of fossil gas GHG lifecycle analyses have been completed to which the manure biogas analysis can be compared. This comparison is imperative to determine whether manure RNG has a significant climate mitigation potential.

Need to Focus on Natural Carbon Sinks

All current commercial forms of bioenergy require land and risk carbon debts that last decades into the future. Given the urgency of the climate problem, terrestrial carbon management can keep carbon out of the atmosphere for many decades. Even though such options can have permanence challenges, they offer substantial near- and medium-term CO_2 mitigation, providing time for R&D to improve the durability of terrestrial sinks and otherwise keep carbon sequestered.

The focus of policy should not be substituting biofuels for fossil fuels downstream in the energy sector but rather on increasing the rate at which CO_2 is removed from the atmosphere upstream in the land-use sector. This includes the many opportunities of natural carbon sinks that protect and rebuild carbon stocks in the biosphere. Recent work has highlighted the very large and relatively low-cost potential of reforestation and land conservation. Largely by avoiding deforestation and by reforesting harvested areas, up to one-third of current CO_2 emissions from fossil fuels could be sequestered in the biosphere.

We need to urgently move away from bioenergy and toward natural terrestrial carbon sinks. Researchers and policymakers must pursue actionable mitigation approaches that have the best chance of significantly reducing atmospheric CO_2 concentrations in the near and medium term. When the biosphere is engaged, the emphasis should shift toward large-scale natural climate solutions, including the protection, restoration, and enhancement of forests and other terrestrial carbon sinks rather than harvesting the biosphere for energy. The most ecologically sound, economical, and scalable ways to accomplish that task are by protecting and enhancing natural climate sinks.

Given the urgency of the climate problem and costs (both ecologic and economic) of claiming large areas of land for bioenergy, much greater clarity is needed. The pressing question is not about the ideal mix of technology for a future world. Rather, it is about what is actionable today for reducing atmospheric CO_2 buildup with maximal confidence, minimal risk, and a realistic appraisal of technology and resource constraints.

Recommendation: MPSC reject the use of energy crops, forestry and forest residue, and ag residue for bioenergy without a full EIS is completed for each of these potential Michigan bioenergy sources.

Recommendations

Recommendation: Prior to any approval of the use of "biomass waste" for bioenergy, the MPSC should require a full environmental impact statement, which includes potential land use changes, with ample public participation for each of the biomass sources: manure, forestry, and cropland residue.

Recommendation: the MPSC needs to consider the impacts of climate change on the supply of manure as a biogas feedstock.

Recommendation: the MPSC needs to consider a declining dedication of U.S. crops to feed for livestock to meet the challenges of an increasingly hungry world. This is an immediate challenge. Less livestock feed would result in less manure.

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Resources

Reconsidering bioenergy given the urgency of climate protection.
https://www.pnas.org/doi/10.1073/pnas.1814120115

Correcting a fundamental error in greenhouse gas accounting related to bioenergy.
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwies9fW8_r4AhXXBTQIHTdGBGEQFnoECAkQAQ&url=https%3A%2F%2Fwww.sciencedirect.com%2Fscience%2Farticle%2Fpii%2FS0301421512001681&usg=AOvVaw0VDJCIAv8tYVKzPnQ5t1n7)

Europe rethinks its reliance on burning wood for electricity.
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwil4OSp9fr4AhWAkGoFHRBmBxoQFnoECBUQAw&url=https%3A%2F%2Fwww.ehn.org%2Feurope-rethinks-its-reliance-on-burning-wood-for-electricity-the-new-york-times-2657344453.html&usg=AOvVaw3N10d_IQwI4BUCMc6rpskz

Biomass carbon accounting overview
https://www.pfpi.net/wp-content/uploads/2011/04/PFPI-biomass-carbon-accounting-overview_April.pdf)\\

Shifting cultivation geographies in the Central and Eastern US.
https://iopscience.iop.org/article/10.1088/1748-9326/ac6c3d

Rapid global phase-out of animal agriculture has the potential to stabilize greenhouse gas levels for 30 years and offset 68% of CO2 emissions this century.
https://journals.plos.org/climate/article?id=10.1371/journal.pclm.0000010

Redefining agricultural yields: from tonnes to people nourished per hectare.
https://iopscience.iop.org/article/10.1088/1748-9326/8/3/034015/meta