Table 6-4. These data show that the densification of wood converts this resource into a substance which is superior to the raw feedstock in terms of fuel value per unit of volume. Figure 6-8 shows the typical energy content of biomass versus moisture content.

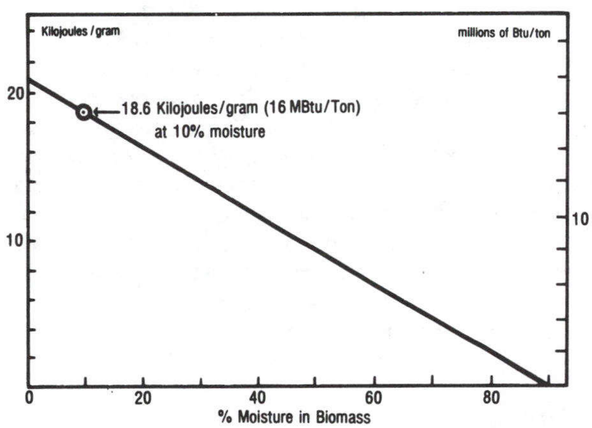
Table 6-4: ENERGY DENSITIES OF WOOD BY MASS AND VOLUME

Fuel	Water Content (%)	Density (gams/cm³)	Heat of Combustion[a] Mass (MED) (kilojoules/gram)	Volume (VED) (kilojoules/cm³)
Wood	10	0.6	18.6	11.2
Densified Wood	10	1.0	18.6	18.6

[a] Values shown are representative of a range for each fuel.

Source: After Reed and Bryant, 1978, p. B-2.

Figure 6-8: SENSITIVITY OF ENERGY CONTENT TO MOISTURE CONTENT IN WOOD



Source: After Reed and Bryant, 1978, p. B-5.

The first patent for densification was issued in 1880 and described a process in which sawdust or other wood residues were heated to 150°F and compacted to the "density of bituminous coal" with a steam hammer. Since then a number of patents have been issued for similar processes but, in general, five forms of biomass densification are now practiced commercially: pelleting, cubing, extrusion, briquetting and rolling-compressing.

Depending on the feedstock and the degree of compaction, densified biomass may have a water-repellent skin. However, exposure to water should be avoided during storage, particularly if the DBF has a high paper content. Because compacted fuels have a low moisture content, they biodegrade slowly and can be stored for long periods but only if kept dry. Biomass pellets make a satisfactory fuel for fixed-grate boilers, either supplementing or replacing coal.

While DBF does not share two advantages of coal — concentrated sources of supply and an established industrial infrastructure — neither does it share many of its liabilities, such as sulphur emissions, environmental disruption by strip-mining and black lung disease in coal workers. Although any economic analysis of DBF versus coal is highly site- and time-sensitive, it appears that DBF may have an economic advantage in regions with abundant biomass but no coal. DBF may also be preferable to coal for industrial or utility processes where sulphur abatement is required.

The technology for burning DBF in supplement to or in replacement of coal is well developed. Suspension and spreader stoker coal-firing systems can burn DBF with little or no modification. Boilers specifically designed to burn wood — fluidized bed combustors, small firetube boilers, bark burning boilers, and vortex combustors — will also burn DBF and are commercially available today in a wide range of capacities.

It is neither practical nor economical to substitute DBF in existing gas and oil boilers. DBF is, however, an attractive feedstock for low- to medium-Btu gasification. The product gas can be used to produce process heat and to fuel existing gas and oil installations with only minor engineering modifications. Because gasifiers perform best on a uniform, dense and clean feedstock, DBF may be preferable to coal or green biomass.

Other potential uses of DBF include fueling residential, commercial or industrial central heating systems; fueling airtight wood stoves; firing external combustion engines; fueling fireplaces and outdoor grills; and producing pyrolysis oil and high-density charcoal. In summary, the process of densifying biomass holds the promise of providing a dry, uniform, easily stored and conveniently shipped fuel from the wide variety of residues produced by forest, agriculture and food processing industries.

CONCLUSION

The Committee feels that there are definite advantages to be gained from increased exploitation of Canada's wood resources and that one of the ways of making wood a more attractive and versatile fuel is by densification.

RECOMMENDATION

As the technology for biomass densification is available now and is being used in some loca-