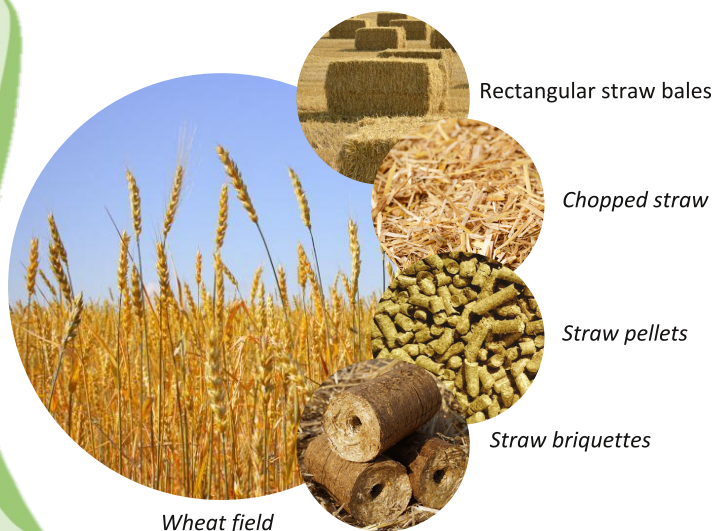


Global agriculture produces millions of tonnes of residues every year and although they are a promising feedstock for bioenergy use, they are currently underutilized. Straw is one of the most abundant agricultural residues available.

Straw is an agricultural by-product consisting of dry stalks of cereal plants after the grain and chaff have been removed. It makes up about half of the yield of cereal crops such as barley, oats, rice, rye, oilseed rape and wheat.

Denmark is leading in utilizing straw as an energy resource. About 1.5 million tonnes of straw is used annually for energy production. During the last decades, straw consumption for electricity production in CHP and power plants has reached almost 1 million tonnes per year through the implementation of the Danish Biomass Action Plan.



Wheat field

Rectangular straw bales

Chopped straw

Straw pellets

Straw briquettes

Straw is usually harvested and stored in **bales**. If not used directly in bale form, it can be **chopped** and further upgraded to **pellets** or **briquettes**.

For 2012, BIOCORE project, estimated that the annual quantity of harvestable straw for the EU, Ukraine and Balkan countries is **215 million tonnes (dry matter)**. France, Germany, Ukraine, the United Kingdom, Poland, Spain, Italy, Romania and Hungary produce 90% of the harvestable straw.

Typical yield for straw is between **2.5 - 4 t (dry matter) per hectare**.

Straw is available from July to August for winter crops and from late August to late September for spring sown crops.

For energetic purposes, straw is mostly used for electricity and/or heat generation in direct combustion in dedicated facilities, since it is considered a "difficult" fuel due to its low ash melting temperatures. Apart from that, straw is used as animal feed, for mushroom compost, as animal bedding or it can be mulched into the soil in order to increase soil organic matter content.

Indicative fuel composition

Property	Units	Wheat straw*
Moisture content	w-% a.r.	15
Ash content	w-% d.b.	5.0
Net Calorific Value	MJ/kg a.r.	14.6
Bulk density	kg/m ³ a.r.	100 ^{bales} / 60 ^{chopped}
Energy density	MWh/m ³ a.r.	0.41 ^{bales} / 0.24 ^{chopped}
N	w-% d.b.	0.5
S	w-% d.b.	0.1
Cl	w-% d.b.	0.4
Ca	mg/kg d.b.	4000
K	mg/kg d.b.	10000
Na	mg/kg d.b.	500
Si	mg/kg d.b.	10000

a.r.: as received
d.b.: dry base

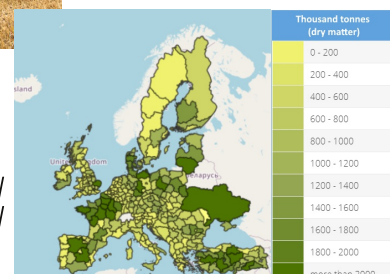
*Agrobiomass composition can vary significantly. The given values are only indicative of typical values for this type of agrobiomass. More information on the typical variation of straw can be found in Annex B of EN 17225-1.

Image sources: wheat field - www.heritagestraws.com, straw bale - www.careerpro.com, chopped straw - www.vestjens.co.uk, straw pellets - www.einuva.eu, straw briquettes - www.en.asket.pl, straw baler - www.farms.com



Straw baler

S2Biom-2030 cereal straw technical potential



Find out more about straw heating and use cases, fuel suppliers etc. in AgroBioHeat's **Agrobiomass Heating Observatory**



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