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“Development on the margin”

## Improving Household Energy Systems in Rural Ethiopia: A Comparative Study of Traditional Energy Sources and Biogas

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### Abstract

Traditional biomass like fire wood, crop residues and cow dung are still the main energy sources in rural areas of developing countries. Due to environmental and health issues an alternative energy management system has to be found, with an energy source being energy-effective and cost-efficient at the same time. Biogas, as renewable energy, gets highly promoted recently in developing countries.

In this context, the potential of wood, cow dung, biogas and biogas digestate as energy source was investigated and compared in terms of energy and fertiliser values as well as economic efficiency in rural Ethiopia. Fuel samples were taken at different rural households and fixed dome biogas plants with a volume of 4 to 12 m<sup>3</sup>. Dried samples were analysed for combustion characteristics, namely calorific value, volatile matter and ash content. Further, standard water boiling tests were performed on local stoves for wood and dung cake and the widely distributed Cambodian biogas stove. We also analysed fertiliser values of the different fuels and ash remaining from cooking with fire wood.

Cow dung and biogas digestate show similar combustion characteristics. However, their energy value proved much lower than those of biogas. Field tests showed that dung as single fuel for cooking was not sufficient for the preparation of meals. Fertiliser values are generally higher for ash than for dung and digestate which contain similar nutrient levels,

At the observed energy values, biogas proves to be economically more efficient than other fuels, in particular wood or dung. Moreover, energy from biogas provides synergies between cropping and livestock systems through saving agricultural labour for wood collection and providing fertiliser from slurry.

**Keywords:** Biogas, dung, energy source, fertiliser