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Electricity from Rice Husk

A Potential & Eco- friendly Way to Electrify India

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***Abstract*—** as per reports it can be stated that the energy demanded by India is continuously increasing day-by-day. For the sake of providing energy security the amount of fossil fuels imported is quite high. With this, in fossil fuel there are several components like CO2, SO2 and NOX which presents an adverse effect to the environment.

To find an alternative solution to this big problem and arrive to a satisfactory result, re-usable (renewable) energy sources are needed to be developed. In India the Rice is grown in a very large quantity and it holds a considerable rank in exporting to the rest of the countries, here rice husk is a potential source of energy. To produce energy the Rice mills can utilize rice husk produced by them. However, the energy produced must be such that leads minimum damage to the environment. In coal and oil-fired power generation have a lesser amount of SO2 and NOX emission, but higher than for natural gas. In this process the CO2 obtained from combustion of rice husk is taken as zero as it does not contribute to global warming. The CO and dust emissions are comparatively higher than the conventional power production pointing which is required for improving the combustion efficiency of the rice husk power plant. Overall, it suggests that rice husk will be successful feedstock to produce electricity and works well than fossil fuels (basically coal and oil) from the view of environmental emissions. Electrical energy generation of a country determines it's economic development. Thus to compete other developed countries, India must have more than required electrical generation technique so that it can pace up the developmental process. To get development India has to, make the electricity available to most possible doors.

.***Keywords***- *Rice husk, gasification, gas turbine, power plant, electrostatic precipitator, obstacles, Conclusion*

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1. Introduction

All societies require energy services to meet basic human needs (e.g., lighting, cooking, transportation, and communication). Access to a cheap, stable, and sustainable electricity supply is a precursor for attaining and sustaining socio-economic development. It is a fundamental requirement for poverty reduction. However, about 1.4 billion people worldwide do not have access to electricity. The demand of electricity is increasing all over the world. In India the peak demand of electricity is 303 GW (by the end of June 2016) and estimated by the year 2020 it will be more than 400 GW. To mitigate this huge demand, Govt. has to search for new ways of electricity generation. Over the whole world is now penetrating for a greener way to generate electricity. In view of the increasing demands for electricity in the country, alternative grid renewable energy solutions are needed to diversify power generation from the vast supply of renewable biomass materials. India, as an agrarian economy has ample opportunity to bridge the electricity demand-supply gap by utilizing its abundant biomass resources such as agricultural residues. The main crop of India is paddy. India has been estimated to be produced 128 million tons in 2016-2017. So, rice husk is very much existing here. By using this huge amount of rice husk, we can generate a good amount of electricity & can distribute it to the rural areas at a cheaper rate.

2. Rice Husk: Characteristics & Availability :-

The characteristics & chemical composition of rice husk has made it easy to use it for electricity generation. The availability of rice husk is also discussed in this point to have an overview of the scenario of the current rice husk production and its availability in India.

2.1. Characteristics & chemical composition of rice husk :-

The outermost layer of paddy is called rice husk. It is also known as rice hull. Usually in rice mills it is separated from the rice. Rice husk has some specific characteristics which has made it simple to be used as an energy resource.

* The average caloric value of rice husk is 3040 K Cal/kg.
* 1 ton of rice paddy can produce 240 kg of rice husk.

A typical analysis of the chemical composition of given in the table below:

Table 1: Chemical composition of rice husk

Property	Range
Bulk density (kg/m3)	96-160
Length of husk (mm)	2.0 – 5.0
Hardness (Mohr's scale)	5-6
Ash %	22-29
Carbon %	≈ 35
Hydrogen %	4 – 5
Oxygen %	31 – 37
Nitrogen %	0.23 - 0.32
Sulphur %	0.04 - 0.08
Moisture %	8 – 9

2.2. Availability of rice husk in India :-

India is one of the world's largest producers of white rice and brown rice, accounting for 20% of all world rice production. Every year approximately 120 million tons of paddies are produced in India. This gives around 24 million tons of rice husk and 4.4 million tons of rice husk ash every year. The use of rice husk for electricity generation in efficient manner is likely to transform this agricultural by-product or waste into a valuable fuel for industries and thus might help in boosting the farm economy and rural development. India being the second largest rice producer in the world.

3. Block Diagram Electricity Generation from Rice Husk

There are different methods to generate electricity from rice husk. Within some powerful ways of electricity generation, following is power generation through the rice husk gasification. This entire system is designed in such a way that it evolves complete zero emission. To clear the concept of process a diagram elaborating the process is presented namely Fig. 1.

The first step is biomass storage in it rice husk is placed for processing. It reserves the rice husk. Once the reserve is done, it is than passed on to the gasifier and here some chemical reactions are done so that syngas can be produced for use. Different types of gasifier are available in the market. The cheapest gasifiers is downdraft gasifier even this gasification chamber generates product gas with very low tar content. In it, at the top of gasifier biomass fuel is kept. Then as the fuel moves downward, it reacts with air (the gasification agent). The major processes are described further below.

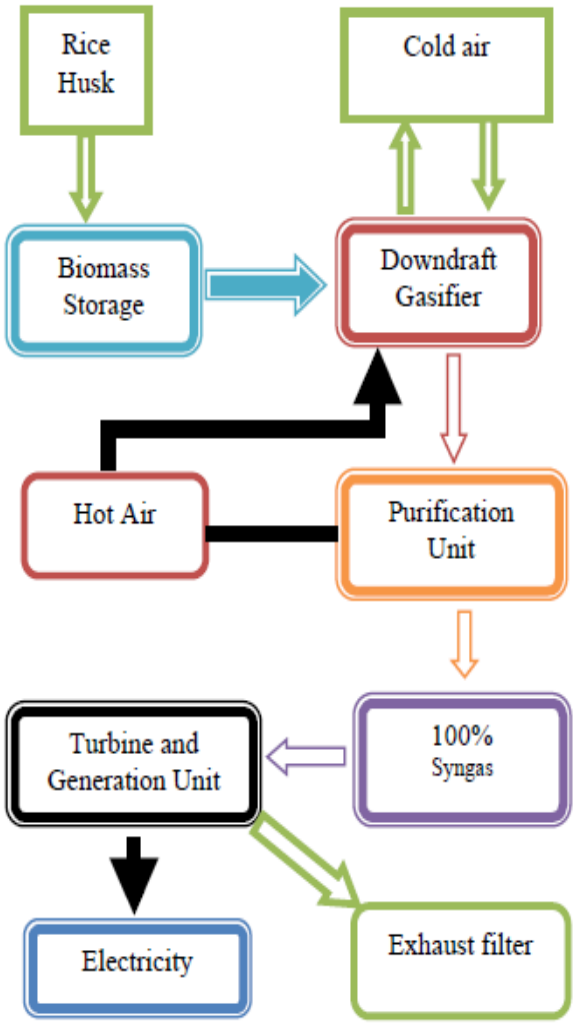

Figure 1. Block diagram of a rice husk electricity production unit

3.1. Downdraft Gasification:-

In downdraft gasifier gas and the solids flow in the same downward direction. A schematic diagram of a downdraft gasifier is given in fig. Figure Shows that rice husk is entered in the arrangement from the top of the component and the process progresses at it goes down. The actions involved in the full process are drying, pyrolysis and combustion also known as gasification. In Downdraft Gasifier System, the controlled intake of air (oxygen) is fed into the chamber containing downward movement of biomass material. After going through the process, the producer fuel gas is finally collected and drawn off at the base of this Gasifier. It is an efficient technique which has the capacity to process the biomass containing the moderate moisture (up to 30%). About 5 to 10 minutes time is needed to ignite the combustion and bring the plant to an operative temperature. Downdraft Gasifier is best suitable for the applications where the temperature control is critical, and the cleaner fuel gas is required. These Gasifiers

can be used in those applications where moderate temperature is required up to 1100°C.

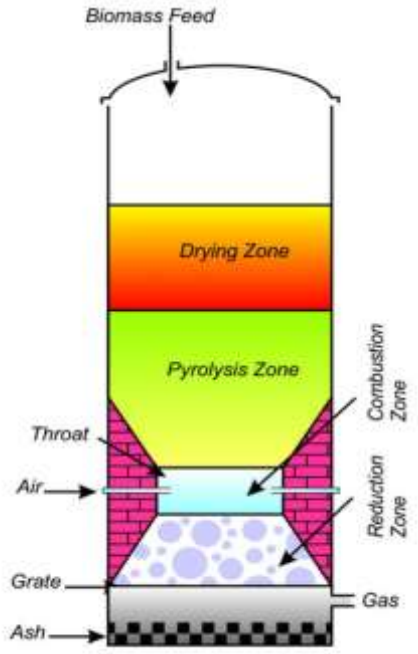

Figure 2. Schematic diagram of a downdraft gasifier

3.2. Purification Unit:-

With the help of dry type purification unit the process of purification can be turned more environmental friendly. In it for water purification no gas is required, which resultantly created no water pollution; even the processing of gas is completed in chamber thus the reverse effect to area through gas is prevented. With this the components like No liquid tars, no desertion of dirty water with ammonia and other gases makes the process and environment pollution free. To maintain this type of system minimum cost is required because of no slug.

While the presentation of Production its efficiency is to the maximum because of the gas being recoverable and could be reused for drying the rice husk or heating the gasifier. This process is highly suitable and convenient as it allows turbine to generate electricity.

3.3. Turbine and Generation Unit :-

This unit is the power generation section of the system.

Here the syngas collected from the purification system is used for generation of electricity. Two types of turbines can be used: gas turbine or steam turbine. If steam turbine is to be used, it will require a boiler where water will be heated and made steam using syngas and the efficiency will not be so high. So here it is best to use gas turbines. The efficiency of gas turbine is far better than the previous process. Here in this process, the syngas is taken into the combustion chamber, mixed with air and then combusted. It produces flue gas, which is flown through the blades of the turbine. The turbine absorbs energy from the high pressurized hot gas and rotates. As a result the gas becomes low pressure which will be exhausted. Now this exhaust gas will be passed through a chimney which includes a high featured filter and ejected into air. The turbine shaft is connected with a generator which generates electricity while the turbine rotates. The figure below shows the diagram of electricity generation unit.

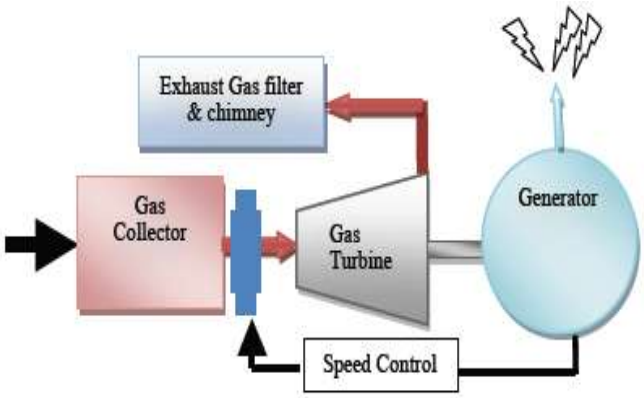

Figure 3. Schematic diagram of generation unit

4. Examples of Husk Power Plant :-

To Get Developed one Every Country in world is trying to generate Greener way to Generate Electricity so it's Very Good option for all Developing Countries. Now a day's Electricity generations from rice husk projects are being popular.

In India **"Husk Power Systems"** started its operations with one plant in 2007. As on date, it has 57 plants in operation across 250 villages of Bihar and Uttar Pradesh impacting 2,00,000 lives. The HPS initiative saves 42,000 liters of kerosene and 18,000 liters of diesel per year.

Apart From This some more Private Companies in India also have started use of Rice Husk for Electricity Generation Purpose.

	Name	:- Vandana Vidhyut Limited.
	Location	:- Bilaspur, Chhattisgarh.
	Capacity	:- 7.7 MW

International Example :-

1.	Name	:- Dreams power Ltd
	Location	:- Dhaka, Bangladesh
	Capacity	:- 250 KWh.
2.	Name	:- Golden Daun Keo rice mill.
	Location	:- DaunTeav Village, Cambodia.
	Capacity	:- 600 KWh.

5. Obstacles / Disadvantages :-

There are some obstacles which causes difficult to implement such kind of power plant in India. Some of the Obstacles are :-

Availability of rice husk: Though India is a rice producing country, rice husk is not available all the year round. Especially in the rainy season the rice mills cannot continue their work properly. As a result the supply of rice husk is almost off in that particular season. This time is called scarcity time.

Require Lots of space for Fuel Storage:
To Avoid inconsistency of Fuel in scarcity time lots of space requires to store the Fuel.

Efficiency of Power Plant: The Disadvantages Of this Plant is this is not as efficient as generation of electricity from conventional power plant.

6. Conclusion

It is very much important for India to ensure its own energy security. The conventional energy sources are decreasing Year by Year. So now This is Only time to take the renewable energy sources in action. Electricity generation from rice husk can be a better option of conventional energy sources in India. It is comparatively cheaper to install, easy to handle. Based on the analysis in this paper the Rice Husk power generation in India is viable with substantial financial return. Most potential developers of this resource are rice millers. But, this resource is not yet exploited due to their lack of awareness on this kind of power generation and lack of financial support.

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