Development of life cycle assessment for residue-based bioenergy

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Propositions

Thesis: Development of life cycle assessment of residue-based bioenergy
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1. In addition to the general difficulties experienced when conducting LCA of bioenergy, residue-based bioenergy adds another layer of complexity requiring specific approaches that are different from those approaches for product-based bioenergy (This thesis, Chapter 1).

2. The global warming impacts of scenarios based on complete inventories (including biogenic carbon) can be substantially higher or lower than those assuming carbon neutrality (excluding biogenic carbon), suggesting that biogenic carbon neutrality assumption introduces a bias to the 'true' values (This thesis, Chapter 4).

3. Biomass valuation as goods or waste plays an enormous role in affecting the environmental performances of bioenergy systems (This thesis, Chapters 4 and 6).

4. Biomass residues left on the fields is a promising source of bioenergy feedstock, however, unsustainable removal may adversely affect soil quality and hamper long-term future harvests (This thesis, Chapter 5).

5. In order to complete carbon balance, the inventory of biomass residues decomposed on fields should consider both emissions into the atmosphere and the soil matrix (This thesis, Chapter 5).

6. The importance of bioenergy in the future energy mix has been supported by an optimistic estimate made by International Energy Agency (IEA, 2009: Bioenergy - a Sustainable and Reliable Energy Source) that, by 2050, bioenergy could sustainably contribute up to one third of global primary energy supply.

7. With the growing demand for resources, challenges to the expansion of bioenergy rest not only on the competition for land and increasing food price (de Oliveira et al., 2005; BioScience 55: 593-602), but also on the competition with other emerging uses of biomass residues such as for mulch, compost, fibers, or biorefinery feedstocks.

8. Not all steps in LCA procedures are based on sciences; some are based on subjective elements. It is the reason that LCA stands for life cycle assessment rather than life cycle analysis (Baumann and Tillman, 2004: The Hitch Hiker's guide to LCA).

9. An LCA is powerful tools to quantify environmental impact of a product system, but its application is often limited by the lack of relevant inventory data (Finnveden et al., 2009; J Environ Manag 91: 1–21).

10. In addition to dealing with sustainable production, more effort should also be put forth for sustainable consumption; however, consuming less appears to not be an easy accomplishment for many of us.

11. We all live in an interconnected world; what we do will eventually affect others.

12. An essential step in starting a research is asking the right question, but what is 'right'? In some cases, it goes beyond scientific considerations.