Power Generation and Pollution control using Dual Energy Sources derived from Processed Waste Materials

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***Abstract*—Processed waste materials are currently a threat to the society. It is a bit tedious task to eliminate but it is possible to recycle and produce energy from it. Processed waste products like plastics, papers are easy to sort out and can be converted into usable from of Energy. Our Project is based on how we can produce energy efficiently from processed products providing different types of loads as output.**

The main objective of our project is to eliminate the toxic gases which are released during the incineration of Processed waste materials and to produce a cleaner version of energy and to avoid pollution. Burning trash can cause long-term health problems. The toxic chemicals released during burning include nitrogen oxides, sulphur dioxide, volatile organic chemicals (VOCs) and polycyclic organic matter (POMs). Burning plastic, paper and treated wood also releases heavy metals and toxic chemicals, such as dioxin. This is eliminated during the process and an effective way of energy production is obtained. The result achieved using this project is high power different power electricity generation (i.e.) AC load output, DC load output, wireless power transfer, pollution control mechanism and efficient energy production

I. INTRODUCTION

A. GENERATION UNIT

India produces 3.5 million tons of processed wastes annually with 25,490 per capita. Processed waste generation has quadrupled in India over the past five years. Also, the pandemic created a surge in plastic production from FMCG markets, E-commerce, food- delivery devices etc. The main problem is uncollected plastic wastes, which accounts for 40% dumped in landfills, clogging water bodies and polluting streets.

Processed waste materials are not ecofriendly and they need to be replaced. As a part of the development of alternatives we have developed “Power generation and pollution control using dual energy sources” which produces electricity from burning processed wastes and is provided to different loads such as AC load, DC load and wireless charging system and in order to avoid pollution, a pollution filter mechanism is also added as a part of our system which is the main extension to the development.

B. FILTRATION UNIT

Air pollution control systems are very important requirements in any of the industries in order to ensure a safe working in the environment required to safeguard the lives of workers and protect the environment. Petroleum, energy production, coal, and metal mining, chemical, and waste management industries are part of a long list of the industries which generate a considerable amount of toxic waste which needs to be kept in check. The equipment used for air pollution control removes volatile organic compounds and hazardous air pollutants from the air. The latest advancements in the technology have made sure that the entire process occurs efficiently. According to the WHO reports, Air pollution is a group of one carcinogenic and has adverse the effects on human health, particularly causing

respiratory diseases. Even the checking of suspended particles in "visibly clean" gas is mandatory nowadays to make sure that the workplace and the environment is not getting too much harm.

An Electrostatic precipitator is used for the purpose of pollution control unit. It is built very compact and small such that it can be used for domestic and commercial purposes. This is used to remove the toxic particles from the gas emitted from the production unit.

KEYWORDS: *Non-Biodegradable waste, Organic compounds, Pollution control mechanism, Adulterants, carcinogenic, particulate matter.*

II. LITERATURE SURVEY

1. Energy Generation from Bio-Waste using Normal and Chemical Decomposition Technique to Meet Power Demand in Urban Areas- R. Premkumar; L. Vijaya raja; R. Dhanasekar; Rupa Kesavan; S. Sreevaragi; M. Swetha 2022 Energy production from biodegradable wastes and the procedure followed behind it was studied and verified the possibility with non-Biodegradable wastes. [1]

2. Biodegradable Wastes: An Alternative Clean Energy Source- Adetola O.O, Layade K.T, Oyedeji O.T, Akinyemi O.E, Adaaja B.O, Adegboyega D.A, Arabambi I.O Forestry Research Institute of Nigeria, P.M.B 5054 Jericho Hills Ibadan Nigeri. March 2021 The efficiency of the Project and pollution control methods was identified and studied and have been implemented some of the measures in our project[2]

3. Network of Outdoor Air Purification Systems: Air Quality Measurement, Analysis and Display Systems using Mesh Network Topology -KM Nivetha Department of ECE, Rajagiri School of Engg. & Tech., Rohith Joseph Mathew department of EEE, Rajagiri School of Engg. & Tech., Suveta Yadav department of ECE, Rajagiri School of Engg. & Tech., Caroline Ann Sam department of EEE, Rajagiri School of Engg. & Tech., G Sreekumar department of AEI, Rajagiri School of Engg. & Tech., Salman Faris Steag Centre of Smart City Tech., Rajagiri School of Engg. & Tech., Kakkanad, India. 2021 Our study based on how to control air pollution was studied and identified.[3]

4. A survey on active power filters control strategies- Khoisan Steela; Bharat Singh Rajpurohit. 2014 types of filters which can be used for pollution filtration was studied and identified.[4]

Abbreviations and Acronyms:

PCB - Printed Circuit Board, LED - Light Emitting Diode, MOSFET - Metal Oxide Semiconductor Field Emitting Transistors, IC – Integrated Circuits

A. Units

Potential -V (volts), Current - I (ampere), Battery capacity- mAH (milli ampere hours), Power- W (watts), Luminous intensity- mcd (milli candela), Frequency- Hz (hertz), Temperature- °C (Celsius), Capacitance- µF (micro farad), Resistance- Ω (ohms)

Equations

To calculate output of your solar panel system,

$$E = A * r * H * PR$$

where,

E = Energy (kWh), A = Total solar panel area (m2)

r = solar panel yield or efficiency(%)

H = Annual average solar radiation on tilted panels (shadings not included)

PR = Performance ratio, coefficient for losses (range between 0.5 and 0.9, default value = 0.75)

SOLAR PANEL EFFICIENCY CALCULATION:

Efficiency= (Panel power(in kWh)/(Panel length × Panel width (m))×100%

III. PROPOSED SYSTEM

This paper focuses on producing energy from burning plastic wastes. The project revolves around supplying current in form of three types of loads such as AC, DC, and wireless transmission. As burning plastics produce a large amount of toxic gas, we have included an electrostatic precipitator for the pollution control mechanism.

IV. BLOCK DIAGRAM

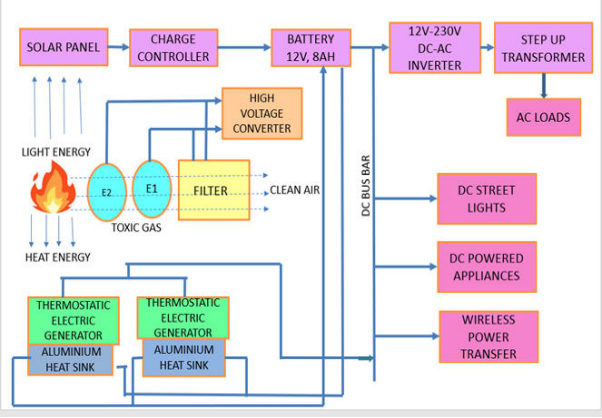

Fig. Design of Proposed System

V. METHODOLOGY

The working model consists of two phases which includes the power supply unit and load unit. The power supply unit

consists of solar panel of 6V connected in series around the fire generation unit. It is connected to the battery of 12 V. The 12 V battery is connected to two different loads which include DC and AC loads respectively. The DC load side consists of a booster and filter circuit built with capacitors of specification 2200µF/50v and is sent to the DC load. On the other hand, AC load unit consists of an inverter circuit and a centre tapped transformer. The inverter circuit consists of IC4017, ICNE555 Timer, IRFZ44N MOSFET, IC7809 Voltage regulator which is used to convert DC power to AC power. The 12-0-12 Centre tapped transformer is used to step up the 12V AC power from the inverter circuit to 230V and provide it to the AC load.

VI. WORKING MODEL

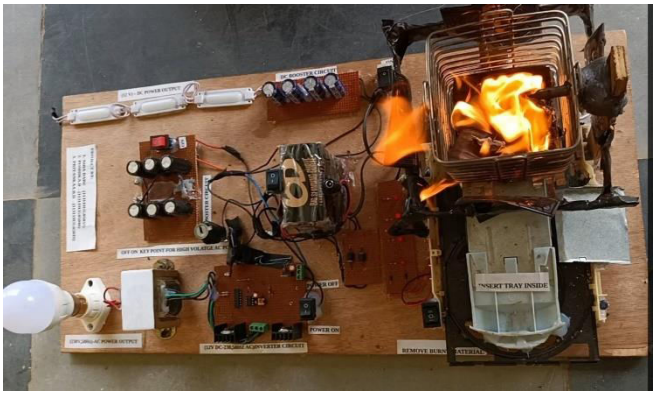

Fig. Working Model of Proposed System

All garbage and burning materials are directed to the combustion chamber unit, where they are burned, generating light and heat energy. The solar panel converts the light energy into electrical energy, which provides the electricity for charging the battery. After completely burning, the burnt material will remain as ash, which will be collected using the ash tray chamber unit and removed using a conveyor system.

The solar panel converts the light energy from the sun into electrical energy using a photo-vertex cell that is made up of PN junction materials, mainly silicon materials. When the light energy flow terms are emitted on the surface of that PV, it starts to generate electrical potential across each cell. Solar panels are connected in series to make a 16-watts output supply that has been used to charge the 12-volt lithium-ion battery, so the power output from the solar panel, can fully charge the battery, and it can be used directly for DC light systems and for AC loads using the inverter circuit.

Full solar panel output energy electrical energy is connected to the output power LED circuit that shows the indication level of the output power that has been produced by the solar panels that is 12 volts DC connected to the DC capacitor filter circuit that filters the DC supply and senses the filtered DC supply to the reverse current protection diode unit that remains the reverse current flow from the battery to the solar panel that unplugs the solar panels For 12 volt dc to 231 AC, an inverter is used that converts 12 volt DC from the battery to 12 volt AC, and it is faded to a step up of primary 12 volt, 2 amps AC, and secondary 230 that converts that 12 volt AC to 230 AC. Shandar, it is fed to the AC terminal for the home power supply unit or to AC loads. Another 12-volt DC section is taken from the DC bus bar and fed to the capacitor. Filtered output 12-volt DC is input and sent to the LED via the positive terminal of the DC lights. When we reduce electricity using solar panels made from waste materials, we use a starter to turn on a light automatically at night. Then the heat energy from the fire and flame is transmitted through a heat sink aluminum metal bar to maintain and spread the heat evenly to the thermoelectric generator module. SP1848-27145 is thermoelectric power electric TEG. It produces a maximum of 5V and 150°C and 127 semiconductor particles in the area 40×40 mm.

TSP1848 will generate up to 5V,400mA each 2 modules. So, 2 watts each × 2= 4 watts. The Solar panel and SP1848 module output are connected through a reverse current production diode and sent to the MOSFET (MPPT) circuit which then will produce a constant and efficient output to the battery. Before sending it to the battery, a reverse current production diode is used to prevent the current from battery to the panels causing damage to them.

The hot and polluted air and smoke from the top chamber will be sent to the electrostatic precipitator which has two electrodes namely E1 and E2. While passing through it will filter all the chemicals of the polluted air. Thus, cleaning the air and smoke by ionization process by the electrode. Then the smoke will be filtered. So, pollution will be reduced. The power from the DC busbar will be converted to high voltage AC circuit using the DC high voltage converter circuit that can be used to electrode terminals E1, E2

II. INVERTER CIRCUIT

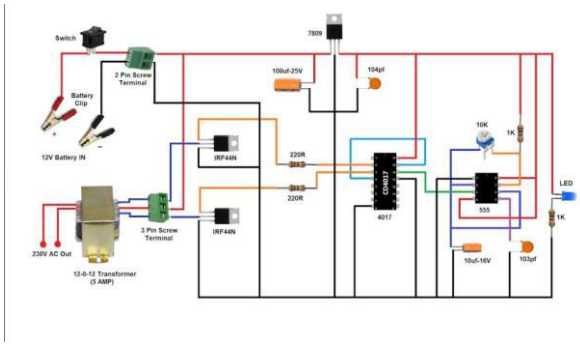

Fig. Circuit representation of Inverter

SOLAR PANEL SPECIFICATION:
Voltage= 12 to 15 v max
Current=0.2 to 0.6 max
Power=8.5 watts max
So, 12×0.6=8 watts max
8 watts per hour

BATTERY CAPACITY:
We used Lithium-Ion Battery 18650
3 set of 2 battery in parallel and that 3 set are connected in series.
Each cell specification
V=3.7 to 4.1 max
I=2.2 AH
Efficiency will be nearly 99.5%
So, 3.8v × 2.2 AH = 8.36 watts hour each cell
Current adds up in parallel connection,
so 2.2+2.2= 4.4AH
Voltage adds up in series connection,
so 4.1+4.1+4.1= 12.3V

BATTERY CHARGING VOLTAGE:
Charging current for battery =Battery AH × 10%/100
= 4.4 × 10%/100
=440/100
=0.44 Amps
There will be during charging so we can raise the amps by 0.44 to 0.55 Amps
Charging time for 4.4AH battery=4.4/0.44
=10 hours

THERMO ELECTRIC GENERATOR SPECIFICATION:
Voltage = 6 v max
Current = 0.48 A max
Power = 2.88 watts max
Operation temperature= 0 to 170°c
6v × 0.480A = 2.88 watts output power per hour
n overall = 1-(1-n overall 1)(1- n overall 2)

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CONCLUSION

By using our project, we can eliminate plastic from the environment. Reducing processed wastes can create a greater impact in the environment and therefore, the land is being polluted by non-biodegradable waste. So, using this project we not only eliminate wastes from the environment but also filter the toxic gases released from burning the plastic materials by using a pollution filtering ciruit.

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