From:	Moomaw, William R
To:	Holly Stallworth/DC/USEPA/US@EPA
Subject:	Comments on the Deliberative Draft Report of the Biogenic Carbon Emissions Panel
Date:	03/19/2012 04:21 PM
Attachments:	PastedGraphic-2.tiff ATT00001.txt Comments on the Discussion of Timing in the Draft Report of the EPA Biogenic Emissions Advisory Panel by Berry, Farber, Galloway, Godfrey, Kammen, Moomaw, O'Hare, Searchinger (March 19, 2012).pdf ATT00002.txt Comments on the Discussion of Timing in the Draft Report of the EPA Biogenic Emissions Advisory Panel by Berry, Farber, Galloway, Godfrey, Kammen, Moomaw, O'Hare, Searchinger (March 19, 2012).pdf

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Dear Ms. Stallworth:

Attached please find comments by eight climate researchers from several universities regarding the role of time in the treatment of carbon dioxide emissions in the Deliberative Draft Report of the Biogenic Carbon Emissions Panel. The comments are jointly authored by me, William Moomaw, Tufts, Steven Berry of Yale, Daniel Farber of Berkeley, James Galloway of Virginia, Charles Godfray of Oxford, Daniel Kammen of Berkeley, Michael O'Hare of Berkeley and Tim Searchinger of Princeton.

We would appreciate it if you would distribute our comments to the full panel membership for their consideration.

Thank you very much for the opportunity to contribute to this process,

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COMMENTS ON TIMING OF EMISSIONS TO THE ADVISORY PANEL ON BIOGENIC EMISSIONS FOR THE U.S. EPA

(March 19, 2012)

We write to comment on the discussion in the draft report related to timing of emissions. That discussion potentially applies to bioenergy from the harvest of trees, bioenergy from the clearing of forests for ethanol production, and indeed to any greenhouse gas mitigation strategy. We believe it is inconsistent with scientific, economic and policy analysis of the value of early rather than later reductions in greenhouse gas emissions.

The thrust of the draft report's discussion now is to favor at a minimum a 100-year time frame for evaluating the net emissions consequences of bioenergy, with an encouragement to use even longer time frames. The discussion also treats net emissions or net radiative forcing at any time during that window as having the same social costs. Before addressing the rationale, we wish to point out several implications of that argument.

One, this thinking would justify the cutting down of any forest so long as it is assumed to grow back or come close to growing back within 100 years. Although other environmental factors might be used to justify some limitations, from a greenhouse gas perspective the panel's analysis implies no limit on the quantity of global forests that could be beneficially cleared for energy from a climate perspective. For example, although some bioenergy proponents have suggested that it should be acceptable to remove "excess forest growth" – which the panel's report in effect notes elsewhere would still reduce the forest carbon sink – the use of 100-year time-frame would justify the removal without limit of perhaps most of the world's standing trees. The same language applied to ethanol would justify the direct clearing and displacement of much of the world's forests for ethanol crops.

Two, the panel's analysis would apply not just to bioenergy but also to any climate mitigation strategy and therefore justify long delays in action. From the standpoint of the atmosphere, there is no physical difference between a bioenergy measure that causes emissions today and reduces them decades from now and any other energy mitigation strategy that emits today but promises reductions in the future whether by planting trees or merely by reducing energy emissions at that time. In fact, the critical difference between bioenergy with long pay-backs and mere delays in energy mitigation is that the bioenergy strategy will actually increase emissions in the near-term.

Three, the panel's analysis would therefore endorse strategies that make it impossible to meet the emissions goals endorsed by most countries and President Obama of limiting climate change to 2°C. Although different emissions trajectories, types of emissions and complexities in climate feedbacks make it impossible to provide a single conclusion of the timing of reductions needed to meet such a goal, all analyses indicate a need for large immediate reductions over the next several decades. For example, in a companion paper to the "cumulative emissions" paper cited in the panel report, the same authors found that greenhouse gas emissions between 2010 and 2050 must average roughly half of present emissions of roughly 50 gigatons for there to be a 50% chance of holding climate change to the 2° target even assuming much more dramatic reductions thereafter (M. Meinshausen et al. [2009], Greenhouse-gas emission targets for limiting global warming to 2 °C, *Nature* 458, 1158-1162). Substantial emissions reductions within the next decade also substantially increase the likelihood of meeting the target. Any suggestion that delaying actual emissions reductions well into the century would not alter even the degree of peak warming is inaccurate.

Four, the draft report's analysis implies policies that call upon people today to pay for "mitigation" efforts that not only fail to reduce, but may even increase, the damages they and perhaps their children experience. We can see no moral justification for such a policy because the alternatives include policies that reduce damages for all. The draft report's approach would almost certainly make the challenge of mobilizing world action against climate change that much harder.

The draft discussion offers two arguments for focusing on cumulative emissions over at least 100 years and probably longer. The principal argument is that cumulative emissions are the key determinants of peak emissions. That is a physical and mathematical finding for a certain category of emissions trajectories in the study cited (M.R. Allen et al. [2009], Warming caused by cumulative carbon emissions towards the trillionth tonne, *Nature* 458, 1163-1166). But that study does not imply the magnitude of the peak remains unaffected by how soon and by how much mankind starts reducing emissions as the same authors' sister publication discussed above shows such a claim is not valid. As one author of both *Nature* studies stated in a press release at the time of their publication: "These cumulative budgets imply that substantial reductions in global emissions need to begin soon, before 2020." http://www.smithschool.ox.ac.uk/save-the-trillionth.

In addition, this argument implicitly assumes that public policy should only be concerned with peak temperature whenever it occurs, and it implicitly assumes that the only alternative to bioenergy with high up-front emissions would be to continue use of fossil fuels. Of course, if the only alternative to high-emitting bioenergy is no reduction in fossil emissions at all, peak warming will eventually become higher with

fossil fuels than with bioenergy. But we should care about damages from earlier warming in their own right for many reasons, including not only harm to people but risks of feedback effects and crossing tipping points such as an irreversible release of methane from the Arctic. And the true alternative to bioenergy with high up-front added emissions and a long pay-back is a mitigation measure that reduces emissions relatively immediately such as wind, solar and energy conservation, or even alternative forms of bioenergy and possibly nuclear. Those measures will reduce peak emissions as well, but they will also provide the opportunity to hold the peak to lower levels, limit damages to people over the next several decades, reduce the risk of adverse feedback effects and crossing tipping points, and provide options to build on them with further mitigation down the road. Those characteristics all have value.

The second approach suggested by the draft report, based on the work of Cherubini et al., calculates the average warming effect of carbon dioxide over 100 years taking account not only the normal decay of atmospheric carbon dioxide through absorption by the ocean and by vegetation generally but also the added reductions due to the regrowth of the cut forest. This approach values earlier mitigation higher than later mitigation but relatively modestly. But it assumes without justification that the only concern is the average radiative forcing over 100 years regardless of when that warming occurs, so there is no discounting of that radiative forcing based on when it occurs. To take an extreme implication of this logic, reducing methane emissions, which have 12 year atmospheric lifetimes, by one ton in year one would have roughly the same value as the same methane reduction eighty-eight years later because both would reduce radiative forcing by the same average amount within a 100-year period.

Using the Cherubini approach for policy would also treat the absorption of carbon by the ocean, which leads to ocean acidification, not only as of no consequence but also as a positive good. Ocean acidification should be a substantial concern with greenhouse gas emissions as it may lead to irreversible losses of coral reefs and marine biodiversity. It is one thing to recognize the scientific consequences of that effect on atmospheric warming; it is another to formulate policy in a way designed to promote it.

The proper treatment of time for different aspects of global warming policy depends on different factors. For estimating the present value of future climate damages, the only relevant factors are those that dictate how we value damages in the future compared to the present. For evaluating the time value of emissions, other factors come into play. The use of bioenergy with a long payback has the effect of allowing an emitter today to claim a present reduction for activities that will not actually reduce emissions for decades. Because EPA has weighed all the risks and costs of global warming and decided to pursue at least some immediate reductions, the real

question for EPA is the relative value of one alternative that reduces emissions immediately with another that increases emissions for decades and only restores the atmosphere to its previous condition long in the future. (In fact, if forest harvesting is used continuously, the emissions never become carbon neutral entirely and therefore never fully return the atmosphere to the previous state.) Factors that should weigh in this decision include critical economic factors that are nowhere present in the panel's discussion. There is an option value as earlier mitigation gives us the option to add more mitigation down the road to achieve greater total mitigation 100 years out. However much we value damages to people in the future, we also care about the immediate damages to people now and soon. Reducing the risk of potential adverse feedback effects or of crossing irreversible tipping points creates a value that should enter into the equation. Path dependency of technologies should also play a role, and bioenergy technologies that require a perpetual incursion of carbon debt each time fuels are burned commits to a technology that down the road will repeat the cycle of boosting emissions for many years to gain eventual reductions, which would impede a shift to more rapid mitigation at a future date. The time value of money also plays a role. So long as we want at least some early reductions, those early reductions will cost more than achieving the same reductions in the future, which means that measures that produce present and future reductions are not an equal trade-off. All of these considerations give immediate mitigation more value than later mitigation.

In the forest bioenergy context, there is the added cost from the risk that the promised forest regrowth will not actually occur as the proposed accounting assumes that long-term forest regrowth will happen. A comprehensive survey of statutes and regulations undertaken at the national and state level undertaken by one of us revealed that only one state, New York, requires a guarantee that trees will be allowed to regrow in order to qualify for a carbon credit. Even if legal guarantees were put in place, 100% compliance would be implausible.

One useful touchstone for thinking about this issue is an emissions trading system with a fixed cap over time. Such a system would inherently allow an emitter to pursue future mitigation that increased emissions in the short-term only if it bought offsetting credits up-front. The costs of such a strategy would include the cost of capital to purchase these offsets, which are only paid back over time, and the loss of option value in committing early to a specific technology to generate reductions down the road. The likely discount factor would be steep in this context, greatly reducing the value of such bioenergy use. Before the panel recommends an alternative method that places no weight on the timing of emissions, it should have a strong rationale for doing so that we do not see.

Although our comments focus on climate accounting, we also note that this limited

focus ignores the value of forest and other ecosystem services, such as biodiversity, timber, water management, nutrient recycling, and culture and recreation (Millennium Ecosystem Assessment (2005), www.maweb.org/en/index.aspx). We can only imagine how attempts to protect forests through programs such as REDD plus in developing countries would be significantly undermined by actions that would claim a carbon credit for combustion of our forests.

In the limited time for reviewing the draft, we do not have the opportunity to propose an alternative approach, but we would recommend that the panel abandon its present approach, and if it wishes to provide guidance on timing factors, to seek further input.

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