

# Bioenergy and biofuels in New Zealand



## Biomass

Biomass is any organic material which has absorbed sunlight and stored it in the form of chemical energy. Examples are wood, energy crops and waste from forests, or farms. The word biomass simply denotes the biological raw material the fuel is made of.

Wood and wood residues are the largest biomass energy source today. Wood can be used as a fuel directly or processed into pellet fuel or other forms of fuels. Other plants can also be used as fuel, for instance corn, switchgrass, miscanthus and bamboo.

Organic waste is also made up of biomass. Organic waste is any material that is biodegradable and comes from either a plant or an animal. Biodegradable waste is organic material that can be broken into carbon dioxide, methane or simple organic molecules. Examples of organic waste include green waste, food waste, food-soiled paper, non-hazardous wood waste, green waste, and landscape and pruning waste. The main waste feedstocks are wood waste, agricultural waste, municipal solid waste, and manufacturing waste.

## Bioenergy

Bioenergy is energy made from biomass or biofuel.

The extraction of energy from biomass may be via one of three pathways:

1. **Thermal conversion** processes produce heat from the biomass.
2. Many **chemical conversions** are based on established coal-based processes, such as the Fischer-Tropsch synthesis.[8] Like coal, biomass can be converted into multiple commodity chemicals.[9]
3. **Biochemical processes** have developed in nature to break down the molecules of which biomass is composed, and many of these can be harnessed. In most cases, microorganisms are used to perform the conversion. The processes are called anaerobic digestion, fermentation, and composting.

The IPCC (Intergovernmental Panel on Climate Change) defines bioenergy as a renewable form of energy and considers that the use of forest biomass for energy is [carbon neutral](#).

## Biofuels

The word biofuel is often used by the media for liquid or gaseous fuels, used for transportation, however this is misleading as there are solid, liquid and gaseous biofuels. Wood is a solid biofuel.

A range of solid, liquid or gaseous biofuels can be created by thermal, chemical or biological conversion of biomass. Thermal conversion processes use heat as the dominant mechanism to upgrade biomass into a better and more practical fuel. The basic alternatives are torrefaction, [pyrolysis](#), and gasification, these are separated mainly by the extent to which the chemical reactions involved are allowed to proceed (mainly controlled by the availability of oxygen and conversion temperature).

Biomass can be supplied as a fuel in chipped or shredded form, or densified into pellets or [briquettes](#). The sources of biomass could be wood, or herbaceous such as straw, hemp, or miscanthus. Wood pellets or briquettes can be manufactured from raw wood, [paper](#), [cardboard](#) or [pallets](#).

[Torrefaction of biomass](#) can be described as a mild form of pyrolysis at temperatures typically ranging between 200 and 300°C in an inert and reduced environment. Biomass torrefaction has gained widespread attention due to its benefits as a standalone process to improve biomass properties to be at par or similar to those for coal in electricity generation or as a pretreatment step before pyrolysis and gasification processes. It has also found application in other processes like steel production where it is aiming to replace coal or work alongside coal by co-firing the coal with biomass at certain proportions.

Based on the source of biomass, transport biofuels are classified broadly into two major categories:

- Conventional (First-generation) biofuels are made from food sources grown on arable lands, such as sugarcane and corn. Sugars present in this biomass are fermented to produce bioethanol, an alcohol fuel which serves as an additive to petrol, or in a fuel cell to produce electricity. Bioethanol is made by fermentation, mostly from carbohydrates produced in sugar or starch crops such as corn, sugarcane, or sweet sorghum. Bioethanol is widely used in the United States and in Brazil. Biodiesel is produced from the oils in for instance rapeseed or sugar beets and is the most common biofuel in Europe.
- Advanced (Second-generation) biofuels utilize non-food-based biomass sources such as perennial energy crops and agricultural residues/waste. The feedstock used to make the fuels either grow on arable land but are byproducts of the main crop, or they are grown on marginal land. Waste from industry, agriculture, forestry and households can also be used for second-generation biofuels, using e.g. anaerobic digestion to produce biogas, gasification to produce syngas or by direct combustion. Cellulosic biomass, derived from non-food sources, such as trees and grasses, is being developed as a feedstock for ethanol production, and renewable diesel which has the same molecular structure as mineral diesel and is thus a drop-in fuel can be produced from a wide range of biomass sources.

Gaseous biofuel (**biogas**) is produced by anaerobic digestion. The biogas can be upgraded to be biomethane which has the same specification as retailed natural gas. Being of the same specification means that biomethane can be injected into natural gas distribution systems as a replacement for natural gas.

**BioLPG** is propane produced from renewable feedstocks such as plant and vegetable waste material; it is also called renewable propane and biopropane. It is identical in use and performance to conventional LPG. BioLPG reduces CO<sub>2</sub> emissions up to 80% compared to use of LPG. BioLPG can be produced in a number of ways depending on the feedstock and process. Currently, the main production method is the renewable diesel production process.