Biomassgasifier.com
Global Energy Collaborations
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Power Generation System by Biomass Gasification

Preface:

The biomass gasification system produces a valuable gas named producer gas - "Syngas" (Synthetic gas). The biomass (agricultural), used for this purpose is materials such as: rice stems, rice husks, cotton stalks, corn stalks, millet stalks, wood dust, cane trash, wheat straws, hemp palm husks and other forms of biomass. This system can produce electric power in the range of 400kW – 15.0MW by using a few parallel modular units.

Since Biomass itself is almost sulfur free, the gasification process will not produce any sulfur oxide emissions (SO_x). However, fuels such as diesel and HFO contain a considerable amount of sulfur. HFO could have as much as 4% sulfur and therefore requires special additional treatment to neutralize these emissions.

Similarly the gasification of biomass produces very low concentrations (if any) of nitrous oxide emissions (NO_x) when manufacturing the "Syngas" and thereafter leads also to low emissions in the combustion engines.

System concept and efficiency:

Production of **1** KW power, requires only 1.55 - 1.95kg of rice husks, wood dust or crop stalks as fuel. The water used in the cooling system of this process can be recycled after undergoing a simple treatment and thereby having no harmful effects to the ecological system and the environment. Self power consumption of this systems is low with percentages ranging between 6 - 9% of the generated total power.

This project is an ideal solution for regions where there are large quantities of biomass waste resources, mills, farms, nearby forests etc.

In consideration of the above mentioned particulars, the feasibility of such Power station will give a high ROI (Return of Investments) in a short period of time. The reasoning to this high ROI is due to the cost of the fuel being negligible – near **ZERO (0),** only labor, drying and grinding (if woods) has to be considered. In most other power stations, fuel cost corresponds to approximately 60-75% of power selling price, in our case, there is a saving of approximately 70% compared with other forms of power stations.

The technology of producing power by gasification of biomass is easy to operate, simple and economical in maintenances and service, has no high pressure steam/boilers, no turbines, easy to start, run standard combustion generator- **NO STACK / CHIMNEY at ALL !!!**

The power station requires a small land area to operate. It is environmental-friendly, simple to install, and it can gasify most kinds of agricultural biomass. These will in turn produce very low cost valuable electric power energy source.

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Technical background:

In order to remove the soot, ash and tar particles in the biomass producer gas - “Syngas” and prevent the formation of secondary pollution to the environment, the biomass gasifying equipment effectively uses mechanical & electronic systems, which reduce the soot, dust and tar particle content in the produced gas to a certain extent, the equipment for collecting soot, ash and tar is highly efficient, it was designed and developed mainly for large-scale fossil-fuel power plants, chemical plants and waste incineration plants. As our “Syngas” flow is relatively small in ordinary biomass gasifying generating projects, and there are some differences between biomass gas and the gas treated in fossil-fuel plants, temperature are low, less oxygen, therefore the adopting technology can solve most of biomass gasification demands.

Requirement of the feedstock granule size is ≤2cm, moisture content ≤20%, the whole project could be supplied with special drying system if needed, that can be done by using special dryer system which is heated by using the residual heat for drying.

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Gasification power generation system

Gasifier - dedusting system

Purification System

Gas Generator

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HG Series of Biomass Gasification System

Biomass pyrolysis gasification has different production ratio of soot and tar at different operating temperatures. If carbonization temperature is 400-600℃, the production ratio of tar is 13% - 37%, and it is 5% - 15% when using fixed bed gasification furnace, when operating temperature is 800℃, the production ratio in a fluidized bed gasifying furnace is about 2.5%. Tar content in raw Producer gas - "Syngas" without treatment is about 1 - 3 g/Nm^3. The Syngas must be condensed to remove soot & tar before it is sent to internal combustion engine. As it is well known, the caloric value of tar is very high and it is about 30MJ/kg (7,140Kcal/Kg). The heat value of tar increases up to 10% of total heat value of gas.

"Syngas" standards shouldn't have particulates more than 50mg/m3 which is the highest acceptable figure for internal combustion engines, some engine manufacturers also requires that dust/ash/soot content should be ≤ 25mg/Nm^3, H2S≤10mg/Nm^3.

In our gasification system, according to long practical field tests, output content of soot, tar ash and dust is ≤ 23mg/Nm^3 only.

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HG Series Biomass Gasification and gas supply/storage systems

Technical Specifications:

No.	Item / wer	400KW	800 KW	1MW	1.5MW	2.0MW	3.0MW *
1	Building are (m^2)	350	400	480	550	600	740
2	Main building height (m)	6	6	6	6	6	6
3	Cooling pool - L x W, Depth 3m	12×5	15×5	18×5	22×5	25×5	27 x5
4	Total units weight (T)	22	28	32	40	50	61
5	"Syngas" production rate (Nm^3/h)	1,400	2,800	3,500	5,300	7,000	10,500
6	Raw material (biomass) consumption (kg/h)	800	1,600	2,000	3,000	4,000	6,000
7	Acceptable material moisture content (%)	16	16	16	16	16	16
8	Gasifying efficiency (%)	65	65	65	65	65	65
9	Self consumption (kW)	39	73	84	130	160	210
10	Gasifier dimensions (m)	Φ1.4,H=7.5	Φ2.0,H=10.0	Φ2.2,H=12.0	Φ3.0,H=12.0	Φ3.7,H=14.0	
11	Ash discharging type	Dry	Dry	Dry	Dry	Dry	Dry

*** We do special modular units up to** 15.0MW ! **Biomass gasification by standard combustion gas motor generators.**

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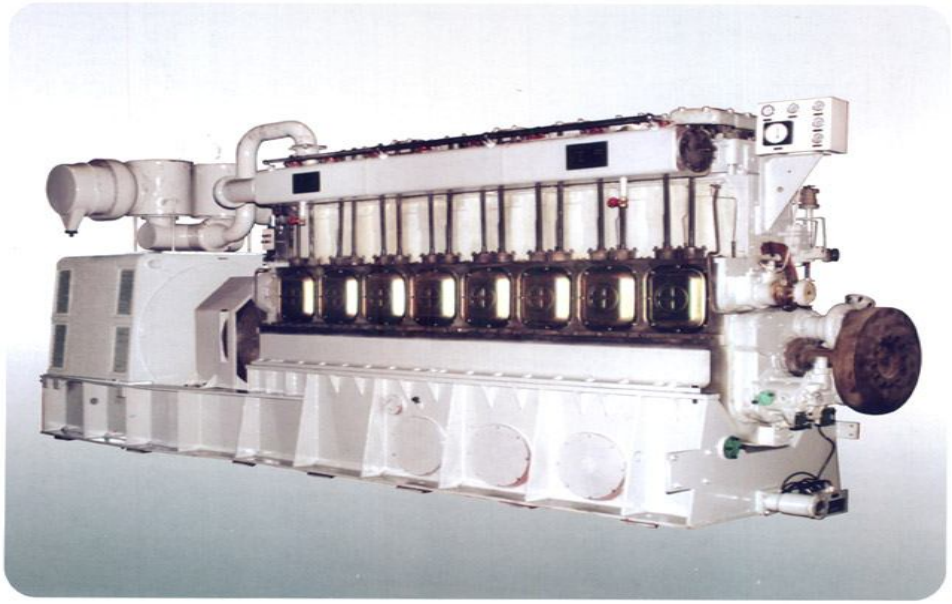
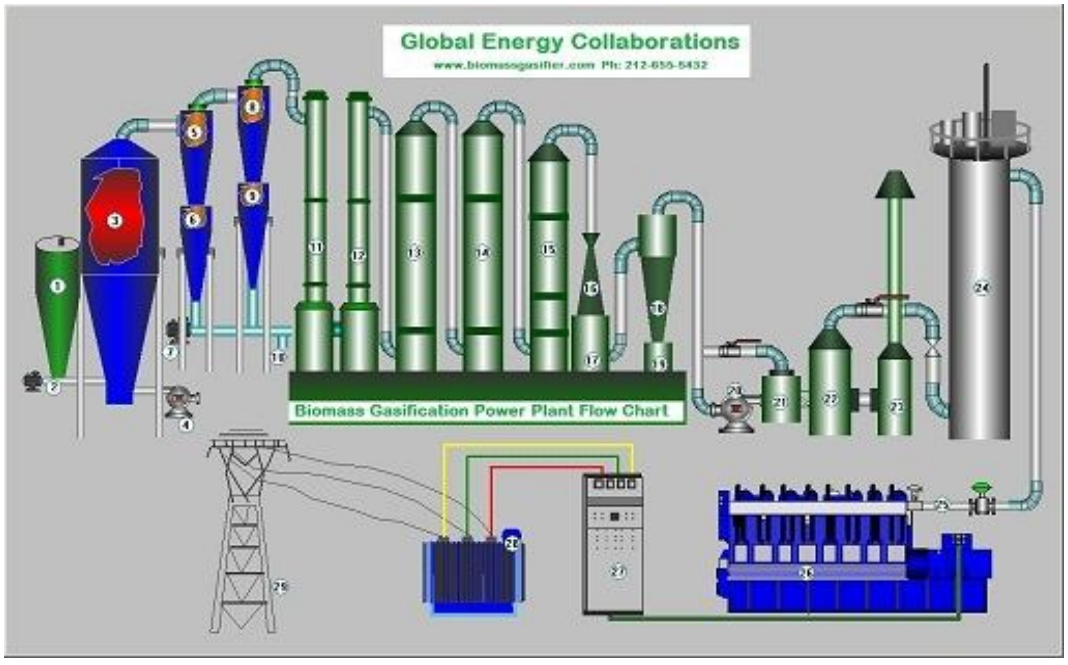
SPECIAL CONVERTED 'SYNGAS' ENGINE



Technological flow-chart of biomass gasification power system



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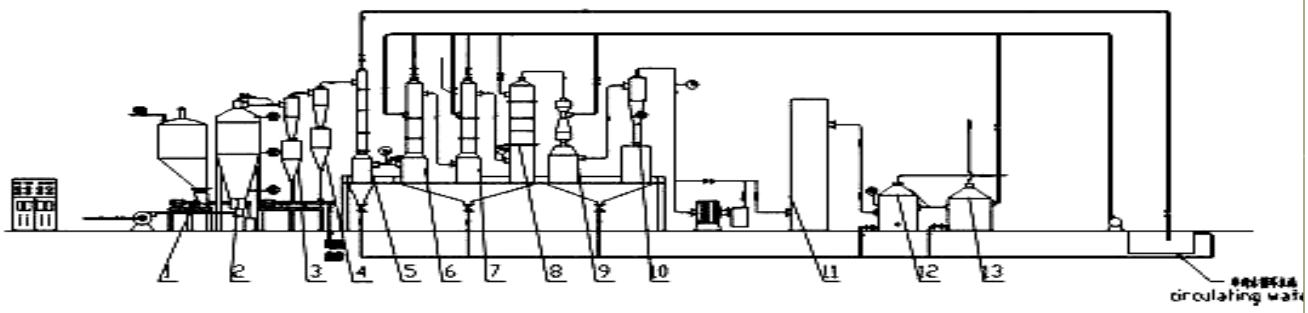
Biomass Feedstock: Straws, Husks, Maize, Wood chips/flours, hemp palm Husk, Coconut waste, Eucalyptus chips, Bagasse.

Syngas analysis:

CO:12-18%, CO**2**: 10-16%, CH**4**: 4-8%, H**2**: 3-7%, CnHm: 1-1.4% ,
O**2**: 0.5-1.2%, N**2**: 54-60%.
Heating caloric value - 5,200KJ/Nm3 (LHV 1,240Kcal/Nm^3, HHV 1,350Kcal/Nm^3).

Content of dry ash after gasification (near 25% of raw material):

Density at free state: 172.5Kg/m^3
Density compressed state: 295 Kg/m^3
Carbon (when using rice husk) ash: 40 - 45%.
Silica content: 43 - 52%.



1. **Temporary hoper/silo**
2. **Gasification furnace CFB**
3. **Cyclone dust collector 1**
4. **Cyclone dust collector 2**
5. **Pipes precipitator**
6. **Spray/shower tower1**
7. **Spray/shower tower2**
8. **Bobbles/Foam absorbing unit**
9. **De-Cocker**
10. **Water separator**
11. **Electro-Static Precipitator system (ESP)**
12. **Buffering unit.**
13. **Sealed water trap – prevents gas leak**

- **Water circulating cooling pool**

System operation principles:

Feedstock from silo raw-material and air are controllable, the incineration is a fluidized bed under normal pressure, controlled temperature furnace lets the feedstock stream go through pyrolysis gasification and having producer gas - "Syngas", at the same time the thermally cracked process gas-phase tar occurs in the furnace.
The efficient produced "Syngas" by gasification, reached two stages of highly efficient cyclone - soot, dust, ash removers, then the raw Syngas enters cleaning & cooling system
and after processing by several stages of cleaning including electronic systems and better cooling again, the purified "Syngas" is transferred to the gas storage, by balancing and controlling the pressure in the big container it can supply steady constant flow to the combustion engines generators.

	Raw material*	Feedstock input (KG) per 1 kwh
1	Saw dust	1.4-1.5 kg/kwh
2	Eucalyptus chips	1.2-1.3 kg/kwh
3	Woodchip (gen.)	1.4-1.7 kg/kwh

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4	Coconut fiber dust	1.6-2.0	kg/kwh
5	straw	1.7-1.8	kg/kwh
6	Palm bunch	1.7-1.9	kg/kwh
7	Rice husk	1.7-2.0	kg/kwh
8	Crop stalk	1.7-2.0	kg/kwh
9	Sugar Bagasse	1.7-2.0	kg/kwh

*** In most cases, it is ZERO (0) value to use this kind of raw waste**

Power production:

Done by common standard gas combustion engines, can be supplied with 50 or 60 Hz generators, Engines have little monthly maintenance, more checking needed once a year as per engine manufacturer instructions.

Connection of generators to Mains grid utility is done by simple modular common standard units. Switch-Gear, Synchronization, Step-Up station etc., can provide as well.

*** OUR Gasification advantages: Simple operation by non-skilled people, NO engineers, NO steam, neither boiler, NO high pressure, few piping works, Standard Internal Combustion Engines, basic civil works, accomplished in 6 - 8 months from order!!!.**