

# Wood Energy: An Overview of Biomass

—Dale Greene, PhD

Over the past four to five years, the topic of renewable energy has received an enormous amount of attention. Today, Congress is considering legislation to reduce carbon emissions and renewable energy mandates for electricity production that could significantly change how our nation uses energy over the coming decades. Forest landowners are understandably excited about these prospects for greater use of wood and strengthened markets for timber products.

But at the same time, there is no shortage of misinformation and at times downright snake oil out there in many of the discussions in the media or on the street. This is not simply a technical issue; it is loaded with politics, so many often wonder about the accuracy of statements they hear or read. Most Americans would prefer their energy to be domestic, low-carbon, and cheap—a good political sound bite perhaps, but not likely in today's real world.

A good place to start in considering renewable energy opportunities is to consider where we are today.

The United States annually consumes approximately 100 quadrillion btu (quads) of energy in all forms. All renewables account for just 6 percent of this total, and that is nearly equally accounted for by biomass (47 percent) and hydropower (45 percent). Solar and wind combined account for less than 5 percent of renewable energy sources—that is 5 percent of 6 percent, or about three-tenths of one percent (0.3 percent) of our total energy use. Biomass today accounts for 10 times

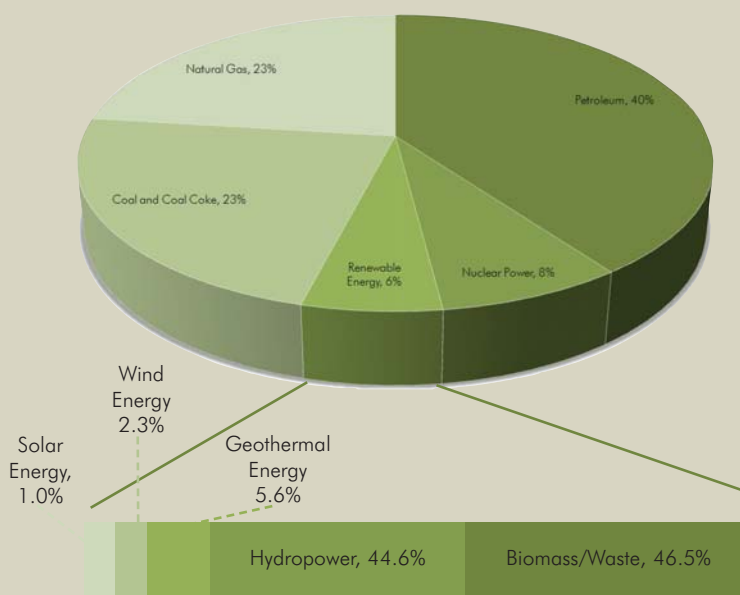
the energy production of solar and wind combined and the forest products industry is responsible for 75 percent of it.

But to understand where the opportunities lie for the future, we also have to examine how we use energy. We basically use energy in three ways: to produce electricity (39 percent), for residential and industrial heating (33 percent), and in transportation (28 percent). Electricity use continues to grow, and a significant shift to electric or plug-in hybrid cars would further escalate electricity use. The big issue with electricity is that about half of it (52 percent) is produced by burning coal. Any realistic program to deal with reducing carbon emissions must address this reliance on coal. Use of transportation fuels has flattened in the United States as consumers

respond to recent high fuel costs by changing driving patterns and buying more efficient cars. Higher government targets for auto fuel efficiency may also help reduce demand for fuel, but history shows this is less likely. In any case, the big issue with transportation fuel is that 96 percent of it is based on petroleum and the U.S. imports two-thirds of the oil it consumes. From a political and national security standpoint, we would like to see our transportation fuel be more reliant on domestic sources.

Wood offers the potential to help meet a wide range of energy uses including electricity production, liquid fuels, and industrial/residential heating. Today, we are seeing this interest expressed in the marketplace through plants that produce electricity, wood pellets, and ethanol from wood.

Energy Use (Total U.S. Consumption: 100 quadrillion Btu)



## Wood Pellets

The market for wood pellets has grown tremendously over the past five years. Wood pellets are burned in stoves and furnaces to provide heat for residential and commercial applications. Shortages of wood pellet stoves have been commonplace during the fall and winter months over the past few years. However, the largest market for wood pellets has been and will continue to be power plants, primarily in Europe, that purchase wood pellets for co-firing with coal. Modern coal plants pulverize or crush coal into a fine powder to obtain more complete combustion with lower emissions. Since wood pellets are made from extruded wood flour, they readily mix with coal in such applications, whereas a standard wood chip would clog such systems with its long fibers. In addition, wood pellets have a far higher btu content per unit volume, thus they are ideal for long-distance shipping. Several plants in the southern United States today produce wood pellets for shipment to the European Union (EU) to produce electricity. The renewable targets adopted by EU countries in an attempt to meet Kyoto Protocol goals and the associated subsidies provided by these countries have created this market. The *Wall Street Journal* reported on July 7, 2009, that EU wood pellet imports were up 62 percent during the first three months of 2009 compared to the same period in 2008. This market is currently worth over \$400 million annually. While most wood pellets pro-

duced in the U.S. today are bound for EU markets, a U.S. renewable electricity mandate and/or a carbon cap and trade system could redirect at least some of this production for domestic consumption.

## Ethanol

We all seem to pay more attention to the price of transportation fuel than the cost of electricity since the price is posted on most street corners and we pay for gasoline as we use it, not once a month. The 2007 Energy Bill increased the target for U.S. ethanol production to 36 billion gallons by 2022, and only 15 billion gallons are to be corn-based. This leaves the remaining 21 billion gallons to be from cellulosic or other "advanced" sources. Ethanol producers are currently suffering financially from soft demand for fuel due to the slow economy, as well as low fossil fuel prices. In addition, cellulosic ethanol producers have yet to produce ethanol from wood at a pro-

duction scale successfully, although this appears likely to change in the next two to three years. Significant production improvements are needed along with sustained higher fossil fuel prices to make cellulosic ethanol production financially appealing.

This market holds promise for the future, but in the short-term it will be a small market. One reason for this is that the U.S. gasoline market is approaching a limit on the amount of ethanol it can use with the current 10 percent mix in gasoline. We consume about 150 billion gallons of gasoline per year, so a 10 percent mix requires about 15 billion gallons of ethanol. Current capacity is around 13 billion gallons. Clearly, that leaves little room for more ethanol from corn or cellulosic sources. We could increase our consumption of ethanol by moving to a 15 percent mix (an option currently being evaluated by the government) or by wider use of E85 fuel (85 percent ethanol, 15 percent gasoline). We have



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seen a significant increase in the production of vehicles that can run on E85, but millions of cars in the current fleet cannot use it and they will be on the road for many more years. We also need massive investments in retail distribution systems to allow the sale of E85 fuel at gas stations as well as changes in transportation infrastructure to move ethanol to markets outside of the Midwest. Ethanol holds promise for helping reduce our dependency on foreign oil sources, but moving to it will take time, perhaps most of the next decade.

### Electricity

The largest potential renewable energy market for wood is likely to be electricity production. While we are still learning how to make ethanol from wood, we are well acquainted with burning wood to produce steam for either direct industrial use, electricity generation, or a combination of the two (CHP—combined heat and power). Recent figures reported by RISI in

their monthly Wood Biomass Market Report show nearly 60 percent of the currently announced wood biomass demand for new energy facilities in North America involves electricity production. A renewable electricity mandate on utilities would result in a significant move toward biomass for electricity, especially in the eastern U.S. where solar and wind energy sources are not as reliable or efficient as in the Midwest and West.

Wood can be used to produce electricity in several ways, including co-generation, co-firing, or direct firing with wood. Co-generation typically suggests a manufacturing plant such as a pulp mill that produces steam for on-site use as well as to turn a turbine that produces electricity that can be sold onto the grid. Co-firing involves the mixing of wood with another fuel (typically coal) to increase the renewable mix and often to reduce air emissions. We are seeing conversions of existing plants to use wood (100 percent or co-fire), as well as power plants construct-

ed at new sites (greenfield locations). Many utilities have existing coal plants that are too small to be economical today, but are in good locations to convert to wood use. Converting such plants to wood often involves less capital per MW of generation capacity and may offer an easier permitting process than for a greenfield location. In other cases, utilities are opting to build new plants to take advantage of the latest technologies throughout the plant as well as to site the facility in a desirable wood basket. Other factors that are always a consideration in locating power plants include water availability (for cooling and steam) and proximity to high-voltage transmission lines to allow power to be economically placed on the grid.

A number of wood-fired electricity plants are currently announced, under permit review, or under construction. Most have announced that they will use “wood waste” as a feedstock. That statement is true, but only to a point. Most will obtain the majority of their



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feedstock as round pulpwood or in-woods chips for the simple reason that there is not enough wood waste to fully source any of these plants. They will use a mix depending on market availability and price. This is good news for forest landowners and logging contractors.

### Government Obstacles

While government policies such as carbon cap and trade and renewable electricity mandates are helping make the wood energy markets develop today, government policies are also major obstacles in the development of these markets.

One major issue has been the definition of "renewable biomass". This is important because biomass that does not meet this definition may not count toward meeting renewable electricity or cellulosic ethanol goals set by the government. In short, the 2007 Energy Bill defined renewable biomass in such a way that most forest biomass in the U.S. would not qualify. Significant legislative work by the Forest Landowners Association and other forest industry organizations has resulted in much more sensible definitions in the current Farm Bill and the version of the

Waxman-Markey Climate Change bill passed by the House in early June. Keeping practical definitions in legislation that are workable in the woods and in the marketplace are absolutely crucial if a strong wood bioenergy market is to develop and play a significant role in meeting our renewable energy needs.

Another issue involves how harvesting forest biomass is rated as "sustainable". Several states have adopted or are considering adoption of biomass harvesting guidelines to give guidance to forest landowners on this issue. These guidelines should be written carefully, because their use is likely to be a requirement if harvested biomass is considered to be "renewable biomass" as discussed in the previous paragraph. Such guidelines will most likely be state-specific to reflect regional differences in forest types, growth rates, and markets. Forest landowners should get involved in or stay updated on the development of these guidelines in their states.

While the economy continues to struggle, the future for the use of wood to meet renewable energy targets for our country has many bright spots. Markets for wood pellets and electrici-

ty are here today or will be in a matter of months, if federal legislation is passed with sensible definitions and language to allow wood to fully participate. Ethanol produced from wood will also be a growing market, but may take longer to fully develop as production technology and infrastructure changes take time to get in place. Wood is already producing 10 times the renewable energy for our country as does solar and wind combined. We can do even more and will certainly be a major piece of the "patchwork quilt" of sources required to reduce our dependence on fossil fuels in coming years.

### About the Author

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