

Editorials

How to Account for CO₂ Emissions from Biomass in an LCA

Ari Rabl*, Anthony Benoist, Dominique Dron, Bruno Peuportier, Joseph V. Spadaro and Assaad Zoughaib

Ecole des Mines, 60 boul. St.-Michel, 75272 Paris 06, France

* Corresponding author (ari.rabl@gmail.com)

DOI: <http://dx.doi.org/10.1065/lca2007.06.347>

In a part of the LCA community, a special convention has been established according to which CO₂ emissions need not be counted if emitted by biomass. For example, many studies on waste incineration do not take into account CO₂ from biomass within the incinerated waste, arguing that the creation of biomass has removed as much CO₂ as is emitted during its combustion. The logic of such a practice would imply absurd conclusions, e.g. that the CO₂ emitted by burning a tropical forest, if not counted, would equalize the climate impact of burning a forest and preserving it, which is obviously wrong. Likewise, the benefit of adding carbon capture and sequestration (CCS) to a biomass fueled power plant would not be evaluated because that CO₂ is totally omitted from the analysis.

To avoid such conclusions, we recommend that emission and removal of CO₂ be counted explicitly at each stage of the life cycle. For example, in a study of a biomass fuel chain (where biomass is grown as fuel to be burned in a power plant), the removal of CO₂ should be counted explicitly for the biomass plantation, and the emission of CO₂ explicitly for the power plant. The net effect is of course zero or almost zero in this case: the biomass has been produced only to provide fuel for the power plant. But for an LCA of waste treatment, the appropriate system boundary is at the point where the waste has been produced, since it has been produced regardless of the chosen treatment method. Thus the CO₂ emitted during incineration has to be counted fully. If CCS is included in these examples, such explicit accounting automatically yields the appropriate results, whereas the above-mentioned convention would wrongly assume that removal and emission are balanced.

Explicit accounting for CO₂ at each stage offers a further advantage, namely it allows the dynamic modeling of emission and removal. The time dimension is crucial for systems with a long delay between removal and emission of CO₂, for example, the use of wood for buildings, furniture and wood-based materials. Such CO₂ is sequestered for decades or centuries, but eventually much or all of it will be re-emitted to the atmosphere. Different processes for the re-emission may have very different time scales. It is not appropriate to neglect such delays, even if one does not use monetary valuation and discounting in quantifying the damage costs associated with climate change.

By explicitly counting CO₂ at each stage, the analysis is consistent with the 'polluter pays' principle and the Kyoto rules which imply that each greenhouse gas contribution (positive or negative) should be allocated to the causing agent. For example,

under a system of greenhouse gas taxation, the CO₂ from using wood for space heating should be taxed the same way as CO₂ from oil heating, and a credit for CO₂ removal should be paid only when and where the wood is replaced by new growth.

A selection of interesting aspects on CO₂ in general, published in *Int J LCA* in the period of 1996 through 2007 (see also this issue, pp. 282–307), is cited below [1,3–10,13–15]. The conference report [12] deals with the topic of this editorial (see also [2,11]).

References

- [1] Bovea MD, Cabello R, Querol D (2007): Comparative Life Cycle Assessment of Commonly Used Refrigerants in Commercial Refrigeration Systems. *Int J LCA* 12, 299–307
- [2] Fabian P, Kohlpaintner M, Rollenbeck R (2005): Biomass burning in the Amazon-fertilizer for the mountaineous rain forest in Ecuador. *Env Sci Pollut Res* 12, 290–296
- [3] Flower DJM, Sanjayan J (2007): Greenhouse Gas Emissions due to Concrete Manufacture. *Int J LCA* 12 (5) 282–288
- [4] Helms H, Lambrecht U (2007): The Potential Contribution of Light-Weighting to Reduce Transport Energy Consumption. *Int J LCA, Special Issue* 12 (1) 58–64
- [5] Kakudate K, Kajikawa Y, Adachi Y, Suzuki T (2002): Calculation Model of CO₂ Emissions for Japanese Passenger Cars. *Int J LCA* 7 (2) 85–93
- [6] Kim S, Dale BE (2005): Life Cycle Inventory Information of the United States Electricity System. *Int J LCA* 10 (4) 294–304
- [7] Kim S, Overcash MR (2000): Allocation Procedure in Multi-Output Process: An Illustration of ISO 14041. *Int J LCA* 5 (4) 221–228
- [8] Marita N, Sagisaka M, Inaba A (2002): Life Cycle Inventory Analysis of CO₂ Emissions. Manufacturing Commodity Plastics in Japan. *Int J LCA* 7 (5) 277–282
- [9] Matsuhashi R, Kudoh Y, Yoshida Y, Ishitani H, Yoshioka M, Yoshioka K (2000): Life Cycle of CO₂-Emissions from Electric Vehicles and Gasoline Vehicles Utilizing a Process-Relational Model. *Int J LCA* 5 (5) 306–312
- [10] Nakano K, Aoki R, Yagita H, Narita N (2007): Evaluating the Reduction in Green House Gas Emissions Achieved by the Implementation of the Household Appliance Recycling in Japan. *Int J LCA* 12 (5) 289–298
- [11] Nolasco D, Lima N, Hernández PA, Pérez NM (2007): Non-Controlled Biogenic Emissions to the Atmosphere from Lazareto Landfill, Tenerife, Canary Islands. *Env Sci Pollut Res*, DOI: <<http://dx.doi.org/10.1065/espr2007.02.392>>
- [12] Peuportier B, Kellenberger D, Anink D, Mötzl H, Anderson J, Vares S, Chevalier J, König H (2004): Inter-comparison and benchmarking of LCA-based environmental assessment and design tools. Sustainable Building 2004 Conference, Warsaw, October 2004. The conference paper is available at: <<http://www.cep.ensmp.fr/english/themes/cycle/index-2.html>>. A more complete report is available from: <<http://www.etn-presco.net/generalinfo/index.html>>
- [13] Ross S, Evans D, Webber M (2003): Using LCA to Examine Greenhouse Gas Abatement Policy. *Int J LCA* 8 (1) 19–26
- [14] Rozycki C, Koeser H, Schwarz H (2003): Ecology Profile of the German High-speed Rail Passenger Transport System, ICE. *Int J LCA* 8 (2) 83–91
- [15] Spirinckx C, Ceuterick D (1996): Biodiesel and Fossil Diesel Fuel: Comparative Life Cycle Assessment. *Int J LCA* 1 (3) 127–132