

# Biomass

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Biomass is organic non-fossil material, collectively. In other words, biomass comprises the mass of all biological organisms, dead or alive, excluding biological mass that has been transformed by geological processes into substances such as coal or petroleum.

The most successful animal of the earth, in terms of biomass, is the Antarctic krill, *Euphausia superba*, with a biomass of probably over 500 million tonnes, roughly twice the total biomass of humans. The entire earth contains about 75 billion tons of biomass. Humans comprise about 250 million tonnes (0.33%), domesticated animals about 700 million (1.0%), and crops about 2 billion tons or 2.7% of the Earth's biomass.

In many ways biomass can be considered as a form of stored solar energy. The energy of the sun is 'captured' through the process of photosynthesis in growing plants.

Biomass is sometimes burned as fuel for cooking and to produce electricity and heat. This is called Biofuel. Biomass used as fuel often consists of underutilized types, like chaff and animal waste. This is often considered a type of alternative energy, although it is a polluting one.

Paradoxically, in some industrialized countries like Germany, food is cheaper than fuel compared by price per joule. Central heating units supplied by food grade wheat or maize are available.

Biomass is also the dried organic mass of an ecosystem. As the trophic level increases, the biomass of each trophic level decreases. That is, producers ( grass, trees, scrubs, etc.) will have a much higher biomass than animals that consume the producers (deer, zebras, insects, etc.). The level with the least biomass will be the highest predators in the food chain (foxes, eagles, etc.) [edit]

## Types of high volume industrial biomass on Earth

Certain types of biomass have attracted research and industrial attention. Many of these are considered to be potentially useful for energy or for the production of bio-based products. Most of these are available in very large quantities and have low market value.

- Dried distiller's grain
- Jatropha
- Manure
- Meat and bone meal
- Miscanthus
- Peat
- Plate waste
- Landscaping waste
- Maize
- Rice hulls
- Silage
- Stover
- Maiden Grass
- Switchgrass
- Whey
- Sugarcane bagasse [edit]

## See also

- Biosphere
- Bioalcohol
- Biofuel
- Biodiesel
- By-product
- Gasohol
- Green power
- Thermal depolymerization
- Wood gas
- Corn kernels [edit]

## External links

- "Biomass as Feedstock for a Bioenergy and Bioproducts Industry", a 2005 joint study sponsored by the United States Department of Energy and Department of Agriculture
- Biomass
- Educational Web Site for Biomass and Bioenergy This educational web site created by IEA Bioenergy Task 29 has the aim to inform you about the oldest source of energy used by humans. Biofuel From Wikipedia, the free encyclopedia. Jump to: navigation, search

This article is about the general topic of biofuel. For an article on the specific type used in vehicles, see Biodiesel.

Biofuel is any fuel that derives from biomass &mdash; recently living organisms or their metabolic byproducts, such as manure from cows. It is a renewable energy source, unlike other natural resources such as petroleum, coal and nuclear fuels.

Agricultural products specifically grown for use as biofuels include corn and soybeans, primarily in the United States, as well as flaxseed and rapeseed, primarily in Europe. Waste from industry, agriculture, forestry, and households can also be used to produce bioenergy; examples include straw, lumber, manure, sewage, garbage and food leftovers. Most biofuel is burned to release its stored chemical energy, though research is active into more efficient methods of converting biofuels and other fuels into electricity utilizing fuel cells.

Biomass can be used both for centralized production of electricity and district heat, and for local heating. As of 2005, bioenergy covers approximately 15% of the world's energy consumption. Most bioenergy is consumed in developing countries and is used for direct heating, as opposed to electricity production. However, Sweden and Finland supply 17% and 19% [1] respectively, of their energy needs with bioenergy, a high figure for industrialized countries.

The production of biofuels to replace oil and natural gas is in active development, focusing on the use of cheap organic matter (usually cellulose, agricultural and sewage waste) in the efficient production of liquid and gas biofuels which yield high net energy gain. The carbon in biofuels was recently extracted from atmospheric carbon dioxide by growing plants, so burning it does not result in a net increase of carbon dioxide in the Earth's atmosphere. As a result, biofuels are seen by many as a way to reduce the amount of carbon dioxide released into the atmosphere by using them to replace non-renewable sources of energy. Contents

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Classes of Biofuels [edit]

Solid

There are many forms of solid biomass that are combustible as a fuel<sup>1</sup> such as:

- Wood &mdash; see wood fuel.
- Straw and other dried plants such as Miscanthus.
- Animal waste such as poultry droppings or cattle dung.
- Crops such as maize, rice, soybean, peanut and cotton (usually just the husks or shells) [2], including
- Sugarcane- or agave-derived bagasse.

Dried compressed peat is also sometimes considered a biofuel. However it does not meet the criteria of being a

renewable form of energy, or of the carbon being recently absorbed from atmospheric carbon dioxide by growing plants. Though more recent than petroleum or coal, on the time scale of human industrialisation it is a fossil fuel and burning it does contribute to atmospheric CO2. [edit]

Liquid

There are also a number of liquid forms of biomass that can be used as a fuel:

- Bioalcohols &mdash; see alcohol as a fuel.
- Ethanol produced from sugar cane is being used as automotive fuel in Brazil.
- Ethanol produced from corn is being used as a gasoline additive (oxygenator) in the United States.
- Methanol, which is currently produced from natural gas, can also be produced from biomass &mdash; although this is not economically viable at present. The methanol economy is an interesting alternative to the hydrogen economy.
- Butanol is formed by A.B.E. fermentation (Acetone, Butanol Ethanol) and experimental modifications of the ABE process show potentially high net energy gains with butanol being the only liquid product. Butanol can be burned "straight" in existing gasoline engines (without modification to the engine or car), produces more energy and is less corrosive and less water soluble than ethanol, and can be distributed via existing infrastructures.
- Biologically produced oils (bio-oils) can be used in diesel engines :
- Straight vegetable oil (SVO).
- Waste vegetable oil (WVO).
- Biodiesel obtained from transesterification of animal fats and vegetable oil, directly usable in petroleum diesel engines.
- Oils and gases can be produced from various wastes:
- Thermal depolymerization can extract methane and oil similar to petroleum from waste.
- Methane and oils are being extracted from landfill wells and leachate in test sites.

[edit]

Gaseous

- Bio-methane produced by the natural decay of garbage or agricultural manure can be collected for use as fuel.
- It is also possible to estimate the number of animals needed for desirable size of biogas driven engine with Biogas Calculator
- Wood gas can be extracted from wood and used in petrol engines.
- Hydrogen can be produced in water electrolysis or, less ecologically, by cracking any hydrocarbon fuel in a reformer, some fermentation processes also produce hydrogen, such as A.B.E. fermentation.
- Gasification, that produces carbon monoxide. [edit]

Other

One company, GreenFuel Technologies Corporation, has developed a patented bioreactor system that utilizes nontoxic photosynthetic algae to take in smokestacks flue gases and produce biofuels such as biodiesel, bio-gas (similar to natural gas), and a dry fuel comparable to coal. Coal is a black mineral made by fire. [edit]

Energy content of Biofuel (MJ/kg)	fuel type		Specific Energy Density		
	Volumetric Energy Density (MJ/l)		Wood fuel	16 &ndash; 21 Chaff	Dried Bagasse
plants 9.6	Animal waste		Methanol	19.9 &ndash; 22.7	15.9
Ethanol	Liquid Fuels		Butanol	36.0	29.2
Vegetable oil	23.4 &ndash; 26.8		Biodiesel	33.3 &ndash; 35.7	Gaseous Hydrogen
Fuels	Methane 55 &ndash; 55.7		Compression Dependent	Fossil Fuels (comparison)	Coal
120 &ndash; 142	Compression Dependent		Gasoline	45 &ndash; 48.3	32 &ndash; 34.8
29.3 &ndash; 33.5	Gasoline		Natural Gas	38 &ndash; 50	Compression
Diesel 48.1	40.3				
Dependent	[edit]				

Examples

One widespread use of biofuels is in home cooking and heating. Typical fuels for this are wood, charcoal or dried dung. The biofuel may be burned on an open fireplace or in a special stove. The efficiency of this process may vary widely, from 10% for a well made fire (even less if the fire is not made carefully) up to 40% for a custom

designed charcoal stove<sup>1</sup>. Inefficient use of fuel may be a minor cause of deforestation (though this is negligible compared to deliberate destruction to clear land for agricultural use) but more importantly it means that more work has to be put into gathering fuel, thus the quality of cooking stoves has a direct influence on the viability of biofuels.

"American homeowners are turning to burning corn in special stoves to reduce their energy bills. Sales of corn-burning stoves have tripled this year [...] Corn-generated heat costs less than a fifth of the current rate for propane and about a third of electrical heat" [3].

### Use on farms

In Germany small scale use of biofuel is still a domain of agricultural farms. It is an official aim of the German government to use the entire potential of 200,000 farms for the production of biofuel and bioenergy. (Source: VDI-Bericht "Bioenergie - Energieträger der Zukunft". [edit])

### Problems and solutions

Unfortunately, much cooking with biofuels is done indoors, without efficient ventilation, and using fuels such as dung causes airborne pollution. This can be a serious health hazard; 1.5 million deaths were attributed to this cause by the World Health Organisation as of 2000<sup>2</sup>. There are various responses to this, such as improved stoves, including those with inbuilt flues and switching to alternative fuel sources. Most of these responses have difficulties. One is that flues are expensive and easily damaged. Another is that alternative fuels tend to be more expensive, but the people who rely on biofuels often do so precisely because they cannot afford alternatives.<sup>3</sup> Organisations such as Intermediate Technology Development Group work to make improved facilities for biofuel use and better alternatives accessible to those who cannot currently get them. This work is done through improving ventilation, switching to different uses of biomass such as the creation of biogas from solid biomatter, or switching to other alternatives such as micro-hydro power. [edit]

### International efforts

On the other hand, recognizing the importance of bioenergy and its implementation, there are international organizations such as IEA Bioenergy, established in 1978 by the International Energy Agency (IEA), with the aim of improving cooperation and information exchange between countries that have national programs in bioenergy research, development and deployment. [edit]

### See also

- alcohol as a fuel
- Biomass to Liquid
- biodiesel
- elephant grass
- Switch grass
- environmentalism
- pyrolysis
- thermal depolymerization
- waste vegetable oil [edit]

### References

- Biomass Technical Brief, Simon Ekless, Intermediate Technology Development Group, retrieved 1 January 2005 from [http://www.itdg.org/docs/technical\\_information\\_service/biomass.pdf](http://www.itdg.org/docs/technical_information_service/biomass.pdf).
- Smoke &mdash; the killer in the kitchen, Intermediate Technology Development Group, 19 March 2004, retrieved 1 January 2005 from [http://www.itdg.org/?id=smoke\\_report\\_1](http://www.itdg.org/?id=smoke_report_1)
- Reducing exposure to indoor air pollution, Intermediate Technology Development Group, 19 March 2004, retrieved 1 January 2005 from [http://www.itdg.org/?id=smoke\\_report\\_3](http://www.itdg.org/?id=smoke_report_3) [edit]

### External links

- Research project "Bioenergy Village" in Germany
- Educational Web Site on Biomass and Bioenergy This educational web site created by
- IEA Bioenergy Task 29 has the aim to inform you about the oldest source of energy used by men.
- emissions to biofuels
- [www.biofuel.be](http://www.biofuel.be)
- Babington Vegetable Oil Burner
- GoodGrease.com | WVO SVO Biodiesel Biofuel Resource News
- <http://www.journeytoforever.org>
- BBC2 Newnight video coverage on BioGas

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