iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** XI **Month of publication:** November 2022

DOI: https://doi.org/10.22214/ijraset.2022.47078

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue XI Nov 2022- Available at www.ijraset.com

Green for Green: Approach to Sustainable use of Stubble

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Abstract: ***The contemporary zeitgeist of the national capital is rendered in haze and smog due to extensive stubble burning. The paper talks of the various steps the government has already taken and tries to identify the lacuna behind its unjust boom. It also looks at the effective use of various agro wastes and turning them into a 21st-century industry product, for biogas generation or construction material, which can foster a pyramidal development through economic, environmental, and social sustainability. It also identifies the indispensable role of the government not just in creating awareness and structuring better policies but rather in providing opportunities by agglomerating the demand and supply chain to stimulate the waste into revenue generation.***
Keywords: sustainability, stubble burning, agro waste, construction material, revenue generation

I. INTRODUCTION

India being the land of rivers has always been extensively rich in agriculture. The Northern Plains is stitched with exceedingly rich alluvial soil which does promote agriculture and cultivation all along its stretch. So, geography has enhanced the standard of crop production in the states of Haryana, Punjab, Uttar Pradesh, and West Bengal. But with time and technology evolving at light-years holding on to the conventional process of agriculture has led to certain constraints. The residue generated from farming is often used by farmers as fodder for their cattle and poultries. Sometimes it's even sold at considerable rates to different manufacturers and industries. However, the stubble that is left on the ground is generally set on fire as cutting them becomes a tough job. There are many reasons for this. One of the major reasons is that with a spike in merchandised farming almost 2ft of stubble is left behind and this residue takes a long time to decompose. In-case of paddy the residue is hard and contains a significant amount of silica making it unsavoury for the cattle. This leads the farmers to stubble burning to get rid of the crop debris quickly and effectively.

In the past years, this has become a bottleneck specifically for the states of Haryana and Punjab. A personal experience has spiked visualizations about its deadly consequences. Stubble burning has been an issue in predominantly agriculturally based areas. The burning of the agricultural residue increases the amount of CO2, CO, Nitrogen dioxide (NO2), Ammonia, etc in the atmosphere which eventually leads to air pollution and smog in the winter. The process has set an exemplary dichotomy which is loving our green and earning from it and on the other hand, degrading it through the emission of greenhouse gases.

II. THE CONTEMPORARY CONTEXT

The consistent practice of the process has led to severe degradation of the air quality in and around Delhi. The national capital has shown deterioration in the Air Quality Index. Approximately 137.16 gigagrams (1 Gg = 1,000,000 kilograms) and 163.75 Gg of PM2.5 and PM10 were emitted from stubble burning in Punjab, according to a study on district-wise detailed emission inventory in 2020. In Haryana, the concentration of PM2.5 and PM10 was found to be 56.95 Gg and 72.15 Gg respectively. India generates around 500 million tonnes of crop residue according to the Union Ministry of New and Renewable Energy. A significant part of it is utilized as fodder and domestic fuel. But out of this almost 140 million tonnes remains unattained and out of that 92 million tonnes is burnt. The government has taken several steps to get rid of this ditch and has been successful to a certain extent. On successful experiment on power generation through crop residue, the organization has envisioned the use of 5 million tonnes of biomass pellets which are made of stubble and crop residue for power generation. It has planned to develop 17 power plants around the country for the efficient implementation of the idea. Apart from the aspect of power generation, it can create a large number of rural employment. Revamping the Waste to Energy mission targeting a 15-megawatt biogas generation is one of the key steps towards residue management. Apart from this the laws like section 144 CrPC banning the burning of paddy, The Air Prevention and Control of Pollution Act 1981, The Environment Protection Act 1986, etc actually control stubble burning. To intervene in the ground zero policies are formulated promoting the agricultural mechanization for in-suit management of crops, providing education, information, and communication for awareness on in-suit crop residue.

III. DEVELOPMENTAL VISION

Despite resolute efforts, the light doesn't seem close. These efforts pragmatically target individual concerns and provide solutions sequentially. The situation demands a more holistic and inter-mingled approach. From a strict perspective, stubble burning is an inexpensive and effective method to remove excess residue to facilitate timely planting. On a close analysis of this, the only issue that sticks is the timely management of it. The process of burning stubble can subsequently be reduced with proper policies and government interventions on the collection of the debris upon the consent of the plot owner. This residue can then be used for energy production, biogas generation, or even manufacturing of construction materials all under the supervision of the government. The revenue generated can then compensate for the investment in due process. The process is capable of producing a large number of rural and semi-urban employment, initiation of MSMEs, and most importantly a new school of thought. This does not just aim to significantly reduce stubble burning but also opens limbs for economic development, through the development of MSMEs taking part in the process, of environmental and social sustainability.

IV. THE POSSIBLE WAY FORWARD

A significant process of revenue generation is by selling residue as fodder. The program asks us to roll our stock of residue generated to the poultry, stable, etc to feed cattle and other live stocks. Practicing this on a governmental scale will lead to the transaction of such fodder which will eventually help in revenue generation. Haryana has 46.9 million paltry populations and 4.4 million buffalo populations. Once this process becomes a government scheme, it will move us a step ahead toward self-sufficiency. Small and medium enterprises can work effectively on duly decided regions. The importance of the program lies in its very existence as an instantaneous alternative to feeding the cattle.

A. Biogas Production

According to PBNS, on March 31 of 2022, Union Minister for Power and New and Renewable Energy (MNRE), R.K Singh in a written reply to Rajya Sabha informed that a total of 249 Waste-to-Energy plants, 819 Biomass Power plants, and 50.8 lakhs small biogas plants have been set up in the country to generate power/ Biogas/ Bio-CNG. Communal and domestic initiatives in the process of biogas generation through crop residue can significantly help in meeting the energy requirement which is enough of an outcome. This has been a movement ever since the 1970s. There are major biogas plants providing power supply to a community, and at the same time, we have a private biogas system providing 1 m3-10 m3 of biogas to individual houses. A brief calculation essentially defines the rice and residue proportion required for biogas production.

Rice Husk: 20% of Paddy
Bran layers: 11% of Paddy
Rice: 69% of Paddy
Rice: Straw = 1:(0.7-1.4) ≈1:1
Average paddy yield in 1 acre= 30.5 Quintal
1 Acre= 80 Katha
Therefore, 80 Katha yields 30.5 x 100 Kg
1 Katha yields 30.5x1000/80= 38.125 Kg
Now the proportion is 1:1
19.06 Kg of rice produces 19.06 Kg of straw (residue)
Approx. 4000 m3 of biogas can be generated from 10 tonnes of residue
10 ton = 4000 m3
1 ton = 400 m3
1 kg = 400/1000 = .4 m3
19.06 kg produces .4 x 19.06 m3 of biogas
= 7.625 m3 of biogas

These approximately suffice a household. So if this residue is sold to the government, it can easily generate the required power and earn revenue and in return, we can even move towards self-sufficiency with this approach. The initial investment is required from the government side for setting the basic infrastructure and process mobility which can foster immense profit. The idea of small-scale power generation is a path to follow in India due to the abundant availability of resources and the conventional ecological process followed for its generation. The government plays an integral part in creating awareness about the same amongst the farmers. Notion amalgamated policies looking for effective cultivation of sustainable and renewable sources of energy is essential to turn the idea into reality.

B. Use Of Crop Residue For Manufacturing Of Construction Materials

For quite some time this has not been a conformist idea in the context of India. But with the advancement in technology we have reached to stage where sparing utilization of these crop residues can be easily used for the manufacture of organic and sustainable building materials such as fiber-reinforced composite, lightweight bricks green concrete, severe insulation materials, and many more. The benefit of such manufacturing is evident due to the surplus availability of resources at lower costs and high returns. Initial investments might be a concern in some cases but, with innumerable government policies to financially support the various scales of enterprises, the process can sail through.

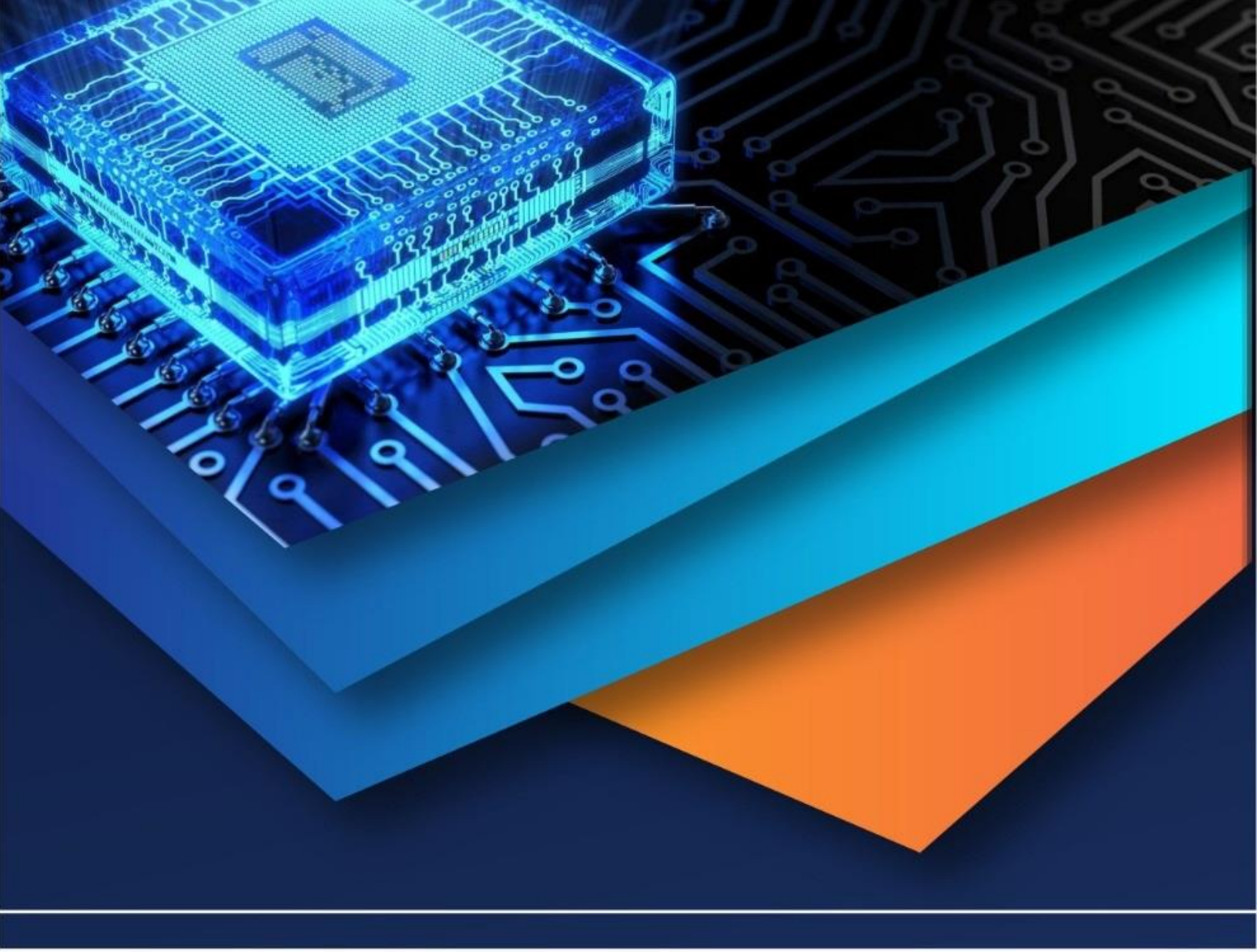
The effective use of crop residues such as rise husk can be used as rice husk ash can be a potential alternative to cement increasing the impermeability, corrosion resistance to reinforcement, strength, and workability of the concrete. Sugarcane bagasse ash (SCBA) can be used for the manufacturing of green cement. Fiber cement boards made out of crop residue are an affordable and aesthetic alternative to MDF boards, Plastic boards, etc. They are cost-effective and termite proof. Straw and residue can also be used to manufacture fly ash bricks and mud bricks, with a certain percentage of residue, of varying sizes which is also lightweight and a sustainable product. These bricks can be potential alternatives to ACC blocks. Agro-waste-generated bricks are cheaper than the others but are most suitable for the construction of lower structural loads. The process of manufacturing such bricks asks for multi-layered interventions of the government for setting up industries and MSMEs. Various insulation materials can be manufactured using these crop residues. The agro-based wastes are showcases good thermal properties and make them appropriate for the construction of houses in villages. These insulation materials can be transformed into insulation panes using hemp and concrete. The accent of the idea of sustainable designs welcomes the use of such panels to attain thermal comfort rather than the consistent use of mechanical ventilation. Fiber-mixed gypsum developed by mixing a proportion of rice and wheat husk can improve the qualities of gypsum boards which lie as the most important building material in the contemporary context. This adds a whole new spectrum to the Waste to Energy Mission. The advancement in construction technology has marked the scope for various prefabricated construction materials which elevates the pace of construction. The architects and engineers are aware of the fact that the very approach to sustainable design lies in the use of low-carbon emitting material for construction. The construction industry is a major revenue-generating industry, even a slight change in approach can reciprocate the multidimensional use of such materials.

V. CONCLUSION

The process has dialectic benefits. One side of it provides an alternative to pollution challenges that often arise from irregular disposal and dumping of wastes in landfills or even burning them. The other part looks at the generation of new tasks and activities. This gives rise to new scopes and employment. Setting up a system of certain scheme or policy and infrastructure that buys residue from the common people and invest it as a raw material for manufacturing such building materials can be a game changer. The government can play an integral role in stimulating a smooth demand and supply chain. A proper understanding of the produced material and interlinking with the region which asks for its optimum use can enhance this process to a scaled level. The bricks produced using crop residue can easily be used in the construction of small pakka houses under various housing schemes. The raw straw and converted insulated panels can be a mainstream product in regions of extreme climate. Ladakh being at a cradle state of civilization has initiated the use of carbon-free and sustainable products for construction. This will not only be a step towards sustainable use of materials (reduce, recycle & reuse) but also will be a step forward towards sustainable growth that shows potential job opening apart from agriculture, trade, and business and most importantly, exposure to the things that are not yet mainstream. The easier we make it for the common people to understand the process and the notion that the smaller steps to be taken having a farsighted vision will never compromise their needs and importance, the more successful we become as a team.

REFERENCES

[1] Agriculture Victoria: Crops and horticulture: Managing stubble (2022).
[2] Krishi Jagaran: Stubble burning in India: Causes, effects and measure (2022). (https://krishijagran.com/blog/stubble-burning-in-india-causes-effects-measures/?amp=1)
[3] IREAD: Waste to Energy- ISO 9001:2015; 27001:2013 Crop Residue Burning in India: Policy Challenges and Potential Solutions
[4] Crop Residue Burning in India: Policy Challenges and Potential Solutions:S. Bhuvaneshwari, Hiroshan Hettiarachchi, and Jay N. MeegodaInt. J. Environ. Res. Public Health 2019, 16(5), 832; (https://doi.org/10.3390/ijerph16050832)
[5] Hindustan Times: Sep 28, 2022: NTPC to partially use crop residue to fire power plants



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