GHG emission factors for bioelectricity, biomethane, and bioethanol quantified for 24 biomass substrates with consequential life-cycle assessment

Greenhouse gas (GHG) emission savings from biofuels dramatically depend upon the source of energy displaced and the effects induced outside the energy sector, for instance land-use changes (LUC). Using consequential life-cycle assessment and including LUC effects, this study provides GHG emission factors (EFs) for bioelectricity, biomethane, and bioethanol produced from twenty-four biomasses (from dedicated crops to residues of different origin) under a fossil and a non-fossil energy system. Accounting for numerous variations in the pathways, a total of 554 GHG EFs were quantified. The results showed that important GHG savings were obtained with residues and seaweed, both under fossil and non-fossil energy systems. For high-yield perennial crops (e.g. willow and Miscanthus), GHG savings were achieved only under fossil energy systems. Biofuels from annual crops and residues that are today used in the feed sector should be discouraged, as LUC GHG emissions exceeded any GHG savings from displacing conventional energy sources. (C) 2016 Elsevier Ltd. All rights reserved.

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