

# BIOFUEL USE ASSESSMENTS IN AFRICA: IMPLICATIONS FOR GREENHOUSE GAS EMISSIONS AND MITIGATION STRATEGIES

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**Abstract.** The energy balances of most African countries suggest that biofuels (woodfuel, crop and wood residues, and dung) constitute the largest share of total energy consumption (up to 97% in some sub-Saharan Africa countries). There is, however, an increasing scarcity of woodfuel (fuelwood and charcoal), the major biofuel, and a feared increase in greenhouse gas (GHG) emissions associated with biofuel combustion. The extent of GHG emissions is estimated from biofuel consumption levels that are in turn based on methodologies that might be inaccurate. A questionnaire, supplemented by informal interviews, are used to collect data, yielding information regarding end-uses, technologies used, scale of consumption, determinants of fuel consumption, and interfuel substitution (among other parameters). The survey revealed that cooking is the major end-use, with other common uses, such as space and water heating. Improved stoves that provide better combustion efficiency and, thus, reduce woodfuel consumption have not been widely disseminated and are associated with higher methane emissions than open fires. More than 90% of the households in Africa use open fires. Consumption is presented as per capita for households and as products and quantity of fuel in the small scale industries, commercial, and public sectors. Among the determinants for biofuel consumption are affordability, availability of the fuel, and interfuel substitutions. Flaws in estimating biofuel consumption yield large uncertainties in GHG emissions, with implications for the development of policies on energy planning and environmental protection. However, the application of scenarios can guide policy formulation.

## 1. Introduction

Biomass is an important source of energy for the majority of the population in developing countries (Agarwal, 1986). In sub-Saharan Africa (excluding South Africa), it accounts for 73% of the total energy consumption (Table I). In Burkina Faso, Ethiopia, Malawi, Rwanda, Somalia, Tanzania, and Uganda, biomass accounts for more than 80% of total energy consumption. Only a few countries, such as Zimbabwe, Seychelles, and Mauritius, depend on biomass fuels for less than 50% of total energy consumption (Table II). The most important sources of biomass fuels in Africa are woodfuel (fuelwood and charcoal), crop and wood residues, and dung (Hall, 1994). Woodfuel is, undoubtedly, the most important source of biomass energy and, because of its increasing scarcity, it is a subject of major concern in Africa and the rest of the developing world.

The bulk of biomass is consumed by the domestic sector, whereas a small, but significant proportion is consumed by small-scale industrial and commercial enterprises and public institutions (Eberhard, 1986). The combustion of biomass is associated with the production of GHGs, namely carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxides (N<sub>2</sub>O), nitrogen oxides (NO<sub>x</sub>), and ozone (O<sub>3</sub>). In the *IPCC Guidelines for National Greenhouse Gas*