Biomass Gasification Technology

for producing Electricity ,Thermal Heat and Gas

GB Gasifired

power and heat from biomass

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Company Profile

- GB Gasifired is a recognized leader in biomass conversion to wood gas and biomass processing – Gasifier Unit
- Gasification technologies delivered is a Czech technology with its R&D in Europe and specially manufactured in India for world market.
- Our endeavour is to understand the customer's requirements so as to offer not only a superior product but also a most suitable business solution.
- It is this commitment to the customers' business that drives our efforts towards creating advances in technology through innovation and towards bettering our customers' business through productivity and profitability.

Gasification Process

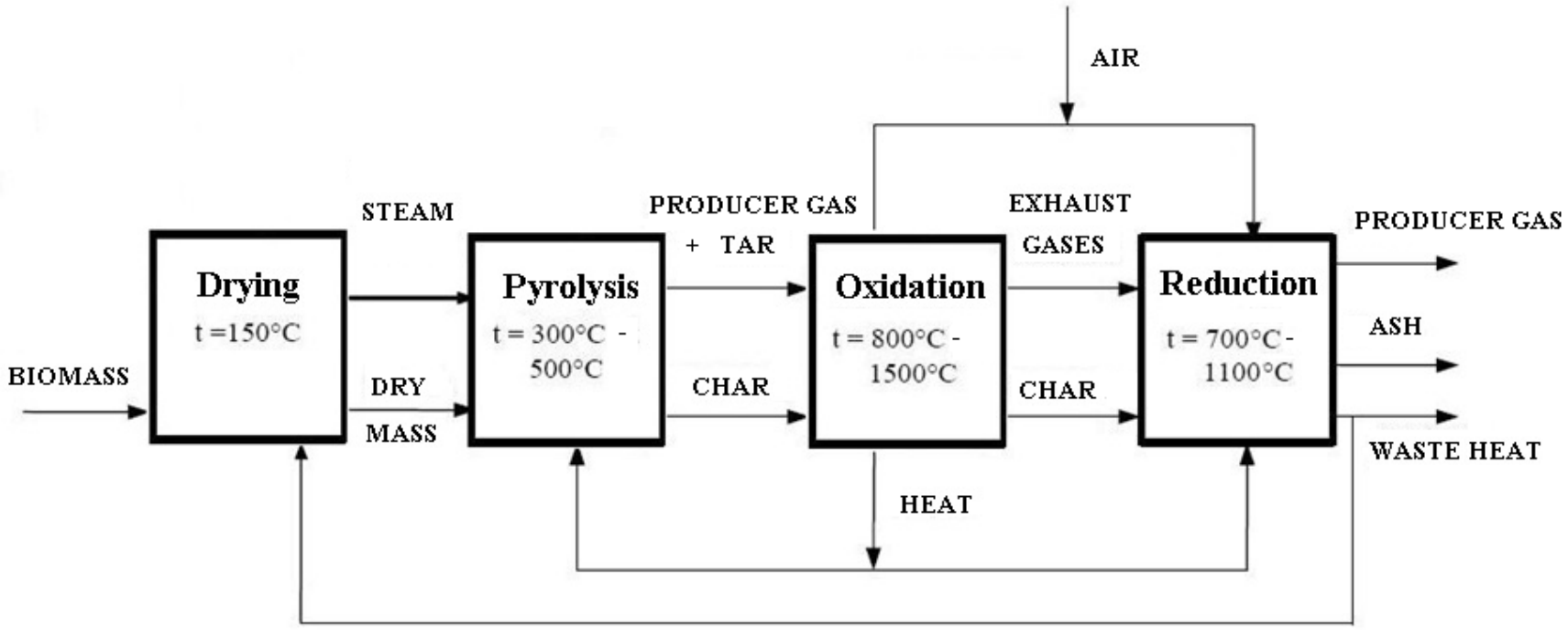
- Gasification is based on a thermo-chemical process, during which the input raw material is converted to a combustible gas (known also as Syn-Gas or wood gas) by means of the gasification medium (usually it involves air, vapour or their mixtures) and heat.

- Gasifier unit is essentially a chemical reactor, where several thermo-chemical processes take place, such as:

  - drying
  - pyrolysis
  - combustion
  - reduction

- Most biomass materials (husk rice , bamboo, coconuts ,wood, straw, grass, etc.) can be converted into gaseous fuel known as Syn-Gas, which comprises carbon monoxide, hydrogen, carbon dioxide, methane, and nitrogen.

Basic Gasification Principle



Process Description

- Gasifier unit is a thermal reactor, which thermally cracks the biomass into a gaseous state by the application of intense heat in a controlled oxygen starved atmosphere.

<u>Downdraft Gasifier:</u>

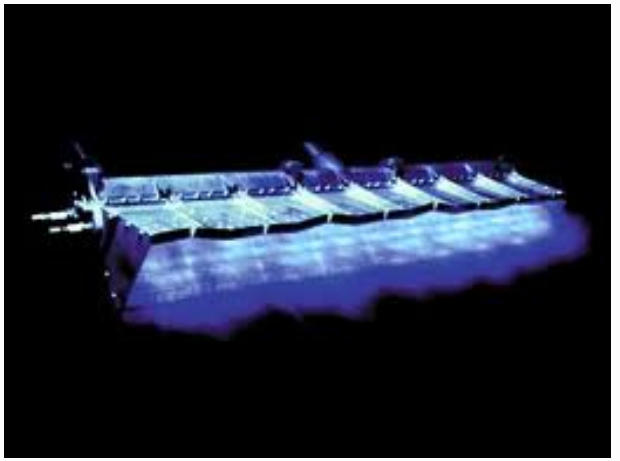
- The biomass is fed at the top of the reactor and moves downwards towards the grate by gravity. During this motion, it passes through the “drying”, “pyrolysis”, “controlled combustion” and “reduction” zones in that order.

- The boundaries of each of the zone above are not rigid but transitional.

- Moreover, depending on the wood characteristics and the load, the height of each zone also varies. Each of the zones have a specific reaction component to perform, resulting in the formation of “Syn-Gas” and ash/char mixture at the end of the reduction zone, where the grate is located.

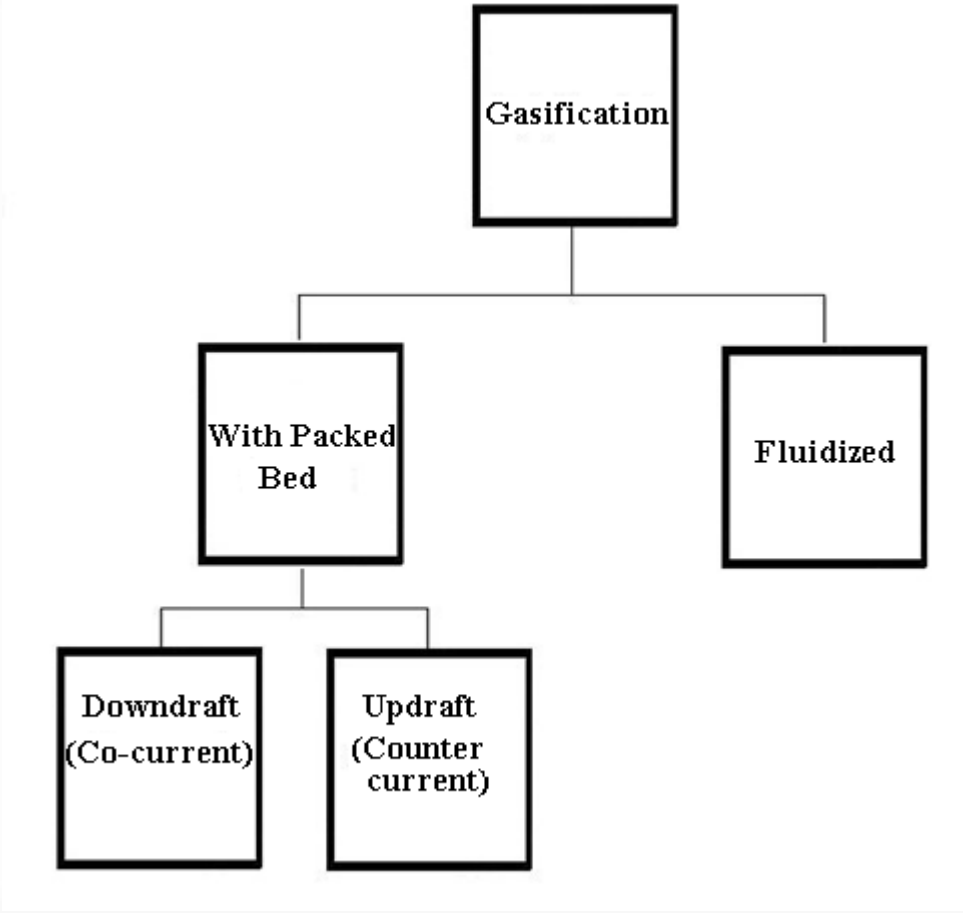
Syn-Gas

- The Syn-Gas flame temperature can be as high as 1 100°C.
- Each kilogram of air-dry biomass (10% moisture content) yields about 2,5 m^3_N of Syn-Gas.
- Conversion efficiency of the gasification process is in the range of 80%–90%.
- The main combustible components of the Syn-Gas are Carbon monoxide (20-25% v/v), Hydrogen (8-10% v/v), Methane (2-4% v/v) and small quantities of other higher gaseous hydrocarbons besides other non-combustibles like Carbon dioxide (8-10% v/v) and nitrogen (50-55% v/v).



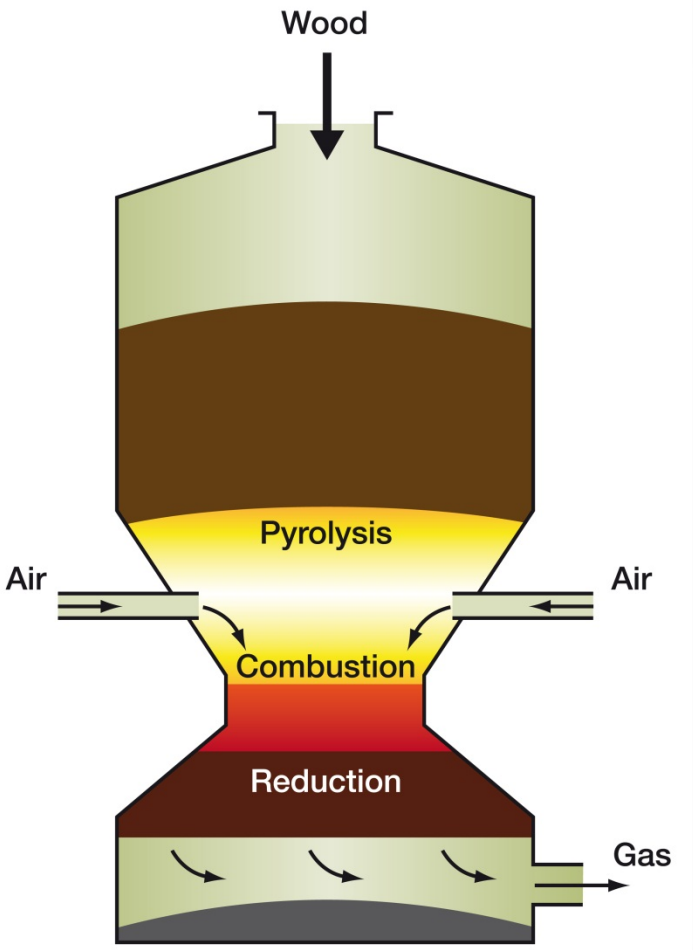
- This gas has a lower calorific value (1000–1200 kcal/nm3 or 4,19 – 5,02 MJ/m^3_N) compared to natural gas or liquefied petroleum gas, but can be burnt directly with high efficiency.

Basic Gasifier Types Delivered by GB Gasifired



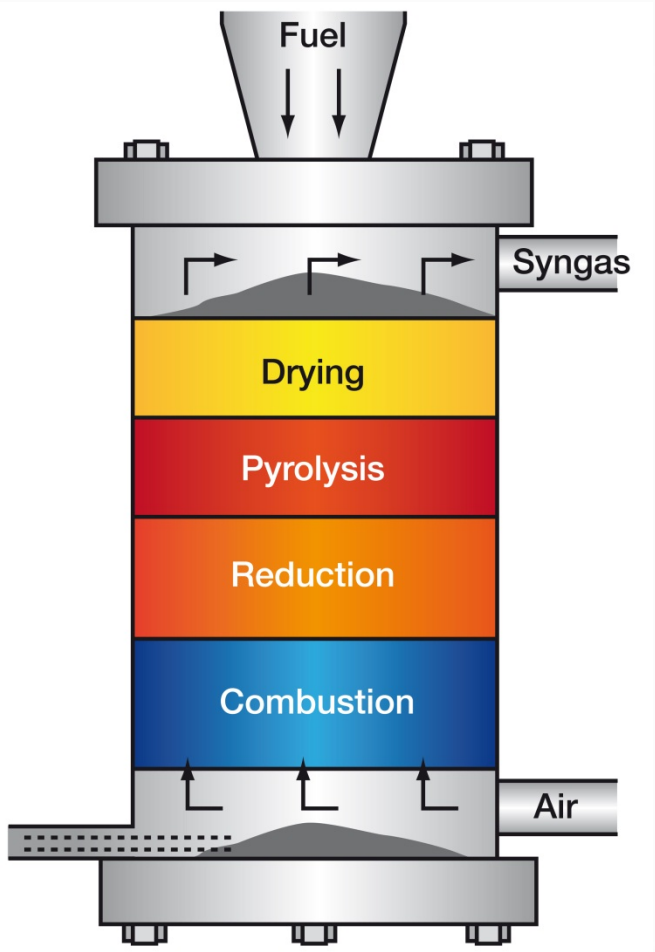
Downdraft (Co-current) Gasifier

- Air is introduced into downward flowing packed bed or solid fuels and gas is drawn off at the bottom
- Suitable for units with internal combustion engines after appropriate cleaning
- For applications where clean fuel gas is required and where temperature control is critical



Updraft (Counter-Current) Gasifier

- Has clearly defined zones for partial combustion, reduction, and pyrolysis
- Air is introduced at the bottom and act as countercurrent to fuel flow
- The gas is drawn off at higher location of the reactor
- Achieves the highest efficiency as the hot gas passes through fuel bed



Fluidized Twister Gasifiers

- Are based on entrained-flow principle
- Have the ability to convert a practically any biomass into high quality Syn-Gas with negligible tars
- The only limitation in this gasifier is the fuel size < 3 mm
- Have the ability to gasify even poor fuels (soya husk, mustard stalk, sunflower husk, etc.) that contain high ash

Main Features of Fluidized Gasifier Technology

- Feedstock flexibility: Suitable for almost all kind of Biomass
- Incredibly Small footprint
- High carbon conversion: > 98 %
- Shorter start-up time
- High availability and low maintenance
- Tar free raw Syn-Gas
- best suited for applications that have medium to large thermal energy requirements, typically starting from 500 kWth – 12 000 kWth max.

Gas Cleaning System

Gas cleaning system contains hot cyclone, a rough and fine filter.

- Particles of larger dimensions are separated in the hot cyclone.

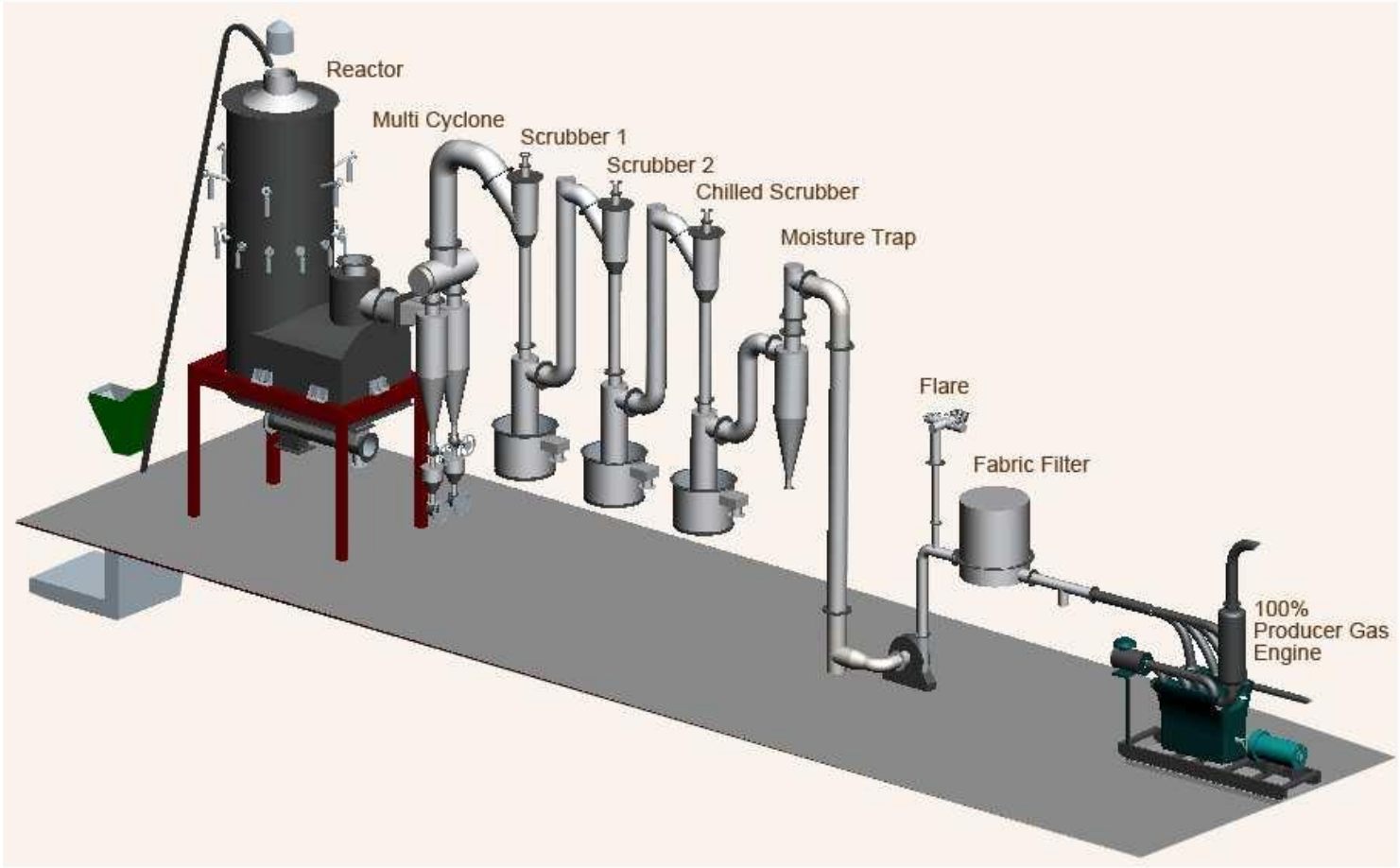
Hot Gas Filter System

- The GB Gasifired - Vergassen incorporates a unique hot gas fine filtration system (optional), a first of its kind, which can clean hot gases (temperatures up to 600 °C).
- The dry gas filtration has an efficiency of over 96% for particulates over 10 micron size.
- It can typically produce a clean gas with less than 50 micrograms per m3 of particulate matter.

Indirect Gas Cooler

- The GB Gasifired system uses only indirect gas cooler and thereby eliminates water based gas cleaning. Thus, there is no sticky "tar" and tar contaminated effluents to be handled / disposed .

Gas Cleaning - GB Gasifired –Vergassen System



Gasifier Parameters

- Typical payback is within < 48 months
- Fully Automated Gasification system & Burners
- Very low maintenance, easy to operate
- Compact Foot Print
- Multi Fuel systems – proposal based on the fuel type
- Dry Gas System
- Zero Tar/ Effluent system
- Highest Overall Efficiency

Advantages of GB Gasifired Technology

- Simplicity and easy operation
- Clean Syn-Gas
- Low values of dust particles
- High efficiency (for some types up to 91%)
- Indirect gas cooling
- Hot gas filtration system
- Compact footprint
- Highest overall efficiency
- Quick start-up and stop
- Empty running at the time of low load
- Multi fuel system
- Low investment costs and low operation and maintenance costs
- **Fully automated operation**

GB Gasifired System

OPTIONAL MODULE CONTAINS:

- Reactor pressure control: to maintain precise required amount of gas and its quality.
- Load synchronizer: to control and regulate gas generation based on the load requirement in order to eliminate the problems with over-pressurizing the excess gas/low heat availability and to eliminate the need to burn the excess gas.
- Automatic filer operation: to prevent problems such as clogging and transfer of dust from the filter.
- Control based on the load (optional): gas generation (and subsequently the consumption of fuel wood) is automatically controlled to fallow the thermal load requirement..
- A wide range of fully automatic burners for any application
- PLC panel, remote control and monitoring

Typical Applications

Counter current Gasifier

- For applications where moderate amounts of dust in the fuel gas are acceptable and a higher flame temperature is required
- Packaged Boilers
- Thermic Fluid heaters
- All kinds of Fryers
- Rotary type roasters
- Aluminium Melting /Annealing Furnace

Co-current Gasifier

- Temperature up to 600°C
- Continuous Baking ovens (Bread, Paint)
- Batch type baking oven – rotary oven for bread
- Dryers & Curing
- Boilers
- Thermic fluid heaters
- Annealing furnaces
- Direct fired rotary kilns Internal combustion
- Engines and CHP

Selection of Suitable Input Material

- Various types of gasifier units need various types of fuels in order to reach the best possible efficiency

Examples of biomass, which may be used by gasifier units:

- Downdraft gasifier – wood, coconut shells
- Updraft gasifier – wood, coconut shells
- Fluidized Twister gasifier – rice husk, bamboo dusk, saw dust, wheat dusk

rice husk

bamboo dusk

wheat husk

Selection of Suitable Input Material

pellets

bark

briquets

straws

coconut shells

sawdust

Syn-Gas Utilization

Division:

- Power and heat generation (cogeneration)
- Direct combustion of gas for technological processes

Syn-Gas Utilization

Power generation

Gas combustion in cogeneration units

- Conversion to power with high efficiency of about 38 – 41,5 %, thermal efficiency of 45 - 49% , ORC modules Green Machine to utilize heat.
- Performance range from 10 kW to 3 000 kW.
- Suppliers of cogeneration units: Guascor, Jenbacher, MWM, Cummins, Ashok Leyland , Mahindra.

Syn-Gas Utilization

Direct combustion:

1) Utilization of gas for heating
2) Technological demand

- Reduction of costs for fuels over 50%.
- Syn-Gas can be introduced by piping from the gasifier to furnaces/fire chambers, etc. and can be combusted in specially-designed burners instead of fossil fuels (fuel oil / light diesel oil / diesel oil / liquefied petroleum gas / compressed natural gas
- Hot water, vapour, technological air heating

Downdraft Gasifier Performance Range

Performance range	Wood biomass consumption - Max. (12% moisture content)#			Power Generation
[kWe/hr]	[kg/hr]	[kg/day]	[t/year]	[MWh/year]
10	17	408	139	116
24	40	960	327	273
40	65	1560	532	443
70	110	2640	900	750
120	190	4560	1555	1296
240*	375	9000	3069	2558

 # Wood/ Biomass consumption based on 12% moisture,
*** Fuel: wood Block, coconuts shells**

Universal Gasifier – UG - Performance Range

To our customers we offer gasifier units in the performance range from tens of kW up to applications with the performance in MW.

Performance range	Fuel consumption			Power Generation
[kWe/hr]	[kg/hr]	[kg/day]	[t/year]	[MWh/year]
70	84	2016	688	573
80	96	2304	787	656
120	144	3456	1181	984
200	240	5760	1968	1640
400	480	11520	3936	3280
500	600	14400	4920	4100
800	960	23040	7872	6560
1000	1200	28800	9840	8200
1500	1800	43200	14760	12300
2000	2400	57600	19680	16400
2500	3000	72000	24600	20500
3000	3600	86400	29520	24600

Number of operation hours 8 200 [hrs/year]
With the biomass humidity of about 12%.

The above models are for Powdery type Biomass like saw dust , bamboo dusk , rice husk (grinded), wheat husk (grinded)based models .
(Size < 3mm, & moisture content < 12% moisture),

Thank you for your attention

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