The Biomass Conundrum: Do We Have to Burn the Furniture to Save the Planet?

Extended Abstract #46

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INTRODUCTION

Biomass, once touted as a “green” alternative to fossil fuels, seems to be suffering regulatory setbacks recently. For example, the U.S. Environmental Protection Agency (EPA) issued the “Tailoring Rule” in June 2010 which makes no distinction between biogenic and anthropogenic carbon dioxide (CO_2) emissions when permitting a facility under the Title V or Prevention of Significant Deterioration permitting programs. In a less visible vein, in early May 2011 the Commonwealth of Massachusetts announced proposed rules that would restrict access to tax credits for large wood-burning power plants. These, among other regulatory actions, have drawn the ire of the biomass and bioenergy industries. What’s going on here? What is the status of biomass in a national energy policy vis-à-vis climate change management and sustainability initiatives? Should we discount natural biogenic CO_2 emissions or should they be treated equal with anthropogenic biogenic CO_2 emissions? What role, if any, should life-cycle emissions and the concept of carbon neutrality play in accounting for greenhouse gases? Is there an equitable manner to address issues of timing in carbon uptake and release in sinks and sources? Can we justify the incentivization of using biomass as an energy source as a means of reducing reliance on fossil fuels?

This presentation will examine these and other questions regarding the biomass and biogenic CO_2 emissions.

BACKGROUND

Living things and others that were once living—flora and fauna—hold, or sequester, carbon in one form or another. This conglomerate of material can be generically referred to as biomass. When the carbon in biomass is oxidized by combustion or decomposition, the resulting CO_2 is referred to as biogenic CO_2. Biogenic CO_2 consists of both natural and anthropogenic biogenic

CO_2, although distinguishing between the two as a practical matter can be difficult. Some examples of biogenic CO_2 include the following.

- CO_2 derived from the combustion of biological material, including all types of wood and wood waste, forest residue, and agricultural material,
- CO_2 from the biological decomposition of waste in landfills and wastewater treatment plants,
- CO_2 from the combustion of biogas collected from the biological decomposition of waste in landfills and wastewater treatment plants,
- CO_2 from the combustion of the biological fraction of municipal solid waste or of biosolids, and
- CO_2 from the combustion of the biological fraction of tire-derived fuel.

If more carbon is taken up by biomass than is released to the atmosphere, then the biomass is a sink for carbon; otherwise, the biomass is a source of carbon to the atmosphere. As a convention and for consistency with international standards for reporting of greenhouse gas emissions, biogenic CO_2 emissions from the combustion of biomass are not typically included in national-level greenhouse gas inventories. For example, while the federal Mandatory GHG Reporting Rule (40 CFR 98) requires biogenic CO_2 emissions to be reported, these emissions are reported as a separate line item and do not count "against" the reporting facility. This is due in some part to the concept that these biogenic CO_2 emissions are "carbon neutral" which will be discussed further below. However, the issue is not monolithic and can be quite complex. Highlighting this complexity is the fact that two federal regulations, the "Tailoring Rule" and the Mandatory GHG Reporting Rule, treat biogenic emissions differently, with the first regulation turning a blind eye to the source of CO_2 emissions, while the latter regulation accounts for biogenic emissions separately from non-biogenic emissions. In fact, the applicability determination for the Mandatory GHG Reporting Rule is based entirely on fossil fuels with biomass-derived fuels not counting towards the reporting threshold.

ISSUES

Is the proper understanding of biogenic CO_2 a mere accounting nicety or is there a weightier problem at issue here? With worldwide demand growing for biomass as a means to fulfill renewable energy goals, there is a keen interest in understanding the place of biogenic CO_2 in the scheme of climate change. With the apparent special treatment of biogenic CO_2 emissions, one wonders whether there may be a discernible difference between one parcel of CO_2 and the next. Does it beg the question to paraphrase George Orwell that all molecules of CO_2 are equal but some are more equal than others?

To be clear, it should be noted that there is no difference between the radiative forcing of a molecule of CO_2 from a biogenic source and one from combustion of a fossil fuel. In particular, CO_2 from standing biomass (e.g., from forest land, crop land, or grass land) is by international convention accounted for in the land use, land use change and forestry (LULUCF) sector rather than in the energy sector to avoid double counting of emissions. One has to ask oneself, with respect to determining the impacts of CO_2 on climate change, is knowing the source of the carbon (e.g., fossil fuel or biomass) as important as knowing where the carbon is going (e.g., atmosphere, biomass, ocean, etc.)?

Current policy in the U.S. is based on accounting for the national greenhouse gas inventory on the concept that biogenic CO_2 is carbon neutral. Simply stated, this means that combustion or oxidation of biomass would cause no net increase in CO_2 emissions on a lifecycle basis, that is, biogenic CO_2 emissions can be considered equivalent to the CO_2 that was absorbed by the biomass when it was growing. This view requires a presumption of sustainability, e.g., that carbon released by harvested woody biomass will be reabsorbed by growing trees. In the Manomet study released in 2010, the researchers concluded that for national forests where stocks of carbon are harvested for biomass, forest regeneration and growth would not instantaneously recapture all the carbon released as a result of using the woody biomass for energy generation. This is due to the fact that per unit of usable energy, biomass typically releases more CO_2 than fossil fuels. The impacts on climate change from the release of biogenic CO_2 from woody biomass will depend on specific characteristics of the site being harvested, the energy technologies used, and the time frame over which the impacts are viewed.

Of course, there are many aspects to this issue, including spatial scale, temporal scale, and (biomass) species differences that make the issue of carbon neutrality chimerical. Again, to take the example of woody biomass, changes in carbon in forests depend on rates of harvesting, growth, and mortality and may best be accounted for on a national scale. According to the EPA, carbon stored in forests has continued to increase for decades, despite harvesting. The position of the Intergovernmental Panel on Climate Change is that a sustainable forest management strategy that balances forest-sequestered carbon with yield of timber or energy from the forest provides the greatest mitigation benefit for greenhouse gases.

EPA considers the complex matters surrounding this issue to warrant specific study and has elected to defer for a period of three years the application of the Prevention of Significant Deterioration permitting program and the Title V operating permit program to biogenic CO_2 emissions (76 FR 43490). EPA suggested in that Federal Register notice, published on July 20, 2011, that it will be evaluating the possibility of considering accounting for those emissions on a generic basis, a case-by-case basis, or a feedstock basis. While a case-by-case accounting for carbon may arguably be the most accurate and reliable approach, it is also the most time consuming and data intensive. By comparison, the approach used to account for carbon from biomass in the LULUCF sector is not without sophistication, relying on satellite imaging and statistical sampling of geographical areas, but it is also subject to greater uncertainty.

The temporal scale of release and subsequent sequestration of biogenic CO_2 does raise some concerns. While true carbon neutrality may attach in the future to a given amount of biogenic CO_2 released from the combustion of a batch of harvested biomass, in the short term it does not occur quickly, and may not occur at all absent sustainable practices. Through the mechanism of combustion, the release of biogenic CO_2 will occur over a much shorter time frame than the sequestration of that same amount of biogenic CO_2 by living biomass. The fact that the carbon was already sequestered in the initial batch of biomass prior to its harvesting and combustion is immaterial, since once the biomass is combusted, the biogenic CO_2 is for the most part returned to the atmosphere and its later sequestration in other living biomass is not assured, leaving it available to contribute further to climate change.

SUMMARY

The title of this extended abstract may seem like a somewhat off-kilter surmise on the role of biogenic CO_2 in climate change. However, the implicit premise was straightforward. If biogenic CO_2 "doesn't count", then have we found the panacea to reverse climate change? That is, if we just burn biomass to the exclusion of burning fossil fuels in the generation of energy or for other purposes, are we striking a death blow against climate change? If we can't sustainably manage our living biomass resources appropriately to ensure adequate long-term supplies, will we have to turn to other forms of biomass (think great-grandma's Chinese Chippendale desk or that Stickley inlaid high-backed chair recently acquired at the antique store) to keep the screws on climate change? While the question may be relatively simple, the answers are multifaceted, complex, and still open to discussion.