

## Miscanthus fuel: Pellet and briquettes overview

Extracted from Gemco Energy

By [Jack Huang](#) Nov 27, 2014

[www.biofuelmachines.com/miscanthus-pellet-mill-and-miscanthus-pellet-study.html](http://www.biofuelmachines.com/miscanthus-pellet-mill-and-miscanthus-pellet-study.html)

### Miscanthus

Miscanthus species or elephant grasses is a high yielding energy crop. They are perennial, rhizomatous grass, which can grow more than 3 meters tall in a growing season. Miscanthus giganteus has high value for biomass fuel production, which makes them one of the most popular energy plants. Miscanthus now is widely planted in Asia, North America, and Europe.



### Features of Miscanthus

- Miscanthus is a perennial plant. Once it planted, it does not need to be replanted again which will save the production cost and lower the impact to environment caused by annual sowing.
- Miscanthus can improve the soil quality by adding organic matter to the soil. At the meantime, it causes less soil compaction and erosion for it needs no tillage.
- Miscanthus is a low input crop, which recycles nutrients back and stores at the root. Thus, it needs little or no fertilize after being established.

### Application of Miscanthus

Miscanthus as an economical crop is widely used. Generally, they are used in the following ways:

- As raw materials for biomass fuel production, such as, miscanthus pellets or briquettes production, used with coal or peat.
- As animal bedding, such as horse bedding, cat litter, etc.
- As materials for construction materials production such as medium density fibre board (abbreviated as MDF) production.
- As raw materials for paper production.
- As horticulture raw materials for plant pots construction.

## Miscanthus as fuel

Miscanthus as an energy crop has obvious advantages over fossil fuels in terms of ecological reservation, i.e. miscanthus has a positive carbon balance and contributes to the greenhouse gases emissions. Due to its high level biomass production and lower production cost and low impact on soil, miscanthus is very suitable as renewable raw materials for biofuel production.

### Miscanthus characteristic for fuel production

Heating values is one of the decisive factors for defining the energy content of a biomass fuel, which indicates the combustion quality of the fuel. Biomass heating value is determined by the elemental composition of the materials and affected by the variation in cell wall composition and ash. The heat value of miscanthus is from 17 to 20 MJ/Kg-1. The proportion of lignin can be seen as an indicator of the heating value for its relatively lower oxygen concentration than holocellulose. The chemical composition and combustion characteristics of miscanthus is presented in the following diagram for your reference.

No.	Characteristic	Value (% wt)	Test method
1	Total moisture	9.30	SR 5264:1995 CEN/TS 14774 – 1,2,3 : 2004
2	Ash	1.70	ASTM D 3174:2004 CEN/TS 14775 : 2004
3	Volatile matter	74.28	STAS 5268:1990 CEN/TS 15148:2005
4	Carbon	44.21	ASTM D 5373:2006, ISO 351:1996 CEN/TS 15104:2005
5	Hydrogen	6.21	
6	Oxygen (by difference)	48.57	
7	Sulfur	0.00	
8	Nitrogen	0.56	
9	Chlorine	0.45	ISO 3634:1979
10	Lower heating value	16039 kJ/kg	ISO 1928:2009
11	Higher heating value	17673 kJ/kg	CEN/TS 15148:2005

**Miscanthus chemical composition and combustion characteristics**

### Economic values of miscanthus as fuel

One acre of Freedom Giant Miscanthus can produce 25 tons of biomass, or over 3000 gallons of ethanol, or 375 million BTU of energy, or energy that can support two US households for a whole year, or 2,400 us dollar of income at the current prices and at mean time it can absorb 43 tons CO<sub>2</sub> from the atmosphere.

Comparing with fossil fuel, miscanthus pellets and briquettes are very competitive. One ton of miscanthus can generate 4 MW hours of heat which is equivalent to that of 500 litres of heating oil. One ton of miscanthus can produce 1.8 MW of electricity, which is equivalent to that of 0.7 t of coal. The density of miscanthus pellets is around 600kg/m<sup>3</sup> while the density of miscanthus briquettes is around 450-500kg/m<sup>3</sup>.

### Miscanthus pellets

Miscanthus pellets are made by the miscanthus [pellet mill](#). Even though miscanthus can be burned directly for heat, miscanthus pellets have a better combustion performance. In the following diagram,

the combustion characteristics of the miscanthus and miscanthus pellets are presented for your reference.

Materials	Moisture content	Ash content	Calorific value	Density
Miscanthus	during harvest, 29-33% Storage phase, less than 15%	About 3.7%	12.96 MJ/kg	150kg/m <sup>3</sup>
Miscanthus pellets	Less than 8%	0.5-2%	19.59MJ/kg	600kg/m <sup>3</sup>

**comparison of miscanthus and miscanthus pellets**

**Advantages of miscanthus pellets**

Comparing with miscanthus, it is easy to see miscanthus pellets have the following advantages:

- Lower moisture content, which will be much more suitable for burning.
- Lower ash content, which will reduce the risk of slag during burning.
- Higher calorific value, which will generate more heat during burning.
- Higher density which will be much more easy and convenient for transportation and storage.
- Densified and uniform pellets makes the burning much more clear and stable.

**Miscanthus pellets market**



**Miscanthus pellet fuel**

Biomass fuel pellets and briquettes are in demand in Europe currently as the focus on environment protection is increased and the fossil fuel resources are reduced. In 2005, the European Biomass Plan was published and showed the requirement for pellet fuel. As a high yield and environment friendly energy crop, miscanthus is one of the favourite raw materials for pellet production, which are used by large scale power plants for heat, power generation or by households for heating and boiling.

**Miscanthus pellets production.**

As for miscanthus pellets production, there are several tips that need to be paid attention to.

Firstly, the hammering of the miscanthus. Since the miscanthus is hard, it is important to crush the miscanthus into proper size and get them ready for pelletising. During this procedure, a hammer mill is

needed. Secondly, the drying of miscanthus. Drying is necessary to get the right moisture content. When the moisture content of the miscanthus is around 15%, it will be suitable for pellet production. Last but importantly, a high quality pellet mill is necessary for miscanthus pellets production for the high density of miscanthus fiber. A high compression die will ensure the strength of miscanthus pellets.

### Miscanthus briquettes



Miscanthus briquettes fuel

Miscanthus also can be made into briquettes fuel, which is usually used for wood burners, power plant, open fires and chimineas, etc. The miscanthus briquettes can be produced by the briquette machines. There are various briquette machines that can be used to produce miscanthus briquette. The [stamping briquette machine](#) is recommended for you. With the briquette machine, miscanthus can be produced into briquettes with the diameter of 70mm or pellets of 8 mm, 10mm, 22mm, and 30mm. The properties of miscanthus briquettes are shown in the following diagram for your reference.

Net calorific value	Ash content	Water content	Softening temperature of ash	Nitrogen	Sulphur	Chlorine
MJ/kg dm	wt.-% dm	wt.-%	°C	wt.-% dm	wt.-% dm	wt.-% dm
17.7	3.1	7.5	1,010	0.24	0.035	0.025
dm...dry matter, wt.-%...weight %						

Miscanthus fuel briquettes properties

### Advantages of miscanthus briquettes

- Higher burning efficiency. Highly concentrated miscanthus briquettes can provide high heat value so that more heat can be produced.
- Condensed size. Densified briquettes just like pellets are very hard and its size has been reduced 90% comparing with that before briquetting.
- Smoke and ash free. The burning of briquettes produces less smoke and ash.
- Besides the above advantages, briquettes also have other advantages such as, cheap, easy to delivery, sustainable, etc.