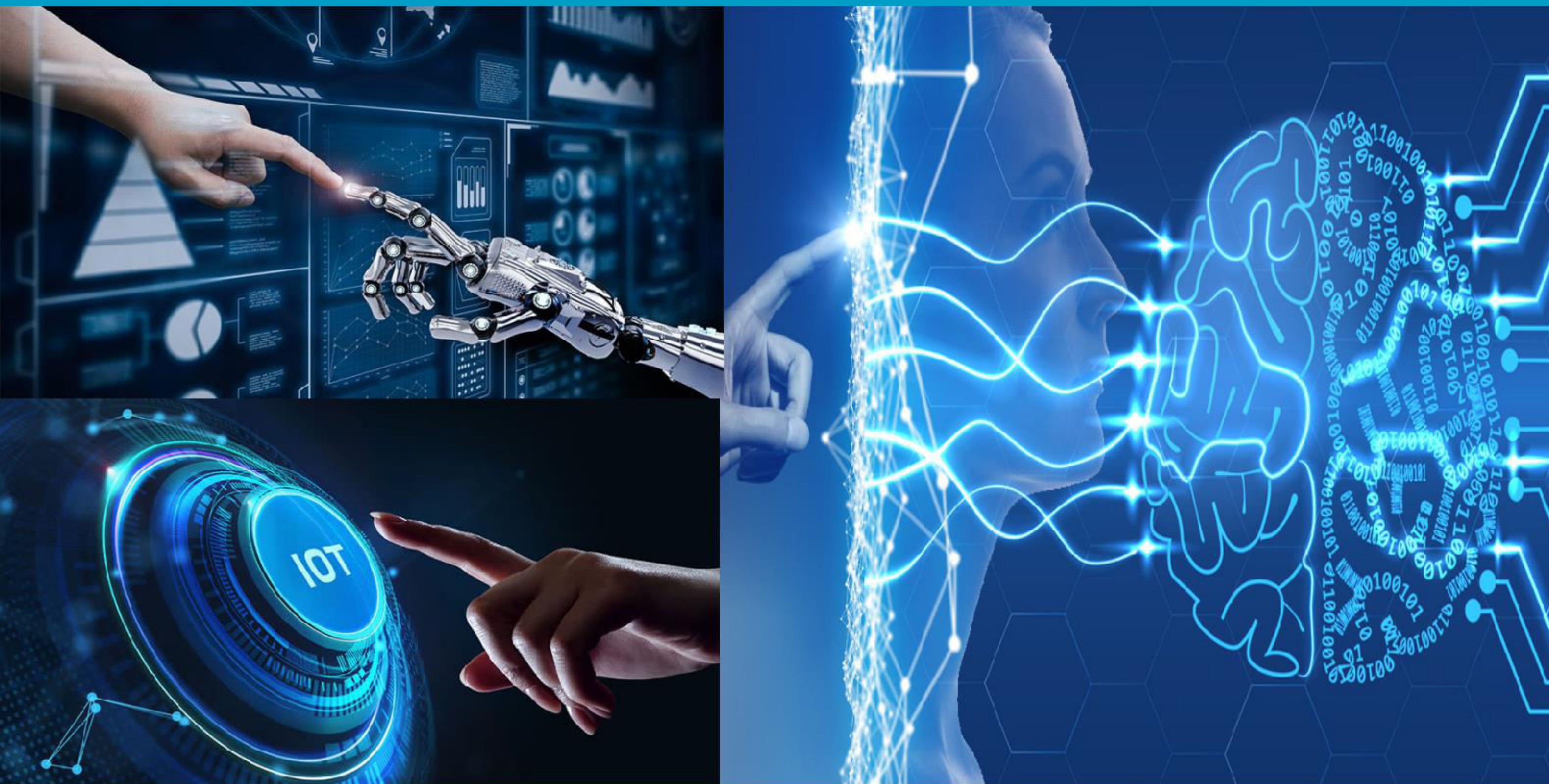
IJMRSETM

e-ISSN: 2395 - 7639



INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEARCH

IN SCIENCE, ENGINEERING, TECHNOLOGY AND MANAGEMENT

Volume 10, Issue 4, April 2023

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 7.580

+91 99405 72462 +9163819 07438 ijmrsetm@gmail.com www.ijmrsetm.com

| ISSN: 2395-7639 | www.ijmrsetm.com | Impact Factor: 7.580| A Monthly Double-Blind Peer Reviewed Journal |

| Volume 10, Issue 4, April 2023 |

| DOI: 10.15680/IJMRSETM.2023.1004035

Design and Implementation of Solid Waste Management System

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ABSTRACT: The electricity sector in India supplies the world's 6th largest energy consumer, accounting for 3.4% of global energy consumption by more than 17% of global population. About 65.34% of the electricity consumed in India is generated by thermal, 21.53% by hydroelectric power plants, 2.70% by nuclear power plants and 10.42% by Renewable Energy Sources. More than 50% of India's commercial energy demand is met through the country's vast coal reserves. The rural areas are struggling with a chronically tight supply of electrical power. In order to properly manage the changing conditions, knowledge and estimation of the available resources and applying their relation with the population is of utmost importance. Solid waste management is one of the most essential functions in a country to achieve a sustainable development. The most common ways to treat waste in India today are open dumping and uncontrolled burning. These methods are causing severe environmental pollution and health problems.The garbage has several nutrients and hence can be advantageously processed to produce many bye products and end products viz. gas, electricity and also organic manure which is highly suited for organic farming. Incineration is a waste treatment process that involves the combustion of organic substances contained in the waste generated. Incineration and other high-temperature waste treatment systems are described as "thermal treatment". During incineration, waste materials are incinerated into ash, flue gas, and heat. The ash is mostly formed by the inorganic constituents of the waste, and may take the form of solid lumps or particulates carried by the flue gas. The flue gases generated in this case can be used to generate electric power. A mechanical interface, consisting of a boiler, heater and a suitable coupling transmitter is incorporated for this process. The output of this step up is connected to the battery for converting mechanical energy into electrical energy. Thus, electricity is produced through solid waste management.

KEYWORDS: Solid Waste, Electricity, Boilers, Heating, Turbine, LED Bulb.

I. INTRODUCTION

1.1 General

Man has needed and used energy at an increasing rate for its sustenance and well being ever since he came on the earth a few million years ago. Primitive man required energy primarily in the form of food. He derived this by eating plants or animals, which he hunted. Subsequently he discovered fire and his energy needs increased as he started to make use of wood and other bio mass to supply the energy needs for cooking as well as agriculture. He added a mew dimension to the use of energy by domesticating and training animals to work for him.

With further demand for energy, man began to use the wind for sailing ships and for driving windmills, and the force of failing water to turn water wheels. Till this time, it would not be wrong to say that the sun was supplying all the energy needs of man either directly or indirectly and that man was using only renewable sources of energy. The industrial revolution, which began with the discovery of the steam engine (AD 1700), brought about great many changes. For the first time, man began to use a new source of energy, viz. coal, in large quantities. A little later, the internal combustion engine was invented (AD1870) and the other fossil fuels, oil and natural combustion engine extensively. The fossil fuel era of using non-renewable sources had begun and energy was now available in a concentrated form. The invention of heat engines and then use of fossil fuels made energy portable and introduced the much needed flexibility in mans movement.

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1.2 Why it is important?

Nowadays, the waste generated is so complex in nature and consists of varied schemical or biological constituents. Based on the chemical composition or reactive properties of the trash, it is classed as hazardous waste or non-hazardous waste. The waste's properties Solid waste management lowers or eliminates pollution, harmful effects on the environment and human health, but also promoting economic growth development and a higher standard of living Involved are a variety of processes. For a municipality, trash management must be done efficiently. Monitoring is one of them. Collection, transportation, processing, recycling, and disposal are all steps in the process.

1.3 Objective of our project

- To assess the type and nature of wastes produced. To evaluate the methods for handling, storage, transportation, and disposal that have been implemented.
- Identify any potential environmental consequences of the production of waste.
- To make recommendations for proper waste processing and disposal.

1.4 Waste To Energy – Technology Option

Incineration, coprocessing, Anaerobic Digestion (AD), Landfill Gas (LFG), and pyrolysis / gasification are the five Waste to Energy technologies covered in this chapter at the municipal level (further also called alternative technologies). In the municipal sector, these five technologies serve a variety of purposes and uses, system of waste management. Some technical background is required for each technique. The information is followed by a list of eligible trash categories and a conclusion. A synopsis of operational, environmental, legal, and financial issues are given.

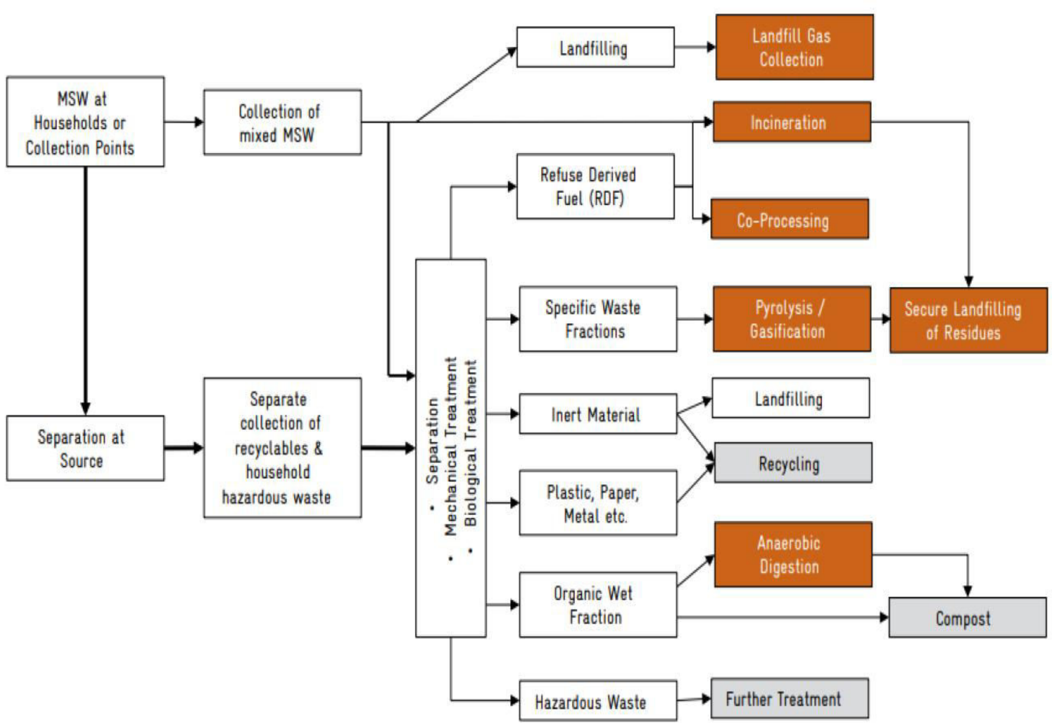

Figure 1: Overview of MSW material flow and its different utilization and treatment options

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II. TECHNOLGICAL DESCRIPTION

When flammable components in waste achieve the required ignition temperature and come into contact with oxygen, an oxidation reaction takes place. The temperature of the reaction is between 850 and 1450oC, and the combustion process takes place. It occurs in both the gaseous and solid phases, releasing heat energy at the same time. To permit a thermal chain reaction, the waste must have a minimum calorific value, and self-sustaining combustion (also known as autothermic combustion), in which there is no need for oxygen. Other fuels will be required. Exhaust gases are produced during incineration and, after cleaning, are released into the atmosphere. A flue is a conduit or tunnel that allows gases to escape into the atmosphere. These flue-gases are made up of Heat, dust, and gaseous air make up the majority of the available fuel energy. The contaminants that must be removed with the help of a flue-gas purification process. Excess heat from combustion can be used to make steam for electricity generation, district heating/cooling or steam supply for nearby process industry. Plants that utilise cogeneration of thermal power (heating and cooling) together with electricity generation can reach optimum efficiencies of 80%, whereas electricity generation alone will only reach maximum efficiencies of about 20%.

2.1 Suitable Waste Fractions

MSWI is designed to treat typically mixed and largely untreated domestic waste and certain industrial and commercial wastes. A key parameter is the energy content, the so-called lower calorific value (LCV) in MJ/kg. To ensure autothermic combustion of the waste LCV should not be below 7 MJ/kg on average over a year [15] (for comparison: The LCV of 1 kg fuel oil is about 40 MJ/kg). In developing countries the LCV of unsorted MSW is often below this threshold due to a dominant organic content with high moisture and a significant level of inert waste fractions such as ash or sand.

Table 1: Prior separation of recyclables influences the characteristics of the remaining waste

Fraction removed	Prime impacts of removal on remaining waste
Glass, metals, ash, minerals from construction and demolition waste	Increased calorific value Decreased quantity of slag and recoverable metals
Paper, cardboard and plastic	Calorific value decreases Chlorine loads (e.g. from PVC) in emissions decrease
Organic waste from kitchen and garden	Decreased moisture loads Increased calorific value
Bulky wastes	Reduced effort for shredding waste
Hazardous waste (e.g. batteries, electronics)	Reduced effort to remove toxic volatile heavy metals from air emissions (e.g. mercury) Reduced concentration of toxic pollutants in slag and fly ash (e.g. cadmium, lead, zinc)

2.2 Operational Aspects

The operation of highly complex MSW requires well developed technical and management skills. Requirements are: a continuous MSW supply chain, a homogenized waste mix fed continuously to the combustion chamber, process parameter and emission parameters adjusted and controlled, scheduled maintenance, the purchase of auxiliary materials and spare parts, guaranteed energy supply to direct customers, managed disposal or further use of process residues, etc. Siting of the MSW where year-round use of generated electricity can be ensured is an important factor, increasing the likelihood of reliable revenues. For this reason MSW should be sited in industry parks, with short distances to waste sources. Only managers, engineers and technicians with proven capabilities and experiences should be assigned to key functions. If the qualifications are not available locally, international experts need to be contracted long term and a capacity building program launched.

2.3 Environmental Aspects

An objective of MSW is to contribute to an overall reduction of the environmental impact that might otherwise arise from wild dumping, open burning or landfilling of the waste. The volume reduction of waste by incineration helps to

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save scarce and valuable space for landfill and protect the environment. A fraction of the energy recovered can also be considered to be carbon neutral, due to the biomass content in MSW. However, MSW facilities also generate large amounts of flue gases which must be treated, even when incineration has taken place under optimum combustion conditions. Pollutants in flue gases take the form of dust and gases such as Hydrogen Chloride (HCL), Hydrogen Fluoride (HF) and sulphur dioxide (SO2). A number of compounds containing mercury, dioxins or nitrogen dioxide (NO2) may only be removed using highly advanced chemical processes, which substantially increase project costs.

III. MATERIALS LIST & PROTOTYPE VIEW

3.1 Specifications

(1) Boiler Unit

Boilers are used to generate steam from water by heating it in various ways. The flow lamp is utilised in our project to heat water, which is then transformed into steam.

Material: Mild Steel
1. Height of the cylinder– 18 inch(450mm)
2. Diameter of the cylinder- 8 inch(200mm)
3. Thickness of the cylinder-12mm
4. Volume of the cylinder- 20 Litres(approx.)

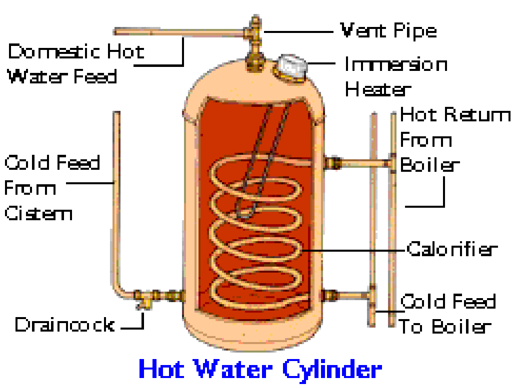

Figure 2: Labelled Conventional Boiler

Figure 3: Boiler unit

(2) Heater (or) Flow Lamp

AC Supply/ SINGLE PHASE / 1500-2000 WATTS

(3) Dc Generator

Shunt-Wound DC Generator Output Voltage vs. Load Current A shunt-wound generator provides a far more steady voltage output than a series-wound generator while running at a constant speed under varied load conditions. There is an output voltage. This shift is due to the fact that the load increases. As the current rises, the voltage drop across the armature coil (I R) rises as well, the output voltage will drop.

International Journal of Multidisciplinary Research in Science, Engineering, Technology & Management (IJMRSETM)

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As a result, the magnetic field is reduced as the current across the field drops, resulting in a further drop in voltage If the load current is substantially higher than the supply current. The output voltage drops dramatically due to the generator's design. The loss in output voltage is small within the generator's design range.

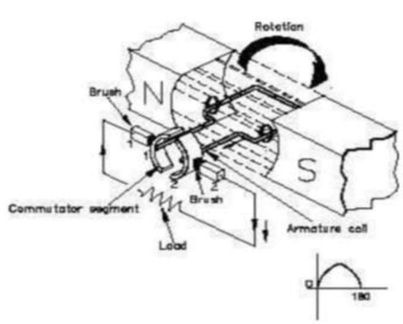

Figure 4: Theory of operation

Figure 5: DC Generator – 12V

(4) Stand (or) Frame

Mild Steel L Angle:

It is a high atmospheric corrosion resistant steel plates, abrasion resistant steel plates that is used to withstand the boiler unit.

Figure 6: Frame

(5) Turbine

The potential and kinetic energy of fluids are extracted and converted into mechanical energy by a turbine, which is a rotational mechanical device.It is a primary mover that converts the mechanical energy of the turbine shaft into the energy of the working fluid.

Aluminium Material
Width: 6 Inch, **Blades:** 28 No’s

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Figure 7: A Small Size Aluminium Turbine

(6) Copper Tube

Figure 8: Copper Tube (2 Meter)

(7) Ball Valve For Steam Entry

Figure 9: Gate valve

IV. WORKING PRINCIPLE

The block diagram of steam power plant is shown in figure, it consist of a boiler unit, 12 voltage battery, an inverter and a florescent lamp. As we studied from the generator gives a D.C. output of 12V this D.C. output is not always constant there is some variation in this D.C. output this cannot be given to the battery storage it may weaken the life of the battery. So in order to get constant D.C. output and also to avoid the reverse flow of current to the panel in the case of no load a charge controller have been used this help us to allow only the constant voltage of 12V D.C. to the battery and also it act as an blocking diode and protect the motor principle.

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By this way the battery gets charged then this D.C. storage is given to an inverter this inverter inverts 12V D.C. to input in to AC output, step upped in to 230V.The 230V AC supply is given to the supply to the lamp. The lamp used for street lighting is 230V, 50 Hz, single-phase supply.

4.1 Procedure

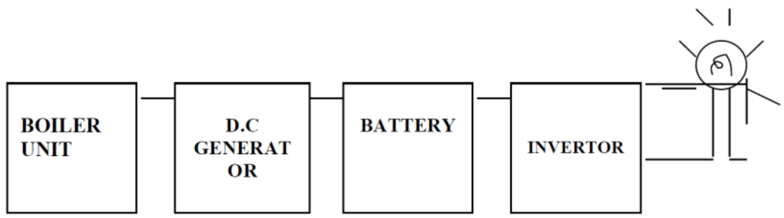

Figure 10: Block Diagram

A boiler unit, 12 voltage battery, an inverter, and a fluorescent bulb are illustrated in the block diagram of a steam power plant. The generator produces a 12V D.C. output, however this D.C. output is not always consistent; there is some volatility. This D.C. output cannot be provided to the battery storage since it may shorten the battery's life.

The power source So, in order to maintain a constant D.C. output while also avoiding the reverse flow of electricity, A charge controller has been utilised to provide current to the panel when there is no load. To provide a consistent voltage of 12V D.C. to the battery while simultaneously acting as an inverter. Protect the motor principle with a blocking diode. The battery is charged in this manner, and the D.C. storage is transferred to an inverter. Inverter converts 12V D.C. input to AC output, which is then step-upped to 230V. The 230V AC power supply. The lamp's supply is delivered to the lamp's supply. For street lighting, a 230V, 50W lamp is utilised. Supply frequency is Hz, and it is a single-phase supply.

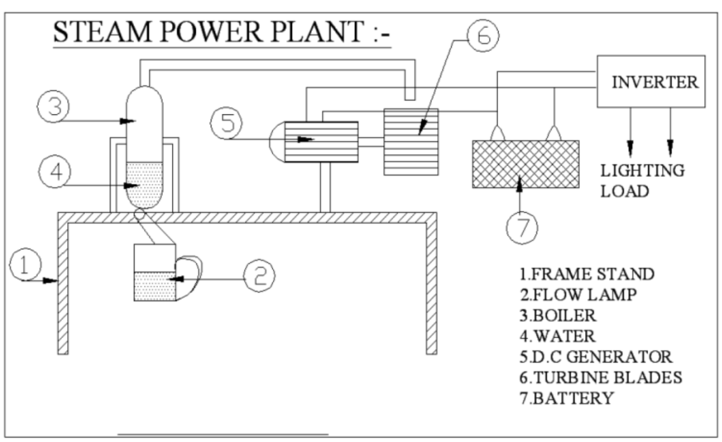

Figure 11: Experimental Setup

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Figure 12: Prototype

V. CONCLUSION

This project work has provided us an excellent opportunity and experience, to use our knowledge. We gained a lot of practical knowledge regarding, planning, purchasing, assembling and machining while doing this project work. We feel that the project work is a good solution to bridge the gates between institution and industries.

We are proud that we have completed the work with the time successfully. The "Electrical Power Generation from Waste" fabricated model is working with satisfactory conditions. We are able to understand the difficulties in maintaining the tolerances and also quality. We have done to our ability and skill making maximum use of available facilities. In conclusion remarks of our project work, let us add a few more lines about our impression project work. Thus we have developed a proto type model which helps to know how to achieve low cost thermal power plant model. By using more techniques, they can be modified and developed according to the applications. To ensure that this renewable energy source can compete in the electric power market, specific energy selling pricing should be explored along with tax incentives. It is necessary to separate waste before they can function. Educating the public about the importance of sorting waste at the source is an important first step. Campaigns should encourage citizens to demonstrate their moral commitment to the earth in order to change their behaviour. To that end, environmental awareness should be a primary goal of these initiatives.

It is also important to encourage the commercialization of garbage that may be recycled and reused. In order to utilise WMT (Waste Management Technique) technologies and India must adopt the practises of developed countries. There should be continual monitoring of environmental factors (such as leachate, fly ash, and slag) in order to ensure that appropriate controls can be implemented.

REFERENCES

[1]. Municipal solid waste management and landflling technologies: a review Sonil Nanda · Franco Berruti 2020.
[2]. Solid waste management challenges for cities in developing countries Lilliana Abarca Guerrero a, Ger Maas , William Hogland 2021.
[3]. Designing an integrated municipal solid waste management network: A case study - ArsalanYousefloo,

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| DOI: 10.15680/IJMRSETM.2023.1004035

RezaBabazadeh 2020.

[4]. Critical review on technological advancements for effective waste management of municipal solid waste — Updates and way forward - Priya Prajapati et al, 2021.

[5]. Review of life-cycle environmental consequences of waste-to-energy solutions on the municipal solid waste management system - Ioan-Robertstrate et al 2020.

[6]. Waste-to-energy supply chain management on circular economy capability: An empirical study - YudiFernando 2022.

[7]. Recent trends in solid waste management status, challenges, and potential for the future Indian cities – A review - AkhileshKumar et al 2020.

[8]. Life cycle assessment of municipal solid waste management options for India HarshitKhan delwal et al 2019.

[9]. A framework for sustainable and integrated municipal solid waste management: Barriers and critical factors to developing countries - MarcioBatista et 2021.

[10]. Opportunities and challenges for solid waste reuse and recycling in emerging economies: A hybrid analysis - Tat-DatBui et al 2022.

[11]. Urban biowaste integrated management based on synergy mechanism and multi-objective optimization: A case study in Suzhou, China - FanFei et al 2022.

[12]. Raising Awareness on Solid Waste Management through Formal Education for Sustainability: A Developing Countries Evidence Review Justice Kofi Debrah et al; 2021.

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