Geophysical Research Abstracts
Vol. 18, EGU2016-6877, 2016
EGU General Assembly 2016

Predicting moisture and economic value of solid forest fuel piles for improving the profitability of bioenergy use

Ari Lauren, Jyrki-Pekko Kinnunen, and Lauri Sikanen
Natural Resources Institute Finland, Joensuu, Finland (ari.lauren@luke.fi)

Bioenergy contributes 26 % of the total energy use in Finland, and 60 % of this is provided by solid forest fuel consisting of small stems and logging residues such as tops, branches, roots and stumps. Typically the logging residues are stored as piles on site before transporting to regional combined heat and power plants for combustion. Profitability of forest fuel use depends on smart control of the feedstock. Fuel moisture, dry matter loss, and the rate of interest during the storing are the key variables affecting the economic value of the fuel. The value increases with drying, but decreases with wetting, dry matter loss and positive rate of interest.
We compiled a simple simulation model computing the moisture change, dry matter loss, transportation costs and present value of feedstock piles. The model was used to predict the time of the maximum value of the stock, and to compose feedstock allocation strategies under the question: how should we choose the piles and the combustion time so that total energy yield and the economic value of the energy production is maximized? The question was assessed concerning the demand of the energy plant.
The model parameterization was based on field scale studies. The initial moisture, and the rates of daily moisture change and dry matter loss in the feedstock piles depended on the day of the year according to empirical field measurements. Time step of the computation was one day. Effects of pile use timing on the total energy yield and profitability was studied using combinatorial optimization.
Results show that the storing increases the pile maximum value if the natural drying onsets soon after the harvesting; otherwise dry matter loss and the capital cost of the storing overcome the benefits gained by drying. Optimized timing of the pile use can improve slightly the profitability, based on the increased total energy yield and because the energy unit based transportation costs decrease when water content in the biomass is decreased.