A Billion-Ton Feedstock Supply for a Bioenergy and Bioproducts Industry: Technical Feasibility of Annually Supplying One Billion Dry Tons of Biomass

Summary

Biomass–all photosynthetic carbon containing plant and plant-derived materials, not just the starch, sugar, and oil crops already used for food and energy–has great potential to provide renewable energy for America's future. In addition to the many benefits common to any renewable energy use, biomass is particularly attractive, because it is the only current renewable source of liquid transportation fuel. This, of course, makes it an invaluable way to reduce oil imports–one of our most pressing energy needs. The U.S. Department of Energy and the U.S. Department of Agriculture are both strongly committed to expanding the role of biomass as an energy source. In particular they support biomass fuels and products as a way to reduce need for oil and gas imports, as a way of supporting the growth of agriculture, forestry, and rural economies, and as a way to foster major new domestic industries–biorefineries–making a variety of fuels, chemicals, and other products.

A key question, however, is how large a role biomass could play. Assuming that economic and financial policy and advances in conversion technology make biomass fuels and products more economically viable could the biorefinery industry be large enough to have a significant impact on energy supply and oil imports? Any and all contributions are certainly needed, but would the biomass potential be sufficiently large to justify the necessary capital replacements in the fuels and automobile sectors? Petroleum refineries, for example, are very large, capital-equipment-intensive operations. Would there be enough biomass feedstock available to warrant retooling some of those refineries to process biomass instead of or in addition to petroleum?

The purpose of this report is to determine whether in the long-term time period the land resources of the United States are capable of producing a sustainable supply of biomass sufficient to displace 30% or more of the country's present petroleum consumption. This 30% goal was set by a joint advisory committee to the two departments as a vision for making a major contribution to U.S. energy needs. It would require approximately 1 billion dry tons of biomass feedstock per year.

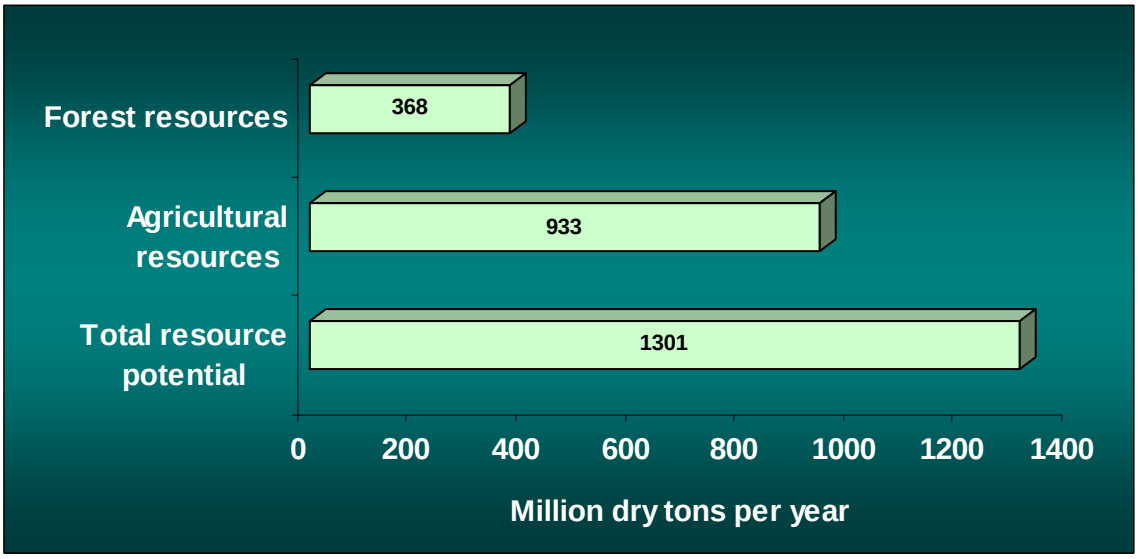
The short answer to the question of whether that much biomass feedstock can be produced is yes. Looking at just forestland and agricultural land, the two largest potential biomass sources, this study found potential exceeding 1.3 billion dry tons per year–enough to produce enough biofuels to meet more than one-third of the current demand for transportation fuels. This 1.3-billion-dry ton-per-year potential is based on a more than six-fold increase in production from the amount of biomass currently consumed for bioenergy and biobased products. About 933 million dry tons of sustainably removable biomass could be produced on agricultural lands and about 368 million dry tons could come from forestlands.

From agricultural lands, the U.S. can produce more than 900 million dry tons of biomass annually from agricultural lands and still continue to meet food, feed, and export demands. The projection includes 425 million dry tons of annual crop residues, 377 million dry tons of perennial crops, 56 million dry tons of grains used for biofuels, and 75 million dry tons of animal manures, process residues, and other miscellaneous feedstocks. The critical assumptions are that yields of corn, wheat, and other small grains have increased by 50%; soybeans have an increased

residue to grain ratio of 2:1; harvest technology is capable of taking 75% of annual crop residues (when sustainably removable); all cropland is managed with no-till methods; 55 million acres of cropland, idle cropland, and cropland pasture are dedicated to the production of perennial bioenergy crops; all manure in excess that which can applied on-farm for soil improvement under anticipated EPA restrictions; and all other residues and wastes are utilized.

From forestlands, the projection includes 52 million dry tons of fuelwood harvested for residential and commercial applications, 144 million dry tons of residues from wood processing mills and pulp and paper mills, 47 million dry tons of urban wood wastes including construction and demolition debris, 64 million dry tons of residues from logging and site clearing operations, and 60 million dry tons of biomass from fuel treatment operations to reduce fire hazards. All of these forest resources are sustainably available on an annual basis and take into account factors affecting forest access and environmentally sensitive areas, equipment recovery restraints, and merchandizing of recoverable biomass into higher-valued products.

This 1.3 billion dry ton potential can be produced with relatively modest changes in land use and agricultural and forestry practices. Moreover, this estimated potential should not be thought of as an upper limit. It is just one scenario and Departments of Energy and Agriculture scientists will continue to explore more advanced scenarios that could further increase the amount of biomass available for bioenergy and biobased products.



Annual Biomass Resource Potential Exceeds 1.3 Billion Dry Tons