How certain are greenhouse gas reductions from bioenergy? Life cycle assessment and uncertainty analysis of a forest residues-to-electricity supply chain.
How certain are greenhouse gas reductions from bioenergy?
A case study of a forest residues-to-electricity supply chain

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Purpose of this work
Bioenergy will play an important role in reaching national and international climate change targets. By 2020 about 10% of the EU's primary energy requirements could be supplied by biomass1. However, bioenergy is linked to a number of challenges, which have to be considered. If the application of bioenergy is implemented and supported from a climate change and sustainability perspective, bioenergy systems must deliver real emission reductions and be sustainable to justify their utilisation.2 There are standards for evaluating GHG emissions but the results depend on assumptions at many points along the supply chain, with significant uncertainties attached. The purpose of this work is therefore to evaluate these uncertainties and the significance for the potential of bioenergy to reduce GHG emissions and fulfill sustainability criteria. References: 1 EEA (European Environment Agency), 2013. EU bioenergy potential from a resource-efficiency perspective. 2 Thornley, P., 2012. Biofuels Review Report for Government Office for Science. Report number BA07067/2012/rep001r04.1.

Methodology
The research focuses on uncertainties arising from processes in forest residues-to-electricity supply chain related to GHG emissions and assessed with evaluating these. The main sources of uncertainty are examined and their emissions and environmental impacts evaluated. This is done with a whole systems approach, including direct and indirect impacts as well as sustainability. Greenhouse gas emissions and environmental impacts are assessed through life cycle assessment, with sensitivity and uncertainty analysis conducted for parameters representing the greatest uncertainty.

Main sources of uncertainties in a forest residues supply chain

Forest residues-to-electricity supply chain

Results
The research is still in progress, but preliminary findings identified carbon sequestration and carbon stocks, emissions from soils, production management, spatial aspects, regional and meteorological variations, indirect impacts and measuring black carbon emission from combustion as main sources of uncertainty. Sources of uncertainty encompass these sorts of natural variability and data uncertainty, but also methodological variations, including the scope of system considered.

Conclusion
Uncertainty in GHG emissions from bioenergy supply chains cannot be fully eliminated, but their better characterisation will support evaluation of their significance to the overall GHG reduction potential of bioenergy systems and their possible contribution to emission reduction targets. This will also support policy development by improving the understanding of bioenergy impacts and avoid unintentional outcomes from energy and climate change policies.

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References: