

# What is Biomass?

## Introduction

In exploring the topic of woody biomass production and utilization, you will need to have a fairly thorough understanding of the various types of biomass that can be used for heat, power, electricity, transportation fuels, and other bioproducts. This chapter provides a comprehensive discussion of woody biomass and a basic overview of agricultural biomass.

## Biomass

Biomass is carbon based and is composed of a mixture of organic molecules containing hydrogen, usually including atoms of oxygen, often nitrogen and also small quantities of other atoms, including alkali, alkaline earth and some heavy metals. These metals are often found in functional molecules such as the porphyrins which include chlorophyll which contains magnesium.

## Plant Material

The carbon used to construct biomass is absorbed from the atmosphere as carbon dioxide ( $\text{CO}_2$ ) by plant life, using energy from the sun.

Plants may subsequently be eaten by animals and thus converted into animal biomass. However the primary absorption is performed by plants.

If plant material is not eaten it is generally either broken down by micro-organisms or burned:

- If broken down it releases the carbon back to the atmosphere, mainly as either carbon dioxide ( $\text{CO}_2$ ) or methane ( $\text{CH}_4$ ), depending upon the conditions and processes involved.
- If burned the carbon is returned to the atmosphere as  $\text{CO}_2$ .

These processes have happened for as long as there have been plants on Earth and is part of what is known as the carbon cycle.

## Fossil Fuels

Fossil fuels such as coal, oil and gas are also derived from biological material, however material that absorbed  $\text{CO}_2$  from the atmosphere many millions of years ago.

As fuels they offer high energy density, but making use of that energy involves burning the fuel, with the oxidation of the carbon to carbon dioxide and the hydrogen to water (vapour). Unless they are captured and stored, these combustion products are usually released to the atmosphere, returning carbon sequestered millions of years ago and thus contributing to increased atmospheric concentrations.

## The Difference Between Biomass And Fossil Fuels

The vital difference between biomass and fossil fuels is one of time scale.

Biomass takes carbon out of the atmosphere while it is growing, and returns it as it is burned. If it is managed on a sustainable basis, biomass is harvested as part of a constantly replenished crop. This is either during woodland or arboricultural management or coppicing or as part of a continuous programme of replanting with the new growth taking up  $\text{CO}_2$  from the atmosphere at the same time as it is released by combustion of the previous harvest.

This maintains a closed carbon cycle with no net increase in atmospheric  $\text{CO}_2$  levels.

## Categories of Biomass Materials

Within this definition, biomass for energy can include a wide range of materials.

The realities of the economics mean that high value material for which there is an alternative market, such as good quality, large timber, are very unlikely to become available for energy applications. However there are huge resources of residues, co-products and waste that exist, in which could potentially become available, in quantity, at relatively low cost, or even negative cost where there is currently a requirement to pay for disposal.

There are Five basic categories of material:

- **Forestry / Waste Land Waste** , from forestry, arboricultural activities or from wood processing or trees grown vastly in barren lands
- **Energy Crops:** high yield crops grown specifically for energy applications
- **Agricultural Residues:** residues from agriculture harvesting or processing
- **Food Waste**, from food and drink manufacture, preparation and processing, and post-consumer waste
- **Industrial Waste And Co-Products** from manufacturing and industrial processes.