Feed or bioenergy production from agri-industrial residues?

An overview of the GHG emissions including indirect land-use change impacts

Tonini, Davide; Hamelin, Lorie; Astrup, Thomas Fruergaard

Publication date:
2014

Document Version
Publisher's PDF, also known as Version of record

Feed or bioenergy production from agri-industrial residues? An overview of the GHG emissions including indirect land-use change impacts

DAVIDE TONINI[1*], LORIE HAMELIN[2] and THOMAS F. ASTRUP[1]

1 *Department of Environmental Engineering, Technical University of Denmark (DTU), 2800 Kgs. Lyngby, Denmark.*
[2] *Department of Chemical Eng., Biotechnology and Environmental Tech., University of Southern Denmark (SDU), Odense, Denmark.*

Second generation biofuels produced from "residual" biomasses are considered promising ways of producing bioenergy. However, many studies tend to forget that these biomasses are today used for specific purposes, (e.g. feeding). This means that their use for energy would induce cascading consequences on the food/feed market, or on the carbon balance of the soil. The first are commonly called indirect land-use changes (iLUC), as they cause an increase in the international demand of a food/feed product, finally inducing an expansion of cropland into other ecosystems. Failing to account for these consequences may lead to misrepresent the actual environmental impacts.

This study quantified, by use of consequential life cycle assessment (cLCA), the environmental impacts associated with a number of bioenergy scenarios involving selected agri-industrial residues. Three relevant conversion pathways were considered: combustion, fermentation to ethanol, and to biogas. The iLUC impacts were quantified and included in the assessment.

The LCA results revealed that, for all scenarios, GHG emissions from indirect land-use changes were the major contributor to the total GHG impact (up to ca. 40-60% of the total induced GHG emissions).

All in all, the use of biomasses that are today used as animal feed (e.g. beet molasses) induced significant GHG emissions through iLUC. These were quantified at between 1-3.5 t CO_2/t dry residue depending upon the nutritional value.

The recommendation is to avoid the use for bioenergy of those substrates having a significant nutritional value. Conversely, the energy use of substrates having low nutritional value (e.g. straw) may provide considerable GHG savings.