



## Solid Biofuels Bulletin No. 1

# SOLID BIOMASS FUELS



This bulletin is the first in a series of bulletins related to solid woody biomass fuels (solid biofuels). The information captured in the series is based on a suite of Solid Biofuel Standards developed and published by the International Organisation for Standardization (ISO). The bulletins are aimed primarily at consumers who are using or considering solid biofuels for space heating. The intent is to provide easy-to-read introductory guides to the use of solid biofuels. The series may also be of interest to fuel suppliers, equipment manufacturers, testing laboratories and regulators.

This bulletin introduces sources of biomass, provides definitions for solid biofuels and their key characteristics.

### What is Biomass?

The term ‘biomass’ encompasses all organic materials of biological origin and can be sourced from various operations including:

- forestry and arboriculture (the management of woody plants);
- agriculture and horticulture (the management of vegetable garden plants);
- aquaculture (the farming of aquatic organisms).

Woody biomass from forestry and arboriculture operations is by far the most common biomass available in Canada and worldwide. Forest biomass generated by the Canadian forest sector adheres to rigorous forest management practices, i.e. sustainable harvesting and replanting of harvested areas.

Sources of woody biomass include:

- **forest, plantation and other virgin wood** – such as stem wood, segregated wood from city forests, parks, gardens, roadside maintenance and logging residues;



- **by-products and residues from the wood processing industry** – generated during the production of forest products and includes hog fuel (unrefined wood fibre), slabs, sawdust, shavings and bark;
- **used wood** – post-consumer wood waste, such as construction and demolition wood, pallets and wood packages.

**“The objective of the ISO 17225 series is to provide unambiguous and clear classification principles for solid biofuels and to serve as a tool to enable efficient trading of biofuels, to enable good understanding between seller and buyer, and for communication with equipment manufacturers.”**

From ISO International Standard 17225-1: Solid Biofuels – Fuel Specifications and Classes

## What are Solid Biofuels?

Solid biofuels are produced from biomass through processing steps such as chopping, drying, chipping, grinding and densifying (pelletizing or briquetting). This improves the physical and chemical properties: i.e. particle size, moisture content and energy content. Densification is usually required for efficient and economical long distance transportation, bulk handling and storage. Additional processes are under development (torrefaction, steam processing) to further improve fuel quality by increasing energy content, mechanical durability and reduce water absorption. Solid biofuels are available in various forms including:

- **Firewood:** cut and/or split logs, preferably dried and usually with uniform length.
- **Wood Chips:** chipped wood with a defined size, a typical length of 5 to 50 mm, and a low thickness compared to length; produced by mechanical processing with sharp tools.
- **Briquettes:** densified (compressed) biomass fuel in a cubic or cylindrical form with a diameter of more than 25 mm.
- **Wood Pellets:** densified biomass fuel in a cylindrical form with a diameter of up to 25 mm and length of 5 to 40 mm.

## Advantages of Standardization

Since the early days of village markets an axiom has been that you should get what you pay for. From the development of hand-held scales to current exotic laser and microwave devices, the goal has been a uniform set of criteria or standards to facilitate commerce. These same criteria should be applied to solid biofuels in which what you are buying is really the energy in the fuel. Determination of this “energy quantity” requires more than simple measurement of weight and/or volume. Agreed-upon standardization criteria allow consumers, suppliers and regulators to have confidence in the consistency and performance of solid biofuels. Heating equipment manufacturers can then also design and engineer their systems to match the fuel specifications.

Industrial energy systems fueled with biomass fuels are custom designed with sophisticated controls and appropriate air emission control equipment. They can burn wood residue, such as hog fuel, efficiently and effectively. Space heating equipment, on the other hand, is typically factory built and may not have advanced controls or emission control equipment (mainly because of cost constraints). Furthermore, the equipment is not generally managed by professional engineers and facilities are typically located in populated areas. This makes fuel

**Table 1.** Comparison of key fuel property specifications of wood residue and solid biofuels

Fuel Property	Wood Residue*	Firewood	Wood Chips	Briquettes	Wood Pellets	Thermally Treated Biofuels**
Moisture Content	High	High-Medium	High-Medium	Medium	Low	Low
Energy Content	Low	Low-Medium	Medium	Medium-High	Medium-High	High
Bulk Density	Low	Low-Medium	Low-Medium	Medium-High	High	High

\* Often referred to as hogfuel

\*\* Standards for classes and specifications of thermally treated biofuels are currently in development by ISO TC 238.

**Table 2.** Solid biofuels bulletins by Natural Resources Canada

Technical Bulletin	Purpose
No.1 – Solid Biomass Fuels	Introduction to biomass and solid biofuels
No.2 – Primer for Solid Biofuels	Guide to definitions, classes/grades and fuel properties
No.3 – CAN/CSA-ISO Solid Biofuels Standards	Detailed listing of CAN/CSA-ISO standards for grading and testing
No.4 – Graded Wood Pellets	Explains fuel specifications as defined in the CAN/CSA-ISO 17225 Part 2
No.5 – Graded Wood Briquettes	Explains fuel specifications as defined in the CAN/CSA-ISO 17225 Part 3
No.6 – Graded Wood Chips	Explains fuel specifications as defined in the CAN/CSA-ISO 17225 Part 4
No.7 – Graded Firewood	Explains fuel specifications as defined in the CAN/CSA-ISO 17225 Part 5

standardization a crucial requirement for safe, reliable and efficient operation.

Standards such as those published by ISO and CSA lay out the key properties affecting the energy content and performance of biofuels (Table 1). These properties include not only the form (size, shape and density) but also the energy and moisture contents and non-combustible portion (ash).

Standards for solid biofuels have been developed by the International Organisation of Standardization (ISO) within the 17225 series (8 parts), and, are adopted and available through the Canadian Standards Association Group (CSA) in Canada<sup>1</sup>.

Part 1 of the CAN/CSA-ISO 17225 includes comprehensive classifications and specifications for broad range of solid biofuels sourced from forestry, arboricultural, agricultural, horticultural and aquatic origins. Parts 2 to 8 of the CAN/CSA-ISO 17225 standards detail specifications for graded biofuels for applications in residential, commercial and industrial sectors.

In addition to the CAN/CSA-ISO 17225 series, standards for sampling and testing methodologies for verification purposes and for the safe handling and storage of pellets are slated for release by 2018.

Natural Resources Canada aims to make the new CAN/CSA-ISO 17225 solid biofuel standards widely known, understandable and user-friendly through a series of bulletins listed in Table 2. These bulletins are intended to provide the reader with a brief summary of the standards and highlight the most relevant information<sup>2</sup>.

## Solid Biofuels and Carbon Impact

94 % of the forest land in Canada is publicly owned<sup>3</sup>. Management of this forest land involves integrating environmentally responsible and sustainable biomass harvest practices and forest management plans. Forestry in Canada upholds strong environmental values and has stringent requirements for forest regeneration, protection of species-at-risk and the integrity of ecosystems. Less than 1% of managed forest in Canada is harvested each year (Figure 1).

Forest harvesting and wood processing leave behind biomass as by-products and residues from logging and milling operations; biomass residues are also generated during thinning operations. These by-products and residues, resulting from sustainable forest practices and operations, are used as raw material for solid biofuel production. Other sources such as insect- or fire-killed trees and urban wood waste can also be valuable for solid biofuel production.

The use of solid biofuels is renewable, can replace energy generated from fossil fuels and help displace greenhouse gas (GHG) emissions from fossil fuels. It can also lower the risk of forest fires by managing the forest floor debris.

The net benefit of bioenergy to the environment is particularly significant when the sources of the woody biomass are by-products and residues and used wood. Other factors affecting the net environmental benefits of bioenergy over time include:

- alternative usage of the biomass (is the biomass left to decay, landfilled or manufactured into a consumer product?),

- type of fossil fuel being replaced (such as coal, fuel oil, propane, or natural gas),
- forest growth rates,
- furnace / boiler design and efficiency, air pollution controls, and operating conditions.

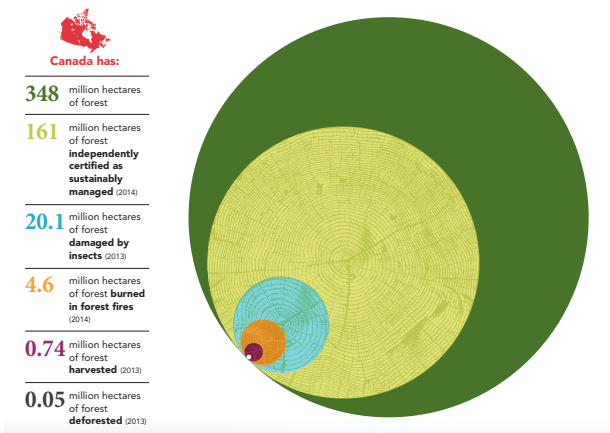
**SUSTAINABLE FOREST MANAGEMENT**

## When will Canada harvest its last tree?

**Never.**

Canada's forests are renewable resources that are carefully managed to ensure that their social, economic and environmental benefits are available for generations to come.

In fact, studies have confirmed that Canada has some of the most rigorous forest management policies in the world.



**Figure 1.** Allocation of Canada's forest coverage<sup>3</sup>

## Summary

- Solid biofuels can replace fossil fuels for heat and/or electricity production resulting in greenhouse gas emissions reductions and socio-economic benefits.
- There is increasing interest in the use of solid biofuels in commercial and institutional heating applications in Canada.
- Renewable, standardized solid biofuels offer consistent quality, leading to improved performance, lower maintenance costs and reduced emissions.
- Canada now has standards for solid biofuels under the CAN/CSA-ISO 17225 series.

## References & Links

1. CSA Group - [www.csagroup.org](http://www.csagroup.org) for CAN/CSA-ISO 17225-Solid Biofuels – Fuel Specifications and classes – Part 1 to 8.
2. Natural Resources Canada – [www.nrcan.gc.ca](http://www.nrcan.gc.ca) for the Solid Biofuels Bulletin Series.
3. The State of Canada's Forests – Annual Report 2015, <http://www.nrcan.gc.ca/forests/report/16496>

## Acknowledgement

This bulletin was prepared in collaboration with Canadian Institute of Forestry, FPIInnovations, Ontario Ministry of Natural Resources and Forestry, Pembina Institute, Wood Pellet Association of Canada, and Wood Waste to Rural Heat.

