Comments submitted by Donna Albert, PE (retired)
Clean Fuel Standard (CFS) rulemaking, 4nov2026

To the Washington State Department of Ecology CFS rulemaking team:

Throughout this rulemaking process, I have pointed out that WA GREET and other commonly used models that quantify fuels emissions fail to include all of the climate emissions of fuels that rely on biomass as an input. These "missing" climate emissions come from changes in use that are not recognized as land use change, indirect land use change, lost opportunity cost (including foregone carbon sequestration opportunities of alternative land uses), failure recognize soil degradation, and underestimating nitrous oxide emissions due to intensive agriculture.

The scale of the land-use-related climate emissions which are NOT included in WA GREET and similar models is so great, that if they were included, the models would show that the climate emissions of agricultural biofuels are similar to or substantially greater than fossil fuels.

I am going to ignore the tasks you have asked us to comment on, which are of minor consequence compared to this failure.

California and Washington are not counting all the climate emissions of biofuels

When linking the Washington Cap and Trade system and Washington Carbon Fuel Standard to California, Oregon and Canada, provide for accounting for all climate emissions as described in my comments below.

I have chosen this article about corn ethanol because it clearly demonstrates unaccounted-for emissions in tools and models used by EPA and California:

1. The Sobering Truth About Corn Ethanol, by Jason Hill, University of Minnesota (Proceedings of the National Academies of Sciences of the United States of America, a scientific journal)

   https://www.pnas.org/doi/10.1073/pnas.2200997119

The above "PNAS Commentary" article pulls together several studies, with links to references included.

The failure to account for all emissions of biofuels is not limited to corn ethanol (see the sentence I underlined in the excerpt below). It is probable that the failure

to account for all climate emissions as described in this article applies to all biofuels made from purpose-grown agricultural or forestry biomass, because when burned all these biofuels have stack/tailpipe emissions comparable to those of fossil fuels, intensive industrial agriculture and industrial clear-cut forestry are net-emitters of greenhouse gas, and all biofuels from agricultural or woody biomass use more land than fossil fuels.

Note the following excerpt from the article above: "The findings of Lark et al. (4) also suggest that greater scrutiny should be given to the models that are used in a regulatory context to evaluate the GHG emissions associated with fuels of all types. The authors compare their results with those from three other modeling efforts—1) the US Environmental Protection Agency's Regulatory Impact Assessment for RFS2; 2) the Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) model from Argonne National Laboratory, and 3) the Global Trade Analysis Project (GTAP) model as used by California Air Resources Board—all of which show considerably lower GHG emissions from domestic land use change caused by recent production of corn ethanol. This difference supports other recent concerns that these commonly used models underestimate the emissions consequences of land use change (11–13), which in turn leads to their overestimating the climate change benefits of corn ethanol (e.g., refs. 14–16)."

2. Growing Crops Is Not An Energy Solution (EarthJustice article covers research by Timothy Searchinger of Princeton)

   https://earthjustice.org/experts/ashley-ingram/growing-crops-for-fuel-is-not-a-climate-solution-sustainable-agricultural-practices-arent-going-to-change-that

The above article, which references the work of Timothy Searchinger of Princeton, explains the lost Carbon Opportunity Cost of biofuels due to its massive land use, and explains lost biodiversity (could have rewilded) and food security (could have grown food). It explains that when all the land use emissions and lost opportunity emissions associated with land use are accounted for, the climate emissions of **agricultural biofuels are worse than using fossil fuels**. This would also apply to ethanol, biodiesel, other drop-in fuels for internal combustion engines, and renewable natural gas to replace fossil natural gas. Because they also have high emissions at the stack or tailpipe and require massive land use in the form of industrial clearcut logging, the same logic applies to fuels made from woody biomass (for example, pellets to generate electricity, and fuels like RNG or aviation fuel from woody biomass).

As far as I can tell, most **drop-in substitutes for gasoline, diesel, boiler, or jet fue**l share the same two inherent flaws:

- **When burned, the tailpipe climate emissions and health effects are comparable to fossil fuels**.
- **The feedstock for making the fuel requires large amounts of agricultural land or intensively managed forest land**.

If the two inherent flaws above apply, **none of the methods that could be used to create these fuels could absorb enough CO2 from the atmosphere to make up for those tailpipe/stack and land use emissions** (of course, those processes are also net-emitter of greenhouse gas).

It is difficult to imagine how advanced "drop-in" biofuels such as cellulosic-, synth-, methanol-, and electro-fuels could overcome tailpipe or stack emissions similar to fossil fuels (in health and climate impacts), AND the climate emissions and other environmental harms caused by massive land use (whenever biomass is used in making the fuel).

Drop-in Fuels Made from Captured Carbon - Not a Climate Solution

Fuels made from captured carbon release the once-captured CO2 to the atmosphere after a delay of only months. I don't see how this is a climate solution. This short delay would look approximately the same to the atmosphere as just burning fossil fuels.

Renewable Natural Gas (RNG) - Not a Climate Solution

Regarding renewable natural gas (RNG), it has **climate emissions and health impacts comparable to fossil natural gas when burned**, and is an agricultural biofuel with **all the same land use climate emissions problems as other agricultural biofuels**.

Low Emissions Waste Methane - **cannot replace more than a few percent of current natural gas use**

Truly unavoidable waste methane from wastewater treatment plants, landfills and dairies exists in exceedingly small quantities that are best used onsite or nearby. Burning unavoidable methane emissions usually results in lower climate emissions than releasing them to the atmosphere. However, **blending this unavoidable methane with fossil methane results on higher long term emissions if this practice is used to extend the life of fossil fuel infrastructure or greenwash the use of fossil fuels**. How is this accounted for by WA-GREET?

The total potential amount of unavoidable waste methane nationally is in the neighborhood of **3% of current natural gas use,** and **better management should reduce these sources over time**. For this reason, truly unavoidable waste methane from wastewater treatment plants, landfills and dairies **can never replace more than a few percent of current fossil methane (aka natural gas) use**.

Intentionally Creating MORE Methane - Not a Climate Solution

DO NOT CREATE METHANE FROM WASTE INTENTIONALLY FOR ENERGY USES. It is irresponsible to **intentionally** create a greenhouse gas that is 80 times worse than CO2. **Leaks from widely distributed methane production facilities such as CAFOs are inevitable**. Production of methane by CAFOs is prone to unobserved leakage and **lacks the intensive oversight such a dangerous greenhouse gas deserves**.

It also **makes no sense to intentionally create methane from agricultural or forest biomass.** Land use emissions and foregone sequestration make the total greenhouse gas emissions of methane created from agricultural biomass or intensely managed forest biomass greater than the climate emissions of fossil (aka “natural”) methane gas. When it leaks, as it inevitably does, methane is a powerful greenhouse gas, 80 times worse than CO2. When burned it creates levels of CO2 emissions comparable to those of fossil methane, and produces similar indoor and outdoor air pollution to fossil methane, producing comparable diseases and early deaths.

Biofuels emit greenhouse gases at every stage of production and use:

- Biomass comes from intensive **industrial agriculture and intensive industrial forestry,** both of which **are net emitters of CO2**.
- The **processes** that produce methane from biomass are **net emitters of CO2 and methane to the atmosphere.**
- **When bio-methane is burned it emits CO2 to the atmosphere,** just like fossil methane.

In addition to climate emissions, large scale growing of purpose-made biofuels on agricultural land causes serious environmental impacts such as high water use and chemical use, causes water pollution and eutrophication, and results in biodiversity loss. As climate change makes it more difficult to grow food, committing large amounts of agricultural land to grow biomass for fuel and creating large scale dependence on that biofuel may result in higher food prices and even food shortages.

Mixing Hydrogen with Fossil or Bio-Methane (aka Natural Gas) is Not a Climate Solution

Only a small percentage of hydrogen can be mixed with natural gas in existing distribution infrastructure, resulting in continued use of large amounts of natural gas. Mixing hydrogen with natural gas could not reduce climate emissions 70% by 2040 or 95% by 2050. Hydrogen can be mixed with fossil natural gas for incremental climate emissions reductions in industrial uses during the transition off natural gas, under conditions where hydrogen leaks (high climate impact) can be mostly eliminated; however, hydrogen must not be mixed into the fossil natural gas distribution for home and commercial heating because hydrogen in even small amounts is very dangerous at the point of appliances - people would inevitably die in accidents. Continuing to burn fossil gas indoors causes diseases and early deaths - adding small amounts of hydrogen would make little difference in health impacts. **Mixing hydrogen with bio methane extends the life of fossil fuel infrastructure such as natural gas lines, gas turbines, and furnaces. How are those extended emissions quantified in WA-GREET tables**?

The Wood Pellet Controversy Illustrates the Basic Problems with Most (or All) Biofuels

Like agricultural biofuels, biofuels from forest biomass have stack/tailpipe emissions similar to fossil fuels PLUS emissions associated with land use. Please listen to this podcast. This is a good introduction to the climate emissions of biofuels in general.

3. Podcast by David Roberts, What's the deal with burning wood pellets for energy? A conversation with Rita Frost of NRDC and Brenna Bell of 350 PDX - explains burning wood pellets for electricity has greater climate emissions at the stack than burning coal (and toxic air pollution), creates substantial climate emissions when the wood is harvested, and creates climate emissions and toxic pollution for the community during manufacture of the pellets. The pellet industry has been devastating to naturally regenerated forests and wetland habitat in the SE USA, and is causing health problems in communities there. https://www.volts.wtf/p/whats-the-deal-with-burning-wood?r=281f1&utm_medium=ios&triedRedirect=true

Non-Climate Impacts - Not Accounted For in WA-GREET

How will you account for the health impacts and early deaths caused by indoor and outdoor air pollution in CFS and Linkage decisions? No child should be sick, and no one should die early — not one person — because we choose to continue to burn stuff for energy. We have better alternatives. Make the health of people a minimum requirement in every decision you make, not an afterthought.

How will you account for water use, and impacts to food? No one should be denied plentiful and affordable food and water.

How will you account for biodiversity losses in CFS and Linkage decisions? We cannot afford further biodiversity losses.

Although Planetary Boundaries may seem to be outside the scope of this rulemaking, we ignore the physical limitations of the earth at our peril. **We cannot draw down the climate emissions in the atmosphere without a functioning biosphere.** When considering the Lost Opportunity Cost of land use, remember that we must restore land and oceans to a healthy natural state. Current land use practices have converted naturally regenerated forests to plantation forests and converted farmland to urban sprawl. Using agricultural land and forest land to grow biomass for fuel exacerbates our careless abuse of the natural systems which support life on earth. Please listen to this presentation by Johann Rockström, and see references at the link below.

4. Introduction to Planetary Boundaries (You Tube presentation): https://www.youtube.com/watch?v=QCFGS6z9CxM

   Link to papers on this topic:
   https://www.stockholmresilience.org/research/planetary-boundaries.html

Thanks for considering all this. **Failing to understand the full physical cost of biofuel use in the real world is a huge and costly mistake**. Please do not continue to ignore this, just because it does not fit into the rulemaking process.

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