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Global wood-based energy usage, associated greenhouse gas emissions, and policy options to mitigate emissions

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Forests continue to provide a key source of energy throughout the world. Many developing countries, especially those with lowest incomes, rely on wood energy for cooking, heating, and power. Several developed countries increasingly use wood for renewable energy. When sustainably managed, forests can help address both energy demand and greenhouse gas (GHG) mitigation.

Our broad purpose with this study is twofold; first, formulate a more comprehensive understanding of wood energy usage and its GHG emissions, and second, consider wood energy as part of the broader energy and climate policy portfolio around the world, including developing and developed countries. Our geographic scope is global, but we generate our estimates at the country-level.

We first explain alternative sources of wood energy and technologies to utilize them. We then use data primarily from FAO and International Energy Agency to estimate current and future uses of wood energy around the world. Thereafter, we discuss wood energy GHG accounting, and use recent emissions intensity estimates1 to assess past, current, and future emissions from wood energy. Next, we examine options for mitigating emissions from wood energy, including technological improvements, substitution of wood for fossil fuels, and improving forest management. Then, we study wood energy in the national, regional, and international climate policy agreements, including past CDM/JI projects associated with wood fuels. Finally, we synthesize our findings and discuss the potential of wood energy to support wider energy and climate policy goals. We find considerable heterogeneity in the role of wood energy in the broader energy portfolio. Asia and Africa are the world's largest producers of wood fuel, and some countries depend on wood for over 80% of residential energy use. In high-income countries, wood energy is commonly produced relatively efficiently, thus, less GHG intensively. In Asia, total wood fuel usage is declining, whereas Africa continues an increasing trend. Globally, GHG emissions from wood fuel are about 2% of all emissions. In some countries, especially in East Africa, wood fuel emissions constitute a large share of emissions. Our results show where total and per-capita emissions are concentrated and where the greatest potential for emissions mitigation exists. Our key contribution is to comprehensively and globally assess wood fuel in the context of broader energy portfolio and climate policy. We provide novel estimates of past and future emissions associated with wood energy, including their geographic variation.

Our findings help inform forest, energy, and climate policies throughout the world. Our focus on GHG emissions is particularly relevant prior to the Paris COP in December. Our assessments of developing countries are pertinent, as increased developing country participation is high on the agenda in international climate policy. Improving sustainability of wood energy provides developing countries options to address emissions; international climate policy offers developed countries instruments to support such efforts. Finally, more sustainable use of forests for energy has important implications on their capacity to support other benefits to people, including wood and non-wood ecosystem services.

1) Bailis, R. et al. (2015). The Carbon Footprint of Traditional Woodfuels. Nature Climate Change.