

Commentary on the Billion Ton Report and the Potential Role of Dedicated Energy Crops

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The United States uses 180 billion gallons of transportation fuel per year, and imports about a third of its petroleum (equivalent of about 60 billion gallons per year) from unstable parts of the world (about 15% from the Middle East, 8% from Venezuela and 7% from Nigeria). In a report released by the US DOE and USDA in April 2005, commonly referred to as the "Billion Ton Report" (http://feedstockreview.ornl.gov/pdf/billion_ton_vision.pdf) it was suggested that production of a billion dry tons of biomass per year could provide the needed 60 billion gallons to replace the oil imported from these sources. It follows that the conversion efficiency assumed in this report is about 60 gallons/ton. However, several sources, including private companies that are attempting to commercialize cellulosic biofuel technologies, claim that a conversion efficiency of 120 gal/ton is entirely feasible, and some are projecting yields as high as 180 gal/ton or more.

The Billion Ton Report indicates that production of 1.36 billion tons per year should be feasible including 428 million tons from annual crop residues, 368 million tons from forest residues and 377 million tons from 55 million acres of dedicated energy crops, along with grain and other miscellaneous sources. There is some concern about the potential negative impacts of crop residue removal. While opinions on this matter differ, there seems to be general consensus among soil scientists that there is inadequate long term data on this topic in most regions of the country to confidently recommend what proportion of crop residues can be removed without affecting soil productivity. In contrast, there appears to be less concern about negative environmental impacts of using dedicated perennial crops like switchgrass, and forest resources to produce energy. In fact, several aspects of developing these resources as energy feedstocks will definitely have positive environmental impacts, such as reduced danger of wild fires if forests are thinned and the harvested material is used for energy, or soil improvement that results if annual crops are replaced with perennial grasses.

Production of 377 million tons of biomass per year from 55 million acres of perennial energy crops like switchgrass, as projected in the Billion Ton Report, works out to be an average yield of $377/55 = 6.85$ tons/acre. This is a modest yield projection which is already achievable in the Southeast. Plant geneticists and agronomists are confident that yield of these crops can be raised to at least 10 tons/acre within 5 to 10 years. If these projections are accepted, then 55 million acres of perennial dedicated energy crops would provide 550 million dry tons of biomass per year. In turn, this would convert to 66 billion gallons of liquid fuel per year at an efficiency of 120 gal/ton. At this same conversion efficiency, the 368 million tons of biomass projected to come from forest resources would produce another 44 billion gallons a year. This amounts to a total of 110 billion gallons/year from dedicated energy crops and forest resources combined, or the equivalent of all the imported oil (60% of total annual consumption) with no use of crop residues at all.

Another issue of interest is to examine the feasibility of the plan to reduce gasoline consumption by 20% (or 36 billion gallons per year) within 10 years, as laid out by President Bush in the 2007 State of the Union address. Since the Billion Ton Report projects that 368 million tons of forest material is available immediately, at a yield of 100 gal/ton this would provide 36.8 billion gallons. Therefore, the feedstocks to meet this goal are already available. The challenge is to verify commercial feasibility of a conversion technology and deploy it rapidly. Consequently, it is concluded that dedicated perennial energy crops alone could replace the 60 billion gallons of gasoline equivalent currently imported by the US from unstable parts of the world without the need to use any crop residues at all. Furthermore, if forest resources are added, all imported oil (60% of total consumption) could be replaced, or the 20 in 10 plan announced this year by President Bush could be achieved using forest resources alone.