Analyzing a Biomass Energy-Powered Generating (PKL) Power Plant and its Distinctive Characteristics in Contrast to Alternative Generating Facilities

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ABSTRACT

Biomass energy is becoming more and more prominent in the realm of renewable energy. Due to its many properties and practical applications, recently developed PKL power, which is mostly produced from the juice or malt of pathor kuchi leaves, has the potential to be a substantial source of energy. The current power plants that generate power are quite useful, despite their numerous drawbacks and negative environmental repercussions. However, a plant for electricity can be designed with PKL malt as its main fuel source. This kind of power plant has a number of important characteristics, such as affordability, environmental friendliness, fuel accessibility, etc.

Keyword: *PKL, PKL Electricity, Gas Turbine Power Plant, Steam Power Plant, Hydro power plant.*

1. Introduction

This article offers a proposal and design for a power station that generates electricity using biomass energy. The primary fuel used to produce electricity is PKL (Pathor Kuchi Leaves) malt. People have sought to become more civilized from the dawn of time by learning how to use power and energy more wisely in order to meet the growing demands of an expanding population. In this situation, a country can benefit greatly from a biomass-based power plant that generates electricity, both economically and environmentally. This study compares the characteristics of the PKL power plant to those of other power plants and displays the voltage and current results of generating electricity from the PKL facility. This report is expected to yield some fruitful future research using PKL and other green power sources.

Fig.1 : Experimental preparation of pkl extract and waste

2. PKL Electricity

2.1. Introduction to PKL Electricity and PKL Electric Panel

The newest form of energy produced from biomass, known as PKL power, is a major component of energy produced from renewable sources. The biomass energy used in this study work comes from Bryophyllum Kalanchoe (Genus: Kalanchoe) [1].The main structural unit, or foundation block, is the PKL Cell.It's composed of juice and PKL malt. The manufactured PKL cell unit has an electrical rating of about 1.5 volts. Multiple PKL cells that are joined by wires make up a PKL electrical module. Multiple PKL Electric modules combine to make a PKL electric panel. Multiple PKL electric panels are used to build PKL electric arrays. The PKL electric module is primarily used to generate power using PKL electric arrays.

2.2. Optimal Features of PKL Electricity

The subsequent graph may be seen if the PKL electricity's current vs. voltage curves are put on a graph. Figure 2 displays a typical characteristics curve. The curve's intercepts on the X-axis and The open circuit voltage (VOC) and short circuit current (ISC) are the names of the Y-axis. The location on the curve that produces the biggest area rectangle is the highest useable power. We use symbols such as Im and Vm to represent the current and voltage values that generate the maximum power. The fill factor (FF) of the cell is the ratio (Im Mm/ISC VOC).
Naturally, its value falls between 0 and 1.

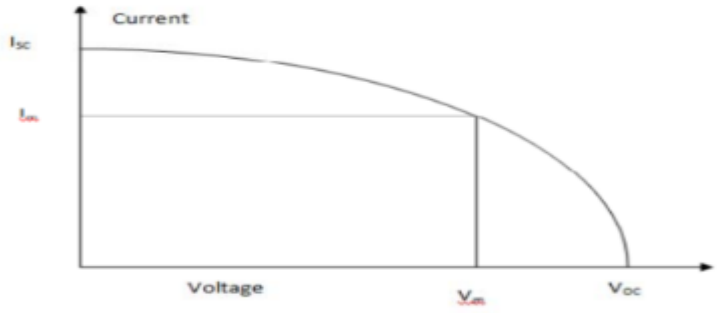

Fig.2 : PKL electricity's ideal properties curve.

2.3. PKL Power Production

Different produced current and voltage values over an extended length of time have been recorded, tabulated, displayed on a graph, and contrasted with the ideal values in order to ascertain the actual behavior of the PKL power panel. The table under shows the recorded current and voltage values over a predetermined period. The current values with change in time with load are shown in the first data table. Five minutes of local time have been taken into account as the time interval between these two data records.

Time Interval	Current, I(With Load)(Amp)
Each data has been taken having 5 minute interval.	0.74
	0.73
	0.72
	0.70
	0.68
	0.65
	0.62
	0.60
	0.58
	0.55

Fig. 3: Change of current over time

The table below therefore illustrates the outcome of the voltage change over time under the loaded situation.

Time Interval	Voltage,V(With Load)(Volt)
Each data has been taken having 5 minute interval.	4.30
	4.15
	1.07
	4.02
	3.89
	3.75
	3.68
	3.62
	3.55
	3.50

Fig. 4: Change of voltage over time

In order to distribute the electricity, the generated output of the PKL can be passed and transferred to the distributing zones.

Fig. 5: Production of PKL power

2.4. PKL Power Plant for electricity

It is possible to build a profitable power station using the electricity produced by PKL Malt. These electrodes will begin to generate electricity immediately as they come into contact with the malt or electrolytic juice. The fact that this PKL malt's electricity can power any DC or AC load (an inverter is required) is its greatest advantage. To provide ac loads, the energy produced must go via the inverter. It is also able to sense DC loads in a parallel manner.

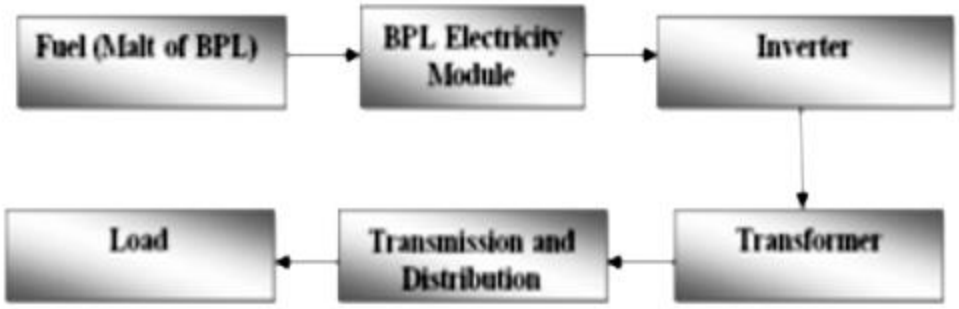

Fig. 6: A basic process diagram of a power plant producing PKL electricity.

2.5. Choosing the Location

Such generating stations can be built without restriction. Anywhere can be used to construct them. However, since PKL (pathor kuchi Leave) malt is the primary fuel source, it would be preferable if the BPL cultivation area was closer to the plant in order to save transportation costs.

2.6 Benefits and Drawbacks

Benefits:

- Extremely cheap fuel costs.
- steady electricity supply.

- The ability to plant in any local area.
- Low operating and maintenance costs.
- Not harmful to the environment and friendly to humans.

Drawbacks:

- Requires weekly maintenance.
- (single generating station) unable to provide enough electricity to power a whole city.

3. Other Generating Plants

3.1. Gas Turbine Power Plant

A gas turbine serves as the primary engine in a gas turbine power plant, which generates electricity. In a gas turbine plant, the combustion byproducts power the turbine directly, in contrast to steam power plants where the combustion products are used to create steam. Diesel engines operate differently in that the combustion takes place inside the engine.

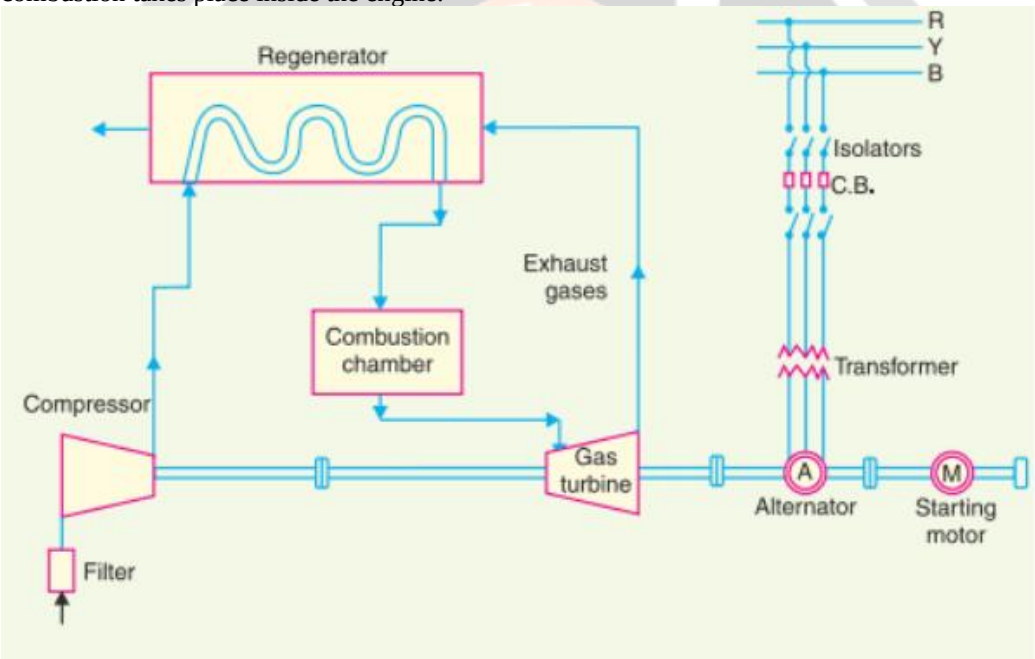

Fig. 7: Schematic diagram of a Simple Gas Turbine Power plant

3.1.2. Choosing a Location

The following factors are taken into consideration when deciding where to locate gas turbine power plants:

- Distance from the load center.
- Fuel and land accessibility.

3.1.3. Benefits and Drawbacks

Benefits:

- Construction costs are lower than those of steam and hydroelectric power plants.
- No energy loss during standby.
- Takes up less room than a steam plant with a comparable capacity.

Drawbacks:

- Gas turbine plants have higher running costs than other plant types.
- They have a comparatively lower net power output.
- Their overall efficiency is noticeably low.

3.2. Steam Power Plant

The energy contained in fossil fuels (such as coal, oil, and natural gas) or fissile fuels (such as uranium and thorium) is continuously converted into rotational energy by a steam power plant, which ultimately produces electricity. The working fluid is water, which goes between stages of liquid and vapor during its operational cycle. In contrast to some other plants, the combustion byproducts are used to create steam, which expands inside the turbines, rather of directly powering the turbines.

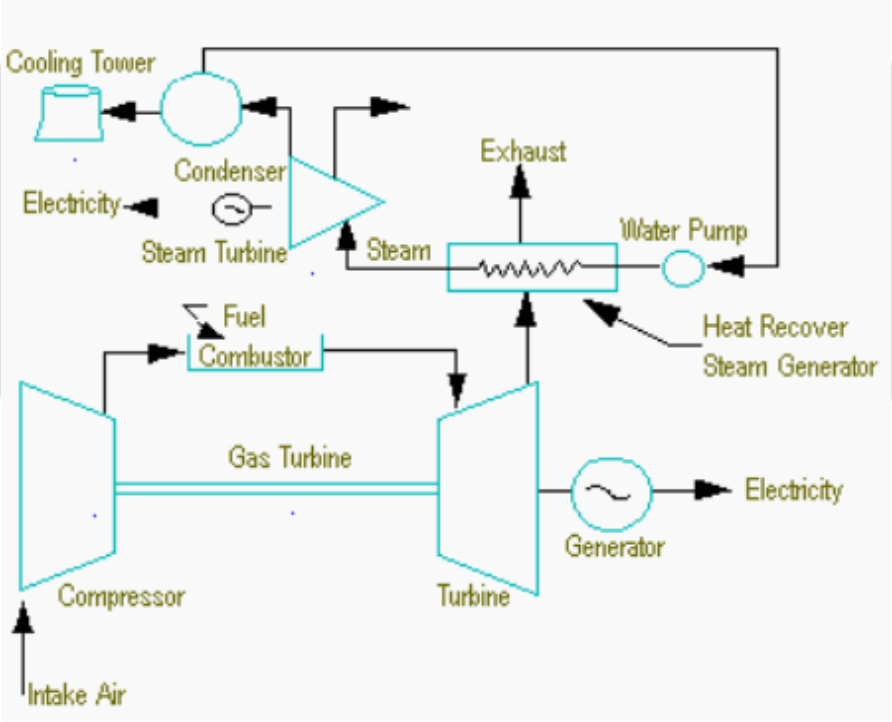

Fig. 8: Water, Steam and Fuel Gas flow diagram of Steam Power Plant.

3.2.1. Choosing a Location

Below are the factors considered for selecting a steam power plant site.
• Energy transfer.
• Provision of fuel and water.
• Property worth and taxation.

3.2.2. Benefits and Drawbacks

Benefits:

• Operating expenses are minimal when compared to those of a gas turbine power station.
• Enhanced efficiency is observed.
• Less refined fuel sources are viable for use.

Drawbacks:

- Managing and storing fuels and disposing of ash pose significant challenges in steam plants.
- This includes the need for extensive space, approximately 250 acres for a 2000MW coal-fired plant.
- Maintaining plant cleanliness is particularly challenging due to issues with fuel and ash handling.

3.3. Hydro Power Plant

Hydroelectric power plants harness the energy of falling water to generate electricity. These plants utilize the potential energy of water stored at high levels to produce electrical energy. Certain criteria need to be met for the establishment of a hydroelectric power plant. Firstly, there must be an abundant water supply at an adequate elevation, and secondly, a suitable location must be identified. The power output of such plants is contingent upon factors such as the volume of water available, its flow rate, the elevation difference (head), among others.

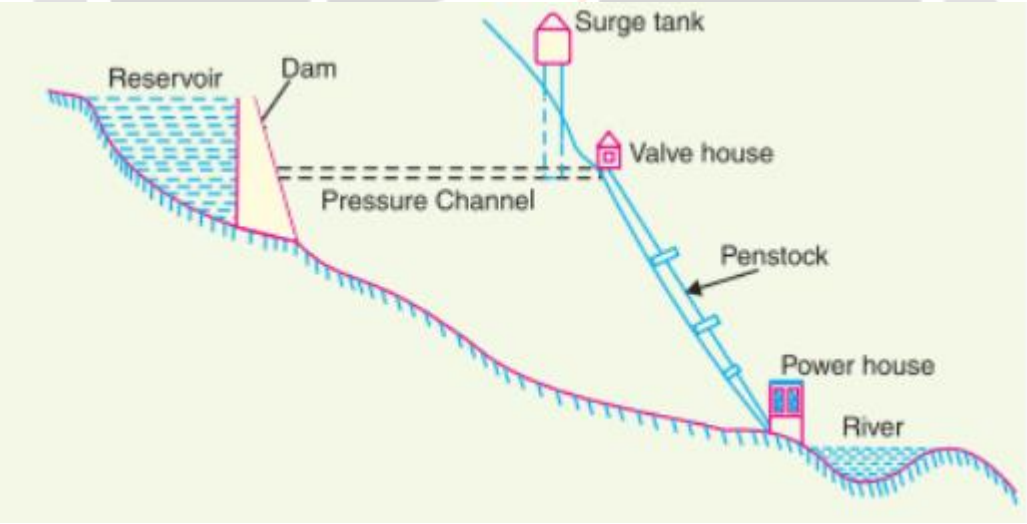

Fig. 9: Schematic Arrangement of a Hydro Electric Power Plant

3.3.1. Choosing a Location

The location choice for a hydroelectric power plant relies on several crucial factors:

- Water availability.
- Capacity for water storage.
- Geological assessments and water head.
- Water pollution and sediment buildup.

3.3.2. Benefits and Drawbacks of Hydro Electric Power Plant

Benefits:

• Since water serves as the energy source, this type of plant doesn't need any fuel.
• It incurs minimal operating costs and eliminates issues related to fuel handling, storage, and ash disposal.

Drawbacks:

• A significant amount of space is needed.
• The construction costs are exceedingly high and the erection process takes a considerable amount of time.
• Due to their location in remote hilly areas, considerable distances necessitate long transmission lines to connect them to the load center.

4. Comparison and Discussion

Comparing the site selection processes and the pros and cons outlined, it's evident that describing the operation of the BPL Electricity Power Plant is comparatively straightforward compared to other power plants. Its advantages include reduced noise, lower fuel and operational costs, minimal maintenance, lower conversion expenses, and fewer necessary equipment. However, there are limitations such as its capacity not being sufficient to supply power to an entire city, and it requires weekly maintenance. Nonetheless, this type of power plant is suitable for smaller loads and is environmentally friendly, posing no harm to living organisms. Additionally, it can be constructed for individual household usage.

5. Future Works

This type of eco-friendly power station designed for off-grid connections can be constructed, along with the option to incorporate hybrid power generation models such as solar/wind combinations. Even though there exists a hybrid model utilizing solar and wind energy conversion, it's feasible to integrate it seamlessly with BPL (Broadband over Power Line) electricity modules to establish a highly efficient hybrid power facility.

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