DOVETAIL COMMENTARY

What Do Biomass Energy and Recycling Have in Common? Wood!

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Wood is a unique and ubiquitous material. It is unique in that it is completely renewable in a sustainable manner and comes in both great volume and in great variety; thousands of species are available[1]. It is ubiquitous both as a result of that natural variety and its chemical-physical structure. This structure enables the material to be able to function well at the molecular, fiber, and macro level in an unbelievable array of uses and situations.

It is important to consider the derivation of wood. Although most of us are taught the basics of photosynthesis in school, the implications of this formation are rarely obvious and even less often applied to the debates of material use, reuse, recovery, and recycling. The following is a fundamental balance equation representing how wood is formed.

$$6H_2O + 6CO_2 <=> C_6H_{12}O_6 + 6O_2$$

Basically water, (H2O), dominantly taken up from the ground through the roots, combines with carbon dioxide (CO2) from surrounding air in the presence of sunlight to form cellulose (C6H12O6) (as well as lignin, hemicellulose and a variety of other complex hydrocarbons), and releases oxygen (O2) to the atmosphere. Wood is made up of about 50±3% Carbon, 6±1% Hydrogen, and 44±3% Oxygen. In most North American species there is also a minute amount (0.2%±) of inorganic material based on other elements absorbed from the environment.

According to Scientist Neil degrasse Tyson we should not be shocked that these elements form so well and so relatively easily to create a living plant. Hydrogen, Carbon, and Oxygen are three of the top four available elements in our galaxy[2]. And carbon is considered the most chemically active element in the periodic table, able to interact to make extremely complex molecules and in a greater number of combinations than all other elements combined[3].

Wood's "easy" construction via photosynthesis is important because the reverse is also true. That is, the complete inorganic oxidation (i.e., combustion) of wood basically results in the recycling of CO2 and H2O back into the atmosphere. And not only is the recycling of the basic elements of wood easy to do, the previously harvested solar power is converted to usable energy in the process. The combustion process liberates about 8600 Btu's per pound for hardwood and

9000 Btu's per pound for softwood, or essentially the same amount of energy soaked up from the sun in forming the wood through photosynthesis. [4]

But what about all that smoke and creosote you might ask? Well, according to Rick Curkeet, PE and Chief Engineer at Intertek Testing Services, creosote and smoke represent unburned fuel. So it is important to efficiently combust woody biomass – which can be accomplished using modern high efficiency biomass burners.

Additional elements may be present in wood. That is, wood is a living material and other elements may be either absorbed from the environment (e.g., trees grown on a brownfield site) or purposely added through painting, treating, or creation of composites. While wood that has been combined with another material may present a challenge to achieving clean combustion, in general, the burning of woody material is simply part of the natural recycling process of releasing 99.8% of the constituent elements back "from whence they came."

What about the negative impacts of releasing CO2 into the atmosphere? Well, if the woody biomass comes from sustainably managed forest systems and trees are continuously replanted, or thinning processes optimize other growth, than it is simply a continuation of nature's natural cycle. Nature has always burned things (forests, savannas, prairies) and it is the growth of plants that has harvested the CO2 from the air and the energy from the sun that has balanced those events over time.

So, one way to look at wood-derived energy is that it combines the benefits of recycling with the benefits of solar energy. Perhaps we should reframe the discussion of biomass energy by rephrasing the language. Maybe one way to encourage a more sustainable way of thinking is to rename "biomass energy," using instead the terminology "woody biomass recycling through combustion!"